FACULTY OF ENGINEERING, LIFE SCIENCES & MANAGEMENT

IASE Deemed University

Gandhi Vidya Mandir, Sardarshahr
(Rajasthan) – 331401,
INDIA

Teaching and Examination Scheme and Syllabus

for

Diploma in Mechanical Engineering
(Three-Year Full Time Diploma in Engineering Programme)
(SEMESTER SCHEME)

Sessions 2016-17

Rules and Guidelines for the Students

1. The Diploma in engineering (Mechanical Engineering) course is a three year (Six Semesters) full time integrated Diploma programme.

2. THE PROGRAMME

The Diploma in engineering (Mechanical Engineering) course is a three year (Six Semester) full time degree program .The course structure and program administration are as follows.

3. COURSE STRUCTURE

The three years, six semester teaching consists of Theory (Lectures and Tutorials) and Practicals/ Sessionals (Laboratory work, Engineering Graphics, Workshop Practice and Project etc.).Examination will be held at the end of the each semester. Details of these are given in the Teaching & Examination Scheme.

4. PROGRAMME ADMINISTRATION

4.1 Medium of Instruction

English/Hindi shall be the medium of instruction and examination.

4.2 EVALUATION

(a) Each subject will be evaluated through a theory paper at the end of the semester carrying 80 marks along with continuous evaluation of sessional work, carrying 20 marks. The theory paper shall be of three hour duration. The sessional work will consist of continuous assessment of student's performance by teachers in tutorial classes, and class tests.

(b) Three class tests will be organized in each semester as per the scheme. The higher two out of the marks scored in the three tests will be considered for the sessional marks.

(c) Evaluation of laboratory practical work and Engineering Graphics (Drawing) will be through continuous assessment throughout the semester as well as examination at the end of the semester.

(d) Project: The project work will be carried out in the VI semester. The topic of the project will be approved by the Head of the Department and the entire project work will be carried out under the guidance of a teacher of the department approved as project supervisor by the Head of the Department. The nature of the project work will consist of varying proportions of designing, fabrication, testing and analysis of results. The project topic can also be taken from a live industrial problem. The report of the completed project shall be signed by the guide and submitted to the Head of the Department on or before the last working day of the sixth semester. The evaluation of the project will be done by a board consisting of two examiners.

5. PROMOTION

5.1 The maximum span period of a program is six years from the date of registration in the program.

5.2 The minimum marks for passing the examination for each semester shall be **40%** of all the subjects (theory and practical) of the semester.

5.3 A student will be permitted to attend the classes of the second/fourth/sixth semesters immediately after the examination of the first/third/fifth semester's examination, as the case may be, provided he/she has appeared in the first/third/fifth semester examination, respectively.

5.4 To be eligible for promotion to the 3rd semester of the program a student must have successfully cleared at least 50% of total subjects including practicals of the first and second semesters taken together.

5.5 To be eligible for promotion to the 5th semester of the program a student must have successfully cleared at least 50% of total subjects including practicals and sessionals of the third and fourth semesters taken together.

5.6 A student promoted to the third/fifth semesters, without having cleared all the papers, will have to appear and pass the backlog papers of the first/third semesters along with the regular examination of the first/third semesters and backlog papers of the second/fourth semesters along with the regular examination of the second/fourth semesters.

5.7 Award of Grade:

- **Academic Year**: Two consecutive (one odd + one even) semesters constitute one academic year.

- **Choice Based Credit System (CBCS):** The CBCS provides choice for students to select from the prescribed courses (core, elective courses).

- **Course**: Usually referred to, as 'papers' is a component of a programme. All courses need not carry the same weight. The courses should define learning objectives and learning outcomes. A course has been designed to comprise lectures/ tutorials/laboratory work/ field work/ outreach activities/ project work/ vocational training/viva/seminars/term papers/assignments/presentations/self-study etc. or a combination of some of these.

- **Credit Based Semester System (CBSS)**: Under the CBSS, the requirement for awarding a degree is prescribed in terms of number of credits to be completed by the students.

- **Credit Point**: It is the product of grade point and number of credits for a course.

- **Credit**: A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week.

- **Cumulative Grade Point Average (CGPA)**: It is a measure of overall cumulative performance of a student over all the semesters. The CGPA is the ratio of total credit points secured by a student in various courses in all semesters and the sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

- **Grade Point**: It is a numerical weight allotted to each letter grade on a 10-point scale.

- **Letter Grade:** It is an index of the performance of students in a said course/semester/programme. Grades are denoted by letters O, A+, A, B+, B, C, P and F.

Letter Grade	% Scale	Grade Point
O (Outstanding)	90% and Above	10
A+(Excellent)	80% to 89.99%	9
A(Very Good)	70% to 79.99%	8
B+(Good)	55% to 69.99%	7
B(Above Average)	50% to 54.99%	6
C(Average)	45% to 49.99%	5
P (Pass)	40% to 44.99%	4
F(Fail)	Less than 40%	0
Ab (Absent)	Absent	0

- **Programme**: An educational programme leading to award of a Degree.

- **Semester Grade Point Average (SGPA)**: It is a measure of performance of work done in a semester. It is ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal places.

- **Semester**: Each semester will consist of 15-18 weeks of academic work equivalent to 90 teaching days. The odd semester may be scheduled from July to December and even semester from January to June.

- **Transcript or Grade Card or Certificate:** Based on the grades earned, a grade certificate shall be issued to all the registered students after every semester. The grade certificate will display the course details (code, title, credit points, grade secured) along with SGPA of that semester and CGPA earned till that semester.

5.8 If a student (who has successfully completed the programme) wishes to reappear in one or more theory papers of the first, second, third, fourth, fifth, sixth semesters for the purpose of improving his/her marks, he/she will be permitted to do so on payment of requisite examination fee along with the regular examinations of that semester; however, the total number of such attempts shall not exceed four theory papers during the span period of the programme. For this his/her previous performance in the paper/papers concerned shall be treated as cancelled. The application for such reappearing/re-examination must be submitted before the next examination of the corresponding semester. However, such candidates shall not be considered for award of gold medal.

5.9 A student to be eligible for award of degree has to clear all papers offered during four-year programme within the span period of eight years.

6. LATERAL ENTRY

Students who have passed 10+2 or ITI examination from the Board of Technical Education, Rajasthan, or its equivalent with a minimum of 55% marks in aggregate for general category and 40% for SC/ST/OBC candidates can be admitted to the Third Semester of the Diploma programme.

7. ATTENDANCE:

All students are required to have 75% attendance in each subject and there must be 75% attendance of the student before he/she could be permitted to appear in the examination.

8. RULES FOR CHANGE OF BRANCH FOR THE STUDENTS OF III SEM. DIPLOMA.:

8.1. The faculty, on the basis of applications received from desirous students up to the date and time notified by the Director, will prepare a merit list of the students. The list will be prepared on the basis of overall merit of the I (Semester) result only and the applications for change of branch will be processed as per the merit list.

8.2. **Eligibility Criteria:**

(a) The students must have passed the I Semester Diploma Examination in all components in one attempt with at least **"B+"** grade. The student with back papers or whose result has not been declared will not be considered for change of branch.

(b) In case any student has applied for re-valuation/ re-totalling of his/her marks of I Semester Diploma and the result has not been received till the time of change of branch, such a student will not be entitled for change of branch on the basis of his/her subsequently revised result.

8.3. **Procedure:**

(a) Applications in a specified format (developed by the faculty) for change of branch will be invited by the Director/Principal of the faculty on the basis of the result of I (Semester) B. Tech. in duplicate, upto the date notified by the University. One copy of each such application will be sent to the University by that date.

(b) The students would submit a photo copy of I (Semester) Examination mark sheet of that year along with the application. The student may give as many preferences as possible against the vacant seats in respective branch.

(c) A seat matrix shall be prepared by the faculty, as per the details of the vacant seats.

(d) Due to change of branch, the strength of student in any branch should not fall short of 75% of the enrolled students in that branch in that year. And under no circumstances, due to change of branch, the number of seats in a particular branch shall exceed the sanctioned strength approved by the AICTE, for that batch.

(e) All students who have applied for the change of branch in-time will be called for counselling by the admission council of the faculty and considered for change of branch as per merit, preference and availability of seat. However, at the time of the counselling, if any student wishes to withdraw his/her application he/she can do so by a written request. In case any student does not present himself/herself for counselling, his/her branch will be changed as per the preference mentioned in the application form, merit and availability of seat. Once a student has been permitted to change of a branch it will not be withdrawn.

TEACHING & EXAMINATION SCHEME

For Diploma in Engineering – Three Year (6 Semester) Full Time Diploma Programme

Diploma in Mechanical Engineering – Second Year **Semester – III**

Subject Code	Title	Hrs. / Week			Credit	IA		Exam		Total
		L	T	P		Th	P	Th	P	
DME-301/ DME-301-P	Strength of Materials- I	3	1	2	5	20	30	80	20	150
DME-302/DME-302-P	Fluid Mechanics – I	3	1	2	5	20	30	80	20	150
DME-303/DME-303-P	Manufacturing Processes-I	3	-	2	4	20	30	80	20	150
DME-304/DME-304-P	Thermal Engineering- I	3	1	2	5	20	30	80	20	150
DME-305/DME-305-P	Materials and Materials Science	3	-	2	4	20	30	80	20	150
DME-306	Electrical Engineering	3	-	-	3	20	-	80	-	100
DME-307-P	Machine Drawing	-	-	4	2	20	-	80	-	100
DME-308	Discipline & Extra Curricular Activity	1								50
	Total	**18**	**3**	**14**	**29**					**1000**

Diploma in Mechanical Engineering – Second Year **Semester – IV**

Subject Code	Title	Hrs. / Week			Credit	IA		Exam		Total
		L	T	P		Th	P	Th	P	
DME-401/DME-401-P	Strength of Materials- II	3	1	2	5	20	30	80	20	150
DME-402/DME-402-P	Fluid Machines	3	-	2	4	20	30	80	20	150
DME-403	Fluid Power and Tribology	3	-	-	3	20	-	80	-	100
DME-404/DME-404-P	Internal Combustion Engine	3	-	2	4	20	30	80	20	150
DME-405/DME-405-P	Workshop Technology – I	3	-	4	5	20	30	80	20	150
DME-406/DME-406-P	Energy Audit and Management	3	-	2	4	20	30	80	20	150
DME-407	Theory of Machines	3	-	-	3	20	-	80	-	100
DME-408	Discipline & Extra Curricular Activity	1								50
	Total	**21**	**1**	**12**	**29**					**1000**

IA- Internal Assessment **T- Tutorial**

L- Lecture **P- Practical**

Th- Theory

TEACHING & EXAMINATION SCHEME

For Diploma in Engineering – Three Year (6 Semester) Full Time Diploma Programme

Diploma in Mechanical Engineering – Third Year **Semester – V**

Subject Code	Title	Hrs. / Week			Credit	IA		Exam		Total
		L	T	P		Th	P	Th	P	
DME-501/ DME-501-P	Industrial Engineering & Computer Aided Drafting	3	1	2	5	20	30	80	20	150
DME-502/DME-502-P	Safety in engineering industry	3	-	2	4	20	30	80	20	150
DME-503/DME-503-P	Metrology	3	1	2	5	20	30	80	20	150
DME-504/DME-504-P	Thermal Engineering- II	3	1	2	5	20	30	80	20	150
DME-505/DME-505-P	Workshop Technology – II	3	1	2	5	20	30	80	20	150
DME-506	DME 506 Power Plant Engineering	3	-	-	3	20	-	80	-	100
DME-507-P	Practical Training (24 Working Days)	-	-	2	1	-	60	-	40	100
DME-508	Discipline & Extra Curricular Activity				1					50
	Total	**18**	**4**	**12**	**29**					**1000**

TEACHING & EXAMINATION SCHEME

For Diploma in Engineering – Three Year (6 Semester) Full Time Diploma Programme

Diploma in Mechanical Engineering – Third Year **Semester – VI**

Subject Code	Title	Hrs. / Week			Credit	IA		Exam		Total
		L	T	P		Th	P	Th	P	
DME-601/DME-601-P	Refrigeration and Air- Conditioning	3	1	2	5	20	30	80	20	150
DME-602/DME-602-P	Automobile Engineering	3	-	2	4	20	30	80	20	150
DME-603/ DME-603-P	Manufacturing Processes – II	3	1	2	5	20	30	80	20	150
DME-604/DME-604-P	C.N.C. Machines and Automation	3	-	2	4	20	30	80	20	150
DME-605/DME-605-P	Machine Design	3	-	4	5	20	30	80	20	150
DME-606	ME 606 Mechanical Estimating and Costing	3	-	-	3	20	-	80	-	100
DME-607	Project	-	-	4	2	20	-	80	-	100
DME-608	Discipline & Extra Curricular Activity				1					50
	Total	**18**	**2**	**16**	**29**					**1000**

IA- Internal Assessment **T- Tutorial**
L- Lecture **P- Practical**
Th- Theory

Semester III

DME-301 Strength of Materials- I

Unit I Simple Stress and Strain:

1.1 Various mechanical properties

- 1.1.1 Elasticity
- 1.1.2 Plasticity
- 1.1.3 Ductility
- 1.1.4 Brittleness
- 1.1.5 Toughness
- 1.1.6 Hardness

1.2 Concept of stress and strain

- 1.2.1 Type of force - Direct, shear
- 1.2.2 Stress - Tensile, compressive, shear

1.3 Hooke's law

- 1.3.1 Statement of Hooke's law
- 1.3.2 Young's modulus of elasticity
- 1.3.3 Tensile test diagram
  - 1.3.3.1 Gauge length
  - 1.3.3.2 Limit of proportionality
  - 1.3.3.3 Elastic limit
  - 1.3.3.4 Yield point, Yield strength
  - 1.3.3.5 Ultimate stress
  - 1.3.3.6 Rupture strength
  - 1.3.3.7 Nominal stress
  - 1.3.3.8 Proof stress

1.4 Working stress and factor of safety

1.5 Stress and strain calculations

- 1.5.1 Principle of superposition
- 1.5.2 Bar of homogeneous section
  - 1.5.2.1 Bar of uniform cross-section
  - 1.5.2.2 Bar of steeped cross-section
- 1.5.3 Bar of composite section

1.6 Temperature stresses

- 1.6.1 Homogeneous section
- 1.6.2 Composite section

1.7 Shear stresses

1.7.1 Modulus of rigidity
1.7.2 Complementary shear stress
1.7.3 Concept of single shear and double shear
1.7.4 Shear strain

1.8 Poisson's ratio and volumetric strain

1.8.1 Lateral strain
1.8.2 Longitudinal strain
1.8.3 Volumetric strain
1.8.4 Bulk modulus

1.9 Relationship between elastic constants (Derivation)

1.9.1 E=3K(1-2/m)
1.9.2 E=2N(1+1/m)
1.9.3 E=9KN/(3K+N)

Unit 2 Compound Stress:

2.1 Introduction
2.2 Stress components on an inclined plane

2.2.1 Induced by direct stresses
2.2.2 Induced by simple shear
2.2.3 Induced by direct and simple shear stresses

2.3 Mohr's circle :

2.3.1 For like direct stresses
2.3.2 For unlike direct stresses
2.3.3 For two perpendiculars direct stresses with state of simple shear

2.4 Principal stresses and planes

2.4.1 Major principal stress
2.4.2 Minor principal stress
2.4.3 Mohr's circle method for principal stresses

Unit 3 Strain Energy:

3.1 Introduction
3.2 Strain energy from stress - strain diagram
3.3 Proof resilience
3.4 Types of loading - gradual, sudden, impact

3.4.1 Stress in gradual loading
3.4.2 Stress in sudden loading
3.4.3 Stress in impact loading

Unit 4 Bending Moments and Shear Force:

4.1 Basic concept

4.1.1 Types of support

4.1.1.1 Movable hinge support (roller)
4.1.1.2 Immovable hinge support
4.1.1.3 Fixed support

4.1.2 Types of beam
4.1.2.1 Cantilever beam
4.1.2.2 Simply supported beam
4.1.2.3 Fixed beam
4.1.2.4 Continuous beam
4.1.2.5 Overhanging beam

4.1.3 Types of load

4.1.3.1 Point load
4.1.3.2 Distributed load - uniformly and non uniformly

4.2 Shear force and bending moment

4.2.1 Concept and calculation of shear force and bending moment
4.2.2 Sign convention for shear force and bending moment

4.3 Bending moment and shear force diagrams (for point loads, U.D.L. and their combinations)

4.3.1 Cantilever beam
4.3.2 Simply supported beam
4.3.3 Simply supported beam with over hang

Unit 5 Moment of Inertia:

5.1 Concept of moment of Inertia
5.2 Radius of gyration
5.2.1 Parallel axis theorem
5.2.2 Perpendicular axis theorem
5.3 Moment of Inertia of various sections.
5.3.1 Rectangle
5.3.2 Triangle
5.3.3 Circle
5.4 Moment of inertia of unsymmetrical section like : T-section, channel section, L-section etc.

5.5 Bending Stresses in Beams :
5.5.1 Concept of bending stress
5.5.2 Theory of simple bending
5.5.3 Assumptions in theory of simple bending
5.5.4 Use of equation M/I=FY=E/R (without proof)
5.5.5 Design criterion and section modulus
5.5.6 Section modulus
5.5.7 Calculation of max bending stress in beams of rectangular, circular, I and T section

DME-301-P Strength of Materials- I

1. Study of extensometers
2. Study and operation of UTM
3. Tensile test on mild steel specimen and plotting stress strain curve.
4. Bending test on timber beams.
5. Compression test on common structural materials viz. timber, cast iron etc.
6. Determination of toughness of cast iron and mild steel specimen by Charpy and Izod test.
7. Hardness test by Brinell and Rockwell tester.

REFERENCE BOOKS:

1. Strength of Materials & Theory of Structures (vol. I) — B.C.Punmia
2. Strength of Materials — Ramamurtiham
3. Strength of Materials — Junarkar
4. Strength of Materials — R.S. Khurmi
5. Strength of Materials (Hindi) — Gurcharan singh

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DME-302 FLUID MECHANICS - I

Unit 1 Introduction:

- 1.1 Introduction concepts
  - 1.1.1 Fluids and solids
  - 1.1.2 Liquid, gas and vapour
- 1.2 Fluid mechanics
  - 1.2.1 Kinematics
  - 1.2.2 Dynamics
- 1.3 Fluid properties
  - 1.3.1 Density
  - 1.3.2 Specific volume
  - 1.3.3 Specific gravity
  - 1.3.4 Viscosity
    - 1.3.4.1 Newton's law of Viscosity
    - 1.3.4.2 Dynamic and Kinematic Viscosity
  - 1.3.5 Compressibility
  - 1.3.6 Surface tension - soap bubble, drop
  - 1.3.7 Capillarity
  - 1.3.8 Vapor pressure and its importance

Unit 2 Fluid Pressure and its Measurement:

- 2.1 Definition and its units
- 2.2 Pascal's law
  - 2.2.1 Intensity of pressure at a point in fluid at rest
  - 2.2.2 Pressure head
- 2.3 Pressure
  - 2.3.1 Atmospheric pressure
  - 2.3.2 Gauge pressure
  - 2.3.3 Vacuum pressure
  - 2.3.4 Absolute pressure
  - 2.3.5 Differentials pressure
- 2.4 Law of hydrostatic pressure
- 2.5 Brahma's press
- 2.6 Pressure measurement
  - 2.6.1 Manometers
    - 2.6.1.1 Piezometer - its limitation
    - 2.6.1.2 U-tube - simple, differential, inverted
    - 2.6.1.3 Micro-manometers
    - 2.6.1.4 Inclined tube micro-manometers
  - 2.6.2 Mechanical gauge
    - 2.6.2.1 Bourdon gauge
    - 2.6.2.2 Bellow gauge
    - 2.6.2.3 Diaphragm gauge
    - 2.6.2.4 Dead weight gauge

Unit 3 Hydrostatics:

- 3.1 Total pressure
- 3.2 Centre of pressure
- 3.3 Total pressure and center of pressure in following cases
  - 3.3.1 Plane surface immersed horizontally
  - 3.3.2 Plane surface immersed vertically
  - 3.3.3 Plane surface immersed at an angle
  - 3.3.4 Curved surface (no proof)
- 3.4 Working of lock gates, sluice gate
- 3.5 Pressure on masonry dams of rectangular and trapezoidal sections and their condition of stability

3.6 Hydro kinematics :
- 3.6.1 Description of fluid flow
- 3.6.2 Eular approach
- 3.6.3 Lagrangian approach

3.7 Definition of path line, stream line

3.8 Types of flow
- 3.8.1 Steady - Non steady
- 3.8.2 Uniform - Non uniform
- 3.8.3 Laminar - Turbulent
- 3.8.4 One, Two, Three dimensional flow

3.9 Continuity equation (no proof) :
- 3.9.1 Assumption
- 3.9.2 Rate of discharge
- 3.9.3 For one dimensional flow

Unit 4 Hydrodynamics and Measurement of Flow:

4.1 Energy of fluid - pressure, kinetic and potential

4.2 Bernoulli's theorem (no proof)
- **4.2.1** Assumptions and its limitation
- **4.2.2** Conversion of pressure into pressure head, velocity into kinetic head

4.3 Applications of Bernoulli's theorem
- 4.3.1 Pitot-tube
- 4.3.2 Venturimeter
- 4.3.3 Orifice meter

Unit 5 Orifices and Notches:

5.1 Definition and classification

5.2 Discharge through small orifices

5.2.1 Coefficient of contraction

5.2.2 Coefficient of velocity

5.2.3 Coefficient of discharge

5.2.4 Coefficient of resistance

5.3 Time of emptying a vessel of uniform cross section through an orifice at bottom.

5.4 Notches - Classification

5.4.1 Crest, Nappe

5.4.2 Difference between notch and weir

5.5 Flow over -

5.5.1 Triangular notch

5.5.2 Rectangular notch

DME-302-P FLUID MECHANICS - I

1. Study of different types of manometers and pressure gauges
2. Verification of Bernoulli's theorem
3. Determination of C_d for Venturimeter
4. Determination of C_d for Orificemeter
5. Determination of C_c,C_v and C_d of small orifice
6. Visit of a nearby dam

REFERENCE BOOKS:

1.	Fluid Mechanics & Machines	Dr. Jagdish Lal
2.	Fluid Mechanics & Machines	Dr. R.K.Bansal
3.	Fluid Mechanics & Machines	R.S.Khurmi.
4.	Hydraulics & Pneumatics	H.L. Stewart.

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DME-303 MANUFACTURING PROCESS - I

Unit 1 Welding Process:

1.1 Classification of welding process, Industrial applications of welding.

1.2 **Gas Welding :**

1.2.1 Principle of oxy-acetylene gas welding, Construction of oxy- acetylene cutting torch and gas welding torch

1.2.2 Blowpipes, single stage and double stage regulators.

1.2.3 Gas cutting (oxy-acetylene), lance cutting, flames gauging, grooving

1.3 **Electric Welding Process :**

1.3.1 Difference between A.C and D.C arc welding, Equipments and accessories of A.C and D.C welding plants

1.3.2 Effect of polarity, length of arc, penetration, crater, arc blow

1.4 Electrodes (Metal and Carbon), B.I.S specification for welding Symbols and electrodes, Flux and their functions

1.5 Resistance welding

1.5.1 Spot welding, butt welding, flash welding

1.5.2 Seam welding, percussion welding and projection welding

1.6 Atomic hydrogen welding

1.7 Shielded metal arc welding, Submerged arc welding

1.8 Pressure welding

1.9 Welding distortion, welding defects, method of controlling welding defects and inspection of welded joints

Unit 2 Modern Welding Methods:

2.1 Tungsten inert gas welding (TIG)

2.1.1 Principle of operation, advantages, limitations, Applications.

2.2 Metal inert gas welding (MIG)

2.2.1 Principle of operation, advantage, limitations.

2.3 Thermit welding

2.4 Electro slag welding, Electron beam welding

2.5 Ultrasonic welding, Laser beam welding

2.6 Robotic welding

2.7 **Pattern Making :**

2.7.1 Introduction to materials - timber, metal, plastics and plaster of Paris etc.

2.7.2 Allowances- shrinkage, draft, machining, distortion and shake

2.8 Types of Patterns :

2.8.1 Solid, Split loose piece, match plate

2.8.2 Sweep, Gated, Skeleton, segmental, follow board, Colour code for patterns as per B.I.S.

Unit 3 Moulding Sand Ingredients:

3.1.1 Moulding sands-green, dry, loam, facing, baking, parting and core sands.

3.1.2 Silica grain, binders, additive, moisture

3.1.3 Properties of molding sand, permeability, refractoriness, adhesiveness, cohesiveness, strength, flowability, collapsibility

3.1.4 Tempering, sand conditioning and sand muller.

3.2 Core and Core Making :

3.2.1 Core, core print and core boxes

3.2.2 Types of cores, functions, advantage of core, shrinkage of cores

3.2.3 Core sand and binders, core loams, oil and CO_2 cores, synthetic resin

3.2.4 Core Making procedure, core oven and core baking.

3.3 Testing of Moulding Sands :

3.3.1 Need for testing chemical analysis, moisture content test, clay content test, Grain fineness test

3.3.2 Permeability test, hardness and strength tests.

Unit 4 Mould Making:

4.1.1 Moulding boxes, hand tools used for mould making

4.1.2 Steps involved in making a mould, gating system: definition and brief idea of basin, sprue, runner and gates

4.1.3 Moulding machines - Squeeze machine, jolt squeeze machine and sand slinger.

4.1.4 Moulding processes - Green sand, dry sand, loam, Co_2 moulding, skin dried, plaster, metal moulding

4.2 Special Casting Techniques :

4.2.1 Die casting - Hot chamber, cold chamber process

4.2.2 Investment or lost wax process

4.2.3 Centrifugal casting - True, Semi centrifugal, centrifugal

4.2.4 Shell moudling Advantages, Disadvantages and application of above processes

Unit 5 Melting Furnaces:

5.1.1 Cupola furnace – Construction and operation.

5.1.2 Crucible furnace of tilting types - construction, operation

5.2 Castings defects :

5.2.1 Different types of defects

5.2.2 Testing of defects - Radiography, magnetic particle inspection, Ultrasonic inspection

DME-303-P MANUFACTURING PROCESSES – I

1. Making following types of joints by gas welding :

1.1 Preliminary joining practice on gas welding

1.2 Vertical welding

2. Exercises of gas welding on the following

2.1 Aluminium welding

2.2 Brass welding

2.3 Copper welding

2.4 C.I. welding

3. Gas cutting of the following types

3.1 Preliminary gas cutting practice

3.2 Stock cutting by oxy acetylene

3.3 C.I. cutting

4. Making following types of joints by arc welding

4.1 Preliminary joining practice by arc welding

4.2 Butt and lap joint (in vertical position travel up and down)

4.3 Welding of outside corner joint

5. Exercise on spot welding

6. Exercise on brazing

7. Exercise on TIG/MIG/CO_2 welding

8. Pattern making :

8.1 Preparation of solid pattern (single piece)

8.2 Preparation of split pattern

8.3 Preparation of self cored pattern

9. Preparation of the following types of moulds.

9.1 Floor moulding

9.2 Turn over moulding.

10. Testing of moulding sand- moisture content

11. Moulding and casting of

11.1 A solid pattern

11.2 A split pattern

12. Testing and inspection of casting defects visually

Foundry exercise can be shown in a nearby industry/ foundry.

REFERENCE BOOKS :

1. A Text Book of Welding Technology — O.P. Khanna
2. Welding Technology — Tahil Manghnani
3. A Text Book on Foundry Technology — M.Lal & O.P.Khanna.
4. Foundry Engineering — Tahil Meghnani
5. Manufacturing Process - I — R.K. Yadav

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DME-304 THERMAL ENGINEERING - I

Unit 1 Basic Concept and Gas Laws:

1.1.1 Thermodynamics, property-Intensive and Extensive, system - open, closed and isolated

1.1.2 Energy - Internal energy, potential energy, kinetic energy, heat, work, specific heat, enthalpy

1.1.3 Boyle's law, Charle's law, Joule's law

1.1.4 Characteristics gas equation, gas constant, mol, universal gas constant and molar specific heats

1.1.5 Simple numerical problems

1.2 Laws of Thermodynamics :

1.2.1 Zeroth law of thermodynamics

1.2.2 First law of thermodynamics.

1.2.3 Second law of thermodynamics Concept of entropy

1.2.4 Constant volume, constant pressure, isothermal, adiabatic polytropic processes, throttling and free expansion, work done during these processes.

1.2.5 Simple numerical problems

Unit 2 Availability:

2.1.1 Available and unavailable energy

2.1.2 Effectiveness

2.1.3 Irreversibility in flow and non-flow process.

2.2 Formation of Steam and its Properties :

2.2.1 Generation of steam at constant pressure, various stage of steam- wet steam, dry steam saturated steam, dryness fraction, super heated steam, degree of super heat.

2.2.2 Critical point, triple point, thermodynamic properties of steam - specific volume, specific enthalpy, specific internal energy, specific entropy.

2.2.3 Steam property diagram: temperature - entropy diagram, enthalpy- entropy diagram, pressure - enthalpy diagram

2.2.4 Heating and expansion of steam during thermodynamic processes, Change of internal energy and entropy of steam during processes

2.2.5 Simple numerical problems Use of steam tables and Mollier charts.

Unit 3 Steam Generators:

3.1 Definition of boiler according to I.B.R., classification of boilers, description and working of Lancashire, Cochran and Babcock and Wilcox boilers, Comparison of water tube and fire tube boilers.

3.2 Brief description and working of boiler mountings and accessories used in common boilers.

3.3 Special characteristics of high-pressure boilers, Structural details and working of Lamont, Benson and Schmidt Hartmann boilers

3.4 Introduction to Indian Boiler Act.

Unit 4 Boiler Performance:

4.1 Actual evaporation, Equivalent evaporation, Factor of evaporation, Boiler efficiency

4.2 Heat losses in boiler plants, Boiler power, Energy balance sheet of boiler.

4.3 Simple numerical problems

Unit 5 Vapour Power Cycle:

5.1 Rankine cycle, modified rankine cycle, representation on p-v, t-s and h-s charts and efficiency

5.2 Simple numerical problems

DME-304-P THERMAL ENGINEERING - I

1. Study by models/charts/actual units of the following:

1.1 Common type of fire tube and water tube boilers.

1.2 Boiler mountings

1.3 Boiler accessories

1.4 High pressure boilers

2. Determination of dryness fraction of steam by separating and throttling calorimeter

REFERENCE BOOKS :

1. Thermal Engineering (Hindi) Verma & Gulecha
2. Thermal Engineering Vol.1 Mathur & Mehta .
4. Thermal Engineering R.S. Khurmi

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DME-305 MATERIALS AND MATERIAL SCIENCE

Unit-1 Classification and Properties of Materials:

1.1.1 Introduction to engineering materials
1.1.2 Classification of materials
1.1.3 Thermal, chemical, electrical, mechanical properties of various materials
1.1.4 Selection criteria for use in industry

1.2 Structure of Metals and Their Deformation :

1.2.1 Metal structure
1.2.2 Arrangement of atoms in metals
1.2.3 Crystalline structure of metals
1.2.4 Crystal imperfections
1.2.5 Deformation of metal
1.2.6 Impact of cold and hot working on metal structure.

Unit-2 Ferrous Materials:

2.1.1 Classification of iron and steel
2.1.2 Sources of Iron ore and its availability
2.1.3 Manufacture of pig iron, wrought iron, cast iron and steel
2.1.4 Types of cast iron: white, malleable, grey, mottled, nodular and alloy and their usage.
2.1.5 Classification of steels
2.1.6 Different manufacturing method of steel open hearth, bessemer, electric arc.
2.1.7 Specification as per BIS and equivalent standards
2.1.8 Effect of various alloying elements on steel
2.1.9 Plain carbon steel.
2.1.10 Use of alloy steels (Tool steel, stainless steel, spring steel)

2.2 Non Ferrous Materials :

2.2.1 Important ores and properties of aluminum, copper, zinc, tin, lead
2.2.2 Properties and uses of nonferrous alloys

Unit-3 Engineering Plastics and Fibers:

3.1 Introduction of plastics
3.2 Classification - Thermoplastic and thermosetting plastics
3.3 Various trade names of engineering plastics and their application
3.4 Fibers and their classification : Inorganic and organic fibers
3.5 Composite materials

Unit-4 Insulating Materials:

4.1.1 Various heat insulating material and their usage like asbestos, glass wool thermocole, cork, puf, china clay.
4.1.2 Various electrical insulating materials and their use.

4.2 Testing of Metals and Alloys :

4.2.1 Identification tests : appearance, sound, spark, weight, magnetic, band microstructure, filing

Unit-5 Fundamental of Heat Treatment :

5.1 Principles of heat treatment
5.2 Theory of solid solution
5.3 Iron-carbon diagram
5.4 TTT curve in steels and its importance
5.5 Basic idea about martenstic transformation
5.6 Various heat treatment processes - hardening, tempering, annealing, normalising, case hardening and surface hardening.
5.7 Types of heat treatment furnaces.

DME-305-P MATERIALS AND MATERIAL SCIENCE

1. Classification of about 25 specimens of materials / parts into
   - 1.1 Metals and non metals
   - 1.2 Metals and alloys
   - 1.3 Metals and non ferrous metals
   - 1.4 Metals and non ferrous alloys

2. Given a set of specimens of metals and alloys (copper, brass, aluminium, cast iron HSS, Gun metal) : identify and list the various properties possessed by them

3. 3.1 Study of heat a treatment furnace
   3.2 Study of thermocouple / pyrometer

4. Study of a metallurgical microscope and a polishing machine.

5. To prepare specimens of following materials for microscopic examination and to examine the microstructure of the specimens of the following materials : (any three)
   - 5.1 Brass
   - 5.2 Copper
   - 5.3 Grey CI
   - 5.4 Malleable CI
   - 5.5 Low carbon steel
   - 5.6 High carbon steel
   - 5.7 HSS

6. To temper a given specimen and find out difference in hardness (with the help of hardness tester) as a result of tempering.

REFERENCE BOOKS :

1.	Engineering Material	B.K. Agarwal
2.	Elements of Metallurgy	H.S. Bawa
3.	Materials and Metallurgy Lab Manual	Adithan & Bahl
4.	Material Science	R.K. Rajput

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DME-306 ELECTRICAL ENGINEERING

Unit-1 D.C. Machines:

1.1 Construction
1.2 Operation of D.C. generator
1.3 Operation of D.C. motor
1.4 Types of D.C. generator and motor
1.5 Starters
1.6 Speed control methods
1.7 Characteristics of D.C. motors

Unit-2 Transformer:

2.1 Construction of single phase transformer
2.2 Types of transformer
2.3 Principle of operation
2.4 E.M.F equation
2.5 Testing of T/F
- 2.5.1 Polarity test
- 2.5.2 Open circuit test
- 2.5.3 Short circuit test

2.6 Efficiency and losses
2.7 Voltage regulation
2.8 Single phase auto transformer
2.9 Types of 3 phase transformers
2.10 Cooling methods

Unit-3 Induction Motor:

3.1 Construction and working principle of single-phase induction motor
3.2 Types of single phase induction motors (description only)
3.3 Production of rotating magnetic field by three phase currents.
3.4 Construction and working principle of three-phase induction motor
3.5 Torque equation
3.6 Torque slip characteristics
3.7 Starting and speed control of 3-phase induction motor
3.8 Various types of starters
3.9 Methods of increasing starting torque
3.10 Application

Unit-4 Industrial Drives:

4.1 Elementary idea for industrial drives
4.2 Application of industrial drives in following fields -
- 4.2.1 Rolling mill
- 4.2.2 Textile mills
- 4.2.3 Paper mill
- 4.2.4 Crane
- 4.2.5 Mines
- 4.2.6 Lathe machine
- 4.2.7 Pumps
- 4.2.8 Food processor, refrigerators punches

4.3 Electric Heating:

- **4.3.1** Advantages of electric heating over other types of heating
- **4.3.2** Principle of operation, construction and uses of electrical heating in -
- 4.3.3 Resistance heating
- 4.3.4 Induction heating
- 4.3.5 Arc heating

4.4 Brief idea of high frequency heating, dielectric heating and its application.

Unit-5 Illumination:

5.1 Nature of light
5.2 Standard terms and definitions
5.3 Laws of illumination
5.4 Types of lamps
- 5.4.1 Tungston
- 5.4.2 Halogen
- 5.4.3 Sodium
- 5.4.4 Neon
- 5.4.5 Mercury vapour lamp
- 5.4.6 Fluorescent tubes.

5.5 Instrumentation and Measurement : Principle, construction and working of the following measuring instruments -
- 5.5.1 Ammeter and voltmeter (moving coil and moving iron type)
- 5.5.2 Dynamometer types wattmeter
- 5.5.3 Single phase AC energy meter
- 5.5.4 Multimeter and megger

5.6 Transducers
5.7 Measurements of mechanical quantities like pressure, strain, temperature

REFERENCE BOOKS :

1. Electrical Engineering (Hindi & English) K.D. Sharma
2. Electrical Technology B.L.Theraja
3. Utilization of Electrical Power H.Pratap

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DME-307-P MACHINE DRAWING

Preparation of assembly drawing sheets from detailed drawings:

1. Couplings
2. Plummer block and foot step bearing
3. Machine vice
4. Tail stock
5. Shaper tool head
6. Steam stop valve
7. Feed check valve
8. I.C. Engine connecting rod and piston
9. Drilling jig

Exercises for sketch book:

1. Jigs, Bushes and fixtures
2. Pulleys : Straight arm pulley, loose and fast pulley
3. Pipe fittings and pipe joints - Pipe fittings and their symbols, flanged pipe joint and spigot and socket joint

REFERENCE BOOKS:

1. Machine Drawing — Laxmi Narayanan & Mathur
2. Machine Drawing — P.S Gill
3. Machine Drawing — R.B.Gupta
4. Machine Drawing — Sidheswar

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Semester IV
DME-401 Strength of Materials- II

Unit I

1. Deflection :

1.1 Concept of deflection of a beam

1.2 Use of standard formula for calculating deflection (for point loads, U.D.L. and their combination)

1.2.1 Cantilever beam

1.2.2 Simply supported beam

2. Columns and Struts :

2.1 Concept of column and struts

2.2 Modes of failure

2.3 Types of column; long and short

2.4 Buckling loads

2.5 Slenderness ratio

2.6 Euler's formula (without proof)

2.6.1 Both ends hinged

2.6.2 One end fixed and other end free

2.6.3 Both ends fixed

2.6.4 One end fixed and other end hinged

2.6.5 Limitations of Euler's Formula

2.6.6 Equivalent length

2.7 Rankine's formula

Unit II

1. Torsion of Shaft :

1.1 Concept of torsion

1.1.1 Angle of twist

1.1.2 Polar moment of Inertia

1.1.3 Assumptions in the theory of pure torsion

1.2 Derivation and use of $q/r=T/J=Nv/l$

1.3 Relation between power and torque

1.4 Combined stress due to bending and torsion in solid and hollow shaft

Unit III

1. Springs :

1.1 Introduction and classification of springs

1.2 Flat carriage springs

1.2.1 Application of flat carriage springs

1.2.2 Determination of number of leaves and their sections, deflection and radius of curvature

1.2.3 Quarter elliptical spring

1.3 Closely coiled helical springs :

1.3.1 Application of closely coiled helical springs

1.3.2 Determination of deflection, angle of twist, number of coils and stiffness under axial loading in closely coiled helical springs

Unit IV

1. Thin Cylindrical Shells :

1.1 Use of cylinders

1.2 Stresses due to internal pressure

1.2.1 Circumferential stress or hoop stress

1.2.2 Longitudinal stress

1.3 Design of thin cylinders - calculation of the various dimensions of a thin cylinder

Unit V

1. **Combined Direct and Bending Stress :**
   - 1.1 Effect of eccentricity
   - 1.2 Stress due to eccentric load
   - 1.3 Middle third rule
2. **Frames :**
   - 2.1 Different types of frames
   - 2.2 Calculation of forces in the members of determinate frames
     - 2.2.1 Method of Joints
     - 2.2.2 Method of section
     - 2.2.3 Graphical method

DME-401-P Strength of Materials- II

1. Determination of deflection for various types of loading
2. Torsion test on brass and mild steel
3. Compression test on columns
4. Determination of stiffness of close coiled spring
5. Deflection test on leaf spring.

REFERENCE BOOKS:

1. Strength of Materials & Theory of Structures (Vol. I) — B.C.Punmia
2. Strength of Materials — Ramamuritham
3. Strength of Materials — Junarkar
4. Strength of Materials — R.S. Khurmi
5. Strength of Materials (Hindi) — Gurcharan Singh

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DME-402 Fluid Machines

Unit I

1. Flow Through Pipes :

- 1.1 Types of flow in pipes (Reynold's experiment)
  - 1.1.1 Laminar flow
  - 1.1.2 Turbulent flow
  - 1.1.3 Transient flow
- 1.2 Law of fluid friction
  - 1.2.1 Laminar flow
  - 1.2.2 Turbulent flow
- 1.3 Loss of head due to friction (No. proof)
  - 1.3.1 Darcy's Weisbach equations
  - 1.3.2 Chezy's formula
  - 1.3.3 Manning formula
- 1.4 Other energy losses in pipe (only expressions)
- 1.5 Total energy line and hydraulic gradient line
- 1.6 Pipe arrangement
  - 1.6.1 Pipes in series
  - 1.6.2 Pipes in parallel
- 1.7 Transmission of power through pipes
- 1.8 Siphon
- 1.9 Water hammer

Unit II

1. Impact of Free Jet :

- 1.1 Impulse momentum equation (no proof)
- 1.2 Force exerted by a fluid jet on stationery flat plate
  - 1.2.1 Plate normal to the jet
  - 1.2.2 Plate inclined to the jet
- 1.3 Force exerted by fluid jet on moving flat plate
  - 1.3.1 Plate normal to the jet
  - 1.3.2 Plate inclined to the jet
- 1.4 Force exerted by fluid jet on stationary curved vane
  - 1.4.1 Jet strikes at the centre of symmetrical cured vane
  - 1.4.2 Jet strikes tangentially at one
- 1.5 Force exerted by a fluid jet on moving curved vane.

Unit III

1. Hydraulic Turbines :

- 1.1 Classification of water turbines
- 1.2 Pelton turbine
  - 1.2.1 Working principle
  - 1.2.2 Constructional features
- 1.3 Francis turbine and Kaplan turbine
  - 1.3.1 Working principle
  - 1.3.2 Constructional features
- 1.4 Draft tube
- 1.5 Cavitation
- 1.6 Governing of Turbines
  - 1.6.1 Need for governing
  - 1.6.2 Simple governing mechanism
- 1.7 Surge tank
- 1.8 Turbine performance
  - 1.8.1 Heads - gross, net
  - 1.8.2 Efficiency - Hydraulic, Mechanical, Volumetric, Overall
  - 1.8.3 Unit quantities
  - 1.8.4 Specific speed
  - 1.8.5 Introduction to characteristics curve (no numerical problems)
- 1.9 Numerical problems on turbines

Unit IV

1. Centrifugal Pump :

1.1 Introduction and working principles
1.2 Advantages over reciprocating pump
1.3 Classification
1.4 Constructional features
    1.4.1 Mechanical manometric and overall efficiency
1.5 Head of a pump - static, manometric
    1.5.1 Power required to drive the pump
1.6 Losses in pump and efficiency
1.7 Minimum stating speed
1.8 Pumps in series and parallel
1.9 Priming
1.10 Description and working of multistage centrifugal pump, submersible, deepwell pump and gear pump.
1.11 Numerical problems

Unit V

1. Reciprocating Pump :

1.1 Types of pump
1.2 Main components and working
1.3 Slip
    1.3.1 Percentage slip
    1.3.2 Negative slip
1.4 Work down by a reciprocating pump
1.5 Acceleration of piston
    1.5.1 Its effect on velocity and pressure
1.6 Air vessel
1.7 Troubles in Reciprocating pump and their remedies.
1.8 Numerical problems

2. Miscellaneous Hydraulic Machines :

2.1 Description, working principle of following machines
    2.1.1 Hydraulic accumulator
    2.1.2 Hydraulic intensifier
    2.1.3 Hydraulic press
    2.1.4 Hydraulic coupling and torque converter

DME-402-P Fluid Machines

1. Determination of coefficient of friction for pipes
2. Determination of slip, coefficient of Discharge for a reciprocating pump
3. To draw characteristics curves and efficiency curves of
    3.1 Centrifugal pump
    3.2 Pelton wheel turbine
    3.3 Francis turbine
4. Study of model of Kaplan turbine
5. Study of submersible pump, jet pump, deepwell pump.

REFERENCE BOOKS :

1. Fluid Mech. & Machines — Dr. Jagdish Lal
2. Fluid Mech. & Machines — Dr. R.K.Bansal
3. Fluid mechanics & Machines — R.S.Khurmi.
4. Hydraulics & Pneumatics — H.L. Stewart

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DME-403 Fluid Power and Tribology

Unit I

1. **Introduction :**
   - 1.1 Basic idea about fluid power systems
   - 1.2 Advantage of fluid power
   - 1.3 Application of fluid power
   - 1.4 Description of hydraulic power pack unit
   - 1.5 Characteristics properties of hydraulic fluid
2. **Hydraulic Pumps :**
   - 2.1 Principle of hydraulic pumps and pump capacity
   - 2.2 Classification of pumps
   - 2.3 Construction and working of various rotary and reciprocating oil pumps
3. **Hydraulic Valves :**
   - 3.1 Construction and working of various types of hydraulic valves viz. flow control valves, pressure control valves, direction control, valves check valves and special valves used in fluid power system.

Unit II

1. **Actuators :**
   - **1.1** Various types of hydraulic cylinders
   - **1.2** Cylinder cushioning, cylinder mountings
   - **1.3** Semi rotary actuators
   - **1.4** Different type of hydraulic motors, Hydraulic motor circuits
2. **Accumulators and Heat Exchangers :**
   - 2.1 Function of hydraulic accumulators in hydraulic circuits
   - 2.2 Construction and working of various types of accumulators and heat exchangers
3. **Hydraulic Circuit and Devices :**
   - 3.1 Speed control circuit, pressure reducing circuit, sequencing circuit, reciprocating circuit, rapid traverse and feed circuit
   - 3.2 Intensifier, hydraulic coupling, torque converter and power operated clamping devices
   - 3.3 Fault diagnosis and preventive measures of hydraulic circuits.

Unit III

1. **Packing and Seals :**
   - **1.1** Classification of seals, static seals, dynamic seals
   - **1.2** Sealing materials
2. **Pipes and Pipe Fittings :**
   - 2.1 Study of various types of pipes, tubes and hoses used in hydraulic circuits
   - 2.2 Pipe fittings
   - 2.3 Cutting and bending of pipes and tubes
3. **Pneumatics :**
   - **3.1** Various pneumatic system components viz compressors, Air filters, Regulators and lubricators
   - **3.2** Different types of pneumatic valves and Actuators

Unit IV

1. **Lubrication Principles :**
   - 1.1 Friction, wear
   - 1.2 Necessity of lubrication
   - 1.3 Dry lubrication, Boundary lubrication, hydrodynamic lubrication
2. **Properties of Fluids :**
   - 2.1 Viscosity, temperature and pressure v/s viscosity
   - 2.2 Viscosity index, flash and fire point, oiliness cloud and pour points, emulsification, specific gravity, colour etc.

Unit V

1. Lubricants and Applications:

1.1 Lubricant sources and composition, liquid lubricants, solid lubricants, Greases etc, Lubricant additives

1.2 properties of specific lubricants, selecting the lubricant under various conditions.

1.3 Functions of a lubricant in the following : Sliding bearings, rolling bearing, gears, chains , wire rope, metal working, seals and packing.

1.4 Standard tests for physical and chemical properties of lubricants, performance test, record of scheduling and storage

2. Lubrication of Equipments :

Machine tools, electric motors, air compressors, small tools and appliances, automotive engines (points of lubrication, frequency, types and precaution are to be explained).

3. Lubricant Application System :

Manual devices wick feed and drops feed oiler. Air-oil mist or fog system, Ring, Chain and collar lubrication, Splash lubrication positive feed lubrication.

Pressure circulating system. Centralized lubrication system.

REFERENCE BOOKS :

1. Fluid Power & Tribology Agarwal & Bhatia

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DME-404 Internal Combustion Engines

Unit I

1. **Gas Power Cycles :**
   - 1.1 Otto cycle, Diesel cycle, Dual combustion cycle, Atikinson brayton cycle
   - 1.2 Air standard efficiency
   - 1.3 Effect of compression ratio on efficiency
   - 1.4 Numerical Problems
2. **Principles of Internal Combustion Engines :**
   - 2.1 Introduction and Classification of I.C Engines
   - 2.2 Working principle of four stroke and two stroke cycle and their comparison
   - 2.3 Working and special features of petrol and diesel engines and their comparison and applications
   - 2.4 I.C. engine terms - Bore, stroke, dead centres, crank throw, compression ratio, clearance volume, piston displacement and piston speed, B.S.I. specification for I.C. engine parts
   - 2.5 Valve timing diagrams, firing order and super charging of I.C. engines

Unit II

1. **Petrol Engines :**
   - 1.1 Concept of Carburation, Air fuel ratio
   - 1.2 Simple carburetors and its limitations
   - 1.3 Description of Solex and S.U. types carburetors
   - 1.4 Multi point fuel injection system
   - 1.5 Mechanical and electrical feed pump
   - 1.6 Description of coil ignition system and Magneto ignition system
   - 1.7 Elementary idea of combustion phenomenon, detonation, pre- ignition and octane number

Unit III

1. **Diesel Engines :**
   - 1.1 Description and working of Fuel feed pump
   - 1.2 Injection of fuel, air and airless injection and fuel injectors
   - 1.3 Elementary idea of combustion phenomenon, diesel knock, delay period and Cetane number.
   - 1.4 Introduction to swirl and open combustion chambers
   - 1.5 Introduction to Wankel engine

Unit IV

1. **Cooling, Lubrication and Governing :**
   - 1.1 Necessity of engine cooling
   - 1.2 Properties of coolants
   - 1.3 Methods of cooling and their merits and demerits
   - 1.4 Function of Lubrication, lubrication systems of I.C. Engines
   - 1.5 Governing methods of I.C. Engines.
2. **I.C. Engines Performance :**
   - **2.1** Introduction to basic performance parameters
   - **2.2** Measurement of brake power by rope brake, prony brake and hydraulic dynamometer
   - **2.3** Measurement of Indicated power by engine indicator and Morse test method.
   - **2.4** Energy balance sheet of I.C. engines
   - **2.5** Numerical problems

Unit V

1. **Gas Turbines :**
   - 1.1 Classification and application of gas turbines
   - 1.2 Description of constant pressure (open cycle and closed cycle) and constant volume gas turbines.
   - 1.3 Methods of increasing thermal efficiency of gas turbines, regeneration, inter cooling, re-heating.
   - 1.4 Simple numerical problems

DME-404-P Internal Combustion Engine

1. **Dismantling and Assembly of -** Two-stroke petrol engine, study of various systems, replacement of packing and gaskets, tuning of carburetor setting of magneto points. Checking of engine after assembly for proper running.

2. **Dismantling and Assembly of -**

2.1 4-stroke diesel engine

2.2 Multi cylinder petrol engine - Adjustment of valve timing, Tappet adjustment, tuning of carburetor, Adjustment of pressure in injector, Checking of engine after assembly for proper running.

3. **Dismantling and Assembly of -**

3.1 Scooter carburetor

3.2 Solex carburetor

3.3 S.U. Carburetor

3.4 Study of flow diagram of different jet circuits, practice of various adjustments.

4. **Dismantling and Assembly of -** A. C.mechanical and electrical feed pumps of a petrol engine

5. Dismantling and assembly of diesel engine fuel pumps and injector Various adjustment, Fitting and cleaning of their filters.

6. To draw the energy balance sheet of diesel engine. Use of indicator diagrams to find I.P. determining various efficiencies.

7. To draw energy balance sheet of a multi cylinder petrol engine (I.P. by Morse test). Determining various efficiencies.

8. To draw energy balance sheet of single cylinder petrol engine and draw efficiency and sfc curves.

9. Study of an air compressor and to conduct performance test.

REFERENCE BOOKS :

1. Internal Combustion Engine — Mathur & Sharma
2. Thermal Engineering (In Hindi) — Verma & Gulecha
3. Thermal Engineering Vol 1 — Mathur & Metha.
4. Thermal Engineering — R.S. Khurmi

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DME-405 Workshop Technology – I

Unit I

1. Cutting Tools and Materials :

1.1 Cutting tools
- 1.1.1 Standard shape of single point tool
- 1.1.2 Cutting angles, effect of rake angle, importance of clearance angle
- 1.1.3 Heat produced by cutting and its effect
- 1.1.4 Cutting speed, feed and depth of cut

1.2 Materials
- 1.2.1 Materials of cutting tools and their properties
- 1.2.2 High-speed steel, cobalt steel, tungsten carbide, cemented carbide, stellite, diamond, ceramics.

Unit II

1. Lathe Machine :

1.1 Specifications, Classification of lathe machines
1.2 Constructional features of a centre lathe and its function
1.3 Functions of various parts of lathe
1.4 Different operations, which can be performed on the centre, lathe with and without attachments.
1.5 Calculation of gear trains for thread cuttings
1.6 Lathe attachments and lathe accessories.

Unit III

1. Drilling Machines :

1.1 Description, working and uses of different drilling machines, Multi spindle drill, gang drill, deep hole drill and small diameter hole drill machines.
1.2 Specifications and constructional features of radial arm and upright drilling machines
1.3 Work holding devices, tool holding devices
1.4 Description and types of drills and reamers
1.5 Various operations of drilling machines e.g. drilling, reaming, boring, counter-boring, counter sinking, spot facing, tapping.
1.6 Selection of drill
1.7 Cutting speed and feed according to material of job.

Unit IV

1. Shaping, Planing and Slotting Machines :

1.1 Description, working and uses of various types of shapers, planers and slotters
1.2 Specification, constructional features of a shaper and planer in detail
1.3 Mechanism used in shaper - crank and slotted link, whitworth quick return and hydraulic mechanism, Feed mechanism
1.4 Mechanism of planer
1.5 Various works holding devices and clamping devices used on shaper and planer
1.6 Various shaper and planer operations
1.7 Shaper and planer tools
1.8 Cutting speed, feed and depth of cut on shaper and planer
1.9 Difference between shaper, planer and slotter

Unit V

1. Cutting Fluids and Cooling Process :

1.1 Difference between cutting fluid and coolant
1.2 Functions of cutting fluid and its action
1.3 Requirements of good cutting fluid
1.4 Types of cutting fluids
1.5 Selection of cutting fluids for different material and operations.

DME-405-P Workshop Technology – I

1. Grinding of various types of single point cutting tools
2. Simple exercise on Lathe Machine involving following operations
   - 2.1 Simple turning, facing, step turning, Grooving knurling and taper turning, by compoundrest
   - 2.2 Facing, drilling, boring and step turning, parting off.
   - 2.3 Taper turning by tailstock off set method
   - 2.4 V threading, square threading and taper threading by attachment
   - 2.5 A utility job on lathe machine with a tolerance of ± 0.2 mm
3. Preparing a M.S. block with all faces finished and V grooved on shaper machine
4. Planning practice on a planer on a rectangular C.I plate.
5. Internal slot cutting on the slotter machine

REFERENCE BOOKS :

1. Workshop Technology (Hindi) - II	Tahil Manghnani
2. Workshop Technology (Hindi) - II	B.S.Raghuvanshi
3. Workshop Technology - II	Hazra Chaudhary.
4. Workshop Technology (Hindi)	S.K.Bhatnagar
5. Production Technology	R.K. Jain
6. All About M/C Tools	Gerling

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DME-406 Energy Audit and Management

Unit- I

Energy Scenario: Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, Indian energy scenario, Sectoral energy consumption (domestic, industrial and other sectors), energy needs of growing economy, energy intensity, long term energy scenario, energy pricing, energy security, energy conservation and its importance, energy strategy for the future.

Basics of Energy and its various forms: Electricity basics – Direct Current and Alternative Currents, electricity tariff, Thermal Basics-fuels, thermal energy contents of fuel, temperature and pressure, heat capacity, sensible and latent heat, evaporation, condensation, steam, moist air and humidity and heat transfer, units and conversion, Metric Ton Oil Equivalent conversions.

Unit- II

Energy Management & Audit: Definition, energy audit, need, types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel and energy substitution, energy audit instruments and metering, precautions, thermography, smart metering.

Unit- III

Heating, ventilation, air conditioning (HVAC) and Refrigeration System: Introduction to Psychometrics, Vapor compression refrigeration cycle, refrigerants, coefficient of performance, capacity, factors affecting Refrigeration and Air conditioning system performance and savings opportunities. Vapor absorption refrigeration system: Working principle, types and comparison with vapor compression system and saving potential, heat pumps and their applications, section on ventilation system, ice bank system, and performance assessment of window and split room air conditioners, Star labeled pumps, cold storage refrigeration, and humidification system.

Fans and blowers: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Pressure drop calculation.

Unit- IV

Pumps and Pumping System: Types, performance evaluation, efficient system operation, flow control strategies and energy conservation opportunities. Energy conservation in boiler feed water pump, pumping systems for municipal drinking water, and sewerage, agriculture pump sets.

Cooling Tower: Types and performance evaluation, efficient system operation, flow control strategies and energy saving opportunities assessment of cooling towers. fan less cooling tower, natural draft cooling tower, cooling water treatment.

Lighting System: Light source, choice of lighting, luminance requirements, and energy conservation avenues. Light Emitting Diodes (LEDs), metal halides, fluorescent tube lights, Compact fluorescent lamps (CFL), labeling scheme, high efficiency street lighting, electronic ballast, occupancy sensors, energy efficient lighting controls.

Unit- V

Diesel/Natural gas Power Generating systems: Factors affecting selection, energy performance assessment of diesel conservation avenues. Waste heat recovery.

Energy conservation in Buildings and Energy Conservation Building Codes (ECBC): About Energy Conservation Building Codes (ECBC), building envelope, insulation, lighting, Heating, ventilation, air conditioning (HVAC), fenestrations, water pumping, inverter and energy storage/captive generation, elevators and escalators, star labeling for existing buildings, Energy Service Companies based case studies.

DME-406-P Energy Audit and Management

1. Residential House Wiring Using switches, Fuse, Indicator, Lamp and Energy Meter
2. Types of Wiring
3. Measurements of Electrical Quantities – Voltage, Current, Power and Power Factor in RLC Circuit
4. Measurement of Energy Using Single Phase / Three Phase energy Meter
5. Study Troubleshooting of Electrical Equipment
6. Study of Various Electrical gadgets
7. Assembly of Choke of Small Transformer

8. To prepare a project report on energy audit of following (any one)

8.1 Energy Audit assessments in power plants.

8.2 Energy Audit assessments in steel industry.

8.3 Energy Audit assessments in process industry (cement and textile).

8.4 Energy Audit assessments in buildings and commercial establishments.

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DME-407 Theory of Machines

Unit I

1. Simple Mechanism :

1.1 Introduction to link, kinematic pair, kinematic chain, structure, mechanism, machine
1.2 Slider crank mechanism and its inversion
1.3 Double slider crank chain
1.4 Example of mechanism with higher pairs

2. Velocity and Acceleration in Mechanism :

2.1 Velocity diagrams of four bar and single slider crank mechanisms by relative velocity method and instantaneous centre method
2.2 Acceleration diagram of four bar chain and reciprocating engine mechanism

Unit II

1. Dynamics of Reciprocating Parts :

1.1 Analytical method for velocity and acceleration of piston
1.2 Piston effort, crank pin effort, turning moment diagrams
1.3 Fluctuation of energy and speed
1.4 Energy of a flywheel
1.5 Calculating the weight of flywheel.

Unit III

1. Friction :

1.1 Friction of collars and pivots
1.2 Friction clutches-plate clutch and centrifugal clutch
1.3 Friction in journal bearings
1.4 Rolling friction
1.5 Prony brake, Rope brake and Froude's hydraulic dynamometer.

Unit IV

1. Transmission of Power :

1.1 Flat and V-belt drives
1.2 Velocity ratio of belt drives, slip in belt, and creep in belt.
1.3 Length of open and cross belt drives
1.4 Power transmitted by a belt
1.5 Ratio of driving tension, centrifugal tension, Condition for the maximum power transmission, initial tension in the belt.
1.6 Chain drives - types of chain drives roller chain and inverted tooth chain.
1.7 Gear drives - Types of gear wheels, proportions of gear tooth
1.8 Gear trains - Simple gear train, compound gear train, reverted gear train and simple epicyclical gear train.

Unit V

1. Balancing :

1.1 Static and dynamic balancing
1.2 Balancing of single rotating mass by a single mass in the same plane, by two masses rotating in different planes.
1.3 Partial primary balancing of a single cylinder reciprocating engine

2. Vibration :

2.1 Causes of vibrations in machine, their effects and method of reducing them
2.2 Free or natural vibration
2.3 Forced vibration
2.4 Damped vibration.

REFERENCE BOOKS :

1. Theory of Machines — Jagdishlal
2. Theory of Machines — R.S.Khurmi
3. Theory of Machines — Abdullah Sharif
4. Theory of Machines — Malhotra, Gupta
5. Theory of Machines — S.S. Ratan

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DME-501 Industrial Engineering & Computer Aided Drafting

Unit I

1. Production, Planning and Control :

1.1 Definition and importance, types of production -job, batch and mass forecasting, routing, scheduling, dispatching and follow up.

1.2 Break even analysis and Gantt chart

1.3 Project scheduling, application of CPM and PERT techniques

1.4 Analysis and control of project cost in CPM and PERT, simple numerical problems.

2. Inventory Control :

2.1 Definition, types of inventory - Codification and standardization

2.2 ABC analysis. Economic ordering quantity

2.3 Procurement cost, carrying charges, lead-time, re-order point, simple problems.

Unit II

1. Inspection and Quality Control :

1.1 Definitions, types of inspection and procedure

1.2 Statistical quality control - Basic theory of quality control, Process capability

1.3 Control charts for variables – $\bar{X}$ and R, relationship between control limits and specification limits. Control chart for fraction defective (p), control chart for number of defect (c)Acceptance sampling - Selection of samples, sample size, method of taking samples. Samplings plan - single, double, sequential. Acceptance quality level (AQL), lot tolerance percentage defective (LTPD), producer's risk, consumer's risk. Operating characteristic curve, simple problems.

2. Work Study :

2.1 Definition, advantages and procedure of work-study. Difference between production and productivity, Factors to improve productivity

2.2 Method Study :- Definition, objectives and procedure of method study.

2.3 Symbols, flow process chart (man-machine-material), flow diagram, machine chart, two hand chart

2.4 Critical examination. Developing a new method Principles of motion economy. Therblig symbols, SIMO chart simple problems.

Unit III

1 Plant Location and Layout :

1.1 Definition, factors affecting the site selection of plant

1.2 Factor affecting plant layout

1.3 Types of layout - process, product, combination and fixed position layout

1.4 Techniques in making layout-Flow diagram, templates, distance volume matrix, travel chart

1.5 Line balancing, workstation, Numerical problem.

2 Material Handling :

2.1 Principles of economic material handling

2.2 Hoisting equipment - forklift truck, Cranes- mobile motor cranes, overhead cranes, travelling bridges crane. Derrick crane. Whiler crane

2.3 Conveying equipment - Package conveyors, gravity roller conveyors, screw conveyors, flight or scraper

2.4 conveyors, bucket conveyors, bucket elevators, belt conveyors, pneumatic conveyors.

Unit IV

1. **Overview of Computer Graphics**: - Picture representation, Coordinate Systems, Output Graphics Display devices. Raster Scan Graphics : DDA for line generation and Bresenham's algorithm for line and circle generation.

2. Wire frame models, Parametric representation of curves, Plane curves: line, circle, ellipse, parabola and hyperbola. Space curves : Cubic spline curve, Bezier Curve and B Spline Curves. Blending of Curves.

Unit V

Surface models and entities Parametric representation of Hermite Bicubic surfaces, Bezier surfaces and B-spline Surfaces. Solid Models and entities, Solid Representation: B-rep. and CSG. Comparison between three types of models**.**

DME-501-P Industrial Engineering & Computer Aided Drafting

EXPERIMENTS TO BE PERFORMED (MINIMUM FIVE EXPERIMENTS)

1. Introduction & different features of the CAD Software
2. 2-D Drafting
3. 3-D Modeling
4. 3-D Advanced Modeling
5. Assembly modeling
6. Feature Modification and Manipulation
7. Detailing
8. Sheet Metal Operations
9. Surface Modeling
10. One Dimensional problems of Finite Element Method. *(These exercises may be performed by any of the following Advanced CAD Software such as Pro E /Unigraphics/ AotoCAD Inventor)*

REFERENCE BOOKS:

1.	Industrial Engineering (Hindi)	V.K.Sharma
2.	Industrial Engineering	S.C.Sharma
3.	Industrial Engg. & Management	T.R.Banga
4.	Elements of Work Study	Suresh Dalela
5.	Construction Equipment	Mahesh Verma
6.	Construction Equipment	S.C.Sharma
7.	Industrial Engg. & Management	O.P. Khanna
8.	Production, Operation Management	B.S. Goel

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DME-502 Safety in engineering industry

Unit I

SAFETY IN METAL WORKING MACHINERY AND WOOD WORKING MACHINES
General safety rules, principles, maintenance, Inspections of turning machines, boring machines, milling machine, planning machine and grinding machines, CNC machines, Wood working machinery, types, safety principles, electrical guards, work area, material handling, inspection, standards and codes- saws, types, hazards.

Unit II

PRINCIPLES OF MACHINE GUARDING
Guarding during maintenance, Zero Mechanical State (ZMS), Definition, Policy for ZMS – guarding of hazards - point of operation protective devices, machine guarding, types, fixed guard, interlock guard, automatic guard, trip guard, electron eye, positional control guard, fixed guard fencing- guard construction- guard opening. Selection and suitability: lathe-drilling-boring-milling-grinding-shaping-sawing-shearingpresses- forge hammer-flywheels-shafts-couplings-gears-sprockets wheels and chains-pulleys and belts-authorized entry to hazardous installations-benefits of good guarding systems.

Unit III

SAFETY IN WELDING AND GAS CUTTING
Gas welding and oxygen cutting, resistances welding, arc welding and cutting, common hazards, personal protective equipment, training, safety precautions in brazing, soldering and metalizing – explosive welding, selection, care and maintenance of the associated equipment and instruments – safety in generation, distribution and handling of industrial gases-colour coding – flashback arrestor – leak detection-pipe line safety-storage and handling of gas cylinders.

Unit IV

SAFETY IN COLD FORMING AND HOT WORKING OF METALS
Cold working, power presses, point of operation safe guarding, auxiliary mechanisms, feeding and cutting mechanism, hand or foot-operated presses, power press electric controls, power press set up and die removal, inspection and maintenance-metal sheers-press brakes. Hot working safety in forging, hot rolling mill operation, safe guards in hot rolling mills – hot bending of pipes, hazards and control measures. Safety in gas furnace operation, cupola, crucibles, ovens, foundry health hazards, work environment, material handling in foundries, foundry production cleaning and finishing foundry processes.

Unit V

SAFETY IN FINISHING, INSPECTION AND TESTING
Heat treatment operations, electro plating, paint shops, sand and shot blasting, safety in inspection and testing, dynamic balancing, hydro testing, valves, boiler drums and headers, pressure vessels, air leak test, steam testing, safety in radiography, personal monitoring devices, radiation hazards, engineering and administrative controls, Indian Boilers Regulation.

DME-502-P safety in engineering industry

1. NOISE LEVEL MEASUREMENT AND ANALYSIS
Measurement of noise level for various sources – Impact, continuous and intermittent.
Frequency and spectrum analysis of noise: *Instrument – precision type of Noise level meter with frequency and spectrum analyzer.*
2. VIBRATION MEASUREMENT AND ANALYSIS
Measurement of whole body vibration for various acceleration: *Instrument – vibration simulator and vibration analyzer*

3. FRICTION SENSITIVITY TEST Measurement of friction sensitivity for unstable materials: *Instrument – BAM friction tester*
4. IMPACT SENSITIVITY TEST Measurement of impact sensitivity for unstable materials: *Instrument – BAM fall hammer*
5. THERMAL REACTIVITY TEST Measurement of thermal reactivity for unstable materials: *Instrument – DSC/TGA*
6. EXHAUST GAS MEASUREMENT AND ANALYSIS Measurement of Exhaust gas measurement of IC engines: *Instrument – Gas analyzer*
7. BREATHING ZONE CONCENTRATION Measurement of breathing zone concentration of dust and fumes: *Instrument – personal air sampler*
8. AMBIENT AIR MONITORING Measurement of respirable and non-respirable dust in the ambient air: *Instrument* – High volume sampler
9. CONSEQUENCE ANALYSIS Soft computing skills on developing effects of fire & explosion and dispersion: *Software – PHAST 1 and ALOHA*
10. STUDY OF PERSONAL PROTECTIVE EQUIPMENT: Safety helmet, belt, hand gloves, goggles, safety shoe, gum boots, ankle shoes, face shield, nose mask, ear plug, ear muff, apron and leg guard.
11. STUDY OF FIRE EXTINGUISHERS Selection and demonstration of first-aid fire extinguishers: soda acid, foam, carbon dioxide (CO2), dry chemical powder, halon.

REFERENCE BOOKS:

1. "Accident Prevention Manual" – NSC, Chicago, 1982.
2. "Occupational safety Manual" BHEL, Trichy, 1988.
3. "Safety Management by John V. Grimaldi and Rollin H. Simonds, All India Travelers Book seller, New Delhi, 1989.
4. "Safety in Industry" N.V. Krishnan Jaico Publishery House, 1996.
5. Indian Boiler acts and Regulations, Government of India.
6. Safety in the use of wood working machines, HMSO, UK 1992.
7. Health and Safety in welding and Allied processes, welding Institute, UK, High Tech.
Publishing Ltd., London, 1989.

DME-503 Metrology

Unit I

1. **Limits, Fits and Tolerance:**
   - 1.1 Interchangeability - control and need
   - 1.2 Definitions and Terminology of limits, fits and tolerances
   - 1.3 Basis of limit system
   - 1.4 Type of fits
   - 1.5 Limit gauges
2. **Machine Tool Metrology:**
   - 2.1 Alignment tests
   - 2.2 Performance tests

   Alignment test on lathe and drilling machine

Unit II

1. **Introduction to Metrology:**
   - 1.1 Units and standards of measurement
   - 1.2 International, National and company standards
   - 1.3 Line and end standards
   - 1.4 Errors in measurement
   - 1.5 Precision and accuracy
2. **Linear and Angular Measurement:**
   - 2.1 Vernier calliper, micrometers, height and depth gauges
   - 2.2 Bevel protractor, sine bar, slip gauges, angle gauges and clinometers
   - 2.3 Auto collimator, angle dekkar,
   - 2.4 Taper measurements
   - 2.5 Cylinder bore gauge, Telescopic gauge, feeler and wire gauge

Unit III

1. **Measurement of Surface Finish :**
   - 1.1 Meaning of surface texture, primary and secondary texture
   - 1.2 Terminology of surface roughness
   - 1.3 Factors affecting surface finish
   - 1.4 Representation of surface roughness parameters CLA and RMS values
   - 1.5 Comparison and direct instrument methods of surface finish measurements.

Unit IV

1. **.Comparators:**
   - 1.1 Classification, advantages and working mechanism of dial indicators, passmeters
   - 1.2 Mechanical, Electrical, Electronic and pneumatic comparators
2. **Light Wave Interference:**
   - 2.1 Principle of interference
   - 2.2 Interferometry applied to flatness testing
   - 2.3 N.P.L. flatness interferometer

Unit V

1. **.Gear and Screw Measurement:**
   - 1.1 Screw thread terminology, errors in threads
   - 1.2 Effective diameter measurement by two wire and three wire methods
   - 1.3 Major and minor diameter measurement, Thread micrometers
   - 1.4 Gear tooth terminology
   - 1.5 Gear tooth vernier calliper and its application
   - 1.6 Measurement of gear pitch.

DME-503-P Metrology

1. Internal and External measurement with the vernier calliper
2. Internal and External measurement with micrometer
3. Measurement with height and depth gauges.
4. Measurement with dial indicator using surface plate and accessories for -
   - 4.1 Flatness
   - 4.2 Concentricity
5. Measurement with combination set and bevels protractor
6. Measurement of thread characteristics
7. Study and use of slip gauges and limit gauges.
8. Internal and external taper measurement.
9. Measurement of gear characteristics
10. Measurement of angle with sine bar and slip gauges
11. Study and use of comparators and tool room microscopes.
12. Measurement of bore with cylinder dial gauge for ovality and taper.
13. Measurement of worn out I.C. Engine piston, clearance between cylinder and piston and between bearing and journal

Note : Industrial visit can be arranged to show these practicals to the students.

REFERENCE BOOKS :

1.	Workshop Technology (Hindi) - II	Tahil Manghnani
2.	Workshop Technology (Hindi) - II	B.S.Raghuvanshi
3.	Workshop Technology - II	Hazra & Chaudhary.
4.	Workshop Technology (Hindi)	S.K.Bhatnagar
5.	Production Technology	R.K. Jain
6.	All About M/C Tools	Gerling
7.	Engineering Metrology	R.K.Jain
8.	Engineering Precision Metrology	R.C.Gupta
9.	Engineering Metrology (Hindi)	Mittal
10.	Engineering Metrology (Hindi)	Bhatnagar.
11.	Engineering Metrology	R.K.Rajput
12.	Metrology Lab Manual	Adithen, Bahl
13.	Metrology	M. Mahajan

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DME-504 Thermal Engineering- II

Unit I

1. Steam Nozzles :

1.1 Flow of steam through convergent- divergent nozzle
1.2 Velocity of steam leaving nozzles, Mass of steam discharged through nozzles.
1.3 Critical pressure ratio.
1.4 Area of cross section of throat and exit for maximum discharge. Length of nozzle
1.5 Supersaturated flow
1.6 Numerical problems.

Unit II

1. Steam Turbines :

1.1 Classification and industrial application of steam turbines.
1.2 Principle and operation of impulse and reaction turbine
1.3 Compounding of turbines
1.4 Description of simple De-Laval turbine, velocity diagram, work done and efficiency.
1.5 Description of Parson's reaction turbine, velocity diagram, work done and efficiency.
1.6 Reheating of steam, Bleeding of steam'
1.7 Lubrication system for steam turbines
1.8 Blade materials and defects in blades
1.9 Simple numerical problems.

Unit III

1. Steam Condenser :

1.1 Introduction, main elements of a condensing plant
1.2 Types of condenser
1.3 Low level, high level and ejector type of jet condenser
1.4 Down flow, central flow, inverted flow, regenerative and evaporative type of surface condenser
1.5 Source of air leakage and its effect
1.6 Condenser efficiency and Vacuum efficiency
1.7 Numerical problems.

Unit IV

1. Air Pumps and Cooling Tower :

1.1 Types of air pumps
1.2 Description of wet and dry types air pumps
1.3 Types of cooling towers
1.4 Description of cooling towers

2. Heat Transfer :

2.1 Importance of Heat Transfer
2.2 Mode of Heat transfer
2.2.1 Conduction
2.2.2 Convection
2.2.3 Radiation

Unit V

1.Conduction :

1.1 Fourier's law
1.2 Heat transfer by conduction through a plane & composite wall
1.3 Radial Heat transfer by conduction through a cylinder & sphere
1.4 Overall Heat transfer coefficient
1.5 Critical insulation
1.6 Heat transfer through fins
1.7 Numerical problem

2 Convection :

2.1 Natural convection
2.2 Forced convection
2.3 Heat exchangers

3 Radiation :

3.1 Absorption, Reflection and transmission
3.2 Radiant energy distribution curve
3.3 Emissive power
3.4 Black body & white body
3.5 Grey body
3.6 Kirchoff 's law
3.7 Wien's displacement law
3.8 Planks law & Stefan Boltzman's law
3.9 Radiosity
3.10 Shape factor

DME-504-P Thermal Engineering- II

1. Study of steam turbine
2. Study of steam condensers, Jet condenser and surface condenser
3. Study of air pump
4. Study of cooling towers
5. Study of heat transfer equipments available in the laboratory.

REFERE CE BOOKS :

1. Thermal Engineering Vol. I & Vol. II — Mathur & Mehta
2. Thermal Engineering — R.K. Rajput
3. Thermal Engineering — R.K. Purohit
4. Thermal Engineering — Raynor Joel
5. Elements of Heat Engineering (Vol I & II) — Patel & Karamchandani
6. Thermal Engineering — Rai & Sonrao (Satya Prakashan)
7. Heat Transfer — Arora & Domkundwar

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DME-505 Workshop Technology – II

Unit I

1. Metal Cutting Saws :

1.1 Specifications, description, working and uses of sawing machine

1.2 Description, specification of cutters/ blade for sawing machines, blade setting.

2. Boring :

2.1 Principle of boring

2.2 Classification of boring machines and their description

2.3 Specification of boring machine

2.4 Boring tools

2.5 Boring bars and boring heads

2.6 Description of Jig boring machine

Unit II

1. Milling Machine :

1.1 Specifications and working principle of milling machine

1.2 Classification of milling machines and their brief description and their applications.

1.3 Details of column and knee type milling machine

1.4 Milling machine accessories and attachment -Arbors, adaptors, collets, vices, circular table, indexing head and tail stock, vertical milling attachment, spiral milling attachment, slotting attachment and rack milling attachment.

1.5 Work holding devices.

1.6 Milling methods-up milling and down milling

1.7 Various types of milling cutters and mandrels for milling machines

1.8 Milling operations-face milling, angular milling, form milling, straddle milling and gang milling

1.9 Cutting speed and feed. Simple numerical problems

1.10 Indexing on dividing heads, plain and universal dividing heads

1.11 Indexing methods : direct, plain or simple, compound, differential and angular indexi

1.12 Numerical problems on indexing

1.13 Helical and spiral milling

1.14 Introduction to machining centre

Unit III

1. Grinding and Grinding Machines :

1.1 Purpose of grinding

1.2 Various elements of grinding wheel – Abrasive, Grade, Structure, Bond

1.3 Common wheel shapes and types of wheels - built up wheels, mounted wheels and diamond wheels. Specifications of grinding wheels as per BIS

1.4 Truing and dressing, balancing and mounting of wheel

1.5 Grinding methods: surface grinding, cylindrical grinding and centreless grinding.

1.6 Grinding Machines- cylindrical grinders, surface grinders, internal grinders, centreless grinders and tools and cutter grinders.

1.7 Selection of grinding wheel

2. Capstan and Turret Lathes :

2.1 Concept of ram or capstan type and turret or saddle type machine

2.2 Principal parts of capstan and turret lathes

2.3 Capstan and Turret lathe mechanism : Turret indexing mechanism, Bar feeding mechanism
2.4 Work holding devices : Jaw and collet chucks
2.5 Tool holding devices : slide tool holder, knee tool holder, knurling tool holder, recessing tool holder, form tool holder, Tap and Die holder, V-steady box tool holder, roller steady box tool holder
2.6 Introduction to turret tooling layout
2.7 Difference among capstan, turret and conventional lathe.

Unit IV

1. Automatic Machines :

1.1 Brief description of single spindle and multi-spindle automatic machines viz. Swiss type automatic screw machine and Turret type screw machines
1.2 Transfer Machines- Inline , Rotary Indexing Table , Drum Machines

2. Metal Finishing Processes :

2.1 Purpose of finishing surfaces
2.2 Description of lapping, super finishing, polishing and buffing processes
2.3 Description of honing machine and honing tools

Unit V

1. **Maintenance of Machine Tools :**

1.1 Importance of maintenance
1.2 Different type of maintenance
1.3 Sequence of maintenance operation : Disassembly, washing, fault finding, assembly

2. Installation and Testing of Machine Tools :

2.1 Different types of machine foundation
2.2 Foundation plan
2.3 Machine tool testing

DME-505-P Workshop Technology – II

1. Face milling.
2. Gear cutting on a milling machine. (Spur and Bevel)
3. Key way cutting on shaft
4. Exercise on gang milling
5. Job on Capstan lathe and Turret lathe.
6. Job on grinding machine.
   - 6.1 Surface grinding
   - 6.2 Cylindrical grinding (internal and external)
   - 6.3 Centre less grinding (internal and external)
7. Milling cutter grinding on tool and cutter grinder
8. Job using copying attachment on lathe
9. Exercises on honing and lapping machine
10. Super finishing practice on lathe
11. Maintenance of milling, Grinding and Lathe machines

REFERE CE BOOKS :

1. Workshop Technology II — Hazra Chaudhary
2. Workshop Technology II — Raghuvanshi
3. Production Technology — R.K.Jain & S.C. Gupta
4. Workshop Technology (Hindi) — Tahil Maghnani
5. Production Technology — H.M.T
6. Workshop Technology II & III — Chapman
7. Production Technology — Pandey & Singh

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DME-506 Power Plant Engineering

Unit I

1. Introduction :

1.1 Different types of conventional sources of energy
1.2 Base load and peak load plants
1.3 Scope of conventional energy sources in India
1.4 Status of conventional power plants in India

2. Thermal Power Plants :

2.1 General layout and working
2.2 Factors of site selection
2.3 Methods of coal handling
2.4 Unloading devices
2.5 Ash handling system
2.6 Concept of super thermal power plants
2.7 Combustion equipment
- 2.7.1 Basic requirements
- 2.7.2 Methods of coal burning : Hand firing, Stroker fired systems, Pulverised fuel fired system
- 2.7.3 Coal Burners : Stream line, Turbulent types
- 2.7.4 Combustion control, fluidised bed combustion

Unit II

1. Hydro-Electric Power Plant :

1.1 Advantages and application of hydroelectric power plants
1.2 Elements of hydroelectric power plant
1.3 Plant layout of low head and high head intake
1.4 Combination of Hydel – Thermal power plants Hydro electric power plants in India.

2. Nuclear Power Plant :

2.1 Introduction to nuclear reactions and nuclear fuels
2.2 Site selection of nuclear power plants
2.3 Nuclear reactors : various elements of nuclear reactors.
2.4 Comparison of nuclear power plant with thermal and hydel power plants
2.5 Common types of nuclear reactors
- 2.5.1 Pressurised water reactor
- 2.5.2 Boiling water reactor
- 2.5.3 Gas cooled reactors
- 2.5.4 Liquid metal cooled reactor

2.6 Nuclear power plants in India\
2.7 Hazards in nuclear power plants and safety measures
2.8 Nuclear waste disposal

Unit III

1. Diesel Power Plants :

1.1 Elements of a diesel power plant
1.2 Building and general layout
1.3 Use of diesel engine with steam power plants
1.4 Applications of diesel power plants
1.5 Limitation of diesel power plants

Unit IV

1.Gas Turbine Plants :

1.1 Classification and application
1.2 Elementary description of gas turbines
1.3 Details of elements of a gas turbine plant and plant layout
1.4 Advantages over thermal and diesel power plants

Unit V

1. **Power Plant Economics :**
   - 1.1 Elements of cost of power
   - 1.2 Factors affecting economics of generation and distribution of power
   - 1.3 Factors affecting choice and type of power plants on economics of power generation
   - 1.4 Simple numerical problems on cost of power generation.
2. **Renwal Energy Sources :**
   - 2.1 Present position of conventional energy sources in India
   - 2.2 Need for non-conventional energy sources
   - 2.3 Various alternate energy sources – solar, biogas, wind, geothermal, tidal, Magneto hydro dynamic, thermo electric power etc.

REFERENCE BOOKS:

1.	Power Plant Engineering	Dr. Mahesh Verma
2.	Power Plant Engineering	Keshwani
3.	Power Plant Engineering	Domkumdwar
4.	Power Plant Engineering (Hindi)	Prakash & Kumar
5.	Power Plants Engineering	P.K. Nag (TMH)
6.	Power Plants	G.R. Nagpal
7.	Power Plants Technology	M.M. El-Wakil (Mc-Graw Hill)
8.	Non Conventional Energy Sources	G.D. Rai (Khanna Pub.)
9.	Energy Technology – Non Conventional	S.Rao (Khanna Pub.)
10.	Non Conventional Sources of Energy (Hindi)	Agrawal & Gupta (Nav Bharat)

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DME-601 Refrigeration and Air- Conditioning

Unit I

1.Principles of Refrigeration :

1.1 Meaning : heat pump, refrigeration
1.2 Refrigeration methods
1.3 Units of refrigeration machines
1.4 Rating of refrigeration machines

2. Refrigeration System :

2.1 Air Refrigeration System
- 2.1.1 Reversed Carnot cycle, theoretical and actual. Reversed Brayton cycle-closed and open system.
- 2.1.2 Applications and limitations
- 2.1.3 Advantages and disadvantages of air refrigeration cycle

2.2 Vapour Compression System
- 2.2.1 Theoretical vapour compression cycle
- 2.2.2 Effect of sub- cooling, super heating on compression cycle
- 2.2.3 Deviation of actual cycle from theoretical cycle
- 2.2.4 Coefficient of performance
- 2.2.5 Effect of varying condensing and suction temperatures and pressure on C.O.P.
- 2.2.6 Use of p-h chart. Simple numerical problems

2.3 Methods of improving C.O.P.
- 2.3.1 Flash chamber
- 2.3.2 Sub cooling of liquid refrigerant by using vapour refrigerant
- 2.3.3 Sub cooling by external cooling source
- 2.3.4 Sub cooling with liquid refrigerant

2.4 Vapour Absorption System
- 2.4.1 Simple vapour absorption systems
- 2.4.2 Comparison with vapour compression system
- 2.4.3 Electrolux refrigerator

Unit II

1.Refrigerants:

1.1 Classification
1.2 Important properties of refrigerants
1.3 Nomenclature of refrigerants.
1.4 Refrigerants - primary refrigerants, secondary refrigerants.
1.5 New refrigerants viz : Tetraflouroethane, propone and isobutene

2 Refrigeration System, Components and Controls :

2.1 Reciprocating compressors, rotary compressors, centrifugal compressors
2.2 Condensers of various types
2.3 Cooling towers, spray ponds,
2.4 Evaporators of various types
2.5 Defrosting and throttling devices
2.6 Automatic expansion valve, thermostatic expansion valve and capillary tube, solenoid valve.

Unit III

1. Refrigeration Applications :

1.1 Domestic and commercial refrigerators, their systems, specifications and types
1.2 Water coolers of various types
1.3 Effect of moisture in refrigeration system and methods of removing it.

2.Production of Low Temperature :

2.1 Introduction
2.2 Limitation of vapour compression system in creating of low temperature
2.3 Two stage cascade refrigeration system (no analysis)
2.4 Manufacturing of dry ice (no numerical problems)

Unit IV

1. Pshychrometry :

1.1 Properties of air vapour mixture
1.2 Saturation of air, dry and wet bulb temperatures, dew point temperature, specific humidity, degree of saturation and relative humidity.
1.3 Enthalpy of moist air
1.4 Psychrometric chart and its uses.
1.5 Psychrometric processes, sensible heating and cooling, cooling with dehumidification and humidification, evaporative cooling,
1.6 Mixing of air streams.

Unit V

1. Air-conditioning :

1.1 Physiological basis of air conditioning
1.2 Human comfort, metabolism in human body, comfort chart and effective temperature.
1.3 Summer and winter design conditions
1.4 Air distribution system.

DME-601-P Refrigeration and Air- Conditioning

1. To aquatint with the use of refrigeration tools, charging board, special refrigeration tube fittings.
2. Copper tube jointing practice, flaring and brazing.
3. Study of domestic refrigerator & water cooler with electrical system and equipment arrangement.
4. Study of Window and Split Air-conditioner.
5. Study of following components-
   5.1 Compressor open and hermetic sealed type
   5.2 Expansion valves
   5.3 Starting and over load relay
   5.4 Thermostates
   5.5 Strainer and drier
6. Charging practice on refrigerating machine including making vacuum, pressure testing, charging and final testing for performance
7. Determination of psychrometric properties of air at different places with the help of sling- psychrometer and hygrometer.
8. Using refrigeration trainer test rig to find out its refrigerating capacity, power input and C.O.P.
9. Use of Air-conditioning trainer to find out C.O.P
10. To determine the Ice-making capacity and C.O.P. of an Ice plant.
11. Study of following plants by industrial visits.
    11.1 Ice plant
    11.2 Cold storage plant
    11.3 Central air condition plant
12. A seminar on study of various models of refrigerator and A.C. available in the market.

REFERENE BOOKS:

1. Refrigeration & Air Conditioning — Domkundwar
2. Refrigeration & Air Conditioning — Manohar Singh
3. Refrigeration & Air Conditioning — C.P.Arora
4. Principles of Refrigeration — Dossatt
5. Refrigeration & Air Conditioning — R.K. Rajput
6. Refrigeration & Air Conditioning — R.S. Khurmi

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DME-602 Automobile Engineering

Unit I

1. Introduction:

1.1 Classification of Automobiles

1.2 Chassis and body

1.3 Components of vehicle – basic structure, power unit, transmission system, accessories, superstructure. (Basic functions and arrangements)

1.4 Layout of conventional type vehicle (front engine rear wheel drive)

1.5 Vehicle dimensions – wheel base, wheel track, front & rear overhang, overall dimensions, minimum ground clearance, minimum turning radius.

2. Suspension System:

2.1 Basic functions of suspension system

2.2 Types - Independent and rigid, coil, leaf, torsion bar, air, rubber suspension (Elementary idea)

2.3 Conventional leaf spring rigid beam suspension for light vehicle and with helper spring for heavy vehicles.

2.4 Function, construction and working of Telescopic type shock absorber.

2.5 Sprung and unsprung weight.

Unit II

1. Braking Systems :

1.1 Purpose, principle, classification of brakes.

1.2 Layout and description of mechanical brakes.

1.3 Hydraulic brakes

1.3.1 Principle, layout

1.3.2 Construction & working of single and tandem master cylinder, wheel cylinder

1.3.3 Bleeding of hydraulic brakes

1.3.4 Brake fluids and characteristics

1.4 Maintenance of brakes, brake troubles and remedies.

1.5 Hand brakes

Unit III

1. Wheels and Tyres :

1.1 Wheels

1.1.1 Requirements of wheel

1.1.2 Types- pressed steel disc, wire, light alloy cast wheels

1.2 Tyres

1.2.1 Types (Tubed, Tubless, Cross ply, Radial ply

1.2.2 Cross section of a pneumatic tyre

1.2.3 Specification of tyres

1.2.4 Tyre maintenances, tyre trouble and repair

2. Front axle and Steering System:

2.1 Front axle - types and construction, front wheel stub axle assembly

2.2 Purpose and requirements of steering system

2.3 General arrangement of steering systems steering gear ratio

2.4 Steering system components – steering wheel, steering column, conventional steering linkage, steering and ignition lock

2.5 Construction and working details of different types of steering gear boxes

Unit IV

1. Power Transmission System :

1.1 Clutch :

1.1.1 Purpose and requirements of clutch
1.1.2 Construction of working detail of single plate, coil spring, clutch, multi plate clutch,
1.1.3 Dry and wet clutch
1.1.4 Construction of clutch plate

1.2 Gear Box :

1.2.1 Functions and types of gear boxes
1.2.2 Constructional and working of sliding mesh, constant mesh and synchronous mesh gear boxes
1.2.3 Construction and working of selector and inter locking mechanism

1.3 Final Drive:

1.3.1 Function and constructional details of - Propeller shafts, Universal joints, Sliding joint
1.3.2 Differential - Principles, function, construction and working of conventional differential
1.3.3 Different types of rear axles according to methods of supporting.

Unit V

1. Frame and Body:

1.1 Frame

1.1.1 Function of frame, loads or frame
1.1.2 Frame construction, sub-frame
1.1.3 Defects in frame chassis repair and alignment
1.1.4 Frame less construction

1.2 Body

1.2.1 Types and construction (parts of body)
1.2.2 Main features – strength, stiffness, space air drag, stream lining , weight, vibration, protection against weather, corrosion, safety and economy considerations.
1.2.3 Body alignment
1.2.4 Bumpers – types and functions

DME-602-P Automobile Engineering

1. Study of various tools used in Auto workshop.
2. Study of conventional layout of vehicle.
3. Study and inspection of suspension system of light and heavy vehicles.
4. Study of mechanical and hydraulic braking system and bleeding of hydraulic braking system.
5. Study of Steering system of four wheeler.
6. Study of clutch (single plate & multi plate).
7. Study of sliding mesh, constant mesh and synchronous mesh gear boxes.
8. Study of Propeller shafts, Universal joints, sliding joint, differential and rear axle.
9. Study of frame & body of vehicle.
10. Visit to nearby auto workshop and service station.

REFERENCE BOOKS :

1. Automotive Chassis & Body. P.L.Kohli.
2. Vehicle & Engine Technology (Vol. I & II) Heinz Heisler.
3. Basic Automobile Engineering C.P.Nakra.
4. Automobile Engineering. T.R.Banga & Nathu Singh.
5. Automobile Engineering H.S. Reyat
6. Automobile Engineering (Hindi & English) Kirpal Singh

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DME-603 Manufacturing Processes – II

Unit I

1. Metal Forming Process :

1.1 Forging
- 1.1.1 Forging process, open die forging, closed die forging (drop forging)
- 1.1.2 Press forging, upset forging, Swaging, up setters, roll forging
- 1.1.3 Cold and hot forging, forging defects and their remedies

1.2 Rolling
- 1.2.1 Elementary theory of rolling, types of rolling mills
- 1.2.2 Roll passes, rolling defects and remedies

1.3 Press forming
- 1.3.1 Types of presses, working, selection of press dies, die material.
- 1.3.2 Press operations - shearing piercing, trimming, punching, Notching, shaving, guering or rubber forming, embossing, stamping
- 1.3.3 Deep Drawing

1.4 Extrusion
- 1.4.1 Types of extrusion - Hot and Cold, Direct and Indirect

1.5 Drawing
- 1.5.1 Pipe drawing, Tube drawing

Unit II

1. Conventional Metal Cutting Processes :

1.1 Metal Cutting
- 1.1.1 Elementary theory of metal cutting, chip formation, continuous chip, continuous chips with B.U.E., discontinuous chips
- 1.1.2 Mechanism of chips formation, geometry of chip formation, forces on chip. Merchant's diagram
- 1.1.3 Tool life, Economics of tool life
- 1.1.4 Machinability
- 1.1.5 Factors affecting Machinability

1.2 Broaching Machine :
- 1.2.1 Classification and description of broaching machines
- 1.2.2 Elements of broach
- 1.2.3 Types of boraches

1.3 Gear manufacturing processes :
- 1.3.1 Gears hobbing
- 1.3.2 Gear shaping

1.4 Gear Finishing methods :
- 1.4.1 Gear shaving, gear burnishing

1.5 External threading processes :
- 1.5.1 Die heads, thread milling Thread grinding, thread rolling

Unit III

1. Newer Machining Processes: Introduction, fundamental principles, process, advantages and Limitation, application.

1.1 Mechanical Processes
- 1.1.1 Ultrasonic Machining (USM)
- 1.1.2 Abrasive jet machining (AJM)

1.2 Electro Chemical Processes
- 1.2.1 Electro chemical machining (ECM)
- 1.2.2 Electro chemical grinding (ECG)

1.3 Electrical Discharge Machining (EDM)
1.4 Laser beam machining (LBM)
1.5 Electron beam machining (EBM)
1.6 Plasma arc machining (PAM) and Welding

Unit IV

1. **Metallic Coating Processes:** Metal spraying, galvanizing, Electroplating and anodizing.
2. **Plastic Process - Working principle, Advantages and limitation of following process :**
   2.1 Injection moulding
   2.2 Blow moulding
   2.3 Compressive moulding

Unit V

1. **Jigs and Fixtures :**
   1.1 Importance and use of jigs and fixtures
   1.2 Principle of location
   1.3 Locating devices
   1.4 Clamping devices
   1.5 Types of jigs-Drilling jigs, bushes (fixed, liker, slip). Types of drilling jig - Template jigs, plate jig, channel jig, leaf jig.
   1.6 Fixture for milling, Advantages of jigs and fixtures

DME-603-P Manufacturing Processes – II

1. Exercise on forging operation by power hammers
2. Study of USM.
3. Exercise on buffing.
4. Exercise on lapping.
5. Exercise on super finishing.
6. Exercises on Electro plating.
7. Demonstration of Engine cylinder honing with the help of honing machine through industrial visit.
8. Design and manufacture of one drilling jig.
9. Design and manufacture of one milling fixture.
10. Demonstration of newer machining processes / metal cutting process/ plastic process through industrial visits.

REFEREN CE BOOKS :

1. Production Engineering — R.K. Jain
2. Manufacturing Science — Amitabha Ghosh & A.K. Mallik
3. Production Technology — Pandey.Singh
4. Manufacturing Technology — Gupta & Adithan
5. Modern Machining Methods — M.Adithan
6. Production Engineering — P.C. Sharma (S. Chand)
7. Introduction to Mfg. Process — John Schely (Mc-Graw Hill)
8. Metal Forming Process — G.R. Nagpal (Khanna Pub.)
9. Manufacturing Process – II — Bhatnagar, Sharma (Nav Bhart)

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DME-604 C.N.C. Machines and Automation

Unit I

1. Introduction :

1.1 NC machines
1.2 CNC machines
1.3 DNC machines
1.4 Advantages of NC machines over conventional machines
1.5 Difference between NC machines and SPM
1.6 Advantage and disadvantages of CNC machines over NC machines
1.7 Application of CNC machines

2. **Component of NC Machines :**

2.1 Basic components of NC system
2.2 Input mediums- punched cards, magnetic tapes, floppy disks and papers tape
2.3 NC coding
2.4 Machine control unit (MCU)
2.5 Sub units of MCU
2.6 Machines tool
2.7 Numerical control procedure

Unit II

1. Classification of Numerical Control Machines :

1.1 Classification based on feed back control system
1.2 Feed back devices – Velocity feed back devices and position feed back devices.
1.3 Classification based on motion control system
1.4 Interpolators
1.5 Classification based on circuit technology
1.6 NC coordinate system
1.7 Axis identification

2. Constructional Details of C C Machines :

2.1 Introduction
2.2 Machine structure
2.3 Slide ways
2.4 Spindle
2.5 Drive System
2.6 Motion transmission
2.7 Location of transducers
2.8 Swarf removal
2.9 Safety and guarding

Unit III

1. Tooling for CNC Machines :

1.1 Introduction
1.2 Cutting tools for CNC machines
1.2.1 Pre set tools
1.2.2 Indexable inserts
1.2.3 Qualified tools
1.3 Cutting tools material for CNC machines
1.4 Automatic tool changer (ATC)
1.5 Work holding devices

2. Fundamentals of Part Programming :

2.1 NC Words
2.2 Programming formats
2.3 Part programming for machining- point-to-point , straight line and along curved surface
2.4 Part programming for lathe, milling and drilling operations

Unit IV

1. **Advanced Part Programming :**
   - 1.1 Standardised fixed cycles
   - 1.2 Non- Standardised fixed cycles
     - 1.2.1 Do-loops
     - 1.2.2 Subroutines
2. **Computer Aided Part Programming :**
   - 2.1 Geometry statements
   - 2.2 Motion statements
   - 2.3 Post processor statements
   - 2.4 Auxiliary statements

Unit V

1. **Robotics :**
   - 1.1 Introduction
   - 1.2 Advantages of a robot
   - 1.3 Robot terminology
   - 1.4 Major Features of a robot
     - 1.4.1 Manipulator
     - 1.4.2 Controller
     - 1.4.3 Sensors
     - 1.4.4 Power supply unit
   - 1.5 Types of Robots
     - 1.5.1 According to the structure of Manipulator
     - 1.5.2 According to type of system
     - 1.5.3 According to type of control loops
   - 1.6 Application of robots.
2. **Automation in Manufacturing :**
   - 2.1 Introduction to machining centre
   - 2.2 Introduction to computer Integrated manufacturing (CIM)
   - 2.3 Introduction to flexible manufacturing system (FMS)
   - 2.4 Introduction to group technology (GT)
   - 2.5 Introduction to computer process planning (CAPP)

DME-604-P C.N.C. Machines and Automation

1. To prepare jobs on CNC machine by using various operations like turning, facing, taper turning, step turning, profile cutting, threading, chamfering etc on available machine.
2. To develop various types of CNC machine programmes.
3. Industrial Visit

REFERENCE BOOKS:

1. CNC Machine — Dhanpat Rai & Sons
2. CAD/CAM — Groover (TMH)
3. Computer Aided Manufacturing — Rao, Kundra, Tiari (TMH)
4. CAM — Vikram Sharma (S. K. Kataria & Sons)
5. CAM — S. Vishal (S. K. Kataria & Sons)

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DME-605 Machine Design

Unit I

1. Introduction :

1.1 General consideration in machine design
1.2 General procedure in machine design
1.3 Selection of material
1.4 Working stress and factor of safety, selection of factor of safety
1.5 Stress concentration, stress concentration factor and methods of reducing stress concentration
1.6 Fatigue and endurance limit
1.7 Effect of load, surface finish and size on endurance limit
1.8 Preferred number

Unit II

1. Design of Welding Joints :

1.1 Types of welded joint and Design of lap joint and butt joint
1.2 Strength of transverse and parallel fillet welded joints in axial loading
1.3 Basic welding symbols
1.4 Welded joint subjected to twisting moment and bending moment
1.5 Eccentrically loaded welded joints

2. Design of Screw and Bolts :

2.1 Initial stresses due to screwing up
2.2 Stress due to external forces
2.3 Stress due to combined forces
2.4 Bolt of uniform strength
2.5 Screw thread, designations and its dimensions.
2.6 Design of Power screw
2.7 Design of screw jack

Unit III

1. Design of Joints :

1.1 Design of simple cotter joints
1.2 Design of knuckle joints
1.3 Design of turnbuckle

2. Design of Keys and Couplings :

2.1 Design of sunk key
2.2 Design of rigid flange coupling
2.3 Design of pin type flexible couplings

Unit IV

1. Design of Shaft :

1.1 Shaft subjected to twisting moment
1.2 Shaft subjected to bending moment
1.3 Shaft subjected to combined twisting and bending moment

2. Design of Components :

2.1 Cast Iron pulley
2.2 Flywheel
2.3 Helical spring
2.4 Leaf spring.

Unit V

1. Bearings (no numerical problems) :

1.1 Introduction and Classification
1.2 Material used for bearings and their properties
1.3 Types and uses of rolling contact bearings
1.4 Standard dimension and designations of ball bearings
1.5 Selection of rolling elements bearings

2. **Lever:**

Introduction
Design of a hand lever
Design of a foot lever
Design of Lever for safety valve

DME-605-P Machine Design

1. Selection of material & IS coding
2. Selecting fit & assigning tolerances
3. Examples of Production considerations.
4. Helical compression, tension and torsional springs design
5. Curved Beams
6. Preloaded bolts and bolts subjected to variable stresses
7. Belt, Rope and Chain drive system
8. Gear Design

Problems on

1. Knuckle and Cotter joints
2. Torque : Keyed joints and shaft couplings
3. Design of screw fastening
4. Bending : Beams, Levers etc.
5. Combined stresses : Shafts, brackets, eccentric loading.
6. Design for rigidity (Transverse / Torsional)

REFERE CE BOOKS :

1. Machine Design	Pandya & shah
2. Machine Design	R.S.Khurmi
3. Machine Design	Sharma & Aggrawal
4. Machine Design	V. B. Bhandari
5. Engineering Design	J. E. Shieglay (McGraw-Hill)

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DME 606 Mechanical Estimating and Costing

Unit I

1. Introduction :

1.1 Estimating

- 1.1.1 Definition
- 1.1.2 Importance of estimating
- 1.1.3 Aims and functions
- 1.1.4 Estimating procedure

1.2 Costing

- 1.2.1 Definition
- 1.2.2 Aims of costing
- 1.2.3 Procedure of costing

1.3 Difference between estimating and costing

2. Elements of Costs :

2.1 Material cost
2.2 Labour cost
2.3 Expenses

- 2.3.1 Direct expenses
- 2.3.2 Indirect expenses

2.4 Component of cost
2.5 Overhead cost
2.6 Allocation of on cost

Unit II

1. Break Even Analysis and Equipment Replacement Analysis :

1.1 Break even analysis (cost, volume, profit analysts), determination of Break even point, break even point theory
1.2 Equipment Replacement Analysts

- 1.2.1 Regions
- 1.2.2 Policy
- 1.2.3 Guide line
- 1.2.4 Various methods

1.3 Hire Purchasing

2. Estimation of Material Cost :

2.1 Estimation of volumes, weights and cost of materials for

- 2.1.1 Pulley
- 2.1.2 Spindle
- 2.1.3 Lathe centre
- 2.1.4 Fly wheel
- 2.1.5 Crank shaft

Unit III

1. Labour Costing :

1.1 Type of Wage and Incentive
1.2 Wage Differentials
1.3 Methods of wage Payments
1.4 Job Evaluation

2. Estimation in Machining :

2.1 Cutting speed, feed and depth of cut
2.2 Setup time, operation time, machining, time tear down time, handling time
2.3 Allowances

2.4 Estimation of machining time for various lathe operations :
- 2.1.1 Turning
- 2.1.2 Facing
- 2.1.3 Threading
- 2.1.4 Drilling
- 2.1.5 Chamfering

2.5 Estimation of machining time for Milling operation
2.6 Estimation of machining time for Shaping operation
2.7 Estimation of machining time for Grinding operation
2.8 Metal removal rates

Unit IV

1. Estimation in Welding Shop :
- 1.1 Estimation of electric are welding cost
- 1.2 Estimation of gas welding
- 1.3 Estimation of gas cutting
- 1.4 Factors affecting welding cost

2. Estimation in Forging Shop :
- 2.1 Hand forging
- 2.2 Machine forging
- 2.3 Estimation of losses in forging operation , net weight, Time
- 2.4 Estimation of cost of forging operation

Unit V

1. Estimation in Pattern Making and Foundry Shop :
- 1.1 Pattern allowances
- 1.2 Estimation of pattern cost
- 1.3 Estimation of foundry shop

2. Estimation in Sheet Metal Shop :
- 2.1 Sheet metal operations
- 2.2 Sheet metal joints
- 2.3 Estimation of time and cost in sheet metal operations
- 2.4 Blank layout
- 2.5 Capacity for power press.

REFERENCE BOOKS:

1. Estimating & Costing — Banga & Sharma
2. Mechanical Estimating & Costing — O.P. Khanna
3. Mechanical Estimating & Costing — T.T.T.I.Madras

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