MANUFACTURING TECHNOLOGY-III

Periods/ Week: 5(4+1) Exam: 3 Hrs
Total Periods: 60 End Exam : 80 Marks
IA : 20 Marks
Total 100 Marks

Topic wise distribution of Periods

Sl. No.	Topics	Periods
1	Press Tools	12
2	Jigs and Fixture	12
3	Installation and testing of machine tools	12
4	Special Casting and Powder Metallurgy	12
5	Non conventional machining Process	12
	Total	60 Periods

1.0 Press tools
- 1.1 List various types of die and punch
- 1.2 Explain simple, Compound & Progressive dies
- 1.3 Describe the various advantages & disadvantages of above dies

2.0 Jigs and fixtures
- 2.1 Define jigs and fixtures
- 2.2 State advantages of using jigs and fixtures
- 2.3 State the principle of locations
- 2.4 Describe the methods of location with respect to 3-2-1 point location of rectangular jig
- 2.5 Describe various types of fixtures like screw, flat and wedge
- 2.6 Describe various jigs like plate, template, diameter and box types

3.0 Installation & testing of machine tools
- 3.1 Explain the installation procedure of new machine tool
- 3.2 Describe the testing for geometric accuracy of lathe machine tool
- 3.3 Describe the testing for geometric accuracy of milling machine tool
- 3.4 Describe the testing for geometric accuracy of drilling machine tool

4.0 Special castings and Powder metallurgy
- 4.1 Explain die casting method with relative advantages, disadvantages and field of application
- 4.2 Describe investment casting method with relative advantages, disadvantages and field of application
- 4.3 Explain centrifugal casting such as true centrifugal casting, centrifuging with advantages, limitation and area of application
- 4.4 Define powder metallurgy process
- 4.5 State advantages of powder metallurgy technology technique
- 4.6 Describe the methods of producing components by powder metallurgy technique
- 4.7 Explain sintering

5.0 Non conventional machining process

5.1 Describe the working principle and application of various non conventional machining process with line diagram

5.1.1 Electro chemical
5.1.2 Electro discharge
5.1.3 Plasma arc
5.1.4 Laser beam
5.1.5 Abrasive jet
5.1.6 Electron beam

Recommended books

1. Workshop Technology by Hazra Choudhury Vol.-I
2. Workshop Technology by Hazra Choudhury Vol.-II
3. Production Engg., by P. C. Sharma
4. Production Technology Hand book
5. Materials & Processes in manufacturing - De Garmo (PHI)

5th – semester-MECH

INDUSTRIAL ENGINEERING

Periods/Week : 4+1 Exam : 3hr

Total periods : 60 End exam. Th. : 80 marks

IA : 20 marks

Total :100 marks

Topic wise distribution of periods

Sl.No.	Topic	Periods
01	Motion & Time Study	08
02	Operations Research	06
03	PERT and CPM	10
04	Plant Location and Layout	06
05	Inventory Control	05
06	Estimating and Costing	06
07	Plant Maintenance	07
08	Production Planning & Control	08
09	TQM and ISO 9000/14000	04
	Total Period	60

RATIONALE:

Main objective of Mechanical and Automobile Engineering & Technology is to produce goods and services for benefit to mankind. Such productions are done utilizing various resources like Men, Matrials, machines and Money. Industrial engineering is the subject which allows optimized use of such resources and hence very important for a mechanical engineering.

COURSE CONTENT:

1. Motion and Time Study.
   - 1.1 Work Study.
     - 1.1.1 Defination, necessity, advantages.
       - 1.1.1.1 Work Study.
       - 1.1.1.2 Motion Study.
     - 1.1.2 Explain different types of process chart with symbols.
       - 1.1.2.1 Flow process chart.
       - 1.1.2.2 Outline process chart.
       - 1.1.2.3 Flow diagram.
   - 1.2 Time Study.
     - 1.2.1 Explain time study.
     - 1.2.2 Explain the methods of time study.
       - 1.2.2.1 Stopwatch time study.
       - 1.2.2.2 Work sampling.
     - 1.2.3 Explain performance rating.
     - 1.2.4 Describe different types of allowances.
2. Operations Research.
   - 2.1 Linear Programming.
     - 2.1.1 Formulating of linear programming.
     - 2.1.2 Solution of L.P.P. by graphical method.

3. PERT & CPM.
   4.1 Differentiate between CPM and PERT.
   1.2 Define event.
   1.3 Define activity.
   1.4 Define critical activity.
   1.5 Define dummy activity.
   1.6 Define and explain critical path.
   1.7 Define EST.
   1.8 Define LST.
   1.9 Define EFT.
   1.10 Define LFT.
   1.11 Explain float and slack.
   1.12 Determine project completion time.
   1.13 Find out Probability of meeting scheduled date.
4. Plant location and Layout.
   4.1 Describe the features governing plant location.
   4.2 Define plant layout.
      4.2.1 Describe the objective and principles of plant layout.
      4.2.2 Explain process layout..
      4.2.3 Explain product layout.
      4.2.4 Explain combination layout.
      4.2.5 Explain the storage space requirements.
      4.2.6 Procedure of plant layout.
5. Inventory Control.
   1.1 Classification of inventory.
   1.2 Objective of inventory control.
   1.3 Describe the functions of inventories.
   1.4 Explain economic order quantity & solve problems.
   1.5 Define and Explain ABC analysis.
2. Estimating and Costing.
   2.1 Types of cost.
      2.1.1Explain fixed cost.
      2.1.2Explain variable cost.
      2.1.3Explain semi-variable cost.
   2.2 Describe elements of cost.
   2.3 Classify the overheads.
      2.3.1Factory overhead.
      2.3.2Administrative overhead.
      2.3.3Selling overhead.
      2.3.4Distribution overhead.
   2.4 Prepare simple cost sheet.
   2.5 Estimate cost of production and selling of products.
3. Plant maintenance.
   3.1 Describe the objectives of plant maintenance.
   3.2 Describe the duties, functions and responsibilities of plant maintenance department.

- 3.3 Describe the types of maintenance.
  - 3.3.1 PREVENTIVE maintenance.
  - 3.3.2 Breakdown Maintenance.
  - 3.3.3 Scheduled Maintenance.
  - 3.3.4 Predictive Maintenance.
- 3.4 Some recent developments in plant maintenance.

4. Production planning & control.
   - 4.1 Concept of process planning.
   - 4.2 Process planning procedure.
     - 4.2.1 Selection of process.
     - 4.2.2 Selection of material.
     - 4.2.3 Selection of jigs and fixtures.
     - 4.2.4 Selection tools and gauges.
   - 4.3 Concept of scheduling.
     - 4.3.1 Scheduling technique.
     - 4.3.2 Master Scheduling.
     - 4.3.3 Perpetual Scheduling.
       - 4.3.3.1 Load analysis.
   - 4.4 Concept and procedure for.
     - 4.4.1 Despatching.
     - 4.4.2 Routing.
     - 4.4.3 Progress Control.
5. TQM & ISO 9000/14000.
   - 5.1 Overall idea about total quality management.
   - 5.2 Idea about ISO 9000/14000.

RECOMMENDED BOOKS:

1. Industrial Engineering & Management by O.P.Khanna, Dhanpat Rai & Sons.
2. Industrial Engg & Production Management : Telsang, S. Chand &Co
3. Industrial Engineering & Management by C.N.M Reddy, New Age International Publication.

5th – semester-MECH

Refrigeration and Air Conditioning

Periods/Week : 4+1 Exam : 3hr

Total periods : 60 End exam. Th. : 80 marks

IA : 20 marks

Total :100 marks

Topic wise distribution of periods

Sl.No.	Topic	Periods
01	Introduction to Refrigeration & air Conditioning & its application	03
02	Air refrigeration system	07
03	Vapour Compression, Refrigeration System & Its components & control	12
04	Refrigerants.	03
05	Vapour absorption refrigeration system	08
06	Psychrometry	08
07	Physiological Factors	03
08	Cooling Load Calculation	09
09	Air Conditioning System	07
	Total Period	60

RATIONALE:

Refrigeration is the process of cooling below surrounding temp. Air Conditioning means distribution of air after controlling its temp, humidity for human comfort.

COURSE CONTENT:

1. Development of refrigeration.
   - 1.1 Definition, purpose & applications of refrigeration & air conditioning.
   - 1.2 Heat pump, refrigerator, heat engine.
   - 1.3 C.O.P, unit of refrigerating effect.
2. Air refrigeration system.
   - 2.1 Carnot cycle reversed Carnot cycle.
   - 2.2 Brayton cycle.
     - 2.2.1 Closed System.
     - 2.2.2 Open System.
   - 2.3 Typical problems.
3. Vapour compression refrigeration system, its components & control.
   - 3.1 Theoretical vapour compression cycle.
     - 3.1.1 Effect of sub cooling & super heating.
     - 3.1.2 Effect of evaporator & condenser pressure.
     - 3.1.3 Deviation of actual cycle from theoretical cycle.
   - 3.2 Calculation of C.O.P using refrigeration tables & charts.
   - 3.3 Calculation of volumetric efficiency, of reciprocating refrigerant compressor.
   - 3.4 Functions, types, specification, constructional details & selection of components & controls such as compressor, condenser, expansion valves, capillary tube, evaporator.
   - 3.5 Separator, accumulator, spray pond & cooling towers.

3.6 Control devices, such as solenoid valve, thermostat, low pressure & high pressure cut out, oil safety switch, condensing water control.

4. Refrigerants
   - 4.1 Definition & type of refrigerants commonly used.
   - 4.2 Describe properties.
   - 4.3 Nomenclature.
   - 4.4 Properties of NH3, air, water, CO2, R11, R22 & their application.
5. Vapour absorption refrigeration system.
   - 5.1 Simple vapour absorption system.
   - 5.2 Practical absorption system.
   - 5.3 Refrigerant absorption combinations.
   - 5.4 Large absorption system for water chilling.
   - 5.5 Comparison between vapour absorption & vapour compression system.
   - 5.6 Electrolux system.
6. Psychrometry
   - 6.1 Properties of air-vapour mixture.
   - 6.2 Dry bulb, wet bulb, thermodynamic wet bulb, adiabetic saturation and dew point temperatures.
   - 6.3 Humidity ratio, relative humidity.
   - 6.4 Degree of saturation, enthalpy of moist air.
   - 6.5 Sling and aspiration psychrometers.
   - 6.6 Phchrometric process analysis.
     - 6.6.1 Cooling and dehumidification.
     - 6.6.2 Heating and humidification.
     - 6.6.3 Mixing of two air streams.
     - 6.6.4 Sensible heating and cooling.
7. Physiological Factors.
   - 7.1 Factors affecting human body.
   - 7.2 Metabolism of human body.
   - 7.3 Comfort Chart.
   - 7.4 Effective temperatures.
8. Cooling load calculations.
   - 8.1 Types of loads.
     - 8.1.1 Sensible heat, latent heat, total heat.
     - 8.1.2 Calculation of loads due to different sources of solar, human beings, applications, in filtration.
     - 8.1.3 Sensible heat factor, latent heat factor, total heat factor.
     - 8.1.4 Bypass factor, apparatus due point.
     - 8.1.5 Fresh supply and recirculated air quantities.
9. Air conditioning system.
   - 9.1 Describe and specification of room air conditioner and commercial conditioning system.
   - 9.2 Principle of evaporative cooling.
     - 9.2.1 Air cooler and desert cooler.
   - 9.3 Air distribution systems and ducting.
     - 9.3.1 Air filters, dampers, fans, blower, diffusers.

RECOMMENDED BOOKS:

1. Refrigeration and air conditioning by C.P Arora, TMH.
2. Refrigeration and air conditioning by R.S. Khurmi.
3. Refrigeration and air conditioning by P.L Ballany, Khanna pub.
4. Refrigeration and air conditioning by S.C. Domkundwara and Arora.
5. Refrigeration and air conditioning by M. Prasad, New Age International.

5th – semester-MECH

Mechanical Engineering Design

Periods/Week : 4+1 Exam : 3hr

Total periods : 60 End exam. Th. : 80 marks

IA : 20 marks

Total :100 marks

Topic wise distribution of periods

Sl.No.	Topic	Periods
01	Introduction	08
02	Design of fastening elements	15
03	Design of shafts keys & couplings	10
04	Design of levers	06
05	Design of belt drives & pulleys	10
06	Design of screw jack	05
07	Design of closed coil helical spring	06
	Total Period	60

RATIONALE:

Machine design is the art of planning or devising new or improved machines to accomplish specific purposes. Idea of design is helpful in visualizing, specifying and selection of parts and components which constitute a machine. Hence all mechanical engineers should be conversant with the subject.

COURSE CONTENTS (in terms of specific objectives):

1. Introduction
   - 1.1 State the factors governing the design of machine elements.
   - 1.2 State types of loads.
   - 1.3 Define working stress, yield stress, ultimate stress & factor of safety.
   - 1.4 State mechanical properties of the material of the product.
   - 1.5 Preliminary idea of failure of material due to fatigue & creep.
   - 1.6 Describe design procedure.
2. Design of fastening elements:
   - 2.1 State nomenclatures, form of threads & specifications.
   - 2.2 Describe nature of loads and failure of bolt subjected to initial stresses due to screwing up, stresses due external forces, stresses due to combined force and stresses due to shear load.
   - 2.3 Determine dimensions of bolt and nut by using empirical formula(Hexagonal & Square nut)
   - 2.4 Design eye bolt for a given load by empirical relation.
   - 2.5 State types of welded joints.
   - 2.6 State advantages of welded joints over other joints.
   - 2.7 Determine strength of welded joints for eccentric loads.
   - 2.8 State types of riveted joints.
   - 2.9 Describe failure of riveted joints.
   - 2.10 Determine strength & efficiency of riveted joints.
   - 2.11 Design riveted joints for pressure vessel.
   - 2.12 Design cotter joint.

3. Design of shafts, Keys & Couplings:
   - 3.1 State function of shafts.
   - 3.2 State materials for shafts.
   - 3.3 Design solid & hollow shafts to transmit a given power at given rpm based on
     - a) Strength
       - i) Shear stress
       - ii) Combined bending & tension
     - b) Rigidity
       - i) Angle of twist
       - ii) Deflection
       - iii) Modulus of rigidity
   - 3.4 State standard size of shaft as per I.S.
   - 3.5 State function of keys, types of keys & material of keys.
   - 3.6 Describe failure of key, effect of key way.
   - 3.7 Design rectangular sunk key considering its failure against shear & crushing.
   - 3.8 Design recetangular sunk key by using empirical relation for given diameter of shaft.
   - 3.9 State specification of parallel key, gib-head key, taper key as per I.S.
   - 3.10 State function of coupling and types of couplings.
   - 3.11 Determine the dimension for a C.I flange coupling and coupling bolts for a given torque by using empirical relations.
4. Design of levers
   - 4.1 State types of levers and their function.
   - 4.2 Design hand lever foot lever & bell crank lever.
5. Design of belt drivers and pulleys:
   - 5.1 State types of belt drives & pulleys.
   - 5.2 State formula for length of open and crossed belt, ratio of driving and driven side tension, centrifugal tension and relation between centrifugal tension and tension on tight side for maximum power transmission.
   - 5.3 Determine belt thickness and width for given permissible stress for open and crossed belt considering centrifugal tension.
   - 5.4 Explain types of pulleys for flat belts:
     - 5.4.1 Cast iron pulley.
     - 5.4.2 Steel pulley.
     - 5.4.3 Fast and loose pulley.
   - 5.5 Design a cast iron pulleys using empirical formula only.
     - 5.5.1 Dimensions of pulley.
     - 5.5.2 Dimensions and number of arms.
     - 5.5.3 Dimension of hub.
     - 5.5.4 Problems.
6. Design a screw jack using empirical formula.
   - 6.1 Problem.
7. Design a closed coil helical spring of round rod.
   - 7.1 Materials used for helical spring.
   - 7.2 Standard size spring wire. (SWG)
   - 7.3 Terms used in compression spring.

7.4 Stress in helical spring of a circular wire.
7.5 End connection for helical tension spring.
7.6 Deflection of helical spring of circular wire.
7.7 Eccentric loading of spring.
7.8 Buckling of compression spring.
7.9 Surge in spring.
7.10 Problems.

RECOMMENDED BOOKS:

2. Machine Design by R.S.Khurmi and Gupta, Eurasia publishing House.
3. A Text book of Machine Design by Sharma and Agarwala, S.K.Kataria & Sons.
4. Machine Design By R.B.Gupta, Satya Prakashan.
5. Elements of Machine Design by Panday and Shah, Charotar Publishing Housing.

5th – semester-MECH

Inspection & Quality Control

Periods/Week : 4+1 Exam : 3hr

Total periods : 60 End exam. Th. : 80 marks

IA : 20 marks

Total :100 marks

Topic wise distribution of periods

Sl.No.	Topic	Periods
01	Inspection	12
02	Measurement & Gauging	12
03	Statistical Quality Control	12
04	Standards & Codes	12
05	Instrumentation	12
	Total Period	60

RATIONALE:

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

Course Contents:

1.0 Inspection.

- 1.1 Introduction, units of measurements, standards for measurement and inter changeability.
- 1.2 International, national & company standard, line & wavelength.
- 1.3 Limits, fits & tolerances: study of natural variability of process. Indian standards on limits, fits and tolerance, transition & interference. Positional tolerances: maximum material condition usage of standards for deciding tolerance.
- 1.4 Planning of inspection: what to inspect? When to inspect? Who should inspect? Where to inspect?
- 1.5 Types of inspection: remedial, preventive & operative inspection, incoming in process & final inspection.
- 1.6 Study of factors influencing the quality of manufacture.

2.0 Measurement & Gauging.

- 2.1 Basic principles used in measurement & gauging, mechanical, optical, electrical & electronic.
- 2.2 Study of various measuring instruments like: Calipers, micrometers, dial indicators, surface plate, straight edge, try square, protectors, sine bar and clinometers, comparators-mechanical, electrical & pneumatic. Slip gauges, tool room microscope & profile projector. Talysurf . Limit gauges: plug ring, snap, taper, thread, height, depth, form, wire & their applications for linear, angular, surface, thread & gear measurements, tolerances. Geometrical parameters & errors.
- 2.3 Errors & their effect on quality, concept of errors, measurement of geometrical parameter such as straightness, flatness & parallelism.
- 2.4 Study of procedure for alignment test on lathes, Drilling & milling machines.

2.5 Testing & maintenance of measuring instruments.

3.0 Statistical quality Control.

3.1 Basic statistical concepts, empirical distribution and histograms, frequency, mean, mode, standard deviation, normal distribution, binomial & Poisson (No mathematical derivations)

3.2 Introduction to control charts, namely X, R, P & C Charts & their applications.

3.3 Sampling plans, Selection of sample size, method of taking samples, frequency of samples.

3.4 Inspection plan format & test report.

3.5 Concept of total quality management (TQM)

4.0 Standards & Codes.

4.1 National & International Codes.

4.2 ISO-9000, concept & its evolution & implications.

5.0 Instrumentation.

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

RECOMMENDED BOOKS:

1. Statistical quality Control by M.Mahajan.
2. Engineering Metrology by R.K.Jain.
3. Engineering Metrology by R.K.Rajput.
4. Production Planning Control & Management K.C.Jain & Agrwal.

5th – semester-MECH

MEL-III

Periods/Week : 06
Total periods : 90

Exam : 4hr
End exam Pr. : 50 marks
Sessional : 25 marks
Total :75 marks

1. Theory of M/C Lab:-
   1.1 Determination of centrifugal force of a governor. (Hardness / Watt/Porter)
   1.2 Study & demonstration of static balancing apparatus.
   1.3 Study & demonstration of journal bearing apparatus.
   1.4 Study & demonstration of CAM analysis apparatus.
2. Refrigeration & Air Conditioning Lab.
   2.1 To Study the Construction features of
      i) Domestic refrigerator
      ii) Water cooler
      iii) Window A.C.
      iv) Split A.C.
   2.2 Performance analysis of a refrigeration tutor.
   2.3 Performance analysis of A.C. tutor.

5th – semester-MECH

Inspection & Quality Control Lab.

Periods/Week : 06 Exam : 4hr

Total periods : 90 End exam. Pr. : 50 marks

Sessional : 25 marks

Total :75 marks

I. Linear measurements.
   6. Determination of the thickness of ground MS flat to an accuracy of 0.02mm using Vernier Caliper.
   7. Determination of the inside diameter of a bush component to an accuracy of 0.02 using Vernier caliper.
   8. Determination of diameter of a cylindrical component to an accuracy of .01mm using micrometer & check the result with digital micrometer.
   9. Determine the heights of gauge blocks or parallel bars to accuracy of 0.02mm using vernier height gauge & check the result with digital Vernier height gauge.
   10. Determine the thickness of ground MS plates using slip gauges.

II. Angular measurement:
   1. Determination of angel of Machined surfaces of components using sin bar with slip gauges.
   2. Measurement of V-thread dimensions.
   3. Measurement of spur gear tooth dimensions.