

S'06 : 1 FN : AN 201/AD 301 (1401)

FUNDAMENTALS OF DESIGN AND MANUFACTURING

Time : Three hours

Maximum marks : 100

*Answer FIVE questions, taking ANY TWO from Group A,
ANY TWO from Group B and ALL from Group C.*

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answered at one place.*

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mented with neat sketches. Unnecessary long answers
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Group A

1. (a) What are the major stages of engineering design?
Discuss with a suitable example. 8
- (b) What is the role of need analysis in the design
process? Give one need statement for each of the
following: 8
 - (i) Bicycle
 - (ii) Washing Machine
 - (iii) Personal Computer
 - (iv) Private Car.
- (c) What are the main limitations of the sand casting
process and how are they overcome? 4

(Turn Over)

2. (a) Why is 'clearance' provided in die and punch for blanking and piercing operations? Explain with neat sketches. 8
- (b) Distinguish between cold and hot working with respect to principle, advantages and applications. 6
- (c) What are the distinguishing features between a casting and a pattern? 6
3. (a) What do you mean by design communication? How does a drawing help to a design engineer to share his ideas? 8
- (b) During writing a technical report, what points should be kept in mind for easy communication? 6
- (c) What factors govern the selection of manufacturing process for a product? 6
4. Differentiate between: 5 × 4
- (i) Piercing and Blanking
- (ii) Creative Design and Innovative Design
- (iii) Discrete Manufacturing and Continuous Manufacturing
- (iv) Physical Reliability and Economic Feasibility.

Group B

5. (a) What is the source of heat in resistance welding? Why is the control of pressure important in resistance welding? 8
- (b) Explain briefly the purposes of using fluxes in welding? 6
- (c) Why are truing and dressing necessary for a grinding wheel? 6
6. (a) What do you mean by integration? How does it differ from interfacing? What are the basic needs for integration? 8
- (b) Explain in detail the integration of CAD and CAM. What is the role of computer in this integration? 6
- (c) What are the major benefits derived from group technology concept in manufacturing? 6
7. (a) What is robotic cell? Draw a robotic cell and label its all parts. 8
- (b) What are the main elements of an information system? Distinguish between hard and soft information. 6
- (c) Giving a suitable example, explain the concept of designing a process for manufacturing integration. 6
8. (a) Define cutting velocity, feed and depth of cut as applied to turning in lathes. What major factors are considered while selecting the values of those three machining parameters? 8
- (b) Distinguish between: 4
- (i) Boring and Internal Turning
- (ii) Shaping and Planning.
- (c) What is computer aided process planning (CAPP)? What type of data are required for developing a CAPP system? Distinguish between variant and generative systems of process planning. 8

Group C

9. Write the *most correct* answer : 1 × 6

(A) (i) In which of the following process, the electrode is non-consumable ?

- (a) Gas welding
- (b) Arc welding
- (c) TIG welding
- (d) Thermit welding

(ii) The highest cutting speed is used in

- (a) Centreless grinding
- (b) Surface grinding
- (c) Cylindrical grinding
- (d) Internal grinding

(iii) In the metal forming processes, the stresses induced in the material are

- (a) less than the yield strength of the material.
- (b) greater than the ultimate strength of the material.
- (c) less than the fracture strength of the material.
- (d) less than the limit of proportionality.

(iv) In which process the material is pulled through a die ?

- (a) Extrusion process
- (b) Rolling process
- (c) Wire drawing process
- (d) Forging process

(v) Group technology brings together and organises

- (a) parts and simulation analysis.
- (b) automation and tool production.
- (c) common parts, problems and tasks.
- (d) None of the above.

(vi) Point angle of a twist drill used for drilling hole in mild steel is

- (a) 118°
- (b) 90°
- (c) 180°
- (d) 0°

(B) Answer the following : 2 × 7

(i) How are electrodes specified ?

(ii) Define the term deep drawability.

(iii) What is 'Bath Tub Curve' ?

- (iv) What is parting line ?
- (v) What is the significance of recrystallisation temperature in metal forming ?
- (vi) What is manufacturing logic ?
- (vii) What do you understand by intelligent robots ?

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Group A

1. (a) Explain the term 'design'. Enumerate the various steps involved in design process. Explain these in brief. 2+2+4
- (b) Distinguish clearly the terms 'Need Identification', 'Need Statement' and 'Need Analysis'. 2+2+2
- (c) Explain 'creativity' and 'creative process'. Explain why one should not have mental set to become creative. 3+3
2. (a) What do you mean by 'standards of performance'? Enumerate the factors affecting this. Explain these factors in brief. 2+2+4

- (b) What do you understand by specifications? At what stage these should be defined during the process of product development? Explain. 2+1+3
- (c) Explain 'Evaluation' and 'Evolution' in the design process. 3+3
3. (a) Explain 'Morphological approach'. Enumerate the phases of morphology of design. Explain these in brief. 2+3+3
- (b) Describe the methods of achieving reliability. Compare the reliability of systems with components in series and components in parallel. 3+3
- (c) How will you organise and communicate the design? 3+3
4. (a) Write down the objectives of design for manufacturing. Enumerate the points to be observed while designing for 'Casting' and 'Easier Machining'? 2+3+3
- (b) Name the sand moulding methods. Describe these in brief with the help of figures. What is directional solidification? 2+3+2
- (c) Explain permanent mold casting processes. 5
4. (a) Define cold working of metals. Enumerate its advantages and disadvantages. 2+3
- (b) Differentiate between cold forging method and hot forging method with an example of each process. 4+4
- (c) Explain the role of shearing and clearance in sheet-metal operation. Where is clearance provided in blanking and piercing operations? 3+2+2

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(2)

(Continued)

Group B

5. (a) With the help of figures, explain the following for a single-point cutting tool: (i) Rake angle, (ii) Clearance angle, (iii) Cutting angle, (iv) Nose radius, (v) Tool signature. 1 x 5
- (b) Name different types of chips. Explain their formation. What is chip breaker? 2+4+2
- (c) Describe the working of a drilling machine. What specifications are needed to purchase this machine? 5+2
6. (a) What is surface grinder? Under what conditions the use of this machine is recommended? 2+4
- (b) Describe, with a neat sketch, the working principle of electro-chemical machining. State its applications. What is electrolyte and explain its role? 4+2+2
- (c) What are the advantages of welding joint over other joints? Explain oxy-acetylene gas welding procedure. 2+4
7. (a) Discuss the application of the following in manufacturing: (i) group technology, (ii) simulation, (iii) database management. 2+2+2
- (b) In the present business scenario, the integration of commercial, economic and technological aspects is essential. Justify the statement. 8
- (c) Discuss the application of information technology in the integration of business and technological aspects. 6
8. (a) Explain the available better features in 'computer aided process planning (CAPP)' over the 'conventional process planning approach'. How does CAPP help in selection of machine tools? 6+2

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(3)

(Turn Over)

(b) Describe the role of integration of 'product' and 'process design' for economic manufacturing. 6

(c) What for an 'automated guided vehicle (AGV)' is used? Describe the role of sensors in controllers. 3+3

Group C

9. (A) Explain the following in brief : 2 × 6

(i) Economic feasibility and utility

(ii) Permanent mould casting

(iii) Tool-work interaction

(iv) System concept

(v) Robots

(vi) Recyclability.

(B) Select the *correct answer* out of the alternative choices of the following : 1 × 8

(i) Cores are used to

(a) make desired recess in castings

(b) strengthen moulding sand

(c) support loose pieces

(d) remove pattern easily

(ii) Shell moulding process requires

(a) wooden patterns

(b) sand patterns

(c) plastic patterns

(d) metal patterns

(iii) In arc welding, eyes need to be protected against

(a) intense glare

(b) infra-red rays only

(c) ultraviolet rays only

(d) both infra-red and ultraviolet rays

(iv) The gases used in tungsten inert gas welding are

(a) hydrogen and oxygen

(b) argon and helium

(c) argon and neon

(d) helium and neon

(v) Laser is produced by

(a) graphite

(b) emerald

(c) ruby

(d) diamond

(vi) Production of contours in flat blanks is termed as

(a) blanking

(b) piercing

(c) perforating

(d) punching

(vii) For ferrous materials, the helix angle of drill is taken as

(a) 30°

(b) 45°

(c) 60°

(d) 90°

(viii) The front rake required to machine brass by HSS tool is

(a) 15°

(b) 10°

(c) 5°

(d) 0°

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Group A

1. (a) What are the different stages of Engineering design ?
Discuss with a suitable example. 5 +
 - (b) How will you integrate the functions of design and
Manufacturing? How will it help in achieving
economic manufacturing? 3 +
 - (c) List out the characteristics of a good designer.
2. (a) With the help of an example, explain the concept of
morphology in design

- (b) What is the role of need analysis in the design process? Distinguish between need analysis and need statement. 4 + 4
- (c) Clearly explain 'Brainstorming' with respect to ideonomics. 6
3. (a) What do you understand by design for safety? 5
- (b) What are the essential contents of a technical report? Explain briefly. 5
- (c) Explain the concept of manufacturing as input-output model. What are the different processes that will represent the area of manufacturing? 10
4. (a) Explain the following: 4 + 4
- (i) Considerations in design of castings; and
- (ii) Reliability and robust design.
- (b) Explain investment casting process with the help of neat diagrams. What are its applications? 8
- (c) Differentiate between cold and hot forgings. State the advantages and disadvantages. 4
- Group B**
5. (a) Distinguish between orthogonal cutting and oblique cutting. 6
- (b) Write notes on the following: 3 × 2
- (i) Tool signature
- (ii) Machinability
- (iii) Cutting fluids.
- (c) While doing orthogonal machining with cutting tool having a 10° rake angle, the chip thickness is measured to be 0.40 mm, the uncut thickness being 0.16 mm. Find out the shear plane angle and also the magnitude of shear strain. 8
6. (a) What is surface grinding? When do you recommend the use of this machine? Explain the alternative arrangement of spindle and table of surface grinder along with their relative motions with the help of suitable sketches. 8
- (b) (i) Describe the working of electrochemical machining set up. 4
- (ii) What do you understand by rate of metal removal? 4
- (c) What is manufacturability? Describe its significance in manufacturing. 4
7. (a) Distinguish between hard and soft information. Give examples for each case. 6
- (b) What are the desirable features of database management system? How does it help in manufacturing? Describe briefly a database model for manufacturing. 8
- (c) What is networking? Describe its special features and important elements. 6
8. (a) What do you understand by group technology? How the parts are segregated in broad groups? 6

- (b) Discuss the problems of integrating industrial robots with other flexible automated systems of a modern plant, e.g., AGVS, CNC machine tools, etc. 8
- (c) What is computer Aided Process Planning? How is it superior to manual process planning? Explain. 6

Group C

9. (A) Explain briefly the followings: 2 × 5

- (i) Selection of machine tools
- (ii) Controllers and sensors
- (iii) Primary metal forming processes
- (iv) Design communication
- (v) Simulation and its applications.

- (B) For each question, select the correct answer out of the alternatives provided. Write only the letter code without repeating the text of the question: 1 × 10

- (i) Porosity in thin sections of a casting can be minimized by
- (a) changing progressive solidification to directional solidification.
- (b) changing directional solidification to progressive solidification
- (c) use of open risers
- (d) providing risers with large Area/Volume ratio.

- (ii) Large and heavy castings are made by

- (a) green sand moulding.
- (b) dry sand moulding.
- (c) pressure moulding.
- (d) machine moulding.

- (iii) Blanking and piercing operation can be performed simultaneously on

- (a) simple die.
- (b) progressive die.
- (c) compound die.
- (d) combination die.

- (iv) The tolerances produced by investment casting process are of the order of

- (a) $\pm 0.5 \text{ mm}$
- (b) $\pm 0.05 \text{ mm}$
- (c) $\pm 1 \text{ mm}$
- (d) $\pm 5 \text{ mm}$

- (v) Centering on lathe can be done most accurately on

- (a) four jaw chuck.
- (b) three jaw chuck.

- (c) collet chuck.
- (d) magnetic chuck.
- (vi) The usual ratio of Forward and return stroke in shaper is
- (a) 2:1
- (b) 1:2
- (c) 2:3
- (d) 3:2
- (vii) In grinding operation, for grinding harder material
- (a) softer grade is used.
- (b) high grade is used.
- (c) medium grade is used.
- (d) any grade may be used.
- (viii) Variant type computer aided process planning is most useful when
- (a) large number of part families are involved.
- (b) small number of part families with short product life cycles are involved.
- (c) small number of part families with fairly stable product life cycles are involved.
- (d) very complex parts are involved.

- (ix) Dielectric fluid is must in
- (a) EDM process.
- (b) ECM process.
- (c) ultrasonic machining.
- (d) laser machining.
- (x) Which of the following welding processes uses non-consumable electrode?
- (a) Laser welding
- (b) MIG welding
- (c) TIG welding
- (d) Plasma welding

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Group A

1. (a) Discuss the engineering design process enumerating the various steps involved. 5+5
- (b) What is 'morphological analysis'? How is it useful for the design process? 5+5
2. (a) Explain in brief: (i) Brainstorming; and (ii) Economic feasibility and utility. 5+5
- (b) Discuss 'need analysis' and the 'need identification' processes. 5+5

3. (a) What is the difference between manufacturing and production? Classify the various manufacturing processes. 5+5
- (b) Explain the term 'design for manufacture' giving examples. 10
4. Write short notes on the following: 2 × 10
- (i) Reliability and Robust Design
- (ii) Investment Casting.

Group B

5. (a) Describe in brief the tool-work interaction in turning and drilling processes. 5+5
- (b) How are grinding wheels specified? Explain the role of 'structure' in a grinding wheel. 5+5
6. (a) What is group technology? Discuss the advantages of using group technology in a manufacturing set-up. 5+5
- (b) What is simulation? Explain briefly. How is it useful in design and manufacturing? 5+5
7. Write short notes on the following: 2 × 10
- (i) Database Management System
- (ii) AGV.
8. (a) Discuss in brief Computer Aided Process Planning. Also, describe its types. 10
- (b) What is a robot? How are robots specified? 10

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(2)

(Continued)

Group C

9. (A) Fill in the blanks: 1 × 10
- (i) Grinding wheel is a ——— cutting tool.
- (ii) The most commonly used material for single point cutting tools used on lathe is ———.
- (iii) Drawing is a language of ———.
- (iv) In gas welding, ——— and ——— are mixed.
- (v) Quick return mechanism is used on ——— machines.
- (vi) In hot working, metals are heated ——— the recrystallization temperature.
- (vii) ——— are used on intelligent robots.
- (viii) To create replica of a system, ——— technique is used.
- (ix) Computer aided process planning is the link between ——— and ———.
- (x) AGV is a ——— cart.
- (B) Answer the following in brief: 2 × 5
- (i) Name five commonly used unconventional machining processes.
- (ii) Name two finishing processes which can improve the finish of ground surfaces.
- (iii) Name two advanced welding techniques.
- (iv) Name two investment casting processes.
- (v) Name two allied welding processes.

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(3)

AG 16,000

S'08 : 1 FN : AN 201/AD 301 (1401)**FUNDAMENTALS OF DESIGN AND MANUFACTURING***Time : Three hours**Maximum marks : 100*

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Group A

1. (a) Draw a flow chart showing different stages of engineering design. Explain why some stages are repeated several times. 8
- (b) How will you integrate the functions of design and manufacturing? How will it help in achieving economic manufacturing? 6
- (c) Differentiate between standardization and specification giving appropriate examples. 6
2. (a) Explain in brief (i) robust design, and (ii) role of brainstorming in design idea generation. 3+3

(Turn Over)

- (b) Describe the terms 'economic feasibility', 'recyclability', and 'evaluation of design'. 2+2+2
- (c) What do you understand by 'reliability' and why is it considered? What are three categories of failures? Illustrate graphically number of failures vs. time. 8
3. (a) How will you check the design for clarity, simplicity and safety? Also, explain how design is organised and communicated. 10
- (b) Compare the reliabilities of systems with components in series vs. components in parallel. In a system, there are 10 components in series, each with a reliability factor of 0.95. What is the overall reliability of the system? If each of the 10 components is in parallel and has individual reliability factor of 0.30 only, what is the system reliability? 10
4. (a) How are dissolved gases removed from castings? List *four* casting defects. 6
- (b) With the help of neat sketches, explain extrusion and drawing processes. 6
- (c) Compare the cast and forged products of the same geometry from the viewpoints of strength and quality. 6
- (d) What is the effect of lubrication on die (tool) life during drawing operation? 2

Group B

5. (a) Classify the machining processes. Name the operations which can be performed on a lathe machine. 8
- (b) Differentiate between the shaper and planer. 6
- (c) What do you mean by arc welding? What precautions should be taken during welding? 6

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(Continued)

6. (a) Calculate the cutting time for cutting 150 mm long keyway using HSS end mill of 20 mm diameter having four cutting teeth. The depth of keyway is 4.2 mm, feed per tooth is 0.1 mm, and cutting speed is 38 m/min. Assume approach and over-travel distance as half of the diameter of the cutter and depth of 4.2 mm can be cut in one pass. 10
- (b) On what basis parts are grouped into families in Group Technology (GT)? Discuss with examples. What are the benefits of GT over the conventional setup? 10
7. (a) What is design for manufacturability? How can it be realised in practice? Explain with an example. 10
- (b) What do you mean by unconventional machining processes? Why are these processes necessary? Explain. 6
- (c) Explain briefly information technology and its elements. 4
8. (a) Discuss the applications of following in the field of engineering: (i) Sensors, (ii) robots, (iii) controller, (iv) AGVs, and (v) AS/RS. 15
- (b) What is Computer Aided Process Planning (CAPP)? How is it superior to manual process planning? 5

Group C

9. (A) Explain the following in brief: 5 × 2
- (i) Tool signature
- (ii) Data Base Management System (DBMS)
- (iii) Hot and cold working of metals
- (iv) Modelling vs Simulation
- (v) Soft information

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(Turn Over)

(B) State whether the following statements are *true* or *false*: 1 × 10

- (i) Moulding is carried out in moulding boxes called flasks.
- (ii) Taper turning means to produce a conical surface by gradual reduction in diameter from a cylindrical workpiece.
- (iii) Laser beam machining is an unconventional machining process.
- (iv) Capstan lathe is never used on smaller work.
- (v) Sand mould is an example of permanent mould.
- (vi) Welding does not permit any freedom in design.
- (vii) Discontinuous chips are usually produced while cutting more brittle materials.
- (viii) The size of the shaper or planer is specified by the maximum length of stroke.
- (ix) Non-conductive materials can be machined by ECM process.
- (x) In case of USM, the metal removal cost is low.

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Group A

1. (a) What are the principles of modern engineering design? Discuss the same with a suitable example. 10
(b) What do you mean by morphology of design? Illustrate with the help of an example. 10
2. Describe the following in detail: 2 × 10
(a) Brainstorming technique
(b) Design for manufacture.
3. (a) Explain the sand casting process. Discuss various materials used for making pattern. 10

- (b) What do you mean by reliability? Compare the reliability system with component in series and parallel. 10
4. (a) What is metal working? Discuss advantages of cold working over hot working. 10
- (b) What is the significance of re-crystallisation temperature in metal working? Explain rolling process in brief. 10

Group B

5. (a) What are the main types of chips formed during metal cutting? What are the disadvantages of orthogonal cutting over oblique cutting? 12
- (b) What is tool failure? How it happens? 8
6. (a) How would you specify a lathe machine? List main components of a lathe machine. 10
- (b) Explain the grinding process. What are the various factors considered in selection of proper grinding wheel? 10
7. Explain the following in brief: 4 × 5
- (a) Classification of welding processes
- (b) Automated storage and retrieval systems
- (c) Database management systems
- (d) Automated Guided Vehicles (AGVs).
8. (a) Define the group technology (GT) concept. Discuss different stages involved for adopting a plan for GT. 10
- (b) What is computer aided process planning? How is it superior to manual process planning? Explain. 10

Group C

9. Define/explain the following in brief: 10 × 2
- (i) Robot
- (ii) Hot working
- (iii) Feasibility
- (iv) AS/RS
- (v) Group technology
- (vi) Simulation
- (vii) Welding
- (viii) CNC
- (ix) Heat treatment
- (x) Information technology.

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Group A

1. (a) Consider the example of a product, and briefly explain various steps to be followed to design this product. 10
(b) Define product life-cycle. Explain various stages of product life-cycle with a suitable example. 10
2. (a) Discuss the important features of 'Design for Assembly'. 10
(b) Suggest an organisation structure for the design office of toy manufacturing company. 10

3. (a) Give step-by-step procedure for the investment casting process. Outline some typical applications of this process. 10
- (b) Draw sketches to distinguish between punching and blanking operations of metal forming. 5
- (c) Compare hot working with cold working of metals. Give relative advantages and applications of each. 5
4. (a) Describe the permanent mould casting process. Give any two applications of this process of casting. 10
- (b) Sketch wire drawing operation. What factors determine the drawing ratio? 5
- (c) Sketch a three high rolling mill. Give advantages and limitations of three high rolling over two high rolling. 5

Group B

5. (a) Distinguish between shaping and planing operations. Name the machines on which these operations are performed. 8
- (b) Sketch to describe the formation of a flat surface on a lathe. 6
- (c) Give any three methods of taper turning on a lathe. 6
6. (a) Describe the principle of electrochemical machining or electric discharge machining process. Give advantages and limitations of the process. 10
- (b) Give step-wise procedure for selecting a manufacturing process. 6
- (c) Compare d.c. arc welding with a.c. arc welding. 4

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(2)

(Continued)

7. (a) What do you understand by Group Technology? Mention areas of its application. 10
- (b) Describe the following in brief: 2 × 5
- (i) Computer Aided Process Planning.
- (ii) Automated Guided Vehicles.
8. (a) Sketch and explain submerged arc welding process. Give advantages and limitations of this process. 10
- (b) Discuss salient features of 'design for economic manufacturing'. 10

Group C

9. Briefly describe the following: 10 × 2
- (i) Simulation
- (ii) Drilling operation
- (iii) Information Technology's role in manufacturing
- (iv) Extrusion
- (v) Robust design
- (vi) Design for use
- (vii) Product design specifications
- (viii) Brainstorming
- (ix) Grinding processes
- (x) Cutting tool-workpiece interaction during machining operation.

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(3)

AG—16,000

W'09 : 1 FN : AN 201 / AD 301 (1401)

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*Answer should be brief and to-the-point and be supple-
mented with neat sketches. Unnecessary long answer may result
in loss of marks.*

*Any missing or wrong data may be assumed suitably
giving proper justification.*

Figures on the right-hand side margin indicate full marks

Group A

1. (a) What is product life cycle ? Illustrate, with a suitable example, the various stages of product life cycle ? 10
- (b) Explain the following in detail : 2 × 5
 - (i) Design for reliability
 - (ii) Design for assembly
2. (a) Describe the investment casting process. What are the advantages of investment casting process ? 12

- (b) Briefly explain the characteristics of molding sand required to have a sound mold. 8
3. Explain the following in brief : 4 × 5
- (a) Rolling
- (b) Forging
- (c) Extrusion
- (d) Blanking
4. (a) Explain briefly the various steps to be followed to design a product. 10
- (b) Briefly describe the various product design techniques. 10

Group B

5. (a) What is a Merchant's circle diagram ? Discuss its significance. 10
- (b) Describe the essential parts of a milling machine ? What are the operations that can be performed on a milling machine ? 10
6. (a) With the help of schematic illustrations, describe the principles of operations of EDM machine. 10
- (b) What are the various factors considered in the selection of grinding wheels ? How are grinding wheels specified ? 10
7. (a) What is a Thermit welding ? What does a Thermit mixture consists of and what reaction takes place in Thermit welding ? 10

W'09:1 FN:AN:201/AD:301 (1401)

(2)

(Continued)

- (b) What is manufacturability ? Describe its significance in design for manufacturing. 10
8. Explain the following : 4 × 5
- (a) CIM
- (b) Group technology
- (c) Brainstorming
- (d) Simulation

Group C

9. Define/explain the following : 10 × 2
- (i) AGVs
- (ii) Name fusion welding processes
- (iii) Significance of re-crystalline temperature
- (iv) GT layout
- (v) Function of cores
- (vi) Function of risers
- (vii) Design checks
- (viii) Uses of Information Technology
- (ix) CAPP
- (x) Soldering

W'09:1 FN:AN:201/AD:301 (1401)

(3)

AG-16 000

S'10 : 1 FN : AN 201/AD 301 (1401)

FUNDAMENTALS OF DESIGN AND MANUFACTURING

Time : Three hours

Maximum marks : 100

*Answer FIVE questions, taking ANY TWO from Group A,
ANY TWO from Group B and ALL from Group C.*

*All parts of a question (a, b, etc.) should be
answered at one place.*

*Answer should be brief and to-the-point and be supple-
mented with neat sketches. Unnecessary long answers
may result in loss of marks.*

*Any missing or wrong data may be assumed suitably
giving proper justification.*

Figures on the right-hand side margin indicate full marks.

Group A

1. Select a product, such as the telephone or the television, and prepare sketches to describe how their appearances have changed from their inception to the present. What role has technology had in influencing these changes? 20
2. (a) Explain how the systematic design process can aid in creating quality products. 8
- (b) What is the role of need analysis in the design process. Give one need statement for each of the following: 4 × 3
 - (i) Bicycle
 - (ii) Washing machine
 - (iii) Personal Computer
 - (iv) Private car

3. (a) What are main advantages of the casting process?
What are its limitations and how are they overcome? 8
- (b) Explain the following: 4 × 3
- (i) Rolling
- (ii) Extrusion
- (iii) Blanking
- (iv) Forging
4. (a) Define the term 'reliability' and 'maintainability'.
Compare the reliability of systems with components
in series vs. components in parallel. 10
- (b) What is 'input-output' model? How will you use this
model for a manufacturing process? What are the
main factors on which the selection of a manufactu-
ring process depends? 10

Group B

5. (a) What are the main types of chips formed during metal
cutting? Why are non-homogenous chips formed? 6
- (b) Define cutting speed, feed and depth of cut as applied
to drilling. What are the major factors on which above
three factors depend? 10
- (c) What is cutting ratio? How can it be determined? 4
6. (a) How have integration and information technology
influenced the fields of product design and manu-
facturing? 10
- (b) What is group technology concept in manufacturing?
What are the important benefits derived from it? 10

S'10: 1FN: AN 201/AD 301 (1401) (2)

(Continued)

7. (a) 'Simulation is one type of modelling'— is it true?
Discuss in detail. 6
- (b) What are the main considerations to design a product
by (i) a casting process, and (ii) forging process. 3+3
- (c) What is computer aided process planning (CAPP)?
What are the types of data required for developing
a CAPP system? Differentiate between variant and
generative systems of process planning. 8
8. (a) Explain the basic principle involved in electrochemi-
cal machining. 10
- (b) Would electrochemical grinding be a suitable process
for sharpening ceramic tools? Why or why not?
What about using ultrasonics? 10

Group C

9. Briefly explain the following: 10 × 2
- (i) Design by evolution
- (ii) Problem identification
- (iii) Design morphology
- (iv) AGVs
- (v) Gantry robots
- (vi) Sensors
- (vii) Robust design
- (viii) Drawing and extrusion
- (ix) Casting defects
- (x) Hot and cold working.

S'10: 1FN: AN 201/AD 301 (1401) (3)

AG—20,000

W'10 : 1 FN : AN 201/AD 301 (1401)

**FUNDAMENTALS OF DESIGN AND
MANUFACTURING**

Time : Three hours

Maximum Marks : 100

Answer FIVE questions, taking ANY TWO from Group A, ANY TWO from Group B and ALL from Group C.

All parts of a question (a, b, etc.) should be answered at one place.

Answer should be brief and to-the-point and be supplemented with neat sketches. Unnecessary long answer may result in loss of marks.

Any missing or wrong data may be assumed suitably giving proper justification.

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) Explain briefly various steps to be followed to design a product. Illustrate the same with the help of an example. 6
- (b) What is the role of need analysis in the design process? 6
- (c) What is product life cycle? Illustrate, with a suitable example, various stages of product life cycle. 2 + 6
2. (a) Briefly explain the principle of rolling with a neat sketch. Give three different types of rolling stand arrangements. 8
- (b) What is group technology? How does it help in improving the economy of production processes? 6

- (c) Explain the integration of CAD and CAM in detail. 6
3. (a) Briefly explain the steps involved in making a shell casting mold. 5
- (b) Explain briefly the following : 3 × 5
- (i) Design for manufacturability and its application
- (ii) Various methods of inspection of castings for internal and external defects
- (iii) Various properties of molding sand.
4. (a) What is Merchant's circle diagram ? Discuss its significance. 6
- (b) Differentiate among shaping, planning and slotting as regards to relative tool and work motions. Show sketches of these operations in support to your answer. 6
- (c) Explain different machining operations that can be performed on a vertical spindle milling machine. 8
- Group B**
5. (a) How would you specify a grinder ? Describe various factors used in the selection of a grinding wheel. 8
- (b) Briefly describe the following finishing operations : 3 × 2
- (i) Honing
- (ii) Lapping
- (iii) Buffing.
6. (a) With the help of schematic illustrations, describe the principle of operation of electro-chemical machining. 8
- (b) What are the advantages of unconventional machining processes ? Explain the working of ultrasonic drilling with suitable sketches. 12
7. (a) Explain (showing sketches) the following in brief : 3 × 4
- (i) Submerged arc welding
- (ii) Metal inert gas welding
- (iii) Thermit welding.
- (b) Why is it necessary to achieve directional solidification in castings ? What are the methods usually employed for obtaining conditions suitable for directional solidification ? 8
8. Explain the following : 4 × 5
- (a) Role of simulation, modelling, and optimization in engineering design
- (b) Automatic storage and retrieval system
- (c) Computer Aided Process Planning
- (d) OPTIZ classification system of GT.
- Group C**
9. Briefly explain the following : 10 × 2
- (i) Various methods of heat treatment of steels
- (ii) Group technology
- (iii) Hot tears and cold shut defects in casting
- (iv) HAZ

W'10 : 1 FN : AN 201/AD 301 (1401) (2) (Continued)

W'10 : 1 FN : AN 201/AD 301 (1401) (3) (Turn Over)

- (v) Information technology and its elements
- (vi) Creative, adoptive and variant design
- (vii) Various types of chip formation in a single point cutting operation
- (viii) Extrusion and rolling operations
- (ix) Reliability and maintainability
- (x) Robust design.

S'11 : 1 FN : AN 201/AD 301 (1401)

FUNDAMENTALS OF DESIGN AND MANUFACTURING

Time : Three hours

Maximum Marks : 100

*Answer FIVE questions, taking ANY TWO from Group A,
ANY TWO from Group B and ALL from Group C.*

*All parts of a question (a, b, etc.) should be
answered at one place.*

*Answer should be brief and to-the-point and be supple-
mented with neat sketches. Unnecessary long answers
may result in loss of marks.*

*Any missing or wrong data may be assumed suitably
giving proper justification.*

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) Explain briefly various steps to be followed to design a product with the help of an example. 8
- (b) Discuss the following: 3 × 4
 - (i) Design specifications
 - (ii) Creative design
 - (iii) Design by evolution.
2. (a) What do you mean by morphology of design? Explain briefly. 5
- (b) Explain various stages of a product life-cycle. What is its utility? 5

- (c) Write a descriptive note on 'design checks for clarity, simplicity and safety.' 10
3. (a) What are the advantages and disadvantages of investment casting process? Mention some of its applications. 8
- (b) What is sweep pattern? When is it used? 4
- (c) Define the terms: (i) Sprue, (ii) Gate, (iii) Core, and (iv) Parting line. 4 × 2
4. Differentiate between the following: 4 × 5
- (i) Hot working and cold working
- (ii) Rolling and forging
- (iii) Extrusion and wire drawing
- (iv) Blanking and piercing.

Group B

5. (a) What is chip? What are the main types of chips formed during metal cutting? 8
- (b) Define cutting speed, feed and depth of cut as applied to a shaping process. 4
- (c) What is Merchant's circle diagram? Discuss its significance. 8
6. (a) Describe grinding process. What are the various factors considered during selection of grinding wheels? 8

S'11 : 1FN: AN 201/AD 301 (1401) (2)

(Continued)

- (b) Compare the machining characteristics of different machining processes (such as EDM, ECM and USM) with respect to (i) metal removal rate, (ii) surface finish obtained, (iii) depth of surface damage, and (iv) power required for machining. 4 × 3

7. (a) What do you mean by Computer Aided Process Planning (CAPP) and state some of its advantages. Under what situations, CAPP is preferred as compared to manual process planning. 10
- (b) Identify some of the benefits in integrating the design and manufacturing processes. What are the basic elements that go into making up a robotic cell for a particular application? 10
8. (a) What is gas welding? Explain different types of flames in oxy-acetylene welding. State their specific applications. 10
- (b) Define group technology concept in manufacturing. Discuss the stages involved for adopting a plan for group technology. 10

Group C

9. Briefly explain the following: 10 × 2
- (i) Selection of machine tools
- (ii) Design for manufacturability
- (iii) Database management
- (iv) ASRS
- (v) Concept of a system

S'11 : 1FN: AN 201/AD 301 (1401) (3)

(Turn Over)

- (vi) Design for assembly
- (vii) Brainstorming
- (viii) Design specifications
- (ix) Closed die forging
- (x) Velocity of shear in metal cutting.

W'11:1 FN:AN 201/AD 301 (1401)**FUNDAMENTALS OF DESIGN AND MANUFACTURING**

Time : Three hours

Maximum Marks : 100

*Answer FIVE questions, taking ANY TWO from **Group A**,
ANY TWO from **Group B** and ALL from **Group C**.*

*All parts of a question (a, b, etc.) should be
answered at one place.*

*Answer should be brief and to-the-point and be supple-
mented with neat sketches. Unnecessary long answer may
result in loss of marks.*

*Any missing or wrong data may be assumed suitably
giving proper justification.*

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) Explain the term 'design'. Enumerate various steps involved in design process. Explain these steps in brief. 2 + 4 + 4
- (b) Distinguish between 'need identification' and 'need analysis'. 5
- (c) Differentiate between 'standardization' and 'specification' giving appropriate examples. 5
2. (a) What is morphology of design ? Explain all parts of morphology of design. 4 + 6

- (b) Explain 'evaluation' and 'evolution' in the design process. 6
- (c) How will you organize and communicate the design ? 4
3. (a) What is 'manufacturing' ? How is it different from 'production' ? 6
- (b) What is 'design for manufacture' ? Explain. 6
- (c) Define the terms 'reliability' and 'maintainability'. 8
4. Describe the following : 4 × 5
- (a) Investment casting
- (b) Technical report
- (c) Rolling
- (d) Extrusion.
- (c) What is Information Technology ? How are its elements important in present scenario ? 4 + 4
7. Explain the following in detail : 5 × 4
- (a) Group Technology
- (b) Simulation
- (c) Robot
- (d) AGV
8. (a) What is Computer Aided Process Planning ? How is it better than manual process planning ? 8
- (b) What do you mean by unconventional machining processes ? Discuss their importance. 6
- (c) Define cold working of metals. Enumerate its advantages and disadvantages. 6

Group C

9. Briefly explain the following : 10 × 2
- (i) Design by evolution
- (ii) Gantry robots
- (iii) Sensors
- (iv) AS/RS
- (v) Robust design
- (vi) Casting
- (vii) Forging
- (viii) Brainstorming
- (ix) Feasibility
- (x) System
- Group B**
5. (a) Classify machining processes. Name the operations performed on a lathe machine. How will you specify a lathe machine ? Show sketches. 4 + 2 + 4
- (b) Differentiate between shaper and planar. 5
- (c) What is arc welding ? What precautions should be taken during welding by arc welding process ? 5
6. (a) What is surface grinder ? Under what conditions the use of this machine is recommended ? 2 + 4
- (b) What are the advantages of welding joint over other joints ? Explain oxyacetylene gas welding. 2 + 4

S'12:1 FN:AN 201/AD 301(1401)

**FUNDAMENTALS OF DESIGN AND
MANUFACTURING**

Time : Three hours

Maximum Marks : 100

*Answer FIVE questions, taking ANY TWO from Group A,
ANY TWO from Group B and ALL from Group C.*

*All parts of a question (a, b, etc.) should be
answered at one place.*

*Answer should be brief and to-the-point and be supple-
mented with neat sketches. Unnecessary long answers may
result in loss of marks.*

*Any missing or wrong data may be assumed suitably
giving proper justification.*

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) What is product life cycle ? Illustrate various stages
of product life cycle with a suitable example. 8
- (b) Describe the following in detail : 3 × 4
 - (i) Design for reliability
 - (ii) Design for assembly
 - (iii) Design for re-cyclability
2. (a) What are the main requirements to design a pro-
duct ? Explain briefly various steps to be followed
to design a product. 4 + 4

(Turn Over)

- (b) Explain briefly the engineering design process and its structure. 8
- (c) Briefly explain the concept of following with respect to the new product design : 2×2
- (i) Brainstorming
- (ii) Morphological analysis
3. (a) Describe the die casting process. Explain briefly the advantages and disadvantages of die casting process over sand casting process. 12
- (b) List the various characteristics that are required in the dry sand molding. 8
4. Explain the following in brief : 4×5
- (i) Rolling and various types of rolling stand arrangements
- (ii) Advantages and disadvantages of hot and cold rolling
- (iii) Captive foundry
- (iv) Shell molding process.

Group B

5. (a) Draw the Merchant's force diagram and state the assumptions made in its development. 8
- (b) Describe the essential parts of a lathe machine. Explain the various processes that can be performed on a lathe machine. 8
- (c) Differentiate between shaping, planing and slotting as regards to relative tool and work motion. 4

S'12 : 1 FN : AN 201/AD301 (1401)

(2)

(Continued)

6. (a) Describe the mechanism of material removal in ultrasonic machining with the help of schematic illustrations. 10
- (b) What are the various factors considered in the selection of grinding wheels ? How are grinding wheels specified ? 10
7. Briefly explain (using neat sketches) the method of joining the metals by the following welding processes. Also, explain the advantages and disadvantages of each process : 4×5
- (i) Thermit welding
- (ii) Submerged arc welding
- (iii) TIG welding
- (iv) MIG welding
8. Write short notes on the following : 4×5
- (i) CAPP
- (ii) Group Technology
- (iii) AS/RS
- (iv) Simulation and modelling

Group C

9. Define/explain the following : 10×2
- (i) AGVs
- (ii) Significance of re-crystalline temperature
- (iii) Sensors and robots
- (iv) Function of cores

S'12 : 1 FN : AN 201/AD301 (1401)

(3)

(Turn Over)

- (v) Uses and application of Information Technology
- (vi) CIM
- (vii) Data Base Management System
- (viii) Differences between soldering and brazing
- (ix) Creative, adoptive and variant designs
- (x) Cold shut defect : causes and remedies.

W'12:1 FN:AN201/AD301 (1401)

**FUNDAMENTALS OF DESIGN AND
MANUFACTURING**

Time : Three hours

Maximum Marks : 100

*Answer FIVE questions, taking ANY TWO from Group A,
ANY TWO from Group B and ALL from Group C.*

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answered at one place.*

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mented with neat sketches. Unnecessary long answers
may result in loss of marks.*

*Any missing or wrong data may be assumed suitably
giving proper justification.*

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) What are the different stages of engineering design ?
Discuss with a suitable example. 8
- (b) How are needs for a particular product analysed ? 6
- (c) Differentiate between morphology and anatomy of
design. 6
2. (a) What are the main limitations of the sand casting
process and how are they overcome ? 6
- (b) What is investment casting ? What are its advantages
and limitations ? 8

(Turn Over)

- (c) What are the distinguishing features between a casting and a pattern? 6
3. (a) What is metal forming? What are the various processes of metal forming? 6
- (b) Explain the following terms as applicable to rolling process: 3×2
- (i) Neutral point
- (ii) Angle of bite
- (iii) Draft
- (c) Explain the difference between punching and blanking with the help of neat sketches. 8
4. (a) Enumerate the reasons responsible for the development of advanced (unconventional) machining processes. Under what manufacturing conditions you will prefer to use these processes as compared to conventional machining processes. 8
- (b) Make a list of important process parameters in case of (i) electro-discharge machining, and (ii) ultrasonic machining. $3 + 3$
- (c) What are the capabilities that an effective Computer Aided Process Planning (CAPP) system should have? Discuss in brief. 6
- (b) What is information system design? List major steps explaining in brief the steps to be followed in the design of an information system for manufacturing. 10
- (c) What is data life cycle? Explain briefly. 4
6. (a) Define welding. Classify different welding processes. 4
- (b) What do you mean by polarity? Distinguish between straight and reverse polarity. What is the main advantage of having different polarities? 6
- (c) Two 1 mm thick steel plates (sheets) are to be spot welded at a current of 10,000 A. Assuming effective resistance to be $200 \mu\Omega$, and current flow time of 0.1 sec, calculate the heat generated during the process. If the density of the spot weld nugget is 8 g/cm^3 and its volume is $120 \times 10^{-3} \text{ cm}^3$, calculate the efficiency of the process, assuming 1380 joules of heat are required to melt 1 g of steel. 10
7. (a) Define speed, feed and depth of cut as applied to a drilling machine. 6
- (b) What is grinding? What are the parameters that control the grinding process? 8
- (c) Find the angle at which the compound rest should be set to turn a taper on the workpiece having a length of 200 mm, larger diameter 45 mm and smaller diameter 30 mm. 6
8. (a) Discuss the concept of resolution, accuracy and repeatability of a robot arm. 8

Group B

5. (a) What is group technology? What are the important benefits derived from group technology concept in manufacturing? 6

W'12:1FN:AN201/AD301(1401)

(2)

(Continued)

W'12:1FN:AN201/AD301(1401)

(3)

(Turn Over)

- (b) Discuss the future of factory automation in the light of industrial robotics. 6
- (c) Distinguish between end effectors and sensors as applied to robots. 6

Group C

9. Explain the following in brief : 10 × 2
- (i) Modular design
 - (ii) Brainstorming
 - (iii) Recyclability
 - (iv) Flash in a forging operation
 - (v) Manufacturing integration
 - (vi) Selection of a manufacturing process
 - (vii) Reliability
 - (viii) Economic feasibility
 - (ix) Permanent mould casting
 - (x) Robust design.

S'13 : 1 FN : AN 201/AD 301 (1401)

FUNDAMENTALS OF DESIGN AND MANUFACTURING

Time : Three hours

Maximum Marks : 100

**Answer FIVE questions, taking ANY TWO from Group A,
ANY TWO from Group B and ALL from Group C.**

*All parts of a question (a, b, etc.) should be
answered at one place.*

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mented with neat sketches. Unnecessary long answer may
result in loss of marks.*

*Any missing or wrong data may be assumed suitably
giving proper justification.*

Figures on the right-hand side margin indicate full marks

Group A

1. (a) What is design? Write the checklist for engineering design problems. 2 + 6
- (b) Explain four major dimensions of functionality of design. 8
- (c) What is design review ? 4
2. (a) What is communication ? What are the factors on which effectiveness of communication depends ? 2 + 6
- (b) Differentiate between morphology of design and anatomy of design. 8
- (c) Write the main elements of any technical report. 4

3. (a) What is pattern? Explain different types of pattern allowances with a suitable diagram. 2 + 6
- (b) Explain briefly the following terms relating to casting : 4 × 2
- (i) Permeability of moulding sand
- (ii) Role of clay in casting
- (iii) Core and core print
- (iv) Elements of gating system
- (c) What is the difference between hot chamber and cold chamber die casting ? Why is aluminium alloy not used in hot chamber die casting ? 3 + 1
4. (a) Explain progressive dies, compound dies and combination dies with a suitable diagram. 8
- (b) Define forging. Explain sequentially the various passes used in drop forging with a suitable diagram. 2 + 6
- (c) Briefly explain the meaning of draught and elongation as related to hot rolling. 4

Group B

5. (a) What are the various methods available for taper turning in a lathe ? Explain their specific advantages and limitations. 5 + 3
- (b) Write short notes on the following : 4 × 2
- (i) Straddle milling
- (ii) Spade drills

- (iii) Advantage of hydraulic shaping
- (iv) Climb milling
- (c) A grey cast iron shaft is machined in a centre lathe in 1 min with a single cut. The shaft is 100 mm long and 75 mm in diameter. If the feed used is 0.30 mm/revolution, what was the cutting speed used ? Assume over run = 2 mm. 4
6. (a) Define centreless grinding. Describe the type of centreless grinding operations. Write the advantage and limitation of centreless grinding. 1 + 4 + 3
- (b) Explain the principle of EDM with a neat sketch. 8
- (c) What are the three basic manufacturability considerations for design of weldments ? 4
7. (a) Differentiate between direct numerical control and computer numerical control. 4
- (b) Explain the need of database for a manufacturing organisation. 4
- (c) What are the classification of robots ? 4
- (d) Differentiate between variant process planning and generative process planning. 4
- (e) What is 'Rule of Hundred' with respect to integration ? 4
8. (a) Describe the factors on which selection of manufacturing method is done for a particulate product. 10
- (b) Discuss the stages involved for adopting a plan for group technology. 10

Group C

9. Explain/solve the following in brief : 10 × 2

- (i) Quill punches**
- (ii) Embossing and coining**
- (iii) Product simplification**
- (iv) Modular design**
- (v) Customize product design**
- (vi) String milling**
- (vii) Projection welding**
- (viii) Lead-through programming for robots**
- (ix) For resistance spot welding of two 2.5 mm thick aluminium plates, 5500 A current was passed for 0.2 sec. Estimate heat energy required for welding. (Assume resistance = 75 μ ohm)**
- (x) Capacity planning.**

W'13: 1 FN: AN 201/AD 301 (1401)

**FUNDAMENTALS OF DESIGN AND
MANUFACTURING**

Time : Three hours

Maximum Marks : 100

*Answer FIVE questions, taking ANY TWO from Group A,
ANY TWO from Group B and ALL from Group C.*

*All parts of a question (a, b, etc.) should be
answered at one place.*

*Answer should be brief and to-the-point and be supple-
mented with neat sketches. Unnecessary long answer may
result in loss of marks.*

*Any missing or wrong data may be assumed suitably
giving proper justification.*

Figures on the right-hand side margin indicate full marks.

Group A

1. (a) Explain briefly various steps to be followed to design a product. Illustrate the same with the help of an example. 4 + 4
- (b) Discuss the following : 3 × 4
 - (i) Creative design
 - (ii) Innovative design
 - (iii) Use of artificial intelligence in designing a product
2. (a) What is product life cycle ? Illustrate, with a suitable example, various stages of product life cycle. 2 + 6

(Turn Over)

- (b) What are various shortfalls in traditional product design methodology? 6
- (c) Compare the reliability system with component in series against components in parallel. 6
3. (a) What are various steps used to prepare a mold in shell molding process? Give the advantages and disadvantages of shell molding process over green sand molding process. 2 + 6
- (b) What are various constituents of a molding sand? What are the properties desirable of molding sand from the standpoint of sound castings? 2 + 6
- (c) Define the following terms and their functions: 2 × 2
- (i) Riser
- (ii) Chaplets
4. (a) Briefly explain the principle of rolling with a neat sketch. Give three different types of rolling stand arrangements. 4 + 4
- (b) Explain the following processes using neat sketches wherever necessary: 3 × 4
- (i) Extrusion
- (ii) Blanking
- (iii) Piercing
- Group B**
5. (a) What is Merchant's circle diagram? Discuss its significance. 6
- (b) Differentiate between shaping, planning, and slotting as regards to relative tool and work motions. Draw sketches of these operations in support of your answer. 8
- (c) Explain different machining operations that can be performed on a vertical spindle milling machine. 6
6. (a) How would you specify a grinder? Describe various factors used in the selection of a grinding wheel. 8
- (b) Briefly describe the following finishing operations: 3 × 4
- (i) Honing
- (ii) Lapping
- (iii) Buffing
7. (a) Describe the principle of operation of electro-discharge machining with the help of schematic illustrations. 8
- (b) What are the advantages of unconventional machining processes? Explain the working of electro-chemical machining process with suitable sketches. 12
8. (a) Explain the following in brief with neat sketches: 2 × 4
- (i) Submerged arc welding
- (ii) Metal inert gas welding
- (b) Explain the following: 3 × 4
- (i) Automatic storage and retrieval system
- (ii) Computer Aided Process Planning

(iii) OPTIZ classification system of Group Technology

Group C

9. Briefly explain the following : 10 × 2

- (i) Various methods of heat treatment of steels**
- (ii) Group Technology**
- (iii) Design for reliability**
- (iv) Design for manufacturability**
- (v) Various types of chip formation in a single point cutting operation**
- (vi) Robust design**
- (vii) Thermit welding**
- (viii) HAZ**
- (ix) Hot and cold working of metals**
- (x) Data base management system**

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