

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

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

Group A

1. (a) Discuss the stages in engineering design process with the help of example. 6
- (b) Differentiate between standardization and specification giving appropriate examples. How are 'preferred numbers' useful in standardization? Explain with the help of a suitable example. 8
- (c) Explain in brief: 6
 - (i) Robust design
 - (ii) Role of brain storming in design idea generation.

2. (a) What is the role and importance of aesthetics in design? What are the important aesthetic design requirements? Discuss. 6
- (b) In a system there are four components in parallel followed by three components in series. The components in parallel have a reliability of 0.7 each and those in series have a reliability of 0.8 each. Determine the reliability of entire system.
Define the terms :
- (i) Reliability
(ii) Mean time to failure, and
(iii) Mean time between failure. 8
- (c) Write short notes on : 6
- (i) Design communication
(ii) Tools of information technology.
3. (a) Explain, with diagram, a process for the production of seamless tubes and pipes. 6
- (b) Define Shrinkage and Porosity in castings. How can one tell whether cavities in castings are due to porosity or shrinkage?
How are dissolved gases removed from castings? List four casting defects. 8
- (c) What checks are recommended for ensuring design's clarity, simplicity, modularity and safety? Explain. What is design for maintenance? 6
4. (a) What are the major classifications of basic manufacturing processes? Highlight the characteristics of each and its specific applications (at least two). 6

- (b) How would you give the specifications for a (i) lathe machine, (ii) milling machine? 6
- (c) Explain Investment Casting Process with the help of neat diagram(s). What are its applications? 8

Group B

5. (a) What is Computer Aided Process Planning? How is it superior to manual process planning? Explain. 6
- (b) On what basis parts are grouped into families in Group Technology? Discuss citing examples.
What are the benefits of GT over the conventional setup? 6
- (c) What are the differences between conventional and non-conventional machining processes?
List three finishing operations commonly used in manufacturing? Why are these operations necessary? Explain. 8
6. (a) What is an FMS? What are its components? Why do FMS require major capital expenditure? And why is an FMS capable of producing a wide range of lot sizes? 6
- (b) With the help of schematic illustration, describe the principle of operation of EDM process. 6
- (c) Explain the tool-work interaction process and mechanism of chip formation. Represent the interaction with the diagram. 8
7. (a) Define modelling and simulation. 'Simulation is a type of modelling'. Justify giving an example. 6

(b) Explain (i) Robots and (ii) Automated Storage and Retrieval Systems (AS/RS) v material handling systems. Highlight their components, working and applications. 8

(c) What is design for manufacturability? How can it be realised in practice? Explain with an example. 6

4. (a) Schematically represent the surface grinding process. What are the components of a surface grinding machine? List some applications of surface grinding. 6

(b) Describe the basic fusion welding process. Explain the process details of submerged arc welding. 6

(c) Explain the following in brief: 8

(i) Design for economic manufacturing

(ii) Basic tools of integration

(iii) Information technology and its elements.

Group C

9. (A) For each question, select the *correct* answer out of the alternatives provided: 1 × 12

(i) Which one of the following is not a function of a riser?

(a) to help the flow of metal towards the mould cavity

(b) to provide escape to hot gases

(c) to feed the metal to the casting as it shrinks during solidification

(d) to help streamline the flow of metal into runner

(ii) The required cutting speed in metre/min in machining a workpiece with a diameter of 100 mm and a speed of 500 rpm will be

- (a) 628
- (b) 262
- (c) 157
- (d) 37.7

(iii) Quick return mechanism is used in

- (a) slotter
- (b) broach
- (c) milling
- (d) lathe

(iv) The collapsible tooth-paste tubes are produced by

- (a) impact extrusion
- (b) direct extrusion
- (c) indirect extrusion
- (d) tube extrusion

(v) Aluminium oxide abrasive is used for grinding

- (a) gray cast iron
- (b) high speed steels
- (c) cemented carbides
- (d) ceramic materials

(vi) Which of the following materials is used as the dielectric fluid in electro-discharge machining?

(a) Kerosene

(b) NaCl

(c) NaOH

(d) NaNO_3

(vii) Wax pattern is used in

(a) die casting

(b) shell moulding

(c) investment casting

(d) plaster moulds

(viii) The material used for coating the electrode is called

(a) flux

(b) slag

(c) deoxidiser

(d) binder

(ix) Casting is a preferred process for parts having

(a) a few details

(b) many details

(c) non-symmetrical shape

(d) none of the above

(x) Size of shaper is specified by

(a) size of table

(b) h.p. of motor

(c) ratio of forward to return stroke

(d) length of stroke

(xi) A standard ground drill has a point angle of

(a) 90°

(b) 100°

(c) 118°

(d) 120°

(xii) When the grains of a grinding wheel become dull, then it must be

(a) replaced

(b) trued

(c) dressed

(d) treated

(B) Write briefly about the following, giving an example wherever applicable:

2 × 4

(i) Design for recyclability

(ii) Ergonomics

(iii) Automated Guided Vehicles (AGVs)

(iv) System concept.