

SUMMER 2005
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 answers may result in loss of marks.

Any missing data or wrong data may be assumed suitably

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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? 6
- List three finishing operations commonly used in manufacturing? Why are these operations necessary? Explain. 3
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) vs 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
8. (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 element.

Group C

9. (A) For each question, select the correct answer out of the alternatives provided: 1 x 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 meter/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 electric fluid in electro-discharge machining?
- (a) Kerosene
 - (b) NaCl
 - (c) NaOH
 - (d) NaN₃
- (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:
- 2x 4
- (i) Design for recyclability
 - (jj) Ergonomics
 - (jji) Automated Guided Vehicles (AGVs)
 - (iv) System concept.

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Group A

1. (a) Explain 'Design Process'. Illustrate the step followed with the help of a figure. Also explain the flow of work during the design process. 2 + 2 + 4
 (b) Explain the role of 'need' in design. How the needs for a particular product design process analysed? 3 + 3
 (c) Describe the role of standardisation in the complex products. How the specifications help the customers? 3 + 3

2. (a) What do you understand by 'morphology of design'? Discuss the phases of feasibility study, preliminary design and detailed design. 3 + 5
 (b) Explain the term 'Design for manufacturability'. State the guidelines to implement it. 4 + 2
 (c) Describe the terms 'economic feasibility', 'recyclability' and 'evaluation of design'. 2 + 2 + 2

3. (a) What do you understand by 'reliability' and why it is considered? What are three categories of failures? Illustrate graphically number of failures vs. time. 2 + 2 + 2
 (b) How will you check the design for clarity, simplicity and safety? Also explain how design is organised and communicated. 4 + 4
 (c) Give the classification of manufacturing processes. Name the commonly used casting processes. With the help of a figure explain investment casting. 1 + 1 + 4

4. (a) Why should we do hot working of metals? Enumerate the advantages and disadvantages of hot working. Describe three high mill. 1½ + 2½ + 4
 (b) Explain 'extrusion' and 'drawing' processes. 3 + 3
 (c) Describe 'punching' and 'blanking' operations with the help of figures. 3 + 3

Group B

5. (a) How do you define the cutting ability of a cutting tool? Give the classification of cutting tools. How will you select the materials of a cutting tool? 2½ + 2½ + 3
 (b) Classify the machining processes. Name the operations which can be performed on a lathe machine. Describe the process to carry out the turning operation on the lathe machine. 2 + 2 + 4
 (c) Differentiate between the shaper and planer. Explain what process takes place during the return stroke of a shaping machine. 2 + 2

6. (a) Describe the working principle of 'arc welding'. Explain the shielded arc welding and how does it save the weldment from oxidation and absorption of nitrogen. What precautions need to be observed in arc welding? 2 + 4 + 2
 (b) Enumerate the advantages of unconventional machining methods. Describe the

- working of electro-discharge machining with the help of a figure. 3 + 5
- (c) Define information. Enumerate the facts about information. How will you build up information system? 1+1+2
7. (a) What do you understand by 'Group Technology'? Enumerate the advantages and disadvantages of group technology. 3+5
- (b) Discuss the use of classification system of group technology. Also discuss the application of cluster analysis. 3+3
- (c) Explain 'simulation' and 'database management system'. 3+3
8. (a) Enumerate and describe the important points to be considered at the time of design for easier machining of a component. 8
- (b) Write notes on the following: 8
- (i) Controllers
- (ii) Sensors
- (iii) Robots
- (iv) Automated guided wheels,
- (c)(i) How will you consider the economic aspects for manufacturing during design? 2
- (ii) Describe computed aided process planning. 2
- Group C**
9. (A) Explain the following in brief: 2x6
- (i) Brainstorming
- (ii) Forging
- (iii) Design for assembly
- (iv) Robust design
- (v) Design for shipping
- (vi) Safety in design.
- (B) Select the correct answers out of the alternative choices of the following: 1x8
- (i) Steel and cast iron pipes are casted by
- (a) die casting
- (b) continuous casting
- (c) centrifugal casting
- (d) investment casting
- (ii) Facing sand used in foundry work comprises
- (a) alumina, silica and clay
- (b) silica and clay
- (c) clay and alumina
- (d) silica and alumina
- (iii) The criteria for selection of electrode diameter in arc welding is
- (a) type of welding process
- (b) thickness of the components to be welded
- (c) voltage used
- (d) current used
- (iv) In arc welding, arc is created between electrode and work by
- (a) flow of current
- (b) voltage
- (c) contact resistance
- (d) electrical resistance
- (v) Hot working improves the mechanical properties of the metal due to
- (a) recovery of grains
- (b) recrystallisation
- (c) grain growth
- (d) refinement of grain size

- (vi) In four high rolling mill the bigger rollers are called
- (a) guide rolls
 - (b) back up rolls
 - (c) main rolls
 - (d) support rolls
- (vii) In drawing operation, the metal flows due to
- (a) ductility
 - (b) work hardening
 - (c) plasticity
 - (d) shearing
- (viii) Centering can be done most accurately on
- (a) four jaw chuck
 - (b) three jaw chuck
 - (c) collet chuck
 - (d) magnetic chuck.

Compiled by By

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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
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 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:

2x7

- (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

- Q.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)
- Q.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)
- Q.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 organize and communicate the design? (3+3)
- Q.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 mould casting processes. (5)

Group B

- Q.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 and
 (v) Tool signature (1x5)
 (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)
- Q.6 (a) What is surface grinder? Under what conditions the use of this machine is recommended? (4+2)
 (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)
- Q.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 the information technology in the integration of business and technological aspects. (6)

Q.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)

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

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

Group C

Q.9 (A) Explain the following in brief: (2x6)

(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: (1x8)

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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- | | | |
|---|---|-----|
| 1 | (a) What are the different stages of Engineering design? Discuss with a suitable examples. | 5+3 |
| | (b) How will you integrate the functions of design and manufacturing? How it will help in achieving economic manufacturing? - | 3+3 |
| | (c) List out the characteristics of a good designer. | 6 |
| 2 | (a) With the help of an example, explain the concept of Morphology of Design. | 6 |
| | (b) What is the role of the 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 | Explain the following: | |
| | (a) Considerations of design of castings, and | 4 |
| | (b) Reliability and robust design | |

GROUP - B

- | | | |
|---|---|---|
| 5 | (a) Distinguish between orthogonal casting and oblique cutting. | 6 |
| | (b) Write notes on the following: | |
| | (i) tool signature | 2 |
| | (ii) Machinability | 2 |
| | (iii) cutting fluids | 2 |
| | (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 the shear strain. | 8 |
| 6 | (a) what is surface grinding? When do you recommend the use of the machine? Explain the alternative arrangement of spindle and table of surface grinder along with their relative motion with the help of suitable sketches. | 8 |
| | (b) (i) describe the working of 'electromechanical machining set up. | 4 |
| | (ii) What do you understand by rate of metal removal? | 4 |
| | (c) What is manufacturability? Describe the 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. | 8 |

- 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. AGV, 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 the following:
- (i) Selection of Machine tools 2
- (ii) Controllers and sensors 2
- (iii) Primary metal forming process 2
- (iv) Design communication 2
- (v) Simulation and its application 2
- (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.
- (i) Porosity in thin sections of a casting can be minimised by: 1
- (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: 1
- (a) green sand moulding (c) pressure moulding
- (b) dry sand moulding (d) machine moulding
- (iii) Blanking and Piercing operation can be performed simultaneously on: 1
- (a) simple die (c) compound die
- (b) progressive die (d) combination die
- (iv) The tolerance produced by investment casting process are of the order 1
- (a) +/- 0 . 5 mm (c) +/- 1 mm
- (b) +/- 0 .0 5 mm (d) +/- 5 mm
- (v) Centering on lathe can be done most accurately on: 1
- (a) four jaw chuck (c) collet chuck
- (b) three jaw chuck (d) magnetic chuck
- (vi) The usual ratio of Forward and return stroke of shaper is: 1
- (a) 2 : 1 (c) 2 : 3
- (b) 1 : 2 (d) 3 : 2
- (vii) In grinding operation, grinding harder material: 1
- (a) softer grade is used (c) medium grade is used
- (b) high grade is used (d) any grade may be used
- (viii) Variant type computer aided process planning is most useful when: 1
- (a) large number of part families are involved
- (b) small number of part families with short product life cycle are involved
- (c) small number of part families with fairly stable product life cycle are involved
- (d) very complex parts are involved
- (ix) Dielectric fluid is must in : 1
- (a) EDM Process (c) ultrasonic machining
- (b) ECM Process (d) laser machining
- (x) Which of the following welding processes uses non - consumable electrode? 1
- (a) Laser welding (c) TIG welding
- (b) MIG 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: 2x10
 (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: 2x10
 (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

Group C

9. (A) Fill in the blanks: 1 x 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: 2x5

- (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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SUMMER 2008:
FUNDEMENTALS OF DESIGN AND MANUFACTURING

1. (a) Draw a flow chart showing different stages of engineering design. Explain why stages are repeated several time. (8 M)
- (b) How will you integrate the functions of design and manufacturing? How will it help in achieving economic manufacturing (6M)
- (c) Differentiate between standardization and specification giving appropriate examples. (6 mark)
2. (a) Explain in brief (i) robust design, and (ii) role of brainstorming in design idea generation. (3+3 mark)
- (b) Describe the terms 'economic feasibility', 'recyclability', and 'evaluation of design'. (2+2+2M)
- (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 mark)
3. (a) How will you check the design for clarity, simplicity and safety? Also, explain how design is organized and communicated (10M)
- (b) Compare the reliabilities of system 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 factor of 0.30 only, what is the system reliability? (10M)
4. (a) How are dissolved gases removed from castings? List four castings? List four casting defects. (6 mark)
- (b) With the help of neat sketches, explain extrusion and drawing processes. (6mark)
- (c) Compare the cast and forged products of the same geometry from the view points of strength and quality. (6 mark)
- (d) What is the effect of lubrication on die (tool) life during drawing operation? (2mark)

Group B

5. (a) Classify the machining processes. Name the operations which can be performed on a lathe machine (8 mark)
- (b) Differentiate between the shaper and planner. (6M)
- (c) What do you mean by arc welding? What precautions should be taken during welding? (6 mark)
6. (a) Calculate the cutting time for cutting 150 mm long keyway using HSS end mill of 20 mm diameter having cutting speed is 38m/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 M)
- (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 M)
7. (a) What is design for manufacturability? How can it be realized in practice? Explain with an example. (10 M)
- (b) What do you mean by unconventional machining process? Why are these processes necessary? Explain (6 M)
- (c) Explain briefly information technology and its elements. (4 M)
8. (a) Discuss the applications of following in the field of engineering: (15M)
- (i) Sensors, (ii) robots, (iii) Controller. (iv) AGVs, and (v) AS/RS.

(b) What is computer Aided process planning (CAPP)? How is it superior to manual process planning? (5M)

Group C

9. (A) Explain the following in brief: (5×2M)
- (i) Tool signature
 - (ii) Data Base Management System (DBMS)
 - (iii) Hot and cold working of metals
 - (iv) Modelling vs Simulation
 - (v) Soft information
- (B) State whether the following statements are true or false:
- (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 work piece
 - (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.

WINTER 2008**FUNDAMENTALS OF DESIGN AND MANUFACTURING**

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

Group A

- 1 (a) what are the principle 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 material used for making pattern. (10)
- (b) What do you by reliability? Compare the reliability system with component in series parallel. (10)
4. (a) What is metal working? Discuss advantages of cold working over hot working. (10)
- (b)What is the significance of re-crystallization 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 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
8. (a) Define the 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? Explain. (10)

Group C

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

SUMMER 2009**FUNDAMENTALS OF DESIGN AND MANUFACTURING**

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, c etc) should be answered at one place.
Answer should be brief and to-the-point and be supplemented 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) Consider the example of 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 organization structure for the design office of toy manufacturing company. (10)
3. (a) Give steps-by-steps procedure for the investment casting process. Outline some typical applications of the 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 of each (5)
4. (a) Describe the permanent mould casting process. Give any two application of this process of casting. (10)
(b) Sketch wire drawing operation. What factors determine the drawing ratio?
(c) Sketch a three high rolling mill. Give advantages and limitations of three high rolling. (5)

GROUP B

5. (a) Distinguish between shaping and planing operations. Name the machine 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 process. Give advantages and limitation of the process. (10)
(b) Give steps-wise procedure for selecting a manufacturing process. (6)
(c) Compare d.c welding with a.c welding. (4)
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) Design for use
 - (vi) Product design specifications
 - (vi) Brainstorming
 - (ix) Grinding processes
 - (x) Cutting tool-work piece interaction during machining operation.

Winter 2009

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.

Answers 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 indicates full marks.

1. (a) What is product life cycle ? Illustrate with suitable example, the various stages of product life cycle? (10M)
- (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 M)
- (b) Briefly explain the characteristics of moulding sand required to have a sound mold. (8M)
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 M)
- (b) Briefly describe the various product design techniques. (10M)

Group B

- 5 (a) What is a Merchant's circle diagram ? Discuss its significance. (10M)
- (b) Describe the essential parts of a milling machine? What are the operations that can be performed on a milling machine? (10 M)
6. (a) With the help of schematic illustrations describe the principles of operations of EDM machine. (10M)
- (b) What are the various factors considered in the selection of grinding wheels? How are grinding wheels specified? (10M)
7. (a) What is a Thermite welding ? What does a Thermite mixture consists of and what reactions takes place in Thermite welding? (10M)
- (b) What is manufacturability? Describe its significance in design for manufacturing. (10M)
8. Explain the following: 4×5
 - (a) CIM
 - (b) Group technology
 - (c) Brain storming
 - (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) Use of information technology
- (ix) CAPP
- (x) Soldering.

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SUMMER 2010:
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 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: (4x3)
 - (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: 4x3
 - (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 manufacturing 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 manufacturing? 10
- (b) What is group technology concept in manufacturing? What are the important benefits derived from it? 10

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) a 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 electrochemical machining. (10)
- (b) Would electrochemical grinding be suitable process for sharpening ceramic tools? Why or why not? What about using ultrasonics? (10)

Group C

9. Briefly explain the following (10x2)
- (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

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WINTER 2010
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, c etc) should be answered at one place.

Answer should be brief and to-the-point and be supplemented 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) 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 process? (4)
- (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 applications
 - (ii) Various method of inspection of casting for internal and external defects

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 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: (3×4)
 - (i) Honing (ii) Lapping (iii) Buffing
6. (a) With the help of schematic illustrations, describe the principle of operation of electro- chemical machine (8)
- (b) What are the advantages of unconventional machining process? 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 casting ? What are the methods usually employed for obtaining conditions suitable for directional solidification? (8)
- 8. Explain the following: (4×5)
 - (a) Role of simulation, modeling and optimization in engineering design.
 - (a) Role of simulation, modeling and optimization in engineering design.
 - (b) Automatic storage and retrieval system
 - (c) Computer Aided process planning
 - (d) OPITZ classification system of GT.

GROUP-C

- 9. Briefly explain the following: (10×2)
 - (i) Various methods of heat treatments of steels
 - (ii) Group technology
 - (iii) Hot tears and cold shut defects in casting
 - (iv) HAZ
 - (v) Information technology and its elements
 - (vi) Creative, adoptive and variant design
 - (vii) Various types of chip formation I a ingle point cutting operation
 - (viii) Extrusion and rolling operations
 - (ix) Reliability and maintainability
 - (x) Robust design

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SUMMER 2011
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, c etc) should be answered at one place.

Answer should be brief and to-the-point and be supplemented with neat sketches.

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

Group A

- 1 (a) Example 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 advantage and disadvantages 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 write 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 Merchants circle diagram? Discuss its significance. (8)

6. (a) Describe grinding process. What are the various factors considered during selection of grinding wheels? (8)
- (b) Compare the machining characteristics of different machining process (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 situation, 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) AS/RS
 - (v) Concept of a system
 - (vi) Design of assembly
 - (vii) Brainstorming
 - (ix) Closed die forging
 - (x) Velocity of shear in metal cutting

WINTER 2011**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 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 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.

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 join over other joints? Explain oxyacetylene gas welding 2+4
- (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 process? 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

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SUMMER 2012

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 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 a 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 product? Explain briefly various steps to be followed to design a product. (8)
- (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 various characteristics that are required in the dry sand moulding (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)
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 the 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 modeling

Group C

9. Define/explain the following:

(10×2)

- (i) AGVs
- (ii) Significance of re-crystalline temperature.
- (iii) Sensors and robots
- (iv) Functions of cores
- (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.

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