MANUFACTURING PROCESSES
(MECH 2204)

Time Allotted : 2½ hrs **Full Marks : 60**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 4 (four) from Group B to E, taking one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A

1. Answer any twelve: **12 × 1 = 12**

Choose the correct alternative for the following

(i) The purpose of the riser in the sand casting process is
(a) to provide a passage for molten metal to enter the mould cavity
(b) to cool the molten metal before it enters the mould cavity
(c) to compensate for shrinkage defects in the casting
(d) to direct the flow of molten metal away from the mould cavity.

(ii) Hardness of green sand mould increases with
(a) increase in moisture content beyond 6%
(b) increase in permeability
(c) decrease in permeability
(d) increase in both moisture content and permeability.

(iii) The primary function of a core print in casting is
(a) to create internal features in the casting
(b) to provide additional support for the sand mould
(c) to improve the surface finish of the final casting
(d) to facilitate the alignment of cores within the mould.

(iv) The purpose of using a flux in arc welding is
(a) to provide heat insulation
(b) to remove impurities from the base metal
(c) to control the flow of gas
(d) to regulate the welding current.

(v) In MMAW, what is used as the heat source for melting the base metal and the filler metal?
(a) Electric arc (b) Gas flame
(c) Laser beam (d) Induction heating

(vi) Two streams of liquid metal which are not hot enough to fuse properly result into a casting defect is known as,
(a) Cold shut (b) Swell (c) Sand wash (d) Scab

(vii) In Spot welding, electrodes used are made of
(a) aluminium (b) copper (c) iron (d) lead

(viii) Acetylene gas is kept in cylinders by mixing with
(a) alcohol (b) acetone (c) acetic acid (d) folic acid

(ix) What is sintering in powder metallurgy?
(a) A process of melting metal powders to form a solid mass
(b) A process of compressing metal powders into a desired shape
(c) A process of heating metal powders below their melting point to bond them together
(d) A process of removing excess metal from the surface of a part.

(x) Which of the following is not a property of thermoplastics?
(a) Recyclable (b) Soft and weak
(c) Easy to mold (d) Can be used at high temperatures.

Fill in the blanks with the correct word

(xi) The process of filling the mould cavity under high pressure with molten metal is known as _____.

(xii) In _____casting method, the molten metal is poured and allowed to solidify while the mold is revolving.

(xiii) _____ is a forming process where a metal billet is forced through a die to create a desired shape.

(xiv) The first step in powder metallurgy is to produce _____.

(xv) Hot working process is the plastic deformation of metal which is carried out above _____ temperature.

Group - B

2. (a) Classify the different manufacturing processes with their applications. *[(CO1)(Understand/LOCQ)]*

(b) A cast product of a particular material has dimensions of 75 mm × 125 mm × 20 mm. The total solidification time of the product is found to be 2 mins as calculated using Chvorinov's rule having the index, n=2. If under the identical casting conditions, the cast product shape is changed to a cylinder having diameter 50 mm and height 50 mm, then find the total solidification time in minutes. *[(CO2)(Apply/IOCQ)]*

(2 + 4) + 6 = 12

3. (a) State the applications of Hot and Cold chamber die casting. Discuss the reason for making the sprue in taper shape instead of straight. *[(CO2)(Understand/LOCQ)]*

(b) A cylindrical job with diameter of 200 mm and height of 100 mm is to be cast using the modulus method of riser design. Assume that the bottom surface of the cylindrical riser does not contribute as a cooling surface. If the diameter of the riser is equal to its height, then find the height of the riser (in mm). *[(CO2)(Apply/IOCQ)]*

(4 + 2) + 6 = 12

Group - C

4. (a) What are the various types of flames typically encountered in gas welding and describe each flame with a suitable diagram. *[(CO1)(Remember/LOCQ)]*

   (b) Explain the basic principles behind manual metal arc welding, including the role of the electrode, welding current, and arc formation? *[(CO1)(Understand/LOCQ)]*

6 + 6 = 12

5. (a) What are the advantages and limitations of TIG, MIG welding methods in terms of productivity, weld quality and applicability to different materials? *[(CO3)(Analyse/IOCQ)]*

   (b) Write down the application areas of the resistance welding process? State any two types of welding defects and reason behind its occurrence. *[(CO3)(Remember/LOCQ)]*

6 + (2 + 4) = 12

Group - D

6. (a) Differentiate between hot working and cold working of metals. *[(CO4)(Analyze/IOCQ)]*

   (b) In a single pass rolling operation, a 20 mm thick plate with plate width 100 mm is reduced to 18 mm. The roller radius (R) is 250 mm and rotational speed (N) is 10 rpm. The average flow stress for the plate material is 300 MPa. Find the power (kW) required for the rolling operation. *[(CO4)(Apply/IOCQ)]*

4 + 8 = 12

7. (a) Discuss the advantages and disadvantages of a forging process with a casting process. *[(CO4 & CO2)(Understand/LOCQ)]*

   (b) A spool of wire has a starting diameter of 2.5 mm. It is drawn through a die with an opening that is to 2.1 mm. The entrance angle of the die is 18°. Coefficient of friction at the work-die interface is 0.08. The work metal has a strength coefficient of 450 MPa and a strain hardening coefficient of 0.26. The drawing is performed at room temperature.
   Determine: (i) area reduction, (ii) draw stress and (iii) draw force required for the operation. *[(CO4)(Apply/IOCQ)]*

4 + 8 = 12

Group - E

8. (a) What are the sequential steps involved in the powder metallurgy process? Briefly explain those processes. *[(CO5)(Evaluate/HOCQ)]*

   (b) What are thermoplastic and thermosetting plastics, and how do they differ in terms of their molecular structures and properties? *[(CO5)(understand/LOCQ)]*

(2 + 4) + (3 + 3) = 12

9. (a) Describe the advantages, limitations and applications of the blow moulding process. *[(CO5)(Remember/LOCQ)]*

(b) Explain the basic principles of thermoforming and also state how heat and pressure are used to shape thermoplastic sheets into desired forms.

[(CO6)(Analyse/IOCQ)]

6 + (3 + 3) = 12

Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	47.91	45.83	6.2

Course Outcome (CO):

After the completion of the course students will be able to

1. Form basic idea of different mechanical manufacturing processes (except machining) & related equipment along with type of products manufactured through such processes.
2. Acquire working knowledge of sand casting process.
3. Know about different arc welding processes, resistance welding process, friction welding process.
4. Familiarize with different forming processes like rolling, forging, extrusion & their specific applications.
5. Learn about powder metallurgy process & different plastic moulding processes.
6. Acquire working knowledge of press working process.

**LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question.*