Master of Engineering in Mechanical Engineering Examination, 2025

(2nd Semester)

Subject: Advanced Manufacturing Processes

Time: Three hours **Full Marks: 100**

(*Answer Any Five Questions*)

1. a) Explain with the help of a neat sketch the extrusion OR injection molding process for shaping of Plastics. 10

   b) What is *isostrain* and *isostress* loading of fibre composites? Which is advantageous and why? 10

2. a) What are Metal-Matrix and Ceramic-Matrix composites? Give examples, advantages and application areas of the same? 10

   b) What are the steps involved in making useful products from ceramics? What role does additives play in shaping of the ceramics ? 10

3 a) Determine the hourly rate for a work centre from the following data:

Direct labour rate: Rs.200/- per hr. ; Applicable labour factory O/H:40%;

Capital investment in the m/c: Rs. 50 lacs; Service life=8yrs; Salvage Value=0;

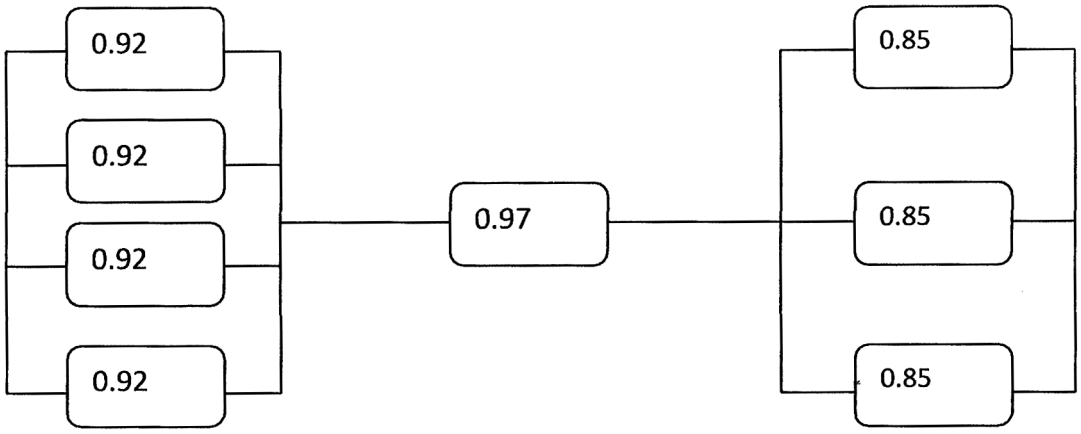
Applicable M/C factory O/H: 40%; Rate of return=10%; C R F=0.1875.

The work centre is operated 8hrs. shift/day for 250 days/yr. (10)

b) A batch of 50 pcs is to be manufactured in a factory for a particular customer. Raw materials and tooling are supplied by the customer. The total time for processing the parts is 200 hrs. Direct labour cost=Rs.90/- per hr. The factory O/H rate is 125% and the corporate O/H rate is150%. Calculate cost of the job.(06)

c) What are the benefits of adopting Group Technology? (04)

4 a) A complex engineering design can be described by a reliability block diagram as shown below:



In subsystem A two components must operate for the subsystem to function successfully. Subsystem C has true parallel reliability. Calculate the reliability of each subsystem and overall system reliability. (10)

b) Consider a process plant working 40 hours per week. In a 46 week year (allowing for plant shutdown for holidays, etc.) total possible working time is 1840 hours. During the year the plant has 20 breakdowns which gave a total downtime of 30 hours. Calculate the reliability statistics. (05)

c) A production machine operates 80 hr/week at full capacity. Its production rate is 20 units/hr. During a certain week the machine produced 1200 parts. Calculate the utilization of the machine during the week under consideration. (05)

5. a) Explain the key concepts in Intelligent Manufacturing. What are key technologies involved in its implementation ? (12)

b) What are the challenges in implementing Intelligent Manufacturing? (08)

6. a) A solid cylindrical ceramic part is to be made whose final length must be L=25 mm. It has been established that for this material, linear shrinkages during drying and firing are 9% and 5%, respectively, based on the dried dimension L_d, Calculate (i) the initial length L_o of the part and (ii) the dried porosity P_d if the porosity of the fired part, P_f is 4%. (10)

b) Suppose that we have a 0.5-in^2 (323-mm^2) bar that is 60% glass and 40% polyester by volume. What are the stresses and strains in the individual components? Assume loading parallel to the fibres, or iso-strain loading. (10)

7. a) Why is it important to improve surface quality of engineering components? Discuss any two surface improvement methods including their advantages/disadvantages and application areas. (10)

b) Differentiate between subtractive, additive and virtual Rapid Prototyping (RP). Explain the Fused-deposition modeling(FDM) process. (10)

8 a) What are the different components of a Manufacturing System? Discuss any two. (08)

b) Write short notes on:(any two)

i)CMM (Coordinate Measuring Machine), ii)Fourier Transform Infrared Spectroscopy iii) 3D Scanning iv) Laser Interferometer (12)

9 a) What is Nanometrology? Why is it important? Give examples of any two nanometrology measurement techniques along with their applications. (12)
b) Differentiate between Contact Metrology and Non-contact Metrology citing examples. (08)