



COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Government of Maharashtra.)
SHIVAJI NAGAR, PUNE - 411 005

END Semester Examination

(MT(ILE)-14001) Selection of Materials & Processes

Course: B.Tech

Branch: Metallurgical Engineering

Semester: Sem VII

Year: 2014-2015

Max.Marks:60

Duration: 3 Hours

Time:- 2.00 pm - 4.00 pm

Date:20/11/2014

Instructions:

MIS No.

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1. Figures to the right indicate the full marks.
2. Mobile phones and programmable calculators are strictly prohibited.
3. Writing anything on question paper is not allowed.
4. Exchange/Sharing of anything like stationery, calculator is not allowed.
5. Assume suitable data if necessary.
6. Write your MIS Number on Question Paper

Q.1 (a) Explain with example interactions of different design elements with each other. [5]

(b) Rewrite the following paragraph with the blanks filled with correct or phrases: [4]

'The strength (σ_T) of a solid requires careful definition. For metals it is _____; For polymers it is identified as the stress at which stress-strain curve becomes markedly _____ at strain of _____%. Strength of ceramics and glasses depends on the mode of loading. In tension it is _____ and in compression it is _____. The strength in compression (σ_c) is _____ times that of strength in tension (σ_T). The ceramic strength can also be measured in bending. The _____ is the maximum surface stress in a bent beam at the instant of _____.

(c) State the relation between Young's modulus (E), Shear modulus (G) and Bulk Modulus (K) for the isotropic materials. [1]

Q.2 (a) What factors does material density and moduli of most material depend upon? Explain how they are related to each other. [4]

(b) What are the four main steps involved in the process for material selection? Explain each step not more than 3 lines. [6]

Q.3 (a) State the design requirements in terms of function, objective, constraints and free variables for following applications [4]

1] A material is required for a heat exchanger to extract heat from geo-thermally heated, saline, water at 120°C (and thus under pressure).

2] A furnace is required to sinter powder-metal parts. It operates continuously at 650°C while the parts are fed through on a moving belt. For reasons of space the insulation is limited to a maximum thickness of $x = 0.2$ m.

- (b) Which are general conflicting objectives which influence material choice? Explain in brief 'trade off strategies' based on optimization theory. [6]
- Q.4 (a) What are the different inputs to cost model? Write down cost equations and explain three major groups of it. [5]
- (b) Compare casting and forging process based on **any five** process attributes. [5]
- Q.5 (a) List down process requirements for manufacturing of following components in terms of function, constraints, objective and free variable. [6]

Car hood (bonnet) – A typical composite hood weighs is 8–10 kg which is to be produced 100,000 units/month. The shape is a dished-sheet and the requirements on tolerance and roughness are 0.2mm and 2 mm, respectively.

Plastic bottles - Plastic bottles are used to contain fluids as various as milk and engine oil. A typical bottle weighs about 30 grams and has a wall thickness of about 0.8 mm. Production rate is 1,000,000 bottles.

- (b) State the design requirements for slender, solid cylinder legs of the table which supports table top without buckling. The leg is a slender column of material of density ρ and modulus E . Its length, L , radius r and the maximum load, F , it must carry are determined by the design. Derive material Indices with following data: [8]

Elastic buckling load for a table leg:

$$F_{\text{critic}} = \frac{\pi^2 EI}{L^2}$$

Where,

$$I = \frac{\pi r^4}{4} = \text{second moment of area of column.}$$

Also state what material property –charts is required for material property selection?

- (c) Draw and explain typical graph showing relationship between relative cost per component and the no. components produced. Also write in brief about 'economic batch size' with help of graph. [6]
