COLLEGE OF ENGINEERING, PUNE

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

END Semester Examination

Design and Selection of Materials (TH) $\left(MT14001 \right)$

Course: B.Tech   Branch: Metallurgical Engineering

Semester: Sem VII

Year: 2014-2015

Max.Marks:60

Duration: 3 Hours   Time:- 2.00 pm - 5.00 pm

Date:30/11/2014

Instructions: MIS No. ☐☐☐☐☐☐☐☐

1. Q 1 and Q7 are compulsory.
2. Answer any Four from remaining.
3. Figures to the right indicate the full marks
4. Mobile phones and programmable calculators are strictly prohibited.
5. Writing anything on question paper is not allowed.
6. Exchange/Sharing of anything like stationery, calculator is not allowed.
7. Assume suitable data if necessary. Write your MIS Number on Question Paper

Q 1. (a) Enumerate the most commonly used engineering materials and state at least one

   important properties and application of each.   (5)

   (b) Explain the steps involved in conceptual strategy for materials selection.   (5)

Q 2. (a) Explain stress-strain curve for a ceramic in tension and compression. What is MoR? (4)

   (b) If the true stress-strain curve of a ductile material is represented by the equation
   $\sigma = 110 \epsilon^{0.20}$, what is the ultimate tensile strength for Engineering curve?   (4)

   (C) What is rapid prototyping system? How they are classified?   (2)

Q.3 (a) What is " Archard wear constant'? What are different modes of abrasive wear?   (4)

   (b) Derive the material index for 'light stiff beam' with the following design requirements.

   Which material property-chart is required for the material selection purpose?   (6)

Function: Beam

Constraints : Length L is specified
Beam must support a bending load F with minimum deflection δ,
Bending stiffness S is specified)
Objective: Minimize the mass of the beam, m

Q 4. (a) Explain the signification of factor of factor of safety in design with suitable example.(5)

(b) What are the different joining operations? Explain each of them not more than 3 lines each. (5)

Q.5 (a) Explain the economic criteria for selection with suitable example. (4)

(b) What do you mean by fixed costs and variable costs? With the help of a graph explain the 'Break even point'. (3)

(c) Which material can be selected for designing 'heat exchanger tubes' and why? (3)

Q.6 (a) Use the following data to make fracture toughness (plane-strain), K_{1C} versus tensile strength ,σ_{ts} material property chart. (5)

Material	K_{1C}(MPa √m)	$\sigma_{ts,}$ (MPa)
Cast irons	22-54	350-1000
High carbon steels	27-92	550-1640
Medium carbon steels	12-92	410-1200
Low carbon steels	41-82	345-580
Low alloy steels	14-200	460-1200
Stainless steels	62-280	480-2240

(b) Explain "cost model". Derive the equation for 'total shaping cost per part'. (5)

Q 7. (a) " Explain with the help of a flow chart the 'Weighted property method of material selection' using the performance indices. How will you scale the properties for their maximization and minimization?" (6)

(b) Write the design requirements for the following applications: (4)
   I. Boating oar
   II. Light strong tie