

Design and Selection of Materials (MT 802)

Full marks: 70

Time: 3h

Write any five questions

1. (a) Discuss the length scale based design approach with suitable example. 7  
(b) Enumerate the applicability of performance index in the selection of materials with suitable example. 7
2. (a) 'Purer conductors exhibit better conductivity'-Justify. Explain the role of strengthening mechanisms in respect of the strength-conductivity balance of the conductors'. 7  
(b) Explain the origin of dielectric property. What is dielectric loss? Give an example of design, based on dielectric loss. 7
3. (a) State the relation between thermal and electrical conductivity of metals. How to achieve cooling of the electronic chips? 7  
(b) Explain ferroelectric behavior with a suitable application. 7
4. (a) Compare the desired properties between hard and soft magnetic materials. 7  
(b) Enumerate the selection of soft magnetic materials for electrical application for varying level of frequency. 7
5. (a) Explain the optical transparency of metal and dielectrics in terms of the interaction of optical beam with such materials. 7  
(b) Explain the genesis of fluorescence, phosphorescence and electro luminescence. 7
6. (a) Enumerate the basis of materials selection for light and stiff tie rod, panel and beam 7  
(b) compare the strengthening mechanisms for (a)brass for marine components (b) non-heat treatable wrought Al- alloys for cans (c) cast Ni alloys for jet engine 7
7. (a) Explain the role of residual life in fatigue based design. 7  
(b) Furnish the deformation mechanism map taking the correlation among stress, deformation temperature, homologous temperature ( $T/T_m$ ) and materials index ( $\sigma/E$ ) into account 7
8. (a) Correlate the potential materials and technological application areas in the temperature ( $^{\circ}C$ ) ranges of (i)-200 to -273 (ii) 400-600 (iii) 1000-1200. 7  
(b) Enumerate the load limited, displacement limited and energy limited design. 7