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Total No. of Pages : 02

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M.Tech.(ME) (Sem.–1)

ADVANCE MACHINE DESIGN

Subject Code : MME-505

M.Code : 38206

Time : 3 Hrs. Max. Marks : 100

INSTRUCTION TO CANDIDATES :

1. Attempt any FIVE questions out of EIGHT questions.
2. Each question carries TWENTY marks.

Q1. Compare and explain the use of different theories of failure. Discuss the selection criteria for brittle and ductile materials. (20)

Q2. The shaft of an overhang crank subjected to a force P of 1 kN is shown in Fig 1. The shaft is made of plain carbon steel 45C8 and the tensile yield strength is 380 N/mm^2. The factor of safety is 2, Determine the diameter of the shaft using the maximum shear stress theory. (20)

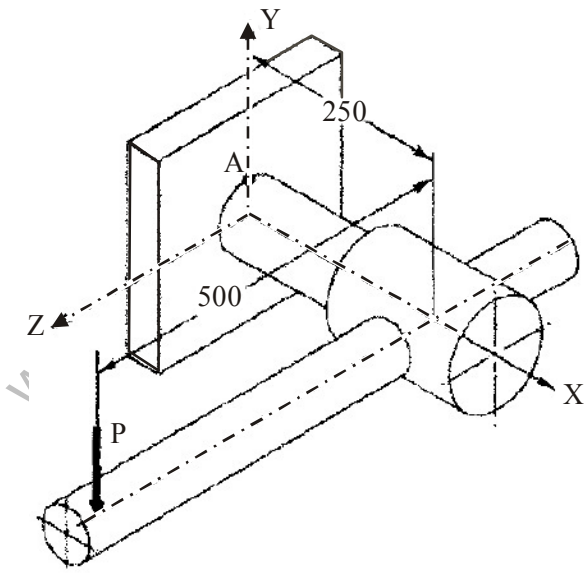

Fig. 1

Q3. A steel wheel of diameter 150 *mm* and width 40 *mm* carrying a load 2kN rolls on a flat rail made of cast iron. Estimate the depth at which the maximum shear stress occurs for these materials. At this critical depth, calculate the Hertzian stresses for the wheel. Poisson's ratio of 0.292. (20)

Q4. A cantilever spring having 10 *mm* wire diameter is made of stainless steel 4Cr18Ni10 (S_{ut} = 860 N/mm^2 and S_{yt} = 690 N/mm^2). The force P acting at the free end varies from 75 N to 150 N. The surface finish of the wire is equivalent to the machined surface. There is no stress concentration and the expected reliability is 50%. Calculate the number of stress cycles likely to cause fatigue failure. (20)

Q5. a) What is probabilistic approach to design? Explain the procedure to predict reliability of a bearing. (10)

b) Explain creep behavior. How it affects the design of machine element? What is the effect of temperature and stress on creep? (10)

Q6. a) Describe the theory of fracture mechanics under static loading. Also explain various mode of fracture. (10)

b) A steel support strap designed to hold a 60000-N static load in axial tension was accidently sawcut during production and now has an edge crack in it. Determine the safety factor of the original, uncracked strap based on yielding and its new "cracked" safety factor based on fracture mechanics. How large could the crack get before it fails? The material is steel with S_y = 540 MPa and K_c = 66 MPa-m0.5. The length l = 6 m, width b = 80 mm, and thickness t = 3 mm. The crack width a = 10 mm. The crack is completely through the thickness at one edge of the 80-mm width, Assume the ratio a/b is < 0.13. (10)/

Q7. a) Explain the philosophy of Computer Aided Machine Design. What are the advantages and disadvantages of using analysis software to design machine elements? (10)

b) Describe the design process of springs and how CAD helps in accelerating this design process? (10)

Q8. Write short notes on :

(a) Fatigue strength and endurance limit (5)

(b) Stages of fatigue failure (5)

(c) Finite element method (5)

(d) Limit Design (5)

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.