INTERNATIONAL CENTRE FOR APPLIED SCIENCES



iv) Hardness

vi) Endurance limit

v) Stress concentration factor

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B.Sc. (Applied Sciences) in Engg. End – Semester Theory Examinations – May 2021 IV SEMESTER - DESIGN OF MACHINE ELEMENTS (IME242) (BRANCH: MECHANICAL)

Time: 3 Hours	s DATE: 17 May 2021	Max. Marks:50
✓ 1 ✓ 1 ✓ 1	Answer all Questions. Missing data, if any, may be suitably assumed Design data handbook is permitted	
1A. Define the following:		(3)
i) Strain energy		
ii) Resilience		
iii)To	ughness	

- 1B. A bolt is subjected to a tensile load of 18 kN and a shear load of 12 kN. The material has yield strength of 326.8 MPa. Taking factor of safety as 2.5, determine the core diameter according to the following theories of failure. i) Rankine's theory ii) Maximum Shear stress theory. (4)
- 1C. Steel rod made of SAE 4140 oil quenched is to be subjected to reversal axial load 180000N. Determine the required diameter of the rod using FOS= 2. Use Soderberg criteria. B=0.85, C=0.8. (3)
- 2A. An intermediate shaft of gear box has two gears (A and B) mounted on shafts having bearings C₁ and C₂ as shown in Fig1.The Pitch circle diameters of gears A and B are 500mm and 250 respectively. C_m=2, C_t=1.5, Shaft material is alloy steel of UTS=620N/mm² and Yield strength=480 N/mm².The tangential and radial forces are as shown in Fig.Q2A.Design the shaft based on ASME code of design.
 (8)



Fig.Q2A

2B. Briefly discuss the stresses in key with a neat sketches.

(2)

- 3A. A power transmission screw having a single start square thread with a nominal diameter of 36 mm and pitch 6 mm propels a weight of 25 kN at 5rpm. The collar has a mean diameter of 45 mm. The coefficient of friction at thread is 0.15 and the coefficient of friction at the collar is 0.12. Determine: (6)
 - (i) The power of motor required to drive the screw
 - (ii) The efficiency
 - (iii) Length of bronze nut required if the allowable bearing pressure is 12 MPa
 - (iv) Length of lever, if a force of 300 N is exerted at the end of the lever
- 3B. Design a spring for a balance to measure 0 N to 1000 N over a scale of deflection 0- 80 mm. The spring index of spring is 5. The approximate number of turns is 30. The modulus of rigidity is 85kN/mm². Also calculate the maximum shear stress induced. (4)
- 4. A pair of continuously lubricated helical gears transmits 15 kW at 9000 rpm of the pinion. The teeth are of 20° full depth involute profile. The velocity ratio is 3:1. The pinion is made of C45 steel and gear is made of untreated forged steel. The number of teeth on the pinion is 20. The face width is 15 times the module. The helix angle is 20°. Design the gears based on strength and suggest suitable hardness for the gears. (10)
- 5A List the merits and demerits rolling contact bearings. (2)
- **5B**. Explain the stresses in threaded fasteners (bolt and nut). (2)
- 5C. The main bearing of a centrifugal pump runs at 1440 rpm and diameter of the journal is 75 mm. The load on the bearing is estimated to be 11500N. Take the temperature of the oil 70° C. Ambient temperature is 25°C. Suggest whether artificial cooling necessary or not? (6)
