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Question Paper Code: U6A02

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2024

Sixth semester

Agricultural Engineering

21UAG602 - DESIGN OF BASIC MACHINE ELEMENTS

(Regulation 2021)

(Approved data book is permitted)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The difference between the upper limit and lower limit of a dimension is known as CO1-U
(a) Basic size (b) Nominal size (c) Tolerance (d) Actual size
2. The largest permissible size for a dimension is known CO1-U
(a) Lower limit (b) Upper limit (c) Basic size (d) Actual size
3. If the diameter of a solid shaft is increased two times, the torque transmitted will be CO1-U
(a) Two times (b) Four times (c) Eight times (d) Sixteen times
4. The torque required to produce a twist of one radian per unit length of the shaft is known as CO1-U
(a) Polar modulus (b) Torsional rigidity (c) Flexural rigidity (d) Young's modulus
5. The crest diameter of a screw thread is same as CO1-U
(a) Major diameter (b) Minor diameter (c) Pitch diameter (d) None of the above
6. Welded joint is called as CO1-U
(a) Permanent joint (b) Linked joint (c) Temporary joint (d) Movable joint

7. The springs made in the form of a cone disk to carry a high compressive force is CO1-U
- (a) Helical (b) Belleville (c) Leaf (d) None of the above
8. The longest leaf in Semi-elliptic leaf spring is known as CO1-U
- (a) Chief leaf (b) Master leaf (c) Major leaf (d) Higher leaf
9. Hydrostatic bearing usually use _____ as lubricant CO1-U
- (a) Oil (b) Grease (c) Water (d) None of the above
10. What is the most important feature of lubrication that determines the life of a bearing? CO1-U
- (a) Viscosity (b) Grade of grease (c) E.P. additives (d) viscosity index

PART – B (5 x 2= 10 Marks)

11. Explain about the various phase of design process? CO1 -U
12. Explain about the types of keys? CO1 -U
13. Why are welded joints preferred over riveted joints? CO1 -U
14. State any two functions of springs. CO1 -U
15. Classify the types of bearing? CO1 -U

PART – C (5 x 16= 80 Marks)

16. (a) A bolts is subjected to an axial pull of 10 KN and a transverse shear force of 5 KN. Determine the diameter at the bolt required according to: (i) Maximum Principal stress theory (ii) Maximum Principal strain theory (iii) Maximum shear stress theory. Assume yield of bolt material is 300 MPa and poisson ratio = 0.25, FOS =2.5 CO3-App (16)

Or

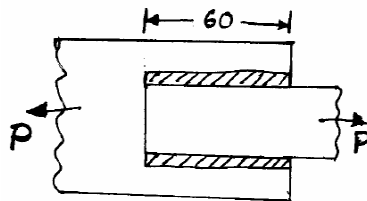
- (b) A machine component is subjected to fluctuating stress that varies from 40 to 100 N/mm². The corrected endurance limit stress for the machine component is 270 N/mm². The ultimate tensile strength and yield strength of material are 600 and 450 N/mm² respectively. Find the factor of safety using: (i) Gerber theory (ii) Soderberg line (iii) Goodman line and (iv) Also, find factor of safety against static failure. CO3-App (16)

17. (a) Design a muff or sleeve coupling for a shaft to transmit 35KW at 350 rpm. The safe shear stress for the steel shaft is 50N/mm² and it is 15 N/mm² for the cast iron muff. The allowable shear and crushing stress for the key material are 42 N/mm² and 120 N/mm² respectively CO2-App (16)

Or

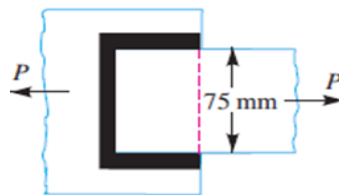
- (b) Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression. CO2-App (16)

18. (a) A plate 60mm and 10mm thick is weld to another plate by two parallel fillet welds as shown in fig. Determine the shaft load that the weld joint can carry. The allowable working stress in shear for the weld material is 75N/mm². CO3-App (16)



Or

- (b) A Plate 75mm wide and 12.5mm thick joined with another plate by a single transverse weld and a double parallel fillet weld joint as shown in fig. the maximum tensile and shear stresses are 70 MPa and 56 Mpa respectively. Find the length of each parallel fillet weld, if the joint is subjected to both static and fatigue loading CO3-App (16)



19. (a) Design a helical spring for a spring loaded safety valve (Rams bottom safety valve) for the following conditions: Diameter of the valve seat = 65 mm; Operating pressure = 0.7 N/mm²; Maximum pressure when the valve blows off freely = 0.75 N/mm²; Maximum lift of the valve when the pressure rises from 0.7 to 0.75 N/mm² = 3.5 mm; maximum allowable stress = 550 MPa; Modulus of rigidity = 84 kN/mm², Spring index = 6. CO2-App (16)

Or

- (b) Design a leaf spring for a truck to the following specifications. CO2-App (16)
Maximum load on the spring = 140kN, number of springs = 4, material of springs is chrome vanadium steel, permissible tensile stress = 600 N/mm² Maximum number of leaves = 10, span at spring = 1000mm, permissible deflection = 80mm, young's modulus of the spring = 200KN/mm².

20. (a) Design a journal bearing for a centrifugal pump from the following data: CO2-App (16)

Load on the journal=20000N, Speed of the journal=900rpm, Type of oil is SAE10, for which the absolute viscosity at 55°C=0.017kg/m-s, Ambient temperature of oil = 15.5°C, Maximum bearing pressure for the pump=1.5N/mm². Calculate also mass of the lubricating oil required for artificial cooling, If the rise of temperature, if the rise of temperature of oil be limited to 10°C heat dissipation coefficient=1232W/m²/°C

Or

- (b) Select a suitable Conrad-type deep-groove ball bearing for the following data, the radial load is 7500N and axial load is 4500N, the shaft speed is 2000rpm, the L₁₀ life required is 4.9 x 10⁸ revolutions; the inner ring of the bearing rotates. cond Half of the portion. CO2-App (16)