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Question Paper Code: U6A02

B.E. / B.Tech. DEGREE EXAMINATION, NOV 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 ability of material to resist scratching and indentation is CO1-U
(a) Hardness (b) Stiffness (c) Resilience (d) Surface finish
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. When a ductile material is loaded in excess of a certain value, a gradual increase in elongation takes place with time. this phenomenon is known as CO1-U
(a) creep (b) fatigue (c) stress concentration (d) overstrain
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. In order to avoid tearing of the plate at edge, the distance from the centre line of the rivet hole to the nearest edge of the plate in terms of dia of rivet d should be equal to CO1-U
(a) d (b) 1.25 d (c) 1.5 d (d) 2 d
6. Welded joint is called as CO1-U
(a) Permanent joint (b) Linked joint (c) Temporary joint (d) Movable joint

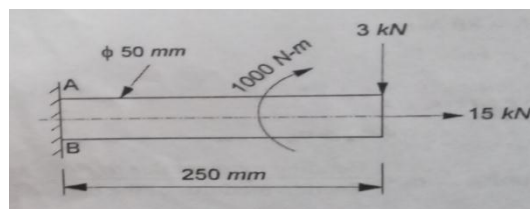
7. The springs made in the form of a cone disk to carry a high compressive force is CO1-U
- (a) Helical (b) Belleville (c) Leaf (d) None of the above
8. An elastic member which deflects under the action of load and regains its original shape after the removal of load is CO1-U
- (a) shaft (b) bolt (c) spring (d) coupling
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. Why normal stress theory is not suitable for ductile materials? CO1 -U
12. Which material used for flange or flange coupling? CO1 -U
13. Why are welded joints preferred over riveted joints? CO1 -U
14. How will you find whether the given helical spring is a compression spring or tension spring? CO1 -U
15. Explain about life anti-friction bearings? CO1 -U

PART – C (5 x 16= 80 Marks)

16. (a) A shaft as shown in figure is subjected to a bending load of 3 kN, pure torque of 1000 N-m and an axial pulling force of 15 kN. Calculate the stress at A and B. CO3-App (16)



Or

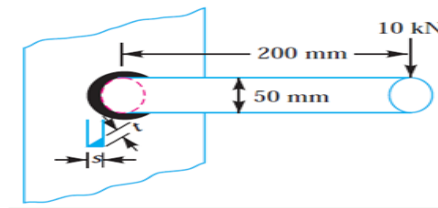
- (b) A shaft of 200mm length is cantilever rod of circular section. It is subjected to a cyclic transverse load that varies from -50 to 150 KN. Determine the diameter of the shaft assuming a factor of safety of 2, size correction factor of 0.85 and surface correction factor of 0.9. The material properties are ultimate strength = 550MPa; yield strength = 320MPa and endurance limit = 275MPa. Theoretical stress factor = 1.4, Notch sensitivity factor = 0.9. 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/mm^2 and it is 15N/mm^2 for the cast iron muff. The allowable shear and crushing stress for the key material are 42N/mm^2 and 120N/mm^2 respectively CO2-App (16)

Or

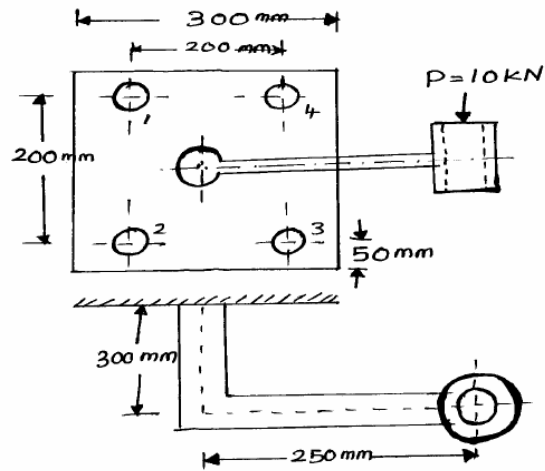
- (b) Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression. CO2-App (16)

18. (a) A 50 mm diameter solid shaft is welded to a flat plate as shown in Figure. If the size of the weld is 15 mm, find the maximum normal and shear stress in the weld. CO3-App (16)



Or

- (b) A rigid steel bracket subjected to a vertical force of 10kN is shown in fig. It is fastened to a vertical sanction by means of four identical bolts. Determine the size of the bolts by maximum shear stress theory. The maximum permissible shear stress in any bolts is limited to 50N/mm^2 . 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.

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 with the CO2-App (16)
 following data:

Diameter of the journal = 150mm

Load on bearing = 40KN

Speed of journal = 900rpm

Or

- (b) Select a suitable ball bearing for a drilling machine spindle of CO2-App (16)
 diameter 40mm rotating at 3000rpm. It is subjected to radial load of 200N and axial thrust of 1000N. It is to work for 45hours a week for one year.