Reg. No. : | | | | | | | | | | | | |

Question Paper Code: U5704

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

Fifth Semester

Mechanical Engineering

21UME504 DESIGN OF MACHINE ELEMENTS

(Regulations 2021)

(Design data book may be permitted)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Yield point in fatigue loading as compared to static loading is CO1-U

   (a) higher (b) lower (c) same (d) none of these

2. When a material is subjected to varying stresses, it fails under stresses considerably lower than the ultimate stress. Such type of failure of the material is known as CO1- U

   (a) creep (b) fatigue (c) stress concentration (d) over strain

3. A key capable of fitting in a recess milled out in a shaft is known as CO1- U

   (a) Feather key (b) Gib head key (c) Woodruff key (d) Flat saddle key

4. The element which join two misaligned shafts to transmit the motion is called CO1- U

   (a) Muff Coupling (b) Flange Coupling (c) Rigid Coupling (d) Flexible Coupling

5. A rivet is specified by_____ CO1- U

   (a) shank diameter (b) length of rivet

   (c) type of head (d) length of tail

6. The parallel fillet welded joint is designed for_____ CO1- U

   (a) tensile strength (b) compressive strength

   (c) bending strength (d) shear strength

7. When helical compression spring is cut into halves, the stiffness of the CO1- U

resulting spring will be._____

(a) same (b)double (c)one-half (d) one-fourth

8. The cross-section of the flywheel arms is usually _____ CO1- U

(a) elliptical (b) rectangular (c) I-section (d) L-section

9. In a full journal bearing, the angle of contact of the bearing with the journal is _____ CO1- U

(a) 120° (b) 180° (c) 270° (d) 360°

10. In thrust bearings, the load acts _____ CO1- U

(a) along the axis of rotation (b) parallel to the axis of rotation

(c) perpendicular to the axis of rotation (d) in any direction

PART – B (5 x 2= 10Marks)

11. Summarize the various phases of design process. CO1 -U

12. How the keys are classified? CO1 -U

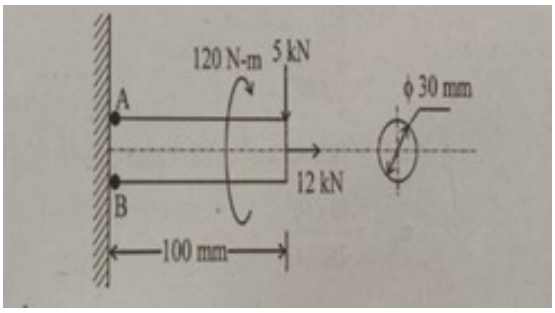
13. What is an economical joint. CO1 -U

14. What is the main function of a flywheel in an engine? CO1 -U

15. Explain the primary function of a crankshaft in an internal combustion engine. CO1 -U

PART – C (5 x 16= 80Marks)

16. (a) A Circular shaft of 30mm diameter is subjected to an axial load , bending moment and twisting moment as show in figure. Determine the maximum principle stress, minimum principle stress and maximum shear stress at point A and B CO2 App (16)



Or

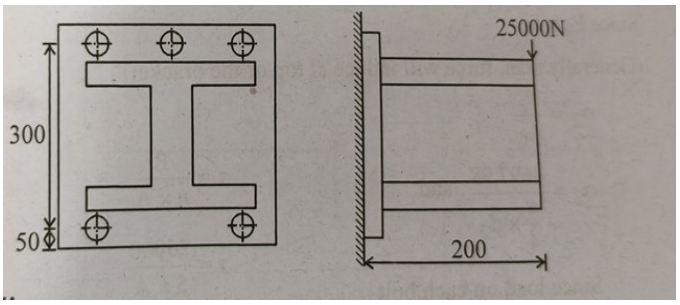
(b) A shaft is transmitting 100 kW at 160 rpm. Find a suitable diameter for the shaft, if the maximum torque transmitted exceeds the mean by 25%. Take maximum allowable shear stress as 70 Mpa. CO2 App (16)

17. (a) Design a cast iron flange coupling for a mild steel shaft transmitting 70 kW at 250 rpm. The allowable shear stress in the shaft is 40MPa and the angle of twist is not to exceed 1° mm in a length of 20mm diameters. The allowable shear stress in the coupling bolt is 30MPa. CO3 App (16)

Or

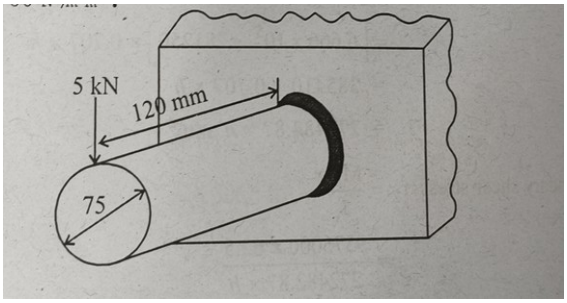
(b) Design a marine type flange coupling to transmit 3.5 MW at 100 rpm. The permissible shear stress in the shaft and bolts may be taken as 50 N/ mm^2.. CO3 App (16)

18. (a) A bracket is attached to a wall by 5 bolts, three at top and two at bottom as shown in the figure. A vertical load of 25000N act at 200 mm. eccentrically from the plane of bolts .calculate the suitable size of bolt. Assume maxShear stress = 50 N/mm^2. CO3 App (16)



Or

(b) A shaft of 75mm diameters is welded to a plate by means of fillet weld as shown in fig .determine the size of weld, take max stress for the weld materials is 80 N/ mm^2. CO3 App (16)



19. (a) A helical spring has 75 mm outer diameter and 10mm of wire diameter is subjected to the axial load 900N. The spring has 10 active coils. Determine the maximum shear and deflection. (assume G=80*10^3 n/mm^{20}) CO4 App (16)

Or

(b) A cylinder double acting steam engine delivers 185000 w at 100 revolution per min. The maximum fluctuation of energy per revolution is 15 % of the energy developed per resolution. The speed variation is limited to 1 % either way from the mean. the mean diameter of the rim are 24000 mm,
Determine the Design the flywheel. CO4 App (16)

20. (a) Design a journal bearing for a centrifugal pump with the following data CO4 App (16)

- Load on the journal =10 KN
- Diameter of the journal = 70mm
- Speed = 1400rpm
- Atmosphere temperature = 15 ^{o}C
- Absolute viscosity of oil at 60^{o}C = 23CP

Or

(b) Design a connecting rod having I section for an engine application. The bore of 0.150 m, length of the rod =0.35 m stroke length of 0.200 m, gas pressure of 3 Mpa and engine speed of 2250 revolution per minute. Assume weight of the reciprocation parts are 0.025 KN. CO4 App (16)