

CBCS SCHEME

21ME63

Sixth Semester B.E./B.Tech. Degree Examination, June/July 2026

Machine Design

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. Discuss the use of codes and standards. (04 Marks)
- b. Explain the following theories of failure
 - i) Maximum Normal Stress Theory
 - ii) Maximum Shear Stress Theory
 - iii) Distortion Energy Theory (06 Marks)
- c. For the member shown in Fig Q1(c), determine the stress induced at A and B in the member

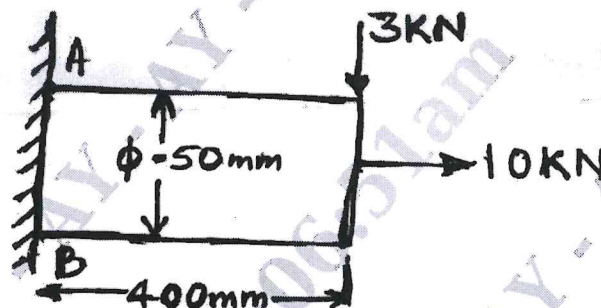


Fig Q1(c)

(10 Marks)

OR

- 2 a. With the help of S-N diagram, explain how low cycle and high cycle fatigue. (04 Marks)
- b. A 500 N weight dropped through a height of 25 mm impacts the centre of a 300 mm long simply supported steel square beam. If the maximum allowable bending stress is 90 MPa, find the dimension of side of the beam and the maximum deflection. Neglect the inertia effect. Take $E = 200 \text{ GPa}$, (refer Fig Q2(b)).

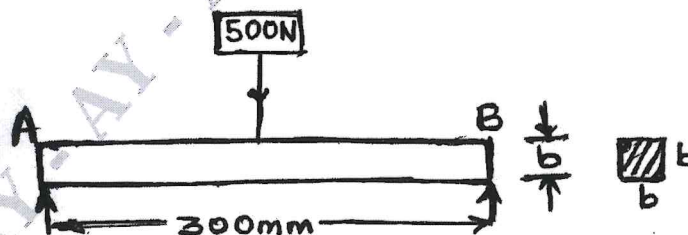


Fig Q2(b)

(16 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-2

- 3 A 45C8 shaft transmitting 15 kW at 210 rpm is supported between two bearings 1000 mm apart. The shaft has two gears, keyed to it. The pinion having 24 teeth and module 6 mm is located 200 mm to the right of left bearing and delivers power to a gear mounted behind it. The gear having 80 teeth of module 6 mm is located 100 mm to the left of the right bearing and receives power from a pinion such that the tangential force acts vertical. Taking combined shock and fatigue factors 1.75 in bending and 1.25 in torsion, determine the shaft diameter. (20 Marks)

OR

- 4 a. Design a flange coupling to connect a shaft of motor and centrifugal pump for the following specification output = 3000 rpm, total head = 20 m, pump speed = 600 rpm, pump efficiency = 70%, C_{40} steel for shaft and C_{35} steel for bolt with FOS = 2, use allowable shear stress of casting flange is 15 N/mm^2 . (14 Marks)
- b. List and explain the different types of springs and its materials. (06 Marks)

Module-3

- 5 a. Design a triple riveted lap joint with zig zag riveting for steel plates 20 mm thick using tensile stress $\sigma_t = 90 \text{ N/mm}^2$, Compressive stress $\sigma_c = 120 \text{ N/mm}^2$ and shear stress $\tau = 60 \text{ N/mm}^2$. (12 Marks)
- b. A steel plate 15 mm thick and 50 mm wide is welded to another plate by transverse weld to sustain a tensile load of 25 kN. Determine the length of weld required by taking the permissible stress equal to 110 MPa. When :
- The load is static
 - The load is dynamic
- (08 Marks)

OR

- 6 a. Explain Caulking and fullering with neat sketch. (04 Marks)
- b. A bracket is fixed to the wall by means of four bolts and loaded as shown in Fig Q6(b). Calculate the size of bolts if the load is 10 kN and the design shear stress for bolt material is 40 MPa.

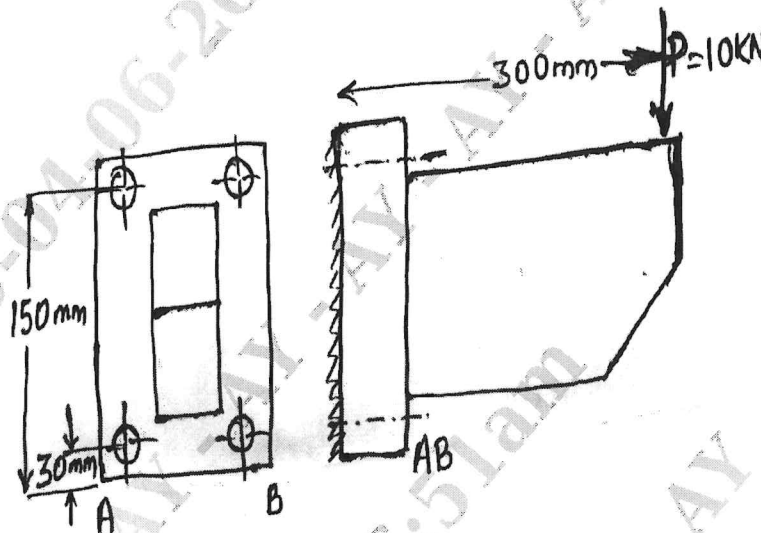


Fig Q6(b)

(16 Marks)

Module-4

- 7 A pair of carefully cut spur gears with 20° full depth involute profiles is used to transmit 12 kW at 1200 rpm of pinion. The gear has to rotate at 300 rpm. The material used for both pinion and gear is medium carbon steel whose allowable bending stress may be taken as 230 MPa. Determine the module and face width. Suggest suitable hardness. Take 24 teeth on pinion and modulus of elasticity as 210 GPa. (20 Marks)

OR

- 8 A pair of helical gears is to transmit 16 kW. The teeth are 20° stub involute, Helix angle is 45° , pinion runs at 10000 rpm and gear at 2500 rpm. The centre distance is to be around 200 mm. The gear are made of cast steel ($\sigma_{d1} = 100$ MPa). Endurance strength = 618 MPa. Determine the module and face width from static strength consideration and check the gear for wear. (20 Marks)

Module-5

- 9 a. A multiple clutch has steel on bronze is transmit 8 kW at 1440 rpm. The inner diameter of contact is 80 mm and outer diameter is 140 mm. The clutch operates in oil with expected coefficient of friction 0.1, the average allowable pressure is 0.35 MPa. Assume uniform wear theory and determine the following :
- i) Number of steel and bronze plate
 - ii) Axial force required
 - iii) Actual Maximum pressure (12 Marks)
- b. A simple band brake of drum diameter of 600 mm has a band passing over it with an angle of contact of 225° , while one end is connected to fulcrum and the other end is connected to the brake lever at a distance of 400 mm from the fulcrum. The brake lever is 1 m long. The brake is to observe a power of 15 kW at 720 rpm. Design the brake lever of rectangular c/s, assuming depth to be thrice the width take allowance stress 80 MPa. (08 Marks)
- OR**
- 10 a. List the assumption and derive the Petroff equation. (10 Marks)
- b. Explain different types of rolling contact bearing and their application. (10 Marks)

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