CBCS SCHEME

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21AU53

Fifth Semester B.E. Degree Examination, June/July 2024
Design of Automobile Components

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 general consideration in designing a machine component. **(06 Marks)**

b. State and explain different mechanical properties of metals. **(06 Marks)**

c. Discuss the important non-metallic material of construction used in engineering practice. **(08 Marks)**

OR

2 The load on a bolt consists of an axial pull of 10 KN together with a transverse shear forces of 5 KN. Find the diameter of bolt required according to,

(i) Maximum principal stress theory.
(ii) Maximum shear stress theory.
(iii) Maximum principal strain theory.
(iv) Maximum strain energy theory.
(v) Maximum distortion energy theory.

Take permissible tensile stress at elastic limit = 100 MPa, Poisson's ratio = 0.3 **(20 Marks)**

Module-2

3 a. A knuckle joint required to withstand a tensile load of 25 kN. Design the joint if the permissible stress are (σ_t) Tensile stress = 56 MPa, Shear stress = 46 MPa (τ), Compressive stress = 70 MPa (σ_C), find (i) Knuckle pin (ii) Single eye (iii) Double eye. **(10 Marks)**

b. A solid circular shaft is subjected to a bending moment of 3000 N-m and a torque of 10,000 N-m. The shaft is made of 45C8 steel having ultimate tensile stress of 700 MPa and a ultimate shear stress of 500 MPa. Assuming Factor of Safety as 6. Determine diameter of shaft. **(10 Marks)**

OR

4 a. A circular solid shaft transmit 300 kW @ 250 rpm. Permissible shear stress is 30 N/mm^2 and angle of twist 1° in a length of 2 meters. Determine diameter of shaft. Take $G = 1\times10^5$ N/mm^2. **(10 Marks)**

b. Design and sketch the assembly of a knuckle joint to connect two mild steel rods subjected to an axial pull of 100kN. The allowable stress for rods and pin are 100MPa, 130MPa and 60MPa in tension, crushing and shear respectively. The bending of the pin is prevented by selection of proper fit. **(10 Marks)**

Module-3

5 a. Derive an expression for stress induced in closed helical coiled spring. **(06 Marks)**

b. A loaded narrow gauge car weights 18 kN and moving at a velocity of 80 m/min is brought to rest by a buffer consists of two helical springs. In bringing the car to rest the spring undergoes a compression of 200 mm. The allowable shear stress is 0.3 GPa and the spring index is 8. Design a suitable spring. Take G = 84 GPa. **(14 Marks)**

OR

6 a. Derive an expression for torque transmitted in plate clutch considering uniform pressure theory. **(05 Marks)**

b. How the brakes are classified? List the different types of mechanical brakes? **(05 Marks)**

c. A multi-plate clutch is used to transmit 5 kW at 1440 rpm. The inner and outer diameter of the contacting surface are 50 mm and 80 mm respectively. The co-efficient of friction and allowable pressure intensity for lining may assumed as 0.10 and 350 KPa. Determine

(i) Number of friction plate and pressure plate.
(ii) Axial force required to transmit power.
(iii) The actual average pressure.
(iv) Actual maximum pressure intensity after wear. **(10 Marks)**

Module-4

7 Design a connecting rod for 4-stroke petrol engine with following data :
Piston diameter = 0.10 m ;
Stroke = 0.14 m ;
Length of connecting rod, Centre to centre = 0.315 m ;
Weight of reciprocating parts = 18.2 N ;
Compression ratio = 4 : 1
Speed = 1500 rev/min with possible overspeed of 2500,
Gas pressure = 2.45 MPa
Assume any further data required. **(20 Marks)**

OR

8 Design a centre crankshaft for a single acting 4 stroke single cylinder engine to operate at 200 rpm. The particular of engine are as follows :
Cylinder Bore = 250 mm,
Maximum gas pressure = 2.5 MPa
Length of stroke = 300 mm,
Ratio of length of connecting rod to crank radius = 4.5 ;
Weight of flywheel cum belt pulley = 2 KN,
Total belt pull = 4 kN,
Mean effective pressure = 0.5 MPa,
Width of hub for flywheel cum belt pulley = 400 mm.
The torque on the Crankshaft is maximum when the crankshaft turns through 25° from TDC and at this position gas pressure inside the cylinder is 2 MPa. The belt are in horizontal position. The crankshaft main bearing are 500 mm center to center. Assume any further data required. **(20 Marks)**

Module-5

9 a. Explain piston materials. **(04 Marks)**

b. Design a suitable aluminium alloy piston with 2 compression rings and one oil ring for a petrol engine of following particular :
Cylinder diameter = 0.10 m,
Peak gas pressure = 3.2 MPa,
Mean effective pressure = 0.8 MPa,
Average side thrust = 2400 N,
Skirt bearing pressure = 0.22 MPa,
Bending stress in piston crown = 36 MPa,
Crown temperature difference = 70 $^{\circ}$C,
Heat dissipated through crown = 157 kW/m^2
Allowable radial pressure = 0.04 MPa ;
Bending piston in ring = 90 MPa,
Heat conductivity K = 160 W/m/$^{\circ}$C
Assume any further data required for design. **(16 Marks)**

OR

10 a. Explain the following :
(i) Valve rotators
(ii) Valve seats
(iii) Valve guider **(12 Marks)**

b. Write a short note on operating condition and operating temperature. **(08 Marks)**

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