CBCS SCHEME

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21AU53

Fifth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Design of Automobile Components

Time: 3 hrs. Max. Marks: 100

Note: 1. *Answer any FIVE full questions, choosing ONE full question from each module.*
2. *Use of design handbook is allowed.*
3. *Missing data can be assumed suitably.*

Module-1

1 a. Explain the mechanical properties of engineering materials. **(06 Marks)**

b. Explain the general considerations in design process. **(06 Marks)**

c. Determine the stress induced for the loaded member shown in Fig.Q1(c) at points A and B.

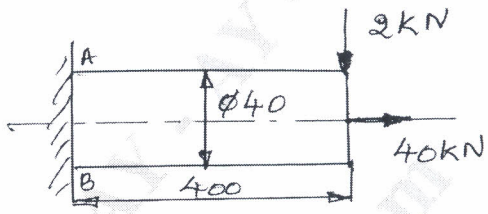

Fig.Q1(c) **(08 Marks)**

OR

2 a. Explain the following future theories:
(i) Maximum normal stress theory
(ii) Maximum shear stress theory **(06 Marks)**

b. Explain the Soderbergs and Goodman's criterias for infinite life in fatigue design. **(06 Marks)**

c. A cantilever beam as shown in Fig.Q2(c) made up of cold drawn steel of circular cross section with diameters 26 mm and 13 mm as shown. It is subjected to varying load from 3F (positive) to –F (negative). Solve and determine the maximum load, taking FOS 2.5. Theoretical stress concentration factor at the radius is 1.42, Notch sensitivity of 0.9 and σ_u = 550 MPa, σ_y = 400 MPa, σ_{en} = 200 MPa. Analyze the beam at the change of cross section.

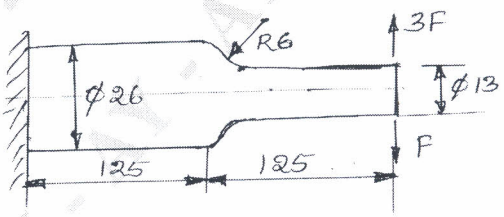

Fig.Q2(c) **(08 Marks)**

Module-2

3 a. Classify the keys with applications and sketches. **(06 Marks)**

b. Design a square key for fixing a gear on a shaft of diameter 25 mm, 15 KW of power at 720 RPM is to be transmitted from the shaft to the gear. The key is made of steel 50 C4 material with a yield strength of 460 N/mm^2. Factor of safety is taken 3. Yield strength in compression assumed to be equal to the yield strength in tension. Determine the dimensions of the key. **(06 Marks)**

c. Design a unprotected type CI flanged coupling for a steel shaft transmitting 30 KW at 200 rpm. The allowable shear stress in the shaft and key is 40 MPa. The maximum torque transmitted is 20% greater than the full torque. The allowable shear stress in bolt is 60 MPa and in CI flange is 40 MPa. **(08 Marks)**

OR

4 A solid shaft made up of steel running at 600 rpm is supported on bearings 600 mm apart. The shaft receives 40 KW through a 400 mm diameter pulleys weighing 400 N located 300 mm to the right of left bearing by a vertical flat belt drive. The power is transmitted from the shaft through another pulley of diameter 600 mm weighing 600 N is located 200 mm to the right of right bearing. The belt drives are at right angles to each other and ratio of belt tensions is 3. Determine the size of shaft necessary, if the allowable shear stress is in the shaft material is 40 MPa and loads are steady. **(20 Marks)**

Module-3

5 a. Explain the following terms with respect to springs:
(i) Spring stiffness
(ii) Spring index
(iii) Solid length
(iv) Free length **(08 Marks)**

b. Design a valve spring for an automobile engine, when the valve is closed, the spring produces a force of 45 N and when it opens, produces a force of 55 N. The spring must fit over the valve bush which has an outside diameter of 20 mm and must go inside a space of 35 mm. The lift of the valve is 6 mm. The spring index is 12. The allowable stress may be taken as 0.33 GPa. Modulus of rigidity 80 GPa. **(12 Marks)**

OR

6 a. Explain working of single and multiple plate clutch with sketches. **(10 Marks)**

b. A multiplate clutch having effective outer diameter 250 mm and inner diameter 150 mm has to transmit 60 KW at 1200 rpm. The end thrust is 4.5 kN and coefficient of friction is 0.08. Calculate the number of plates assuming uniform pressure and uniform wear theories. **(10 Marks)**

Module-4

7 a. Explain the functions of connecting rod with sketches. Also list the forces acting on the connecting rod. **(10 Marks)**

b. Determine the cross section dimensions of a rectangular section connecting rod. Length of connecting rod is 400 mm. Maximum gas load 20 kN. Permissible compressive stress for the connecting rod material 100 N/mm^2. **(10 Marks)**

OR

8 a. Sketch and explain the different types of crank shaft. **(08 Marks)**

b. Design an overhang or side crank shaft with two main bearings and a fly wheel in between them for an IC engine having single cylinder 250 mm × 300 mm. The flywheel cum belt pulley weighs 10 kN. The maximum pressure is 2 MPa. The ratio of length of connecting rod to crank length is 4.5. Total belt pull is 5 kN. The torque is maximum when the crank is at 35° from inner dead centre. The gas pressure at this instant is 1.05 MPa. Width of hub for flywheel cum belt pulley is 200 mm. Assume any further data required for the design. **(12 Marks)**

Module-5

9 a. Explain the main functions of piston, also sketch the trunk piston for IC engine. **(08 Marks)**

b. The following data refers to the piston of a four stroke diesel engine:
Cylinder bore 100 mm, material for piston rings – grey cast iron, allowable tensile stress 90 N/mm^2, allowable radial pressure on cylinder wall 0.035 MPa. Thickness of piston head 16 mm, number of piston rings 4. Determine the following:
(i) Radial width of piston rings
(ii) Axial thickness of piston rings
(iii) Gap between the free ends of the piston ring before assembly and after assembly
(iv) Width of top land
(v) Width of ring groves
(vi) Thickness of piston barrel
(vii) Thickness of barrel at open end **(12 Marks)**

OR

10 a. Sketch and explain over head valve of IC engine components with their functions. **(10 Marks)**

b. Sketch and explain different types of valve rotators and cam types used in IC engines. **(10 Marks)**

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