

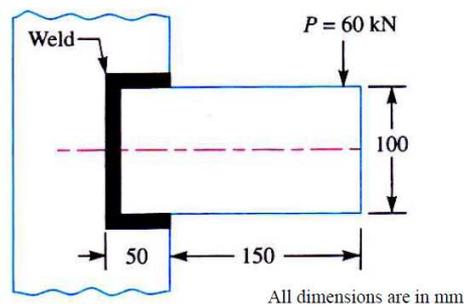
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|---|-----|-------------------|
| 17. List out the stresses to be considered while designing a screw fastening. | CO5 | [K ₁] |
| 18. Name the possible modes of failure of riveting joint. | CO5 | [K ₁] |
| 19. What type of spring is used in mechanical wrist watch? | CO6 | [K ₁] |
| 20. State the functions of the flywheel? | CO6 | [K ₁] |

Answer any FIVE Questions:-
PART C (5 x 14 = 70 Marks)
(Answer not more than 300 words)

Q.No. 21 is Compulsory.

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| 21. It is required to design a rigid type flange coupling to connect two shafts. The input shaft transmits 37.5 kW power at 180 rpm to the output shaft through the coupling. The service factor for the application is 1.5. i.e. the design torque is 1.5 times of the rated torque. Select suitable materials for various parts of the coupling, design the coupling and specify the dimensions of its components. | CO3 | [K ₃] |
| 22. (i) A forged steel bar of 50 mm in diameter is subjected to a reversed bending stress of 250 N/mm ² . The bar is made of steel 40C8 ($\sigma_{ut} = 600$ MPa). Calculate the life of the bar for reliability of 90%.
(ii) What is meant by curved beam? Explain the factors that differentiate the analysis of straight beam and curved beam. | (9)
(5) | CO1 [K ₃]
CO1 [K ₃] |
| 23. A cold drawn steel rod of circular cross-section is subjected to a variable bending moment of 565 N-m to 1130 N-m as the axial load varies from 4500 N to 13500 N. The maximum bending moment occurs at the same instant that the axial load is maximum. Calculate the required diameter of the rod for a factor of safety 2. Neglect any stress concentration and column effect. Assume the following values:
Ultimate strength = 550 N/mm ²
Yield strength = 470 N/mm ²
Size factor = 0.85
Surface finish factor = 0.89
Correction factors = 1.0 for bending
= 0.7 for axial load
The endurance limit in reversed bending may be taken as one-half the ultimate strength. | CO2 | [K ₃] |

24. A solid shaft of diameter 'D' is used in power transmission. Due to modification of the existing system, it is required to replace the solid shaft by a hollow shaft of the same material and equally strong in torsion. Further, the weight of the hollow shaft per metre length should be half of the solid shaft. Calculate the outer diameter of the hollow shaft in terms of 'D'. CO3 [K₃]
25. Design a full hydrodynamic journal bearing with the following specification for machine tool applications: Journal diameter is 75 mm, radial load is 10 kN, journal speed is 1440 rpm, minimum oil film thickness is 22.5 microns, inlet temperature is 400 and the bearing material is Babbitt. Calculate the length of the bearing and select suitable oil for this application. CO4 [K₃]
26. A rectangular steel plate is welded as cantilever to a vertical column and supports a single concentrated load P, as shown in Fig. Calculate the weld size if the shear stress in the same is not to exceed 140 N/mm². CO5 [K₃]



27. A helical tension spring is used in spring balance to measure the weights. One end of the spring is attached to the rigid support while the other end, which is free, carries the weights to be measured. The maximum weight attached to the spring balance is 1500 N and the length of the scale should be approximately 100 mm. Spring index can be taken as 6. The spring is made up of oil-hardened and tempered steel wire with ultimate tensile strength 1360 N/mm² and modulus of rigidity is 81370 N/mm². The permissible shear stress in the spring wire should be taken as 50% of the ultimate tensile strength. Design the spring and calculate (i) wire diameter (ii) mean coil diameter (iii) no. of active coils (iv) required spring rate (v) actual spring rate. CO6 [K₃]
