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MMPD-102

M.E/M.Tech., I Semester

Examination, June 2016

Advance Machine Design

Time : Three Hours

Maximum Marks : 70

Note: i) Answer any five questions.

ii) All questions carry equal marks.

1. A spherical pressure vessel with 500mm inner diameter is welded from steel plates of cold drawn C20 steel of ultimate strength 440 N/mm^2. The vessel is subjected to internal pressure which varies from 2 N/mm^2 to 6 N/mm^2. If the reliability of the vessel is 95% and the required factor of safety is 3, design the vessel for an infinite life period.

2. Determine the main dimensions of multi-collar thrust bearing for a propeller shaft of a 450 kW marine oil engine. The engine makes 300rpm; the shaft diameter is 160mm. The boat speed is 6 m/s.

3. A mass of 50 kg drops through 25mm at the centre of a 250mm long simply supported beam. The beam has a square cross-section. It is made of steel 30C8 (s_{yt} = 400 N/mm^2) and the FOS is 2. The modulus of elasticity is 207kN/mm^2. Determine the dimension of the cross-section of the beam.

4. Explain the creep phenomenon with neat curves.

5. A railway wagon moving at a velocity of 2 m/s is brought to rest by a bumper consisting of two helical compression springs arranged in parallel. The springs are compressed by 150mm in bringing the wagon to rest. The mass of the wagon is 1000kg. The spring index can be taken as 6. The springs are made of oil-hardened and tempered steel wire with ultimate tensile strength of 1500 N/mm^2 and modulus of rigidity of 81 kN/mm^2. The permissible shear stress for the spring wire can be taken as 50% of the ultimate tensile strength. Design the springs and calculate:
   i) Maximum force on each spring
   ii) Wire diameter
   iii) Mean coil diameter and
   iv) Number of active coils

6. A solid circular shaft of diameter d is subjected to a bending moment of M_b and a torsional movement of N_r. prove that according to maximum principal stress theory,

$$\frac{S_{yt}}{f_s} = \frac{16}{\pi d^3}\left[M_b + \sqrt{M_b + M_b^2}\right].$$

7. Design a pair of helical gears for transmitting 20kW. The pinion orates at 1800 rpm and the gear at 400 rpm.

8. Design and sketch a suitable drive along with the shaft and the key for an input of 11kW at 1440 rpm and speed reduction of 27.

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