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# MMPD-102

## M.E/M.Tech., I Semester

Examination, December 2014

## Advance Machine Design

*Time : Three Hours*

*Maximum Marks : 70*

*Note:* Attempt any five questions, all questions carry equal marks. Use of design data handbook is permitted. Assume suitable data if necessary, clearly mentioned it.

1. a) Explain, different 'Theories of Failure'.
   b) Write an account of the effect of mean stress upon the fatigue life of a metallic component. How mean stress may be allowed for fatigue calculations?

2. a) Explain the creep phenomenon with the help of characteristic creep curve.
   b) A steel shaft 60 mm diameter rotates at 1200 rpm. It is made of steel having allowable shear stress as 60 MPa. Find the safe power that can be transmitted by the shaft. Also find the angle of twist in a length of 1m taking rigidity modulus as 80 GPa.

3. A helical valve spring is to be designed for an operating load range of 90N to 135N. The 90N load acts when the valve is closed and 135N force acts when the valve is open. The deflection of the spring is 7.5 mm.

4. a) Discuss the various types of gear tooth failure. Explain how will you take care of the failure in your Design?



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   b) An epicyclic gear train consists of an arm and two gears A and B having 30 and 40 teeth respectively. The arm rotates about the centre of the gear A at a speed of 80 rpm counter clockwise. Determine the speed of the gear B if the gear A revolves at 240 rpm clockwise.

5. The follower of a dwell-rise-dwell cam is assembled with a retaining spring with sufficient pre-compression. It is raised through 30 mm with a uniform velocity for 120° rotation of the cam after which there is a dwell period for 60° rotation of the cam. The equivalent mass and stiffness of the follower are 0.3 kg and 700 N/mm respectively. The stiffness of the spring is 50 N/mm and the cam speed is 3150 rpm. Determine the follower response at an interval of 15° during the rise and the dwell period and plot the same.

6. Design a Journal bearing for a 10 MW, 1000 rpm steam turbine which is supported by two bearings. Consider the bearing to be an average industrial bearing.

7. A turbine shaft transmits 500 KW at 900 rpm. The permissible shear stress is 80 N/mm$^2$ while twist is limited to 0.5° in a length of 2.5 m. Calculate the diameter of shaft. Take G = $0.8\times10^5$ N/mm$^2$. If the shaft choosen is hollow with $\frac{d_i}{d_o} = 0.6$. Calculate the percentage saving in the material.

8. Write short notes on following (any four):
   i) Von-Mises Theory
   ii) Tribological phenomenon
   iii) Logarithmic function for gear
   iv) Kloomok and muffley function
   v) Fatigue strength design
   vi) Bearing lubrication system.

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