Roll No ....

MMPD-102

M.E/M.Tech., I Semester

Examination, December 2016

Advance Machine Design

Time : Three Hours

Maximum Marks : 70

Note: i) Attempt any five questions. All questions carry equal marks.

ii) Use of design data hand book is permitted.

1. a) Explain the meaning of the term stress concentration and discuss its significance in relation to the fatigue life of metallic components.

   b) A machine member is subjected to the following stress. σ_x = 150 mPa, Z_{xy} = 24 mPa.

   Find the equivalent stress as per the following theories of failure

   i) Normal stress theory

   ii) Von mises theory

2. a) List the main type of wear and estimate overall contribution to industrial wear from each. Describe the mechanism of one of the wear mechanism.

   b) Write an account of the effect of mean stress upon the fatigue life of a metallic component. How mean str may be allowed for fatigue calculation?

3. a) What is permissible shear stress of the shaft and explain cause and types of misalignment between two connecting shaft?

b) Design a leaf spring for thickness and width of length 720mm with deflection of 120mm and capable of absorbing 600Nm of strain energy. Assume permissible bending stress of 900 mPa and E = 206 GPa. for the spring material.

4. a) What are the components of force acting on gear tooth and common types of tooth failure?

b) The Pitch circle of a train of spur gear are shown in figure Gear A receive, 3.6 kW power at 600 rev/min. through its shaft and rotor in close wise direction. In the power and motion transmission arrangement Gear A is driver gear, Gear B. is idler and Gear C is driven with number of teeth as 30, 60 and 40, respectively. The module is 5mm calculate :

   i) The torque on each gear shaft and

   ii) The components of gear tooth force
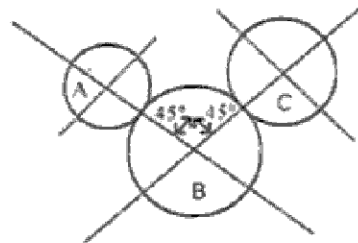
5. The follower of a dwell-rise-dwell cam is assembled with a retaining spring with sufficient precompression. It is raised through 30mm with uniform velocity for 120° rotation of the cam after which there is a dwell period for 60° rotation of the cam the equivalent mass and stiffness of the follower 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 rise and the dwell period and plot the same.

6. It is required to design a helical compression spring subjected to a maximum force 1250 N. The deflection of the spring corresponding to maximum force should be approximate 30mm. The spring index can be taken as 6. The spring is made of patented and cold-drawn steel wire of Grade 1. The constant A and m can be taken as 1753 and 0.182 respectively $(G = 81370 \text{ N/mm}^2)$ the permissible shear stress. for 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) Total No. of coils

   v) Free length of the spring

   vi) Pitch of the coil

7. A turbine shaft transmits 500 kW at 900 rpm. The permissible. Shear stress is 80 N/mm². while twist is limited to 0.5° in a length of 2.5m. Calculate the diameter of the shaft. Take $G = 0.8 \times 10^5 \text{N/mm}^2$ if the shaft chosen is hollow with $d_i/d_o = 0.6$ Calculate the % saving in the material.

8. Write short note on the following (any four) :

   a) Tribological Phenomenon

   b) Kloomok and Muffley function

   c) Fatigue strength design

   d) Bearing lubrication system

   e) Logarithmic function for gear

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