Code No. 2384 / N

FACULTY OF ENGINEERING

B.E. 3/4 (M/P) II-Semester (Main) Examination, April / May 2013

Subject : Machine Design

Time : 3 Hours **Max. Marks: 75**

Note: Answer all questions of Part - A and answer any five questions from Part-B.

PART – A (25 Marks)

1. What is concentric spring? Enumerate the advantages.
2. What is nip of leaf spring? Explain.
3. Compare the beam strength of spur and helical gears.
4. Sketch bevel and worm gears and show the forces acting on it.
5. Describe the assumptions in differential equation derived by Osborne Reynold for theory of hydrodynamics lubrication.
6. What is L_{10} and L_{10h} life of the bearing?
7. Describe the materials used and their properties for piston and connecting rod.
8. What are design considerations for the fly wheel used in IC Engines?
9. How curved beam theory of bending is different from straight bending ? Explain.
10. Mention the criteria for the design of machine frames.

PART – B (5x10=50 Marks)

11. A helical compression spring is required to deflect through 25mm when the external force acting on it varies from 500 to 1000N. The spring index is 8. The spring has square and ground ends. There should be a gap of 2mm between adjacent coils when the spring is subjected to the maximum force of 1000N. The spring is made of cold drawn steel wire with ultimate tensile strength of 1000 MPa, and permissible shear strength is 500 MPa, G=81370 MPa. Design the spring the calculate : (i) wire diameter (ii) Mean coil diameter (iii) number of active coils (iv) total number of coils (v) solid length (vi) free length.

12. A semi elliptic leaf spring used for automobile suspension consists of three extra full length leaves and 15 graduated leaves including the master leaf. The centre to centre distance between two eyes of the spring is 1.5m. The maximum force acting on spring is 100 kN. For each leaf the ratio of width to thickness is 9:1.E=200GPa, the leaves are prestressed in such a way that when the force is maximum, the stresses induced in all leaves are same and equal to 450MPa. Determine (i) the width and thickness of leaves, (ii) the initial nip; and (iii) the initial preload required to close the gap C between extra full length leaves and graduated length leaves.

13. A steel pinion with 20^o full depth involute teeth is transmitting 7.5 kW power at 1000 rpm from an electric motor. The starting torque of the motor is twice the rated torque. The number of teeth on pinion is 25, while module is 4mm. The face width is 45mm. Assuming that velocity factor accounts for the dynamic calculate (i) the effective load on the gear tooth; and (ii) the bending stresses in gear tooth.

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14. A pair of straight bevel gears consists of a 24 teeth pinion meshing with a 48 teeth gear. The module at the outside diameter is 6mm, while face width is 50mm. The gears are made of grey cast from FG 220 (Sut=220 MPa), pressure angle is 20^{o}. The teeths are generated and assume that velocity factor accoutns for the dynamic load. The pinion rotates at 300 rpm and the service factor is 1.5, calculate (i) the beam strength of the tooth, (ii) the static load that the gears can, transmit with a factor of safety of 2 for bending consideration and (iii) the rated power that the gears can transmit.

15. A ball bearing with a dynamic load capacity of 22.8KN is subjected to a radial loads of 10KN. Calculate (i) the expected life in million revolutions that 90% of the bearings will reach (ii) the corresponding life in hours, if the shaft is rotating at 1500 rpm; and (iii) the life that 50% of the bearings will complete or exceed before fatigue failure.

16. The following data is given for the cap and bolts of big end of connecting rod; engine speed = 1500 rpm, Length of connecting rod = 320mm, Length of stroke=140mm, Mass of reciprocating parts = 1.75 kg, Length of crane pin=54mm, Diameter of cranks pin = 38mm, Permissible tensile stress for bolts = 120 MPa, permissible bending stress for cap=120MPa, calculating the nominal diameter of bolts and thickness of cap of the big end.

17. Design a crane hook with the load lifting capacity of the crane as 250 kW. The weight of the hook is 50kN.

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