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VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (Mech. Engg.) III Year II-Semester Old Examinations, May-2019

Machine Design

Time: 3 hours Max. Marks: 70

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

Part-A (10 × 2 = 20 Marks)

1. A helical spring of wire diameter 6mm and spring index 6 is acted by an initial load of 800N. After compressing it further by 10mm the stress in the wire is 500MPa. Find the number of active coils. G = 84000MPa.
2. What is the curvature effect in a helical spring? How does it vary with spring index?
3. Classify various types of gears and mention the various types of gear tooth failures
4. What condition must be satisfied in order that a pair of spur gears may have a constant velocity ratio?
5. Differentiate between 'Hydrodynamic', 'Wedge film lubrication' and 'Squeeze film lubrication'.
6. Define the terms Bearing Modulus and Somerfield number.
7. At what angle of the crank, the twisting moment is maximum in the crankshaft?
8. Mention the various types of stresses induced in the connecting rod.
9. A curved bar of square cross section with 6 cm sides and mean radius of curvature 9 cm is initially unstressed. Determine the distance between neutral axis and principal axis through centroid. What is the radius of curvature of neutral axis?
10. A crane hook has a trapezoidal cross section of 25 cm wide inside and 12.5 cm wide outside and its thickness is 25 cm. Determine the position of neutral axis from inside if Centre of curvature is 25 cm from inside.

Part-B (5 × 10 = 50 Marks)

11. a) A spring is subjected to a variable load; varying from 500 N to 900 N. Determine the diameter of wire and mean diameter of the coils. Take factor of safety as 1.5. Assume the other needed data for the solution. Use Wahl's method. [7]

    b) What is nipping in a leaf spring? Discuss its role. [3]

12. a) A pair of helical gears consist of a 20 teeth pinion meshing with a 100 teeth gear. The Pinion rotates at 720 r.p.m. The normal pressure angle is 20^0 while the helix angle is 25^0. The face width is 40 mm and the normal module is 4mm. The pinion as well as gear are made of steel having ultimate strength of 600 MPa and heat treated to a surface hardness of 300 B.H.N. The service factor and factor of safety are 1.5 and 2 respectively. Assume that the velocity factor accounts for the dynamic load and calculate the power transmitting capacity of the gears. [7]

    b) Name various types of failure of gear tooth and mention various types of preventive measures. [3]

13. a) A 80 mm long journal bearing supports a load of 2800 N on a 50 mm diameter shaft. The bearing has a radical clearance of 0.05 mm and the viscosity of the oil is 0.021kg/m-s at the operating temperature. If the bearing is capable of dissipating 80 J/s, determine the maximum safe speed. [7]

    b) Compare hydrostatic and hydrodynamic lubrications [3]

Contd... 2

14. a) Design a C.I. trunk-type piston for a single cylinder, four stroke cycle engine, developing 5 kW at 600 RPM. Diameter of piston is 120 mm and the maximum explosion pressure is 4.5 MPa. Heat supplied to the engine is 19000 kJ/kWh. About 6% of the heat is conducted through the piston crown. The heat conduction factor for CI may be taken as 46 W/m/^{0}C. The temperature difference between the centre and edge of the crown may be taken as 250^{0}C. [7]

    b) State and explain the various stresses induced in a connecting rod. [3]

15. a) Design a crane hook with the load lifting capacity of the crane as 250 kW. The weight of the hook is 50 kN. [7]

    b) Mention the applications of C-clamp. [3]

16. a) A spring loaded safety valve for a boiler is required to blow-off at a pressure of 1.5 N/mm^2. The Diameter of the valve is 60 mm. Design a suitable compression spring for the safety valve, assuming spring index to be 6, and 25 mm initial compression. The maximum lift of the valve is 15 mm. The shear stress in the spring material is to be limited to 450 MPa. Take G=0.84 x 10^5 MPa. [7]

    b) Mention the various applications of Spur and Helical gears. [3]

17. Answer any ***two*** of the following:

    a) Discuss the Load-Life relationship in rolling contact bearings. [5]

    b) Discuss the design of Piston of a 4-stroke Petrol engine. [5]

    c) Derive the expression for radius of neutral axis of a curved beam. [5]