Q1. Briefly elucidate the phenomenon of stress concentration with necessary diagrams (3)

Q2. Define factor of safety, what are the different factors on which factor of safety depends? (3)

Q3. A bolt is under an axial thrust of 15 kN together with a transverse shear force of 6 kN. Calculate the diameter of the bolt according to i) Maximum Principal Stress theory, ii) Maximum Shear Stress theory, Take elastic limit in simple tension = 200 N/mm^2, Factor of Safety = 2 (4)

Q4. It is required to design a helical compression spring subjected to a maximum force of 1250 N. The deflection of the spring corresponding to the maximum force should be approximately 30 mm. The spring index can be taken as 6. The spring is made of patented and cold-drawn steel wire. The ultimate tensile strength and modulus of rigidity of the spring material are 1090 and 81370 N/mm^2 respectively. The permissible shear stress for the spring wire should be taken as 50% of the ultimate tensile strength. Design the spring and calculate: Wire Diameter, mean coil diameter. (5)

Q5. From the previous question data, number of active coils, calculate free length and pitch of the spring. (3)

Q6. For the spring designed from the previous question, draw the sketch showing the relevant dimensions of the spring. (2)

Q7. Design a pair of spur gears to transmit 20 kW from a shaft rotating at 1000 rpm to a parallel shaft which is to rotate at 310 rpm. Assume the number of pinion 31 and 20^o full depth tooth form. The material for pinion is C40 steel (untreated) and for gear cast steel 0.2%C (untreated). The gear is subjected to medium shock and 8 – 10 hrs duty per day, calculate the module, gear dimensions. (4)

Q8. For the data in the previous question, calculate the error and the type of gear chosen. (3)

Q9. For the data from the previous question, calculate the dynamic load on the gear tooth. (3)

Q10. Select a suitable ball bearing for the shaft of axial flow compressor having the following details. Radial load = 3560 N, Axial load = 1675 N, Speed of the shaft = 1440 rpm, diameter = 65 mm, bearing life = 70 hrs/week for 6 years. (5)

Q11. State at least 4 disadvantages of Rolling element bearings. (2)

Q12. State any 4 differences between sliding contact and rolling contact bearings. (3)

Q13. Select a roller chain to transmit 30 kW from a 900 rpm rotor to a line shaft rotating about 200 rpm. Service conditions will be 10 hr/day with moderate shock load conditions. (4)

Q14. For the data in previous question calculate the optimum centre distance, chain length in pitches, no of teeth on the sprockets. (3)

Q15. Explain the phenomenon of creep in a belt drive with the necessary diagram. (3)