



R18 Regulation

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

Subject code: 2P5CA

B.Tech V Semester Supplementary Examinations, January 2023

Design of Machine Members -I

(Mechanical Engineering)

Maximum Marks: 70

06-01-2023

Duration: 3 hours

- Note:
1. This question paper contains two parts A and B.
 2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
 3. Part B consists of 5 Units. Answer any one full question from each unit.
 4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks

(10x2M=20 Marks)

1. What are the steps In Machine Design Process?
2. Explain about the stress concentration?
3. Derive the Soderburg equation.
4. Discuss the about the Fatigue stress and Endurance Limits?
5. Write about the failure of the riveted joints?
6. Write the difference between riveted joints and welding joints?
7. Define the keys and various types of keys ?
8. Define factor of safety.
9. List out the various types of couplings and its Functions of couplings?
10. What is the function of transmission shaft?

Part-B

Answer All the following questions.

(5X10M=50Marks)

11. The load on a bolt consists of an axial pull of 10 kN together with a transverse shear force of 5 kN. Find the diameter of bolt required according to
1. Maximum principal stress theory; 2. Maximum shear stress theory; 3. Maximum principal strain theory; 4. Maximum strain energy theory; and 5. Maximum distortion energy theory. [10M]

OR

12. A cylindrical shaft made of steel of yield strength 700 MPa is subjected to static loads consisting of bending moment 10 kN-m and a torsional moment 30 kN-m. Determine the diameter of the shaft using two different theories of failure, and assuming a factor of safety of 2. Take $E = 210 \text{ GPa}$ and poisson's ratio $= 0.25$. [10M]

13. Derive the Equation of Goodman's Equation for combination of stresses? [10M]

OR

14. Determine the thickness of a 120 mm wide uniform plate for safe continuous operation if the plate is to be subjected to a tensile load that has a maximum value of 250 kN and a minimum value of 100 kN. The properties of the plate material are as follows: Endurance limit stress = 225 MPa, and Yield point stress = 300 MPa.
The factor of safety based on yield point may be taken as 1.5. [10M]

- 15 Two plates of 7 mm thick are connected by a triple riveted lap joint of zig-zag pattern. Calculate the rivet diameter, rivet pitch and distance between rows of rivets for the joint. Also state the mode of failure of the joint. The safe working stresses are as follows :
Tensile stress= 90 MPa ; Shear stresses= 60 MPa ; and compressive stresses= 120 MPa. [10M]
OR
- 16 Design the longitudinal joint for a 1.25 m diameter steam boiler to carry a steam pressure of 2.5 N/mm². The ultimate strength of the boiler plate may be assumed as 420 MPa, crushing strength as 650 MPa and shear strength as 300 MPa. Take the joint efficiency as 80%. Sketch the joint with all the dimensions. Adopt the suitable factor of safety. [10M]
- 17 Design and draw a cotter joint to support a load varying from 30 kN in compression to 30 kN in tension. The material used is carbon steel for which the following allowable stresses may be used. The load is applied statically. Tensile stress = compressive stress = 50 MPa ; shear stress = 35 MPa and crushing stress= 90 MPa. [10M]
OR
- 18 The big end of a connecting rod is subjected to a maximum load of 50 kN. The diameter of the circular part of the rod adjacent to the strap end is 75 mm. Design the joint, assuming permissible tensile stress for the material of the strap as 25 MPa and permissible shear stress for the material of cotter and gib as 20 MPa. [10M]
- 19 A solid circular shaft is subjected to a bending moment of 3000 N-m and a torque of 10 000 N-m. The shaft is made of 45 C 8 steel having ultimate tensile stress of 700 MPa and a ultimate shear stress of 500 MPa. Assuming a factor of safety as 6, determine the diameter of the shaft. [10M]
OR
- 20 Design a cast iron protective type flange coupling to transmit 15 kW at 900 r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used : Shear stress for shaft, bolt and key material=40 MPa
Crushing stress for bolt and key=80 MPa Shear stress for cast iron=8 MPa.
Draw a neat sketch of the coupling. [10M]