



R18 Regulation

Subject code: 2P5CA

# TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

## B.Tech V Semester Supplementary Examinations, December 2024

### Design of Machine Members -I (ME)

Maximum Marks: 70

Date: 23.12.2024

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 which carries 10M.
  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 |                                                                  | CO | Bloom Tx |
|----------------------------------------------------------------|------------------------------------------------------------------|----|----------|
| 1                                                              | What are the steps In Machine Design Process?                    | 1  | L1       |
| 2                                                              | Write about the stress concentration?                            | 1  | L1       |
| 3                                                              | Derive the Goodman's Equation?                                   | 2  | L1       |
| 4                                                              | Write about the endurance limit ?                                | 2  | L1       |
| 5                                                              | Write about the failure of the riveted joints ?                  | 3  | L1       |
| 6                                                              | Write the difference between riveted joints and welding joints ? | 3  | L1       |
| 7                                                              | What are the functions of key?                                   | 4  | L1       |
| 8                                                              | What is sunk key?                                                | 4  | L1       |
| 9                                                              | What is coupling? Where do you use it?                           | 5  | L1       |
| 10                                                             | What is the function of transmission shaft?                      | 5  | L1       |

#### Part-B

| Answer All the following questions. (5X10M=50Marks) |                                                                                                                                                                                                                                                                                                                                       | CO | Bloom Tx |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----------|
| 11                                                  | Explain the procedure for Engineering Design process? [10M]                                                                                                                                                                                                                                                                           | 1  | L2       |
| 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 $E = 210$ GPa and poisson's ratio = 0.25. [10M] | 1  | L2       |
| 13                                                  | Find the diameter of a shaft to transmit twisting moments varying from 800 N-m to 1600 N-m. The ultimate tensile strength for the material is 600 MPa and yield stress is 450 MPa. Assume the stress concentration factor = 1.2, surface finish factor = 0.8 and size factor = 0.85. [10M]                                            | 2  | L2       |
| OR                                                  |                                                                                                                                                                                                                                                                                                                                       |    |          |
| 14                                                  | A circular bar of 500 mm length is supported freely at its two ends. It is acted upon by a central concentrated cyclic load having a minimum value of 20 kN and a maximum value of 50 kN. Determine the diameter of bar by taking a factor of safety of 1.5, size effect of 0.85, surface finish factor                               | 2  | L2       |

|    |                                                                                                                                                                                                                                                                                                                                                                                                               |   |    |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----|
|    | of 0.9. The material properties of bar are given by : ultimate strength of 650 MPa, yield strength of 500 MPa and endurance strength of 350 MPa. [10M]                                                                                                                                                                                                                                                        |   |    |
| 15 | Explain the various ways in which a riveted joint may fail ? [10M]                                                                                                                                                                                                                                                                                                                                            | 3 | L2 |
| 16 | Find the efficiency of the riveted joint Single riveted lap joint of 6 mm plates with 20 mm diameter rivets having a pitch of 50 mm. Assume Permissible tensile stress in plate = 120 MPa Permissible shearing stress in rivets = 90 MPa Permissible crushing stress in rivets = 180 MPa. [10M]                                                                                                               | 3 | L2 |
| 17 | A 45 mm diameter shaft is made of steel with a yield strength of 400 MPa. A parallel key of size 14 mm wide and 9 mm thick made of steel with a yield strength of 340 MPa is to be used. Find the required length of key, if the shaft is loaded to transmit the maximum permissible torque. Use maximum shear stress theory and assume a factor of safety of 2. [10M]                                        | 4 | L2 |
|    | OR                                                                                                                                                                                                                                                                                                                                                                                                            |   |    |
| 18 | Design a sleeve and cotter joint to resist a tensile load of 60 kN. All parts of the joint are made of the same material with the following allowable stresses : $\sigma_t = 60$ MPa ; $\tau = 70$ MPa ; and $\sigma_c = 125$ MPa. [10M]                                                                                                                                                                      | 4 | L2 |
| 19 | Design and draw a cottered foundation bolt which is subjected to a maximum pull of 50 kN. The allowable stresses are : $\sigma_t = 80$ MPa ; $\tau = 50$ MPa ; and $\sigma_c = 100$ MPa. [10M]                                                                                                                                                                                                                | 5 | L2 |
|    | OR                                                                                                                                                                                                                                                                                                                                                                                                            |   |    |
| 20 | Design and make a neat dimensioned sketch of a muff coupling which is used to connect two steel shafts transmitting 40 kW at 350 r.p.m. The material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15 MPa. [10M] | 5 | L2 |