**20ME502**

**Hall Ticket Number:**

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| **III/IV B.Tech (Regular) DEGREE EXAMINATION** | | | |
| **February,2023** | **Mechanical Engineering** | | |
| **Fifth Semester** | **Design of Machine Elements** | | |
| **Time:** Three Hours | | **Maximum: 7**0 Marks | |
| *Answer Question No. 1 Compulsorily.* | | | (14X1 = 14 Marks) |
| *Answer* ***ANY ONE*** *question from each Unit.* | | | (4X14=56 Marks) |

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| 1. | a) | List out the various phases of design process. | CO1 | L2 | 1M |
|  | b) | List out any two important mechanical properties of engineering materials. | CO1 | L1 | 1M |
|  | c) | Briefly explain S-N curve | CO2 | L2 | 1M |
|  | d) | Define endurance limit | CO2 | L2 | 1M |
|  | e) | Compare riveted and welded joints for at least 2 points. | CO3 | L2 | 1M |
|  | f) | What do you understand about the preloading of bolts? | CO2 | L2 | 1M |
|  | g) | Distinguish a wood screw from a machine screw | CO2 | L2 | 1M |
|  | h) | In an eccentrically loaded riveted joint, each rivet will have different diameter. Is the statement true or false. | CO3 | L2 | 1M |
|  | i) | Which type of riveted joint is preferred to get the required diameter for a boiler | CO3 | L2 | 1M |
|  | j) | For which type of material Soderberg equation is suitable | CO2 | L2 | 1M |
|  | k) | What is nipping in a spring | CO4 | L2 | 1M |
|  | l) | What is the helix angle in a closely coiled helical spring | CO4 | L2 | 1M |
|  | m) | State the nature of stress in a spring. | CO4 | L2 | 1M |
|  | n) | Explain the condition for self locking of a screw | CO4 | L2 | 1M |
| **Unit -I** | | | | | |
| 2. | a) | The stresses at a point in a body are sx = 90 N/mm2, sy = 20 N/mm2, and sxy = 80 N/mm2. The material tests syp = 280 N/mm2. Find the factor of safety according to the:  i. Maximum principal stress theory of failure  ii. Maximum shear stress theory of failure  iii. Maximum strain energy theory of failure. | CO1 | L3 | 7M |
|  | b) | Discuss in detail the factors which govern the selection of material for a machine component. | CO1 | L2 | 7M |
|  |  | **(OR)** |  |  |  |
| 3. | a) | What is stress concentration and Explain methods to reduce stress concentration . | CO1 | L3 | 4M |
|  | b) | A circular bar of 500mm length is supported freely at its two ends. It is acted upon by a central concentrated cyclic load having a minimum value of 20kN and a maximum value of 50kN. Determine the diameter of bar by taking a factor of safety of 1.5, size effect of 0.85, surface finish 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. | CO1 | L3 | 10M |
|  |  | **Unit -II** |  |  |  |
| 4. | a) | Explain Goodman’s method to calculate the safe values of fluctuating stress. For what materials it is applicable? | CO2 | L2 | 7M |
|  | b) | A simply supported beam has a concentrated load at the center, which fluctuates from a value of P to 4 P. The span of the beam is 0.5m and its cross-section is circular with a diameter of 0.06m. Taking for the beam material an ultimate stress of 700MPa, a yield stress of 500MPa, endurance limit of 330MPa for reversed bending, and a factor of safety of 1.3, calculate the maximum value of P. Take a size factor of 0.85 and a surface finish factor of 0.9. | CO2 | L3 | 7M |
|  |  | **(OR)**  **P.T.O**  **20ME502** | | | |
| 5. | a) | What is meant by Bolt’s of uniform strength and explain the methods to prepare the same. | CO2 | L3 | 4M |
|  | b) | A steel plate subjected to a force of 5 kN and fixed to a channel by means of three identical bolts is shown in Fig. The bolts are made of plain carbon steel 30C8 having permissible shear strength of 100MPa and the factor of safety is 3. Determine the diameter of the shank. | CO2 | L3 | 10M |
|  |  | **Unit -III** | |  |  |
| 6. | a) | Enumerate the different types of riveted joints. | CO3 | L1 | 7M |
|  | b) | Two plates 16mm thick are joined by a double riveted lap joint. The pitch of each row of rivets is 90mm. The rivets are 25mm in diameter. The permissible stresses are 140MPa in tension, 80MPa in shear and 160MPa in crushing. Find the efficiency of the joint. | CO3 | L3 | 7M |
|  |  | **(OR)** |  |  |  |
| 7. | a) | Explain the procedure to design Welded joint subjected to eccentric load. | CO3 | L3 | 4M |
|  | b) | A welded joint, as shown in Fig. is subjected to an eccentric load of 2500 N. Find the size of the weld, if the maximum shear stress in the weld is not to exceed 50 N/mm2. | CO3 | L3 | 10M |
|  |  | **Unit -IV** |  |  |  |
| 8. | a) | Write the procedure to design a compressive spring. | CO4 | L3 | 4M |
|  | b) | Design and draw a valve spring of a petrol engine for the following operating conditions: Spring load when the valve is open = 400N, Spring load when the valve is closed = 250N, Maximum inside diameter of spring = 25mm, Length of the spring when the valve is open = 40mm, Length of the spring when the valve is closed = 50mm, Maximum permissible shear stress = 400MPa. | CO4 | L3 | 10M |
|  |  | **(OR)** |  |  |  |
| 9. | a) | Explain about the different types of threads used in power screws. | CO4 | L3 | 4M |
|  | b) | Design the spring for an elevator at the bottom of which 8 identical springs are set in parallel to absorb the shock of the elevator in case of failure. The weight of the elevator is 20 kN and has a free fall of 1.2 m from rest. The spring is made of 20 mm dia wire and has a spring index of 5.5. Each spring has 12 active turns. Neglect the effect of counter weight. | CO4 | L3 | 10M |

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