**18ME503**

**Hall Ticket Number:**

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| **III/IV B.Tech (Regular) DEGREE EXAMINATION** | | | |
| **February, 2021** | **Mechanical Engineering** | | |
| **Fifth Semester** | **Design of Machine Elements - I** | | |
| **Time:** Three Hours | | **Maximum :** 50 Marks | |
| *Answer Question No.1 compulsorily.* | | | (1X10 = 10 Marks) |
| *Answer ONE question from each unit.* | | | (4X10 = 40 Marks) |
| **Part - A** | | | |

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| 1. | Answer all questions | | | (1X10 =10Marks) | |
|  | a) | | List out the various types of machine design | |  |
|  | b) | | What do you understand by “preferred numbers”? | |  |
|  | c) | | What is meant by factor of safety? | |  |
|  | d) | | Mention various factors that affect endurance limit of a machine part | |  |
|  | e) | | What is meant by bolts of Uniform strength | |  |
|  | f) | | What are the various types of riveted joint failures? | |  |
|  | g) | | Distinguish between transverse and parallel fillet welded joints | |  |
|  | h) | | What is the function of shaft? | |  |
|  | i) | | What is feather key? Give its applications | |  |
|  | j) | | How would you classify Couplings | |  |
| **Part - B** | | | | | |
| 2. | a) | | Explain the engineering materials classification with an example. | | 4M |
|  | b) | | Explain the basic procedure involved in design of any machine component. Draw the flow chart for design procedure | | 6M |
| 3. | a) | State and explain any two theories of failure | | | 4M |
|  | b) | The stresses induced at a critical point in a machine component made of steel 45C8 (Syt = 380N/mm2 ) are σx = 100 N/mm2 , σy = 40N/mm2 , τxy = 80N/mm2.Calculate the factor of safety by (i) the Maximum Normal stress theory (ii) the Maximum shear stress theory (iii) the distortion energy theory. | | | 6M |
| 4. | a) | | Explain the methods to reduce stress concentration | | 4M |
|  | b) | | A transmission shaft of cold drawn steel 27Mn2 (Ultimate tensile strength Sut = 500 N/mm2 and yield strength Syt = 300 N/mm2) is subjected to a fluctuating torque which varies from –100 Nm to +400 Nm. The factor of safety is 2 and the expected reliability is 90%. Neglecting the effect of stress concentration, determine the diameter of the shaft. Assume Load correction factor for shear = 0.577, Surface finish factor = 0.8, Size factor = 0.85, Reliability factor = 0.897. | | 6M |
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| 5. | a) | Explain the method of determining the size of the bolt when the bracket carries an eccentric load perpendicular to the axis of the bolt | | | 4M |
|  | b) | A steel plate subjected to a force of 3 kN and fixed to a vertical channel by means of four identical bolts is shown in Figure 1. The bolts are made of plain carbon steel 45C8 (Syt = 380 N/mm2) and the factor of safety is 2. Determine the diameter of the shank.    Figure 1 | | | 6M |
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| 6. | a) | Explain the different types of riveted joints with neat sketches. | | | 4M |
|  | b) | Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m diameter subjected to a steam pressure of 0.95 N/mm2. Assume joint efficiency as 75%, allowable tensile stress in the plate 90 MPa, compressive stress 140 MPa and shear stress in the rivet 56 MPa | | | 6M |
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| 7. | a) | What are the advantages of welded joints compared with riveted joints? | | | 4M |
|  | b) | A steel plate, 100 mm wide and 10 mm thick, is joined with another steel plate by means of single transverse and double parallel fillet welds, as shown in Figure 2. The strength of the welded joint should be equal to the strength of the plates to be joined. The permissible tensile and shear stresses for the weld material and the plates are 70 and 50 N/mm2 respectively. Find the length of each parallel fillet weld.  Figure 2 | | | 6M |
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| 8. | The layout of a transmission shaft carrying two pulleys B and C and supported on bearings A and D is shown in Figure 3. Power is supplied to the shaft by means of a vertical belt on the pulley B, which is then transmitted to the pulley C carrying a horizontal belt. The maximum tension in the belt on the pulley B is 2.5 kN. The angle of wrap for both the pulleys is 180° and the coefficient of friction is 0.24. The shaft is made of plain carbon steel 30C8 (Syt = 400 N/mm2) and the factor of safety is 3. Determine the shaft diameter on strength basis.  Figure 3 | | | | 10M |
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| 9. | It is required to design a rigid type of flange coupling to connect two shafts. The input shaft transmits 37.5 kW power at 180 rpm to the output shaft through the coupling. The design torque is 1.5 times of the rated torque. Assume shaft is made by plain carbon steel of grade 40C8 (Syt = 380 N/mm2) with factor of safety is 2.5. Bolts and Keys are made by plain carbon steel of grade 30C8 (Syt = 400 N/mm2) with factor of safety 2.5 Flanges are made by Grey cast iron FG 200 (Sut = 200 N/mm2) with factor of safety 6 | | | | 10M |

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