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**Presidency University**

**Bengaluru**

**SCHOOL OF ENGINEERING**

**SUMMER TERM END TERM EXAMINATION - AUGUST 2024**

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| **Semester : B.TECH. - Summer** | **Date : 06-08-2024,** |
| **Course Code : MEC3004/3090** | **Time : 09.30am to 12.30am** |
| **Course Name : Design of Machine Elements-I** | **Max Marks : 100** |
| **Program : B.TECH.** | **Weightage : 50%** |

**Instructions:**

1. *Read the all questions carefully and answer accordingly.*
2. *Use of Design Data Handbook allowed.*

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| **PART A** | | | |
| **ANSWER ANY 4 QUESTIONS 5Q X 3M=20M** | | | |
| 1 | What is the surface finish factor for a cylindrical component subjected to torsion, having sharp circular grooves & having an ultimate tensile strength of 600 MPa? | (CO 1) | [Knowledge] |
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| 2 | Define notch sensitivity. | (CO 2) | [Knowledge] |
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| 3 | Explain the phenomenon of fatigue failure mechanism. | (CO 4) | [Knowledge] |
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| 4 | Shear strengh, tensile strength and crushing strength of riveted joint is 800 kN, 700 kN, 500 kN respectively. Strength of unriveted plate is 1000 kN. What will be the efficiency of this riveted joint? | (CO 5) | [Knowledge] |
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| 5 | What is fatigue failure, and how does it occur? | (CO 3) | [Knowledge] |
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| 6 | What is endurance limit? | (CO 2) | [Knowledge] |
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| **PART B** | | | |
| **ANSWER ANY 5 QUESTIONS 5Q X 10M=50M** | | | |
| 7 | Why is the endurance limit obtained from standard specimens not directly applicable to actual components? List the factors that cause this discrepancy. | (CO 2) | [Comprehension] |
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| 8 | The key is transmitting 475 Nm. of torque from the shaft to the hub. The key and shaft are made from commercial steel (Yield strength = 230 MPa).  Design the key for factor of safety of 3. | (CO 3) | [Comprehension] |
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| 9 | Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m in diameter subjected to a steam pressure of 0.95 MPa. 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. | (CO 4) | [Comprehension] |
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| 10 | To analyse the welded connection illustrated in Figure under a 60 kN eccentric force within the plane of the welds, the objective is to determine the necessary size of the welds. Given a permissible shear stress for the weld material of 100 N/mm² and assuming static conditions, what is the appropriate size for the welds to meet the specified shear stress criterion? | (CO 5) | [Comprehension] |
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| 11 | The shaft of an overhang crank subjected to a force P of 2 kN is shown in Fig. The shaft is made of plain carbon steel 45C8 and the tensile yield strength is 400 N/mm^{2}. The factor of safety is 3. Determine the diameter of the shaft using the maximum shear stress theory. | (CO 2) | [Comprehension] |
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| 12 | An offset link subjected to a force of 25 kN is shown in Fig. It is made of grey cast iron FG300 and the factor of safety is 3. Calculate the dimensions of the cross-section of the link. | (CO 2) | [Comprehension] |
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| 13 | How does surface finish affect the fatigue strength of materials, and how is it accounted for in fatigue analysis? | (CO 3) | [Comprehension] |
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| **PART C** | | | |
| **ANSWER ANY 2 QUESTIONS 2Q X 15M=30M** | | | |
| 14 | The dimensions of an overhang crank are given in Fig. The force P acting at the crankpin is 2 kN. The crank is made of steel 30C8 (\sigmayt = 420 N/mm^{2}) and the factor of safety is 2. Using maximum shear stress theory of failure, Calculate the diameter d at the section - XX. | (CO 5) | [Application] |
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| 15 | A mild steel shaft used in a speed boat transmits 15 KW at 300 rpm. It is supported on two bearings 1.2 m apart. The shaft receives power through 450 mm diameter pulley mounted at 300 mm to the right of right bearing. The power is given out through a 300 mm diameter gear mounted at 250 mm to the right of left bearing. The belt drive is horizontal and the gear drives with a downward tangential force. Find suitable diameter of the shaft if yield stress for shaft material is 234 MPa and factor of safety 2. Take Kb = Kt = 1.5. Tension’s ratio of belt is 3. Consider pressure angle is 20 degree. | (CO 2) | [Application] |
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| 16 | Two carts are to be pulled or pushed together by a joint which uses a Cotter. The total load they need to carry is 100kN. The permissible stresses are 120 MPa, 160 MPa & 80 MPa in tensile, compressive and shear respectively. Identify the type of joint, why the particular joint is used? and model the same. | (CO 4) | [Application] |
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