Reg. No. \_\_\_\_\_\_\_\_\_\_\_\_\_



**End Semester Examination – Nov / Dec – 2019**

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| **Code :** | **17ME2020** | **Duration :** | **3hrs** |
| **Sub. Name :** | **DESIGN OF MACHINE ELEMENTS** | **Max. Marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

**(Note: Use of approved data books and data sheets are permitted)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | With help of a block diagram briefly explain the design process. | CO1 | 4 |
| b. | A steel bracket is loaded as shown in the figure given below. The section at A-A is rectangular whose width is 40 mm and thickness‘t’ mm. The permissible tensile stress of the material of the bracket is 60 N/mm2. Determine the thickness of the bracket. untitled1 | CO5 | 16 |
| **(OR)** | | | | |
| 2. | a. | A plate is subjected to tensile force of 100 kN. The width of the plate is 100mm and it has a central hole of diameter 10mm. Determine the thickness of the plate considering the stress concentration concept, if the tensile stress is not to exceed 100 N/mm2. | CO2 | 4 |
| b. | A mild steel bracket is subjected to a pull of 6000N acting at 45° to its horizontal axis as shown in figure given below. The bracket has a rectangular cross section whose depth is twice the thickness. Find the cross sectional dimensions of the bracket, if the permissible stress in the material of the bracket is limited to 60MPa. In figure given linear dimensions are in mm . | CO3 | 16 |
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| 3. | a. | State any two theories of failures and show the related equations. | CO2 | 4 |
| b. | A stepped shaft of diameters D and d is subjected to a variable axial load P which cyclically varies between 0 and 10 kN as shown in figure. The shaft is made of C20 steel, mirror polished with ultimate tensile stress Su = 500 N/mm2 and yield point stress Sy = 260 N/mm2. By using soderberg concept, determine the diameters D and d with D/d = 1.5, factor of safety = 2, notch sensitivity factor = 0.8 and r/d = 0.2 where r is the shoulder radius. Take endurance limit stress = 0.5 Su.  C:\Users\Admin\Downloads\New Doc 2019-08-05 11.55.12.jpg | CO4 | 16 |
| **(OR)** | | | | |
| 4. | a. | Briefly write the design procedure of helical spring. | CO1 | 4 |
| b. | A truck has leaf spring of 10 leaves and is supported at a span length of 1m, with central band of 80 mm wide. A load of 6kN is applied at the centre of spring whose permissible stress is 300N/mm2. The spring has a ratio of total depth to width of about 2.5. Determine the width, thickness, deflection and length of all leaves. | CO3 | 16 |
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| 5. | a. | A shaft made of mild steel is required to transmit 100 kW at 300 rpm. The length of the shaft is 3m. It carries two pulleys, each weight is 1500N supported at a distance 1m from the ends respectively. Assume shear stress 60 N/mm2. Find the diameter of the shaft. | CO5 | 4 |
| b. | Design a Cast Iron rigid flange coupling to transmit 20kW at 1000 rpm from an electric motor to a compressor. The service factor may be assumed as 1.35.  The following permissible stresses may be used:   * 1. Shear stress for shaft, bolt and key materials = 40 MPa   2. Crushing stress for bolt and key = 80 MPa   c. Shear stress for cast iron flange =15MPa. | CO6 | 16 |
| **(OR)** | | | | |
| 6. | a. | Design a rectangular key for a shaft of 50 mm diameter. Shear stress, crushing stress for the key material are 42 MPa and 70 MPan. | CO3 | 4 |
| b. | A line shaft running at 100rpm transmits 20kW. It carries a central load of 1kN. It is supported in bearings, the diatnce between the centres of bearings is 1 meter. The permissible shear stress is 45N/mm2 and bending stress is 70 N/mm2. Determine the diameter of shaft, assuming minor shock loading. | CO5 | 16 |
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| 7. | a. | Determine the thickness of a pressure vessel whose inside diameter is 500mm to store the fluid at 2N/mm2. Take the design tensile stress as 77N/mm2 and assume the expected efficiency as 80%. | CO3 | 4 |
|  | b. | Design a knuckle joint for transmitting an axial load of 60 kN for the following stresses: in tension 60 MPa, in crushing 75 MPa, in shear 40 MPa. Tabulate the specification. | CO4 | 16 |
| **(OR)** | | | | |
| 8. | a. | Write the advantages of riveted joint over welded joint and mention few examples for permanent and temporary joints. | CO1 | 4 |
| b. | Design a cotter joint to support a load of 6 kN. Permissible design stresses are: in tension 60 N/mm2, in crushing 90N/mm2, in shear 40 N/mm2. | CO4 | 16 |
|  | | **Compulsory:** |  |  |
| 9. |  | The turning moment diagram for a multi cylinder engine is drawn to scales of 1mm=600 N-m vertical and 1mm=1.5 degree horizontally . The areas of loops above and below the mean torque line, take in order are -32 , +406 , -267 , +333 , -310 , +226 , -374 , +274 , -256 mm2. The mean speed of the engine is 150 rpm and the fluctuation of speed of the flywheel is not to exceed +10% of the mean speed. Design a Cast Iron flywheel and find out the dimensions of flywheel rim. | CO4 | 20 |