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

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**End Semester Examination – Nov/Dec – 2018**

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| **Code :** | **14ME2029** | **Duration :** | **3hrs** |
| **Sub. Name :** | **DESIGN OF MACHINE ELEMENTS** | **Max. marks :** | **100** |

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

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | A shaft is transmitting 20 kW at 500 rpm. If the allowable shear stress for the shaft material is 60 MPa, find the suitable diameter for the shaft. The shaft is not to twist more than 1° in a length of 2 meters. Take modulus of rigidity as 80 GPa. | CO1 | 10 |
| b. | Determine the required thickness of the steel bracket at section A-A, when loaded as shown in Fig. 1 in order to limit the tensile stress to 60 MN/m2  C:\Users\Jaysheelan1\Downloads\dme qp_1.jpg  Fig. 1 | CO1 | 10 |
| (OR) | | | | |
| 2. | a. | A plate of uniform thickness ‘t’ has two widths of 45 mm and 30 mm with a fillet radius of 5 mm. The smaller width portion has a transverse hole of 15 mm diameter. For the plate material the ultimate tensile strength is 200 N/mm2. Considering stress concentration effect, and assuming a factor of safety of 2.5, find the thickness of plate for a maximum tensile load of 5 kN. | CO2 | 18 |
| b. | Define the term “Equivalent bending moment”. | CO1 | 2 |
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| 3. | a. | A round bar of diameter 40 mm has a smooth ground surface and is made of steel for which ultimate strength is 500 N/mm2 yield strength is 400 N/mm2 and endurance limit is 250 N/mm2. Determine the factor of safety of the bar when it is subjected to alternating bending stress in a symmetric cycle, if the maximum bending moment in the cycle is 640 N-m. | CO2 | 12 |
| b. | Define the following terms  (i) Proportional limit,  (ii) Elastic limit,  (iii) Yield point &  (iv) Ultimate limit | CO1 | 8 |
| (OR) | | | | |
| 4. | a. | Find the diameter of a shaft to transmit twisting moments varying from 500 N-m to 2000 N-m. The ultimate tensile strength is 600 N/mm2; yield stress is 450 N/mm2. Assume stress concentration factor as 1.2, surface finish factor as 0.8, size factor as 0.85 and factor of safety as 2. | CO2 | 18 |
| b. | State the situation where we use soderberg’s equation and Goodman equation. | CO2 | 2 |
| 5. | a. | A short shaft made of C45 steel receiving 50 kW at 300 rpm via a 300 mm spur gear, the power being delivered to another shaft through a flexible coupling. The gear is keyed midway between the bearings. The pressure angle of gear is 20° and design factor is 2. Bearing are 500 mm. apart Find the diameter of the shaft. | CO3 | 10 |
| b. | An engine indicator has a plunger diameter of 20 mm. When the steam pressure on the plunger is 5 N/mm2, the indicator spring is compressed by 12 mm. For a permissible shear stress of 450 N/mm2, spring index of 5 and modulus of rigidity of 80 kN/mm2 design the helical compression spring completely. | CO4 | 10 |
| (OR) | | | | |
| 6. |  | Design a bush type flexible flange coupling to transmit 10 kW at 720 rpm. Allowable shear stress for shaft, key and bolt may be taken as 50 N/mm2 and the crushing stress for the key as 110 N/mm2. The permissible shear stress for the coupling should be limited to 18 N/mm2 and the bearing pressure between the bush and the coupling should be limited to 2 N/mm2. | CO4 | 20 |
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| 7. | a. | Two plates of 9 mm thick are to be joined by a triple riveted, zig-zag, lap joint. Design the joint using the allowable stresses as,  80 MPa for plates in tension  60 MPa for rivets in shear  100 MPa for rivets in crushing  Find also the efficiency of the joint. Also sketch the joint. | CO4 | 16 |
| b. | Define the following terms.  (i) Major diameter or nominal diameter  (ii) Minor diameter or root diameter  (iii) Pitch  (iv) Lead | CO1 | 4 |
| (OR) | | | | |
| 8. | a. | A steel tank having an internal diameter of 2.5 m is required to withstand an internal fluid pressure of 25 N/mm2. The tensile and compressive elastic strength of the material is 200 N/mm2. Find the thickness of the wall of the tank if the working value of the circumferential stress is two-third of the tensile elastic strength. | CO2 | 10 |
| b. | Find out the dimensions of an oval flanged cast-iron coupling to join the cast-iron pipes of 200 mm diameter for carrying steam at a pressure of 3 MPa. | CO3 | 10 |
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|  | | **Compulsory**: |  |  |
| 9. |  | Design a cast-iron piston for a single acting four stroke I.C engine for the following specifications.  Cylinder bore = 100 mm  Stroke length = 120 mm  Maximum gas pressure = 6 MPa  Brake mean effective pressure = 0.7 MPa  Fuel consumption = 0.24 kg/kW/hr  Speed = 2200 rpm | CO4 | 20 |