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

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(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

**UNIVERSITY**

**End Semester Examination – Nov/Dec - 2016**

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| **Code :** | **ME257/ 12ME225** | **Duration :** | **3 hrs** |
| **Sub. Name :** | **Design of Machine Elements** | **Max. marks :** | **100** |

#### **(Use of approved design data book is permitted)**

#### **Answer ALL questions**

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| **PART - A (10 X 1 =10 MARKS)** | | |
| 1. | Define Factor of safety. | (1) |
| 2. | Rankine’s theory is used for \_\_\_\_\_\_\_\_\_\_\_\_materials. | (1) |
| 3. | Distinguish between brittle fracture and ductile fracture. | (1) |
| 4. | Define endurance limit. | (1) |
| 5. | What is spring index? | (1) |
| 6. | Define critical speed of a shaft. | (1) |
| 7. | What is the function of a coupling? | (1) |
| 8. | What are the main functions of the knuckle joints? | (1) |
| 9. | What is the function of connecting rod in IC Engine? | (1) |
| 10. | Gudgeon pin is made of \_\_\_\_\_\_\_\_ material. | (1) |

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| **PART - B (5 X 3 = 15 MARKS)** | | |
| 11. | Describe material properties: Stiffness and Strength. | (3) |
| 12. | What are the differences between closed coil & open coil helical springs? | (3) |
| 13. | What are the purposes in machinery for which couplings are used? | (3) |
| 14. | What are the advantages of screwed fasteners? | (3) |
| 15. | Define coefficient of fluctuation of speed and coefficient of steadiness. | (3) |

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| **PART - C (5 X 15 = 75 MARKS)** | | | |
| 16. | A mild steel bracket as shown in fig. is subjected to a pull of 6000 N acting at 45° to its horizontal axis. 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 60 MPa.  C:\Users\RAJESH\Desktop\Capture.PNG | (15) | |
| **(OR)** | | | |
| 17. | A cylindrical shaft made of steel of yield strength 700 MPa is subjected to static loads consisting of bending moment 10 kN–m and a torsional moment 30 kN–m. Determine the diameter of the shaft using Maximum Shear Stress theory and Maximum Strain Energy theory, and assuming a factor of safety of 2. Take E = 210 GPa and Poisson’s ratio = 0.25. | (15) | |
| 18. | A hot rolled steel shaft is subjected to a torsional moment that varies from 330 N–m clockwise to 110 N–m counterclockwise and an applied bending moment at a critical section varies from 440 N–m to –220 N–m. The shaft is of uniform cross–section and no keyway is present at the critical section. Determine the required shaft diameter. The material has an ultimate strength of 550 MN/mm2 and yield strength of 410 MN/mm2. Take the endurance limit as half of the ultimate strength, Factor of Safety of 2, size effort of 0.85 and a Surface finish factor of 0.62. | (15) | |
| **(OR)** | | | |
| 19. | Design a close coiled helical compression spring for a service load ranging from 2250 N to 2750 N. The axial deflection of the spring for the load range is 6 mm. Assume a spring index of 5. The permissible shear stress intensity is 420 N/mm2 and modulus of rigidity, G = 84 kN/mm2. Neglect the effect of stress concentration. Draw a fully dimensioned sketch of the spring, showing details of the finish of the end coils. | (15) | |
| 20. | A mild steel shaft transmits 20 kW to 200 rpm. It carries a central load of 900 N and is simply supported between the bearing 2.5 m apart. Determine the size of the shaft, if the allowable shear stress is 42 MPa and the maximum tensile or compressive stress does not exceed 56 MPa. Find the size of the required shaft, if it is subjected to gradually applied load. | (15) | |
| **(OR)** | | | |
| 21. | Design a protective cast iron flange coupling for a steel shaft transmitting 15 kW at 200 r.p.m. and having an allowable shear stress of 40 MPa. The working stress in the bolts should not exceed 30 MPa. Assume that the same material is used for shaft and key and that the crushing stress is twice the value of its shear stress. The maximum torque is 25% greater than the dull load torque. The shear stress for cast iron is 14 MPa. | | (15) |
| 22. | Design a knuckle joint for a tie rod of a circular section to sustain a maximum pull of 70 kN. The ultimate strength of the material of the rod against tearing is 420 MPa. The ultimate tensile and shearing strength of the pin material are 510 MPa and 396 MPa respectively. Determine the rod section and pin section. Take factor of safety = 6. | | (15) |
| **(OR)** | | | |
| 23. | Design a gib and cottor joint to carry a maximum load of 35 kN. Assuming that gib, cotter and rod are of same material and have the allowable stresses in tension, shear and compression is 60 N/mm2, 70 N/mm2 and 125 N/mm2 respectively. | (15) | |
| 24. | Design a cast iron piston for a single acting four stroke engine for the following data:  Cylinder Bore = 100 mm; Stroke = 125 mm; Maximum Gas Pressure = 5 N/mm2; Indicated Mean Effective Pressure = 0.75 N/mm2; Mechanical Efficiency = 80%; Fuel Consumption = 0.16 kg per brake per hour; Higher Calorific Value of fuel = 42 MJ/kg; Speed = 2000 rpm. Any other data required for the design may be assumed. | (15) | |
| **(OR)** | | | |
| 25. | The turning moment diagram of a multi–cylinder engine is drawn with a scale of (1 mm = 2.4o) on the abscissa and (1 mm = 650 N-m) on the ordinate. The intercepted areas between the torque developed by the engine and the mean resisting torque of the machine, taken in order from one end are –32, +408, –267, +333, –310, +226, –374, +260 and –244 mm2. The engine is running at a mean speed of 300 rpm and the coefficient of speed fluctuations is limited to 0.03. If the hoop stress in the material of the rim not to exceed 5.6 MPa, determine the suitable diameter and cross-section for the flywheel, assuming that the width is equal to 4 times the thickness. The density of the material may be taken as 7200 kg/m3. Determine the dimensions of the rim. Neglect the effect of the boss and arms. | (15) | |

**ALL THE BEST**