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



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

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| **Code :** | **17ME2001** | **Duration :** | **3hrs** |
| **Sub. Name :** | **ENGINEERING MECHANICS** | **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. | The tension in the supporting cable AB is 10KN. Write the force which the cable exerts on the beam BC as a vector T. Determine the angles of vector T form with the positive x, y and z axis.    Fig. 1 | CO2 | 10 |
| b. | A 5 light string A, B, C, D and E, whose end A is fixed as in the fig.2. The weight W1 and W2 are attached to the string at B and C and the string passes from a small smooth wheel at D carrying a weight of 40 kN at the free end E. In the position of equilibrium, BC is horizontal and AB and CD makes angle of 150° and 120° with the horizontal. Find i. tension in AB, BC and DE of the given string, ii. Magnitude of W1 and W2.    Fig. 2 | CO1 | 10 |
| **(OR)** | | | | |
| 2. | a. | A cantilever beam as in the fig.3 is fixed at A and free at B. Determine the reactions, when it is loaded.    Fig. 3 | CO1 | 5 |
| b. | Three smooth pipes each weighing 20 kN and of diameter 60 cm are to be placed in a rectangular channel with horizontal base as in the fig.4. Calculate the reactions at the points of contacts between the pipes and between the channel and the pipes. Take, width of the channel as 160 cm.    Fig.4 | CO2 | 15 |
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| 3. | a. | State parallel axis theorem. | CO1 | 2 |
| b. | Two planes AC and BC are inclined at 60° and 30° to the horizontal meet at C. A load of 1500 N rests on the plane BC and is tied by a rope passing over a frictionless pulley to a block weighing W N and resting on the plane AC as in the fig.5. The coefficient of friction between 1500 N weight and plane BC is 0.3 and between W and plane AC is 0.27. Determine the least and greatest values of W for the equilibrium of the system.    Fig.5 | CO3 | 18 |
| **(OR)** | | | | |
| 4. | a. | List the various statements of Coulomb laws of friction. | CO3 | 5 |
| b. | Find the moment of Inertia of the given section (fig.6) about its horizontal centroidal axes.    Fig.6 | CO1 | 15 |
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| 5. | a. | A bus starts to move with an acceleration of 0.3 m/s2. When a man who is 15 m behind the bus starts running at 3 m/s2 to catch the bus. After how many seconds, the man will catch the bus. | CO4 | 4 |
| b. | Two blocks A and B of weight 80 N and 60 N are connected by a string, passing through a smooth pulley as in the fig.7. Calculate the acceleration of the body and the tension in the string. Use D’Alembert’s principle.    Fig.7 | CO4 | 16 |
| **(OR)** | | | | |
| 6. | a. | The motion of a body moving on a curved path is given by the equations, x = 4Sin3t and y= 4Cos3t. Find the velocity and acceleration after 2 seconds. | CO4 | 10 |
| b. | 2 weights are connected by a string and move along the rough horizontal plan under action of force 40 N, applied to the first weight as in the fig.8. The coefficient of friction between sliding surfaces of weights and the plane is 0.3. Determine the acceleration of weights in tension in the string using D’Alembert’s principle.    Fig.8 | CO4 | 10 |
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| 7. | a. | State law of conservation of energy. | CO5 | 2 |
| b. | A vehicle with mass 300 kg is travelling at 36 km/hr on the plane road. It is brought to rest after travelling 5m distance. What is average force of resistance acting on the vehicle using conservation of energy. | CO5 | 4 |
| c. | A block weighing 100 N is moving along a horizontal rough surface with coefficient of friction 0.2 with velocity of 5 m/s. A push of 80N inclined at 30° to the horizontal acts on the block. Using work-energy principle, find the velocity of the block after it had moved through a distance of 20 m. | CO5 | 14 |
| **(OR)** | | | | |
| 8. | a. | State principle of virtual work. | CO5 | 2 |
| b. | Define period of restitution and coefficient of restitution. | CO5 | 4 |
| c. | Two bodies of masses 5 kg and 15 kg travelling along the same straight track have respective velocities 10m/s right ato left and 2.5 m/s left to right, just before impact. Take e= 0.75 and find the velocities after impact. Also calculate the energy loss due to impact. | CO6 | 14 |
|  | | **Compulsory**: |  |  |
| 9. | a. | A 20 kg uniform cylinder of radius 160mm rolls up on a slope inclined at 20° with initial velocity of 10m/s. Assuming no slipping, determine the maximum distance that the cylinder will roll up? | CO6 | 10 |
| b. | A cable is wound around a 20 kg cylinder of radius 220 mm as in the fig.9 and its free end is subjected to a constant horizontal pull of 10 N. What is the angular velocity of the cylinder 5 s after the commencement of motion from rest. There is no slip between the cylinder and the plate.    Fig. 9 | CO6 | 10 |