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

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

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| **Code :** | **14ME2001** | **Duration :** | **3hrs** |
| **Sub. Name :** | **ENGINEERIGN 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. |  | The thrust T from the engines of an aircraft makes the aircraft climb at an angle 20° with the horizontal with a uniform speed of 400 kmph as shown in Fig. 1. The resistance R on the aircraft from the surrounding air is given by R = k.v2 (in N), where k = 0.25 and v, the velocity of the aircraft in m.s-1. The weight of the aircraft is 120 kN. Determine the thrust T.  C:\Users\Jaysheelan1\AppData\Local\Microsoft\Windows\INetCache\Content.Word\EM qp_1.jpg  Fig. 1 | CO1 | 20 |
| (OR) | | | | |
| 2. | a. | Two cylinder made of steel (ρ = 7850 kg m-3), are placed between vertical walls, 40 mm apart, as shown in Fig.2. The diameters of the cylinders, A and B, are 26 mm and 18 mm respectively. Both are 40 mm long. A touches the horizontal floor, Determine (i) the reaction between A and B, and (ii) the reaction at the contacts at P, Q and R.  C:\Users\Jaysheelan1\AppData\Local\Microsoft\Windows\INetCache\Content.Word\EM qp_2.jpg  Fig. 2 | CO1 | 10 |
| b. | A huge slab of weight 100 kN is lifted by a crane with the help of three cables as shown in Fig. 3.  C:\Users\Jaysheelan1\AppData\Local\Microsoft\Windows\INetCache\Content.Word\EM qp_3.jpg  Fig. 3  The three cables OA, OB and OC join at O, the crane hook. The height og the point O from the surface of the slab is 2.5 m and is exactly above the centre of the slab. The weight of the slab acts at this centre. Find the tension in each cable. | CO3 | 10 |
|  |  |  |  |  |
| 3. | a. | The link AB of a machine is subjected to two forces F1 and F2 in the plane of the link as shown in Fig. 4. Determine the equivalent force-couple at (a) A and (b) D. The magnitude of the forces F1 and F2 are 2.5 kN and 6.0 kN respectively.  C:\Users\Jaysheelan1\AppData\Local\Microsoft\Windows\INetCache\Content.Word\EM qp_4.jpg  Fig. 4 | CO2 | 15 |
| b. | A couple is free vector. Do you agree with this statement? Give your reasoning. | CO2 | 5 |
| (OR) | | | | |
| 4. | a. | A beam AB, with external forces and supports, is shown in Fig. 5. Determine the support reactions.  C:\Users\Jaysheelan1\AppData\Local\Microsoft\Windows\INetCache\Content.Word\EM qp_5.jpg  Fig. 5 | CO2 | 18 |
| b. | Under what conditions will the moment of a force about a line be zero? | CO1 | 2 |
| 5. | a. | An unequal I section is shown in Fig. 6. Locate the centroid of the section.  C:\Users\Jaysheelan1\AppData\Local\Microsoft\Windows\INetCache\Content.Word\EM qp_6.jpg  Fig. 6 | CO2 | 10 |
|  | b. | Determine the moment of inertia of the T section, shown in Fig. 7, about its centroid x axis.  C:\Users\Jaysheelan1\AppData\Local\Microsoft\Windows\INetCache\Content.Word\EM qp_7.jpg  Fig. 7 | CO3 | 10 |
| (OR) | | | | |
| 6. | a. | Calculate the mass moment inertia of cone as shown in Fig. 8, of homogeneous distribution of mass, about the z-axis. The density of the material of the cone is ρ. (mass per unit volume)  C:\Users\Jaysheelan1\AppData\Local\Microsoft\Windows\INetCache\Content.Word\EM qp_8.jpg  Fig. 8 | CO3 | 16 |
| b. | Write down mathematically the (i) Parallel axis theorem and (ii) the perpendicular axis theorem. | CO1 | 4 |
|  |  |  |  |  |
| 7. |  | A rectangular area with a rectangular cut out is shown in Fig. 9. Determine the product moment of inertia of the area about its centroidal x and y axes.  C:\Users\Jaysheelan1\AppData\Local\Microsoft\Windows\INetCache\Content.Word\EM qp_9.jpg  Fig. 9 | CO2 | 20 |
| (OR) | | | | |
| 8. |  | Two masses A and B are connected through an inextensible light string, which passes over fixed pulleys C and E and over the movable pulley D which is attached to the mass B, as shown in Fig. 9. The pulleys are frictionless and of negligible mass. The coefficient of static and kinetic friction between A and the inclined surface are 0.15 and 0.12. Determine the acceleration of A and B. mA = 5 kg; mB = 25 kg.  C:\Users\Jaysheelan1\AppData\Local\Microsoft\Windows\INetCache\Content.Word\EM qp_10.jpg  Fig. 9 | CO3 | 20 |
|  | |  |  |  |
|  | | **Compulsory**: |  |  |
| 9. | a. | A truck of mass 9000 kg, is moving down a 1 in 50 slope on a road at a speed of 50 kmph. The brakes are applied to bring the vehicle to rest, Fig. 10. The total brake force on the front wheel is 20% more than that at the rear wheels. The vehicle is brought to rest with uniform deceleration giving a stopping distance 20 m. Determine (i) the brake forces at the front and rear wheels. (ii) the wheel reactions at the front and rear and (iii) if µ at the road surface is 0.55, will there be skidding?  C:\Users\Jaysheelan1\AppData\Local\Microsoft\Windows\INetCache\Content.Word\EM qp_11.jpg  Fig. 10 | CO3 | 15 |
| b. | A batsman hits a ball to propel it in the straight forward direction as shown in Fig. 11. The force of impact is 60 N. The mass of the bat is 6.5 kg and is 0.98 m long. The batsman’s grip can be assumed to be at a distance of 0.180 m from the top. The mass centre of the bat is at a distance of 0.62 m from its top. The radius of gyration of the bat about the axis perpendicular to the swing of the bat, passing through mass centre, is 0.25 m. At what point should the ball hit the bat so that the horizontal component of the reaction of the grip is zero? Also evaluate the angular acceleration of the bat during the impact.  C:\Users\Jaysheelan1\AppData\Local\Microsoft\Windows\INetCache\Content.Word\EM qp_12.jpg  Fig. 11 | CO3 | 5 |