Name: Enrolment No:	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

Online End Semester Examination, December 2020

Course: Engineering Mechanics **Semester: III**
Program: B. Tech ASE/ASE+AVE **Time 03 hrs.**
Course Code: MECH 1002 **Max. Marks: 100**

Instructions: a) All questions are compulsory.
b) Assume any suitable value for the missing data

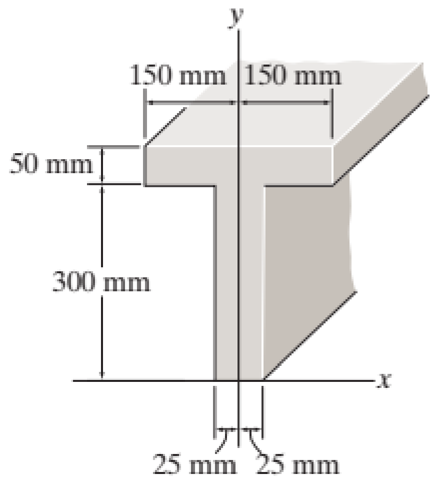
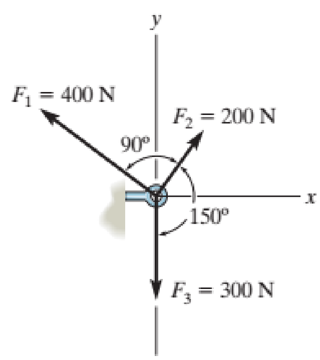
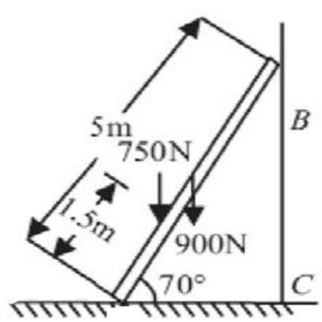
SECTION A

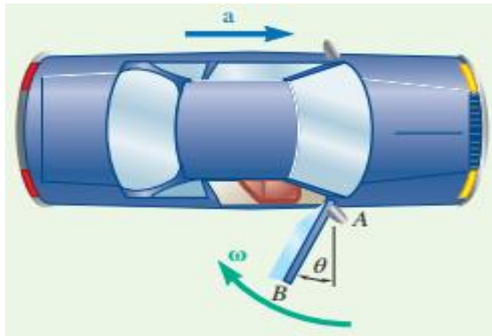
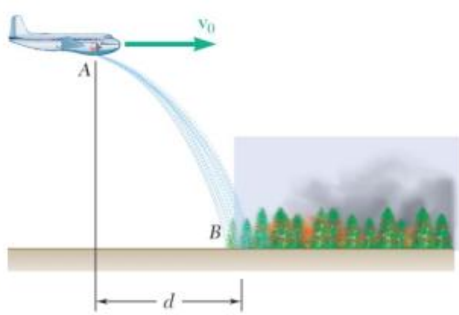
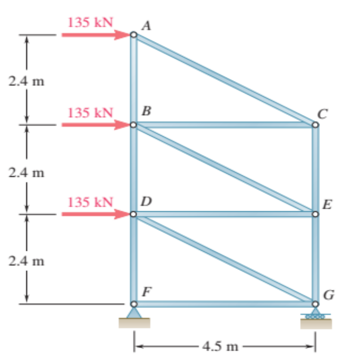
1 .Each Question will carry 5 Marks and has three sub-questions
2. Q1-Q6 are objective and true/false

S. No.		Marks	CO
Q 1	i) In the method of sections for the analysis of forces in the members of a pin-jointed truss, **(2 M)** (a) the section can be cut through any set of members for equal ease of analysis (b) the sections must be cut so that the number of unknowns is limited and determined by employing the conditions of equilibrium. (c) care must be taken to ensure that the section being cut is in equilibrium (d) the sections to be cut are as small as possible ii) The coefficient of friction depends upon **(2 M)** (a) the normal reaction (b) the surface roughness (c) the tangential force applied (d) the speed of movement iii) Radius of curvature for a rectilinear motion is zero **(T/F)** (**1 M)**	5	**CO1**
Q2.	i) One of the following assumptions is **not** necessary in obtaining the equation for parabolic trajectory of a particle: **(2 M)** (a) Air resistance is negligible (b) The gravitational acceleration g is constant (c) The body can be represented by a particle (d) The body must not change its mass during the motion ii) The D'Alembert principle **(2M)**	5	**CO1**

	(a) is a hypothetical principle (b) provides no special advantage over Newton's law (c) is based upon the existence of inertia forces (d) allows a dynamical problem to be treated similar to a statical problem iii) Number of possible equilibrium equation for an isolated particle present in 2 D plane is 3 **(T/F)** **(1 M)**		
Q3	i) Mass moment of inertia of any rigid body about its centroidal axis is **(2 M)** a) Maximum b) Minimum c) Depend on the shape of the body d) zero i) The velocity of a body on reaching the ground from a height h, is **(2 M)** a) $2\sqrt{gh}$ b) $\sqrt{2gh}$ c) $\sqrt{gh}$ d) $2g\sqrt{h}$ ii) Centripetal acceleration acts **away** from the center of rotation **(T/F)** **(1 M)**	**5**	**CO1**
Q4.	i) Moment of inertia of a triangular section of base (b) and height (h) about an axis through its base, is **(2 M)** a) $\frac{bh^3}{3}$ b) $\frac{bh^3}{12}$ c) $\frac{bh^3}{8}$ d) $\frac{bh^3}{36}$ ii) For perfect inelastic collision coefficient of restitution is. (2 M) a) 0 b) 1 c) Any value between 0 and 1 d) Any negative value	**5**	**CO1**

	iii) Energy conservation equation valid in presence of friction (**1 M)**		
Q5	i) Which of the following is a vector quantity (**2 M)** a) Linear acceleration b) Linear velocity c) Linear displacement d) All of the above iii) The coefficient of friction depends on **(2M)** a) Area of contact b) Shape of surface c) Material of surface d) None of the above iv) A fixed support has maximum 2 unknowns (reactions) at the connection **(T/F)** (**1 M)**	**5**	**CO1**
Q6	i) A ladder is resting on a smooth ground and leaning against a rough vertical wall. The force of friction will act **(2M)** a) Towards the wall at its upper end b) Away from the wall at its upper end c) Downward at its upper end d) Upward at its upper end ii) The linear velocity of a body rotating at ω rad/s along a circular path of radius r is given by **(2 M)** a) $\omega^2 r$ b) ω^2 /r c) ωr d) ω/r iii) Moment of inertia increases with increase in the length of given cross-section geometry **(T/F) (1 M)**	**5**	**CO1**
SECTION B			
Q 7	Determine moment of inertia of the below cross section (T- section) about its centroidal axis	**10**	**CO2**

			
Q8.	State the type of forces system shown in fig. below also solve for the magnitude and direction of resultant force with respect to x axis 	**10**	**CO2**
Q9 .	A ladder 5m long shown in Fig. below, rests on a horizontal ground and leans against a smooth vertical wall at an angle 70° with the horizontal. The weight of the ladder is 900N and acts at its middle. The ladder is at the point of sliding, when a man weighing 750N stands 1.5m from the bottom of the ladder. Compute the coefficient of friction between the ladder and the floor 	**10**	**CO2**
Q10.	A driver starts his car with the door on the passenger's side wide open (θ = 0). As the car moves forward with constant acceleration, the angular acceleration	**10**	**CO3**

	of the door is $\alpha = 2.5 \cos \theta$, where α is in rad/ s^2 . Determine the angular velocity of the door as it slams shut ($\theta = 90°$).  OR An airplane used to drop water on brushfires is flying horizontally in a straight line at 300 Km/hr at an altitude of 120 m. Determine the distance d at which the pilot should release the water so that it will hit the fire at B  		
Q11.	Determine the force in members *BD* and *DE* of the truss shown  	**10**	**CO2**

SECTION-C

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<td>Q12</td>
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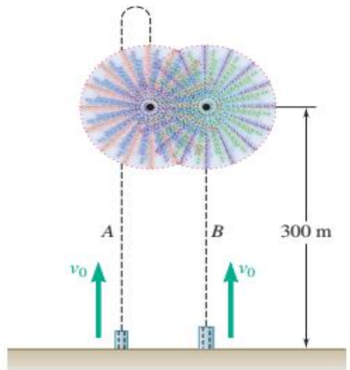
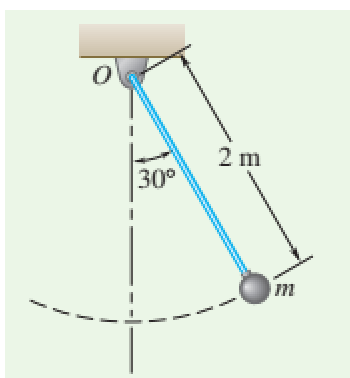
(a) Figure below shows two rockets launch in an event. Rocket A is launched with an initial velocity v_0 = 100 m/s and rocket B is launched t_1 seconds later with the same initial velocity. The two rockets are timed to explode simultaneously at a height of 300 m as A is falling and B is rising. Assuming a constant acceleration g = 9.81 m/s ^{2}, determine (a) the time t_1 , (b) the velocity of B relative to A at the time of the explosion (12 M)


(b) The bob of a 2-m pendulum describes an arc of a circle in a vertical plane. If the tension in the cord is 2.5 times the weight of the bob for the position shown, find the velocity and the acceleration of the bob in that position (8M)


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<td>20</td>
<td>CO3</td>
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