Hall Ticket No | | | | | | | | | | | Question Paper Code: AMEB03

NSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER - I

B. Tech III Semester End Examinations (Regular), December – 2019

Regulations: R18

ENGINERERING MECHANICS

(MECHANICAL ENGINEERING)

Time: 3 hours **Max. Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

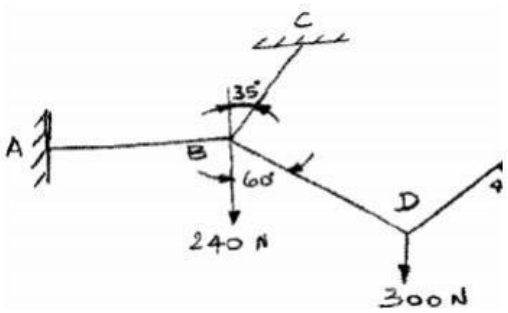
MODULE – I

1. a) Explain the procedure to find the resultant of several forces acting at a point **[7M]**

   b) The force of magnitudes 10KN, 20KN, 25KN & 40KN are concurrent in space and are directed through the points A(3,2,5), B(1,7,4), C(4,-2,4) & D(-2,4,-3) respectively. Determine the resultant of the force system of forces. Given that system of forces are concurrent at the origin. **[7M]**

2. a) Determine the magnitude and the direction of the resultant of two forces 7 N and 8 N acting at a point with an included angle of 60o with between them. The force of 7 N being horizontal. **[7M]**

   b) A system of connected flexible cables as shown in figure is supporting two vertical forces 240 N and 300 N at points B and D. Determine the forces in various segments of the cable. **[7M]**



MODULE – II

3. a) Derive an expression for the minimum effort required along the inclined plane to keep a body in equilibrium position when it is at point of sliding downwards on a inclined plane. **[7M]**

b) Find the forc and its nature in member AD and BC for given cantilever truss loaded by 40KN as shown figure **[7M]**

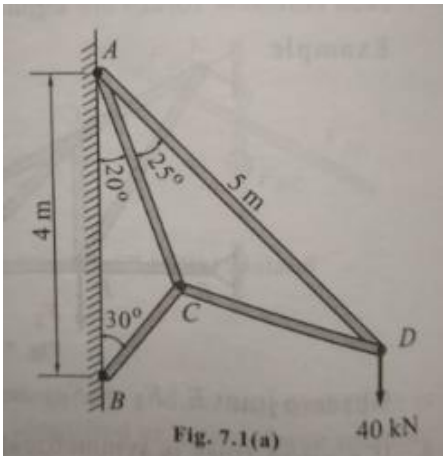
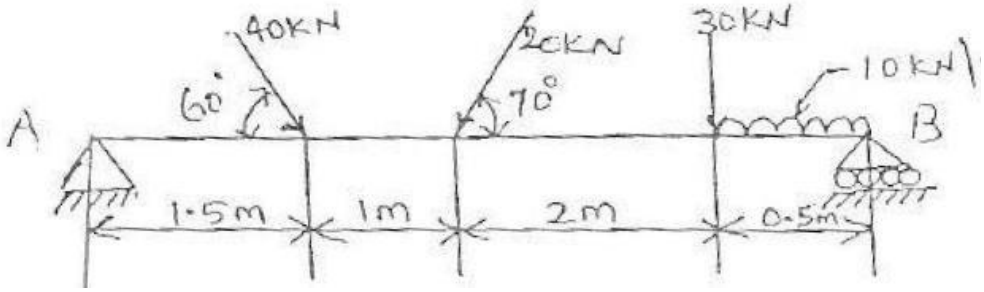


Fig. 7.1(a)

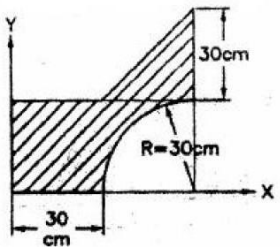
4. a) Solve reactions at points A & B. **[7M]**



b) A mean radius of the screw of a square threaded screw jack is 25mm. the pitch of thread is 7.5mm. if the coefficient of the friction is 0.12, what effort applied at the end of the lever 60cm length is needed to raise a weight of 2KN **[7M]**

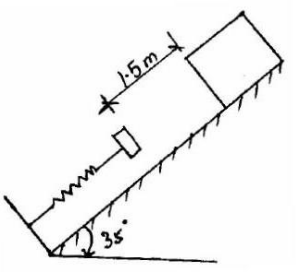
MODULE – III

5. a) Determine the co-odinates of centroid of the shaded area shown in figure **[7M]**



b) A pump lifts $40m^3$ of water to a height of 50m and delivers it with a velocity of 5m/s. what is the amount of energy spent during the process? If the job is done **[7M]**

6. a) A block of mass 50 kg slides down a 35° incline and strikes a spring 1.5 m away from it as shown in Fig. The maximum compression of the spring is 300 mm when the block comes to rest. If the spring constant is 1 kN/m, Solve the coefficient of kinetic friction between the block and the plane. **[7M]**

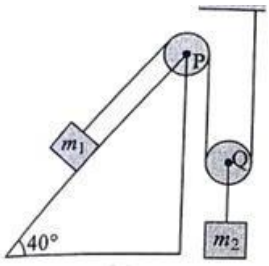


b) Derive an expression for centroid of semi-circle and MI for a rectagle section. **[7M]**

MODULE – IV

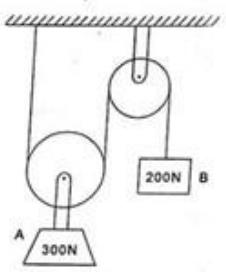
7. a) A body A is projected vertically upwards from the top of a tower with a velocity of 40m/s, the tower being 180m high. After t seconds, another body B is allowed to fall from the same point. Both the bodies reach the ground simultaneously. Calculate t and the velocities of A and B on reaching the ground. **[7M]**

b) Determine the tension in the inextensible string of the system shown the figure 4 below while m_1= 200Kg and m_2=100Kg. Consider the pulley as massless and coefficient of friction as 0.2. **[7M]**



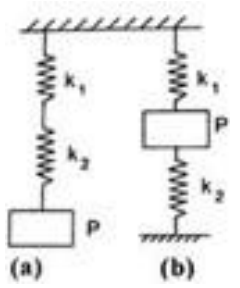
8. a) An elevator weighing 4900N is ascending with an acceleration of 3 m/s2. During the ascent its operator whose weight is 686N is standing on the scales placed on the floor. What is the scale reading? What will be total tension in the cable of the elevator during this motion? **[7M]**

b) Find the velocity of block B shown in figure 2 given below, after 5 seconds starting from rest the axis of the cam shaft. **[7M]**



MODULE – V

9. a) Determine the period of vibration of a weight P attached to springs of stiffness k1 and k2 in two different cases as shown in figure 10 given below. **[7M]**



b) A vertical shaft 5mm in diameter and 1m in length has its upper end fixed to the ceiling. At the lower end it carries a rotor of diameter 200mm and weight 20N. The modulus of rigidity for the rotor is 0.85x105 N/mm2. Calculate the frequency of torsional vibration for the system. **[7M]**

10. a) A body performing simple harmonic motion has a velocity 20m/s when the displacement is 40mm and 3m/s when the displacement is 120mm, the displacement measured from the mid-point. Calculate the frequency and amplitude of the motion. What is the acceleration when displacement is 85mm. **[7M]**

b) A conical pendulum rotates at 100 rev/min. The cord is 150mm long and the mass of bob1.35Kg. Find **[7M]**

i. The amount of which the bob rises above its lowest position
ii. The period
iii. The tension in the cord.

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COURSE OBJECTIVES:

I	Students should develop the ability to work comfortably with basic engineering mechanics concepts required for analyzing static structures.
II	Identify an appropriate structural system to studying a given problem and isolate it from its environment, model the problem using good free-body diagrams and accurate equilibrium equations
III	Understand the meaning of centre of gravity (mass)/centroid and moment of Inertia using integration methods and method of moments
IV	To solve the problem of equilibrium by using the principle of work and energy, impulse momentum and vibrations for preparing the students for higher level courses such as Mechanics of Solids, Mechanics of Fluids, Mechanical Design and Structural Analysis etc...

COURSE OUTCOMES (COs):

CO 1	Understand the concepts of laws of mechanics, force systems and friction forces
CO 2	Determine the spatial systems, forces in frames and the concepts of centroids and centre of gravity.
CO 3	Classification of kinetics and kinematics to solve the problems related to motion of the body.
CO 4	Understand the concept of impulse forces, work energy relations for connected systems.
CO 5	Explore the knowledge on vibrations and simple harmonic motion.

COURSE LEARNING OUTCOMES (CLOs):

AMEB03.01	A basic understanding of the laws and principle of mechanics
AMEB03.02	The ability to solve simple force system problems in mechanics
AMEB03.03	Determine the resultant and apply conditions of static equilibrium to a plane force system
AMEB03.04	Solve the problems of simple systems with the friction, calculate the linear moving bodies in general plane motion and applications of friction
AMEB03.05	Analyze planer and spatial systems to determine the force in the members of truss and frames
AMEB03.06	Solve the problems on different types of beams
AMEB03.07	Obtain the centroid, center of gravity, first moment and second moment of area
AMEB03.08	Understand the concept of virtual work and an ability to solve practical problems
AMEB03.09	Understand the concepts of kinematics of the particles and rectilinear motion
AMEB03.10	Explore knowledge & ability to solve various particle motion problems.
AMEB03. 11	Derive the D' Alembert's principle and apply it to various field problems of kinetic motion.
AMEB03. 12	Determine the impact, impulse and impulsive forces occurring in the system and able to solve the problems
AMEB03. 13	Develop the work energy relations and apply to connected systems.
AMEB03. 14	Understand the fixed axis rotation theory and solving the field problems by application of work energy method.
AMEB03. 15	Introduction to concepts of vibration and explain the relation between simple harmonic motion and the equilibrium systems.
AMEB03. 16	Derive the expressions for the concepts of simple, compound and torsional pendulums.
AMEB03. 17	Explore the use of modern engineering tools, software and equipment to prepare for competitive exams, higher studies etc.

Mapping of Semester End Examinations to Course Learning Outcomes:

SEE Question No.		Course Learning Outcomes		Blooms Taxonomy Level
1	a	AMEB03.02	The ability to solve simple force system problems in mechanics	Understand
	b	AMEB03.01	A basic understanding of the laws and principle of mechanics	Understand
2	a	AMEB03.04	Solve the problems of simple systems with the friction, calculate the linear moving bodies in general plane motion and applications of friction	Understand
	b	AMEB03.03	Determine the resultant and apply conditions of static equilibrium to a plane force system	Understand
3	a	AMEB03.05	Analyze planer and spatial systems to determine the force in the members of truss and frames	Understand
	b	AMEB03.05	Analyze planer and spatial systems to determine the force in the members of truss and frames	Remember
4	a	AMEB03.06	Solve the problems on different types of beams	Remember
	b	AMEB03.07	Obtain the centroid, center of gravity, first moment and second moment of area	Remember
5	a	AMEB03.09	Understand the concepts of kinematics of the particles and rectilinear motion	Understand
	b	AMEB03.08	Understand the concept of virtual work and an ability to solve practical problems	Understand
6	a	AMEB03.10	Explore knowledge & ability to solve various particle motion problems.	Understand
	b	AMEB03.11	Derive the D' Alembert's principle and apply it to various field problems of kinetic motion.	Understand
7	a	AMEB03.12	Determine the impact, impulse and impulsive forces occurring in the system and able to solve the problems	Understand
	b	AMEB03.13	Develop the work energy relations and apply to connected systems.	Remember
8	a	AMEB03.14	Understand the fixed axis rotation theory and solving the field problems by application of work energy method.	Remember
	b	AMEB03.15	Introduction to concepts of vibration and explain the relation between simple harmonic motion and the equilibrium systems.	Remember
9	a	AMEB03.16	Derive the expressions for the concepts of simple, compound and torsional pendulums.	Remember
	b	AMEB03.17	Explore the use of modern engineering tools, software and equipment to prepare for competitive exams, higher studies etc.	Understand
10	a	AMEB03.17	Explore the use of modern engineering tools, software and equipment to prepare for competitive exams, higher studies etc.	Understand
	b	AMEB03.16	Derive the expressions for the concepts of simple, compound and torsional pendulums.	Remember

Signature of Course Coordinator **HOD, ME**