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

NSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER - II

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

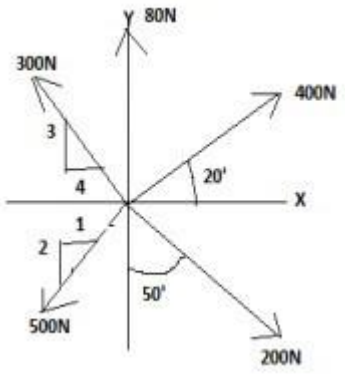
MODULE – I

1. a) Find the magnitude of two forces such that if they act at right angle, their resultant is $\sqrt{10}$, but they act at 60^0 their resultant is $\sqrt{13}$ **[7M]**

   b) The five forces 20N, 30N, 40N, 50N and 60N are acting at one of the angular points of a regular hexagon, towards the other five angular points taken in order. Find the direction and magnitude of the resultant force. **[7M]**

2. a) Determine the horizontal force P to be applied to a block of weight of 1800N to hold it in position on a smooth inclined plane, which makes an angle 30^0 with horizontal reference line.. **[7M]**

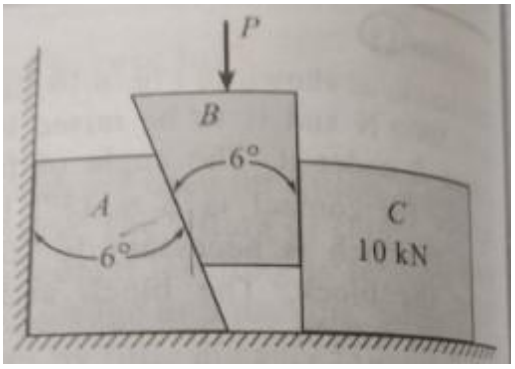
   b) Determine the resultant of system of forces acting as shown in fig. **[7M]**



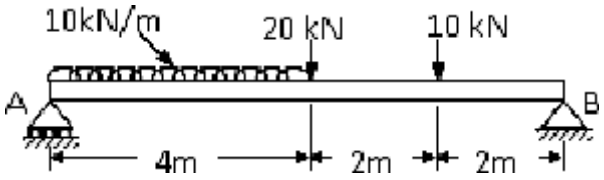
MODULE – II

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

b) Two 6^0 of wedges are used to push a block horizontally as shown figure. Calculate the minimum force reqiured to push the block of weight 10KN. Take coefficient of friction as 0.25 for all contact surfaces **[7M]**



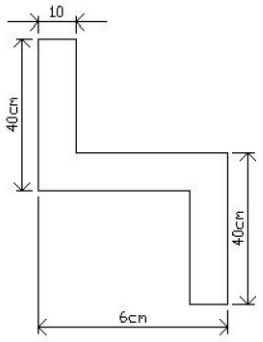
4. a) Solve reactions at points A & B. **[7M]**



b) A ladder of 7M length rests against a vertical wall with which it makes an angle of 45^0. The coefficient of friction for wall and the floor are 0.33 and 0.50 respectively. If a man whose weight is one- half of that of the ladder. How far he will be able to climb the ladder. **[7M]**

MODULE – III

5. a) Design Moment of Inertia about the co-ordinate axes of plane area shown in fig. Also find Polar Moment of Inertia **[7M]**



b) A force of 500N is acting at 30^0 to the horozontal on a block of mass 50kg resting on a horizontal surface.determine the velocity after the block has travelled a distance of 10M. coefficient of kinetic friction is 0.5. **[7M]**

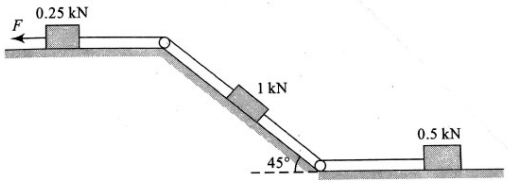
6. a) A pump lifts $40m^3$ of water to a height of 50m and delivers it with a velocity of 5m/s. what is the amount of energy spent during the process? If the job is done in half an hour, what is the input power of the pump which has an overall efficiency of 70%. **[7M]**

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

MODULE – IV

7. a) Derive the expression for range along an inclined plane. What is the necessary condition for obtaining maximum range along an inclined plane? **[7M]**

b) For the system of connected bodies as shown in the figure given below, calculate the force F required to make the motion impending to the left. Use the method of virtual work and take coefficient of friction for all contiguous surfaces except pulleys as 0.25. **[7M]**



8. 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) Two blocks A and B are connected by an inextensible string moving over a frictionless pulley as shown in the figure given below. If the blocks are released from rest, determine the velocity of the system after the travel of 4s. Take the masses of blocks A and B as 20 and 60 kg respectively and coefficient of friction for all the contiguous surfaces as 0.3 **[7M]**

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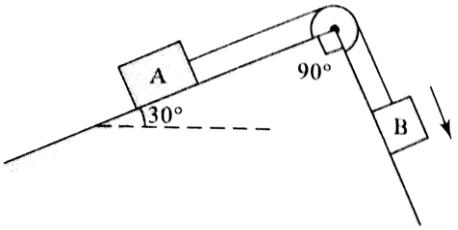

MODULE – V

9. a) Derive an expression for the time period for a spring mass system subjected to free vibration. **[7M]**

b) A weight of 10N attached to a spring oscillates at a frequency of 60 oscillations per minute. If the maximum amplitude is 30mm, find the tension induced in the spring. Also find the spring constant and the maximum velocity in the spring. **[7M]**

10. a) The frequency of free vibrations of a weight W with spring constant k is 12 cycles/s. When the extra weight of 20N is coupled with weight W, the frequency reduced to 10 cycles/s. Find the weight W and stiffness k of the spring. **[7M]**

b) A body moving with SHM has amplitude of 50cm and the period of one complete oscillation is 3s. What will be the speed and acceleration of the body 1/5 of a second after passing the mid position **[7M]**

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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**