Sanjay Ghodawat University, Kolhapur 2019-20
Established as State Private University under Govt. of Maharashtra. EXM/P/09/00
Act No XL, 2017

Year and Program: 2019-20 | **School of Science** Section A | **Department of Mathematics**

Course Code :MTS 305.3 | **Course Title :Mechanics-I** | **Semester : V**

Day and Date – Tuesday 26/11/19 | **End Semester Examination** | **Time:** 1/2hr 10:30 am to 11 am

Max Marks: 100

PRN number – | **Seat no-** | **Answer Booklet No.-**

Students' Signature - | **Invigilator's Signature –**

Instructions:

1) All questions are compulsory.
2) **Attempt Q.1 within first 30 minutes.**
3) Each MCQ type question is followed by four plausible alternatives, Tick (√) the correct one.
4) Answer to question 1 should be written in the question paper and submit to the Jr. Supervisor.
5) If you tick more than one option it will not be evaluated
6) Figures to the right indicate full marks
7) Use **Blue ball pen** only.

Q.1	Tick mark (√) the correct alternative.	Marks 20	Bloom's Level	Cos
(i)	If the greatest possible resultant of two forces $\bar{P}$ and $\bar{Q}$ is twice the least, then $(a)\ \bar{P}=\bar{Q},\ (b)\ \bar{P}=2\bar{Q},\ (c)\ \bar{P}=3\bar{Q},\ (d)\ \bar{P}=4\bar{Q}.$	02	L3	CO1
(ii)	Consider the following two statements: (I)The resultant of two unlike unequal parallel forces $\bar{P}$ and $\bar{Q}$ acting at points A and B is $\bar{P}-\bar{Q}$, acting at point C which divides the line AB internally in the ratio $\bar{P}\cdot AC=\bar{Q}\cdot BC$. (II)The resultant of two like parallel forces $\bar{P}$ and $\bar{Q}$ acting at points A and B is $\bar{P}+\bar{Q}$ acting at point C which divides the line AB externally in the ratio $\bar{P}\cdot AC=\bar{Q}\cdot BC$. Then (a) (I) is true, (b) (II) is true, (c) both (I) and(II) are true,	02	L2	CO2

ESE

(d) both (I) and (II) are false.

(iii) Let a particle be moving along a straight line, with initial velocity u. The distance travelled by the particle in the nth second is given by

$$(a)\, x = un + \frac{1}{2} fn^2, \qquad (b)\, x = u + \frac{1}{2} f(n-1),$$

$$(c)\, x = u + \frac{1}{2} f(2n-1), \quad (d)\, x = u + \frac{1}{2} f(2n+1).$$

02 L3 CO3

(iv) Let $\bar{F}$ be a constant force acting on a particle for time t and produces a distance S, then the impulse of the force is

$$(a)\, \bar{F} \cdot t, \quad (b)\, \bar{F} \cdot S, \quad (c)\, -\bar{F} \cdot S, \quad (d)\, \bar{F} \cdot \bar{p}.$$

02 L2 CO4

(v) The work done by the force in moving the particle from one position to another is

(a) change in potential energy,

(b) change in kinetic energy,

(c) equal to total energy,

(d) always a constant.

02 L2 CO4

(vi) If the force $\bar{F}$ is conservative, then which one of the following is false.

(a) The total energy is conserved,

(b) The work done by the force is equal to the change in the potential energy,

(c) $\bar{F} = -gradV$, where V is the potential energy,

(d) The work done by the force in order to move the particle from one point to another point depends on the path pursued by the particle.

02 L2 CO4

(vii) If a particle is projected from a fixed point with initial velocity u making an angle α with the horizontal, then the horizontal range of the particle is given by

02 L3 CO5

$(a)\, R = \dfrac{u^2 \sin 2\alpha}{g}$, $(b)\, R = \dfrac{u \sin 2\alpha}{2g}$,

$(c)\, R = \dfrac{u^2 \sin \alpha}{2g}$, $(d)\, R = \dfrac{u^2 \sin^2 \alpha}{2g}$.

(viii) For a given velocity of projection, the two directions of projection for the same horizontal range are given by — 02 — L3 — CO5

$(a)\, \alpha,\ \dfrac{\pi}{3} - \alpha$, $(b)\, \alpha,\ \dfrac{\pi}{2} - \alpha$,

$(c)\, \alpha,\ \pi - \alpha$, $(d)\, \alpha,\ \dfrac{\pi}{2} - 2\alpha$.

(ix) Let a particle be projected with initial velocity u making an angle α with the horizontal. Then the time required for the particle to attained the maximum height is given by — 02 — L3 — CO5

$(a)\dfrac{2u \sin \alpha}{g}$, $(b)\dfrac{u \sin \alpha}{2g}$,

$(c)\dfrac{u \sin \alpha}{g}$, $(d)\dfrac{u^2 \sin 2\alpha}{g}$.

(x) Let a particle be projected with initial velocity u making an angle α with the horizontal. Then the vertical component of velocity at any time t is given by — 02 — L4 — CO5

$(a)\, \dot{y} = u \sin \alpha \cdot t$, $(b)\, \dot{y} = u \sin \alpha - gt$,

$(c)\, \dot{y} = u \cos \alpha \cdot t$, $(d)\, \dot{y} = u \sin \alpha \cdot t - \dfrac{1}{2} gt^2$.

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Year and Program: 2019-20 **School of Science** **Department of Mathematics**
Course Code: MTS 305.3 **Course Title: Mechanics-I** **Semester – V**
Day and Date: Tuesday 26/11/19 **End Semester Examination (ESE)** section-B **Time:** 2 Shr 11am to 1.30pm **Max Marks: 100**

Instructions:
1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Non-programmable calculator is allowed

Q.N			Marks	Bloom's Level	CO
Q.2		Attempt any **two** of the following:			CO1
	(a)	Find the components of a force $\bar{F}$ in any two given directions.	06	L2	
	(b)	Three equal forces acting at a point are in equilibrium. Show that they are equally inclined at one another and conversely.	06	L3	
	(c)	Forces $\bar{P}-\bar{Q}$, $\bar{P}$, $\bar{P}+\bar{Q}$ act at a point in directions parallel to the sides of an equilateral triangle taken in order. Find their resultant.	06	L4	
Q.3	(a)	Show that the resultant $\bar{R}$ of two unlike and unequal parallel forces $\bar{P}$ and $\bar{Q}$ acting at two points A and B is $\bar{P}-\bar{Q}$ acting at point C, such that $\frac{P}{BC}=\frac{Q}{AC}=\frac{R}{AB}$.	08	L4	CO2
	(b)	Attempt any **one** of the following:			
	(i)	Three forces $\bar{P}, 2\bar{P}$ and $3\bar{P}$ act along the sides AB, BC and CA of a given equilateral triangle ABC. Find the magnitude and direction of their resultant and also find the point in which its line of action meets the side BC.	06	L4	
	(ii)	Prove that a rigid body under the action of a force and a couple cannot remain in equilibrium.	06	L3	
Q.4		Attempt any **two** of the following:			CO3
	(a)	A particle moving in a straight line with a constant acceleration is observed to be at distances a, b, c, d from the marked point of the line at time $t=0$, n sec., $2n$ sec., and $3n$ sec. respectively. Find the initial velocity and acceleration of the particle.	07	L3	

ESE

				07	L4
	(b)	A heavy particle is projected vertically upwards. Show that if t_1, t_2 are times at which it passes a point at a height h above the point of projection in ascending and descending, then $t_1 t_2 = \frac{2h}{g}$.			
	(c)	A particle is moving from rest on the smooth inclined plane. Show that the velocity acquired at the bottom of an inclined plane is independent of the inclination of the plane. Further show that the velocity is equal to the velocity acquired in falling freely under gravity through the same point.		07	L3
Q.5	(a)	Attempt any **two** of the following:			CO4
	(i)	Let $\bar{F}$ be a force (constant or variable) acting on a particle for the time interval t. Show that the impulse of the force during the interval is equal to the change in momentum.		06	L2
	(ii)	Define energy of a particle. Derive the expression for the kinetic energy of the particle, when its velocity is v, in the form $T = \frac{1}{2}mv^2$. Hence show that the change in the kinetic energy of a body is equal to the work done by the force.		06	L2
	(iii)	Prove that earth gravitational force is conservative.		06	L2
	(b)	A glass marble, whose mass is $\frac{1}{16}$ pounds falls from a height of 25 ft and rebounds a height of 16 ft; find the impulse and the average force between the marble and floor, if the time during which they are in contact be one tenth of a second.		08	L4
Q.6	(a)	Attempt any **one** of the following:			CO5
	(i)	If a particle is projected horizontally with velocity u from a point at any height above the ground, then show that it will describe a parabolic path.		06	L3
	(ii)	If a particle is projected with velocity u making an angle θ with the horizontal, then show that the particle is moving at right angle to its former direction after a time $t = \frac{u}{g \sin\theta}$.		06	L4

(b) A particle is projected with a velocity u making an angle α with the horizon from the point O on an inclined plane, inclined at an angle β to the horizon. Determine (i) the time of flight, (ii) the range of the inclined plane, (iii) maximum range of the projectile and (iv) the magnitude and the direction of the velocity at the top of the inclined plane. 14 L4

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