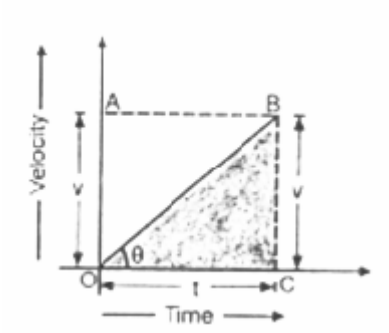
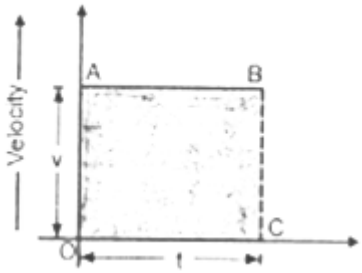
WINTER – 2012 EXAMINATION

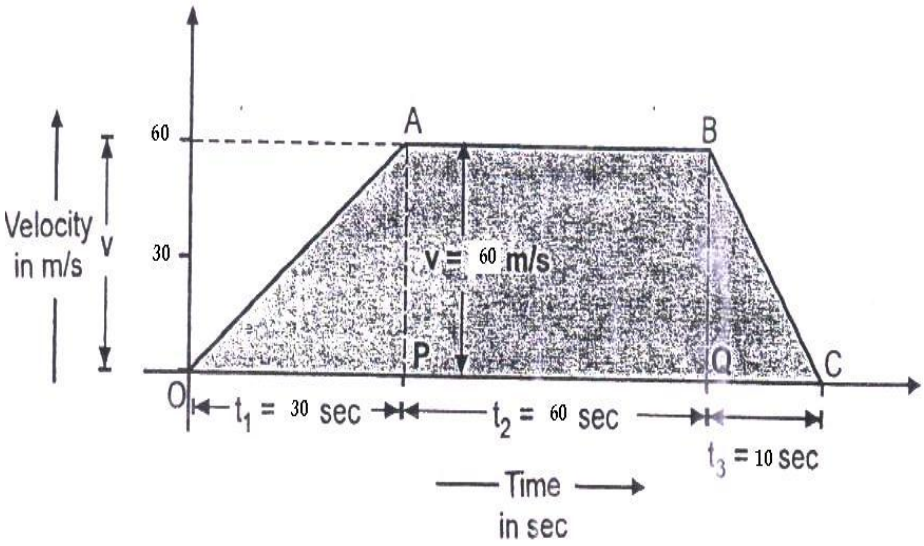
Subject Code: 12020 (Section I) **Model Answer**

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
1)	a)	Vt Diagram of body moving with uniform acceleration. 	1	2
		Vt Diagram of body moving with constant velocity. 	1	
	b)	**Definition of Amplitude:** The maximum distance (displacement) of a particle from mean (equilibrium) position is called as amplitude.	1	2
		Definition of Period: The time required to complete one oscillation/revolution/vibration is called as period.	1	
	c)	**Formula**	1	2
		Answer with unit	1	
		Given $T = 2s$ $a = 2cm = 2\times10^{-2}\,m = 0.02m$ $t = 1s$ $y = ?$		

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
1)	c)	$y = a\sin wt$ $y = a\sin\left(\frac{2\pi}{T}t\right)$ $y = 0.02\sin\left(\frac{2\pi}{2}\times 1\right)$ $y = 0.02\sin(\pi)$ $y = 0m$		
	d)	**Definition of Momentum with unit** The quantity of motion possessed by moving body is called momentum. OR The product of mass & velocity of the body is called as momentum. **SI Unit**: kg-m/s OR N-s	2	2
	e)	**Definition of K.E.** **Equation of K.E.** **Definition of P.E.** **Equation of P.E.** **Definition of K.E.:** The energy possessed by a body by virtue of its motion is called kinetic energy. **Equation: K.E.** = ½ mv^2 **Definition of P.E.:** The energy possessed by a body due to its position is called potential energy. **Equation: P.E**. = m g h	½ ½ ½ ½	2
	f)	Liquid Penetrant Testing is used for surface disorder. Liquid Penetrant Testing works on the principle of capillarity. i.e. liquid rises or goes into the crack by capillary action.	1 1	2

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
1)	g)	**i) Relation between loudness & intensity of sound** The loudness is directly proportional to the log of intensity of sound i.e. $L \alpha \log_{10} I$ OR $L = k \log_{10} I$ **ii) Relation between Bel & Decibel** 1 Bel = 10 decibel OR 1 decibel = 1/10 bel	1 1	2
	h)	**Any Two Suggestions** **Suggestions to reduce sound pollution:** 1. Reducing sound at the source 2. Obstructing(interrupting) the path of noise 3. Protecting the receiver 4. Mounting rubber sheets at the machines 5. Sound pollution in auditorium can be controlled by making hall sound proof also by providing number of ventilators, fans etc. 6. Any other relevant suggestion.	2	2
	i)	**Definition of nanometer:** one nanometer means 10^{-9} m. **OR** Nanometer is the one-billionth part of meter. **Nanoscale:** The scale which is able to measure dimensions in nanometer. i.e. 10^{-9} meter range is called as nanoscale.	1 1	2

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
1)	j)	**Formula** **Answer with Unit** Given $v = 300 m/s$ $n = 300 Hz$ $\lambda = ?$ We have, $v = n\lambda$ $\lambda = \frac{v}{n} = \frac{300}{300}$ $\lambda = 1m$	1 1	2
	k)	**Echo Definition** **Echo:** echo is defined as same sound is heard again after an interval of $\left(\frac{1}{10}\right)^{th}$ sec due to the reflection of original sound from a surface which is kept at a distance greater than 16.5 m from the source of sound **Reverberation:** The persistence of sound due to multiple reflections in a hall even after the source of sound is cut off is called as Reverberation.	1 1	2

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
2)	a)	Given $a = 2m/s^2$ $t = 30s$ $a = \frac{v}{t}$ $v = at$ $v = 2 \times 30$ $v = 60m/s$	1	4
		 	1	
		Distance covered = Area under the graph s= [Area of ΔOAP]+[Area of $\square PABQ$]+[Area of ΔQBC]	1	
		$s = \left[\frac{1}{2} \times OP \times AP\right] + [PQ \times AP] + \left[\frac{1}{2} \times QC \times BQ\right]$ $s = \left[\frac{1}{2} \times 30 \times 60\right] + [60 \times 60] + \left[\frac{1}{2} \times 10 \times 60\right]$ $s = 900 + 3600 + 300$ $s = 4800m$	1	

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
2)	b)	**Equation of displacement & velocity**	1	4
		Table	1	
		Each graph	1	

Graphical representation of displacement, velocity of S.H.M. starting from mean position

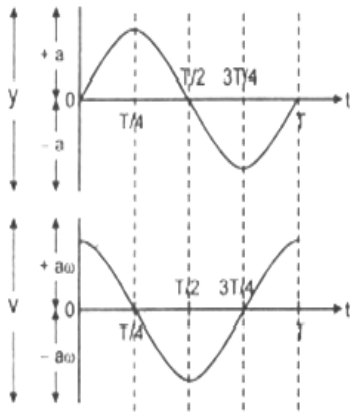
If particle starts from mean position then displacement & velocity are given by,

$y = a\sin\omega t$

$v = a\omega\cos\omega t$

Substituting $\omega = 2\pi/T$ in above equations we can determine the values of displacement & velocity for different values of time t.

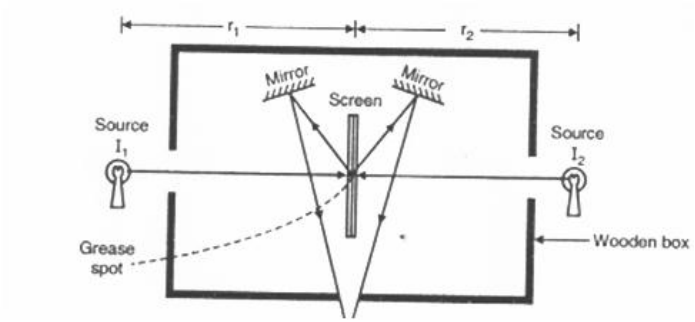
Time(t)	0	T/4	T/2	3T/4	T
$\Theta = \omega t$	0	$\pi/2$	π	$3\pi/2$	2π
Displacement (y)	0	a	0	-a	0
Velocity (v)	$a\omega$	0	$-a\omega$	0	$a\omega$

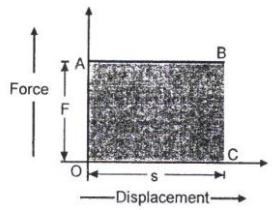
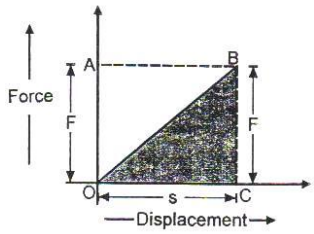
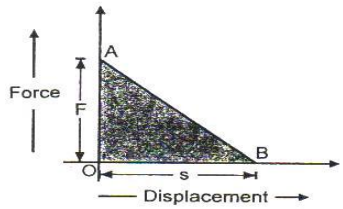


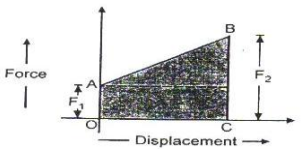
(a) Graph of displacement against time

(b) Graph of velocity against time

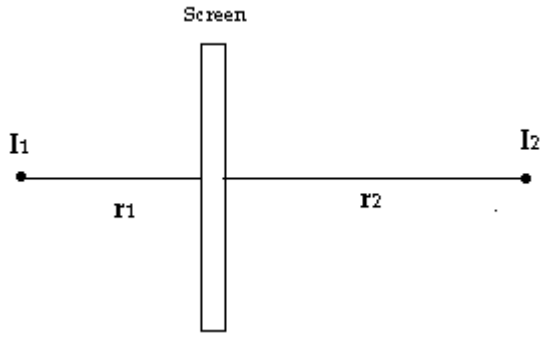
Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
2)	c)	**Formula**	1	4
		Substitution	1	
		Answer with Unit	2	
		Given $a = 8cm/s^2$ $y = 32cm$ $T = ?$ We have, $a = w^2 y$ $w^2 = \frac{a}{y} = \frac{8}{32}$ $w^2 = 0.25$ $w = \sqrt{0.25} = 0.5 rad/s$ $T = \frac{2\pi}{w} = \frac{2 \times 3.14}{0.5}$ $T = 12.56s$		
	d)	**Formula**	1	4
		Substitution	1	
		Answer with Unit	2	
		Ans. **Given :** m = mass of bullet $= \frac{100}{1000} = 0.1$ kg velocity of bullet (v) = 400 m/s M = mass of gun (M) = 10 kg **To Find :** Recoil velocity of gun, V = ? **Soln :** mv = MV where V → Recoil velocity of gun $\therefore V = \frac{mv}{M}$ $V = \frac{0.1 \times 400}{10}$ $V = 4$ m/s		

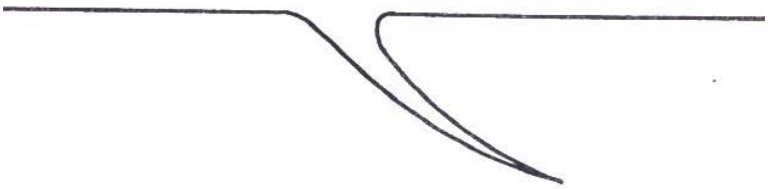
Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
2)	e)	**Labelled Ray Diagram**  	4	4
	f)	**Two applications in electronic field** 1) The flat panel television or computer monitors are products of nanotechnology. 2) The coating used on screens of TV or monitors can be of nanoparticles, which have better properties in terms of colour quality and resolution. 3) Single electron transitor (SET) and magnetic tunnel junction (MTJ) are new devices based on nanotechnology, such devices are faster, compact and cheaper. 4) Or any other relevant factor **Two Applications of nanotechnology in medical field:** 1. Nanotechnology is used in drug delivery effectively. 2. Nanotechnology is used in the effective detection of cancer or tumors. 3. Nanotechnology reduces cost & human suffering. 4. DNA chips & arrays are useful in diagnostics & genetic research 5. Nanotubes with fats inside can dissolve drug. 6. LASER eye surgery & pupil repair with increased precision is due to nanotechnology. (Any other relevant application)	2 2	4

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
3)	a)	**1) Work done by a constant force:** Since the force is constant, the graph is horizontal. Area under the graph is rectangular.  Area under the graph = OA x OC = Fxs	1	4
		2) Work done by gradually increasing force: Graph is straight line and inclined. Area under the graph is triangular.  Area under the graph = ½(OC x BC) = ½(s x F) = Work done	1	
		3) Work done by gradually decreasing force: Graph is straight line and inclined. Area under the graph is triangular.  Area under the graph = ½(OB x OA) = ½(s x F) = Work done	1	
		1) Work done by variable force: Force-displacement graph is a trapezium		

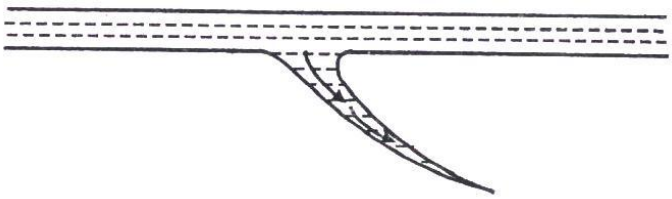
Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
3)		 Area under the graph = ½(OA + CB)x OC = ½(F1+ F2)x s = Work done	1	
	b)	**Formula**	1	4
		Substitution	1	
		Answer with Unit	1	
		Direction	1	
		Given $w_1 = m_1 g = 20N$ $m_1 = \frac{20}{9.81} = 2.04kg$ $w_2 = m_2 g = 10N$ $m_2 = \frac{10}{9.81} = 1.02kg$ $a = \frac{(m_1 - m_2)g}{(m_1 + m_2)}$ $a = \frac{(m_1 g - m_2 g)}{(2.04 + 1.02)}$ $a = \frac{20 - 10}{3.06}$ $a = 3.27 m/s^2$ Acceleration =a=3.27 m/s^2 The weight of 20N will be accelerated in downward direction The weight of 10N will be accelerated in upward direction		

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
3)	c)	**Any four advantages** **The advantages of non-destructive testing over conventional testing method** 1. Rapid inspection of each & every component is possible. 2. 100 % examination of material or production is possible. 3. NDT methods can be automated to lower their costs. 4. Testing is possible on shop, floor because of portable equipments; this controls the equality of further production. 5. Permanent record of testing can be made during the testing process. 6. The destructed parts can be separated in the early stages of manufacturing. This saves the time & production cost. 7. Higher accuracy, reliability & repeatability in the test result can be obtained. 8. Any other relevant advantage.	4	4
	d)	**Statement** **Diagram** **Expression** **Photometric Equation** **Inverse square law of luminance:** Statement: "The intensity of illumination on a surface due to a point source of light is inversely proportional to the square of distance of the surface from the source." $I \alpha 1/r^2$	1 1 1 1	4

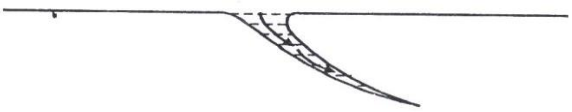
Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
3)	d)	**Photometric Equation:** If two sources of light of illuminating powers I_1 & I_2 are kept at distances r_1 & r_2 from a screen as shown in figure. Then the intensities of illumination at a point on the screen due to two sources are I_1/ r_1^2 & I_2/ r_2^2 respectively.  If the screen is equally illuminated due to two sources then, $I_1/ r_1^2 = I_2/ r_2^2$ $\frac{I_1}{I_2} = \frac{r_1^2}{r_2^2}$ This is photometric equation.		
	e)	**Principle** **Diagram** **Procedure** **Liquid penetration testing method to measure the surface disorder.** **Principle:** It works on the principle of capillarity. **Experimental Procedure:** 1) Surface Penetration: Initially the surface of the specimen is cleaned. Because the presence of flakes, dirt, grease etc on the surface of work piece prevents penetrant to be slip into the cracks. This gives wrong information.	1 1 2	4

Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
3)	e)			

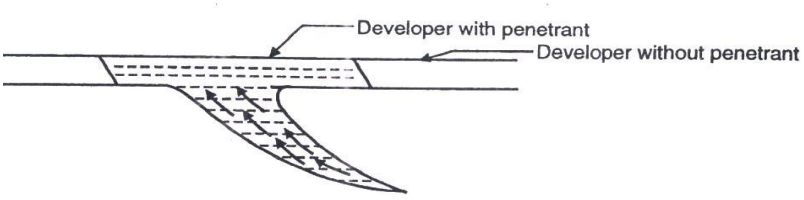
2) Application of Dye penetrant: Suitable fluorescent dye is mixed in penetrant so that its viscosity remains low. This dye penetrant is applied evenly on specimen. Due to capillary action the penetrant goes into the surface open discontinuities. It takes some time. In general case this 'dwell time' is 20-30 minutes.

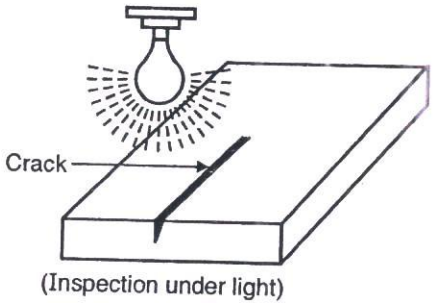


3) Excess penetrant removal: After dwell time is over, the excess penetrant is removed from the surface carefully.



4) Application of developer: A thin layer of developer is applied over the surface. The role of developer is to pull the trapped penetrant out of the crack this provides good visibility of crack.



Que. No.	Sub. Que.	Stepwise Solution	Marks	Total Marks
3)	e)	5) Inspection & evalution of defects: Surface of the specimen is seen under white light or ultraviolet or laser light. The crack can be visualized under light.  (Inspection under light) 6) Post cleaning: After inspection the surface of the specimen is cleaned & the specimen can be used for its intended purpose.		
	f)	**Formula** **Substitution** **Answer with Unit** Given $V = 2500m^3$ $\sum aS = 205$ $t = ?$ $t = \frac{0.164V}{\sum aS}$ $t = \frac{0.164 \times 2500}{205}$ $t = 2s$	1 1 2	4