2010

1/10

15

II - SEM → SUMMER-2018 (80 marks)

May

135 - 230 Days ■ 20 Weeks

SATURDAY

Q1)

(a) → Basic units in SI system are
Kg - metre - sec - Ampere - °Kelvin - Candela - Mole

(b) → G

It is defined as the force acting between 02 unit masses placed UNIT DISTANCE apart in the universe

$$F = G\frac{M_1 M_2}{d^2} \quad \text{or} \quad G = \frac{F \times d^2}{M_1 M_2}$$

Critical Angle

(c) → It is that angle of incidence in the denser (incident) medium for which angle of refraction in the rarer (refracting) medium is 90°.

(d) → Ohm's Law

↳ The current flowing through a conductor is directly proportional to the potential difference applied across its ends provided temperature remains constant

16 May. Sun. 136-229

(e) Uses of Laser in Industry

↳ (*) Melting - cutting - drilling - welding metals
(*) High speed photography
(*) To produce high temp and pressure
(*) Decompose noxious substances from industrial waste and convert them into harmless substances for living beings

(f) 02 properties of Ultrasonics

(*) Longitudinal in nature
(*) Do not spread and can constitute narrow beams
(*) Travel with speed of sound.
(*) High frequency waves
(*) Propagation results in compressions - rarefaction in the medium.

June 2010

Sun	M	T	W	T	F	S	Wk
		1					22
6	7	8	9	10	11	12	24
13	14	15	16	17	18	19	25
20	21	22	23	24	25	26	26
27	28	29	30				27

July 2010

Sun	M	T	W	T	F	S	Wk
				1	2	3	27
4	5	6	7	8	9	10	28
11	12	13	14	15	16	17	29
18	19	20	21	22	23	24	30
25	26	27	28	29	30	31	31

17

134 - 231 Days ■ 20 Weeks

MONDAY

May

2010

GOVERNMENT POLYTECHNIC, SAMBALPUR (RENGALI), ODISHA

8 am

2(g) → Data Given

↳ $r = 6\ m$, $v = 60\ km/hr = \frac{60 \times 1000}{60 \times 60} = \frac{600}{36} = \frac{100}{6}$ mt/sec

$\omega = ?$

9 am

Soln

$v = r\omega \Rightarrow \omega = \frac{v}{r} = \frac{100/6}{6} = \boxed{\frac{100}{36}\ rad/sec}$ Ans

10 am

11 am

2(h) Data Given

↳

12 noon

CIRCULAR COIL $d = 4m$, $I = 2A$, $B_{centre} = ?$

1 pm

Soln

$$B = \frac{\mu_0 I}{2r} = \frac{\mu_0 I}{2 \times d/2} = \frac{\mu_0 I}{d} = \frac{4\pi \times 10^{-7} \times 2}{4}$$

2 pm

3 pm

$\Rightarrow B = 2\pi \times 10^{-7}$ Tesla $\Rightarrow \boxed{B = 6.28 \times 10^{-7}\ Tesla}$ Ans.

4 pm

2(i) M. Flux (ϕ) → It is defined as the dot product of magnetic flux density ($\vec{B}$) and area ($\vec{A}$)

5 pm

$$\boxed{\phi = \vec{B} \cdot \vec{A}}$$

6 pm

7 pm

2(j) → 1st law of Thermodynamics

↳ The heat supplied to a system containing gas is equal to the increase in internal energy of the system and external work done by it

$$\boxed{dQ = dU + dW}$$

dQ → Heat supplied; dU → Increase in internal energy; dW → work done

April 2010

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				1	2	3	14
4	5	6	7	8	9	10	15
11	12	13	14	15	16	17	16
18	19	20	21	22	23	24	17
25	26	27	28	29	30		18

May 2010

Sun	M	T	W	T	F	S	Wk
30	31					1	18
2	3	4	5	6	7	8	19
9	10	11	12	13	14	15	20
16	17	18	19	20	21	22	21
23	24	25	26	27	28	29	22

■ Appointments ■ Notes

2010

03/10

18

May

135 - 230 Days ■ 20 Weeks

TUESDAY

Q. No-2 (5 × 6 = 30 marks)

2(a) Data Given

(Weight)$_{Earth}$ = W_E = 72 kg-wt

(Weight)$_{Man}$ = W_M = ?

$R_M = \frac{1}{2} R_E$

$M_M = \frac{1}{9} M_E$

Soln

$$\frac{W_M}{W_E} = \frac{Mg_m}{Mg_E} = \frac{g_m}{g_E} \quad \| \quad \text{Now } g_m = \frac{GM_m}{R_m^2},\ g_E = \frac{GM_E}{R^2} \quad \| \ (1)$$

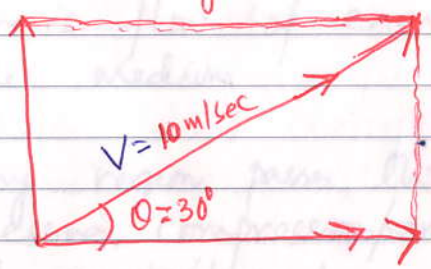
$$g_m = \frac{G(M/9)}{(R/2)^2} = \frac{GM/9}{R^2/4} = \frac{4}{9}\frac{GM}{R^2} = \frac{4}{9}g_E$$

So $g_m = \frac{4}{9}g_E \Rightarrow \frac{g_m}{g_E} = \frac{4}{9}$

Using in equation (1)

$$\frac{W_M}{W_E} = \frac{4}{9} \Rightarrow W_M = \frac{4}{9}W_E = \frac{4}{9} \times 72 \Rightarrow \boxed{W_E = 32 \text{ kg-wt}}$$

2 (b) Data Given



50^m

(*) Horizontal Component = $v\cos\theta = 10\times\cos 30^0$

$= 10 \times \frac{\sqrt{3}}{2} = 5\sqrt{3}$ m/sec

(*) Vertical Component = $v\sin\theta = 10 \times \sin 30^0$

$= 10 \times \frac{1}{2} = 5$ m/sec

■ Appointments ■ Notes

June 2010

Sun	M	T	W	T	F	S	Wk
		1	2	3	4	5	23
6	7	8	9	10	11	12	24
13	14	15	16	17	18	19	25
20	21	22	23	24	25	26	26
27	28	29	30				27

July 2010

Sun	M	T	W	T	F	S	Wk
				1	2	3	27
4	5	6	7	8	9	10	28
11	12	13	14	15	16	17	29
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25	26	27	28	29	30	31	31

19

04/10

2010

139 - 226 Days ■ 21 Weeks

WEDNESDAY

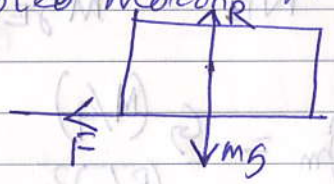
May

2(c) Laws of limiting friction

(*) Limiting frictional force depends on the nature of surfaces in contact and state of roughness
More Rough → More friction
Less Rough → Less friction

(*) Limiting frictional force always acts PARALLEL/TANGENTIAL to the surfaces in contact and always acts opposite to the direction of motion/attempted motion

(*) Frictional force is independent of area of contact between the 02 surfaces



(*) Magnitude of L. frictional force is directly proportional to the Ir force (NORMAL REACTION) acting between 02 surfaces in contact.

$F \propto R \Rightarrow \boxed{F = \mu R}$

(*) Limiting frictional force is independent of speed with which one body slides/rolls/moves over another.

April 2010

Sun	M	T	W	T	F	S	Wk
				1	2	3	14
4	5	6	7	8	9	10	15
11	12	13	14	15	16	17	16
18	19	20	21	22	23	24	17
25	26	27	28	29	30		18

May 2010

Sun	M	T	W	T	F	S	Wk
30	31					1	18
2	3	4	5	6	7	8	19
9	10	11	12	13	14	15	20
16	17	18	19	20	21	22	21
23	24	25	26	27	28	29	22

■ Appointments ■ Notes

2010 May 20

140 - 225 Days ■ 21 Weeks

THURSDAY

05/10

Q2(d)

Progressive and stationary wave

Progressive wave	Stationary wave
(1) Each particle of medium communicates disturbance to the next particle	(1) Disturbance is not communicated from one particle to next. It remain fixed
(2) Amplitude of each particle is the same	(2) Amplitude of particles is ZERO and nodes and maximum at Anti-nodes.
(3) Consecutive particles reach the max^{m} displ^{n} positions at different times	(3) All the particles in between consecutive nodes reach maximum displ^{n} position simultaneously.
(4) There is gradual change in phase from one particle to next	(4) Phase of all particles is same in one segment and opposite in the next segment
(5) No particle is permanently at rest.	(5) Particles at nodes are permanently at rest
(6) There is flow of energy across the medium	(6) There is no flow of energy across any cross section of the medium
(7) Every region passes through successive compressions/rarefactions and crests/troughs	(7) Compressions/Rarefactions and crests/troughs remain fixed in their positions.
(8) While passing through mean posn, every particle acquires max velocity	(8) Max^{n} vel is different for different particles at mean positions.

■ Appointments ■ Notes

June 2010 / July 2010

Sun	M	T	W	T	F	S	Wk
		1	2	3	4	5	23
6	7	8	9	10	11	12	24
13	14	15	16	17	18	19	25
20	21	22	23	24	25	26	26
27	28	29	30				27

Sun	M	T	W	T	F	S	Wk
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Q 2(e)

(Data Given)

$l_0 = 5.2$ mt at $0^\circ C$ $\quad l_{60} = ?$

$\alpha_{steel} = 36 \times 10^{-16}\ {}^\circ C^{-1}$

$\Rightarrow \alpha = \frac{36}{3} \times 10^{-16} = 12 \times 10^{-16}$

$l_t = l_0(1+\alpha t)$

or $l_{60} = 5.2\left[1 + 12 \times 10^{-16}(60-0)\right]$

or $l_{60} = 5.2\left[1 + 12 \times 60 \times 10^{-16}\right]$

$= 5.2\left(1 + 720 \times 10^{-16}\right)$

$= 5.2\left(1 + .72 \times 10^{-13}\right)$

$= 52 + 1.000000000000072$

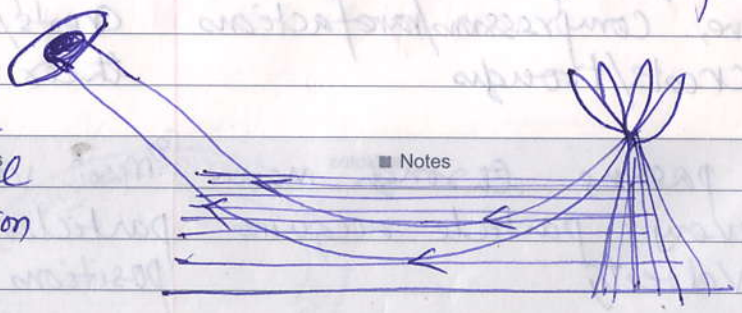
2(f) → <Concept of MIRAGE and LOOMING>

Inferior Mirage (Hot Mirage)

It is an optical illusion experienced by travellers in hot deserts where they see water at a distance. Air in the lower regions is hotter than air in higher regions. Thus density of air is MORE in the upper regions and LESS in the lower regions.

Beam of light coming from a tree travelling from denser to rarer medium. Angle of incidence increases with consecutive layers till it surpasses the critical value and is reflected back due to T.I.R. A virtual image is formed at the eye.

Due to air disturbance, mirage is very in nature. creating the false optical illusion



GOVERNMENT POLYTECHNIC SAMBALPUR (RENGALI), ODISHA

Superior Mirage (Cold Mirage or Looming)

(*) In cold countries, temperature of air in lower regions is Less and hence density is more. Temperature of air in upper regions is more and hence density is Less

(*) Hence, a ray of light starting from a ship (S) on the surface travels from denser → rarer medium, angle of incidence increases with consecutive layers till it reaches critical value

(*) Then rays get reflected back due to T.I.R. On entering the eye, the rays appear to come from S' giving the impression that the ship is floating in air

2(g) Coulomb's law in Magnetism (Statement) 2½ m

The force of attraction or repulsion between 02 magnetic poles is

(1) Directly proportional to the product of their pole strength

AND (2) Inversely proportional to the square of distance between them

$$F \propto \frac{m_1 m_2}{d^2} \text{ or } F = K\frac{m_1 m_2}{d^2}$$

or $$\boxed{F = \frac{\mu}{4\pi}\frac{m_1 m_2}{d^2}}$$

UNIT POLE (Def^n) 2½ m

It is that pole which when placed at UNIT DISTANCE in AIR from a similar and equal pole is repelled by a force of $\frac{\mu_0}{4\pi}$ Nt or 10^{-7} Nt

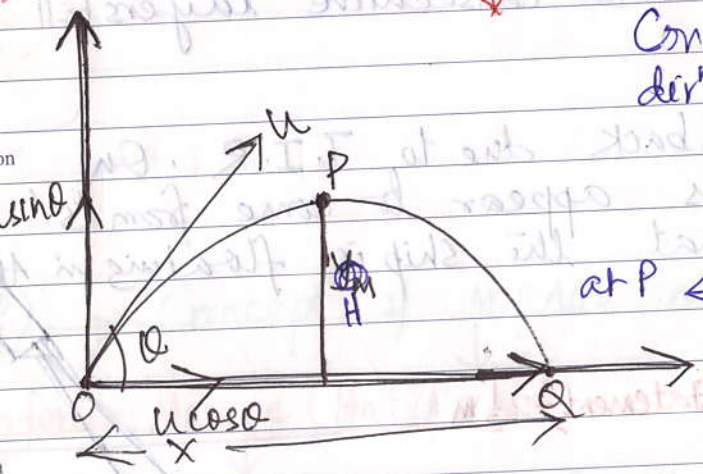
OR

It is that pole which when placed at unit distance in air from a dissimilar and equal pole is attracted by a force of $\frac{\mu_0}{4\pi}$ Nt or 10^{-7} Nt

2(h) → Fleming's Left hand Rule

Stretch the forefinger, middle finger, thumb of left hand mutually ⊥r to each other. If forefinger indicates dir^n of M. field, middle finger indicates dir^n of el. current, then thumb indicates dir^n of force (motion) acting on the c.c.c

3 (A) Formula for Max^n Height (H) of projectile → (2M)
1) fired at angle θ with horizontal



Consider motion in the vertical dir^n only

$v^2 - u^2 = 2as$

at P ← 0 — $(u\sin\theta)^2 = 2\times(-g)\times H$ — at O'

or $-u^2\sin^2\theta = -2gH$

or $\boxed{H = \frac{u^2\sin^2\theta}{2g}}$

(B) → Formula for Horizontal Range (R)

↳ Max^n distance travelled by the projectile in the horizontal dir^n.

Hor. range is travelled due to the hor. component of velocity which is uniform

X = horizontal vel × Total time of flight

$u\cos\theta \times \frac{2u\sin\theta}{g}$

$= \frac{2u^2\sin\theta\cos\theta}{g} = \frac{u^2 2\sin\theta\cos\theta}{g}$

or $\boxed{X = \frac{u^2\sin 2\theta}{g}}$

3(b) / 4m → $F = MR = Mmg = 0.4 \times 100 \times 9.8 =$

$= 40 \times 9.8$

∴ $F = 392$ Newton Ans.

2010

09/10

25

May

145 - 220 Days ■ 22 Weeks

TUESDAY

(c) → formula for Total time of flight (T)

↳ Total time taken by the projectile to come back to the same level from which it was projected.

8 am

t = Time of Ascent = Time of descent = T/2

9 am

$V = u + at$

$\downarrow \quad \downarrow \quad \downarrow$

$0 = u\sin\theta + (-g) \times T/2$

10 am

or $0 = u\sin\theta - \frac{gT}{2}$

∴ $\frac{gT}{2} = u\sin\theta$ ∴ $\boxed{T = \frac{2u\sin\theta}{g}}$

11 am

4(a) / 6m — Wave parameters

12 noon

1 pm

Amplitude → Maximum displacement of a wave on either side of mean position.

2 pm

Wavelength → The linear distance travelled/covered by a wave during one complete oscillation/vibration

OR

3 pm

Distance between 02 consecutive crests/troughs.

OR

4 pm

Distance between 02 consecutive particles in the same phase.

5 pm

Wave-number ($\bar{n}$) → Reciprocal of wavelength ($\bar{n} = \frac{1}{\lambda}$)

6 pm

Frequency → No: of complete waves described in 1 second

7 pm

Time Period → Time taken to describe one full (complete) wave.

■ Appointments ■ Notes

10/10

Establish $V = n\lambda$

$(\text{Velocity})_{\text{wave}} = \frac{\text{Distance covered by the wave}}{\text{Time taken to describe the wave}}$

$v = \frac{\text{wavelength}}{\text{Time-Period}} = \frac{\lambda}{T}$ [As $\frac{1}{T} = f$] $v = \lambda \times \frac{1}{T} = n\lambda$

$v = n\lambda$

(b) Doppler's Effect (Def^n)

It is the apparent change in the frequency (pitch) of a note due to relative motion between source of sound and Listener.

Source at rest, Listener moving towards it

$$n' = \left[\frac{V - (-b)}{V}\right] n = \left(\frac{V+b}{V}\right) n \qquad n' < n$$

(n' ← apparent frequency)

Q5 → Same as Q 4(c) 7m in II-Sem-S/2018 (7 marks)

Q 6 → Same as (+ explain) as Q-6 (b) of II-Sem-S/18 (7m)

~~Doppler Effect~~ Photoelectric Effect (Def^n)

It is the phenomena (process) in which electrons are emitted from a metal surface when light of a suitable wavelength (frequency) is incident upon it.

Laws of P.E emission → Written in Q6 (c) 7m of II-Sem-S/18 (7m)

April 2010

Sun	M	T	W	T	F	S	Wk
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May 2010

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16	17	18	19	20	21	22	21
23	24	25	26	27	28	29	22

■ Appointments

■ Notes