II - Sem / S-2019 (Old) - 80M

< BST-101 >

01/11

01

2010

Q1 (Answer all - 2×10 = 20 marks)

July

182 - 183 Day ■ 27 Weeks

THURSDAY

1(a) / 2m Principle of Homogenity → Dimensional formula of every term on the 02 sides of a correct relation must be SAME

OR

$(Dim)_{LHS} = (Dim)_{RHS}$

1(b) Define 'G' (Universal Gravitational Constant)

'G' is defined as the force of attraction between 02 unit masses placed unit distance apart in the universe

$$F = G\frac{m_1 m_2}{d^2} \Rightarrow G = \frac{F \times d^2}{m_1 m_2}$$

(when $m_1 = m_2 = 1$ kg, $d = 1$ mt $\Rightarrow G = F$)

1(c) / 2m → Greatest and Least Resultant between $\vec{A}$ and $\vec{B}$

↓ $A+B$ ↓ $A-B$

1(d) / 2m 02 properties of Ultrasonics (U/s waves)

1. Longitudinal (sound)
2. high freq
3. highly energetic
4. do not spread (narrow beams)
5. vary in density
6. formation of compressions / rarefactions

(*) U/s Welding — U/s cleaning — fuel gauging — flaw detⁿ — drilling holes — Diagnostic use — metallurgical Ind — Echo sounding — Coagulation

(*) — Producing stable emulsions — detⁿ of el. constants — U/s therapy — Study of microstructure.

1(e)(*) / 2m → Maxⁿ Hor. Range of Projectile

(*) when $\theta = 45^0$, the projectile fired achieves maxⁿ hor. range.

1(f) / 2m → Refractive Index of prism → $\mu = \frac{\sin\left(\frac{A+D_m}{2}\right)}{\sin A/2}$

1(g) / 2m → Define 'J' (Mech. Eqv. of Heat)

'J' is defined as the work done to produce/generate unit quantity of heat

■ Appointments ■ Notes

July 2010 August 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

Sun	M	T	W	T	F	S	Wk
1	2	3	4	5	6	7	32
8	9	10	11	12	13	14	33
15	16	17	18	19	20	21	34
22	23	24	25	26	27	28	35
29	30	31					36

II — S/19 (Old) — BST-101 (80m)

02

02/11

2010

183 - 182 Days ■ 27 Weeks

FRIDAY

July

1 (h) / 2m → Force of repulsion between 02 unit charges in AIR

$Q_1 = Q_2 = 1$ coul, $d = 1$ mt

$F = \frac{1}{4\pi\varepsilon_0}\frac{Q_1 Q_2}{d^2} = \frac{1}{4\pi\varepsilon_0}\frac{1 \times 1}{1^2}$ & $F = \frac{1}{4\pi\varepsilon_0}$ Nt

1 (i) / 2m 02 applns of LASER in medical science

↓

→ Painless cleaning and drilling of tooth cavities

→ Break up kidney stones

→ In eye surgery to attach detached retina

→ Treatment of Liver Cancer

→ Evapourating unwanted deposits in arteries (avoid by-pass surgery)

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1 (j) / 2m → Lenz's law (statement)

↳ Direction of induced emf is such that it opposes the very cause which produces it.

Q2 (Any Six — 6×5 = 30 marks)

↓

2 (a) / 5m $T = 4\pi\sqrt{\frac{L}{g}}$

Check dimn Correctness

$(Dim)_{LHS} = Dim(T) \rightarrow [T^1]$

$(Dim)_{RHS} = Dim\left[4\pi\sqrt{\frac{L}{g}}\right] \rightarrow \sqrt{\frac{L}{L/T^2}} = \sqrt{L \div L/T^2}$

$= \sqrt{L \times \frac{T^2}{L}}$

$= \sqrt{T^2} = \pm T \approx [T]$

As $(Dim)_{LHS} = (Dim)_{RHS} = [T]$

↳ The given eqn is Dim. correct

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
18	19	20	21	22	23	24	30
25	26	27	28	29	30	31	31

■ Appointments ■ Notes

II – S/19 (Old) → BST-101 (80m)

2010

03/11 03

184 - 181 Days ■ 27 Weeks

SATURDAY

July

2(b) (Kepler's Laws of Planetary Motion) State — 5m

1st law (Law of orbits)

→ All the planets revolve round the sun in elliptical orbits with the sun at an foci

2nd law (Law of areas)

→ A planet moves round the sun in such a way that areal velocity is constant

OR

A line joining the sun sweeps out equal areas in equal time

OR

Radius vector from sun to PLANET sweeps out equal areas in equal time.

3rd law (Harmonic Law)

→ The square of time-period of revolution of any planet round the sun is directly proportional to the cube of semi-major axis of elliptical orbit / average distance of planet from sun.

04 Jul. Sun. 185-180

2(c) Establish $v = n\lambda$ (n → freq, λ → wavelength) — 5m

Velocity of wave

$(Vel)_{Body} = \frac{(Distance\ covered)_{Body}}{Time\ taken\ to\ covers\ that\ dist^n}$

$(Vel)_{wave} = \frac{Dist^n\ covered\ by\ the\ wave}{Time\ taken\ to\ describe\ the\ wave}$

$= \frac{Linear\ dist^n\ covered\ by\ wave}{Time\ taken\ to\ describe\ a\ wave}$

$= \frac{WAVELENGTH\ (\lambda)}{TIME\ PERIOD\ (T)}$

$v = \frac{\lambda}{T}$ (from definition)

$= \lambda \times \frac{1}{T}$

$= \lambda \times n$ or $\boxed{v = n\lambda}$

Appointments ■ Notes

August 2010

Sun	M	T	W	T	F	S	Wk
1	2	3	4	5	6	7	32
8	9	10	11	12	13	14	33
15	16	17	18	19	20	21	34
22	23	24	25	26	27	28	35
29	30	31					36

September 2010

Sun	M	T	W	T	F	S	Wk
			1	2	3	4	36
5	6	7	8	9	10	11	37
12	13	14	15	16	17	18	38
19	20	21	22	23	24	25	39
26	27	28	29	30			40

05

04/11

2010

186 - 179 Days ■ 28 Weeks

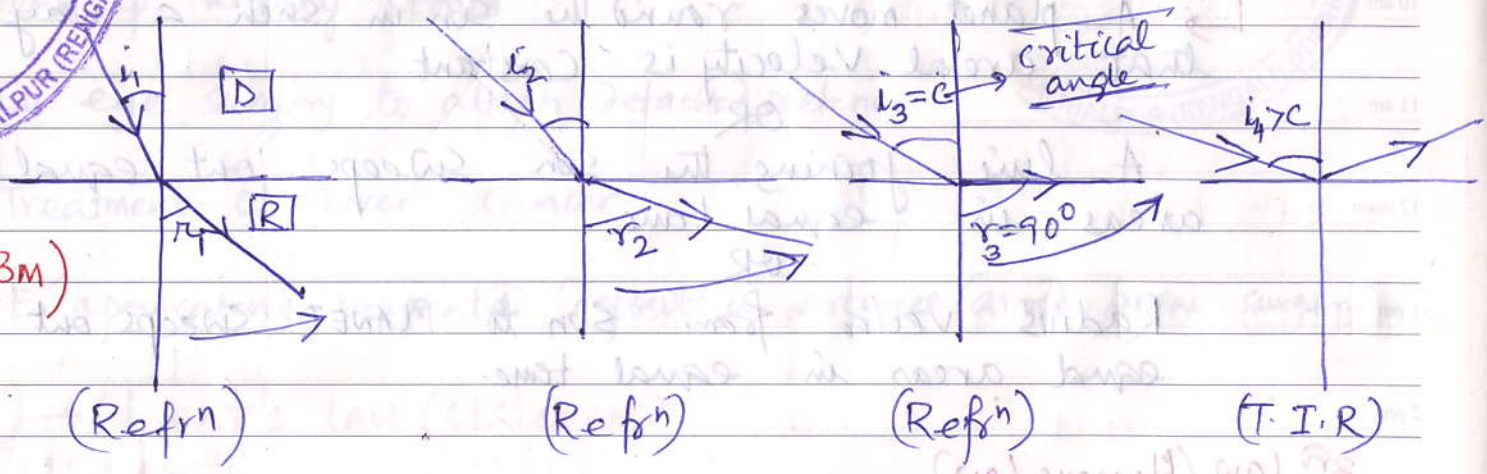
MONDAY

July

Define

2(d) → Total Internal Reflection (with diagram) 5m

Defⁿ (2m) → It is the process or phenomena in which a light ray travelling from denser (incident) medium to rarer (refracting) medium instead of being ~~refracted~~ ~~gets~~ refracted gets reflected back into the denser (incident) medium when the angle of incidence exceeds critical angle



(3M)

(Refⁿ) (Refⁿ) (Refⁿ) (T.I.R)

2(e) (Laws of limiting friction) 5m

↓

→ Limiting frictional force depends upon the NATURE of surfaces in contact and state of ROUGHNESS

Rough ↑ ⇒ frctⁿ ↑

→ L.f.f always acts parallel to the surfaces in contact and acts opposite to the dirⁿ of motion/attempted motion

→ L.f.f is independent of area of surfaces in contact

→ L.f.f is independent of speed of one surface over other

→ Magnitude of l.f.f ∝ Iᴿ between the surfaces

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

↓

Coeffⁿ of friction

05/11

BST-101 II-S/19(old) 80m

06

2010

July

187 - 178 Days ■ 28 Weeks

TUESDAY

2(f) 5m [MAGNETIC LINES of FORCE (Properties)]

(*) Directed away from N.P and towards/into S.P

8 am (*) starts from N.P and ends on S.P in case of an isolated pole

9 am (*) Tangent at any pt indicates the dirⁿ of M.I at that pt

10 am (*) Never intersect (cross) each other as at the pt of intersection two tangents are possible indicating 02 directions of

11 am M.I which is physically not acceptable.

12 noon (*) More concentration of lines of force means stronger M.field.

1 pm (*) Lines tend to contract longitudinally.

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2 pm **2(g) 5m** → [COULOMB'S LAW IN MAGNETISM]

3 pm Statement → The force of attraction & repulsion between 02 magnetic poles is: (1) directly proportional to the product

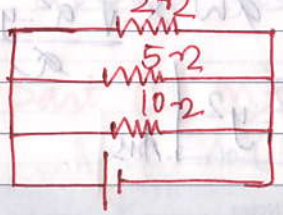
4 pm of their pole strength AND (2) inversely proportional to the square of distance between them

5 pm $F \propto \frac{m_1 m_2}{d^2}$ & $F = K\frac{m_1 m_2}{d^2}$ & $\boxed{f = \frac{\mu}{4\pi}\frac{m_1 m_2}{d^2}}$

6 pm

2(h) 5m Find eqv. resistance R = ?

7 pm



$\frac{1}{R} = \frac{1}{2} + \frac{1}{5} + \frac{1}{10} = \frac{5+2+1}{10} = \frac{8}{10}$

$\Rightarrow \boxed{R = \frac{10}{8} = 1.25\,\Omega}$

2, 5, 10
1, 5, 5
1, 1

■ Appointments ■ Notes

August 2010

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September 2010

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07

2010

Q3 10m

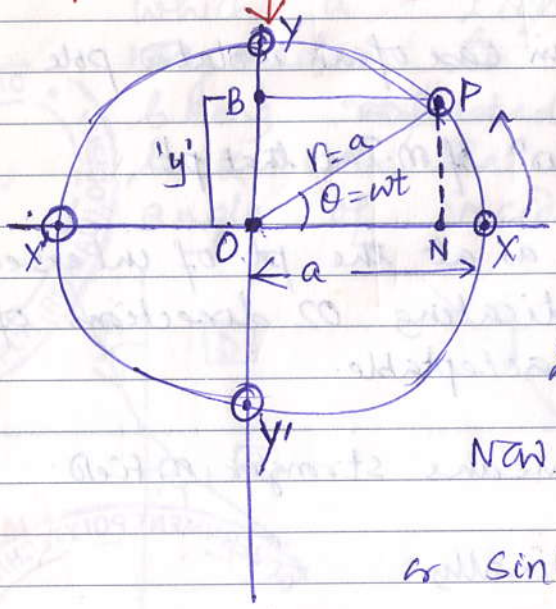
SHM (Displ^n — Velocity — Accl^n — formula Derivation)

188 - 177 Days ■ 28 Weeks

WEDNESDAY

July

[Displ^n eqn in SHM] (3m)



Body executes UCM $X \to P \to Y \to X' \to Y' \to X$

↓

Projection executes SHM from $O \to Y \to O \to Y' \to O \to Y$

When body moves from $X \to P$

Proj^n (particle) moves from $O \to B$

↓

Displ^n $y = OB$

Now $\sin\theta = \frac{PN}{OP} = \frac{OB}{OP}$ (as $PN = OB$)

or $\sin\theta = \frac{y}{a} \Rightarrow \boxed{y = a\sin\theta}$ or $\boxed{y = a\sin\omega t}$ Ans

[Velocity eqn in SHM (v)] (4m)

Vel = (T.R.O.C) displ^n = $\frac{\text{Change in displ}^n}{\text{Change in time}} = \frac{dy}{dt}$

↓

$v = \frac{dy}{dt} = \frac{d}{dt}(y) = \frac{d}{dt}(a\sin\omega t) = a\frac{d}{dt}(\sin\omega t)$

or $\boxed{v = a\omega\cos\omega t}$ (1)

$\sin^2\omega t + \cos^2\omega t = 1$

$\cos^2\omega t = 1 - \sin^2\omega t$

or $\sqrt{\cos^2\omega t} = \sqrt{1 - \sin^2\omega t}$

or $\cos\omega t = \sqrt{1 - \frac{y^2}{a^2}}$

or $\cos\omega t = \frac{\sqrt{a^2 - y^2}}{a}$

So $v = a\omega\cos\omega t = a\omega \times \frac{\sqrt{a^2 - y^2}}{a}$

or $\boxed{v = \omega\sqrt{a^2 - y^2}}$ Ans

2010

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II-S/19(O)
80mw

07/11

08

July

189- 176 Days ■ 28 Weeks

THURSDAY

[Accln eqn in SHM (A) - 3m]

↓

Accln (A) = (T.R.O.C) Velocity = $\frac{\text{change in velocity}}{\text{change in time}}$

So $A = \frac{dv}{dt} = \frac{d}{dt}(v) = \frac{d}{dt}(aw\cos wt) = aw\frac{d}{dt}(\cos wt)$

$\Rightarrow A = aw \times (-w\sin wt)$ or $A = -aw^2\sin wt$

or $A = -w^2 a\sin wt$ → 'y'

So $\boxed{A = -w^2 y}$ Ans.

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5(a) → DEFINE α, β and 'γ' 4m

α → It is defined as the CHANGE (INCREASE) in length of a solid (material) per unit original length per unit degree rise (change) in temperature 2m

β → It is defined as the CHANGE (increase) in AREA of a solid (material) per unit original area per unit degree rise (change) in temperature. 2m

γ → It is defined as the CHANGE (increase) in VOLUME of a solid (material) per unit original volume per unit degree rise (change) in temperature. 2m

5(b) - 1st part (2½ m) - Reln between 'α' and β

$A_t = A_0(1+\beta t)$

$l_t b_t = l_0 b_0(1+\beta t)$

$l_0(1+\alpha t)\, b_0(1+\alpha t) = l_0 b_0(1+\beta t)$

or $l_0 b_0(1+\alpha t)^2 = l_0 b_0(1+\beta t)$

$1+\beta t = (1+\alpha t)^2 = 1 + 2\alpha t + \alpha^2 t^2$ (neglected as v.v. small)

$1+\beta t = 1+2\alpha t$

Comparing

$\boxed{\beta = 2\alpha}$

$A_0 = l_0 b_0$, l_0

$A_t = l_t b_t$, l_t

Appointments ■ Notes

August 2010

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29	30	31					36

September 2010

Sun	M	T	W	T	F	S	Wk
			1	2	3	4	36
5	6	7	8	9	10	11	37
12	13	14	15	16	17	18	38
19	20	21	22	23	24	25	39
26	27	28	29	30			40

09

08/11

2010

190 - 175 Days | 28 Weeks

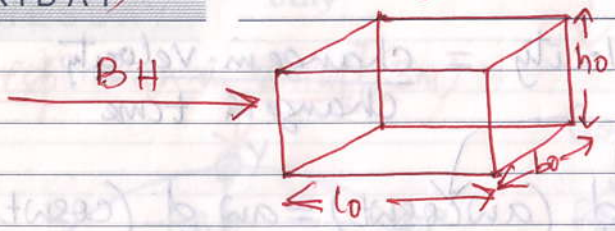
FRIDAY

July

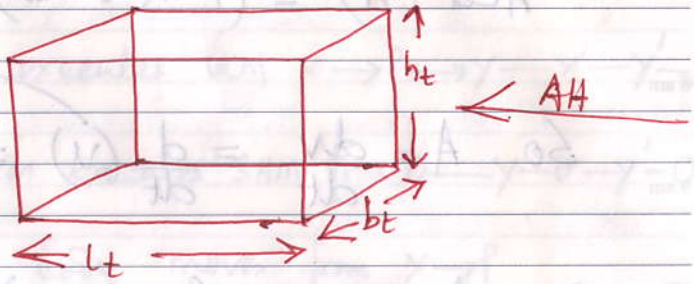
~~5~~ (b) 2nd part → Relation between 'α' and 'r'

(3M)

$V_0 = l_0 b_0 h_0$



$V_t = l_t b_t h_t$



$V_0 \longrightarrow V_t$ $\begin{bmatrix} l_0 \to l_t \\ b_0 \to b_t \\ h_0 \to h_t \end{bmatrix}$

Now $V_t = V_0(1+rt)$ ⇔ $l_t b_t h_t = l_0 b_0 h_0 (1+rt)$

⇔ $l_0(1+\alpha t) b_0(1+\alpha t) h_0(1+\alpha t) = l_0 b_0 h_0 (1+rt)$

⇔ $l_0 b_0 h_0 (1+\alpha t)^3 = l_0 b_0 h_0 (1+rt)$

⇔ $1+rt = (1+\alpha t)^3 = 1 + 3\alpha t + 3\alpha^2 t^2 + \alpha^3 t^3$

neglected as they are very small compared to the other 02 terms

$\alpha \to$ very small

$\alpha^2, \alpha^3 \to$ still smaller

⇔ $1+rt = 1+3\alpha t$

Comparing coefficients on both sides, we have

$\boxed{r = 3\alpha}$

β = Relⁿ between α, β and r (1m)

$\beta = 2\alpha \Rightarrow \alpha = \beta/2$

$r = 3\alpha \Rightarrow \alpha = r/3$

$\Rightarrow \alpha = \beta/2 = r/3$

⇔ $\boxed{\alpha : \beta : r = 1:2:3}$ Ans

June 2010

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July 2010

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■ Appointments ■ Notes

II – S/19

BST-101
II – S/19 (old)
80m

09/11

10

2010

July

191 - 174 Days ■ 28 Weeks

SATURDAY

Q4(a) 4m → KIRCHOFF's LAW (KCL + KVL)

KCL (1st law) (Statement) → Algebraic sum of current meeting at a point (junction of conductors) is ZERO

$$\sum i = 0$$

8 am

9 am

10 am

KVL (2nd law) (Statement) → Algebraic sum of voltages meeten in each part of a closed electric ckt is equal to the total emf of the ckt

$$\sum V = E$$

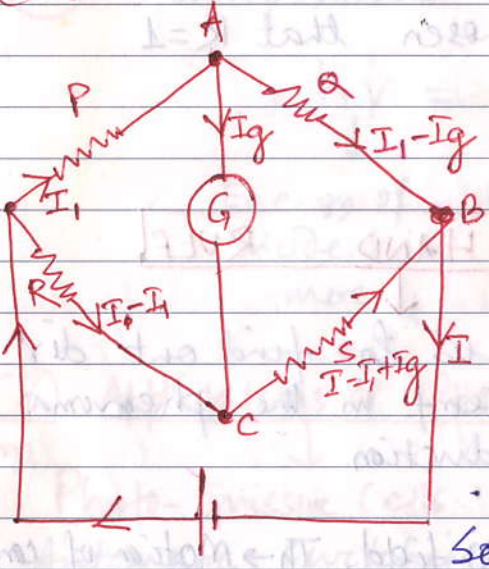
11 am

12 noon

1 pm

Q4(b) (6m) [CONDITION of BALANCE in a WHEATSTONE BRIDGE]

2 pm



3 pm

Applying KVL to Loop ACDA

$$I_1P + I_gG - (I - I_1)R = 0 \text{ (No source of emf)} \quad -(1)$$

4 pm

Applying KVL to loop ABCA

11 Jul. Sun. 192-173

5 pm

$$(I_1 - I_g)Q - I_gG - (I - I_1)S = 0 \quad (\text{II}) \quad -(2)$$

When the W.B is in balanced condition

$$V_B = V_D \Rightarrow V_B - V_D = 0 \Rightarrow I_g = 0$$

6 pm

So $I_1P - (I - I_1)R = 0 \Rightarrow I_1P = (I - I_1)R \quad -(3)$

and $I_1Q - (I - I_1)S = 0 \quad I_1Q = (I - I_1)S \quad (4)$

Dividing 03/04 we get $\frac{I_1P}{I_1Q} = \frac{(I - I_1)R}{(I - I_1)S}$

7 pm

$$\Rightarrow \boxed{\frac{P}{Q} = \frac{R}{S}}$$

■ Appointments ■ Notes

August 2010

Sun	M	T	W	T	F	S	Wk
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September 2010

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12

10/11

2010

193 - 172 Days ■ 29 Weeks

MONDAY

July

Q 6(a) → [Faraday's laws of em induction]

(*) Whenever magnetic flux linked with a closed ckt changes, an emf is induced.

8 am

(*) The induced emf exists (lasts) as long as the change in magnetic flux linkage continues.

9 am

10 am (*) Induced emf (e) is directly proportional to the −ve of time rate of change of magnetic flux linkage

$e \propto -\frac{d\phi}{dt}$

11 am

(*)

12 noon

(*) Induced emf ∝ No: of turns in the closed coil ($e \propto N$)

1 pm

$$e \propto -N\frac{d\phi}{dt} \text{ or } e = -KN\frac{d\phi}{dt}$$

2 pm

The units of e, N, $\frac{d\phi}{dt}$ are so chosen that $K = 1$

3 pm

Hence $\boxed{e = -N\frac{d\phi}{dt}}$

4 pm

(b)

am

5 pm

F. L. HAND RULE

(*) Helps us to find out dir^n of force acting on a C.C.C placed in an uniform magnetic field

6 pm

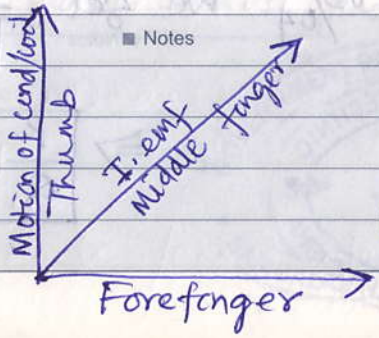
7 pm

(*) FF → M. field/MF — Current
Thumb → Motion (force) of cond^r

F. R. HAND RULE

(*) Helps us to find out dir^n of induced emf in the phenoma of em. induction.

(*) FF → M. field, Th → Motion of cond/coil
MF → Ind emf



June 2010 | July 2010 ■ Appointments ■ Notes

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BST-101
II-S/19 (O)
80 m

13 11/11

2010

July

194 - 171 Days ■ 29 Weeks

TUESDAY

Q7(a) [LAWS of PHOTO-ELECTRIC EMISSION]
(6m)

(*) (1st Law)

→ For a given metal and particular frequency of incident light, the no. of photoelectrons emitted per second (Photoelectric Current) is directly proportional to the Intensity of incident light

(3m)

P.E Current ∝ Intensity of Incident light (more no. of incident Photons)

More photons incident → More electrons emitted ! → more is the P.E current

(*) (2nd law)

→ The maximum K.E of the emitted photoelectron depends on the frequency of incident light but is independent of Intensity

(3m)

$$h\nu = h\nu_0 + \frac{1}{2}mv_{max}^2$$

$h\nu$: Energy of incident is more
$h\nu_0$: Work function (Const)
$\frac{1}{2}mv_{max}^2$: is more

7(b) Applications of PHOTOCELL
4m

Photo-Emissive Cells
- → Automatic switching of street Lights
- → Burglar alarm – fire Alarm – Smoke detectors – closing of lift doors
- → T.V Cameras
- → Sound reproduction in motion picture
- → Measure temp of Sun-Stars
- → Control temp of chem. reactions/furnaces

Photo-Conductive Cells
- → Electronic Ignition acts (Self start)

Photo-Voltaic Cells
- → Aircraft (30-40 volts can be developed across silicon chips)