01/15

II-Sem (N) – 2019 (S) – Th- 2 (A)

ENGG. PHYSICS – 80 marks

1 (a) 2m Power $\rightarrow$ $\frac{\text{~~Energy~~}}{\text{time}}$ or $\frac{\text{work}}{\text{time}} \rightarrow \frac{ML^2T^{-2}}{T} = \boxed{ML^2T^{-3}}$ (1m)

Frequency $\rightarrow$ $[T^{-1}]$ (1m)

1 (b) $\vec{A} = \hat{i} - 2\hat{j} - 3\hat{k}$, $\vec{B} = 2\hat{i} + \hat{j} - 5\hat{k}$

$$\vec{A}\cdot\vec{B} = (\hat{i} - 2\hat{j} - 3\hat{k})\cdot(2\hat{i} + \hat{j} - 5\hat{k})$$
$$= 2\hat{i}\cdot\hat{i} + \cancel{\hat{i}\cdot\hat{j}} - \cancel{5\hat{i}\cdot\hat{k}} - \cancel{4\hat{j}\cdot\hat{i}} - 2\hat{j}\cdot\hat{j} + \cancel{10\hat{j}\cdot\hat{k}} - \cancel{6\hat{k}\cdot\hat{i}} - \cancel{3\hat{k}\cdot\hat{j}} + 15\hat{k}\cdot\hat{k}$$
$$= 2 - 2 + 15 = \boxed{15} \text{ Ans}$$

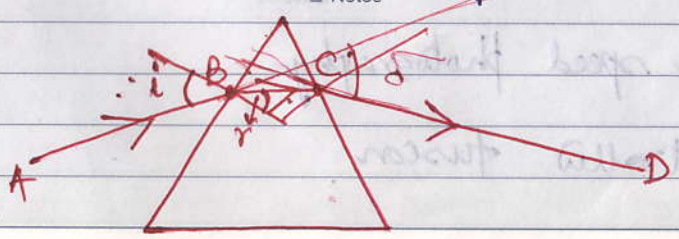
1 (c) → Triangle law of Vector Addition

↳ If 02 vectors are represented in magnitude and direction by 02 sides of a triangle taken in the same order, then their resultant is represented in magnitude and direction by the 3rd side of the triangle taken in opposite order.

1 (d) → Latent Heat of Vapourisation

↳ It is the amount of heat required to convert or change unit mass of any liquid into vapour at it's boiling ~~vap~~ point.

1 (e)



Th-2(A) 80M/519

02/14

1(f) → UNIT POLE

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.

1(g) → 1st law of thermodynamics

When heat is supplied to any system, a part of it is used for increasing the internal energy of the system and the rest part is utilised for doing work.

$$dQ = dU + dW$$

1(h) → Kirchoff's 2nd law

The algebraic sum of voltages in each part of a closed ckt/loop/mesh is equal to the total emf

OR

The algebraic sum of product of current and resistance in each of an el. ckt/loop/mesh is equal to the total emf.

1(i) Applications of Laser in Industry

(i) As it is a high power beam, employed in Melting – cutting – drilling – welding metals

(ii) Decompose noxious substances from industrial waste into harmless substances for human beings

(iii) High speed photography

(iv) Controlled fusion

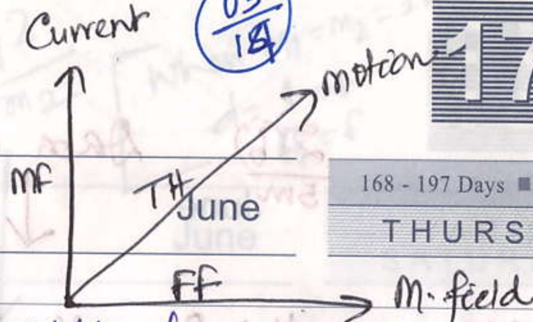
my 02

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

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

Th-2(A)
5/19 (II)
80m

03/14



1(j) → Fleming's Left Hand Rule

↳ Stretch the forefinger - middle finger and thumb of the left hand mutually $\perp^r$ to each other
If the forefinger indicates the dir^n of mag. field — middle finger indicates the direction of current flowing through the conductor — then the thumb indicates the dir^n of force (motion) acting on the c.c.c.

Q2 (ANY SIX — 6×5 = 30 marks)

2(a) Data Given

$F_1 : F_2 = 3 : 5$ i.e $F_1 = 3x$, $F_2 = 5x$ $\quad R = 70N$ $\quad \theta = 60^\circ$ $\quad F_1 = ?$ $\quad F_2 = ?$

Sol^n

$$R^2 = F_1^2 + F_2^2 + 2F_1F_2\cos\theta$$

$$= (3x)^2 + (5x)^2 + 2(3x)(5x)\cos 60^\circ$$

or $(70)^2 = 9x^2 + 25x^2 + 30x^2 \times \frac{1}{2}$

$$= 9x^2 + 25x^2 + 15x^2$$

or $4900 = 49x^2 \Rightarrow x^2 = 100$ or $x = \pm 10 \Rightarrow \boxed{x = 10}$

So $F_1 = 3x = 3 \times 10 = \boxed{30\,N}$ Ans$_1$

$F_2 = 5x = 5 \times 10 = \boxed{50\,N}$ Ans$_2$

Appointments ■ Notes

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

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

2(b) 5m Data Given

CAR $\rightarrow$ $u = 0$, $v = 50\,m/sec$

$t = 5min = 300\,sec$ $a = ?$

Soln $v = u + at$ or $at = v - u$

or $a = \frac{v-u}{t} = \frac{50-0}{300}$

or $\boxed{a = \frac{1}{6}\,m/sec^2}$ Ans

2(c) 5m $\rightarrow$

MASS	WEIGHT
(*) Amt of matter contained or present in a body	(*) Force of the earth on a body
(*) Scalar Qty	(*) Vector Qty
(*) SI unit $\rightarrow$ Kg	(*) SI unit $\rightarrow$ Newton
(*) Dimn $\rightarrow [M]$	(*) Dimn $\rightarrow \frac{ML}{T^2}$ or $[MLT^{-2}]$
(*) constant throughout .	(*) varies from place to place.

2(d) Newton's law of Gravitation 2

(5m) $\rightarrow$ Every (each) particle of matter (body) in this universe attracts every other particle/body with a force which is

(i) Directly proportional to the product of their masses

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

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

May 2010

Sun	M	T	W	T	F	S	Wk
30	31						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

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

Appointments

Notes

Th-2(A)
II - 5/19
80m

$G = \frac{f \times d^2}{m_1 m_2}$ [when $m_1 = m_2 = 1kg$
$d = 1$ mt
$G = f$]

05/14

2(d) Define G (2m)

It is defined as the magnitude of force of attraction acting between 02 unit masses placed unit distance apart in the universe.

2(e) Methods to Reduce friction

→ Rubbing and Polishing
↳ By rubbing — irregularities get smoothened removing the chances of interlocking

→ Use of Lubricants
↳ fills the irregularities — forms a thin layer between them — avoiding interlocking

→ Converting Sliding friction into Rolling friction
↳ use of Ball-Bearing system

→ Proper Selection of Materials
↳ Tyres made of rubber (as friction between Iron and concrete is more ....

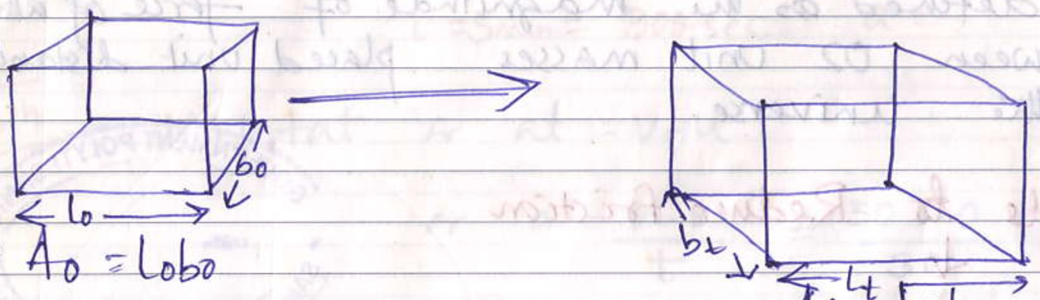
→ Streamlining
↳ Body of Cars/aeroplanes tapered towards the rear/front
↳ Sharp edges or corners are avoided.

Th-2(A) II-S/19 80m

06/14

2(f) → Relation between 'α' and 'β'

BH (at 0°C) AH (at t°C)



$A_0 = l_0 b_0$ $A_t = l_t b_t$

We know that $A_t = A_0(1+\beta t)$

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

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

$\Rightarrow \cancel{l_0 b_0}(1+\alpha t)^2 = \cancel{l_0 b_0}(1+\beta t)$

$\Rightarrow 1 + 2\alpha t + \cancel{\alpha^2 t^2} = 1+\beta t$

neglected as very small as compared to '1' and 'αt'

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

Comparing coefficients of terms on both sides

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

May 2010

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June 2010

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■ Appointments ■ Notes

2(g) → Coulomb's law in Magnetism

Statement The magnitude of force acting 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.

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

$$\text{or} \quad \boxed{f = \frac{\mu_0}{4\pi} \frac{m_1 m_2}{d^2}}$$

2(h) → Faraday's law of Electromagnetic Induction

(*) Whenever magnetic flux linked within an el·ckt changes, emf is induced

(*) The emf induced in the el·ckt exists or lasts as long as magnetic flux linkage continues

(*) Emf induced ∝ -ve of time rate of magnetic flux linkage

(*) $$e \propto -\frac{d\phi}{dt}$$

(*) emf induced ∝ Number of turns in the coil

$$e \propto N$$

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

$$\text{or} \quad \boxed{e = -N\frac{d\phi}{dt}} \qquad K = 1$$

↳ by selecting units properly

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August 2010

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Th-2(A)
II - S/19
80m

08/14

23

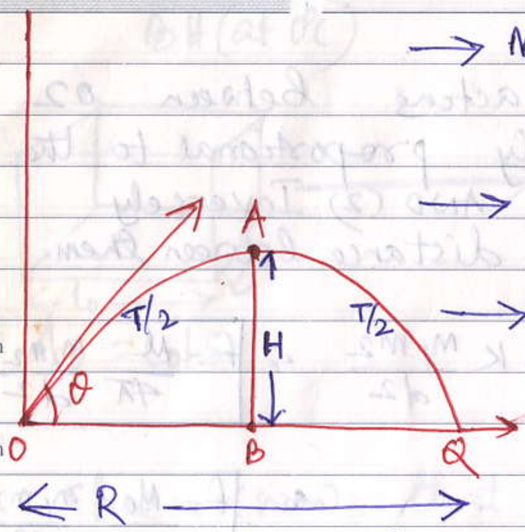
2010

174 - 191 Days ■ 26 Weeks

WEDNESDAY

June

Q3 (1st part) → Time of flight of Projectile (T)



→ Motion from O → A and A → Q are symmetrical

→ Time of Ascent = Time of Descent = T/2

→ At the highest pt $V_y = 0$ (at 'A')

The velocity of the projectile at any instant 't' on the Y-axis is

$$V = u + at$$

$$V_y = u_y + a_y t \qquad [V_y = 0,\ u_y =$$

$$0 = u\sin\theta + (-g)t$$

or $+gt = u\sin\theta$ or $g\frac{T}{2} = u\sin\theta$ or $\boxed{T = \frac{2u\sin\theta}{g}}$

Maximum Height attained (H)

The distance covered by the projectile along Y-axis at any instant can be got from the eqn

$$S = ut + \frac{1}{2}at^2$$

$$y = u_y t + \frac{1}{2}a_y t^2$$

$$H = u\sin\theta\, t + \frac{1}{2}\times(-g)\times t^2$$

$$H = u\sin\theta\, t - \frac{1}{2}gt^2$$

$$= u\sin\theta \times \frac{T}{2} - \frac{1}{2}g\left(\frac{T}{2}\right)^2$$

or $H = u\sin\theta \times \frac{2u\sin\theta}{2g} - \frac{1}{2}\times g\times\left(\frac{2u\sin\theta}{g}\right)^2$

or $H = \frac{u^2\sin^2\theta}{g} - \frac{u^2\sin^2\theta}{2g}$ or $H = \frac{u^2\sin^2\theta}{g}\left(1 - \frac{1}{2}\right)$

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

8 am
9 am
10 am
11 am
12 noon
1 pm
2 pm
3 pm
4 pm
5 pm
6 pm
7 pm

■ Appointments ■ Notes

May 2010

Sun	M	T	W	T	F	S	Wk
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June 2010

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27	28	29	30				27

Range of Projectile (R)

It is the horizontal distance covered with uniform velocity $u\cos\theta$ in a time equal to time of flight

$$v = \frac{x\ (\text{dist})}{t\ (\text{time})} \quad \& \quad x = v \times t$$

$$R = u\cos\theta \times T$$

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

$$\& \quad R = \frac{2u^2\cos\theta\sin\theta}{g} = u^2 \times \frac{2\sin\theta\cos\theta}{g}$$

$$\& \quad \boxed{R = \frac{u^2\sin 2\theta}{g}}$$

Q4 → Data Given (5gm ice at -5°C to water at 60°C)

Sol^n

5gm ice at -5°C →(SH, Q_1)→ 5gm ice at 0°C →(LH, Q_2)→ 5gm water at 0°C →(SH, Q_3)→ 5gm water at 60°C

$$Q_1 = m\,S_{ice}\,\theta = 5 \times 0.5 \times [0-(-5)] = 5 \times 0.5 \times 5 = \boxed{12.5\ \text{cal}}$$

$$Q_2 = m\,L_{ice} = 5 \times 80 = \boxed{400\ \text{cal}}$$

$$Q_3 = m\,S_w\,\theta = 5 \times 1 \times [60-0] = 60 \times 5 = \boxed{300\ \text{cal}}$$

Total heat Req $(Q) = Q_1 + Q_2 + Q_3$

$$= 12.5 + 400 + 300$$

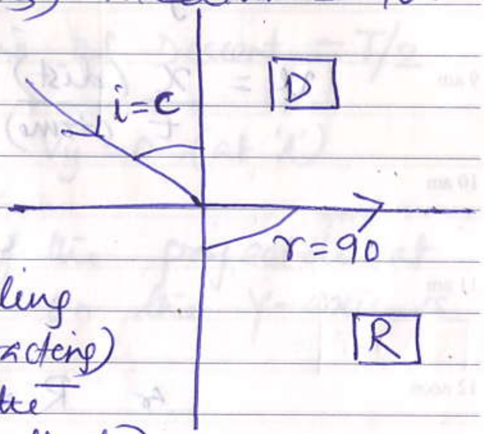
$$= \boxed{712.5\ \text{cal}} \text{ Ans.}$$

Th-2(A)
II - S/19
80m

10/14

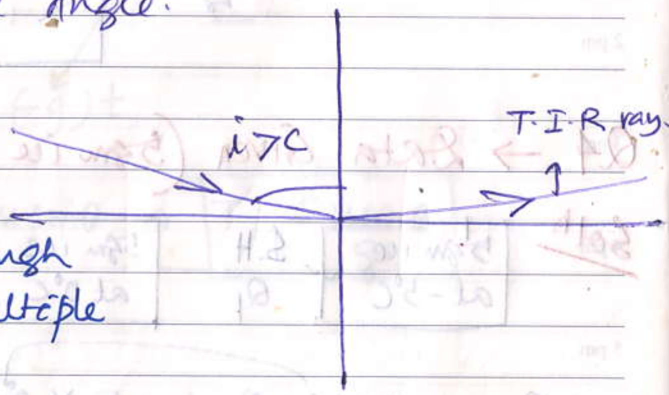
(Q5) — Critical Angle (2+1)

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



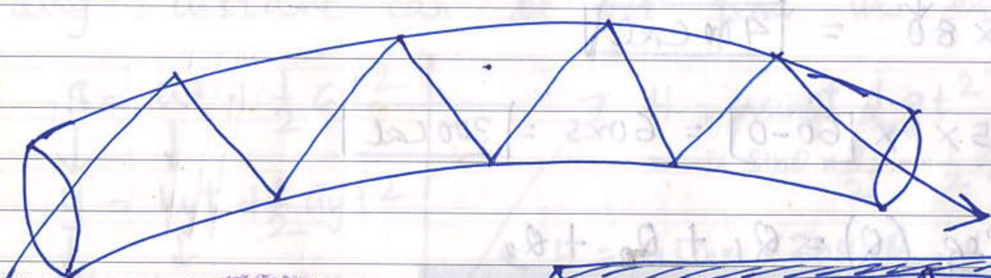
Total Internal Reflection (2+1)

It is ~~p~~ the phenomena (process) in which a light ray travelling from denser (incident) to rarer (refracting) medium ~~is reflected back to the~~ instead of being refracted is reflected back to the denser medium when the angle of incidence exceeds critical angle.

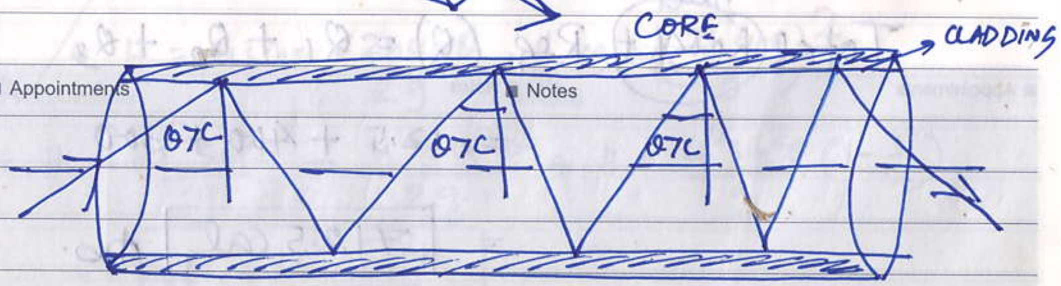


Principle of Optical fibre (2m)

Light energy propagates through the fibre by ~~A Intern~~ multiple total internal reflections.



Core — 2 microns (D)
cladding — 1.5 microns (R)



May 2010

Sun	M	T	W	T	F	S	Wk
30	31					1	18
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June 2010

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		1	2	3	4	5	23
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13	14	15	16	17	18	19	25
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27	28	29	30				27

Appointments

Notes

Th-2(A)
II - 5/19
80m

11/14

2010 June 26 SATURDAY
177 - 188 Days ■ 26 Weeks

Applications of Optical fibres (2m)

(*) used to study internal organs of the body like lungs – stomach etc. which can't be viewed directly

(*) (endoscopy)

(*) used in the field of communication for sending video signals from one place to another

(*) Study of tissues and blood vessels below the skin.

(*) Transmit high energy laser light inside the body for medical purposes

(*) Defence services (*) Cable TV – ~~sensors~~ space vehicles – Ships

(*) Transmission of digital Data

(*) 300 signals can be transmitted at a time.

Q6 → Coulomb's law in Electrostatics

a-5m

27 Jun. Sun. 178-187

Statement → The electrostatic force of attraction or repulsion between 02 charged bodies/particles is:

(3m) 1) directly proportional to the product of their charges

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

$$F \propto \frac{Q_1 Q_2}{d^2} \quad \text{or} \quad F = K\frac{Q_1 Q_2}{d^2}$$

(2m) or $\boxed{F = \frac{1}{4\pi\epsilon}\frac{Q_1 Q_2}{d}}$

or $\boxed{F = \frac{1}{4\pi\epsilon_0}\frac{Q_1 Q_2}{d^2}}$ – Air

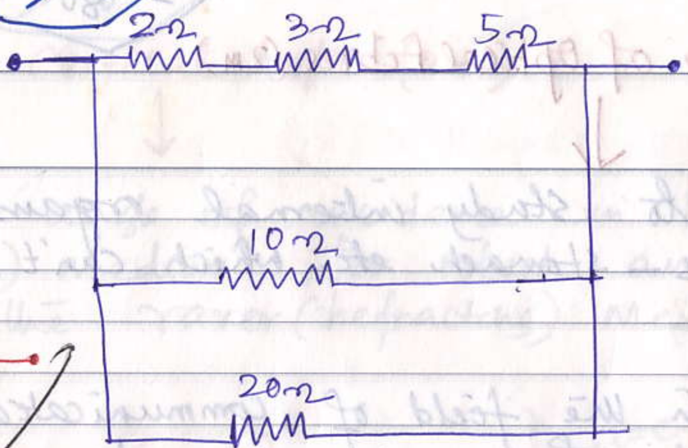
Appointments | Notes

Th-2(A)
II - 5/19
80m

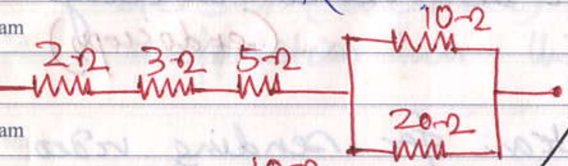
12/14

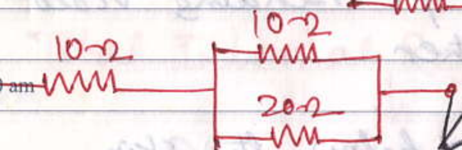
Q6 2nd part (5m)

10, 10, 20
1, 1, 2



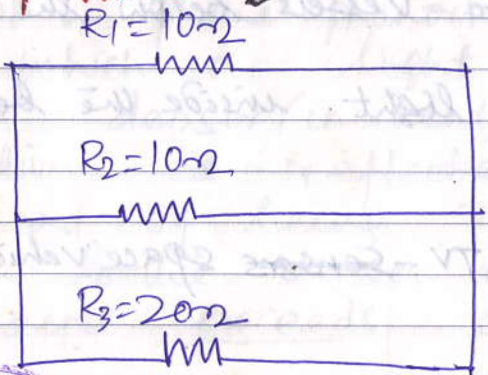
$R = ?$





$$R = R_1 + \frac{R_2 R_3}{R_2 + R_3} = 10 + \frac{10 \times 20}{10 + 20}$$

$$= 10 + \frac{200}{30} = 10 + 6.67 = \boxed{16.67\,\Omega} \text{ Ans}$$



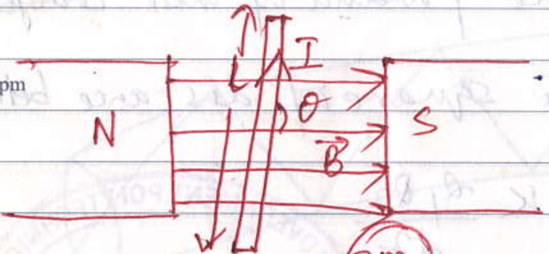
$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$= \frac{1}{10} + \frac{1}{10} + \frac{1}{20}$$

$$\frac{2+2+1}{20} = \frac{5}{20}$$

or $R = \frac{20}{5}$ or $\boxed{R = 4\,\Omega}$ Ans

Q7(a) 6M → Force acting on a current carrying conductor placed in an Uniform magnetic field.



2m

$|\vec{B}| = B$ (magnitude of m.f.D of U.m. field)

l → length of the conductor (2m)

I → current flowing the conductor

θ → Angle between m.field and conductor in the dirn of current

May 2010

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June 2010

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		1	2	3	4	5	23
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13	14	15	16	17	18	19	25
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27	28	29	30				27

Appointments

Notes

2010

Th - 2(A)
II - S/19
80m

13/14

29

June

180 - 185 Days ■ 27 Weeks

TUESDAY

$F \propto B$
$F \propto I$
$F \propto l$
$F \propto \sin\theta$

Combining all expressions we have $F \propto BIl\sin\theta$

8 am

$\Rightarrow f = KBIl\sin\theta$

9 am

2M

The units of f, B, I, l and $\sin\theta$ are so chosen

10 am

such that $K = 1$

11 am

so $\boxed{f = BIl\sin\theta}$

12 noon

Aliter

$\vec{F} = \vec{q}(\vec{v} \times \vec{B})$

1 pm

$|\vec{F}| = |\vec{q}(\vec{v} \times \vec{B})|$

2 pm

$= |\vec{q}\,\vec{v}B\sin\theta\,\hat{n}|$

3 pm

$= qvB\sin\theta$ as $|\hat{n}| = 1$

4 pm

$\Rightarrow f = qvB\sin\theta$

5 pm

$= q \times \frac{l}{t} \times B\sin\theta$

6 pm

$= \frac{q}{t} \times l \times B\sin\theta$

7 pm

$= I \times l \times B\sin\theta \Rightarrow \boxed{f = BIl\sin\theta}$

Appointments

Notes

July 2010

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				1	2	3	27
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August 2010

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22	23	24	25	26	27	28	35
29	30	31					36

30

2019(S)
Th-2(A)
80m

info@tatasponge.com

14/14

2010

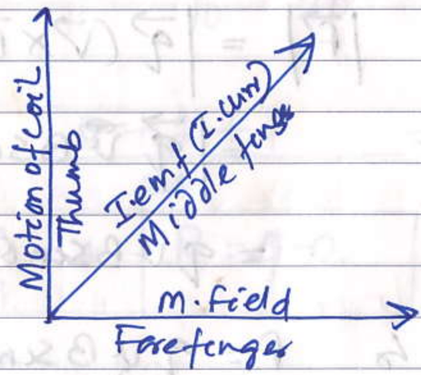
181 - 184 Days ■ 27 Weeks

WEDNESDAY

June

Th-2(A)
II - S/19
80m

Q7 (2nd part)
(4m)

F. L.H.RULE	F. R.H.RULE
1) helps to find out the dirn of force acting on a C.C.C placed in a magnetic field (Electromagnetism)	1) Helps us to find out the dirn of induced emf in the phenomena of em induction
2) FF → m.field mf → current Th → motion (force)	2) Ff → m.field Th → motion of conductor Mf → Dirn of ind. emf (ind current)
3) 	(3) 

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

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

Appointments

Notes