POORNIMA
COLLEGE OF ENGINEERING

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Recognized by UGC under Section 2(f) of the UGC Act, 1956

Sample Tutorial With Solution

(2017-18 to 2021-22)

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• Website: www.pce.poornima.org

POORNIMA
COLLEGE OF ENGINEERING

TUTORIAL SHEETS

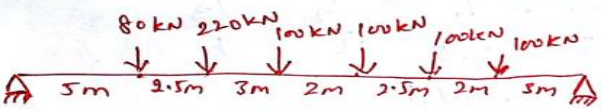
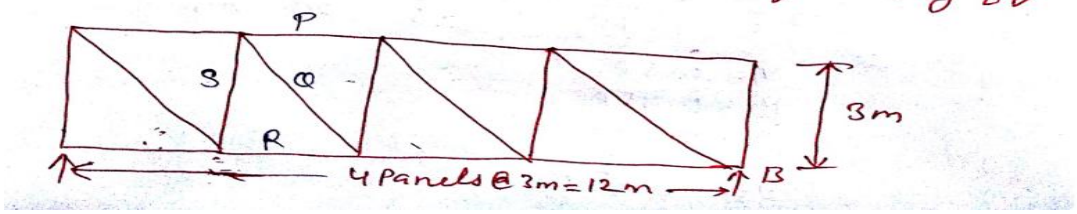
TUTORIAL SHEET — **SHEET No. 01**

Campus: PCE Course: B.Tech | **Class/Section: III Year** | **Date: 12/02/2019**

Name of Faculty: Balwan | **Name of Subject: TOS-II** | **Code: 6CE1A**

Date of Tut. Sheet Preparation: 10/02/2019 **Scheduled Date of Tut. : 12/02/2019 Actual Date of Tut. : 12/02/2019**

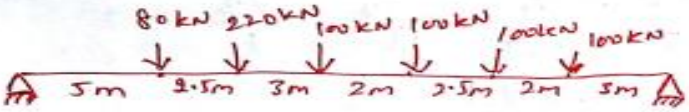
Name of Student:……..Scheduled & Actual Date of H.A. Submission:……&……

FIRST 20 MT. CLASS QUESTIONS	Q.1 The load system shown in fig moves from right to left on a girder of span 20 m. Find the maxi. shear force at a section 7.5 m from the left end. 	**CO 1**	**PO 1**
2 HRS. SOLVABLE HOME ASSIGNMENT (H.A.) QUESTIONS	Q.2 Draw ILD for force in the members P, Q, R, S of truss shown in following fig:- 	**CO 2**	**PO 2**
OTHER IMPORTANT QUESTIONS	**Q. 3** A 3-hinged parabolic arch has a span of 30 m and a central rise of 6 m five wheel loads of 4, 5, 5, 3, 3 KN spaced at 3 m, 2m, 3m, and 2m in order to cross the arch from left to right with the 4 KN load leading. When the leading load is 20 m from the left hinge. Calculate the horizontal thrust in the arch. Also calculate the BM, normal thrust and shear force at the section under tail load.	**CO 3**	**PO 2**

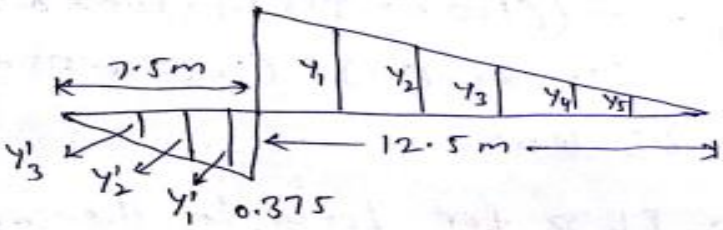
Dr. Mahesh Bundele
B.E., M.E., Ph.D.
Director
Poornima College of Engineering
ISI-6, RIICO Institutional Area
Sitapura, JAIPUR

Q.1 Solution

Q>1 The load system shown in fig moves from right to left on a girder of span 20 m. Find the maxi. shear force at a section 7.5 m from the left end.



Ans:- We need to draw ILD of shear force at that point.



$$\frac{0.625}{12.5} = \frac{y_1}{10} = \frac{y_2}{7} = \frac{y_3}{5} = \frac{y_4}{2.5} = \frac{y_5}{0.5}$$

So $y_1 = 0.50$
$y_2 = 0.350$
$y_3 = 0.250$
$y_4 = 0.125$
$y_5 = 0.025$

So the value of maxi. positive shear force at point C due to moving load set

$$F_{C(+ve)} = (80 \times 0.625) + (220 \times 0.50) + (100 \times 0.35) + (100 \times 0.25) + (100 \times 0.125) + (100 \times 0.025)$$

$$F_{C(+ve)} = 235 \text{ kN}$$

For maxi. Negative S.F. :-

$$\frac{0.375}{7.5} = \frac{y_1}{5.5} = \frac{y_2}{3} = \frac{y_3}{1}$$

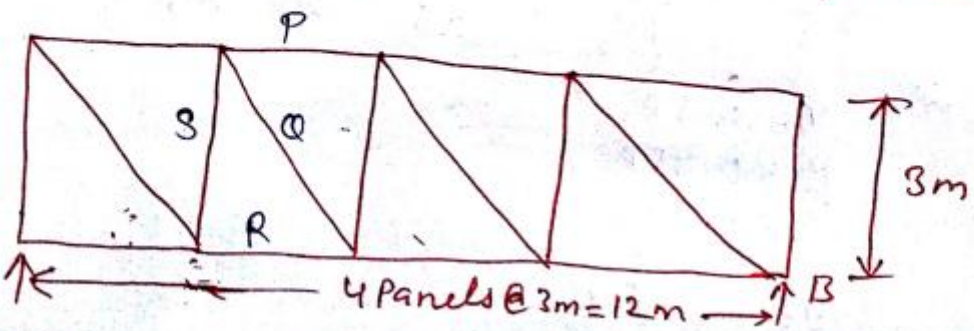
So $y_1 = 0.275$
$y_2 = 0.150$
$y_3 = 0.050$

$$F_{C(-ve)} = -((100 \times 0.375) + (100 \times 0.275) + (100 \times 0.150) + (100 \times 0.050))$$

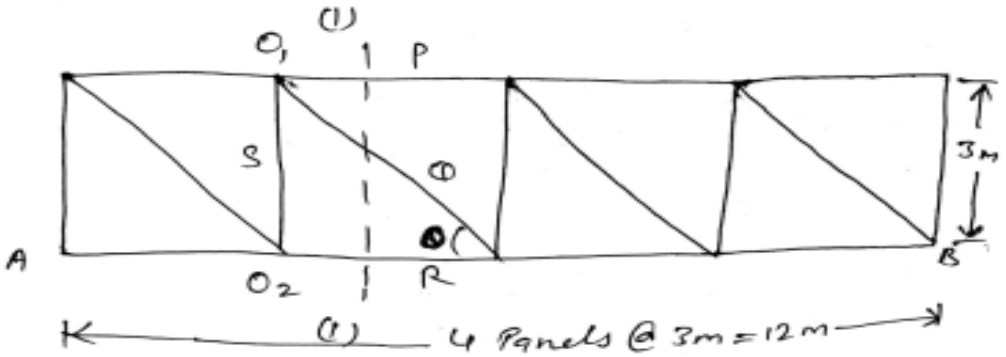
$$F_{C(-ve)} = -85 \text{ kN}$$

Q.2 Solution

Q→2 Draw ILD for force in the members P, Q, R, S of truss shown in following fig:-



Ans:-



→ ILD for P_P

Take section (1)–(1)

$$P_P = \frac{M_T}{3}$$

$$M_T = \frac{6 \times 6}{12}$$

$$P_P = \frac{6 \times 6}{12 \times 3} = P_P = 1 \text{ (comp.)}$$

→ ILD for P_Q = (S.f. in O_2T) / $\sin\theta$

$$\sin\theta = \frac{3}{\sqrt{3^2+3^2}} = \frac{1}{\sqrt{2}}$$

$$\theta = 45^\circ$$

$$P_Q = \frac{3}{12} / \sin 45^\circ$$

$$P_Q = 0.354 \text{ (comp.)}$$

Unit load at T

$$-P_Q \cos\theta + R_A = 0$$

$$R_A = \frac{1}{2}$$

$$\frac{1}{2} = \frac{Q}{\sqrt{2}}$$

$$Q = 0.707 \text{ (Ten.)}$$

→ ILD for the member R

To find ILD at O_1 or (O_2) keep a unit load at O_2

$$R_A = \frac{3}{4}$$

Take moment about O_1

$$R_A = \frac{3}{4} \text{ (Tension at } O_1\text{)}$$

Hence ILD for R_A is a triangle having a maxi. ordinate at O_2 of 3/4

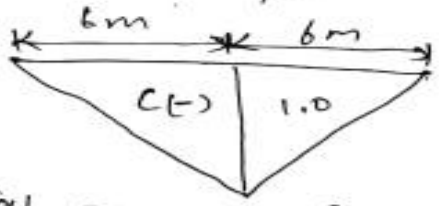
→ ILD for the member P_S

When load is at O_2

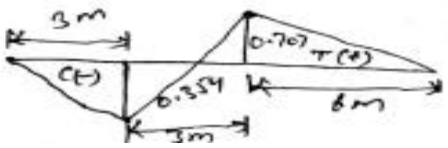
$$P_S = \frac{3}{12} = 0.25 \text{ (comp.)}$$

At T

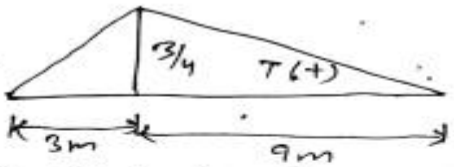
$$P_S = \frac{6}{12} = 0.5 \text{ (Ten.)}$$



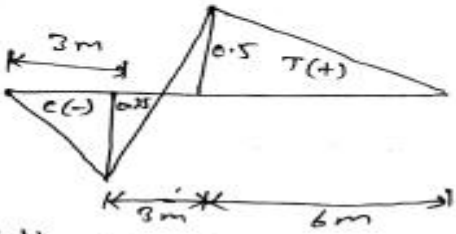
(a) ILD for P_P



(b) ILD for P_Q



(c) I.L.D for P_R



(d) ILD for P_S

Q.3 Solution

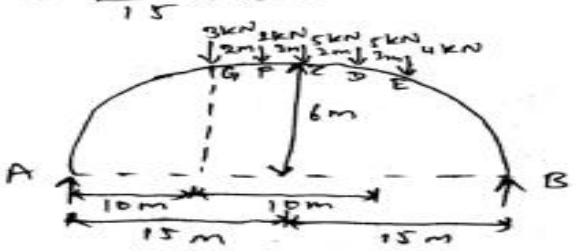
Q → 3

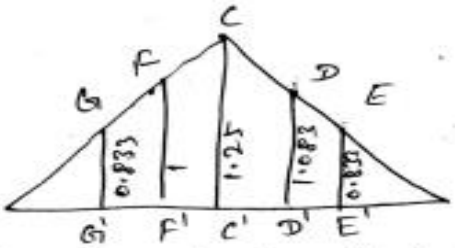
Ans :-

Horizontal thrust ordinates of ILD

$$CC' = \frac{l}{4r} = \frac{30}{4\times 6} = 1.25$$

$$DD' = \frac{1.25}{15} \times (15-2) = 1.083$$





ILD for horizontal thrust

$$EE' = \frac{1.25}{15}(15-5) = 0.833$$

$$FF' = \frac{1.25}{15}(15-3) = 1$$

$$GG' = \frac{1.25}{15}(15-5) = 0.833$$

Horizontal thrust

$$= 4\times 0.833 + 5\times 1.083 + 5\times 1.25 + 3\times 1 + 3\times 0.833$$

$$H = 20.496 \text{ kN}$$

→ At the section under the tail load

considering the tail load slightly to the right side of the each

$$V_A = \frac{1}{30}((4\times 10)+(5\times 13)+(5\times 15)+(3\times 18)+(3\times 20))$$

$$= 9.8 \text{ kN}$$

The equation of Parabola is :-

$$y = \frac{4rx}{L^2}(L-x)$$

$$= \frac{4\times 6x}{30^2}(30-x)$$

$$= \frac{2x}{75}(30-x) = \frac{2\times 30x}{75} - \frac{2x^2}{75}$$

$$\frac{dy}{dx} = \tan\theta = \frac{2\times 30}{75} - \frac{4x}{75}$$

At $x = 10\,m$, $\tan\theta = 0.267$

$\theta = 14.931^\circ$

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$M = 9.8 \times 10 - 20.496 \times y$

As at $x = 10\,m$

$$y = \frac{2\times 10}{75}(30-10)$$

$= 5.333\,m$

$M = 9.8 \times 10 - 20.496 \times 5.333$

$= -11.312\ kN-m$

$F = V_A \cos\theta - H \sin\theta$

$= 9.8 \cos 14.931 - 20.496 \sin 14.931^\circ$

$= 4.188\ kN (\downarrow\uparrow)$

$N = H\cos\theta + V_A \sin\theta$

$= 20.496 \cos 14.931 + 9.8 \sin 14.931$

$N = 22.329\ kN$

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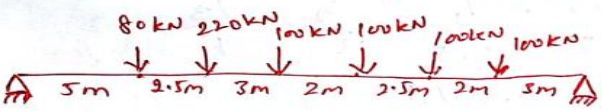
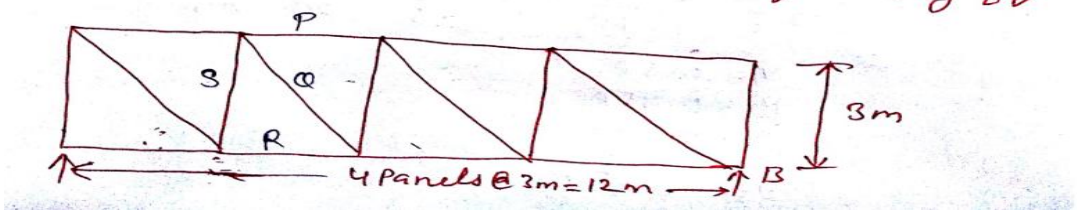
FIRST 20 MT. CLASS QUESTIONS	Q.1 The load system shown in fig moves from right to left on a girder of span 20 m. Find the maxi. shear force at a section 7.5 m from the left end. 	**CO 1**	**PO 1**
2 HRS. SOLVABLE HOME ASSIGNMENT (H.A.) QUESTIONS	Q.2 Draw ILD for force in the members P, Q, R, S of truss shown in following fig:- 	**CO 2**	**PO 2**
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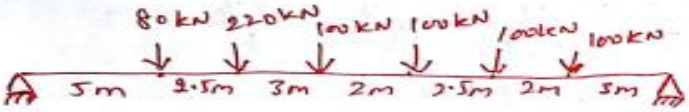

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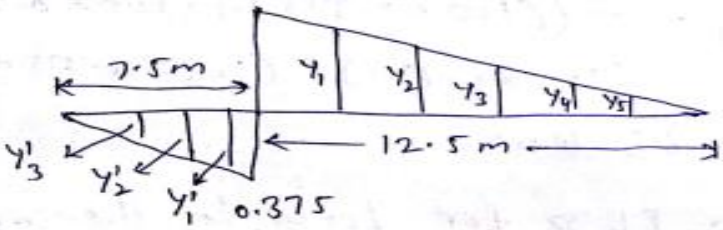

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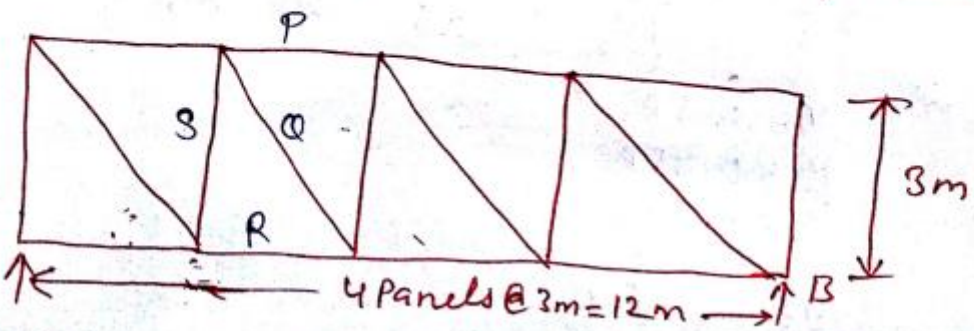

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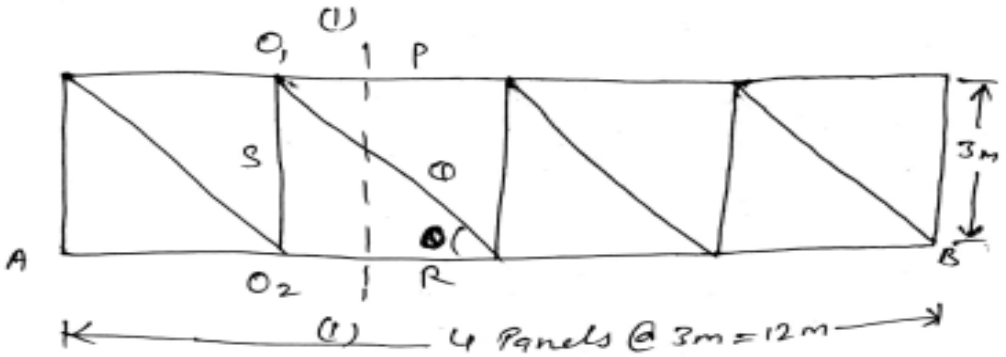

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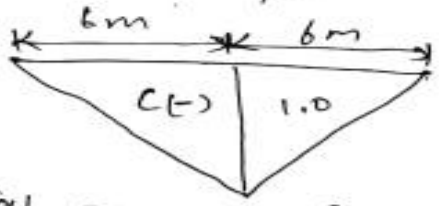
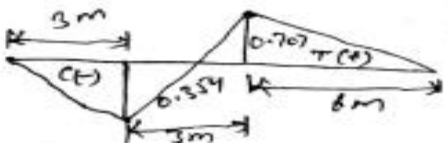
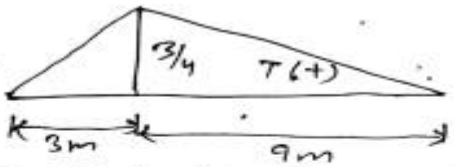


(a) ILD for P_P



(b) ILD for P_Q



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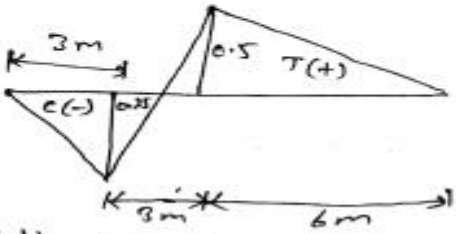

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Q.3 Solution

Q → 3

Ans :-

Horizontal thrust ordinates of ILD

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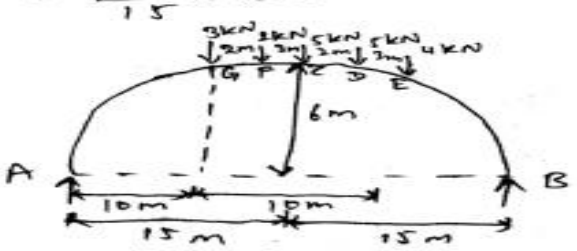

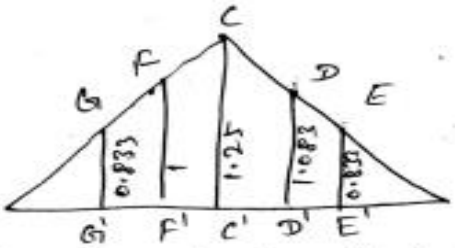

ILD for horizontal thrust

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Horizontal thrust

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$$H = 20.496 \text{ kN}$$

→ At the section under the tail load

considering the tail load slightly to the right side of the each

$$V_A = \frac{1}{30}((4\times 10)+(5\times 13)+(5\times 15)+(3\times 18)+(3\times 20))$$

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The equation of Parabola is :-

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$$= \frac{2x}{75}(30-x) = \frac{2\times 30x}{75} - \frac{2x^2}{75}$$

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$\theta = 14.931^\circ$

At $x = 10\,m$, $\tan\theta = 0.267$

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As at $x = 10\,m$

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$= 5.333\,m$

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$= -11.312\ kN-m$

$F = V_A \cos\theta - H \sin\theta$

$= 9.8 \cos 14.931 - 20.496 \sin 14.931^\circ$

$= 4.188\ kN (\downarrow\uparrow)$

$N = H\cos\theta + V_A \sin\theta$

$= 20.496 \cos 14.931 + 9.8 \sin 14.931$

$N = 22.329\ kN$

POORNIMA
COLLEGE OF ENGINEERING

TUTORIAL SHEET

TUTORIAL SHEET SHEET No. 5

Campus: PCE Course: B.Tech Class/Section: II 4Year Date: 30/8/19

Name of Faculty: Dr. Shilpi Jain Name of Subject: AEM Code: 3CE2-01

Date of Tut. Sheet Preparation:..... Scheduled Date of Tut.:.....Actual Date of Tut. :.....

Name of Student:.....Scheduled & Actual Date of H.A. Submission:.....&.....

	Questions	CO	PO
FIRST 20 MT. CLASS QUESTIONS	Q.1. Obtain the Laplace transform of $\frac{\cos at - \cos bt}{t}$.	4	2
	Q.2. (a) Evaluate $L\left\{\frac{e^{-3t}\sin 2t}{t}\right\}$	4	2
	(b) $\left\{\frac{\cos 2t - \cos 3t}{t}\right\}$		
2 HRS. SOLVABLE HOME ASSIGNMENT (H.A.) QUESTIONS	Q.3. find the $L\{e^{5t}\cos 3t\}$	1	1
	Q.4. Obtain (a) $L\left\{\frac{e^{-t}\sin t}{t}\right\}$	4	2
	(b) $L\left\{\int_0^\infty t e^{-3t}\sin 2t\, dt\right\}$		
OTHER IMPORTANT QUESTIONS	Q.5. Using Convolution Th., Solve	4	2
	(a) $L^{-1}\left\{\frac{s}{(s^2+1)^2}\right\}$		
	(b) $L^{-1}\left\{\frac{1}{(s^2-4)^2}\right\}$		

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Solution

Sol^n 1. $L\left\{\frac{\cos at - \cos bt}{t}\right\} = \int_s^\infty \left(\frac{s}{s^2+a^2} - \frac{s}{s^2+b^2}\right) ds = \left[\frac{1}{2}\log\frac{s^2+a^2}{s^2+b^2}\right]_s^\infty$

$= \frac{1}{2}\log\frac{s^2+b^2}{s^2+a^2}$

Sol^n 2. (a) $L\left\{e^{-3t}\frac{\sin 2t}{t}\right\} = \int_s^\infty \left[\frac{2}{(s+3)^2+4}\right] ds = 2\left[\frac{1}{2}\tan^{-1}\frac{(s+3)}{2}\right]_s^\infty$

$= \tan^{-1}\infty - \tan^{-1}\frac{s+3}{2}$

$= -\cot^{-1}\frac{s+3}{2}$

(b) $L\left\{\frac{(\cos 2t - \cos 3t)}{t}\right\} = \frac{1}{2}\log\frac{s^2+9}{s^2+4}$

Sol^n 3 $L\{e^{5t}\cos 9t\} = \left[\frac{s-5}{(s-5)^2+3^2}\right]$ [$\because$ using 1st shift Rule]

Sol^n (4) (a) $L\left\{e^{-t}\int_0^t \frac{\sin t}{t}\,dt\right\}$

Let $f(t) = \frac{\sin t}{t}$

$L\{f(t)\} = \int_s^\infty \frac{1}{s^2+1} ds = \left[\tan^{-1}s\right]_s^\infty = \cot^{-1}s$

$\Rightarrow L\left\{\frac{e^{-t}\sin t}{t}\right\} = \cot^{-1}(s+1)$

(b) $L\left\{\int_0^t t e^{-3t}\sin 2t\,dt\right\} = (-1)^1\frac{d}{ds}\left[\frac{2}{(s+3)^2+4}\right]$

$= -\frac{d}{ds}\left[(s+3)^2+4\right]^{-1}$

$= \left[(s+3)^2+4\right]^{-2} \cdot 2(s+3)$

$= \frac{2(s+3)}{\left[(s+3)^2+4\right]^2}$

Taking $s \to 0$ both sides.

Now $\int_0^\infty t e^{-3t}\sin 2t\,dt = \frac{6}{[9+4]^2} = \frac{6}{(13)^2}$

Q.5 (a) $L^{-1}\left\{\frac{s}{(s^2+1)^2}\right\}$

Conv. Th.

$$= \frac{2}{2}\int_0^t \cos u \cos(t-u)\,du$$

$$= \frac{1}{2}\left[\int_0^t \left[\cos(u+t-u)+\cos(u-t+u)\right]du\right.$$

$$= \frac{1}{2}\left[\cos t\,[u]_0^t + \left[\frac{\sin(2u-t)}{2}\right]_0^t\right]$$

$$= \frac{1}{2}\left[t\cos t + \frac{\sin t}{2} + \frac{\sin t}{2}\right] = \frac{1}{2}\left[t\cos t + \sin t\right]$$

Soln. 5 (b) $L^{-1}\left\{\frac{1}{(s^2+4)^2}\right\}$

Conv. Th.

$$= \frac{2}{2}\int_0^t \sin 2u \sin(t-u)\,du$$

$$= \frac{1}{2}\left[\int_0^t \left[\cos(2u-2t+2u) - \cos(2u+2t-2u)\right]du\right.$$

$$= \frac{1}{2}\left[\frac{\sin(4u-2t)}{4} - (\cos 2t)\,u\right]_0^t$$

$$= \frac{1}{2}\left[\frac{\sin 2t}{4} - t\cos 2t + \frac{\sin 2t}{4}\right]$$

$$= \frac{1}{2}\left[\frac{\sin 2t}{2} - t\cos 2t\right]$$

POORNIMA
COLLEGE OF ENGINEERING

TUTORIAL SHEET

TUTORIAL SHEET SHEET No. 1

Campus: PCE Course: B.Tech Class/Section: III rd Date: 16/8/2021

Name of Faculty: Ritunj.s Rathore Name of Subject: Engineering Mechanics Code: 3363-04

Date of Tut. Sheet Preparation: 14/8/2021 Scheduled Date of Tut.: Actual Date of Tut.:

Name of Student: Scheduled & Actual Date of H.A. Submission: &

	Questions	CO	PO
FIRST 20 MT. CLASS QUESTIONS	Q.1 Define Rigid Body & deformable body.	CO1	PO1
	Q.2 Draw the flow chart of system of forces	CO1	PO1
2 HRS. SOLVABLE HOME ASSIGNMENT (H.A.) QUESTIONS	Q.3 Determine the resultant of two forces acting on an Rigid body at an angle of 45° at 60N & 40N respectively	CO2	PO2
OTHER IMPORTANT QUESTIONS	Q.4 Find the angle between two equal forces of P when their resultant is equal To (i) P (ii) P/2	CO2	PO2

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DETAILED LECTURE NOTES

Ans 1. **Rigid Body :-** A Body in which the distance between two particles remains constant & size & shape of the body do not change is called rigid body.

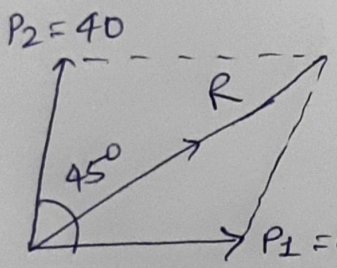
Deformable body :- A body in which the distance between two particles do not Constant & size & shape changed of the body

Ans 2

System of force

- Coplanar
  - Concurrent
  - Parallel
  - Non concurrent
- Non Coplanar
  - concurrent
  - Parallel
  - NON-concurrent

Ans 3



$$\text{Resultant } (R) = \sqrt{F_1^2 + F_2^2 + 2F_1F_2\cos\theta}$$

$$R = \sqrt{(60)^2 + (40)^2 + 2 \times 60 \times 40 \cos 45^\circ}$$

$$R = 92.70\,N$$

Location of Resultant :-

$$\tan\alpha = \frac{f_2 \sin\theta}{f_1 + f_2\cos\theta}$$

$$\Rightarrow \frac{40\sin 45^\circ}{60 + 40\cos 45^\circ} = \frac{40 \times \frac{1}{\sqrt{2}}}{60 + 40 \times \frac{1}{\sqrt{2}}}$$

$$\tan\alpha = 0.320$$

$$\alpha = \tan^{-1}(0.320) = 17^\circ 44' 40''$$

Ans 4 (i) For P

Given $F_1 = F_2 = P$

$$P = \sqrt{P_1^2 + P_2^2 + 2P_1P_2\cos\theta}$$

Square both sides

$$P^2 = P_1^2 + P_2^2 + 2P_1P_2\cos\theta$$

$$P^2 = P^2 + P^2 + 2P^2\cos\theta \qquad \because P_1 = P_2 = P$$

$$P^2 = 2P^2(1 + \cos\theta)$$

$$1 = 2(1 + \cos\theta)$$

$$1 + \cos\theta = 1/2$$

$$\cos\theta = \frac{1}{2} - 1$$

$$\cos\theta = -\frac{1}{2}$$

$$\cos\theta = \cos 120^\circ$$

$$\boxed{\theta = 120^\circ}$$

(ii) for P/2

$$\frac{P^2}{4} = P^2 + P^2 + 2P_1 P_2 \cos\theta$$

$$\frac{P^2}{4} = 2P^2 + 2P^2 \cos\theta$$

$$\frac{P^2}{4} = 2P^2 (1 + \cos\theta)$$

$$1 + \cos\theta = \frac{P^2}{4 \times 2P^2}$$

$$1 + \cos\theta = \frac{1}{8}$$

$$\cos\theta = \frac{1}{8} - 1 = -\frac{7}{8}$$

$$\cos\theta = (-0.875)$$

$$\theta = 151^\circ 2' 4''$$

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POORNIMA
COLLEGE OF ENGINEERING

TUTORIAL SHEET

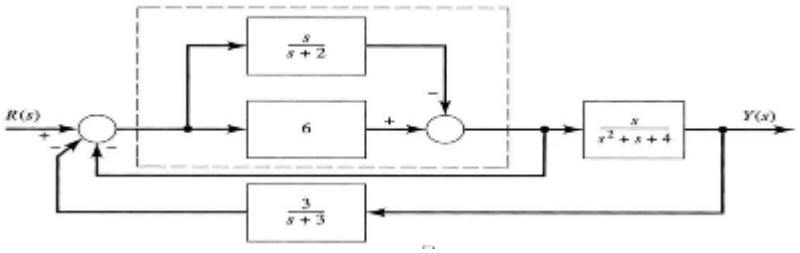
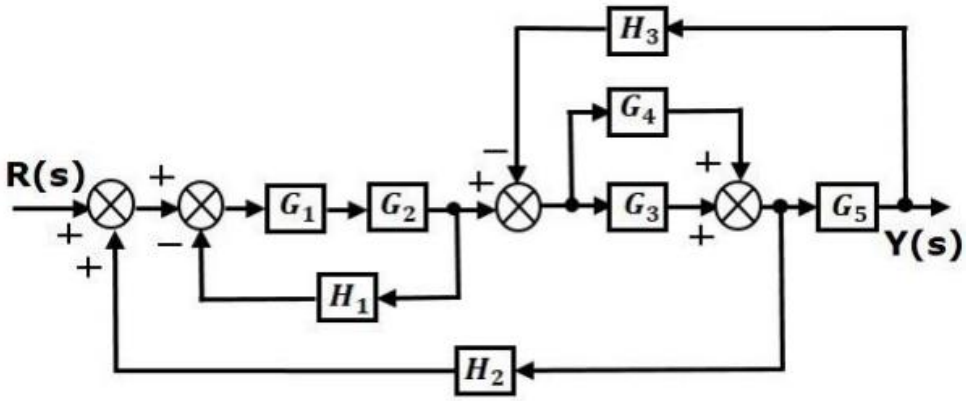
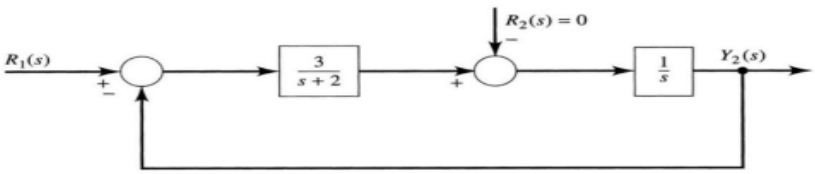
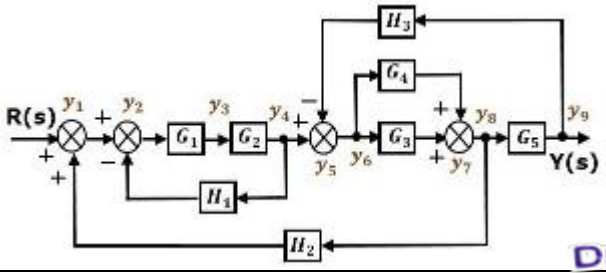
TUTORIAL SHEET

SHEET No….

Campus: PCE **Course: B.Tech.** **Class/Section: V Sem.** **Date: 12 Sept.2020**

Name of Faculty: Mr. Tarun Mishra **Name of Subject: Control System** **Code: 5EC4-03**

Name of Student: **Scheduled & Actual Date of H.A. Submission: 21 September, 2020**

	Questions	CO	PO
FIRST 20 MT CLASS QUESTIONS	Q.1 Determine the transfer function. 	1	1,2,3
2 HRS. SOLVABLE HOME ASSIGNMENT (H.A.)	Q. 1 Consider the block diagram shown in the following figure. Let us simplify (reduce) this block diagram using the block diagram reduction rules. 	1	1,2,
OTHER IMPORTANT QUESTIONS	Q 1. Determine the transfer function Y2(s)/R1(s).  Q.2 Convert block diagram to signal flow graph 	1	1,2

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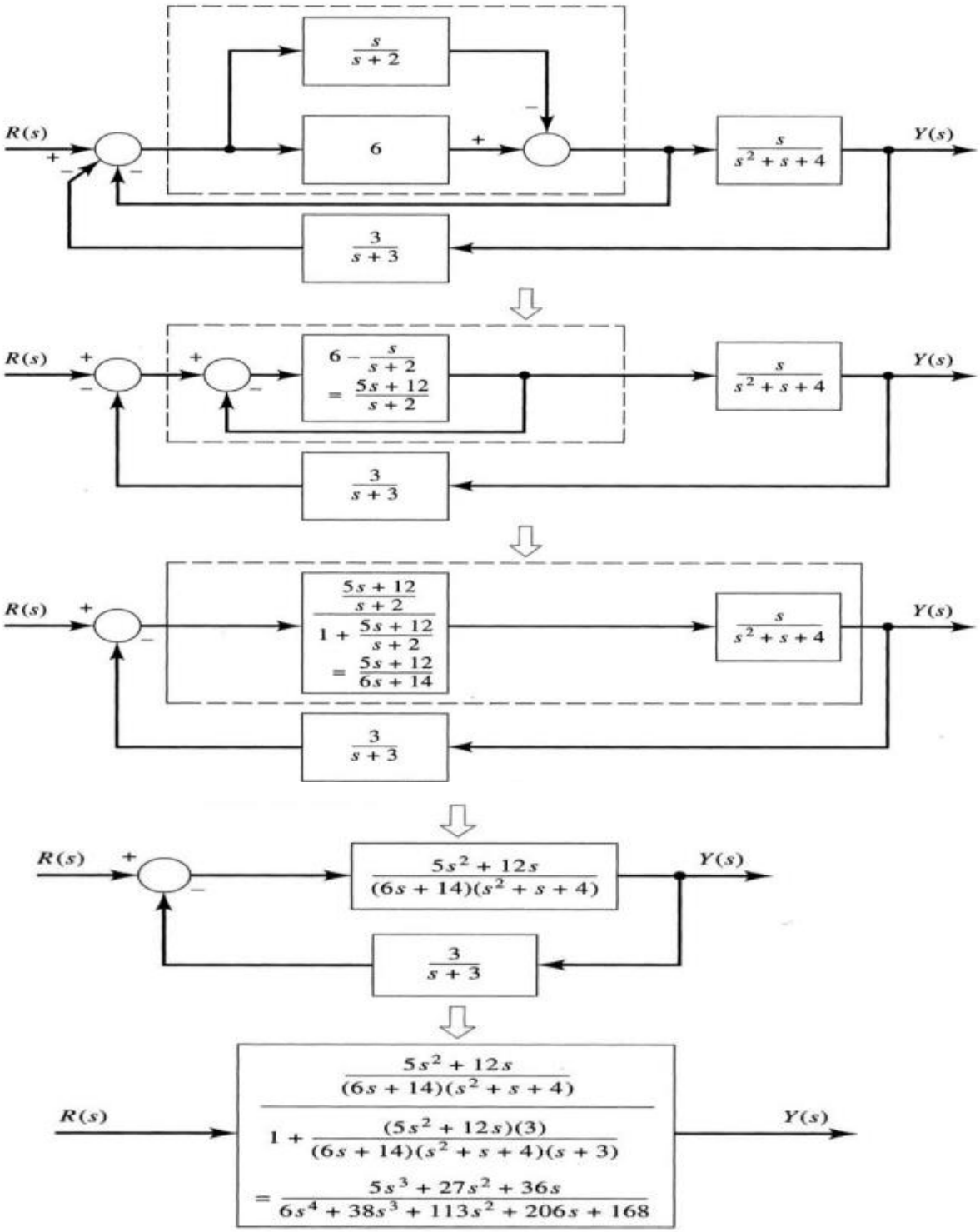
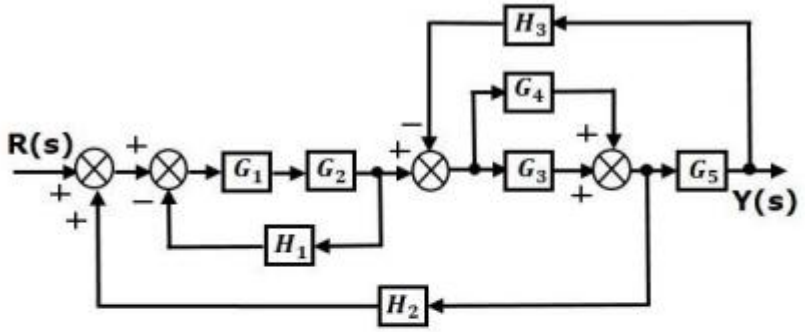
Answers

Q1

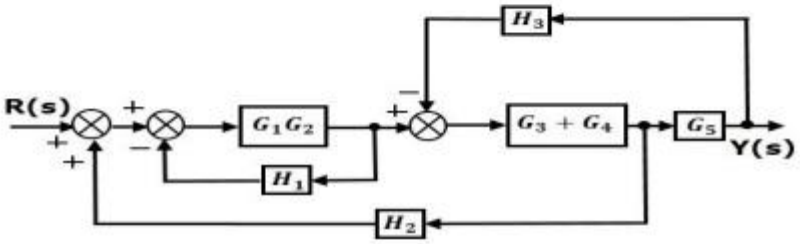
Ans 1



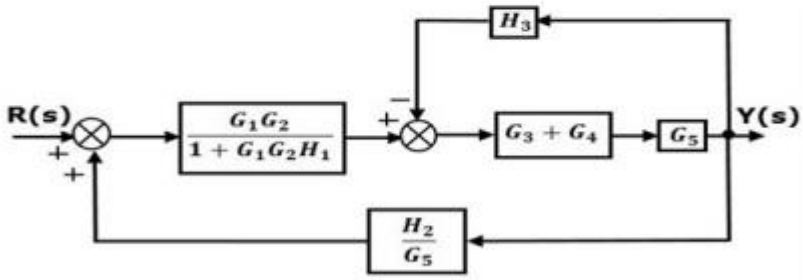
Q1.



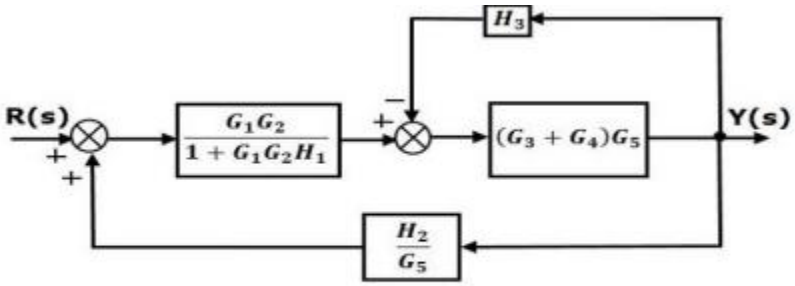
Step 1 – Use Rule 1 for blocks G_1 and G_2. Use Rule 2 for blocks G_3 and G_4. The modified block diagram is shown in the following figure.



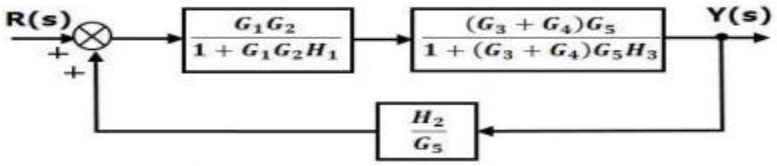
Step 2 – Use Rule 3 for blocks G_1G_2 and H_1. Use Rule 4 for shifting take-off point after the block G_5. The modified block diagram is shown in the following figure.



Step 3 – Use Rule 1 for blocks $(G_3 + G_4)$ and G_5. The modified block diagram is shown in the following figure.

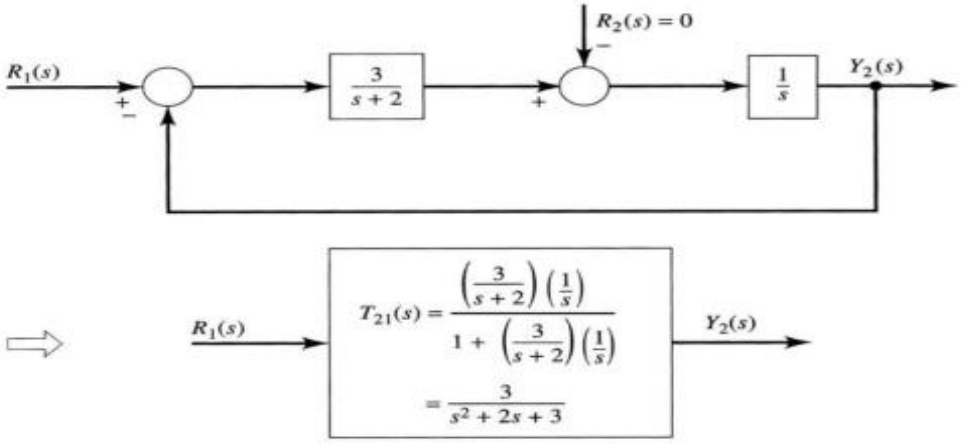


Step 4 – Use Rule 3 for blocks $(G_3 + G_4)G_5$ and H_3. The modified block diagram is shown in the following figure.

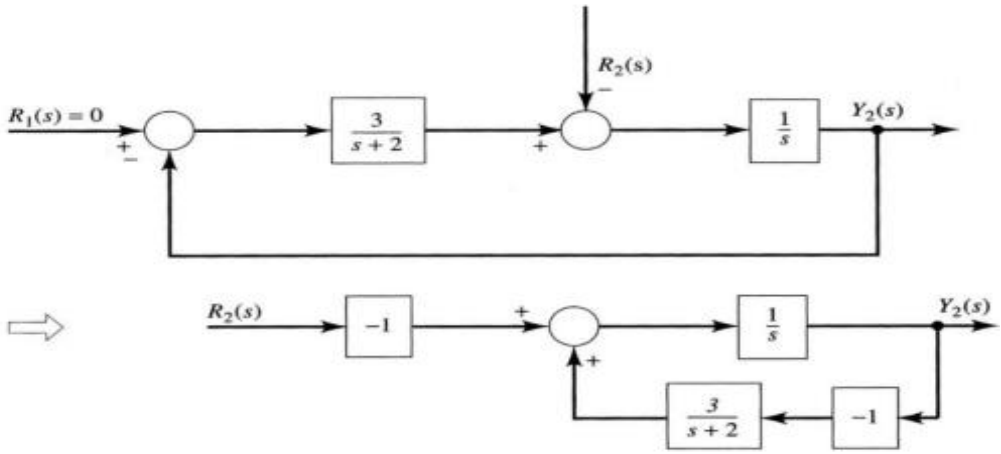


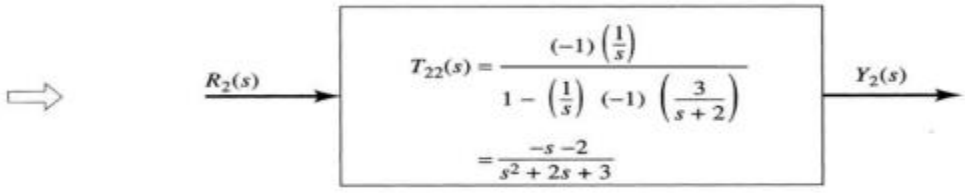
Step 5 – Use Rule 1 for blocks connected in series. The modified block diagram is shown in the following figure.

Q 1



(*a*)





(*b*)

Q2.