✓	22	May 19
	23	
	29	NOV 20, Jan 20
	38	
	41	July 21
	42	Aug 21
	47	
	54	
✓	56	July 19, Jan 19, June 22
	59	Apr 21
✓	62	July 22
✓	65	May 22, Apr 22
	67	Sep 21
	68	Oct 20
✓	73	June 22, march 19
	75	
	76	sep 19
✓	78	NOV 21, dec 21, dec 20
✓	79	Apr 22, June 19, NOV 17
✓	80	March 21, Jan 21
	82	
	85	Feb 22 or 21.

Subramanian

① List ⇒ $\tan\theta = \frac{FLM}{W \cdot GM(F)}$ or $\frac{w \cdot d}{W \cdot GM(F)}$

② $FSC = \frac{idi}{W}$ & $\frac{Lb^3 \cdot di}{12 \cdot W}$ $\left(i = \frac{lb^3}{12}\right)$

& $\frac{FSM}{W}$

③ $GM = KM - KG$

$KB + BM$

$d/2$ $B^2/12d$

④ $GG_1 = \frac{w \cdot d}{W}$

⑤ $RM = W \cdot GZ$

$W \cdot GM \sin\theta$

⑥ change in draft $= \frac{(1.020 - 1.005)}{0.025} \times FWA$

& $FWA = \frac{w}{40TPC}$

⑦ Summer to winter/tropical loadline $= \frac{1}{48} \times$ summer draft

⑧ Trim :- $Tc = \frac{TM}{MCTC}$ or $\frac{w \cdot d}{MCTC}$

$Ta = \frac{Tc \times AF}{LBP}$ $Tf = Tc - Ta$

⑨ DWT available = sinkage × TPC

⑩ mean sinkage $= \frac{w}{TPC}$

⑪ $GZ = GM \sin\theta$

$GZ = \sin\theta (GM + \frac{1}{2} BM \tan^2\theta)$

From July 2022 to Jan 16

July 2022 :- March 19 [Q.NO 14]

June 2022 :- Both Hindship

May 2022 :- may 19, march 18 [Q.NO.13]

April 2022 :- Both Hindship.

March 2022 :- march 17 AM [Q.NO. 20]

Feb 2022 :- may 18 [Q.NO. 17]

Jan 2022 :- [Q.NO. 5(b)]

DEC 2021 :- [Q. NO. 6]

NOV 2021 :- Sep 21, march 21 [Q.NO 1]

OCT 2021 :- Sep 18 [QNO.15]

(2) M.V. HINDSHIP

(1) corn to after draft = $\frac{\text{Trim} \times \text{LCF}}{\text{LBP}}$

(2) Total trim = $\frac{\text{LCB} - \text{LCG}}{\text{MCTC} \times 100} \times$ disp.

If -ve, that mean, trim by head

& Ta = $\frac{\text{Total trim} \times \text{LCF}}{\text{LBP}}$

& Tf = Total trim - Ta

(3) For finishing on even Keel ⇒ LCB = LCG

(4) For finishing upright ⇒ LCM = FLM

(5) FSC = $\frac{\text{FSM}}{W}$

(6) GZ = KN - corrected KG sin θ

Nov 21 ①
Sep 21
Mar 21

Similiar:-
July 19

Draft fwd: 8.500m
Draft aft: 9.700m
Trim: 1.200m by astern

Initial trim: 1.200m
Final trim: 0.500m
Trim caused, Tc: 0.700m or 70cm by head

Trim caused, $Tc = \frac{TM}{MCTC}$

$70 = \frac{TM}{250}$

$TM = 70 \times 250$
$= 17500$ by head

Let us assume x tonnes of cargo to be loaded in 60m fwd
& 600-x tonnes of cargo to be loaded in 40m aft

Weight	distance	Trimming moment
x	60m fwd	60x by head
600-x	40m Aft	$40(600-x) = 24000-40x$ by stern

$17500 = 60x - (24000 - 40x)$
$17500 = 60x - 24000 + 40x$
$17500 + 24000 = 100x$
$41500 = 100x$
$x = 415t$ in 60m fwd
& $600-x = 600-415$
$= 185t$ in 40m aft

Since the COF is amidship
Ta & Tf = $Tc/2 = 0.7/2 = 0.350m$

Mean sinkage = $\frac{w}{TPc} = \frac{600}{20} = 30cm$
$= 0.300m$

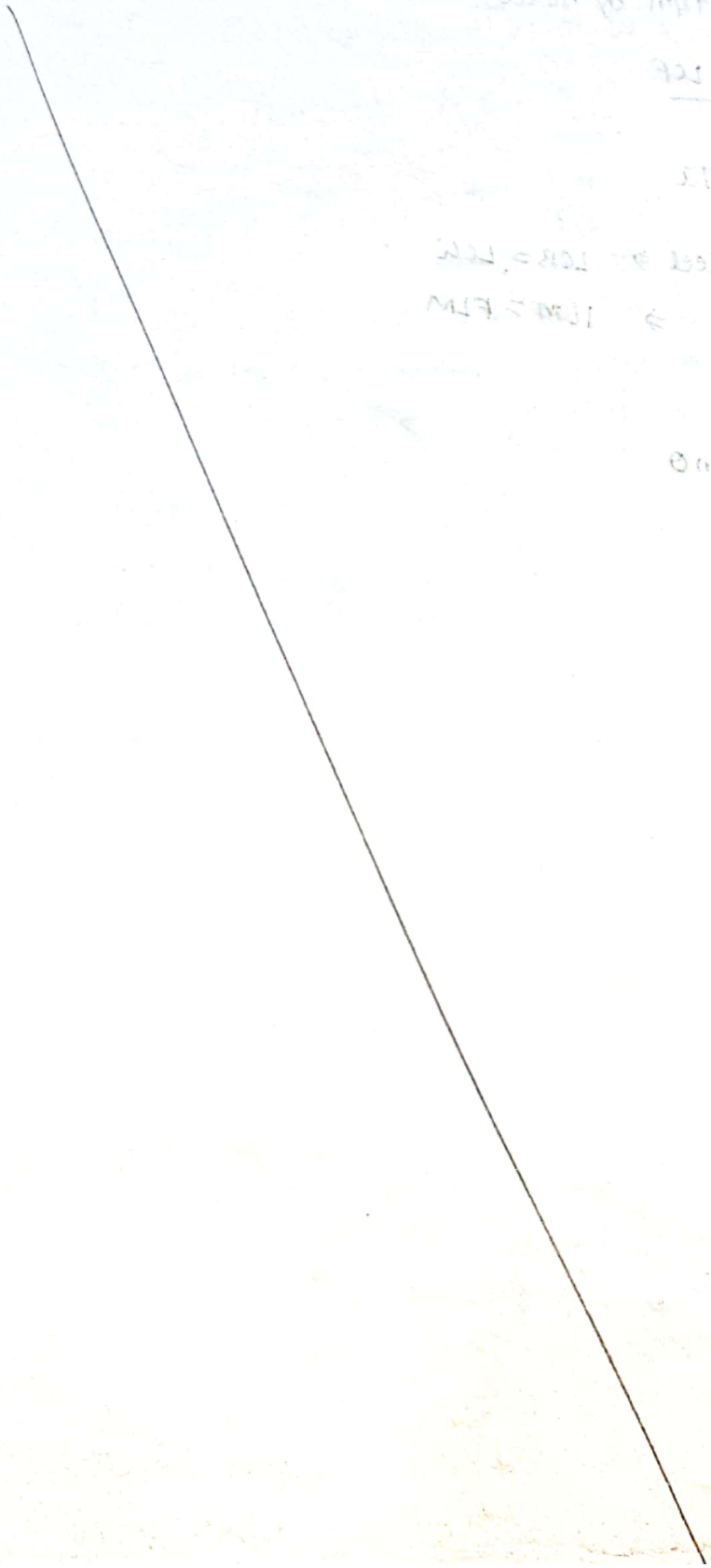
	Fwd	Aft
Original draft:	8.500m	9.700m
Mean sinkage:	(+)0.300m	(+)0.300m
Draft:	8.800m	10.000m
Tf & Ta:	(+)0.350m	(-)0.350m
Final draft:	9.150m	9.650m

Aug 21 ③

∴ Cargo to load = sinkage × TPC

= 20 × 25

= 500 t



July 21 (7)
Dec 20
May 17

Let us assume vessel's summer displacement be x tons (solve this once)

Displacement = u/w vol. x density

x = u/w vol x 1.025

u/w vol = $\frac{x}{1.025}$ ——— (1)

Now, we discharged 300 t

so, displacement in DW = $x - 300$ t

(2) Displacement = u/w vol. x density

$x - 300$ = u/w vol x 1.010

u/w vol. = $\frac{x-300}{1.010}$ ——— (11)

Since at both the time vessel was at summer draft
Hence, u/w vol. remain the same at both time

& ∴ Eqn (1) = (11)

$$\frac{x}{1.025} = \frac{x-300}{1.010}$$

$$1.010x = 1.025(x-300)$$

$$1.010x = 1.025x - 307.5$$

$$307.5 = 1.025x - 1.010x$$

$$307.5 = 0.015x$$

$$x = \frac{307.5}{0.015}$$

$$x = 20500 \text{ t}$$

Hence, initial displacement is 20,500 t

Remark	weight	KG	vertical moment
Initial	20500	7.85	160925
Discharges	(-) 300	14	(-) 4200
	Final W = 20200		Final v.moment = 156725

Final KG = $\frac{\text{Final v.moment}}{\text{Final W}}$

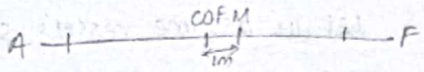
= $\frac{156725}{20200}$ = 7.759m

FSC = $\frac{FSM}{W}$ = $\frac{1500}{20200}$ = 0.074m

KM = 8.050 m
Final KG = 7.759m
GM (solid) = 0.291m
FSC = 0.074 m
GM (Fluid) = 0.217 m

Apr 21 ⑤
July 17
may 16

Initial draft fwd : 7.2m
draft aft : 7.4m
Initial Trim : 0.2m
Final Trim = 0.0m



T_c = 0.2m or 20 cm by head

Trimming moment

Consume 450 shift — x — 60 ft of COF — 70+60 = 130

27000 by head
130x by aft

TM = 27000 − 130x

$$T_c = \frac{TM}{MCTC}$$

$$20 = \frac{TM}{200}$$

TM = 4000 tm by head

$$4000 = 27000 - 130x$$
$$130x = 27000 - 4000$$
$$130x = 23000$$
$$x = 176.92\ t$$

176.92t of oil is to be transferred from fwd deep tank to aft deep tank

---

Jan 22

weight of oil rcrd = vol × density

$$400 = 16 \times 10 \times d \times 0.95$$
$$d = 2.6m$$

5000	7.0	35000
(+) 400	1.3	(+) 520
5400		35520

$$\text{Final KG} = \frac{35520}{5400}$$
$$= 6.578$$

KM = 7.2m

$$GM(solid) = KM - KG$$
$$= 7.2 - 6.578$$
$$= 0.622\ m$$

$$FSC = \frac{\rho b^3 \cdot d}{12 \cdot \nabla}$$
$$= \frac{16 \times 10^3 \times 0.95}{12 \times 5400}$$
$$= 0.235$$

$$GM(F) = GM(S) - FSC$$
$$= 0.622 - 0.235$$
$$= 0.387\ m$$

Dec 21 ⑥ Displacement, W = 10000 t

Initial GM (solid) = 0.5m

FSM = 120 TM

FSC = $\frac{FSM}{W} = \frac{120}{10000} = 0.012$

Initial GM = 0.5 m

FSC = 0.012 m

GM(Fluid) = 0.488 m

Initial listing moment

$\tan\theta = \frac{ILM}{W \cdot GM(F)}$

$\tan 2^\circ = \frac{ILM}{10000 \times 0.488}$

$ILM = \tan 2^\circ \times 10000 \times 0.488$

$= 170.413$ tm to starboard

LM caused = W·d

$= 100 \times 6 = 600$ tm to starboard

Final listing moment, FLM = 170.413 + 600

= 770.413 tm to stbd

$GG_1(1) = \frac{dW}{W} = \frac{100 \times 2}{10000} = 0.02$ m

Initial GM(F) = 0.488 m

$GG_1(1)$ = 0.020 m

Final GM(F) = 0.468 m

Final list ⇒ $\tan\theta = \frac{FLM}{W \cdot GM(F)}$

$\tan\theta = \frac{770.413}{10000 \times 0.468}$

$\tan\theta = 0.16462$

$\theta = 9.35^\circ$ or $9^\circ 20.9'$ to stbd.

NOV 20 ⑦ $\tan\theta = \frac{LM}{W \cdot GM(F)}$

$\theta = 9^\circ$ when heavy lift is being loaded

LM caused = W·d

$= 95 \times 15 = 1425$ tm

Final W = 7000 + 1600 + 95

= 8695 t

KM in final condition = 8.0 m

Remarks	Weight (t)	KG (m)	V. moment (tm)
Initial	7000	7.0	49000
Cargo	+1600	x	(+) 1600x
Heavy lift	+ 95	25	(+)2375
Final W :	8695	Final V.moment :	51375 + 1600x

$$\text{Final KG} = \frac{51375 + 1600x}{8695}$$

$$GM = KM - KG$$

$$= 8.0 - \left(\frac{51375 + 1600x}{8695}\right)$$

$$= \frac{69560 - 51375 - 1600x}{8695}$$

$$= \frac{18185 - 1600x}{8695}$$

$$\tan\theta = \frac{LM}{W.GM}$$

$$\tan 9^\circ = \frac{1425}{8695 \times \frac{18185 - 1600x}{8695}}$$

$$\tan 9^\circ = \frac{1425}{18185 - 1600x}$$

$$0.158 = \frac{1425}{18185 - 1600x}$$

$$0.158(18185 - 1600x) = 1425$$

$$2873.23 - 252.8x = 1425$$

$$2873.23 - 1425 = 252.8x$$

$$1448.23 = 252.8x$$

$$x = 5.729\ m$$

So, the maximum KG at which 1600t are to be loaded is

5.729 m

Oct 20 ⑧

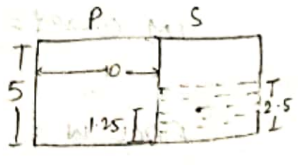
volume of water filled = $15 \times 10 \times 2.5$

$= 375\ m^3$

weight of water filled = volume × density

$= 375 \times 1.025$

$= 384.375\ t$



LM caused = w.d

$= 384.375 \times 5$

$= 1921.875\ tm$

Remark	Weight(t)	KG(m)	V. moment (tm)
Initial	25500	10	255000
Ballast	(+) 384.375	1.25	(+) 480.469

Final W = 25884.375 Final V. moment = 255480.469

$$\text{Final KG} = \frac{\text{Final V. moment}}{\text{Final W}}$$

$$= \frac{255480.469}{25884.375}$$

$$= 9.870\text{m}$$

$$FSC = \frac{id}{W}$$

$$= \frac{lb^3 . dl}{12 . W}$$

$$= \frac{15 \times 10^3 \times 1.025}{12 \times 25884.375} = 0.049\text{m}$$

KM = 10.500 m

Final KG = 9.870m

GM (solid) = 0.630 m

FSC = 0.049 m

GM (fluid) = 0.581 m

List

$$\tan\theta = \frac{LM}{W . GM(f)}$$

$$\tan\theta = \frac{1921.875}{25884.375 \times 0.581}$$

$$\tan\theta = 0.12779$$

$$\theta = 7.28^\circ \text{ or } 7^\circ 16.9'$$

March 20 ⑨ Final list, $\theta = 3^\circ$ $\tan\theta = \frac{LM}{W . GM}$

Let us assume x ton of cargo was washed overboard

$$LM = W . d$$
$$= x . 8$$
$$= 8x$$

Remark	Weight	KG	V. moment
Ship	8000	8.0	64000
weight washed	(-) x	10.0	(-) 10x

Final W = 8000-x Final V. moment: 64000-10x

$$\text{Final KG} = \frac{64000 - 10x}{8000 - x}$$

KM = 8.6m

$$GM(solid) = KM - KG$$

$$= 8.6 - \left(\frac{64000 - 10x}{8000 - x}\right)$$

$$= \frac{8.6(8000 - x) - 64000 + 10x}{8000 - x}$$

$$= \frac{68800 - 8.6x - 64000 + 10x}{8000 - x}$$

$$= \frac{4800 + 1.4x}{8000 - x}$$

$$GM(Fluid) = GM(solid) - FSC$$

$$= GM(solid) - \frac{FSM}{W}$$

$$= \frac{4800 + 1.4x}{8000 - x} - \frac{800}{8000 - x}$$

$$= \frac{4800 + 1.4x - 800}{8000 - x}$$

$$= \frac{4000 + 1.4x}{8000 - x}$$

$$\tan\theta = \frac{LM}{W \cdot GM(F)}$$

$$\tan 3^\circ = \frac{8x}{8000 - x \times \frac{4000 + 1.4x}{8000 - x}}$$

$$\tan 3^\circ = \frac{8x}{4000 + 1.4x}$$

$$209.631 + 0.073x = 8x$$

$$209.631 = 8x - 0.073x$$

$$209.631 = 7.927x$$

$$x = 26.445\ t$$

So, **26.445 t** of cargo was washed overboard

Jan 20 (10) (a) When maximum list

* The maximum list is when crane had just lifted the weight

Remark	Weight	KG	V.moment
Ship	18000	7.0	126,000
Load	(+) 70	40	(+) 2,800
Final W :	18070	Final V. moment:	128,800

$$\text{Final KG} = \frac{\text{Final V.moment}}{\text{Final W}}$$

$$= \frac{128,800}{18070}$$

$$= 7.128\ m$$

KM : 7.900m

Final KG : 7.128m

GM : 0.772m

Listing moment = W·d

= 70 X 16

= 1120 tm to stbd

$$\text{Tan}\,\theta = \frac{LM}{W \cdot GM}$$

$$\text{Tan}\,\theta = \frac{1120}{18070 \times 0.772}$$

$$\text{Tan}\,\theta = 0.080287$$

$\theta = 4.59^\circ$ or $4^\circ 35.4'$ to stbd

(b) Final List when weight is loaded

Remark	weight (t)	KG (m)	V. moment (tm)
Ship	18000	7.0	126,000
load	(+) 70	12.0	(+) 840
Final W :	18070		Final V. moment : 126,840

$$\text{Final KG} = \frac{\text{Final V. moment}}{\text{Final W}}$$

$$= \frac{126,840}{18070}$$

$$= 7.019\,m$$

KM : 7.900m

Final KG : 7.019 m

GM : 0.881 m

Listing moment, LM = W·d

= 70 × 5

= 350 tm to stbd

List

$$\text{Tan}\,\theta = \frac{LM}{W \cdot GM}$$

$$\text{Tan}\,\theta = \frac{350}{18070 \times 0.881}$$

$$\text{Tan}\,\theta = 0.021985$$

$\theta = 1.26^\circ$ or $1^\circ 15.6'$ to stbd //

Nov 19 (11)

$GZ = GM \sin\theta$

↓

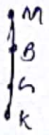
$KM - KG$

↓

$KB + BM$

↓ → $B^2/12d$

$d/2$



For box-shaped vessel, $KB = d/2 = 4/2 = 2m$

$$BM = \frac{B^2}{12d} = \frac{12^2}{12 \times 4} = 3m$$

$$KM = KB + BM$$
$$= 2 + 3$$
$$= 5m$$

$$GM = KM - KG$$
$$= 5 - 4$$
$$= 1$$

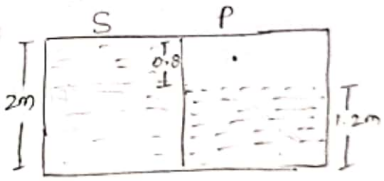
$$GZ = GM \sin\theta$$
$$= 1 \times \sin 5^\circ$$
$$= 0.087\ m$$

Sep 19 (12) Volume of HFO consumed $= 15 \times 12 \times (2 - 1.2)$ (see it once)

$$= 15 \times 12 \times 0.8$$
$$= 144\ m^3$$

Weight of HFO consumed = volume × density

$$= 144 \times 0.95$$
$$= 136.8\ t$$



* KG of oil consumed $= \frac{0.8}{2} + 1.2$

$$= 0.4 + 1.2$$
$$= 1.6\ m$$

Remarks	Weight	KG	vertical moment
Initial	10000	7.075	70750
HFO	(-) 136.8	1.6	(-) 218.88
	Final w = 9863.2 t		Final V. moment = 70531.12

$$\text{Final } KG = \frac{\text{Final V. moment}}{\text{Final w}}$$

$$= \frac{70531.12}{9863.2}$$
$$= 7.151\ m$$

$KM = 7.8$

$$GM(S) = KM - KG$$
$$= 7.8 - 7.151$$
$$= 0.649\ m$$

$$FSC = \frac{Lb^3 di}{12 \cdot w}$$
$$= \frac{15 \times 12^3 \times 0.95}{12 \times 9863.2}$$
$$= 0.208$$

$$GM(F) = GM(S) - FSC$$
$$= 0.649 - 0.208$$
$$= 0.441$$

LM caused = w·d

= 136·8 × 6

= 820·8 tm to stbd

List ⇒ $\tan\theta = \frac{LM}{W \cdot GM}$

$\tan\theta = \frac{820.8}{9863.2 \times 0.941}$

$\tan\theta = 0.188704$

$\theta = 10.69^\circ$ or $10^\circ 41.2'$ to stbd

may 22
May 19 (13) March 18 **

Same as subramanian book Exercise 11 : List Q.NO. (21) (solve it once)

Initial W = 10000 t

KM = 10.800 m

KG = 9.000 m

GM = 1.800 m

(a) ILM ⇒ $\tan\theta = \frac{ILM}{W \cdot GM}$

$\tan 10^\circ = \frac{ILM}{10000 \times 1.8}$

ILM = 3173.9 tm to stbd

Let us assume x tonnes of FW to be transferred.

* LM port = w·d

= x · 12 → 6+6

= 12x

Note:- In Q.No 8 & 12, we have taken half of breadth, bcz these was loading & discharging, but here it is shifting so d is 6+6 = 12

To bring the ship upright,

LM port = LM stbd

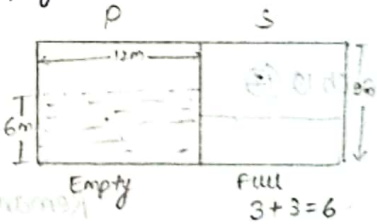
12x = 3173.9

x = 264.49 tonnes of FW is to be transferred to bring the ship upright.

(b) Quantity of FW in stbd tank = volume × density

= 12 × 12 × 9 × 1.000

= 1296 t



d = 6 − 3 = 3

2/3 of FW is to be transferred

So, Quantity of FW is to be transferred = $\frac{2}{3} \times 1296$

= 864 t

Height of FW to be transferred = $\frac{2}{3} \times 9$

= 6 m

* LM caused = w·d

= 864 × 12 (6+6)

= 10368 tm to port

ILM = 3173.9 tm to stbd

FLM = 7194.1 to port

Remark	Weight (t)	KG(m)	V.moment (tm)
Initial	10000	9.0	90000
FW in port	(+) 864	8.6	(+) 2592
FW in stbd	(-) 864	6	(-) 5184
Final w =	10000		Final v.moment = 87408

Final KG = $\frac{\text{Final v.moment}}{\text{Final w}}$

$= \frac{87408}{10000}$

$= 8.741$ m

KM = 10.8 m

Solid GM = KM − KG

$= 10.8 - 8.741$

$= 2.059$ m

(OR)

$GG_1(\downarrow) = \frac{w \cdot d}{W}$

$= \frac{864 \times 3}{10000}$

$= 0.259$

Original KG = 9.000 m

$GG_1(\downarrow)$ = 0.259 m

Final KG = 8.741 m

* prefer doing by GG_1

* $FSC = \frac{i\,di}{W}$

$= \frac{lb^3 \cdot di}{12 \cdot W}$

$= \frac{\frac{1}{12} \times 12^3 \times 1.000}{\frac{1}{12} \times 10000}$

$= 0.173$ m

* But here 2 tanks are slack

FSC = 0.173 + 0.173

= 0.346

GM (Fluid) = GM (solid) − FSC

= 2.059 − 0.346

= 1.713 m

$\tan\theta = \frac{FLM}{W \cdot GM(F)}$

$\tan\theta = \frac{7194.1}{10000 \times 1.713}$

$\tan\theta = 0.4199218$

$\theta = 22.78^\circ$ or 22° 46.7' to port

March 19 (14)

RM = W · GZ

RM = W · GM sin θ

Remark	Weight (t)	KG(m)	V.moment (tm)
vessel	6550	6	39300
cargo	(+) 1500	x	(+) 1500x
Final w =	8050		Final v. moment = 39300 + 1500x

Final KG = $\frac{\text{Final v.moment}}{\text{Final w}}$

$= \frac{39300 + 1500x}{8050}$

KM = 7.0m

$GM = KM - KG$

$= 7.0 - \left(\frac{39300 + 1500x}{8050}\right)$

$= \frac{56350 - 39300 - 1500x}{8050}$

$= \frac{17050 - 1500x}{8050}$

$RM = W \cdot GM \sin\theta$

$350 = 8050 \times \frac{17050 - 1500x}{8050} \times \sin 3°$

$350 = (17050 - 1500x) \times \sin 3°$

$350 = 892.328 - 78.504x$

$78.504x = 892.328 - 350$

$78.504x = 542.328$

$x = 6.908\ m$ ✓

(OR)

$RM = W \cdot GM \sin\theta$

$350 = 8050 \times GM \times \sin 3°$

$GM = \frac{350}{8050 \times \sin 3°}$

$GM = 0.831\ m$

I don't know why answer is coming different

$\text{Final } KG = KM - GM$

$= 7.0 - 0.831$

$= 6.169\ m$

oct 21

sep 18 (15)

$\tan\theta = \frac{LM}{W \cdot GM}$ (see it once)

Remark	Weight	KG	V. moment
Ship	18000	x	18000x
weight	90	29 - 10.90 = 18.1	(+) 1629
	18000		18000x + 1629

$\text{Final } KG = \frac{\text{Final v.moment}}{\text{Final W}}$

$= \frac{18000x + 1629}{18000}$

$KM = 9.70\ m$

$\text{solid } GM = KM - KG$

$= 9.70 - \left(\frac{18000x + 1629}{18000}\right)$

$= \frac{174600 - 18000x - 1629}{18000}$

$= \frac{172971 - 18000x}{18000}$

$$FSC = \frac{FSM}{W} = \frac{2971}{18000} = 0.165\ m$$

$$GM(F) = \text{Solid } GM - FSC = \frac{172971 - 18000x}{18000} - 0.165$$

$$= \frac{172971 - 18000x - 2970}{18000}$$

$$= \frac{170001 - 18000x}{18000}$$

Listing moment, $LM = W \cdot d$

$= 90 \times 19$

$= 1710$ tm to starbd

$$\tan\theta = \frac{LM}{W \cdot GM}$$

$$\tan 5^\circ = \frac{1710}{18000x \times \frac{170001 - 18000x}{18000}}$$

$$\tan 5^\circ (170001 - 18000x) = 1710$$

$$14873.16 - 1574.796x = 1710$$

$$14873.16 - 1710 = 1574.796x$$

$$13163.16 = 1574.796x$$

$$x = \boxed{8.359\ m}$$

July 18 (16) In short cut,

Final $\omega = 22500t$

Final v. moment = 144000
(+) 8000
(+) 12000
(+) 15000
(+) $5x$
(+) $11(2000 - x) = 22000 - 11x$

$179000 + 5x + 22000 - 11x$

$= 2,01,000 - 6x$

$$\text{Final } KG = \frac{\text{Final v. moment}}{\text{Final } W}$$

$$8.75 = \frac{2,01,000 - 6x}{22500}$$

$$196875 = 2,01,000 - 6x$$

$$6x = 2,01,000 - 196875$$

$$6x = 4125$$

$x = \boxed{687.5t}$ in lower hold

$2000 - x = 2000 - 687.5$

$= \boxed{1312.5t}$ in tween deck.

Feb 22
May 18 (17)

Initial :- Draft fwd : 11.48 m
Draft aft : 12.26 m
Trim = 0.78 m by stern
Mean = 11.87 m

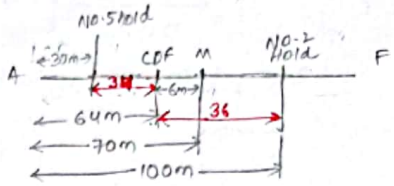
(solve it once)

Final : Draft fwd : 11.90 m
Draft aft : 12.10 m
Trim : 0.20 m by stern
mean draft : 12.00 m

$\frac{140}{2} = 70 - 69$
= 6 m aft of midship

Initial trim : 0.78 m
Final trim : 0.20 m
Trim caused : 0.58 m or 58 cm by head

(a) sinkage = 12 − 11.87
= 0.13 m
= 13 cm



Quantity of cargo still to load = 13 × 32
= 416 t

(b)

			Distance from CDF	
NO.5 hold	x	30m fwd of AP	64−30=34	34x by stern
NO.2 hold	416−x	100m fwd of AP	36	36(416 − x) by head

= 14976 − 36x by head

Tc = 58 cm by head

Tc = $\frac{TM}{MCTC}$

58 = $\frac{TM}{120}$

TM = 6960 tm by head

by head	Head − stern	
6960 =	14976 − 36x − 34x	14976 − 36x − 34x
6960 − 14976 =	−70x	14976 − 70x
−8016 =	−70x	

x = $\frac{8016}{70}$

x = 114.51 t in NO.5 Hold

416 − x = 301.49 t in NO.2 Hold

NOV 17 (18)

Arrival draft : 5.77 m
clearance req : 0.500 m
Depth req : 6.27 m
Depth at bar : 6.00 m
Rise req : 0.27 m = 27 cm

1.020 to 1.005
Density ↓, draft ↑
more discharge

+

FWA = $\frac{w}{40TPC}$
= $\frac{12000}{40 \times 25}$
= 12 cm

change in draft = $\frac{(1.020 - 1.005)}{0.025} \times 12$
= 7.2 cm

Total rise req. = 27 + 7.2
= 34.2 cm

*Remember this

TPC @ 1.020 = $25 \times \frac{1.020}{1.025}$
= 24.878

Cargo need to discharge = 34.2 × 24.878
= 850.828 t

May 17 (19)

Mean distance from waterline = $\frac{120 - 80}{2}$

= $\frac{40}{2}$ = 20 mm below waterline

= 2cm

1m = 100 cm
1m = 1000 mm

+

Summer to winter loadline = $\frac{1}{48}$ × summer draft

= $\frac{1}{48} \times 9.6$
= 0.2m
= 20 cm

+

DWA = $\frac{1.025 - 1.008}{0.025} \times 220$

= 149.6 mm
= 14.96 cm

density ↑, draft ↓
so, we can load more

Total sinkage available = 20 + 14.96 − 2
= 32.96 t

TPC @ 1.008 = $\frac{28 \times 1.008}{1.025}$
= 27.5

DWT available = sinkage × TPC
= 32.96 × 27.5
= 906.4 t

Consumables : (+) 50.0 t (25 × 2)

956.4 t

(b) Her departure draft = ?

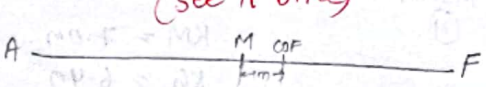
summer draft : 9.6 m
DWA : (+) 0.150 m

Departure draft : 9.750 m

March 17 AM

(20)

COF is 1m fwd of midship. (see it once)



same name substract, diff name add

Weight		HF	Trimming moment	
Load	Discharge		By head	By stern
2000		39	78000	
400		26		10400
100 t shift		125	12500	
	175	2	350	
2225 t			90850	10400

Final T. moment = 80450 tm by head

mean sinkage = $\frac{w}{TPC}$

$= \frac{2225}{34} = 65.4$ cm or 0.654m

$TC = \frac{TM}{MCTC}$

$= \frac{80450}{350} = 229.9$ cm

$= 2.299$ m

$Ta = \frac{TC \times AF}{LBP}$

$= \frac{2.299 \times 76}{350}$

$= 1.165$ m

$AF = \frac{150}{2} + 1$

$= 75 + 1$

$= 76$

$Tf = TC - Ta$

$= 2.299 - 1.165$

$= 1.134$ m

	Fwd	Aft
Original draft:	8.000m	10.300m
mean sinkage:	(+) 0.654m	(+) 0.654m
	8.645m	10.954m
Tf & Ta:	(+) 1.134m	(+) 1.165m
Final draft:	9.779m	9.789m

March 17 pm

(21)

(see it once)

KM = 7.0m

KG = 6.4m

GM = 0.6m

$\tan\theta = \frac{LM}{W.GM}$

$\tan 3^\circ = \frac{LM}{12500 \times 0.6}$

LM = 393.06 tm to stbd

x — 6m to port — 6x to port

500−x — 6m to stbd — 6(500−x) = 3000 − 6x to stbd

To finish upright

LM port = LM stbd

$6x = 393.06 + 3000 - 6x$

$6x + 6x = 393.06 + 3000$

$12x = 3393.06$

$x = 282.8t$ in port

$500 - x = 500 - 282.2$

$= 217.2t$ in stbd.

$\tan\theta = \frac{LM}{W.GM}$

Jan 17 (22)

Sep 16

July 16

$\tan\theta = \frac{LM}{W.GM}$

$\theta = 3.5^\circ$

$LM = w.d$

$= x.3.5$

$= 3.5x$

$W = 7400 - x$

7400	8.0	59200
x	11	(−) 11x
7400−x		59200−11x

$\text{Final KG} = \frac{\text{Final v.moment}}{\text{Final W}}$

$= \frac{59200 - 11x}{7400 - x}$

KM = 8.5

$GM = KM - KG$

$= 8.5 - \left(\frac{59200 - 11x}{7400 - x}\right)$

$$GM = \frac{62900 - 8.5x - 59200 + 11x}{7400 - x}$$

$$GM = \frac{3700 + 2.5x}{7400 - x}$$

If FSM is given find GM(F)

$$\tan 3.5^\circ = \frac{3.5x}{7400 - x \times \frac{3700 + 2.5x}{7400 - x}}$$

$$\tan 3.5^\circ = \frac{3.5x}{3700 + 2.5x}$$

$$226.3 + 0.153x = 3.5x$$

$$226.3 = 3.347x$$

$$x = 67.61t$$

March 16 (23) Out of syllabus.

Jan 16 (24)

$$T_c = \frac{TM}{MCTC}$$

(see it once)

$$T_a = \frac{T_c \times AF}{LBP}$$

250	46.5	11625 by head
300	17.5	5250 by stern
		TM = 6375 by head

$$T_c = \frac{TM}{MCTC} = \frac{6375}{196} = 32.5\,cm$$

$$AF = \frac{116}{2} - 2.5 = 58 - 2.5 = 55.5$$

$$T_a = \frac{32.5 \times 55.5}{116}$$

$$= 15.5\,cm \text{ or } 0.155m$$

$$T_f = T_c - T_a = 32.5 - 15.5 = 17.0\,cm \text{ or } 0.170m$$

$$\text{mean sinkage} = \frac{w}{TPC} = \frac{550}{18} = 30.6\,cm \text{ or } 0.306m$$

	Fwd	Aft
Original draft:	6.500m	7.800m
mean sinkage:	(+) 0.306m	(+) 0.306m
draft:	6.806m	8.106m
Tf & Ta:	(+) 0.170m	(-) 0.155m
Final draft:	6.976m	7.951m

July 17 PM

(25)

$\tan\theta = \frac{w.d}{W.GM}$

$GM = KM - KG$

$= 7.5 - 6.2$

$= 1.3m$

$\tan 4^\circ = \frac{LM}{18000 \times 1.3}$

$LM = \tan 4^\circ \times 18000 \times 1.3$

$LM = 1636.29\ tm$ to port

Present mean draft : 8.6m

Final draft : 8.8m

0.2m or 20cm

DWT available = Sinkage x TPC

$= 20 \times 25$

$= 500t$

x	6m to stbd	$6x$ to stbd
$500-x$	6m to port	$6(500-x)$
		$= 3000 - 6x$ to port

LM port = LM stbd

$1636.29 + 3000 - 6x = 6x$

$1636.29 + 3000 = 6x + 6x$

$4636.29 = 12x$

$x = 386.358\ t$ to stbd

& $500 - x = 113.643\ t$ to port

A.62 of HINDSHIP

July 22 ①

M.V. HINDSHIP

Draft fwd: 8.778m
Draft aft: 8.792m
Mean draft: 8.785m
Trim: 0.014 m by stern

LCF at mean draft 8.785 m,

LCF = 69.923 m

8.60 70.067
8.785 0.156
8.80 69.911
0.2 0.156
1 $\frac{0.156}{0.2} \times 0.185$
= 0.144

Correction to after draft = $\frac{\text{Trim} \times \text{LCF}}{\text{LBP}}$

calc $= \frac{0.014 \times 69.923}{143.16}$

$= 0.007$m

Draft aft: 8.792m
Corrn: 0.007m
HS draft: 8.785m

Displacement at HS draft 8.785m,
18528.7t

8.60 18081
8.785
8.80 18565
0.2 484
1 $\frac{484}{0.2} \times 0.185$
= 447.7

18528.7	72.34	1340366.2
(-) 206.0	17.24	(-) 3551.44
18322.7		1336814.718

Final LCG = $\frac{\text{Final L.moment}}{\text{Final W}}$

$= \frac{1336814.718}{18322.7}$

$= 72.960$ m

LCF 69.989, LCB 72.382, MCTC 207.5, HS draft 8.7 at disp 18322.7t

Total trim = $\frac{\text{LCB} - \text{LCG}}{\text{MCTC} \times 100} \times$ displacement

Total trim = $\frac{72.382 - 72.960}{207.5 \times 100} \times 18322.7$

= -0.510m (that means, trim caused by head)

Ta = $\frac{\text{Total trim} \times \text{LCF}}{\text{LBP}}$

$= \frac{0.510 \times 69.989}{143.16}$

$= 0.249$ m

Tf = Total trim - Ta
= 0.510 - 0.249
= 0.261m

	Fwd	Aft
Final HS draft :-	8.700m	8.700m
Tf & Ta :	(+)0.261m	(-) 0.249m
Final draft :	8.961m	8.451m

②. March 19, June 2022 : Q.73 of HINDSHIP (solve it once) - Finishing on an even keel

③ June 2022 / July 19, Jan 19, Rno 56 of HINDSHIP

Initial displacement = 13750 t
KG = 7.28m
FSM = 1095 tm
List = 2 degree to stbd.

ILM ⇒ $\tan\theta = \frac{ILM}{W \cdot GM}$

KM at 13750 = 8.285 m

GM (solid) = KM - KG
= 8.285 - 7.280
= 1.005 m

$FSC = \frac{FSM}{W} = \frac{1095}{13750} = 0.080\,m$

GM(F) = GM(S) - FSC
= 1.005 - 0.080
= 0.925

$\tan\theta = \frac{ILM}{W \cdot GM(F)}$

$\tan 2^\circ = \frac{ILM}{13750 \times 0.925}$

$ILM = \tan 2^\circ \times 13750 \times 0.925$

ILM = 444.149 to stbd

NO. 3 TD	x	1.8m to stbd	1.8x to stbd
NO. 5 UTD	$365-x$	5.5m to port	$5.5(365-x)$
			$= 2007.5 - 5.5x$ to port

FLM ⇒ $2007.5 - 5.5x - 1.8x$
$= 2007.5 - 7.3x$

To bring vessel upright,

ILM = FLM

$444.149 = 2007.5 - 7.3x$

$7.3x = 2007.5 - 444.149$

$7.3x = 1563.351$

$x = 214.16$ t in NO.3TD

$365 - x = 150.84$t in NO.5UTD

ILM is in stbd
so, we need more in port
Hence, port - stbd
↓ ↓
bada - chota

④ May 2022 :- Similar as Q.-65 of HINDSHIP
Apr 2022 Q.2

⑤ a) NOV 2021, dec 20 A.NO. 78 of HINDSHIP } To achieve a desired trim
b) April 2022 Q.1, Similar as Q.79 of HINDSHIP
Nov 17

⑥ Feb 2022 :- Practise sum :- Page 01 december
may 2018

⑦ Jan 22, Oct 21
sep 18

Her actual displacement = 19050 @ 1.015

Equivalent disp @1.025 = $\frac{19050 \times 1.025}{1.015}$

= 19237.685 t

Vessel was at even keel
Hence, LCB = LCF

LCB at 19237.685t = 72.263m

Hence, Initial LCF = 72.263m

19051	72.288	
19537	72.223	
486	0.065	
1	$\frac{0.065}{486} \times 185.685$	
	= 0.025	

19050	72.263	1376610.2
(+) 487	x	(+) 487x
19537		1376610.2 + 487x

Final LCF = $\frac{\text{Final L.moment}}{\text{Final W}}$

= $\frac{1376610.2 + 487x}{19537}$

Equivalent disp @1.025 = $19537 \times \frac{1.025}{1.015}$ = 19729.5 t

19537	72.223	214.5	
19729.5	72.198		
2.0024	72.159	217.9	
487	$\frac{0.064}{487} \times 192.5$		
	= 0.025		

LCB at 19729.5t = 72.198m

MCTC at 19729.5t = 215.646

Equ. MCTC @1.015 = $215.646 \times \frac{1.025}{1.025}$

= 213.542

$\frac{2.9}{487} \times 192.5$
= 1.146

Total trim = $\frac{LCB - LCF}{MCTC \times 100} \times$ disp.

$$0.20 = \frac{72.198 - \left(\frac{1376610.2 + 487x}{19537}\right)}{213.542 \times 100} \times 19537$$

$$427084 = 72.198 - \left(\frac{1376610.2 + 487x}{19537}\right) \times 19537$$

$$427084 = \frac{1410532.3 - 1376610.2 - 487x}{19537} \times 19537$$

$$4270.84 = 33922.15 - 487x$$

$$487x = 29651.31$$

$$x = 60.886\text{m}$$

HS draft :- 9.279 m
Ta : (+) 0.097m
Aft draft: 9.376m

(8) Dec 21, March 21 :- Q.NO 80 of HINDSHIP - To achieve a desired draft at one end

Final HS draft : find using final disp.

Ta : ——— & we get this

Final aft draft : 4.500 m (known)

we get Ta
↓
Total trim
↓
Final LCG
↓
Box bana ke, equate karke
Get the value of x i.e 115.924 fwd of AP

So, distance abaft the FP = 143.16 − 115.924
= 27.236

(9) Sep 21 :- Practise sum (page 10 December) No. 15

8&11 is almost same

(10) Apr 21, Jan 18 :- Similar as Practice sum (Page 28 november)

(11) Sep 19 :- Q.NO 76 of HINDSHIP - To keep the draft constant at one end

See 2 Nov in stability diary

Final HS draft : find using final disp

Ta : ———

Final aft draft : 6.012 m (Known)

we get Ta
↓
Total trim
↓
Final LCG
↓
Box bana ke, equate karke
Get the value of x i.e. 84.553 m fwd of AP.

(12) May -2017(Batch 2)

Draft fwd : 6.00 m
Draft aft : 6.40 m
Trim : 0.40 m by stern
Mean draft ; 6.20 m

LCF at mean draft 6.20 m = 72.333 m

Corrn to after draft = $\frac{\text{Trim} \times \text{LCF}}{\text{LBP}}$

$= \frac{0.4 \times 72.333}{143.16}$

$= 0.202$ m

Draft aft : 6.400 m
Corrn to after draft : (−) 0.202 m
HS draft : 6.198 m

Displacement at HS draft 6.198 = 12467.47 t

Equivalent disp. in FW = $12467.47 \times \frac{1.000}{1.025}$

= 12163.39 t

KM at 6.198m = 8.385m

6.00	12019
6.20	12472
0.2	453
1	$\frac{453}{0.2} \times 0.198$
	= 448.47

	8.438
	8.384
	$\frac{0.054}{0.2} \times 0.198 =$
	0.053

Initial GM(S) = KM − KG

GM(S) = 8.385 − 6.460m

GM(S) = 1.925m

FSC = 0.080m

Initial GM(F) = 1.845m

$\tan\theta = \frac{ILM}{W \cdot GM(F)}$

$\tan 1.5^\circ = \frac{ILM}{12163.39 \times 1.845}$

$ILM = \tan 1.5^\circ \times 12163.39 \times 1.845$

ILM = 587.65 tm to stbd

Remark	Weight	KG	V. moment	Dist. off CL	T. moment
Initial	12163.39	6.46			
Shifted	200.00	10.37 − 5 = 5.37	(−) 1074		
Final W =	12163.39				

$GG_1(\downarrow) = \frac{W \cdot d}{W}$

$= \frac{200 \times 5.37}{12163.39}$

= 0.088m

Initial KG = 6.460m

$GG_1(\downarrow)$ = 0.088m

Final KG = 6.372m

GM(S) = 8.385 − 6.372

GM(S) = 2.013m

FSC = 0.080m

GM(F) = 1.933m

New LM caused = 200 × 4

= 800 tm to port

FLM = 800 − 587.65

= 212.35 tm to port

$\tan\theta = \frac{FLM}{W \cdot GM}$

$\tan\theta = \frac{212.35}{12163.39 \times 1.933}$

$\theta = 0.52^\circ$ or $0^\circ 31'$ to port