CLASS - 3

STABILITY AND CARGO OPERATIONS

Density and Relative density

1. A tank of 2400 cubic meter volume and 12m depth, have vertical side and horizontal bottom. Find how many tones of oil RD 0.7 it can hold allowing 2% of the volume of tank for exapsion, state the ullage.
2. A rectangular tank measuring 25mx12mx8m has an ullage pipe projecting 0.3m above the tank top. Find the mass of SW in the tank when the ullage is 3.3m.
3. A tank with horizontal base and vertical side and 10m deep, has a rectangular trunkway of 1m high. The volume of the tank alone is 800 cubic meter and that of the trukway is 500 cubic meter. Find the ullage when 5320t of vegetable oil of Rd 0.7 loaded.
4. A rectangular tank has a total depth of 21m and volume of 20600 cubic metre which include a trunkway of 1m high and volume of 600 cubic meter. Find the ullage when 16320 t of oil of RD 0.8 loaded.
5. A rectangular tank has a total depth of 21m and volume of 10250 cubic metre which include a trunkway of 1m high and volume of 250 cubic meter.Find the mass of oil of RD 0.9 loaded if 3% of volume of oil left for expansion.Also state the ullage.

Effect of density on draft and displacement

6. A ship is lying at the mouth of a river in water of density 1024 kg per cu.m and the displacement is 12 000 tonnes. The ship is to proceed up river and to berth in dock water of density 1008 kg per cu.m with the same draft as at present. Find how much cargo must be discharged.
7. A ship arrives at the mouth of a river in water of density 1016 kg per cu.m with a freeboard of 'S' m. She then discharges 150 tonnes of cargo,and proceeds up river to a second port, consuming 14 tonnes of bunkers.When she arrives at the second port the freeboard is again `S' m., the density of the water being 1004 kg per cu. m. Find the ship's displacement on arrival at the second port.
8. A ship is lying at the mouth of a river in water of density 1024 kg per cu. m and the displacement is 12 000 tonnes. The ship is to proceed up river and to berth in dock water of density 1008 kg per cu. m with the same draft as at present. Find how much cargo must be discharged.
9. A ship loads in fresh water to her salt water marks and proceeds along a river to a second port consuming 20 tonnes of bunkers. At the second port, where the density is 1016kg per cu. m, after 120 tonnes of cargo have been loaded, the ship is again at the load salt water marks. Find the ship’s load displacement in salt water.

LOAD LINES

10. A ship of load displacement 18000t and TPC 25t,If she is loading in DW of RD 1.018,by how much may her load line be immerse so that she will not be over loaded.
11. A vessel displaces 14500t,if floating in SW up to her winter load line mark. If she is floating in density of 1.010 with her winter mark at the surface of water, find how much cargo she cal load so that she can float at winter load line mark in SW.
12. A vessel floating in RD of 1.005 with the upper edge of her summer load line mark in the water line to starboard and 50mm above the water line to port. If FWA is 180mm and TPC 24t,find the amount of cargo she can load to bring her to her permissible draft.
13. A vessel lying in a river of RD 1.010 with her summer load line mark 20mm above the water on the starboard and 50mm above the water on port side. Find how much cargo she can load to bring her draft draft to summer load line mark in SW, if TPC 25t and displacement 15000t.
14. A ship floating in dock water of density 1005 kg per cu.m has the lower edge of her Summer load line in the waterline to starboard and 50mm above the waterline to port. FWA= 175mm and TPC = 12 tonnes. Find the amount of cargo which can yet be loaded in order to bring the ship to the load draft in salt water.
15. A ship arrives at the mouth of a river in water of density 1016 kg per cu. m with a freeboard of 'S' m. She then discharges 150 tonnes of cargo,and proceeds up river to a second port, consuming 14 tonnes of bunkers. When she arrives at the second port the freeboard is again `S' m., the density of the water being 1004 kg per cu. m. Find the ship's displacement on arrival at the second port.
16. A vessel arrives at port X at the mouth of a river. Her displacement is 12000 t and arrival draft 5.77 m in RD 1.020. She is to cross a bar upriver before entering port Y. The depth at the bar is 6.0m and RD 1.005. If her TPC is 25, find the minimum quantity of cargo to off load at port X so that she may cross the bar with an under keel clearance of 0.5m.

FINAL KG

17. A ship of displacement 4000 tonnes and KG 6.0m has a weight of 50 tonnes already on board with a KG of 1.9m. The weight is lifted 1.0m above the tank top with a derrick. The head of derrick is 15.0 m above the keel. Find the new KG of the ship when the weight is lifted by the derrick.

18. A vessel is initially displacing 7000 t. KG 8.00m; KM 9.20m (constant).A 80t weight is to be shifted from a position on the centreline, Kg 6.2 m to a position Kg 10.5 m on the centreline using the vessel's own derrick. The derrick head is 35 m above the keel.

    Calculate the vessel's GM when:

    (i) the weight is lifted just clear of its initial stowage position;

    (ii) the weight has been shifted.

19. A ship has a displacement of 7000 tonnes and KG . 6 metres. A heavy lift in the lower hold has KG . 3 metres and mass 40 tonnes. Find the new KG when this weight is raised through 1.5 metres vertically and is suspended by a derrick whose head is 17 metres above the keel.
20. A vessel of displacement = 10112 tonnes, KG = 5.85m, KM = 6.62m has a centrally divided D.B. Tank of dimensions 20.27 x 15.22 x 1.23m which is full of fuel oil of density 0.803 t/m^3. Calculate the GM_{fluid} if 100 tonnes of fuel oil is consumed from each side of the tank on passage if the FSE introduced was 0.11m.
21. A vessel is initially upright and displacing 14250 tonnes. Kg = 8.66m, KM = 10.01m. A port and stbd double bottom tank each having the following dimensions: L = 22m; B = 7.84m; D = 1.8m. The tanks are then partially filled with water of R.D. 1.018 to ullage of 0.3m. Calculate the vessel's final GM allowing for a total free surface effect of 0.15m.
22. A ship of 5000 tonnes displacement has KG 4.5 m, KM 5.3 m. The following cargo is loaded:

    2000 tonnes KG 3:7 m; and 1000 tonnes KG 7:5 m:

    Find how much deck cargo (KG 9 m) may now be loaded if the ship is to sail with a minimum GM of 0.3 m.

23. A ship is partly loaded and has a displacement of 9000 tonnes, KG 6 m, and KM 7.3 m. She is to make a 19-day passage consuming 26 tonnes of oil per day (KG 0.5 m). Find how much deck cargo she may load (KG 10 m) if the GM on arrival at the destination is to be not less than 0.3 m.
24. A vessel displacing 8000 t, has a rectangular deep tank 10m long, 8m wide and 9m deep full of SW. The KM is 7m and KG is 6.2 m. Find the GM when 1/3 of this tank is pumped out.

List

25. A ship 13000 tonnes displacement, KM = 7.2m (constant), KG = 6.5m has a 3.5° list to stbd and has yet to load 600 tonnes of cargo. There is space available with a centre of gravity 6m each side of the centre line. Find how much cargo to load on each side to complete the ship in an upright condition?
26. A ship of Δ = 1700t, KG 2.8m, KM 3.8m is upright, and loads the following cargo and stores:

    350t at Kg 3.2m , 50t at Kg 4.2m, 500t at Kg 2.7m, 100t at Kg 1.3m

- Finally, a lift of 25 tonnes is to be loaded on deck at Kg 5.0m using the ships derrick. The derrick head is 11.0m above the keel and reaches 5.2m from the centreline. Calculate the angle of heel during loading and the GM when the lift is stowed.

27. A vessel is initially upright. KG 7.00 m; KM 8.60m (constant); Present displacement 12 500 t.

    The following operations are now carried out:

    Loaded 30t at Kg 8.0m, 5.0m to port of centreline,

88t at Kg l0.8m, 3.5m to port of centreline,

Discharged 80 t at Kg 5.0m, 11.0m to starboard of centreline

Calculate the final angle and direction of list after completion of operations.

28. A ship of 12000 tonnes displacement, KM = 6.5m, KG = 5.9m floating upright in dock water of density 1024 Kg/cu.m. She has a double bottom tank of length 25m and breadth 16m. The tank is subdivided at the centre line and is partially filled with oil of R.D. 0.9. Find the List if a mass of 50 tonnes is now shifted 15m across the deck.
29. A vessel of 3964 tonnes displacement has a KG of 6.16m, KM 7.55m. Find the list if half the fresh water from a centrally subdivided D.B. Tank of dimension 20.23 x 15.12 x 1.06 m is transferred from port side to stbd side. Initially, the vessel is upright and stbd side tank is empty. Assume that a FSE if 0.14m is introduced due to transferring of water.
30. A ship of 7500 tonnes displacement has KM 8.6 m, KG 7.8 m and 20 m beam. A quantity of deck cargo is lost from the starboard side (KG 12 m,and centre of gravity 6 m in from the rail). If the resulting list is 3 degrees 20 minutes to port, find how much deck cargo was lost.
31. A ship of 12 500 tonnes displacement, KM 7 m and KG 6.4 m, has a 3 degree list to tarboard and has yet to load 500 tonnes of cargo. There is space available in the tween decks, centres of gravity 6 m each side of the centre line. Find how much cargo to load on each side if the ship is to complete loading upright.
32. A ship of 8000 tonnes displacement has a GM □ 0.5 m. A quantity of grain in the hold, estimated at 80 tonnes, shifts and, as a result, the centre of gravity of this grain moves 6.1 m horizontally and 1.5 m vertically. Find the resultant list.

33. A ship of 13 750 tonnes displacement, GM 0.75 m, is listed 2.5 degrees to starboard and has yet to load 250 tonnes of cargo. There is space available in each side of No 3 between deck (centre of gravity, 6.1 m out from the centre line). Find how much cargo to load on each side if the ship is to be upright on completion of loading.

34. A ship is 150m long, displacement 12 000 tonnes, and is floating at drafts of 7m F and 8m A. The ship is to enter port from an anchorage with a maximum draft of 7.6 m. Find the minimum amount of cargo to discharge from a hold whose centre of gravity is 50m aft of the centre of flotation (which is amidships), TPC 15 tonnes, and MCT 1 cm = 300 tonnes m.

GZ CURVE

35. A vessel is loaded up ready for departure. KM is 11.9 m. KG is 9.52 m with a Displacement of 20 550 tonnes. From the ship's Cross Curves of Stability, the GZ ordinates for a displacement of 20 550 tonnes and a VCG of 8 m above base are as follows:

Angle of heel (Degree)	0	15	30	45	60	75	90
GZ ordinate (m)	0	1.10	2.22	2.60	2.21	1.25	0.36

Using this information, construct the ship's Statical Stability curve for this condition of loading and determine the following:
(a) Maximum righting lever GZ.
(b) Angle of heel at which this maximum GZ occurs.
(c) Angle of heel at which the deck edge just becomes immersed.
(d) Range of stability

36. Using the table of KN ordinates below calculate the righting levers for a ship when her displacement is 40 000 tonnes and her actual KG is 10 m.Draw the resulting Statical Stability curve and from it determine:
(a) Maximum GZ value.
(b) Approximate GM value.
(c) Righting moment at the angle of heel of 25
(d) Range of Stability.

Angle of heel (Degree)	0	5	10	15	20	30	45	60	75	90
KN ordinates (m)	0	0.90	1.92	3.11	4.25	6.30	8.44	9.39	9.29	8.50

37. Draw GZ curve as per the following data:
i. Angle of loll 24° and range of stability 53°
ii. Angle of list 24° and range of stability 53°

Increase in draft due to list

38. A box-shaped ship with 12 m beam is foating upright at a draft of 6.7 m. Find the increase in draft if the vessel is now listed 18 degrees.

39. A ship has 20 m beam at the waterline and is floating upright at 6 m draft. If the rise of foor is 0.25 m, calculate the new draft if the ship is now listed 15 degrees.
40. A ship 90 m long, 15 m beam at the waterline, is floating upright at a draft of 6 m. Find the increase of draft when the ship is listed 10 degrees,allowing 0.15 m rise of floor.

41. A box-shaped vessel increases her draft by 0.61 m when listed 12 degrees to starboard. Find the vessel's beam if the draft, when upright, was 5.5 m.

TRIM

42. A ship 100 m long arrives in port with drafts 3 m F and 4.3 m A. TPC 10 tonnes. MCT 1 cm 120 tonnes m. The centre of flotation is 3 m aft of amidships.If 80 tonnes of cargo is

loaded in a position 24 m forward of amidships and 40 tonnes of cargo is discharged from 12 m aft of amidships, what are the new drafts?

43. A ship is 150 m long, displacement 12 000 tonnes, and is floating at drafts of 7 m F and 8 m A. The ship is to enter port from an anchorage with a maximum draft of 7.6 m. Find the minimum amount of cargo to discharge from a hold whose centre of gravity is 50 m aft of the centre of flotation (which is amidships), TPC 15 tonnes, and MCT 1 cm 300 tonnes m.

44. A ship 100 m long has centre of flotation 3 m aft of amidships and is floating at drafts 3.2 m F and 4.4 m A. TPC 10 tonnes. MCT 1 cm 150 tonnes m. 30 tonnes of cargo is then discharged from 20 m forward of amidships and 40 tonnes is discharged from 12 m aft of amidships. Find the final drafts.
45. Find the position of the centre of ¯otation of a ship if the trim remains unchanged after loading the following cargo:
    100 tonnes centre of gravity 8 metres forward of amidships
    20 tonnes centre of gravity 40 metres aft of amidships
    28 tonnes centre of gravity 20 metres aft of amidships

46. A ship arrives in port with drafts 6.8 m F and 7.5 m A. The following cargo is discharged:
    90 tonnes centre of gravity 30 m forward of amidships
    40 tonnes centre of gravity 25 m aft of amidships
    50 tonnes centre of gravity 50 m aft of amidships
    The drafts are now 6.7 m F and 7.4 m A. Find the position of the centre of flotation relative to amidships.

47. A ship is floating at drafts 5.5 m F and 6.0 m A. The following cargo is then loaded:
    97 tonnes centre of gravity 8 m forward of amidships
    20 tonnes centre of gravity 40 m aft of amidships
    28 tonnes centre of gravity 20 m aft of amidships
    The draft is now 5.6 metres F and 6.1 metres A. Find the position of the centre of flotation relative to amidships.

48. A ship's draft is 6.40 metres forward, and 6.60 metres aft.FWA 180 mm. Density of the dock water is 1010 kg per cu. m. If the load mean draft in salt water is 6.7 metres, find the final drafts F and A in dock water if this ship is to be loaded down to her marks and trimmed 0.15 metres by the stern. (Centre of flotation is amidships).
49. A ship arrives port drawing 8 m Fwd, 9 m Aft, LBP 158 m, MCTC 190 t-m, TPC 20 & HF 2 m Aft. The maximum draft allowed to cross a bar is 8.6 m. There is no scope for transfer of any weights onboard. Hence it’s decided to offload some cargo at anchorage. Find the minimum quantity of cargo to offload from No-4 hold, HG 40 m Aft. State the Final Draft Fwd.

50. A ship leaves port with drafts 7.6m F and 7.9m A. 400MT of bunker is burned from a space Whose centre of gravity is 15m fwd of the centre of flotation, which is amidships. TPC 20MT, MCTC 300MT-m. Find the minimum amount of water which must be run into the FPTk (centre of gravity 60m fwd of centre of flotation) in order to bring the draft aft to the maximum of 7.7m. Find also the final draft fwd.

THEORY QUESTIONS:

51. Describe the stability criteria for all vessel as required by ILL 1966 **.**
52. Describe stability criteria as required by IMO grain code.
53. Explains the difference between list and loll and methods of correction.
54. Explains with a suitable diagram the consequences and dangers of a free surface effect on board.
55. Draw a unstable ship diagram and show the followings-COG, COB, Metacentre, Gravitational force, Buoyancy force, capsizing lever.
56. What is hydrostatic draft? Why do you require to obtain hydrostatic draft on board?
57. What is first and 2nd trim corrections?
58. What is stern and stem corrections ?
59. Describe why TPC is not same at every draft of the vessel if density remain constant?
60. Describe how the position of COG and the COB of the vessel changes ?
61. Define FWA & DWA. Draw a load line diagram of a vessel length 99m seen from port side.
62. A ship is lying starboard side to a quay. A weight is to be discharged from the port side of the lower hold by means of the ship's own derrick. Describe the effect on the position of the ship's centre of gravity during the operation.

Cargo operations questions

Topic: Securing cargoes

1. What is cargo securing? Why and how will you secure cargo ?
2. Describes methods of blocking, lashing, shoring, choking and tomming of cargo.
3. Describes methods of securing heavy loads and heavy lifts.
4. Describes methods of stowing and securing vehicles and trailers.

Topic: Deck cargo

1. What is deck cargo? Describe the effect on stability while carrying deck cargo.
2. Outline the recommendations on the stowage and lashing of timer deck cargoes as set out in the IMO Code of Safe Practice for Ships Carrying Timer Deck Cargoes

3. Describe the safe loading/discharging of Ro-Ro cargoes.
4. Describe the precautions to be taken during loading on deck and under deck timber cargo.

Topic: Container cargo

1. Describe the arrangement of a container ship and explain how the position of a particular container is designated
2. Explain the factors involved in planning a container stow with reference to:
   a. stability, trim and list
   b. stresses
   c. stack height and weight
   d. out of gauge
   e. dangerous goods
3. Describe methods of securing containers on deck
4. Describe the types and sizes of container in use

Topic: Bulk cargoes (other than grain)

1. Define the heavy density cargo and explain how you load this cargo if sufficient information not given in stability booklet?
2. Define:
   a. angle of repose
   b. cargoes which may liquefy
   c. flow moisture point
   d. flow state
   e. transportable moisture limit
3. Describe in detail the preparation of cargo holds prior to loading bulk cargoes .
4. Describe the hazards associated with coal cargoes.
5. Describe the importance of monitoring the temperature of the holds associated with carriage of coal cargoes .
6. Describe the precautions to take while carrying coal cargo on board? And Explain how coal should be ventilated.
7. Describe the hazards associated with iron ore cargoes and what are the precautions will you take while loading such cargo on board?

Topic: Bulk Grain Cargo

1. Define the following terms as used in the Interactional Grain Code:
   a. grain
   b. filled compartment
   c. partly filled compartment
2. Describe the cleaning and preparation of holds and decks for the carriage of grain .
3. Describe the dangers associated with using insecticide in cargo holds.
4. Describe the use of and fitting of shifting boards
5. What is DOA ? How will you load grain if your vessel don't have DOA ?

Topic: Cargo Care - Inspection and preparation of holds

1. Outline the items to inspect and reasons for a general inspection of holds
2. Describes how limbers and drain well covers should be treated to prevent suctions being blocked by small debris.

Topic: Segregation and Separation of Cargoes

1. Explain the need for the segregation and segregation to do for dangerous goods
2. Describe the use of port marking to separate parcels for discharge at different ports

Topic: Ventilation and control of sweat

1. Distinguish between ship's sweat and cargo sweat and explain the conditions in which each is experienced
2. Describe the consequence and precautions to observe in voyage from Warm to Cold region and vice versa.

Topic: Refrigerated cargo

1. Define Frozen and Chilled cargo with characteristics and example.
2. What is precooling of cargo. Outline the procedure to observe for carriage of cargo which is not pre-cooled.
3. Briefly describe Vent setting and Defrosting of reefer container
4. Describe the procedure to observe for malfunction of Reefer container at sea.

Topic: Dangerous, hazardous and harmful Cargoes

1. Describe the classification of dangerous goods in the International Maritime Dangerous Goods (IMDG) Code
2. Explain the properties, characteristics and physical state of the different substances, materials and articles covered by the 9 classes of the IMDG Code
3. Identify the marking, labelling and pleading of dangerous goods as required by the IMDG Code and DG in limited quantities
4. Briefly describe the precautions to observe prior and during loading dangerous cargo and after loading at sea
5. Outline the contents of EMS and MFAG
6. Explain the meaning of the following stowage and segregation requirements for the different types of ships:

a. on deck only
b. on deck or under deck
c. away from
d. separated from
e. separated by a complete compartment or hold from
f. separated longitudinally by an intervening complete compartment or hold

Topic: Cargo Handling Equipment and Safety

1. Describe the precautions to observe while using union purchase system.
2. Describe the advantage and disadvantage of ship's crane.
3. A 6 T weight to lift using the three- fold purchase rigged for disadvantage. Calculate the stress on the hauling part and size of rope to be used.
4. Describe the usage of fork lift. What are the hazards associated with fork lift while using it for cargo operation inside the hold?

Topic: Cargo Handling Safety

1. Describe the importance of having a Safe Working Load (SWL) for the cargo gear and what is MSL?
2. Explain how to determine when a cargo runner needs replacing
3. Enumerate the duties of a cargo officer in port

Topic: Tanker Arrangement

1. Describe for crude carriers and product tankers, the general arrangement of:
   a. cargo tanks
   b. pump-rooms
   c. segregated ballast tanks
   d. slop tanks
   e. cofferdams - peak tanks - deep tanks
   f. accommodation
   g. ventilators leading to accommodation and machinery spaces

Topic: Cargo Piping System

1. Explain the arrangement and use of:
   a. deck lines
   b. drop lines
   c. stripping lines
   d. cross overs
   e. by passes
   f. master valves
   g. tank suction valves
   h. sea suction valves

Topic: Cargo Pumps

1. Describe the main operating features of centrifugal pumps and explain why most cargo pumps are of centrifugal type
2. Describe how eductors work and gives examples of their use
3. Describe the safe handling of chemical cargoes
4. Describe the safe handling of liquefied gas cargoes
5. Describe the importance of setting the right pumping rate during the loading and unloading operation

Topic: Precautions before Entering Enclosed or Contaminated Spaces

1. Outline the safe entry procedure in an enclosed space.
2. Define TLV, TWA, and STEL, and gives examples of their value
3. Explain why periodical tests of the atmosphere should be made by persons working in an enclosed space

Topic: Cargo calculations and cargo plans

1. Define: Bale capacity, Grain capacity, Stowage factor and Broken stowage ,Load density & Cargo density.
2. Defines 'ullage' and describe the use of tank calibration tables and given cargo density to calculate the weight in a tank
3. Define Pre-stowage and stowage plan and What are the factors will you consider before making pre-stowage plan ?