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PAST PAPERS

Faculty	*Department / Section/Division*
Not Applicable	*Learning Resource Centre*

Past Papers

Faculty of maritime Science
Department of Navigation

Navigation Foundation
2015-2022

Document Control & Approving Authority	*Senior Director – Quality Management & Administration*

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CINEC CAMPUS (PVT) LTD.
Faculty of Maritime Sciences
Department of Navigation
EDUCATION & TRAINING COURSE: *Navigation Officer Cadet Training Course – Foundation*
COURSE CODE: *ND- 199 / ED 340 - BATCH 25/22*

MID EXAMINATION – QUESTION PAPER

APPLIED MECHANICS

- *Answer any 04 questions only*
- *Total Marks – 100*
- $g = 9.8\ ms^{-2}$

Date: 15/06/2022 *Pass mark 50%* *Time allocated: 3 Hours*

1)

i. Define **velocity** and **acceleration** (2× 3= 6 marks)

ii. A particle starting from rest moves with a constant acceleration of 5 ms^{-2} and covers a distance of 10 m. Then it moves with constant acceleration of 10 ms^{-2} and moves a distance of 20 m. Finally it moves with a constant acceleration of 15 ms^{-2} and moves a distance of 30 m.

(a). Draw a **velocity – time graph** for the particle's motion. (5 marks)

(b). Determine the **velocity** when its displacement is 10 m and **time taken (t_1)?**

(c). Determine the **velocity** when its displacement is 30 m from the origin point?

(d). Find the **time taken (t_2)** which it accelerates with 10 ms^{-2}?

(e). determine the **velocity** when its displacement is 60 m?

(f). Find the **time taken (t_3)** which it accelerates with 15 ms^{-2}?

(g). Find the **total time T** ($t_1 + t_2 + t_3$)?

(7×2=14 marks)

2)

i. Man through a ball at **u** ms^{-1} at angle **θ** to horizontal .(gravitational acceleration as **g** ms^{-2}).show that horizontal range of projectile (R) is

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

(Show your work out) (5 marks)

ii. A stone is thrown upward from the top of a building at an angle of 30^0 to the horizontal and with an initial speed of 20.0 m/s. The point of release is 45.0 m above the ground.

(a) How long does it take for the stone to hit the ground?
(b) Find the stone's speed at impact.
(c) Find the horizontal range of the stone.

(20 marks)

3)

i. State Newton's laws of motion (3 ×4 =12 marks)

ii. A light string passes over a smooth pulley, and carries particles of masses 6 kg and 11 kg at each end.

a) Mark all the force acting on the system (5 marks)

If the system moves freely find;

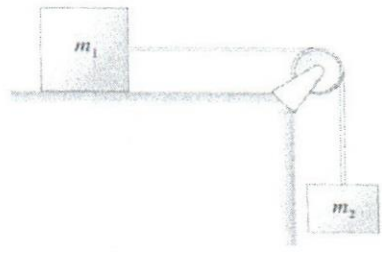
b) find the acceleration of masses and tension of the string

(8 marks)

4)

i. Draw a graph to illustrate the variation of frictional force (F) with applied force. Mention limiting frictional force, Static region and Kinetic region on the graph. (7 marks)

ii. A cord running over a pulley connects two objects. The coefficient of static friction between the object and the table is 0.3, The coefficient of dynamic friction is 0.25. If m_1 = 4.0 kg and m_2 = 8 kg Find,



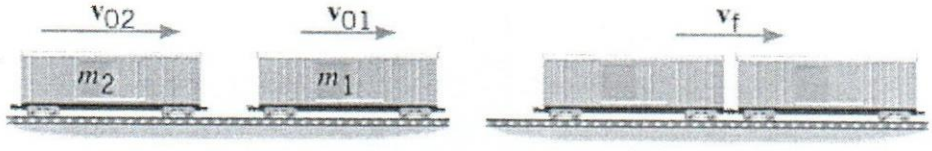
a. Limiting frictional force.
b. Acceleration of the system.
c. Tension of the string. (6 × 3 = 18 marks)

5)

i. What is the impulse of a force of 10 N acting on a ball for 2 seconds?

(6 marks)

ii. A freight train is being assembled in a switching yard, and Figure shows two boxcars. Car 1 has a mass of $m_1 = 65\times10^3$ kg and moves at a velocity of v_{01} = +0.80 m/s. Car 2, with a mass of $m_2 = 92\times10^3$ kg and a velocity of v_{02} = +1.3 m/s, overtakes car 1 and couples to it. Neglecting friction, find the common velocity v_f of the cars after they become coupled.



(a) Before (b) After

(8 marks)

iii. A 5 Kg Cart is pushed by a 30 N force against friction for a distance of 10m in 5 seconds. Determine the Power needed to move the cart.

(4 marks)

iv. How much potential energy is lost by a 5Kg object to kinetic energy due a decrease in height of 4.5 m (4 marks)

v. How fast should a man of mass 50 kg run, so that his kinetic energy is 625 J

(4 marks)

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Department of Navigation
EDUCATION & TRAINING COURSE: *Navigation Officer Cadet Training Course – Foundation*
COURSE CODE: *ND- 199 / ED 340 - BATCH 25/22*

MID EXAMINATION – QUESTION PAPER

CHEMESTRY

- *Answer any 04 questions only*
- *Total Marks – 100*
- $g = 9.8\ ms^{-2}$

Date: 15/06/2022 *Pass mark 50%* *Time allocated: 3 Hours*

Avogadro Constant (N) – 6.022 × 1023 mol-1
H – 1.0, He – 4.0, Li – 6.9, Be – 9.0, B – 10.8, C – 12.0, N –14.0 , O – 16.0, F – 18.9, Ne – 20.2, Na – 23.0, Mg – 24.3, Al – 27.0, Si – 28.1, P – 31.0, S – 32.1, Cl – 35.5, Ar – 40.0, K – 39.1, Ca – 40.1, Ag- 108.0, Cu – 63.5, Fe – 56.0, Co – 58.9, Zn = 65.4, Ag = 107.9, Sn = 117.8

1)

a) Write down the correct chemical formula

i) Magnesium permanganate

ii) Copper (ii) oxide

iii) Sodium Sulphate

iv) Carbon monoxide

v) Propanol

vi) Methane (1×6= 6 marks)

b) Draw the electron structure for

i) B

ii) F_2

iii) P

iv) HF (2×4= 8 marks)

c) Identify the Following Elements.

i) An element having atomic number 9

ii) An element having 14 electrons

iii) An element having mass number 24 and 12 neutrons.

iv) Elements denoted as $^{31}_{15}X$ $^{7}_{3}X$

v) An element having 10 electrons and +3 charge (1×5= 5 marks)

d) Give one example for followings

i) Compound with a covalent bond

ii) Compound with an ionic bond

iii) Homogeneous Mixture

iv) Heterogeneous mixture

v) Compound with metalic bonds

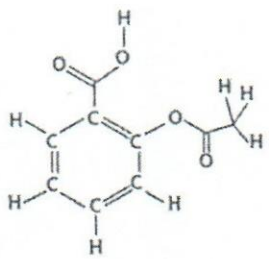
vi) Double displacement reaction (1×6= 6 marks)

2)

a) How many moles of Sn are there in 626.69 g of Sn? (4 marks)

b) How many atoms are present in 53.96 g of Argon (Ar)? (6 marks)

c)



Acetylsalicylic acid commonly known as Aspirin is a prototypical analgesic with a chemical formula $\mathbf{C_9H_8O_4}$. Calculate,

i) mass of one mole of acetylsalicylic acid (aspirin)

ii) mass of one atom of acetylsalicylic acid (aspirin)

iii) The percent composition of H by mass.

iv) The percent composition of O by mass.

v) The percent composition of C by mass in this compound. (3×5= 15 marks)

3)

a) Briefly explain what pH is and write the equation to calculate pH (3 marks)

b) Calculate the pOH of a solution with KW= 10^{-14} & [H+] =0.00075 M (4 marks)

c) Calculate the H+ Concentration of a solution with pKW= 14 & pOH =4.96 (5 marks)

d) What is the pH of a 0.01 M benzoic acid solution?

Given: benzoic acid Ka= 6.5 x 10^{-5}

Benzoic acid dissociates in water as:

$$C_6H_5COOH \rightarrow H^+ + C_6H_5COO^-$$

(9 marks)

e) What are the methods that can be used to identify the pH of a solution?

(4 marks)

4)

a) What is the empirical formula of the compound with the following composition, 47.37 percent C, 10.59 percent H, 42.04 percent O.

(10 marks)

b) Balance Following equation

i. $C_5H_{12} + O_2 \longrightarrow CO_2 + H_2O$

ii. $CH_3CH_2\,CH_2\,CH_2OH + O_2 \longrightarrow CO_2 + H_2O$

iii. $C_2H_6 + O_2 \longrightarrow CO_2 + H_2O$

iv. $C_3H_6 + O_2 \longrightarrow CO_2 + H_2O$

v. $C_6H_{13}\,OH + O_2 \longrightarrow CO_2 + H_2O$

(15 marks)

5)

a) Briefly explain the term "Hydrates" (3 marks)

b) A 1.98 g sample of a cobalt(II) chloride ($CoCl_2.xH_2O$) hydrate is heated over a burner. When cooled, the mass of the remaining dehydrated compound ($CoCl_2$) is found to be 1.55 g. What is the formula for the original hydrate?

(10 marks)

c) What is atomic mass unit (amu)

(2 marks)

d) Calculate the molecular masses (in amu) of the following compounds:

(a) Amoxicillin $C_{16}H_{19}N_3O_5S$

(b) Paracetamol $C_8H_9NO_2$

(10 marks)

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Department of Navigation
EDUCATION & TRAINING COURSE: *Navigation Cadet Training Program – Foundation*
COURSE CODE: *ND- 0199 – BATCH 022*

MID TERM EXAMINATION - QUESTION PAPER

INTRODUCTION TO SHIPPING

- *Answer all questions.*
- *Formulae & all intermediate steps taken in reaching your answer should be clearly shown.*
- *Total Marks: 100*

Date: 15.06.2022 *Pass mark 70%* *Time allocated: 03 Hours*

1) Write short notes on following types of ships.

a) Container
b) General Cargo
c) Bulk Carrier
d) Oil Tanker
e) Ro – Ro

(20 marks)

2) Describe the meaning of following nautical terms.

a) Accommodation
b) Ballast
c) Bulkhead
d) Bunkers
e) Draught
f) Freeboard
g) Hull
h) Leeward
i) Trim
j) Windlass

(20 Marks)

3) **a)** What is the main objective of cargo hold hatch covers?

(5 marks)

b) Describe the types of hatch covers that are mainly used on ships.

(15 marks)

4) **a)** Briefly describe 5 types of containers.

(12 marks)

b) What are the advantages of using Single Point Mooring buoy.

(8 marks)

5) What are the advantages & disadvantages of container shipping?

(20 marks)

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Department of Navigation
EDUCATION & TRAINING COURSE: Navigation Cadet Training Program – Foundation
COURSE CODE: ND- 0199 – BATCH 021

FINAL REPEAT EXAMINATION - QUESTION PAPER

INTRODUCTION TO SHIPPING

- *Answer 5 questions.*
- *Formulae & all intermediate steps taken in reaching your answer should be clearly shown.*
- *Total Marks: 100*

Date: 19.01.2022 *Pass mark 70%* *Time allocated: 03 Hours*

1) Write short notes on following types of ships.

a) Container
b) General Cargo
c) Bulk Carrier
d) Oil Tanker
e) Ro – Ro

(20 marks)

2) **a)** Briefly describe 5 types of containers.

(15 marks)

b) What are the main sizes of containers?

(5 marks)

3) Describe the meaning of following nautical terms.

a) Accommodation
b) Alleyway
c) Ballast
d) Bunkers
e) Deck
f) Knot
g) Leeward
h) List
i) Trim
j) Windward

(20 marks)

4) **a)** List the 3 types of LPG carriers?

b) What is the meaning of CEU?

c) What do you understand by a double hull vessel?

d) How do you identify a container position on a container ship?

e) What is Flag of Convenience?

(20 marks)

5) Write short notes on five busiest and most popular shipping lanes for ocean cargo vessels.

(20 marks)

6) What are the advantages & disadvantages in container shipping?

(20 marks)

7) Describe the purpose of Classification Societies and state 5 members of International Association of Classification Societies (IACS).

(20 marks)

8) a) Describe the general principles and factors influencing the design, type and size of a ship.

(10 marks)

b) What do TEU, FEU, LCL, FCL mean?

(10 marks)

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Faculty of Maritime Sciences
Department of Navigation
EDUCATION & TRAINING COURSE: *Navigation and Engineering Officer Cadet Training Course – Foundation*
COURSE CODE: *ND- 0199 - BATCH 021 & ED - 0340 – BATCH 024*

FINAL EXAMINATION – QUESTION PAPER

APPLIED MECHANICS

- *Answer any 5 questions only*
- *Give your answer to two decimal points*
- *g =9.8 m/s2*

Date: 2021.12.13 *Pass mark 50%* *Time allocated: 03 Hours*

1.

a) Define **acceleration** and **speed** (4 marks)

b) A body starts from rest travels for 36 s with a constant acceleration of 5 ms^{-2}. Then it travels with that velocity for 1 minute. After that it travels with constant retardation and comes to rest in 5 s. **Draw velocity time graph**

Find, (4 marks)

i) Maximum velocity.

ii) Displacement while accelerating.

iii) Displacement with constant velocity.

iv) Constant retardation.

v) Displacement while retarding.

vi) Total displacement. (2× 6 =12 marks)

2. A stone is projected upwards at 30° to the horizontal from a point 175 m above the ground, with initial velocity 20 m/s.

a) How long does the stone take to reach the ground?

b) What is the range of the projectile?

c) What is the velocity of the object when it strikes the ground?

(20 marks)

3.

a) A 0.5 kg ball moves in a circle that is 5.0 m in radius at a speed of 30.0 m/s. Calculate,

i. Angular velocity

ii. Period of time

iii. Frequency

iv. Its centripetal acceleration.

v. The centripetal force on the ball. $(3 \times 4 = 12\ marks)$

b) A mass of 2.0 kg, which may be considered to be a point mass, is attached to a string of length 0.3 m and is rotated at 8.0 rad / s.

i. Calculate the moment of inertia of the mass about the axis

ii. Calculate its angular momentum.

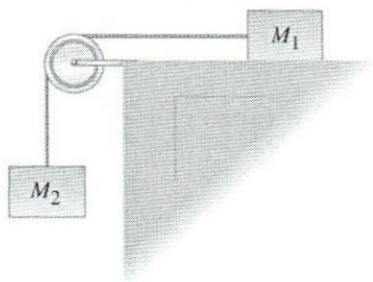
$(8\ marks)$

4.

a) Write the Newton's first law of motion.

(4 marks)

b) The two masses of the system shown in the figure are $M_1 = 5$ kg and $M_2 = 8$ kg. You may assume that the string is inextensible, coefficient of kinetic friction between the crate and the floor is 0.25 and the coefficient of static friction is 0.3 and the pulley is a mass less smooth one.



i. Find the limiting friction force

ii. Find the acceleration of the system.

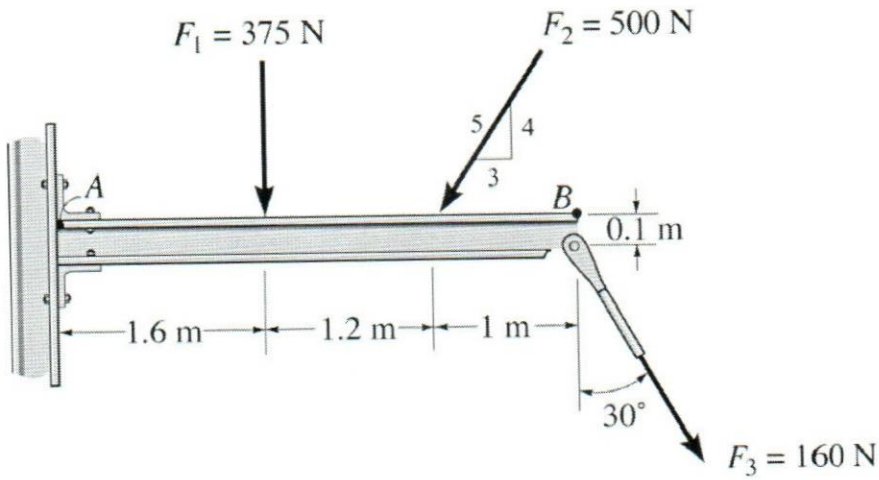
iii. Find the tension of the system. (3 × 4 = 12 marks)

c) A freight train is being assembled in a switching yard, and Figure shows two boxcars. Car 1 has a mass of $m_1 = 65 \times 10^3$ kg and moves at a velocity of $v_{01} = +0.80$ m/s. Car 2, with a mass of $m_2 = 92 \times 10^3$ kg and a velocity of $v_{02} = +1.3$ m/s, overtakes car 1 and couples to it. Neglecting friction, find the common velocity v_f of the cars after they become coupled.

(4 marks)

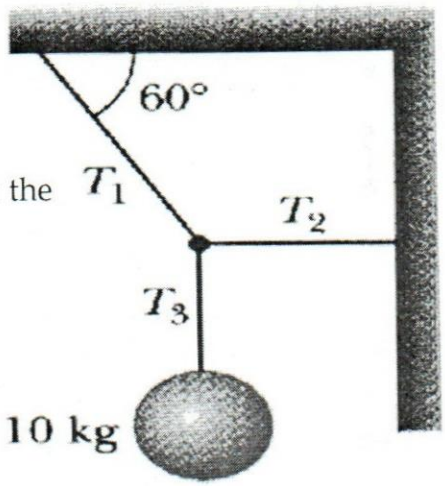
5.

a) Determine the total moment about point A



(10 marks)

b) If the angle between the ceiling and the string A is 60^0 ($\theta = 60^0$)



i. Find the weight of the hanging object

ii. Resolve forces in x direction and y directions at the point O.

iii. Find the tension of the C string T_3.

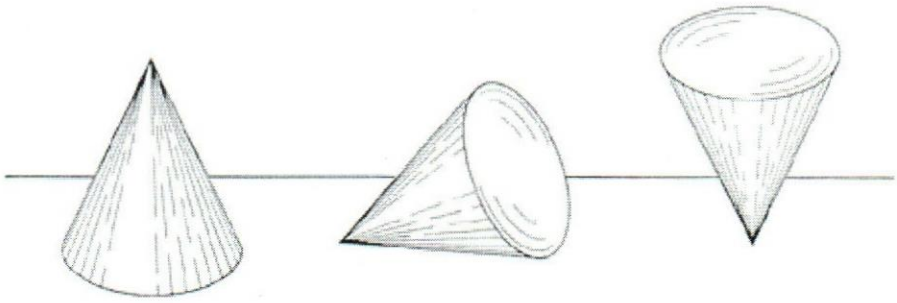
iv. Find the tension of the B string T_2.

v. Find the tension of the A string T_1.

(10 marks)

6.

a) Determine equlibrium state of these cones.



(a) (b) (c)

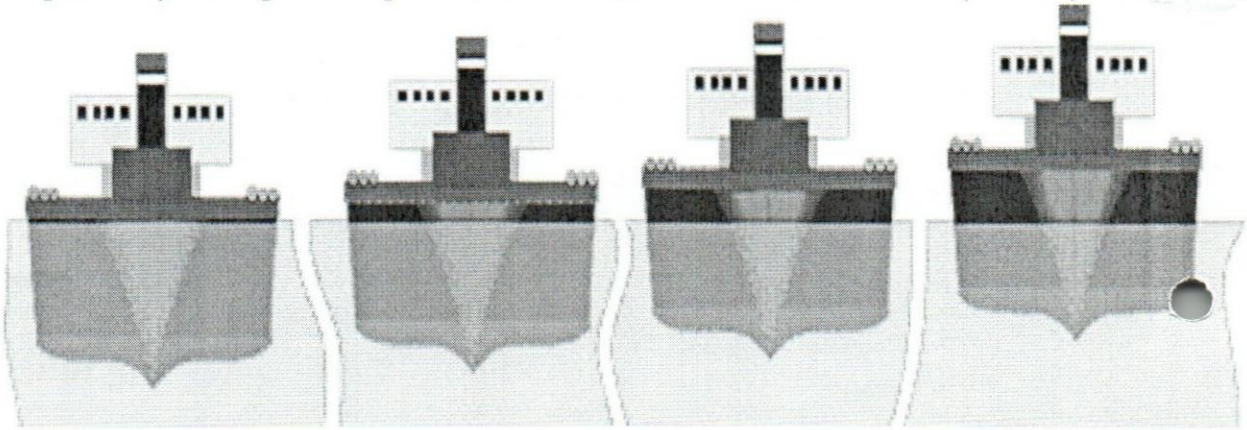
(2 ×3 =06 marks)

b) Center of mass in 2D two particles of mass m_1 =1kg and m_2 =2kg are located at coordinates (1m,2m) and (-2m, 5m) respectively in the xy plane. Find the location of their center of mass (14 marks)

7.

a) State Archimedes' principle. (4 marks)

b) Explain why the depth of ship immersed in the water different? (6 marks)



warm fresh water **cold fresh water** **warm sea water** **cold sea water**

c) Elisabeth purchases a "gold" crown at a market. After she gets home, she hangs it from a scale and finds its weight in air to be 7.84 N. She then weighs the crown while it is immersed in water (density of water is 1000 kg/m3) and now the scale reads 6.86 N. Is the crown made of pure gold if the density of gold is 19.3 x 103 kg/m3?

(10 marks)

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Faculty of Maritime Sciences
Department of Navigation
EDUCATION & TRAINING COURSE: *Navigation Cadet Training Program – Foundation*
COURSE CODE: *ND- 0199 – BATCH 021*

FINAL EXAMINATION - QUESTION PAPER

INTRODUCTION TO SHIPPING

- *Answer all questions.*
- *Formulae & all intermediate steps taken in reaching your answer should be clearly shown.*
- *Total Marks: 100*

Date: 14.12.2021 *Pass mark 70%* *Time allocated: 03 Hours*

1) Describe the meaning of following nautical terms.

a) Accommodation
b) Ballast
c) Bulkhead
d) Bunkers
e) Draught
f) Freeboard
g) Hull
h) Leeward
i) Trim
j) Windlass

(20 Marks)

2) **a)** Describe the Admiralty Charts and Publications catalogue.

(10 marks)

b) Describe the three scales of nautical charts.

(10 marks)

3) **a)** What is the main objective of cargo hold hatch covers?

(5 marks)

b) Describe the types of hatch covers that are mainly used on ships.

(15 marks)

4) Write short notes on following types of ships.

a) Container
b) General Cargo
c) Bulk Carrier
d) Oil Tanker
e) Ro - Ro

(20 marks)

5) Write short notes on following;

a) International Maritime Organization (IMO)
b) International Chamber of Shipping (ICS)
c) International Association of Classification Societies (IACS)
d) Flag of Convenience

(20 marks)

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REPEAT EXAMINATION QUESTION PAPER

CODE - QP
Approved for Quality Management System

EDUCATION & TRAINING COURSE: NAVIGATION OFFICER CADET FOUNDATION COURSE
COURSE CODE: ND 0199

Faculty	Department / Section/Division
Humanities and Education	ELTU

INSTRUCTIONS TO CANDIDATES	Date of the examination = 2021.06.16
Answer all questions.	Duration of the examination = 03 hours
Candidates are not allowed to communicate with and disturb fellow candidates during the examination.	Candidates could be disqualified if you violate examination rules

INDEX NUMBER: .....

For Office use Only

Question No:	1	2	3	4	5	6	7	8	9	10	Total Marks	%	Signature
For Scrutinizer's Use Only (marks)													
For Moderator's Use Only (marks)													

Question 01

(10 Marks)

Read the passage and answer the questions given below <u>in complete sentences</u>.

Note:* Marks will not be given for the incomplete answers.

Abandoned ship

Where are the crew and passengers?

14 December 1872

1. Yesterday morning people saw a small sailing ship enter the Bay of Gibraltar. This was not an unusual site, but the sailors on board were from another ship. The captain of this ship, his wife and child, and the original crew were all missing.

2. The 31-metre Mary Celeste left New York on 7 November and was sailing across the Atlantic to Italy. On board were Captain Benjamin Briggs, his wife Sarah and their two-year-old daughter, Sophie. There were also seven crew members, making a total of ten people. The cargo included 1,701 barrels of industrial alcohol.

3. A week later another ship, the Dei Gratia, left New York for Italy. Captain Morehouse spotted the Mary Celeste off the coast of Portugal. He saw that the ship was out of control. He was surprised, he was a friend of Captain Briggs and knew he was a good seaman. He watched the ship for two hours and tried to make contact but there was no reply. The captain decided to send some of his sailors in a small boat to the Mary Celeste to have a look.

4. They found that the ship was in good condition but there was nobody on the ship. Special equipment and all the ship's papers were missing, except the captain's log book. One of the sailors said, "There was a lot of water inside the ship and the captain's bed was all wet. Also the galley was in a bad state - the cooking pots were everywhere and the cooking stove was knocked over. It looked like they left in a hurry – they didn't take their boots. Perhaps they thought the ship was going to sink. "So how did they leave? The sailor added, "There were no dinghies on board. Also there were ropes hanging over the side, and one was broken. Perhaps they got into a dinghy and the rope broke in bad weather. "Captain Morehouse said that the weather was very bad with strong winds and rain before they found the boat. He put half of his sailors on the empty boat and brought it to Gibraltar.

However, why the crew and passengers left the ship and what happened to them next is a mystery.

Questions

1. Who were missing from the ship? (1 mark)

.....

2. Name the ships that left New York and where were the ships sailing to? (1 mark)

.....

3. Who was Captain Briggs' friend? (1 mark)

.....

4. Was the ship in good condition? Give your reasons (2 marks)

.....

.....

.....

.....

5. What were the sailor's evidence about the mystery of abandoned ship? (3 marks)

.....

.....

.....

.....

.....

6. Write similar words from the passage for the words given below. (2 marks)

Kitchen:..... (refer paragraph 3)

Amazed: .....(refer paragraph 3)

Question 02

(10 Marks)

Fill in the blanks using correct <u>prepositions</u>

1. I looked at the bookcase and saw an interesting story book ..... the top shelf.
2. ..... sunny days we usually go on a picnic.
3. I usually listen ..... pop music, because I'm interested ..... it.
4. I last saw him ..... last March.

Question 03

(10 Marks)

Fill in the gaps with an appropriate <u>wh-question</u>

1. _____ do you live? I live in Canada.
2. _____ do you wake up? I wake up in the morning.
3. _____ is your brother? My brother is at the hostel.
4. _____ do you go for English class? I go to Sigma to learn English.
5. _____ does your father work? My Father works in a bank.
6. _____ is the party? The party is at Water's Edge.
7. _____ are you sad? I have failed the exam.
8. _____ is the bank? The bank is situated next to the railway station.
9. _____do you cook rice? I cook rice in a rice cooker.
10. _____ is the answer to question number 5? The answer for question number 5 is better.

Question 04

Fill in the blanks with a/an/the where necessary. If the article is not needed please draw a line.

(05 marks)

1. Tower of London is popular ..... tourist attraction.
2. His favorite newspaper is..... Guardian.
3. They went for..... stroll around .....St James' Park.
4. .....Statue of Liberty is in..... New York.
5. .....expedition to..... South Pole needs a lot of careful planning.
6. He went on..... expensive holiday to .....Bahamas.

Question 05

Select the appropriate determiner or quantifier and fill the gaps given below. (10 Marks)

(some/few, few, the number of, little, many, most/ the, several, each/a, many, little)

1. Today .....people who enjoy winter sports is much greater than that of twenty years ago.
2. According to the studies, dolphins, whales and ....other sea creatures use highly sophisticated navigation systems.
3. The dietary habits of a child often have ..... to do with that child's eating habits as an adult.
4. In the United States of America, there are literacy classes for workers, ...of whom never graduated from high school.
5. In the first .....months of life, an infant learns how to lift its head, how to smile and how to recognize its parents.
6. Serving .....terms in Congress, Shirley Chisholm became an important United States politician.
7. Although the language learning abilities of apes have surprised ..... scientists, they generally agree that apes do not progress beyond .....linguistic abilities of a two-year-old child.
8. The storm continued for .....of the days when we were in New Orleans, but fortunately there wasn't ..... damage in the city.
9. Heavy fines and jail sentences have made ..... difference in preventing elephant poaching for their tusks.
10. Although .....species of fox are reddish in colour, ...Arctic fox is often pure white.

Question 6

(10 Marks)

Change the following active sentences into passive

1.The gardener plants some trees.

.....

2.Doctor Brown will give you some advice.

.....

3.A famous designer will redecorate the hotel.

.....

4.Steven Spielberg directed "E.T."

.....

5.Someone broke the crystal vase.

.....

6.His parents brought him up to be polite.

.....

7.Fleming discovered penicillin.

.....

8.They will advertise the product on television.

.....

9.Someone remakes that film.

.....

10.Picasso painted that picture.

.....

Question 7

Fill in the blanks with <u>the correct form of the verb</u> given in the brackets (10 Marks)

1. ..... (you / meet) Paul yesterday?
2. Father ..... (work) in the garden now.
3. What ..... (you / do) at the moment?
4. Mr. Jones ..... (paint) his house last month.
5. She ..... (go) to school on foot every day.
6. It ..... (be) hot yesterday.
7. The baby ..... (not / sleep) now.
8. He never ..... (drive) fast.
9. She ..... (leave) Paris in 1987.
10. She always ..... (go) to church on Sunday.

Question 8

Complete **<u>the conditional sentences</u>** using the verb given in brackets. (10 marks)

1. If there is a famine, many ..... (die)
2. If he..... (get) a job, he will marry.
3. If I qualify as an accountant, I ..... (go) abroad.
4. Unless you ..... (qualify), you will not get the post.
5. If they ..... (invite) me, I would have attend the wedding.
6. If you ..... (be) careful, your money would have not been stolen.
7. We would be stupid if we ..... (tell) him about secrect.
8. If we ..... (meet) him tomorrow, We will say hello.
9. If I had studied, I ..... (pass) the exam.
10. If I ..... (be) stronger, I would help you to carry the piano.

Question 9

(10 marks)

Write a letter to the Head of the Navigation Department asking for permission to take two days leave for a leadership programme.

Question 10

Write an essay on <u>one</u> of the following in 125 words (15 marks)

* Natural disasters
* Types of ships
* Why I want to be a Seafarer
* History of Seafaring

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CINEC CAMPUS
Beyond A Graduate

CINEC CAMPUS (PVT) LTD
FACULTY OF MARITIME SCIENCES
DEPARTMENT OF NAVIGATION
EDUCATION & TRAINING COURSE : NAVIGATION OFFICER CADET TRAINING COURSE – FOUNDATION
COURSE CODE : ND- 0199 - BATCH 020

END-TERM EXAMINATION – QUESTION PAPER

INDUSTRIAL CHEMISTRY

- *Answer ANY 5 questions only*
- *Formulae and all intermediate steps taken in reaching your answer should be clearly shown*
- *Total Marks : 100*

Date: 06.04.2021 *Pass mark 50%* *Time allocated: 03 Hours*

Avogadro Constant (N_A) – 6.022×10^{23} mol^{-1}
H – 1.0, He – 4.0, Li – 6.9, Be – 9.0, B – 10.8, C – 12.0, N –14.0 , O – 16.0, F – 18.9, Ne – 20.2, Na – 23.0, Mg – 24.3, Al – 27.0, Si – 28.1, P – 31.0, S – 32.1, Cl – 35.5, Ar – 40.0, K – 39.1, Ca – 40.1, Ag- 108.0, Cu – 63.5, Fe – 56.0, Co – 58.9, Zn = 65.4, Sn = 117.8

1)

a) Write down the correct chemical formula

i) Propane
ii) Potassium permanganate
iii) Ozone
iv) Iron (III) oxide

(1×4= 04 marks)

b) Name the three particles of the atom; and their respective charges. (6 marks)

c) Define the term

i) Metalloid
ii) Hydrate
iii) Heterogeneous mixture
iv) Valence electrons
v) Covalent bonds

(2×5= 10 marks)

2)

a) How many moles are in 12.45 g of Ca? (03 marks)

b) How many molecules are in 36 g of $AgNO_3$?

(05 marks)

c) A hydrate of magnesium sulfate has a mass of 13.52 g. This sample is heated until no water remains. The $MgSO_4$ has a mass of 6.60 g. Find the formula of the hydrate.

(06 marks)

d) What is the empirical formula of the compound with the following composition, 2.1 percent H, 65.3 percent O, 32.6 percent S (6 marks)

---

3)

a) How do you identify an acidic or basic solution by using litmus papers?

(04 marks)

b) If HNO_2 acid ionization constant (K_a) is 4.0×10^{-4}, Calculate the pH value of a 0.036 $moldm^{-3}$ nitrous acid (HNO_2) solution.

Note: we assume, unless stated otherwise, that the temperature is 25 °C

(6 marks)

a) Calculate the pH of

i) 0.03 $moldm^{-3}$ HNO_3 solution (2 marks)

ii) 0.5 $moldm^{-3}$ NaOH solution at 25^0C. (2 marks)

c) Calculate the solubility of $Cu(OH)_2$ in 1 gl^{-1} ? K_{sp} of $Cu(OH)_2$ 2.2×10^{-20}

(06 marks)

---

4)

a) Complete the following table with the observed reactions for the electrochemical cells. Write the correct oxidation and reduction half-reaction in the appropriate column for each.

Cells	***Anode Reaction***	***Cathode Reaction***	***Overall Cell Reaction***
Ba-Zn			
Cu-Pb			
Pb-Ba			

$Zn^{2+}_{(aq)} + 2\,e^- \rightarrow Zn_{(s)}$ $E^\circ = -0.76$ V

$Cu^{2+}_{(aq)} + 2\,e^- \rightarrow Cu_{(s)}$ $E^\circ = +0.34$ V

$Pb^{2+}_{(aq)} + 2\,e^- \rightarrow Pb_{(s)}$ $E^\circ = -0.13$ V

$Ba^{2+}_{(aq)} + 2\,e^- \rightarrow Ba_{(s)}$ $E^\circ = -2.90$ V (09 marks)

b) Consider the following two reduction reactions and their standard electrode potentials:

$Fe+2(aq) + 2e^- \rightarrow Fe(s)$ $E° = -0.44$ V

$Mg^{2+} + 2e- \rightarrow Mg$ $E° = -2.37$ V

i. Write the balanced overall cell reaction for a voltaic cell based on these two half-reactions. (02 marks)

ii. Calculate the standard cell potential. (03 marks)

iii. Write the standard notation of Fe-Ni galvanic cell. (03 marks)

iv. Draw and label the schematic diagram of Fe-Ni galvanic cell. (03 marks)

5)

d) Explain the meaning of corrosion with examples. (04 marks)

e) Explain the physical nature of corrosion product (04 marks)

f) Explain how nature of cathode influencing corrosion? (04 marks)

g) Explain how nature of medium influencing corrosion? (04 marks)

h) Write two corrosion control method and explain it. (04 marks)

6)

a) How does Petroleum form?

b) Explain about Liquid Petroleum Gas (LPG)

c) What are the three types of lubrications?

d) Write four function of lubricant.

e) Write a short note about Semi solid lubricant. (5 x 4= 20 marks)

7)

a) Categorized polymers according to its structural arrangement. (4 marks)

b) Polystyrene is a useful polymer. ($CH_2=CHC_6H_5$)

i. Write its monomer structure

ii. Polymer structure

iii. Give two Uses and applications (4 marks)

c) Mention 4 general properties of metals (4 marks)

d) What are the ways of extraction metals (4 marks)

e) What are the Raw materials of extraction of Iron? (4 marks)

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Colombo International Nautical and Engineering College

CINEC CAMPUS

Faculty of

Maritime Sciences

EDUCATION & TRAINING COURSE: Navigation Officer Cadet Training Course – Foundation

Marine Engineering Officer Cadet Training Course - Foundation

COURSE CODE: ND-199 / BATCH 019

FINAL RE-REPEAT EXAMINATION – QUESTION PAPER

PHYSICS

- Answer any 06 questions only
- Total Marks – 120

Date: 02.11.2019 Pass mark 50% Time allocated: 3 Hours

$\varepsilon_0 = 8.85\times10^{-12}\ C^2/Nm^2$, $\mu_0 = 4\pi\times10^{-7}\ H/m$, $m_e = 9.11\times10^{-31}kg$, $m_p = 1amu = 1.6726\times10^{-27}kg$, $e = 1.6\times10^{-19}\ C$

1.

a. Write the lens formula specifying the sign convention. (6 marks)

b. Draw the ray diagram for an object in front of a convex lens

i. When the object is placed at infinity

ii. When the object is placed between the focus and lens (6 marks)

c. An object ***10 mm*** high is placed ***2 m*** from a convex lens with a focus of 0.1 m. find the location, height, and orientation of the image? (8 marks)

2.

a. Write down the laws of refractions. (4 marks)

b. What is the speed of light in Cubic Zirconia? Assume the index of refraction of Cubic Zirconia to be ***2.176*** and speed of light in free space to be $3.0\times10^8\ ms^{-1}$. (4 marks)

c. The index of refraction of a Moissanite is ***2.65***. Find the speed of light in the Moissanite, the angle of refraction in Moissanite if light is incident from water at an angle of 45^0, and critical angle of incidence for Moissanite - water interface. (12 marks)

3.

a. Describe the interference of light and their application (4 marks)

b. A diffraction grating is rule with ***3000 lines per centimeter***. The first order of a spectral line is observed to diffracted at angle of 20^0. What is the wavelength of the radiation? (6 marks)

c. A grating having ***2300 lines per in centimeter*** produces spectra of mercury arc. The green line of the mercury spectrum has a wavelength of ***5461 A***. What is the angular separation between the first-order green line and the second-order green line? (10 marks)

$1A = 10^{-10}$ m

4.

a. Write an expression for the force(F) acting on a charge(q) which is moving in a magnetic field(B) with a velocity of V. Hence derive an expression for the radius of the path of the electron (6 marks)

b. Doubly charge Helium, He^{2+} ion (atomic mass of ***Helium 4 amu***) is moving with speed of 8×10^6 ***m/s*** at right angles to a magnetic field ***1.28 T***.

i. What is the force on the ion? (4 marks)

ii. What is the centripetal acceleration of the ion? (6 marks)

iii. What is the radius of the circle in which the ion moves? (4 marks)

5.

a. The source of sound s is moving with a velocity ***10 m/s*** towards a stationary observer. The observer measures the frequency of the source as ***1024 Hz***. The velocity of sound in the medium is ***340 m/s***.

i. What is the actual frequency of the source (6 marks)

ii. What will be the apparent frequency of the source when it is moving away from the observer after crossing him? (6 marks)

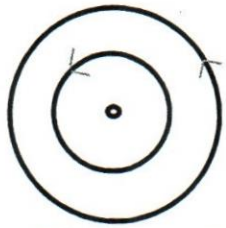
b. A car, sounding a horn producing a note of ***400 Hz***, approaches and the passes a stationary observer O at a steady speed of ***60 km/h*** calculate the change in wave length of the note heard by O. speed of sound in air = ***340 m/s.*** (8 marks)

6.

a. State the ***Biot-Sarvart*** law (4 marks)

b. Write an expression for the ***magnetic flux density (B)*** at the center of a current ***(I)*** carrying circular loops whose radius is ***R*** and number of turns is ***N*** (4 marks)

c. Two current carrying circular loops whose radius are ***16 mm*** (loop 1) and ***12 mm*** (loop 2)with ***400*** and ***200*** terns bear a current of ***300 mA*** for each in same directions. Determine



i. The flux density at the center of the circular loops (6 marks)

ii. The current in the loop 2 which produces the flux density at the center is zero (6 marks)

7.

a. States the ***Amperes' law***. (4 marks)

b. Write an expression for the ***magnetic field*** produced by an infinitely long current carrying conductor. (4 marks)

c. Two long parallel wires separated by distance ***25 mm***. There is current of ***30 mA*** in wire 1 and a current of ***100 mA*** in wire 2 in same directions.

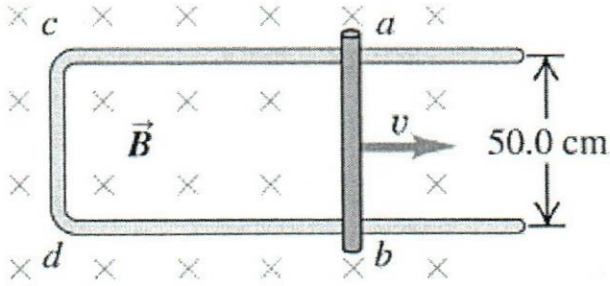
i. Find the total magnetic field at the point which is on the line joining the wire and ***10 mm*** from wire 1 and ***15 mm*** from wire 2. (6 marks)

ii. Find the force acting on each wire per unit length (6 marks)

8.

a. Describe the ***Fleming's right hand rule*** and write an expression for the force (F) on a current (I) carrying conducting rod (L) in a magnetic field (B) (4 marks)

b. A metal rod makes contact with a partial circuit and completes the circuit. The circuit area is perpendicular to a magnetic field, ***B*** with ***0.45 T***. If the resistance of the total circuit is ***0.45 Ω***. Estimate the followings



i. The induced EMF (4 marks)

ii. The current pass through the circuit (6 marks)

iii. The force is required to move the rod with a constant speed of $v = 5$ *m/s*. (6 marks)

9.

a. States the ***Lens's law*** and ***Faraday's law*** in electromagnetic induction (6 marks)

b. A shunt wound generator has an armature resistance of ***0.24 Ω*** and the field coils have a resistance of ***120 Ω***. Its terminal potential difference is ***440 V*** when a current of ***20A*** is delivered to an external circuit. Determine

i. The ***current*** in the field coils (2 marks)

ii. The ***armature*** current (4 marks)

iii. The ***power lost*** in the field windings and armature windings (4 marks)

iv. The ***induced emf*** (4 marks)

END.

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EDUCATION & TRAINING COURSE : Navigation Officer Cadet Training Course – Foundation

Marine Engineering Officer Cadet Training Course - Foundation

COURSE CODE : ND- 199 / ED-340 - BATCH 019/022

FINAL EXAMINATION – QUESTION PAPER

ELECTRONICS

- This question paper consists of eight questions.
- Answer Any SIX (06) Questions

Date: 17.09.2019 | Pass mark 50% | Time allocated: 03 Hrs

➢ ***Some helpful Data:***

* Permittivity of free air/ vacuum (ε_0) – 8.854×10^{-12} F/m
* Charge of electron – $1.602\times10^{19}C$

Barrier potential across a 'Si' Diode – 0.7 V | across a "Ge" Diode 0.3 V

* Resistor Colour Codes:

Black -0, Brown -1, Red -2, Orange -3, Yellow -4, Green -5, Blue -6, Purple -7, Grey -8, White -9, Gold – 5%, Silver -10%, No Colour -20%

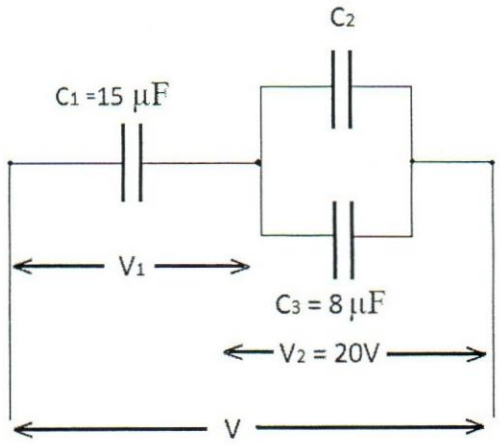
1. a) What is the SI unit of capacitance (4 marks)

   b) Three capacitors of capacitance $2\mu F, 4\mu F$ *and* $6\mu F$ are connected in series to a 220V supply. Find the total capacitance and charge on each capacitor. (6 marks)

   c)

   i. Calculate the capacitance of two metal plates of area $30m^2$ separated by a dielectric 2mm thick and of relative permittivity 6.
   (4 marks)

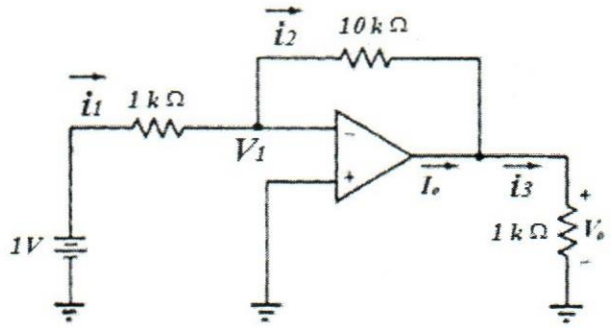
   ii. In the circuit shown in below, total charge is 750 μC. Determine the values of V_1, V and C_2.
   (6 marks)



2. a) What are the properties of an ideal op amp? (3 marks)

b) Draw schematic diagram of summing amplifier. (6 marks)

c) For the circuit in below determine the value of v_1, i_1, i_2, v_o, i_3 *and* i_o. (9 marks)

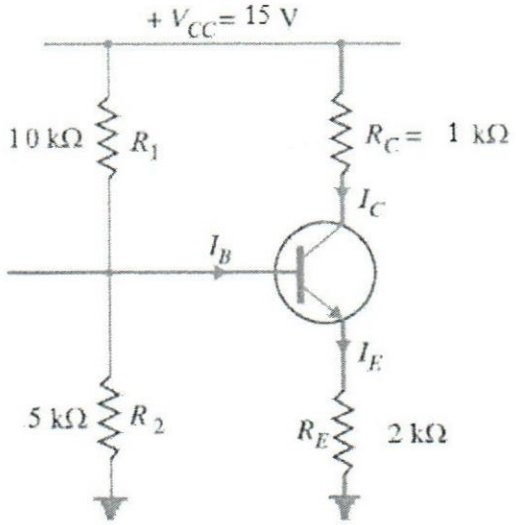


d) Hence, find the voltage gain. (2 marks)

3. a) Draw schematic diagrams of npn and pnp transistors. (6 marks)

b) Describe the various methods used for transistor biasing. (6 marks)

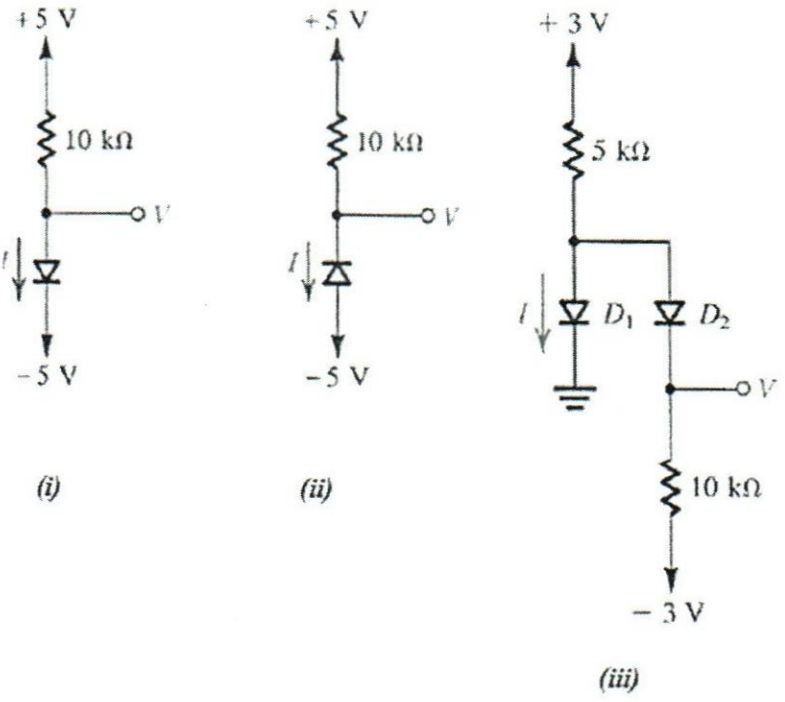
c) Following circuit shows the voltage divider bias method. Draw the load line and determine the operating point. Assume $V_{BE} = 0.7V$. (8 marks)



4. a) Describe formation of diode from pure silicon crystal to P-N junction diode. (6 marks)

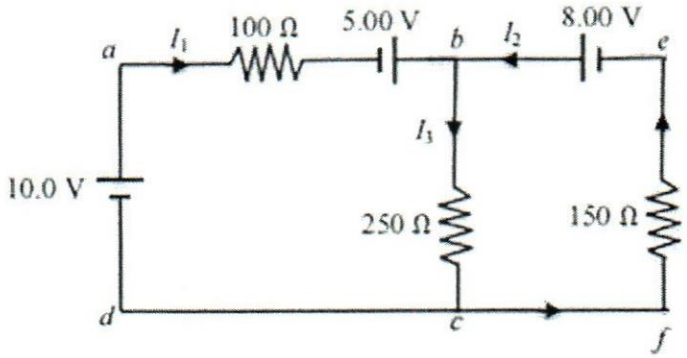
b) Draw schematic diagrams of the full wave and half wave rectifier circuits. (6 marks)

c) Assume that the diodes in the figure are ideal. Find the values of the labeled currents and voltages. (8 marks)



5. a) Express Kirchhoff current and voltage laws. (6 marks)

   b) Consider the DC circuit shown in below and note that the direction of the currents shown in the figure are arbitrary. (14 marks)



   i. Find each branch current.

   ii. What is the direction of the current through 250 Ω resistor? (from b to c or from c to b)

   iii. Determine the potential difference Ve – Vf, with the appropriate sign.

6. a) What are the SI units of following electric quantities? (6 marks)

   i. Electric power ii. Current iii. Voltage

   b) Calculate the resistance of 915 m length of wire having a uniform cross sectional area of 0.77 cm^2 if the wire is made of copper having a resistivity of 1.7×10^{-6} Ωcm. (8 marks)

   c) Calculate power consumption of above resistor if 5A current flows through it. (6 marks)

7. a) What are the SI unit of resistance and resistivity. (4 marks)

   b) What are the factors affecting the resistance of an electrical conductor? (4 marks)

   c) Determine the nominal resistance values of these resistors, given their band colors, and express the allowable tolerance in ohms. (6 marks)

   i. Yellow, Red, Blue, Gold

   ii. Green, Black, Orange, Silver

d) Determine the colour code following resistances. (6 marks)

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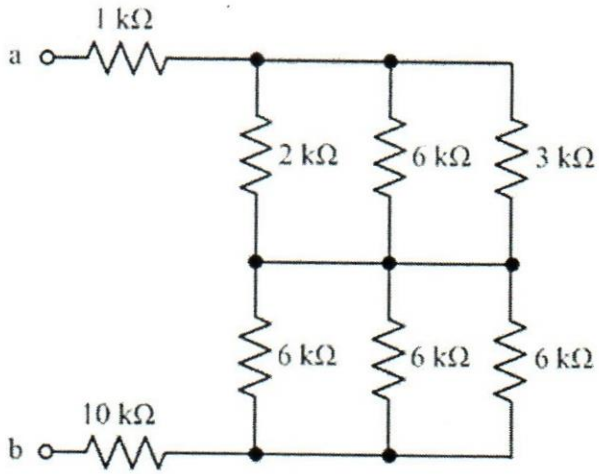
i $47\Omega \pm 10\%$

ii. $20k\Omega \pm 5\%$

8. *a)* If resistors $\mathbf{R_1}$ and $\mathbf{R_2}$ and $\mathbf{R_3}$ are *(i)* in series and *(ii)* in parallel. Write the formula for the equivalent resistance of each network. (4 marks)

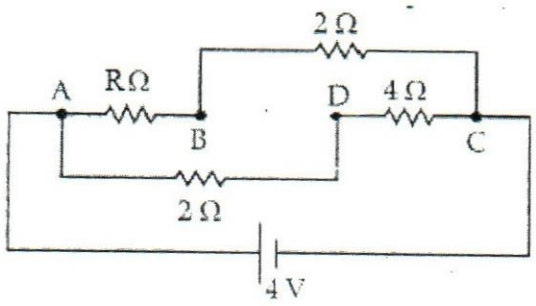
b) Find the equivalent resistance between point a and b. (8 marks)



c) ***i.*** Calculate equivalent resistance of following resistor network, if current drown from

the battery is 2A. (5 marks)

ii. Hence, find the value of resistance R. (3 marks)



END

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Colombo International Nautical and Engineering College

CINEC CAMPUS

Faculty of

Marine Engineering / Maritime Sciences

EDUCATION & TRAINING COURSE : Navigation Officer Cadet Training Course – Foundation

Marine Engineering Officer Cadet Training Course - Foundation

COURSE CODE : ND- 199 / ED-340 - BATCH 019/022

FINAL EXAMINATION – QUESTION PAPER

INDUSTRIAL CHEMISTRY

- *Answer ANY 5 questions only*
- *Formulae and all intermediate steps taken in reaching your answer should be clearly shown*
- *Total Marks : 100*

Date: 17.09.2019 *Pass mark 50%* *Time allocated: 03 Hours*

Avogadro Constant (N_A) – 6.022×10^{23} mol^{-1}

H – 1.0, He – 4.0, Li – 6.9, Be – 9.0, B – 10.8, C – 12.0, N –14.0 , O – 16.0, F – 18.9, Ne – 20.2, Na – 23.0, Mg – 24.3, Al – 27.0, Si – 28.1, P – 31.0, S – 32.1, Cl – 35.5, Ar – 40.0, K – 39.1, Ca – 40.1, Ag- 108.0, Cu – 63.5, Fe – 56.0, Co – 58.9, Zn = 65.4, Sn = 117.8

1)

a) Write down the correct chemical formula

i) Propane

i) Potassium permanganate

ii) Ozone

iii) Calcium carbonate

(1×4= 04 marks)

b) Name the three particles of the atom; and their respective charges. (6 marks)

c) Define the term

i) Mass number

ii) Hydrate

iii) Mixture

iv) Valence electrons

v) Covalent bonds

(2×5= 10 marks)

2)

a) How many moles are in 11.4 g of Cu? (03 marks)

b) How many molecules are in 44 g of $AgNO_3$?

(05 marks)

c) A hydrate of magnesium sulfate has a mass of 13.52 g. This sample is heated until no water remains. The $MgSO_4$ has a mass of 6.60 g. Find the formula of the hydrate.

(06 marks)

d) Ascorbic acid (vitamin C) cures scurvy. It is composed of 40.92 percent carbon (C), 4.58 percent hydrogen (H), and 54.50 percent oxygen (O) by mass. Determine its empirical formula

(6 marks)

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3)

a) If the ion product constant of water is 1×10^{-14} mol^2dm^{-6} at 25^0 C , derive the following equation

$p^H + p^{OH} = 14$

(04 marks)

b) If HNO_2 acid ionization constant (K_a) is 4.0×10^{-4}, Calculate the pH value of a 0.036 $moldm^{-3}$ nitrous acid (HNO_2) solution.

Note: we assume, unless stated otherwise, that the temperature is 25 °C

(6 marks)

a) Calculate the pH of

i) 0.036 $moldm^{-3}$ HNO_3 solution (2 marks)

ii) 0.25 $moldm^{-3}$ NaOH solution at 25^0C. (2 marks)

c) Calculate the solubility of $Cu(OH)_2$ in 1 gl^{-1} ? K_{sp} of $Cu(OH)_2$ 2.2×10^{-20}

(06 marks)

---

4)

a) Complete the following table with the observed reactions for the electrochemical cells. Write the correct oxidation and reduction half-reaction in the appropriate column for each.

Cells	***Anode Reaction***	***Cathode Reaction***	***Overall Cell Reaction***
Ba-Zn			
Cu-Pb			
Pb-Ba			

$Zn^{2+}_{(aq)} + 2\,e^- \rightarrow Zn_{(s)}$ $E^\circ = -0.76$ V

$Cu^{2+}_{(aq)} + 2\,e^- \rightarrow Cu_{(s)}$ $E^\circ = +0.34$ V

$Pb^{2+}_{(aq)} + 2\,e^- \rightarrow Pb_{(s)}$ $E^\circ = -0.13$ V

$Ba^{2+}_{(aq)} + 2\,e^- \rightarrow Ba_{(s)}$ $E^\circ = -2.90$ V (09 marks)

b) Consider the following two reduction reactions and their standard electrode potentials:

$Fe{+}2(aq) + 2e^- \rightarrow Fe(s)$ $E^\circ = -0.44$ V

$Ni{+}2(aq) + 2e^- \rightarrow Ni(s)$ $E^\circ = -0.25$ V

i. Write the balanced overall cell reaction for a voltaic cell based on these two half-reactions. (02 marks)

ii. Calculate the standard cell potential. (03 marks)

iii. Write the standard notation of Fe-Ni galvanic cell. (03 marks)

iv. Draw and label the schematic diagram of Fe-Ni galvanic cell. (03 marks)

---

1)

d) Explain the meaning of corrosion with examples. (04 marks)

e) Explain the physical nature of corrosion product (04 marks)

f) Explain how nature of cathode influencing corrosion? (04 marks)

g) Explain how nature of medium influencing corrosion? (04 marks)

h) Write two corrosion control method and explain it. (04 marks)

2)

a) How does Petroleum form?

b) Write four functions of lubricants.

c) What are the three types of lubrications?

d) What are the three types of lubricants?

e) Write a short note about thick film lubrication.

(5 x 4= 20 marks)

2)

a) Categorized polymers according to their existence. (4 marks)

b) Polystyrene is a useful polymer. ($CH_2{=}CHC_6H_5$)

i. Write its monomer structure

ii. Polymer structure
iii. Give two Uses and applications (4 marks)

c) Mention 4 general properties of metals (4 marks)

d) What are the ways of extraction metals (4 marks)

e) What are the Raw materials of extraction of Iron? (4 marks)

END.

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Marine Engineering Officer Cadet Training Course - Foundation

COURSE CODE : ND- 199 / ED-340 - BATCH 019/022

FINAL EXAMINATION – QUESTION PAPER

ELECTRONICS

- This question paper consists of eight questions.
- Answer Any SIX (06) Questions

Date: 17.09.2019 | Pass mark 50% | Time allocated: 03 Hrs

➢ ***Some helpful Data:***

* Permittivity of free air/ vacuum (ε_0) – 8.854×10^{-12} F/m
* Charge of electron – $1.602\times10^{19}C$

Barrier potential across a 'Si' Diode – 0.7 V | across a "Ge" Diode 0.3 V

* Resistor Colour Codes:

Black -0, Brown -1, Red -2, Orange -3, Yellow -4, Green -5, Blue -6, Purple -7, Grey -8, White -9, Gold – 5%, Silver -10%, No Colour -20%

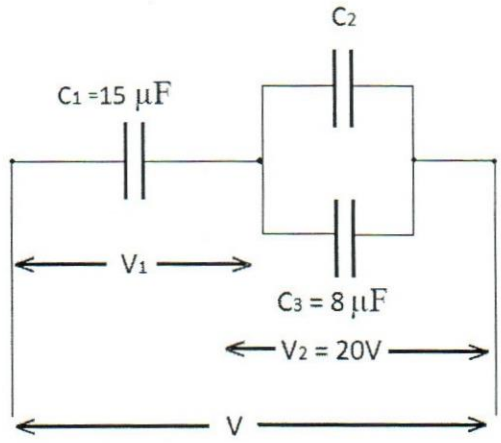
1. a) What is the SI unit of capacitance (4 marks)

   b) Three capacitors of capacitance $2\mu F, 4\mu F$ *and* $6\mu F$ are connected in series to a 220V supply. Find the total capacitance and charge on each capacitor. (6 marks)

   c)

   i. Calculate the capacitance of two metal plates of area 30m^2 separated by a dielectric 2mm thick and of relative permittivity 6.
   (4 marks)

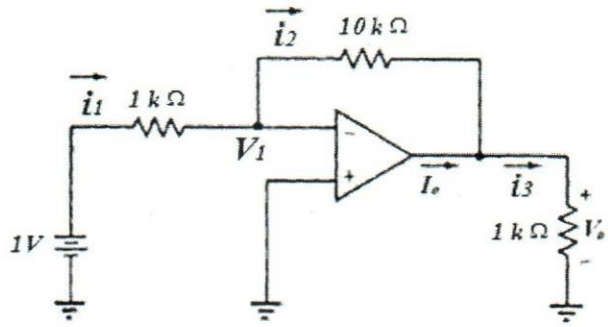
   ii. In the circuit shown in below, total charge is 750 μC. Determine the values of V_1, V and C_2.
   (6 marks)



2. a) What are the properties of an ideal op amp? (3 marks)

b) Draw schematic diagram of summing amplifier. (6 marks)

c) For the circuit in below determine the value of v_1, i_1, i_2, v_o, i_3 *and* i_o. (9 marks)

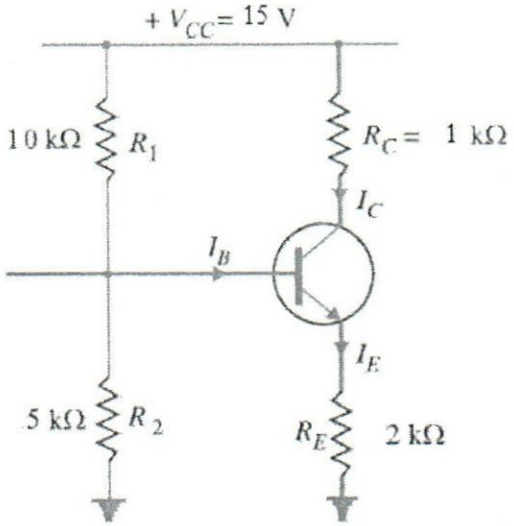


d) Hence, find the voltage gain. (2 marks)

3. a) Draw schematic diagrams of npn and pnp transistors. (6 marks)

b) Describe the various methods used for transistor biasing. (6 marks)

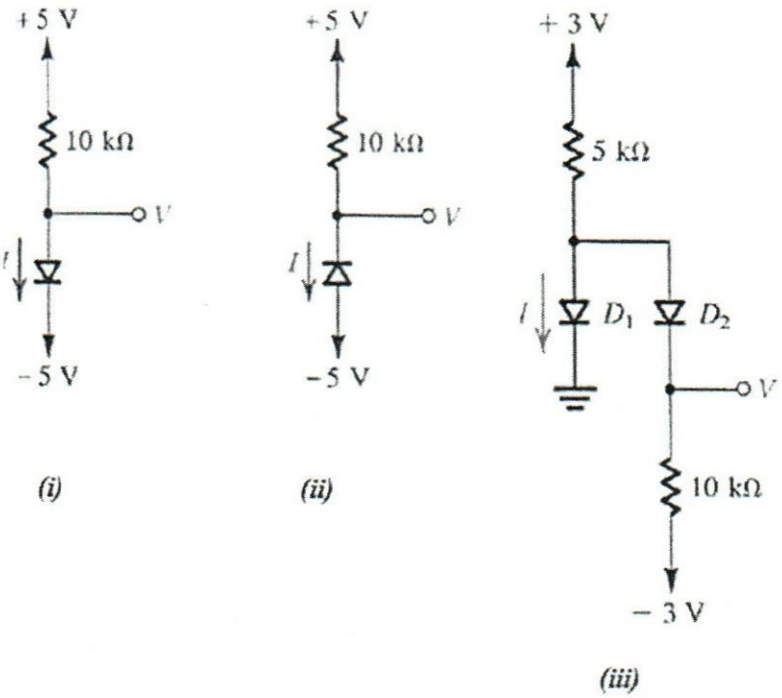
c) Following circuit shows the voltage divider bias method. Draw the load line and determine the operating point. Assume $V_{BE} = 0.7V$. (8 marks)



4. a) Describe formation of diode from pure silicon crystal to P-N junction diode. (6 marks)

b) Draw schematic diagrams of the full wave and half wave rectifier circuits. (6 marks)

c) Assume that the diodes in the figure are ideal. Find the values of the labeled currents and voltages. (8 marks)



d) Determine the colour code following resistances. (6 marks)

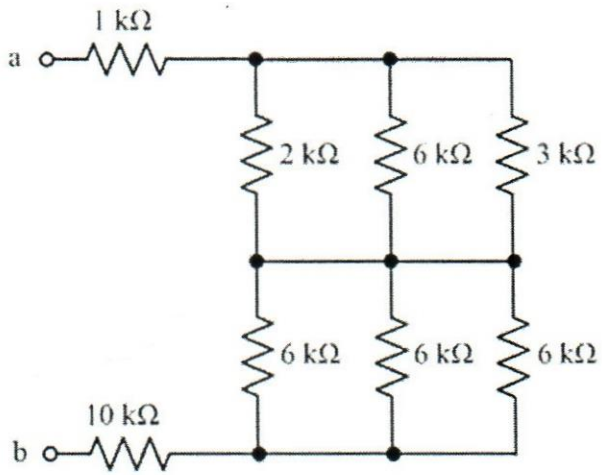
00020

i $47\Omega \pm 10\%$

ii. $20k\Omega \pm 5\%$

8. ***a)*** If resistors $\mathbf{R_1}$ and $\mathbf{R_2}$ and $\mathbf{R_3}$ are ***(i)*** in series and ***(ii)*** in parallel. Write the formula for the equivalent resistance of each network. (4 marks)

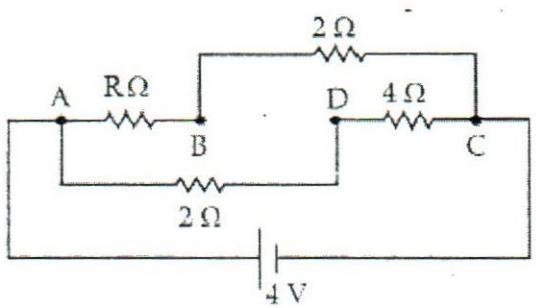
b) Find the equivalent resistance between point a and b. (8 marks)



c) ***i.*** Calculate equivalent resistance of following resistor network, if current drown from

the battery is 2A. (5 marks)

ii. Hence, find the value of resistance R. (3 marks)



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02

Colombo International Nautical and Engineering College

CINEC CAMPUS

Faculty of Maritime Sciences

Department of Navigation

EDUCATION & TRAINING COURSE: NAVIGATION OFFICER CADET TRAINING COURSE FOUNDATION

COURSE CODE: ND- 0199 – BATCH 18

FINAL RE - REPEAT EXAMINATION – QUESTION PAPER

PHYSICS

- Answer 05 Questions Only
- Total Marks 100
- Velocity of light = 3.0×10^8 m/s
- $g = 10\ ms^{-2}$

Date: 18.10.2018 | Pass mark 50 | Time allocated: 03 Hours

$\varepsilon_0 = 8.85\times10^{-12}\ C^2/Nm^2$, $\mu_0 = 4\pi\times10^{-7}\ H/m$, $m_e = 9.11\times10^{-31}kg$, $m_p = 1amu = 1.6726\times10^{-27}kg$, $e = 1.6\times10^{-19}\ C$

1.

a. Define the refractive index of a medium. (3 marks)

b. Write an expression for the refractive index by speed of light in medium (2 marks)

c. The refractive index of certain gemstone (Ruby) to be ***1.76*** and speed of light in free space to be $3.0\times10^8\ ms^{-1}$. What is the speed of light in gemstone? (5 marks)

d. The refractive index of benzene is ***1.4957***. Find

i. The speed of light in the benzene (2 marks)

ii. The angle of refraction in benzene if light is incident from water ($n = 1.333$) at an angle of 25^0 (4 marks)

iii. The critical angle of incidence for benzene - water interface. (4 marks)

2.

a. A standard radio broadcasting station has an assigned frequency between ***530*** and ***1500 kHz***. The VHF television stations have frequencies between ***60*** and ***230 MHz***. While the UHF have frequencies between ***490*** and ***900 MHz***. What is the wavelength corresponding to each of the frequencies mentioned? (8 marks)

b. Ultra violet-light ranges in wavelength roughly from violet at ***360 nm*** to ***70 nm***. Its speed in in vacuum is about 3×10^8 ***m/s***, as is the case for all electromagnetic waves. Determine the corresponding frequency range. (6 marks)

c. Infrared light ranges in wavelength roughly from red at ***700 nm*** to ***1 mm***. Its speed in in vacuum is about 3×10^8 ***m/s***, as is the case for all electromagnetic waves. Determine the corresponding frequency range. (6 marks)

3.

a. A car is moving with a velocity of ***30 m/s*** towards an observer standing on a paddle strain nearby road. The observer measures the frequency of the horn of the car as ***1200 Hz***. The velocity of sound in the medium is ***340 m/s***.

i. What is the actual frequency of the horn (6 marks)

ii. What will be the apparent frequency of the horn when the car is moving away from the observer after crossing him? (6 marks)

b. A policeman, sounding a whistles producing a note of ***2168 Hz***, stands nearby road to stop a car which has steady speed of ***50 m/s*** calculate the change in frequency of the whistle heard by the driver in the car. (8 marks)

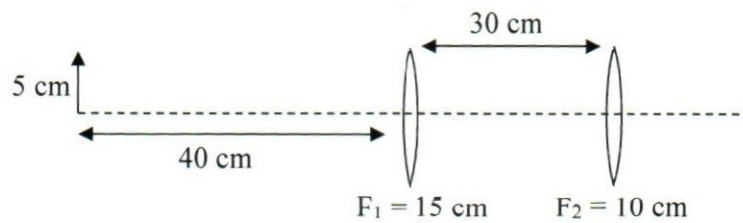
4.

a. Describe the image formed by a thin converging lens when a real object is situated

i. On the focal point F

ii. Inside the front focal point F (8 marks)

b. An object ***5 cm*** high is placed ***40 cm*** from a thin converging lens of ***15 cm*** focal length. A second converging lens of ***10 cm*** focal length is placed ***30 cm*** from the first lens as shown in figure. Find the position, size, and characters of the final image. (12 marks)



5.

a. Write down the beat formula for two tuning-forks of slightly different frequencies of f_1 and f_2 are sounded together. (5 marks)

b. A tuning fork of frequency ***256 Hz*** is sounded with a fork of unknown frequency f Hz, ***5 beats per second*** are heard. When a little plasticine is added to the prongs of the fork, the beats decrease in number. Find the value of f. (7 marks)

c. At a distance ***20 m*** from a small loudspeaker, the amplitude of the sound heard is ***0.012 mm***. find the amplitude at a distance ***30 m*** from the loudspeaker (8 marks)

6.

a. State the ***Biot-Sarvart*** law (4 marks)

b. Write an expression for the ***magnetic flux density (B)*** inside a current ***(I)*** carrying circular loops whose radius is ***R*** and number of turns is ***N*** (4 marks)

a. A circular loops whose radius is ***14 mm*** and ***300*** terns carry a current of ***10 A***. Determine

i. The flux density at the center of the circular loops (4 marks)

ii. The flux density at the center if the current has increased to ***2 A*** (4 marks)

iii. The flux density at the center if the current has dropped to 1***5 A*** (4 marks)

7.

a. States the ***Amperes' law***. (4 marks)

b. Write an expression for the ***magnetic field*** produced by an infinitely long current carrying conductor. (4 marks)

c. Find the ***magnetic field*** at appoint ***10 cm*** from a wire carrying a current of ***50 A***. (4 marks)

d. Two long parallel wires separated by distance ***100 mm***. There is current of ***100 mA*** in wire 1 and a current of ***180 mA*** in wire 2 in same directions.

i. Find the total magnetic field at the point which is on the line joining the wire and ***40 mm*** from wire 1 and ***60 mm*** from wire 2. (4 marks)

ii. At what ***point*** on the line joining the wires is the ***magnetic field zero***? (4 marks)

8.

a. Write an expression for the force(F) acting on a charge(q) which is moving in a magnetic field(B) with a velocity of V. Hence derive an expression for the radius of the path of the electron (5 marks)

b. C 4^+ ion travels at right angles to a magnetic field of ***2.4 T*** with a velocity of ***10^6 m/s***. Find the magnitude of the magnetic force on the ion. (5 marks)

c. A proton is moving with a speed of ***6×10^7 m/s*** at right angle to a magnet field of ***0.2 T***. What is the magnetic force on the electron? What is the radius of the electron moves? (10 marks)

Hint: Use 1^+ ion equals to the magnitude of electron's charge (1.6×10^{-19} C)

9.

a. Describe the ***Fleming's left hand rule*** (5 marks)

02

b. Write an expression for the force (F) on a current (I) carrying conducting rod (L) in a magnetic field (B) (5 marks)

c. Determine the magnetic flux act on a current carrying conductor of ***0.5 m*** long which is kept under a constant force of ***10 N*** if the current in the conductor is ***600 mA***. (5 marks)

d. A coil of ***500*** turns has an area of ***200 mm^2*** and bears a current of ***100 mA***. It is placed with its plane parallel to a magnetic field of intensity ***10 T***. Determine the torque on the coil. (5 marks)

International Nautical and Engineering College
CINEC CAMPUS
Faculty of Maritime Sciences
Department of Navigation
EDUCATION & TRAINING COURSE : NAVIGATION OFFICER CADET TRAINING COURSE FOUNDATION
COURSE CODE : ND- 0199 – BATCH 18

FINAL REPEAT EXAMINATION – QUESTION PAPER

PHYSICS

- *Answer 05 Questions Only*
- *Total Marks 100*
- *Velocity of light = 3.0×10^8 m/s*
- *$g = 10\ ms^{-2}$*

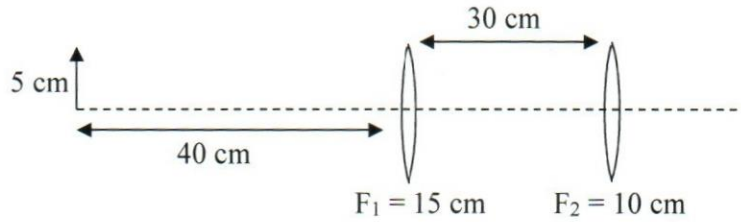
Date: 15.10.2018 *Pass mark 50* *Time allocated: 03 Hours*

$\varepsilon_0 = 8.85\times10^{-12}\ C^2/Nm^2$, $\mu_0 = 4\pi\times10^{-7}$ H/m, $m_e = 9.11\times10^{-31}$kg, m_p = 1amu $=1.6726\times10^{-27}$kg, $e = 1.6\times10^{-19}$ C

1.

a. Describe the image formed by a thin converging lens when a real object is situated
   i. On the focal point F
   ii. Inside the front focal point F (8 marks)

b. An object ***5 cm*** high is placed ***40 cm*** from a thin converging lens of ***15 cm*** focal length. A second converging lens of ***10 cm*** focal length is placed ***30 cm*** from the first lens as shown in figure. Find the position, size, and characters of the final image. (12 marks)



2.

a. A standard radio broadcasting station has an assigned frequency between ***530*** and ***1500 kHz***. The VHF television stations have frequencies between ***60*** and ***230 MHz***. While the UHF have frequencies between ***490*** and ***900 MHz***. What is the wavelength corresponding to each of the frequencies mentioned? (8 marks)

b. Ultra violet-light ranges in wavelength roughly from violet at ***360 nm*** to ***70 nm***. Its speed in in vacuum is about ***3×10^8 m/s***, as is the case for all electromagnetic waves. Determine the corresponding frequency range. (6 marks)

c. Infrared light ranges in wavelength roughly from red at ***700 nm*** to ***1 mm***. Its speed in in vacuum is about 3×10^8 ***m/s***, as is the case for all electromagnetic waves. Determine the corresponding frequency range. (6 marks)

3.

a. The source of sound s is moving with a velocity ***50 m/s*** towards a stationary observer. The observer measures the frequency of the source as ***1050 Hz***. The velocity of sound in the medium is ***340 m/s***.

   i. What is the actual frequency of the source (6 marks)

   ii. What will be the apparent frequency of the source when it is moving away from the observer after crossing him? (6 marks)

b. A car, sounding a horn producing a note of ***500 Hz***, approaches and the passes a stationary observer O at a steady speed of ***20 m/s*** calculate the change in wave length of the note heard by O. (8 marks)

4.

a. Define the index of refraction of a material medium. (3 marks)

b. What is the speed of light in Ethanol? Assume the index of refraction of Ethanol to be ***1.3617*** and speed of light in free space to be $3.0\times10^8\ ms^{-1}$. (5 marks)

c. The index of refraction of benzene is ***1.4957***. Find

   i. The wave length of light in the benzene (4 marks)

   ii. The angle of refraction in benzene if light is incident from water ($n = 1.333$) at an angle of 40^0 (4 marks)

   iii. The critical angle of incidence for benzene - water interface. (4 marks)

5.

a. State the ***Biot-Sarvart*** law (4 marks)

b. Write an expression for the ***magnetic flux density (B)*** inside a current ***(I)*** carrying loops whose radius is ***R*** and number of turns is ***N*** (4 marks)

a. A circular loops whose radius is ***21 mm*** and ***500*** terns carry a current of ***100 mA***. Determine

   i. The flux density at the center of the circular loops (4 marks)

   ii. The flux density at the center if the current has increased to ***200 mA*** (4 marks)

   iii. The flux density at the center if the current has dropped to ***50 mA*** (4 marks)

6.

a. States the ***Amperes' law***. (4 marks)

b. Write an expression for the ***magnetic field*** produced by an infinitely long current carrying conductor. (4 marks)

c. Find the ***magnetic field*** at appoint ***100 mm*** from a wire carrying a current of ***5 A***. (4 marks)

d. Two long parallel wires separated by distance ***200 mm***. There is current of ***50 mA*** in wire 1 and a current of ***70 mA*** in wire 2 in opposite directions.

   i. Find the total magnetic field at the point which is on the line joining the wire and ***120 mm*** from wire 1 and ***80 mm*** from wire 2. (4 marks)

   ii. At what ***point*** on the line joining the wires is the ***magnetic field zero***? (4 marks)

7.

a. Write an expression for the force(F) acting on a charge(q) which is moving in a magnetic field(B) with a velocity of V. Hence derive an expression for the radius of the path of the electron (5 marks)

b. C 4^+ ion travels at right angles to a magnetic field of $0.6\ T$ with a velocity of $10^6\ m/s$. Find the magnitude of the magnetic force on the ion. (5 marks)

c. An electron is moving with a speed of $3\times10^6\ m/s$ at right angle to a magnet field of $1.2\ T$. What is the magnetic force on the electron? What is the radius of the electron moves? (10 marks)

8.

a. Describe the ***Fleming's left hand rule*** (5 marks)

b. Write an expression for the force (F) on a current (I) carrying conducting rod (L) in a magnetic field (B) (5 marks)

c. Determine the magnetic flux act on a current carrying conductor of ***0.25 m*** long which is kept under a constant force of ***5 N*** if the current in the conductor is ***300 mA***. (5 marks)

d. A coil of ***200*** turns has an area of ***600 mm^2*** and bears a current of ***800 mA***. It is placed with its plane parallel to a magnetic field of intensity ***4 T***. Determine the torque on the coil. (5 marks)

9.

a. Write down the beat formula for two tuning-forks of slightly different frequencies of f_1 and f_2 are sounded together. (5 marks)

b. A tuning fork of frequency ***312 Hz*** is sounded with a fork of unknown frequency f Hz, ***4 beats per second*** are heard. When a little plasticine is added to the prongs of the fork, the beats decrease in number. Find the value of f. (7 marks)

c. At a distance ***20 m*** from a small loudspeaker, the amplitude of the sound heard is ***0.012 mm***. find the amplitude at a distance ***30 m*** from the loudspeaker (8 marks)

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Colombo International Nautical and Engineering College

CINEC CAMPUS

Faculty of Maritime Sciences

Department of Navigation

EDUCATION & TRAINING COURSE: Navigation Officer Cadet Training Course – Foundation

COURSE CODE: ND- 0199 - BATCH 018

FINAL REPEAT EXAMINATION – QUESTION PAPER

MATHEMATICS

- *Answer any 06 questions only*
- *Total Marks - 120*

Date: 2018.10.16 *Pass mark 50%* *Time allocated: 03 Hours*

1. a) Sketch the graph of the function $f(x)=\dfrac{x^2-x+1}{x-1}$. (14 marks)

   b) Find gradient at $x=5$. (06 marks)

2. a) Evaluate *i.* $\sin 75^o$ *ii.* $\cos 75^o$. (06 marks)

   hence show that $\tan 75^0=\dfrac{\sqrt{3}+1}{\sqrt{3}-1}$ (04 marks)

   b) i. If $\sin x\cos y=1/4$ and $3\tan x=4\tan y$, Find the value of $\sin(x+y)$. (06 marks)

   ii. Prove that $\sin x\cos x=\dfrac{\cot x}{1+\cot^2 x}$ (04 marks)

3. a) Factorize

3. i. x^2-4x+3

   ii. x^3+5x^2+8x+4 (03 marks each)

   b) If α and β are roots of quadratic equation $ax^2+bx+c=0$, Find the quadratic equation which has roots α^2 and β^2. (08 marks)

   c) Determine the nature of the roots of the equations $x^2+(p+q)x+pq=0$, where p and q are rational. (06 marks)

4. a) Evaluate *i.* $8^{\frac{1}{3}}$ *ii.* $64^{\frac{2}{3}}$ *iii.* $\left(\frac{4}{9}\right)^{\frac{1}{2}}$. (06 marks)

b) Express in the form $a+b\sqrt{c}$

i. $\left(\sqrt{3}+1\right)^2$

ii. $\left(\sqrt{3}+2\right)\left(1-2\sqrt{3}\right)$ (03 marks each)

c) Solve $9^{3-2x}=27$. (08 marks)

5. a) Evaluate $\log_{1/25} 625$ (06 marks)

b) If $\log_{10} 2 = x$, Find $\log_4 5$ in term of x. (06 marks)

c) Solve the following equation. (08 marks)

$$4\log_x 6 - 2\log_x 4 = 2$$

6. a) Differentiate with respect to x. (12 marks)

i. $y = 2x^3 + 3x^2 - 5x + 6$

ii. $y = \frac{x^2-5}{x^3}$

iii. $y = e^x \sin x$

b) If $y = \sqrt{2x^3 - 5}$, find $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$ (08 marks)

7. a) A GP has its first term as 5 and the common ratio as 4/5, Calculate,

i. The 20^{th} term to 3 decimal places. (06 marks)

ii. The sum to infinity of the series. (06 marks)

b) The r th term of a series is (r+3)(r- 4). Find the value of r for the term that has a value of 78.

(08 marks)

8. The points A and B lie on the circumference of a circle with centre O and radius 8.5cm. The point C lies on the major arc AB. Given that angle < ACB = 0.4radians, Calculate the length of the minor arc AB. (20 marks)

9. A rectangular tank is made up of thinsheet metal. The tank has a horizontal square base of side X cm and tank has no top. When full tank holds 500 litres.

   a) Show that the area A of sheet metal needed to make the tank is given by,

   $$A = X^2 + \frac{2000{,}000}{X}.$$ (10 marks)

   b) Find the corresponding value of X for the minimum area. (10 marks)

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Colombo International Nautical and Engineering College

CINEC CAMPUS

FACULTY OF MARITIME SCIENCES

DEPARTMENT OF NAVIGATION

EDUCATION & TRAINING COURSE : NAVIGATION OFFICER CADET TRAINING COURSE – FOUNDATION

COURSE CODE : ND- 0199 - BATCH 018

MID TERM EXAMINATION – QUESTION PAPER

PHYSICS

- *Answer any 06 questions only*
- *Total Marks : 120*

Date: 23.06.2018 *Pass mark 50%* *Time allocated: 03 Hours*

1.

a. Explain what is meant by ***SHM*** (2 marks)

b. Sketch graphs for the variation of kinetic energy, potential energy and total energy with displacement in a simple harmonic motion (6 marks)

c. An object moving with simple harmonic motion has amplitude of ***2 m*** and a period time of ***0.5 seconds***. Determine

i. The frequency of the oscillation (4 marks)

ii. The acceleration at the middle and end of an oscillation (4 marks)

iii. The velocity when the object is ***1.5 m*** away from the origin (4 marks)

2. A block whose mass m is ***0.8 kg*** is fastened to spring whose spring constant k is ***100 N/m***. The block is pulled a distance ***x = 10 cm*** from its equilibrium position at ***x = 0*** on a frictionless surface and released.

a. What are the angular frequency, the frequency and the period of the resulting motion? (5 marks)

b. What is the amplitude of the oscillation? (5 marks)

c. What is the maximum speed of the oscillating block, and where is the block when it has this speed? (5 marks)

d. What is the magnitude of the maximum acceleration of the block? (5 marks)

3.

a. Write the mirror formula specifying the sign convention. (6 marks)

b. Draw the ray diagram for an object in front of a concave mirror
   i. When the object is placed at infinity
   ii. When the object is placed between the focus and mirror (6 marks)

c. An object ***20 mm*** high is placed ***1 m*** from a concave mirror with a radius of curvature of ***4 m***. find the focal length and the location, height, and orientation of the image? (8 marks)

4.

a. Describe the Doppler effect (4 marks)

b. Write expressions for the apparent frequency heard by an observer:
   i. When he is stationary and a source of sound is moving towards him
   ii. When he is moving towards a stationary source of sound (6 marks)

c. A man walking away from a wall at a speed of ***0.5 m/s*** in a direction at right angles to the wall. When he walks, he blows a trumpet steadily. An observer toward whom the man is walking hears ***4*** beats per second. If the speed of sound of sound is ***330 m/s***, what is the frequency of the whistle?

(10 marks)

5.

a. Describe the interference of light and their application (4 marks)

b. A diffraction grating is rule with ***3000 lines per centimeter***. The first order of a spectral line is observed to diffracted at angle of 20^0. What is the wavelength of the radiation?

(6 marks)

c. A grating having ***2300 lines per in centimeter*** produces spectra of mercury arc. The green line of the mercury spectrum has a wavelength of ***5461 A***. What is the angular separation between the first-order green line and the second-order green line? (10 marks)

$1A = 10^{-10}$ m

6.

a. Define pitch, loudness, quality, intensity (8 marks)

b. Write an expression for the sound level change using Intensity or power of source relative to the threshold of hearing (4 marks)

c. A rock band gives rise to an average sound level of ***105 dB*** at a distance of ***10 m*** from the center of the band. As an approximation, assume that the band radiates sound equally into a hemisphere. What is the sound power output of the band (threshold of hearing = 10^{-12} W/m^2

(8 marks)

7.

a. Write expressions for the frequencies of fundamental and of the first two overtones produced in an closed organ pipe (4 marks)

b. An organ pipe ***1.4 m*** long is open at both end. If the velocity of sound is ***334 m/s***, what are the frequencies of the fundamental and of the first two overtones? (6 marks)

c. Two closed pipes, one ***1.45 m*** and ***1.44 m*** in length, are sounded simultaneously. How many beats per second will be produced between the fundamental tones if the velocity of sound ***is 334 m/s***? (6 marks)

8.

a. Describe the followings
   i. Refractive index of a medium
   ii. Total internal reflection (4 marks)

b. Light is passing from air into a liquid and is deviated 19^0 when the angle of incidence is 52^0. Under what conditions will total reflection occur at this interface. (6 marks)

c. A beam of sodium light passes from air into water and then into flint glass, all with parallel surfaces. If the angle of incidence in the air is 45^0, what are the angles of refraction in water and the glass?(n = ***1.333*** and ***1.63*** for water and flint glass, respectively) (10 marks)

9. A plane-progressive wave is represented by the equation

$$y(x,t) = 0.25\sin\left(120\pi t - \frac{50\pi}{24}x\right)$$

Where y is the displacement in millimeters, t is in seconds and x is the distance from a fixed origin O in metres (m). Determine

a. The amplitude (2 marks)
b. The frequency of the wave (4 marks)
c. Its wave length (4 marks)
d. Its speed (4 marks)
e. The phase difference in radians between a point 0.1 m from O and 1.10 m from the origin O (6 marks)

END.

Colombo International Nautical and Engineering College

CINEC CAMPUS

Faculty of Maritime Sciences

Department of Navigation

EDUCATION & TRAINING COURSE : Navigation Officer Cadet Training Course – Foundation

COURSE CODE : ND- 199 - BATCH 018

MID EXAMINATION – QUESTION PAPER

APPLIED MECHANICS

- Answer any 04 questions only
- Total Marks – 100
- $g = 9.8\ ms^{-2}$

Date: 18.06.2018 Pass mark 50% Time allocated: 2.5 Hours

1)

a) Define **Speed** and **acceleration** (2× 2= 4 marks)

b) A cyclist leaves home O and rides along a straight road with a constant acceleration. After 10 seconds, he has reached point A with a speed 15m/s and he maintains this speed for a further 20 seconds until he reaches B before retarding (decelerating) uniformly to rest at C. The whole journey takes 45 seconds. Sketch the **velocity- time graph** for the journey and find; (6 marks)

i) His acceleration from O to A.

ii) His retardation (deceleration) from B to C.

iii) The total distance traveled from O to C.

(9 marks)

c) A tractor exerts a force of 5×103 N on a horizontal chain while moving a load a distance of 50 cm. How much work is done by the tractor?

d) A person lifts a 50 kg bucket from a well and does 4.9 ×103 J of work. How deep is the well?

(6 marks)

2)

i. Man through a ball at **u** ms^{-1} at angle **θ** to horizontal .(gravitational acceleration as **g** ms^{-2}).show that horizontal range of projectile (R) is

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

(Show your work out) (5 marks)

ii. A particle is projected with a velocity of 10 m/s with the angle of projection 30^0 with horizontal. Determine the **velocity** of anther body thrown at an angle of elevation of 45^0 which will have

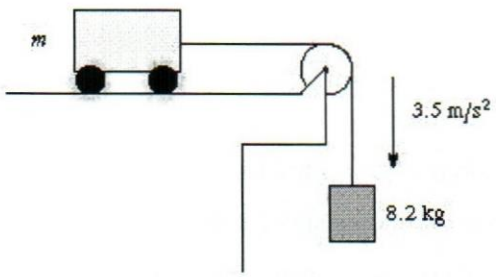
a. Equal time of flight

b. Equal maximum height (2 ×10 =20 marks)

3)

i. State Newton's second law of motion (4 marks)

ii.



a) Mark all the force acting on the system

b) find the mass of car and tension of the string

(13 marks)

iii. An SUV with mass 1.80×10^3 kg is traveling eastbound at 15.0 m/s, while a compact car with mass 9.00×10^2 kg is traveling westbound at 15.0 m/s.The cars collide head-on, becoming entangled.

(a) Find the speed of the entangled cars after the collision.

(b) Find the change in the velocity of each car.

(c) Find the change in the kinetic energy of the system consisting of both cars.

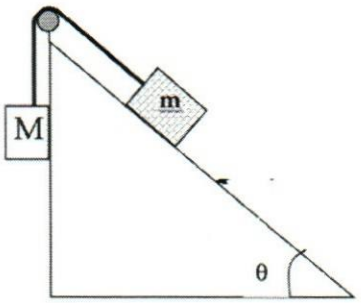
(8 marks)

4)

i. Define friction. Also give the SI unit of friction. (5 marks)

ii. Give way of increasing and reducing friction. (4 marks)

iii. A cord running over a pulley connects two objects. The coefficient of static friction between the object and the table is 0.25, The coefficient of dynamic friction is 0.2. If M =8.0 kg m = 6 kg and $\theta=30^0$. (M is not touching the wall) Find,



a. Limiting frictional force.
b. Acceleration of the system.
c. Tension of the string. (16 marks)

5)

i. Write 4 examples for circular motion? (4 marks)

ii. A car travels at a constant speed of 13.4 m/s on a level circular turn of radius 50.0 m. What minimum coefficient of static friction, μ_s, between the tires and roadway will allow the car to make the circular turn without sliding? (8 marks)

iii. A heavy flywheel of moment of inertia 0.3 kgm2 is mounted on a horizontal axel of radius 0.01 m and negligible mass compared with the flywheel. Neglecting friction, find

a. The angular acceleration if a force of 40 N is applied tangentially to the axel
b. The angular velocity of the flywheel after 12 s from rest?

(4×2 =8 marks)

iv. A race car accelerates uniformly from a speed of 40.0 m/s to a speed of 60.0 m/s in 5.00 s while traveling counterclockwise around a circular track of radius 4.00×10^2 m. When the car reaches a speed of 50.0 m/s, find
(a) the magnitude of the car's centripetal acceleration (b) the angular speed

(5 marks)

End.

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Colombo International Nautical and Engineering College
CINEC CAMPUS
Faculty of Maritime Sciences
Department of Navigation
EDUCATION & TRAINING COURSE: Navigation Officer Cadet Training Course – Foundation
COURSE CODE: ND- 0199 - BATCH 017

FINAL EXAMINATION – QUESTION PAPER

MATHEMATICS

- Answer any 04 questions only
- Total Marks - 400

Date: 2018.01.23 | Pass mark 50% | Time allocated: 02 Hours

1. a) i. Find the remainder if, $4X^{100} + 5X^{90} - 4X^{20} + 2X - 6$ is divided by (X-1) (30 marks)

ii. $\log_2 x + \log_2 y = 3$, and $\log_y x = 2$ find x and y (30 marks)

b) Solve,

$X + 2Y = -3$

$X^2 - 2X + 3Y^2 = 11$ (40 marks)

2. a) The r^{th} term of a series is 2+3r. Find the first 3 terms. (30 marks)

b) A GP has $4^{th\ term}$ as 40, and 9^{th} term as 1.25

i. Find the first term and common ratio of the series. (20 marks)

ii. Show that sum S_n is, $S_n = 640\left[1 - \left(\frac{1}{2}\right)^n\right]$ (20 marks)

c) A sequence $a_1, a_2, a_3, \ldots\ldots\ldots a_n$ is defined by $a_1 = 2$, $a_{n+1} = 2a_n - 1$.
Find the values of a_2, a_3, a_4 (30 marks)

3. a) Find $\frac{dy}{dx}$ using first principals.
i. x^2 ii. $\sqrt{x}$ (40 marks)

b) Find $\frac{dy}{dx}$, when $y = x^3 sin2x$ (30 marks)

c) If $y = x^n lnx$, prove that $x = \frac{dy}{dx} = x^n + ny$ (30 marks)

4. a) Evaluate the following

i. $\int_2^4 3x^5 dx$ (20 marks)

ii. $\int_0^{\pi/2} (\sin x - \cos x)\, dx$ (20 marks)

b) The gradient of a curve is given by $\frac{dy}{dx} = \frac{(x^2+3)^2}{x^2}$, $x \neq 0$

i. Show that $\frac{dy}{dx} = x^2 + 6 + 9x^{-2}$ (20 marks)

ii. If the point (3,20) lies on curve, find an equation for it in the form $y = f(x)$

(40 marks)

5. a) At a certain point A, the angle of elevation of a tower is $\tan^{-1}\left(\frac{5}{12}\right)$, on walking 240m nearer to the tower angle changes to $\tan^{-1}\left(\frac{3}{4}\right)$. What is the height of the tower.

(40 marks)

b) Prove the following.

i. $cos^4A - sin^4A + 1 = 2cos^2A$ (30 marks)

ii. $\frac{1-COS\,2A}{1+COS\,2A} = tan^2A$ (30 marks)

6. a) A rectangular tank is made of thin sheet metal. The tank has a horizontal square base,of side x cm, and no top. When full the tank holds 500 liters.

i. Show that the area, A cm^2 of sheet metal needed to make this tank is given by

$$A = x^2 + \frac{2\,000\,000}{x}$$ (30 marks)

ii. Given that x can vary,find the minimum value of A. (40 marks)

b) Solve the equation

$4^x - 5(2^x) + 4 = 0$ (30 marks)

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Colombo International Nautical and Engineering College
CINEC CAMPUS
FACULTY OF MARITIME SCIENCES
DEPARTMENT OF NAVIGATION
EDUCATION & TRAINING COURSE : NAVIGATION OFFICER CADET TRAINING COURSE – FOUNDATION
COURSE CODE : ND- 0199 - BATCH 017

FINAL EXAMINATION – QUESTION PAPER

INDUSTRIAL CHEMISTRY

- *Answer ANY 5 questions only*
- *Formulae and all intermediate steps taken in reaching your answer should be clearly shown*
- *Total Marks : 100*

Date: 23.01.2018 *Pass mark 50%* *Time allocated: 03 Hours*

Avogadro Constant (N_A) – 6.022×10^{23} mol^{-1}
H – 1.0, He – 4.0, Li – 6.9, Be – 9.0, B – 10.8, C – 12.0, N –14.0 , O – 16.0, F – 18.9, Ne – 20.2, Na – 23.0, Mg – 24.3, Al – 27.0, Si – 28.1, P – 31.0, S – 32.1, Cl – 35.5, Ar – 40.0, K – 39.1, Ca – 40.1, Ag- 108.0, Cu – 63.5, Fe – 56.0, Co – 58.9, Zn = 65.4, Ag = 107.9, Sn = 117.8

1)

a) Write down the correct chemical formula

i) Propane
ii) Ammonia
iii) Ozone
iv) Calcium carbonate

(1×4= 04 marks)

b) Name the three particles of the atom; and their respective charges. (6 marks)

c) Define the term

i) Atomic number
ii) Hydrate
iii) Mixture
iv) Valence electrons
v) Covalent bonds

(2×5= 10 marks)

2)

a) How many moles are in 12.4 g of Zn? (03 marks)

b) How many molecules are in 85 g of $AgNO_3$?

(05 marks)

c) A hydrate of Na_2CO_3 has a mass of 4.31 g before heating. After heating, the mass of the anhydrous compound is found to be 3.22 g. Determine the formula of the hydrate

(06 marks)

d) Chemical analysis shows that citric acid contains 37.51% C, 4.20% H, and 58.29% O.

What is the empirical formula?

(6 marks)

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3)

a) If the ion product constant of water is 1×10^{-14} mol^2dm^{-6} at 25^0 C , derive the following equation

$p^H + p^{OH} = 14$

(04 marks)

b) If HNO_2 acid ionization constant (K_a) is 4.5×10^{-4}, Calculate the pH value of a 0.036 $moldm^{-3}$ nitrous acid (HNO_2) solution.

Note: we assume, unless stated otherwise, that the temperature is 25 °C

(6 marks)

c) Calculate the pH of each of these solutions:
(a) 0.002 M HCl,
(b) 1.3×10^{-4} M $Ba(OH)_2$,

(04 marks)

d) Calculate the solubility of $Cu(OH)_2$ in 1 gl^{-1} ? K_{sp} of $Cu(OH)_2$ 2.2×10^{-20}

(06 marks)

---

2)

a) $Cd^{2+}(aq) + 2e^- \longrightarrow Cd(s)$ $E^0 = -0.40$ V

$Al^{3+}(aq) + 3e^- \longrightarrow Al(s)$ $E^0 = -1.66$ V

Using above Standard Reduction Potentials,

i) Give the anode and cathode half-reactions. (06 marks)

ii) Write the overall equation for the chemical reaction. (04 marks)

iii) Represent the cell using standard notation. (04 marks)

iv) Calculate the cell potential (e.m.f.) of the electrochemical cell. (03 marks)

b) Determine the oxidation number of sulfur in each of the following:

i. H_2S

ii. S_8

iii. H_2SO_4 (03 marks)

---

3)

a) Explain the meaning of corrosion with examples. (04 marks)

b) Explain the factors affect speed of electrolyte corrosion? (04 marks)

c) Explain how nature of cathode influencing corrosion? (04 marks)

d) Explain how nature of medium influencing corrosion? (04 marks)

e) Write two corrosion control method and explain it. (04 marks)

4)

a) How does Petroleum form?

b) Write four functions of lubricants.

c) What are the three types of lubrications?

d) What are the three types of lubricants?

e) Write a short note about thick film lubrication.

(5 x 4= 20 marks)

5)

a) Categorized polymers according to their structural arrangement. (4 marks)

b) Polystyrene is a useful polymer. (CH_2=CHC_6H_5)

i. Write its monomer structure
ii. Polymer structure
iii. Give two Uses and applications (4 marks)

c) Mention 4 general properties of metals (4 marks)

d) What are the ways of extraction metals (4 marks)

e) What are the Raw materials of extraction of Iron? (4 marks)

Colombo International Nautical and Engineering College

CINEC CAMPUS

Faculty of Maritime Sciences

Department of Navigation

EDUCATION & TRAINING COURSE : Navigation Officer Cadet Training Course – Foundation

COURSE CODE : ND- 199 - BATCH 017

MID-TERM EXAMINATION – QUESTION PAPER

MATHEMATICS

- Answer any 04 questions only
- Total Marks - 400

Date: 24.10.2017 Pass mark 50% Time allocated: 02 Hours

Q.1 Simultaneous Equations : Find x & y .

i. $3x - 2y = 5$,

$\frac{2x}{3} + \frac{y}{2} = \frac{-7}{9}$ (50 marks)

ii. $\log_2 x - \log_2 y = 3$,

$\log_y x = 2$ (50 marks)

Q.2 Solve the following Quadratic equations using the formula;

i. $3x^2 - 2x - 8 = 0$ (50 marks)

ii. $x^2 - 5x - 12 = 0$ (50 marks)

Q.3 Logarithms :

i. Show that $(\log_b a) \cdot (\log_a b) = 1$ (40 marks)

ii. If $\log 2 = a$, $\log 3 = b$ and $\log 5 = c$

Express following values in a, b & c

a. log 6 b. log 600 c. log 1.5 (60 marks)

Q.4 Remainder theorem could be given as

$f(x)=(x-a)\,g(x)+R$

Where f(x) is a polynomial and g(x) is a polynomial one degree less than f(x). R is the remainder.

(i) Prove that R = f(a) (25 marks)

(ii) Hence determine the remainder in each case.

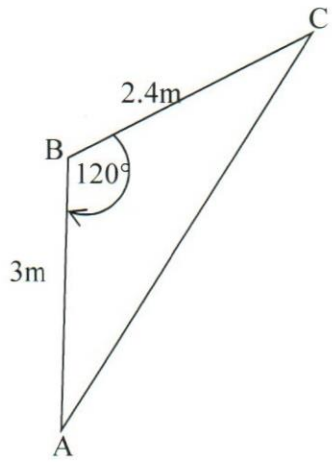
(a) $(5x^3+4x^2-6x+3) \div (x-4)$

(b) $(4x^3+x^2-7x+2) \div (x+3)$

(c) $(3x^4-2x^3-10x-5) \div (x-4)$ (75 marks)

Q.5 Trigonometric Ratios :

i. The figure is a simplified diagram of a crane, with Mast 'AB' and tie 'BC'. Calculate the length 'AC'.



(50 marks)

ii. Show that

$$\sin 2\theta = \frac{2\tan\theta}{1+\tan^2\theta} \quad \text{and} \quad \cos 2\theta = \frac{1-\tan^2\theta}{1+\tan^2\theta}$$

Hence find the value of $\tan 2\theta$

[*Hint:* $\sin 2A = \sin A \cos A$, $\cos 2A = \cos^2 A - \sin^2 A$]

(50 marks)

Q.6 i. Simplify $(16x^{12})^{3/4}$

(30 marks)

ii. Simplify $9x^6\,y^4 \times 2x^5yz^3 \div 6(x^5y^2z)^2$

(40 marks)

iii. If $32\sqrt{2} = 2^a$ Find the value of 'a'.

(30 marks)

End.

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Colombo International Nautical and Engineering College

CINEC CAMPUS

Faculty of Maritime Sciences

Department of Navigation

EDUCATION & TRAINING COURSE : Navigation Foundation Program

COURSE CODE : ND- 0199 BATCH 017

MID TERM EXAMINATION QUESTION PAPER

ELECTRONICS

- Answer ALL questions
- Total Marks : 100

Date: 24.10.2017 Pass mark 50% Time allocated: 02 Hours

(1) Find equivalent resistance of the following circuits.

(20 marks)

(i)

(ii)

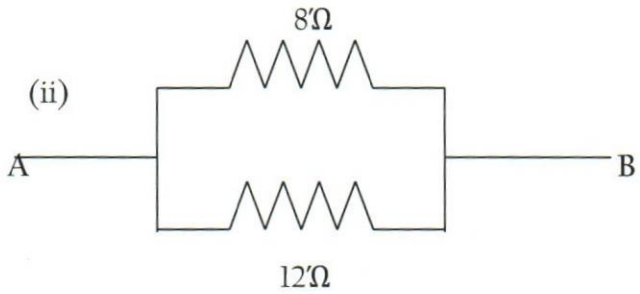


Diagram (1)

(2) With reference to the diagram (2) Calculate

(20 marks)

(i) Current flowing through the battery
(ii) Voltage across each of the resistors.

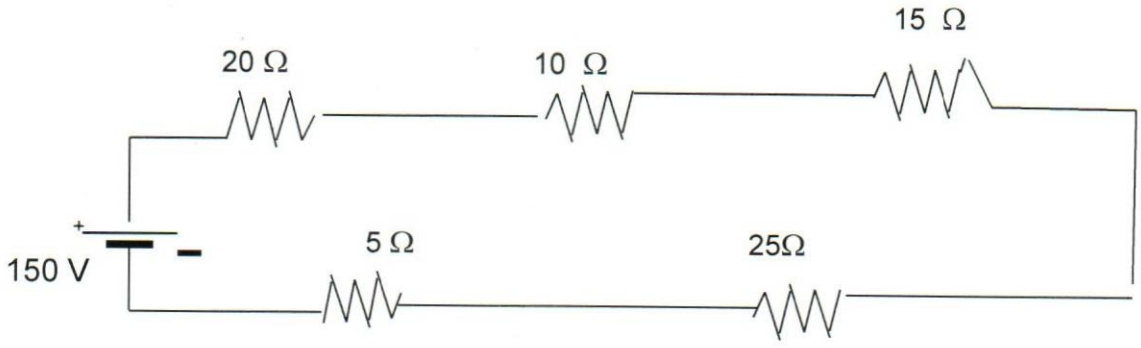


Diagram (2)

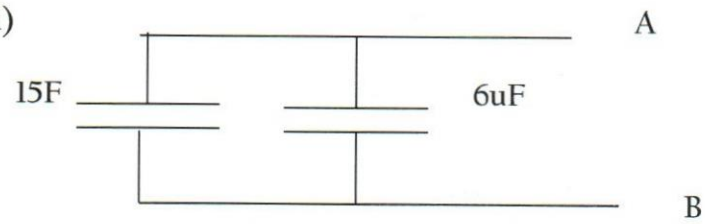
(3) A capacitor has been charged to 20 volts by a constant current of 2A flowing through it for a period of 40 seconds. Find the value of capacitance in Farads.

(10 marks)

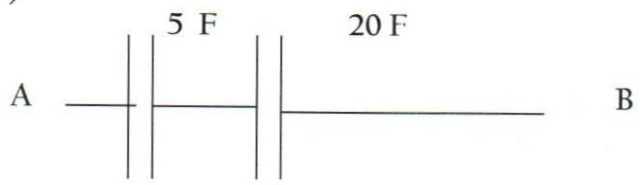
(4) Calculate total equivalent capacitance between points A and B in each circuit shown below.

(10 marks)

(i)



(ii)



(5) A sinusoidal AC voltage has a Peak value 100V . Calculate the

(10 marks)

(i) Peak to Peak Value
(ii) R.M.S. Value
(iii) Average Value
(iv) Periodic time if the frequency of the AC voltage is 50Hz

(6) A coil has an inductance of 2H and has a current of 5 Amperes. This current has increased to 20 amperes within 3 seconds. Calculate the Back E.M.F produced in the coil.

(15 marks)

(7) Uniform coil of conductors with 10 turns has crossed a horizontal and steady magnetic field of 20 Webers within a time period of 4 seconds. Calculate the voltage generated in the coil.

(15 marks)

End.

Colombo International Nautical and Engineering College

CINEC CAMPUS

Faculty of Maritime Sciences

Department of Navigation

EDUCATION & TRAINING COURSE: Navigation Officer Cadet Training Course – Foundation

COURSE CODE: ND- 0199 - BATCH 016

FINAL REPEAT EXAMINATION – QUESTION PAPER

APPLIED MECHANICS

- Answer any 5 questions only
- $g=10m/s^2$
- Give your answer to two decimal points
- $G = 6.67 \times 10^{-11}$ N m^2 kg^{-2} ,mass of the Earth = 6.0×10^{24} kg , radius of the Earth = 6.4×10^6 m ,gravitational field strength close to the surface of the Earth is 9.8 N kg^{-1}

Date: 25.10.2016 Pass mark 50% Time allocated: 03 Hours

1.

a) Define **speed** and **velocity** (4 marks)

b) A cyclist leaves home O and rides along a straight road with a constant acceleration. After 10 seconds he has reached point A with a speed 15m/s and he maintains this speed for a further 20 seconds until he reaches B before retarding (decelerating) uniformly to rest at C. The whole journey takes 45 seconds. Sketch the **velocity- time graph** for the journey and find; (4 marks)

i. His acceleration from O to A.

ii. His retardation (deceleration) from B to C.

iii. The total distance traveled from O to C.

(3×4=12 marks)

2.

a) A mass of 5 kg is attached with the inelastic spring length 3 m. The particle is able to perform the circular motion with the velocity of 4m/s. Find

i. Angular velocity

ii. Period of time

iii. Frequency

iv. Its centripetal acceleration.

v. The tension in the spring

$(2 \times 5 = 10\ marks)$

b) An object hanged on a rope L=0,5m, does rotational motion. If the angle between rope and vertical is 37^0, find the tangential velocity of the object.

(6 Marks)

c) A force of 5.0 N is applied tangent to the edge of a disk of radius 0.8 m and mass 3.0 kg. Calculate the torque produced by this force and the resulting angular acceleration of the disk.

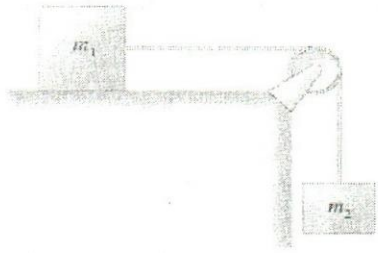
(4 *marks*)

3.

a) Write the Newton's second law of motion.

(4 marks)

a) A cord running over a pulley connects two objects. The coefficient of static friction between the object and the table is 0.3, The coefficient of dynamic friction is 0.25. If $m_1 = 5.0$ kg and $m_2 = 7$ kg Find,



a. Limiting frictional force.

b. Acceleration of the system.

c. Tension of the string. (12 marks)

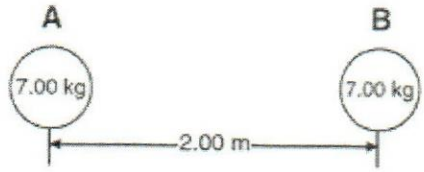
b) A tractor exerts a force of 5×10^3 N on a horizontal chain while moving a load a distance of 50 cm. How much work is done by the tractor?

(4 marks)

4.

i. State Newton's Law of Universal Gravitation

ii. The diagram shows two bowling balls, A and B, each having a mass of 7 kilograms, placed 2 meters apart. What is the magnitude of the gravitational force exerted by ball A on ball B?

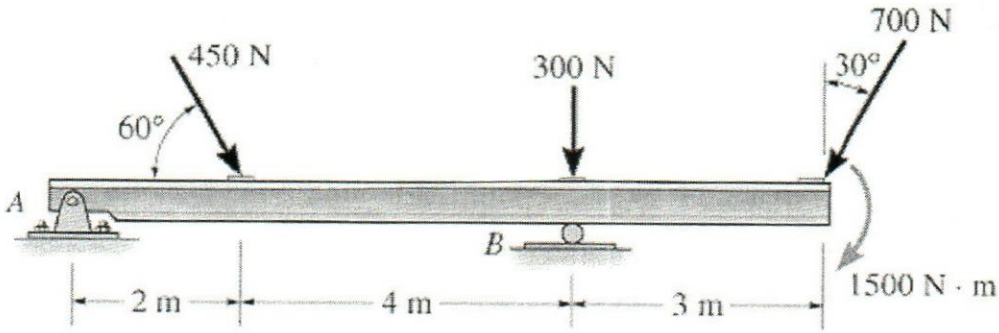


iii. A person weighing 785 N on the surface of Earth would weigh 298 N on the surface of Mars. What is the magnitude of the gravitational field strength on the surface of Mars?

iv. What is the potential you experience at the surface of the Earth? How would the answer be different if your friend who weighs more than you worked it out?

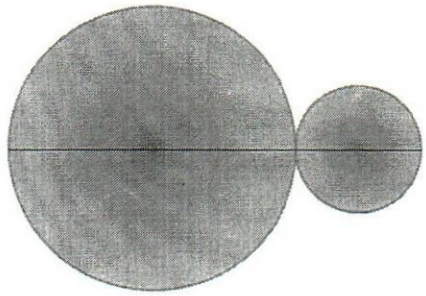
5.

a) Replace the three forces acting on the shaft beam by a single resultant force. Specify **where the force acts** measured from end A ,**Magnitude** and **Direction**



(10 marks)

a) Two solid spheres made up from same material have 6 cm and 3 cm radius. If these spheres welded together find the center of gravity from the center of gravity of bigger sphere's center (Volume of sphere = $\frac{4}{3}\pi r^3$)

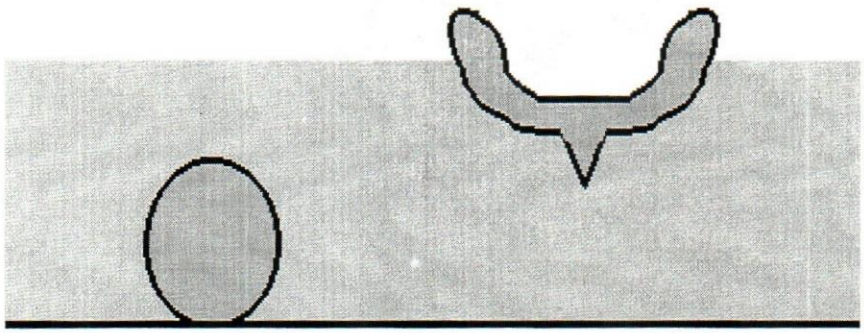


(10 marks)

6.

a) State Archimedes' principle and law of floatation. (8 marks)

a) If the plasticine is formed into a ball, it will sink. But when it is formed into a hull it will float. Why?



(4 marks)

b) A block of Ice cube of volume 20 m^3 and mass of 18000 Kg floats on fresh water of ρ = 1000 kg/m^3.

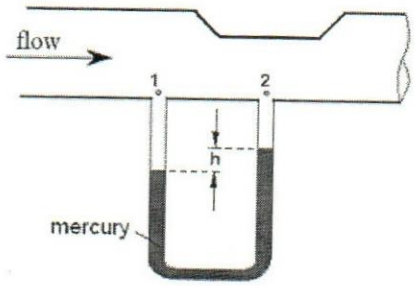
i. Find the up thrust on the ice cube.
ii. Find the volume of the ice cube under the water surface

(8 marks)

7.

a) State Bernoulli's Principle (8 marks)

b) The Venturi tube shown in the figure has a restriction in the cross section, so the speed of the air flow at point "2" is 15 m/s, while the speed at point "1" is 8m/s. Calculate the difference in the level of water in the U-tube under these conditions. [Take the density of air=1.29kg/m^3 and mercury=13500 kg/m^3]



(12 marks)

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CINEC CAMPUS

Faculty of Maritime Sciences

Department of Navigation

EDUCATION & TRAINING COURSE : NAVIGATION OFFICER CADET TRAINING COURSE FOUNDATION

COURSE CODE : ND- 0199 – BATCH 16

FINAL REPEAT EXAMINATION – QUESTION PAPER

PHYSICS

- *Answer 05 Questions Only*
- *Total Marks 100*
- Velocity of light = 3.0×10^8 m/s
- g = 10 ms^{-2}

Date: 2016.10.24 *Pass mark 50%* *Time allocated: 03 Hours*

1.

i. Define Simple Harmonic Motion (SHM) (6 marks)

ii. A 2.0 kg object is attached to a horizontal spring of force constant k = 5 kNm^{-1}. The spring is stretched 10 cm from the equilibrium position and released. Find

a. the period
b. the frequency
c. the amplitude of the motion
d. What is its maximum speed?
e. What is its maximum acceleration?
f. When does the object first reach the equilibrium position?
g. What is the acceleration at this time?

(5× 3 = 15 marks)

2.

i. Fill in the blank

a. Electric current passing through a wire produces _____.

b. The entire range of electromagnetic wave frequencies is known as _____.

c. As frequency increases, wavelength _____.

d. _____ is the number of vibrations that occur in 1 s.

e. Waves that use matter to transfer energy are called _____ waves.

f. _____ is the distance from the top of one crest of a transverse wave to the top of the next crest in that wave.

(6 marks)

ii. Define followings

a. Transverse waves

b. Longitudinal waves (2 ×3 = 6 marks)

iii. Calculate the frequency heard by a stationary listener when an ambulance passes him at a speed of 25 ms^{-1}

a. When the ambulance is moving towards him and
b. When the ambulance is moving away from him.

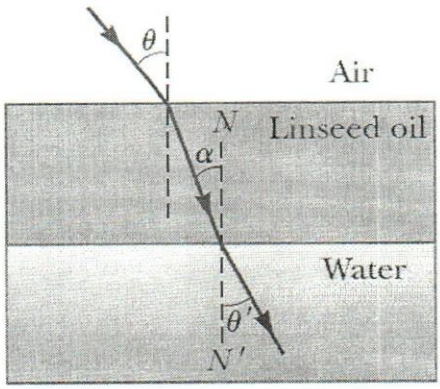
Take the speed of sound to be 340 ms^{-1} and the frequency of the siren to be 1 500 Hz.

(2× 4 = 8 marks)

3.

i. State Snell's law of refraction (4 marks

ii. The figure shows a refracted light beam in linseed oil, making an angle of a $\alpha = 30.0°$ with the normal line NN'. The index of refraction of linseed oil, water and air is 1.48, 1.3 and 1.

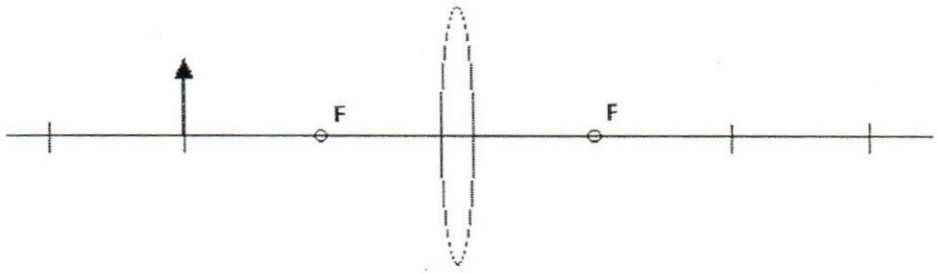


Determine the angles

(a) θ?

(b) θ'? (2× 3= 6 marks)

iii.



a. An object is placed 20 cm from a converging lens that has a focal length of 10 cm as shown in the above diagram. Copy the diagram on your answer script. Make a ray diagram of this situation.

(4 marks)

b. From the ray diagram, write characterize the image.

(2 marks)

iv. What are the Near point and Far point of human eye?

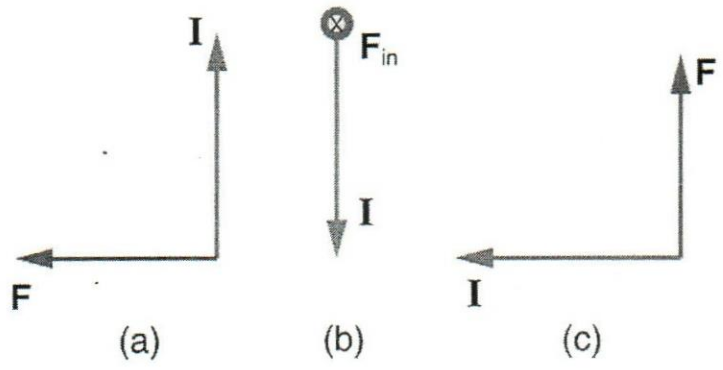
(4 marks)

4.

i. Two pith balls are equally charged and separate so that the strings they hang form an angle of 30.0°. If the strings are 10.0 cm long, and the electrostatic charge on each ball is +0.100 μC, what must be the electrostatic force acting on each? $\left(\frac{1}{4\Pi\varepsilon} = 9 \times 10^9\right)$

(6 marks)

ii. What is the direction of the magnetic field that produces the magnetic force shown on the currents in each of the three cases in Figure, assuming B is perpendicular to I?

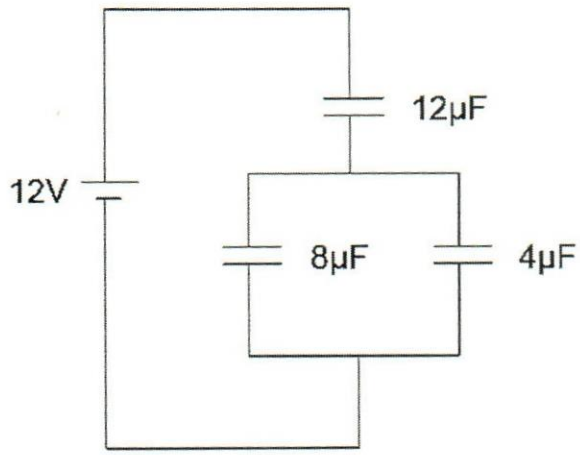


(3 × 2 = 6 marks)

iv. Calculate the number of turns needed in the secondary winding of a transformer to transform a primary voltage of 300 volts down to a secondary voltage of 180 volts, if the primary winding has 1120 turns of wire.

(4 marks)

v. Find the total capacitance



(4 marks)

5.

i. You are supplied with 6 identical dry cells, each of EMF 1.5 V and internal resistance 0.3 Ω. What are the overall EMF and internal resistance when:

a. The cells are connected in parallel?

b. The cells are connected in series?

c. They are connected in three groups, each of two cells in series, and these groups are connected in parallel with one another?

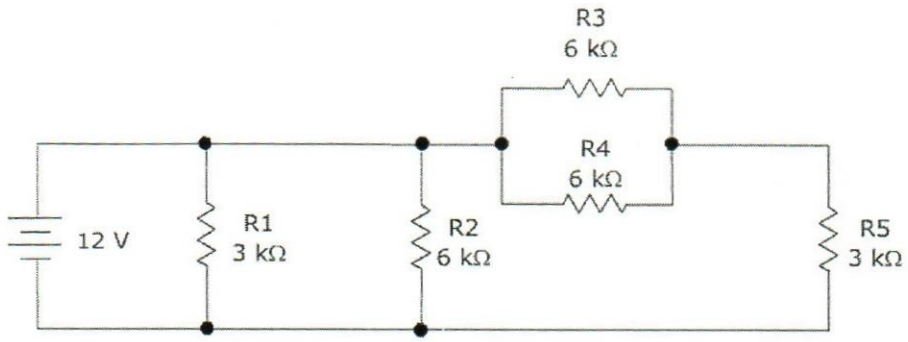
(12 marks)

ii. A battery of EMF E and internal resistance r is connected across a variable resistor. When the resistor is set at 14 Ω the current through it is 0.32 A. When it is set at 24 Ω the current is 0.20 A. Find E and r. (5 marks)

iii. What is the equivalent resistance for series connected N number of r resistors? (3 marks)

6.

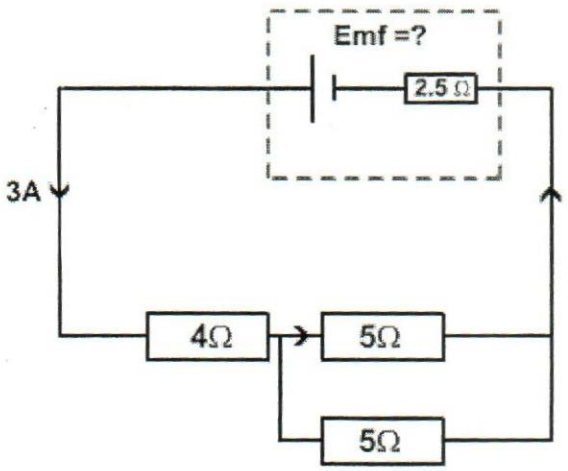
i. Find total resistance



(4 marks)

ii. States Kirchhoff's laws (6 marks)

iii. Use Kirchhoff's Laws to find the EMF of the cell and current trough 5 Ω resistor? (2.5 Ω is the internal resistance of the cell)



(10 marks)

7.

i. Describe about Extrinsic semi-conductors

ii. Draw the diagram and input and output waveforms of half wave rectifier

iii. Draw the pnp and npn transistors and name the collector base emitter

iv. Draw the simplified circuit of an op amp when it using as noninverting amplifier. And draw input and output wave forms

(4 × 5 = 20 marks)

End.

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CINEC CAMPUS

FACULTY OF MARITIME SCIENCES

DEPARTMENT OF NAVIGATION

EDUCATION & TRAINING COURSE : NAVIGATION OFFICER CADET TRAINING COURSE – FOUNDATION

COURSE CODE : ND- 0199 - BATCH 016

MID-TERM EXAMINATION – QUESTION PAPER

INTRODUCTION TO INDUSTRIAL SHIPPING

- *Answer ALL questions*
- *Total Marks : 100*

Date: 2016.06.17 *Pass mark 70%* *Time allocated: 03 Hours*

1) Sketch and Describe five different kinds of ships.

(25 Marks)

2) Define following nautical terms

i) Bridge	vi) Bitts
ii) Bulkhead	vii) Hull
iii) Draught	viii) keel
iv) Freeboard	ix) Bunkers
v) Trim	x) Windlass

(30 Marks)

3) Describe Classification societies and name the members of International Association of classification societies (IACS)

(25 Marks)

4) Write short notes on following

   a) International Maritime Organization (IMO)

   b) International Chamber of Shipping

(10 Marks each)

Colombo International Nautical and Engineering College

CINEC CAMPUS

Faculty of Maritime Sciences

Department of Navigation

EDUCATION & TRAINING COURSE : Navigation Officer Cadet Training Course – Foundation

COURSE CODE : ND- 0199 - BATCH 016

MID-TERM EXAMINATION – QUESTION PAPER

MATHEMATICS

- *Answer any 04 questions only*
- *Total Marks - 400*

Date: 2016.06.14 *Pass mark 50%* *Time allocated: 02 Hours*

Q.2 i. If log 2 = a , log 3 = b and log 5 = c
Express following in a,b and c.

a. log 6
b. log 600
c. log 1.5 (50 marks)

ii. If $p^2+q^2 = 7pq$
show that, $2\log\left(\frac{p+q}{3}\right) = \log p + \log q$ (50 marks)

Q.2 Solve the Simultaneous Equations :

i. $x - 3y = 6$

$3xy + x = 24$ (50 marks)

ii. $\log_2 x + \log_2 y = 3$,

$\log_y x = 2$ (50 marks)

Q.3 i. Express $(5+\sqrt{2})^2$ in the form $m + n\sqrt{2}$

Simplify $(5+\sqrt{2})^2 - (5-\sqrt{2})^2$ (50 marks)

ii. Express in partial functions

$\frac{10x+37}{x^2+3x-28}$ (50 marks)

Q.4 i. Solve for x

$5(2^x) - 4^x - 4 = 0$ (50 marks)

ii. Slove using completing squares method

a. $x^2 + 5x + 2 = 0$

b. $x^2 - 4x - 3 = 0$ (50 marks)

Q.5 i. A *GP* has its first term as 5. The common ratio is 4/5 Calculate ;

a. The 20th term to 3 decimal places. (25 marks)

b. The sum to infinity of the series. (25 marks)

ii. A sequence $a_1, a_2, a_3, \ldots, a_n$ is defined by $a_1 = 2$, $a_{n+1} = 2a_n - 1$, write down the values of a_2, a_3 and a_4 . (50 marks)

Q.6 Prove the following

i. $\cos^4 A - \sin^4 A + 1 = 2\cos^2 A$ (30 marks)

ii. $\frac{\sin A}{(1+\cos A)} + \frac{(1+\cos A)}{\sin A} = 2\text{cosec } A$ (30 marks)

iii. $\frac{1-\cos 2A}{(1+\cos 2A)} = \tan^2 A$ (40 marks)

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CINEC CAMPUS

FACULTY OF MARITIME SCIENCES

DEPARTMENT OF NAVIGATION

EDUCATION & TRAINING COURSE : NAVIGATION OFFICER CADET TRAINING COURSE – FOUNDATION

COURSE CODE : ND- 0199 - BATCH 015

RE -REPEAT EXAMINATION – QUESTION PAPER

INTRODUCTION TO SHIPPING

- *Answer ALL questions*
- *Total Marks : 100*

Date: 12.05.2016 *Pass mark 70%* *Time allocated: 03 Hours*

1) 1.1) Identify and write the specialty of 5 different types of ships. (20 Marks)

2) 2.1) Write short notes on following.

   a) SOLAS Convention (Safety of Life at Sea)
   b) MARPOL Convention
   c) IMDG Code
   d) STCW Convention (5 Marks each)

3) 3.1) Identify 3 major fuel oil types used onboard ships and write short notes on them. (12 Marks)

   3.2) Describe 2 types of containers and elaborate using sketches (8 Marks)

4) 4.1) Describe right hand screw propellers. (10 Marks)

   4.2) Write short notes on following auxiliary, machinery used onboard ships.

   a) Steering Gear
   b) Derricks (5 Marks each)

5) 5.1) Write short notes on following

   a) International Maritime Organization (IMO)
   b) International Chamber of Shipping (5 Marks each)

   5.2) Describe Classification societies and name 5 members of International Association of classification societies (IACS) (10 Marks)

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CINEC CAMPUS

FACULTY OF MARITIME SCIENCES

DEPARTMENT OF NAVIGATION

EDUCATION & TRAINING COURSE : NAVIGATION OFFICER CADET TRAINING COURSE – FOUNDATION

COURSE CODE : ND- 0199 - BATCH 015

FINAL REPEAT EXAMINATION – QUESTION PAPER

INDUSTRIAL CHEMISTRY

- *Answer ANY 5 questions only*
- *Formulae and all intermediate steps taken in reaching your answer should be clearly shown*
- *Total Marks : 100*

Date: 14.02.2016 *Pass mark 50%* *Time allocated: 03 Hours*

Avogadro Constant (N_A) – 6.022 × 1023 mol-1

H – 1.0, He – 4.0, Li – 6.9, Be – 9.0, B – 10.8, C – 12.0, N –14.0 , O – 16.0, F – 18.9, Ne – 20.2, Na – 23.0, Mg – 24.3, Al – 27.0, Si – 28.1, P – 31.0, S – 32.1, Cl – 35.5, Ar – 40.0, K – 39.1, Ca – 40.1, Ag- 108.0, Cu – 63.5, Fe – 56.0, Co – 58.9, Zn = 65.4, Ag = 107.9, Sn = 117.8

1)

a) Write down the correct chemical formula

i) Ethanol
ii) Ammonia
iii) Carbon dioxide
iv) Benzene

(1×4= 04 marks)

b) Name the three particles of the atom; and their respective charges. (6 marks)

c) Define the term

i) Atomic number
ii) Viscosity
iii) Homogeneous mixture
iv) Ionic bond
v) Alloy (2×5= 10 marks)

---

2)

a) How many moles of Cu are there in 103.8 g of Cu? (03 marks)

b) Methane (CH_4) is the principal component of natural gas. How many moles of CH4 are present in 6.07 g of CH_4?

(05 marks)

c) When 5.00 g of $FeCl_3 \cdot xH2O$ are heated, 2.00 g of H_2O are driven off. Find the chemical formula and the name of the hydrate.

(06 marks)

d) What are the empirical formulas of the compounds with the following compositions? (a) 2.1 percent H, 65.3 percent O, 32.6 percent S, (b) 20.2 percent Al, 79.8 percent Cl

(6 marks)

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3)

a) Define the p^H and p^{OH} and express their equations. (04 marks)

b) Briefly explain the terms of Acidic solution and Basic solution at 25^0 C ($k_w = 1 \times 10^{-14}$ mol^2dm^{-6}).

(04 marks)

c) Indicate whether solutions with each of the following ion concentrations are neutral, acidic, or basic: (show your work out)
$[H+] = 5 \times 10^{-8}$ *M*
$[OH-] = 1 \times 10^{-7}$ *M*
$[OH-] = 4 \times 10^{-13}$ *M*

(08 marks)

d) Write down the solubility product expression (K_{sp}) and these solutions
i) $CaSO_4$
ii) $Ca_3(PO_4)_2$

(04 marks)

---

4)

a) $Ag^+ + e- \rightarrow Ag$ ⟶ $E° = 0.80$ V

$Mg^{2+} + 2e- \rightarrow Mg$ $E° = -2.37$ V

Using above Standard Reduction Potentials,

i) Give the anode and cathode half-reactions. (06 marks)

ii) Write the overall equation for the chemical reaction. (04 marks)

iii) Represent the cell using standard notation. (04 marks)

iv) Calculate the cell potential (e.m.f.) of the electrochemical cell. (03 marks)

b) What are the standard for temperature, Concentration and pressure? (03 marks)

---

5)

a) Explain the meaning of corrosion with examples. (04 marks)

b) Explain the physical nature of corrosion product? (04 marks)

c) Explain how nature of medium influencing corrosion? (04 marks)

d) Explain why rusting occurs so rapidly in salt water? (04 marks)

e) Write two corrosion control method and explain it. (04 marks)

6)

a) How does Petroleum form?

b) What is the composition of crude oil?

c) Write four function of lubricants.

d) What are the three types of lubricants?

e) Write a short note about fluid film lubrication.

(5 x 4= 20 marks)

7)

a) Categorized polymers according to its structural arrangement. (4 marks)

b) Explain how polymer structure determines its characteristics. (4 marks)

c) Teflon is a useful polymer. (CH_2CH_2)

i. Write its monomer structure
ii. Polymer structure
iii. Give two Uses and applications (4 marks)

d) Mention 4 general properties of metals (4 marks)

e) What are the Raw materials of extraction of Iron? (4 marks)

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Colombo International Nautical and Engineering College

CINEC CAMPUS

FACULTY OF MARITIME SCIENCES

DEPARTMENT OF NAVIGATION

EDUCATION & TRAINING COURSE : NAVIGATION OFFICER CADET TRAINING COURSE – FOUNDATION

COURSE CODE : ND- 0199 - BATCH 015

FINAL REPEAT EXAMINATION – QUESTION PAPER

APPLIED MECHANICS

- *Answer any 5 questions only*
- *$g=10m/s^2$*
- *Give your answer to two decimal points*

Date: 14.02.2015 *Pass mark 50%* *Time allocated: 03 Hours*

1.

a) Define **acceleration** and **velocity** (4 marks)

b) A cyclist leaves home O and rides along a straight road with a constant acceleration. After 10 seconds he has reached point A with a speed 15m/s and he maintains this speed for a further 20 seconds until he reaches B before retarding (decelerating) uniformly to rest at C. The whole journey takes 45 seconds. Sketch the **velocity- time graph** for the journey and find; (4 marks)

i. His acceleration from O to A.

ii. His retardation (deceleration) from B to C.

iii. The total distance traveled from O to C.

(3×4=12 marks)

2.

a) A 0.2 kg ball moves in a circle that is 3.0 m in radius at a speed of 25.0 m/s. Calculate,

i. Angular velocity

ii. Period of time

iii. Frequency

iv. Its centripetal acceleration.

v. The centripetal force on the ball. $(3 \times 4 = 12\ marks)$

b) A disk of moment of inertia $5\times10^{-4}\,kgm^2$ is rotating freely about axis O through its center at 40 rad/s. Calculate the angular velocity if some wax (W) of mass 0.02kg is dropped on the disk 0.08m from its axis.

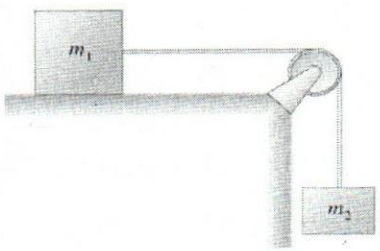
(8 *marks*)

3.

a) Write the Newton's second law of motion.

(4 marks)

b) A cord running over a pulley connects two objects. The coefficient of static friction between the object and the table is 0.3, The coefficient of dynamic friction is 0.25. If m_1 = 5.0 kg and m_2 = 7 kg Find,



a. Limiting frictional force.
b. Acceleration of the system.
c. Tension of the string. (16 marks)

c) A person lifts a 50 kg bucket from a well and does 4.9×10^3 J of work. How deep is the well?

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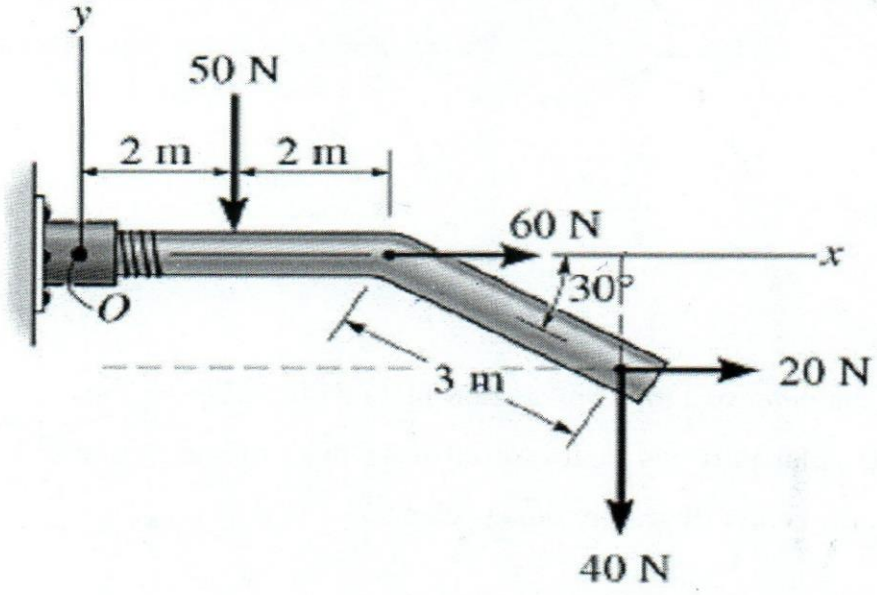
(4 marks)

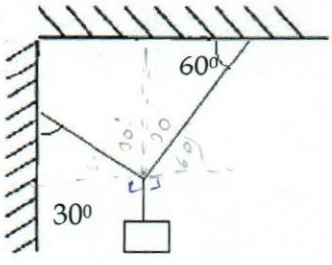
4.

a) Determine the total moment about point A



(10 marks)

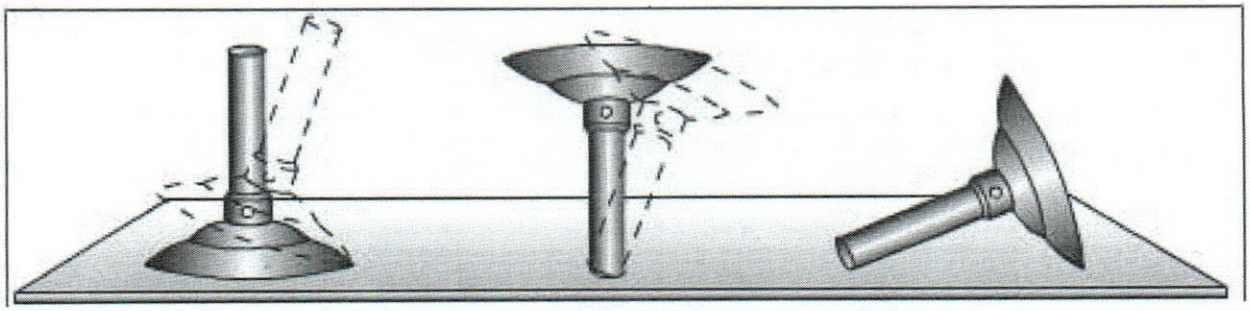
A. A weight of 200 N is supported by two strings as shown in the figure below. Find the tension of each string?



(10 marks)

5.

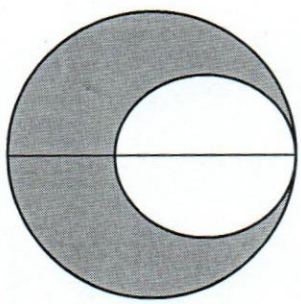
a) Determine equlibrium state of these cones.



(a) (b) (c)

(2 ×3 =06 marks)

b) The diameter of a uniform circular plate width is 56 cm. the diameter of 42 cm circular part has removed out from the plate as shown in the figure. Find the center of gravity of new object?



(14 marks)

6.

a) State Archimedes' principle and law of floatation. (8 marks)

b) An iceberg of relative density 0.92 floats in sea water of relative density 1.024 with 10615 m^3 immersed. (Density of fresh water = 1000 kgm^{-3})

a. Find weight of sea water displaced?

b. Find the mass of ice berg?

c. Find the total volume of the iceberg

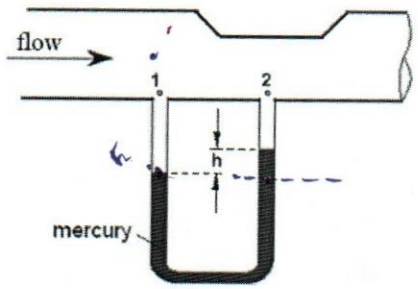
d. Hence determine the fraction of the iceberg below the water-line.

(4 ×3 =12 marks)

7.

a) State Bernoulli's Principle (8 marks)

b) The Venturi tube shown in the figure has a restriction in the cross section, so the speed of the air flow at point "2" is 15 m/s, while the speed at point "1" is 10 m/s. Calculate the difference in the level of water in the U-tube under these conditions. [Take the density of air=1.29kg/m^3 and mercury=13500 kg/m^3]



(12 marks)

Colombo International Nautical and Engineering College

CINEC CAMPUS

FACULTY OF MARITIME SCIENCES

DEPARTMENT OF NAVIGATION

EDUCATION & TRAINING COURSE : NAVIGATION OFFICER CADET TRAINING COURSE – FOUNDATION

COURSE CODE : ND- 0199 - BATCH 015

FINAL REPEAT EXAMINATION – QUESTION PAPER

INTRODUCTION TO SHIPPING

- *Answer ALL questions*
- *Total Marks : 100*

Date: 27.01.2016 *Pass mark 70%* *Time allocated: 03 Hours*

1)

1.1) Write short notes on following types of ships

a) Bulk Carrier
b) Passenger Ships
c) Container Carrier
d) Tanker (3 Marks each)

1.2) Sketch and identify parts of a ship. (8 Marks)

2) 2.1) Write short notes on following.

a) SOLAS Convention (Safety of Life at Sea)
b) MARPOL Convention
c) IMDG Code
d) STCW Convention (5 Marks each)

3) 3.1) Identify 3 major fuel oil types used onboard ships and write short notes on them.

(12 Marks)

3.2) Describe how Sulphur content in fuel oil take part in air pollution and contribution of MARPOL Annex in prevention of such pollution

(8 Marks)

4) 4.1) Describe 4 types of containers and elaborate using sketches. (20 Marks)

5) 5.1) Write short notes on following

a) International Maritime Organization (IMO)

b) International Chamber of Shipping (5 Marks each)

5.2) Describe about Classification Societies and state 5 members of International Association of classification societies (IACS)

(10 Marks)

COLOMBO INTERNATIONAL NAUTICAL AND ENGINEERING COLLEGE

NAVIGATION FOUNDATION - REPEAT **ENGLISH** **FEBRUARY 2016**

Answer all questions

Time – 2 1/2 Hours

Total Marks - 100
Pass Mark - 60
Batch - 15

INDEX NUMBER: .....

For Office use Only

Question No:	1	2	3	4	5	6	7	8	9	10	Total Marks	%	Signature
For Scrutinizer's Use Only (marks)													
For Moderator's Use Only (marks)													

Q1. Read the text and write complete answers for the following questions. (15 marks)

Christopher Columbus was born in Genoa, Italy in 1451. While spending most of his early years at sea, Columbus began to believe that he could find a shortcut to the Indies by sailing west across the Atlantic Ocean. Unfortunately, the King of Portugal refused to finance such a trip, and Columbus was forced to present his idea to the King and Queen of Spain. In 1492, King Ferdinand and Queen Isabella agreed to pay for his trip. They gave him a crew and three ships, the Nina, Pinta and Santa Maria. Columbus sailed aboard the Santa Maria.

The trip was long and hard. Many sailors grew restless and wanted to turn around. After two months at sea, land was finally sighted. The ships docked on the island of Hispaniola. Columbus named the native people he saw "Indians", because he believed he had found the shortcut he was looking for. In actuality, Columbus found North America, a brand new continent at that time. Columbus, however, couldn't be convinced. He died with the belief he had found the shortcut to the Indies. Soon, however, other explorers and nations understood the importance of his discoveries. Columbus' discoveries set the stage for the Age of Exploration, one of the most fascinating and exciting times in world history.

1. Where was Christopher Columbus born? (01 Mark)

   .....

2. When was he born? (01 Mark)

   .....

3. Where did Columbus want to go using the shortcut? (01 Mark)

   .....

4. What was the reason for him to tell his plan to the King and Queen of Spain? (01 Mark)

.....

5. Who gave the consent to fund his voyage? (01 Mark)

.....

6. What was given to Columbus by the King and Queen of Spain? (01 Mark)

.....

7. Why did Columbus name the native people as "Indians"? (01 Mark)

.....

8. Why North America is named as a "brand new continent"? (01 Mark)

.....

9. When Columbus died what was the belief he carried about his discovery? (01 Mark)

.....

10. Explain how Columbus became a famous person in world history. (02 Marks)

.....

.....

.....

11. Find synonyms from the passage for the words given below. (04 Marks)

I rejected - .....

I. sailors - .....

II. indigenous - .....

III. faith - .....

Q2. Fill in the blanks with *a/ an/ the* <u>where necessary.</u> (05 Marks)

1. Amal likes to play ..... volleyball.
2. I bought ..... umbrella to go out in the rain.
3. My daughter is learning to play ..... violin at her school.
4. Please give me ..... cake that is on the counter.
5. I lived on ..... Main Street when I first came to town.
6. Albany is the capital of ..... New York State.
7. My husband's family speaks ..... Polish.
8. ..... apple a day keeps the doctor away.
9. ..... ink in my pen is red.
10. Our neighbours have ..... cat and ..... dog.

Q3. Fill in the blanks with suitable pronouns for the underlined words.

(Note: A pronoun can be used more than once.) (10 marks)

(it, he, we, they, she, you)

1. **My cousin and her friend** were at the mall. ..... were at the mall.
2. Does **your aunt** know what happened? Does..... know what happened?
3. **Peter** is a little sick. ..... is a little sick.
4. **The door** is locked. ..... is locked.
5. **My friend Linda and I** are going on a trip. ..... are going on a trip.
6. Am **I** a good student? Yes, ... are a good student.
7. **My cats** are hungry. ..... are hungry.
8. **Mr. Jones** is a good teacher. ..... is a good teacher.
9. Is **Swedish** a difficult language. Yes, ... is a difficult language.
10. **My brother and I** live in an apartment. . ..... live together.

Q4. Fill in the blanks with the correct from of the verb given in brackets (10 marks)

1. Last year I ..... *(spend)* my holiday in Kandy.
2. Does your brother ..... *(work)* at night ?
3. She ..... *(be)* one of my best friends those days.
4. In 2007, they ..... *(not /publish)* a new book .
5. There ..... *(be)* a big demand for IT engineers in the future.
6. He and I ..... *(be)* in the same batch.
7. Mrs. Perera never ..... *(cook)* her meals.
8. Did they ..... *(go)* to sleep early ?.
9. Every man ..... *(not /like)* buying fast food
10. There ..... *(not /be)* any traffic jam in few years time.

Q5. Fill in the gaps with an appropriate Wh-question word. (10 marks)

1. ..... time is it? It is 9.30 a.m
2. ..... old are you? I am ten years old.
3. ..... do you live ? I live in Malabe.
4. ..... is your birthday? My birthday is in May.
5. ..... is your favorite subject? My favourite subject is English.

6. ..... is your favourite book? My favourite book is Narnia.
7. ..... do you have English classes? I have English classes on Thursday.
8. ..... is your name? My name is Mike.
9. ..... are your parents now? They are at home.
10. ..... do you study English? I do self-study.

Q6. Fill in the blanks using <u>the correct preposition</u> from the list given below. You may use a preposition more than once. (10 marks)

(Across, opposite, at, into, between, in, on, along, before)

1. The meeting started ..... 4 o'clock.
2. The cadet put the tools ..... a box.
3. They sailed ..... the Atlantic Ocean.
4. The pharmacy is situated ..... the hospital.
5. The bank is ..... the police station and the school.
6. They will come to Colombo ..... July 26th ..... the morning.
7. They sailed ..... the equator.
8. He has sailed ..... the Atlantic Ocean twice.
9. We came home ..... it began to rain.
10. Arena came ..... along the road.

Q7. Re arrange these words to make meaningful sentences. (10 Marks)

1. flows / river / the/ Mediterranean / Nile / the / into

   .....
2. take / coat / I / off / coat / my / warm / it / as

   .....
3. set / it / dark / sun / the / and / is / now

   .....
4. a / Peter / rented / car / has

   .....
5. live / you/ how long/ Baker Street ?

   .....

Q8. Fill in the blanks with the correct form adjective given in brackets (10 marks)

1. My brother has a (tidy) ..... room than me.
2. Australia is (big) .....than England.
3. I'm (good) ..... now than yesterday.
4. She's got a (beautiful) ..... house than you.
5. He thinks Chinese is (difficult) .....language in the world
6. Valencia played (bad) ..... than Real Madrid yesterday.
7. Cats are not (intelligent) ..... as dogs.
8. Show me a (good) ..... restaurant downtown.
9. The (hot) .....desert of all is the Sahara and it's in Africa.
10. Who is the (talkative) ..... person in your family?

Q9. Write a letter congratulating a friend who has got selected to follow a maritime course at CINEC (10marks)

Q10. Write an essay on one of the following in 150 words. (10 marks)

1. Natural disasters
2. Types of ships
3. Why I want to be a seafarer

Library

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Colombo International Nautical and Engineering College

CINEC CAMPUS

FACULTY OF MARITIME SCIENCES

DEPARTMENT OF NAVIGATION

EDUCATION & TRAINING COURSE : NAVIGATION OFFICER CADET TRAINING COURSE – FOUNDATION

COURSE CODE : ND- 0199 - BATCH 014

MID TERM - EXAMINATION – QUESTION PAPER

INDUSTRIAL CHEMISTRY

- *Answer ANY 5 questions only*
- *Formulae and all intermediate steps taken in reaching your answer should be clearly shown*
- *Total Marks : 100*

Date: 12.10.2015 *Pass mark 50%* *Time allocated: 2.5 Hours*

Avogadro Constant (N_A) – 6.022×10^{23} mol^{-1}

H – 1.0, He – 4.0, Li – 6.9, Be – 9.0, B – 10.8, C – 12.0, N –14.0 , O – 16.0, F – 18.9, Ne – 20.2, Na – 23.0, Mg – 24.3, Al – 27.0, Si – 28.1, P – 31.0, S – 32.1, Cl – 35.5, Ar – 40.0, K – 39.1, Ca – 40.1, Ag- 108.0, Cu – 63.5, Fe – 56.0, Co – 58.9, Zn = 65.4, Sn = 117.8

1)

a) Write down the correct chemical formula

i) Ethanol

ii) Potassium permanganate

iii) Iron (ii) oxide

iv) Carbon dioxide

v) Silicon dioxide

vi) Propane

(1×6= 6 marks)

b) Draw the electron structure for

i) Na

ii) F_2

iii) S

iv) NaCl

(2×4= 8 marks)

c) Identify the Following Elements.

i) An element having atomic number 11.

ii) An element having 14 protons in its nucleus.

iii) An element having mass number 31 and 15 neutrons.

iv) An element denoted as $^{27}_{13}X$

v) An element having 10 electrons and -2 charge (1×5= 5 marks)

d) Give one example for followings

i) Metal

ii) Metalloid

iii) Homogeneous Mixture

iv) Acid base reaction

v) Covalent bonds

vi) Alloy (1×6= 6 marks)

2)

a) Define these terms,

a. Combustion reaction
b. Metallic bond
c. Isotopes
d. Chemical compound
e. Ionic Bond
f. Valance electrons (3×6=18 marks)

b) Balance Following equation

i. $C_8H_{10} + O_2 \longrightarrow CO_2 + H_2O$

ii. $CH_3CH_2OH + O_2 \longrightarrow CO_2 + H_2O$ (7 marks)

3)

a) How many moles of **Cu** are there in 53.7 g of **Cu**? (4 marks)

b) How many atoms are present in 3.14 g of iron (Fe)? (5 marks)

c) Calculate the percent composition by mass of each of the elements in Nitric acid (HNO_3) (2×3= 6 marks)

d) Monosodium glutamate (MSG), a food-flavor enhancer, has been blamed for "Chinese restaurant syndrome," the symptoms of which are headaches and chest pains. MSG has the following composition by mass: 35.51 percent C, 4.77 percent H, 37.85 percent O, 8.29 percent N, and 13.60 percent Na. What is its molecular formula if its molar mass is about 169 g?

(10 marks)

4) 36

a) What is Atomic Mass Unit (amu) (5 marks)

b) A compound with a mass composition of 87.5 % N and 12.5 % H was recently discovered. What is the empirical formula for this compound?

(10 marks)

c) When 5.00 g of $FeCl_3 \cdot xH_2O$ are heated, 2.00 g of H_2O are driven off. Find the chemical formula and the name of the hydrate.

(10 marks)

5)

a) Briefly explain the terms of Acid and Base (3 marks)

b) Define the p^H and p^{OH} and express their equations.

(4 marks)

c) Calculate the pH of

i) 0.056 $moldm^{-3}$ HNO_3 solution (3 marks)

ii) 0.035 $moldm^{-3}$ NaOH solution at 25^0C. (3 marks)

d) Calculate the concentration of $H^+(aq)$ in

i. a solution in which is [OH-] 0.010 *M*,

ii. a solution in which [OH-] is 1.8×10^{-9} *M*.

Note: we assume, unless stated otherwise, that the temperature is 25 °C

(4 marks)

e) Indicate whether solutions with each of the following ion concentrations are neutral, acidic, or basic: (show your work out)

i. $[H+] = 5 \times 10^{-8}$ *M*

ii. $[OH-] = 1 \times 10^{-7}$ *M*

iii. $[OH-] = 4 \times 10^{-13}$ *M*

(8 marks)

End.

Colombo International Nautical and Engineering College

CINEC CAMPUS

Faculty of Maritime Sciences

Department of Navigation

EDUCATION & TRAINING COURSE: Navigation Officer Cadet Training Course – Foundation

COURSE CODE: ND- 0199 - BATCH 014

FINAL REPEATS EXAMINATION – QUESTION PAPER

APPLIED MECHANICS

- Answer any 5 questions only
- $g=10m/s^2$
- Give your answer to two decimal points

Date: 11.10.2015 | Pass mark 50% | Time allocated: 03 Hours

1.

a) Define **Speed** and **velocity** (4 marks)

b) A cyclist leaves home O and rides along a straight road with a constant acceleration. After 10 seconds he has reached point A with a speed 15m/s and he maintains this speed for a further 20 seconds until he reaches B before retarding (decelerating) uniformly to rest at C. The whole journey takes 45 seconds. Sketch the **velocity- time graph** for the journey and find; (4 marks)

i. His acceleration from O to A.
ii. His retardation (deceleration) from B to C.
iii. The total distance traveled from O to C. (3×4=12 marks)

2.

a) A 6 kg ball moves in a circle that is 2.0 m in radius at a speed of 30.0 m/s. Calculate,

i. Angular velocity
ii. Period of time
iii. Frequency
iv. Its centripetal acceleration.
v. The centripetal force on the ball. $(3 \times 4 = 12\ marks)$

b) A mass of 2.0 kg, which may be considered to be a point mass, is attached to a string of length 0.3 m and is rotated at 7.0 rad / s.

i. Calculate the moment of inertia of the mass about the axis

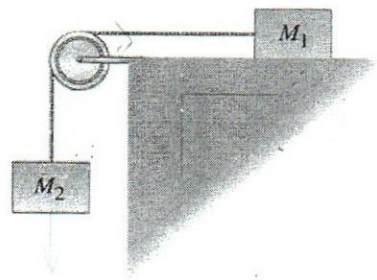
ii. Calculate its angular momentum.

(8 *marks*)

3.

a) Write the Newton's first law of motion.

(4 marks)



b) The two masses of the system shown in the figure are M_1 = 4 kg and M_2 = 7 kg. You may assume that the string is inextensible, coefficient of kinetic friction between the crate and the floor is 0.25 and the coefficient of static friction is 0.3 and the pulley is a mass less smooth one.

i. Find the limiting friction force
ii. Find the acceleration of the system.
iii. Find the tension of the system. (3 × 4 = 12 marks)

c) A parachutist of mass 55 kg falls out of an airplane at a height of 1,000 m.

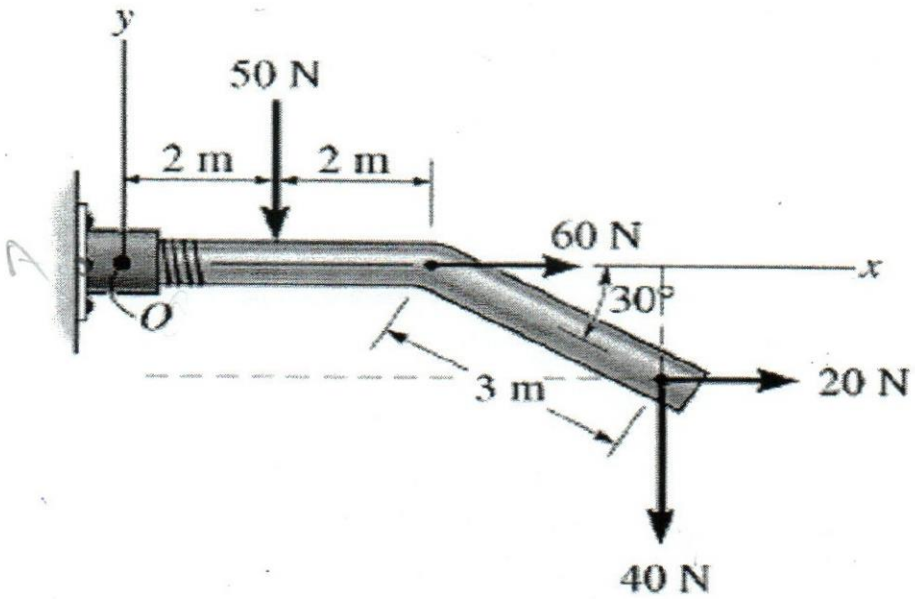
i. What is his speed on hitting the ground assuming no air resistance? If he actually hits the ground at 50 m /s,

ii. how much mechanical energy was lost to air resistance?

(2 × 2 = 4 marks)

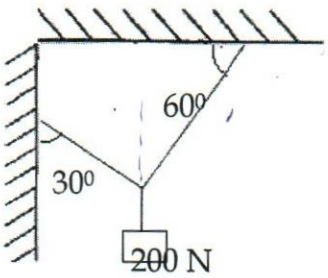
4.

a) Determine the total moment about point A



(10 marks)

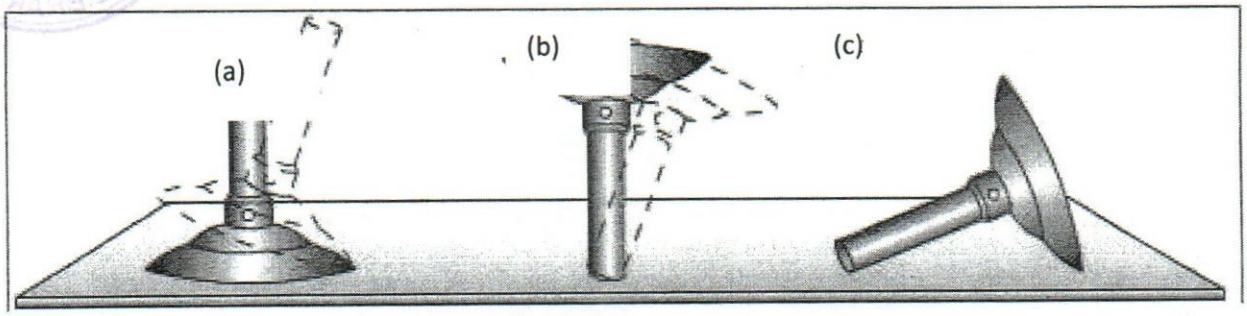
b) A weight of 200 N is supported by two strings as shown in the figure below. Find the tension of each string?



(10 marks)

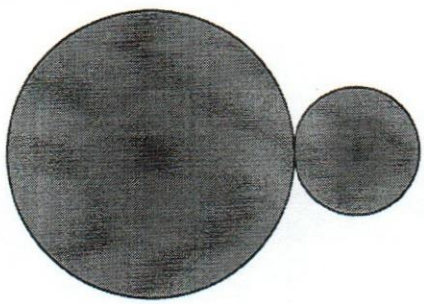
5.

a) Determine equlibrium state of these objects.



(2 ×3 =06 marks)

b) Two solid spheres made up from same material have 6 cm and 3 cm radius. If these spheres welded together find the center of gravity from the center of gravity of bigger sphere's center (Volume of sphere = $\frac{4}{3}\pi r^3$)

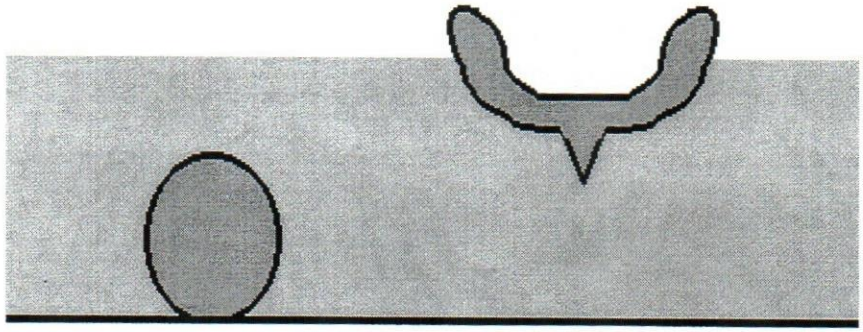


(12 marks)

6.

a) State Archimedes' principle and law of floatation. (6 marks)

b) If the plasticine is formed into a ball, it will sink. But when it is formed into a hull it will float. Why?



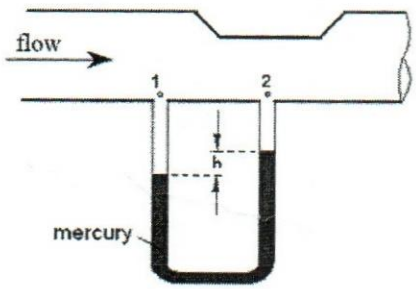
(4 marks)

c) Elisabeth purchases a "gold" crown at a market. After she gets home, she hangs it from a scale and finds its weight in air to be 7.84 N. She then weighs the crown while it is immersed in water (density of water is 1000 kg/m3) and now the scale reads 6.86 N. Is the crown made of pure gold if the density of gold is 19.3×10^3 kg/m^3. (10 marks)

7.

a) State Bernoulli's Principle (8 marks)

b) The Venturi tube shown in the figure has a restriction in the cross section, so the speed of the air flow at point "2" is 15 m/s, while the speed at point "1" is 10 m/s. Calculate the difference in the level of water in the U-tube under these conditions. [Take the density of air=1.29kg/m^3 and mercury=13500 kg/m^3]



(12 marks)

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COURSE CODE : ND- 0199 - BATCH 014

FINAL REPEAT EXAMINATION – QUESTION PAPER

INTRODUCTION TO INDUSTRIAL SHIPPING

- *Answer ALL questions*
- *Total Marks : 100*

Date: 10.10.15 *Pass mark 70%* *Time allocated: 02 Hours*

1) i. Identify and write the specialty of 5 different types of ships. (10 marks)
ii. Describe 5 types of containers and elaborate using sketches (10 marks)

2) i. Write short notes on following common nautical terms.
a) Ahead
b) Draught
c) Free board
d) Bulbous bow
e) Double bottom tanks

(5 Marks each)

3) i. Identify 3 major fuel oil types used onboard ships and write short notes on them. (12 marks)

ii. Describe how Sulphur content in fuel oil take part in air pollution an contribution of MARPOL Annex in prevention of such pollution

(8 marks)

4) i. Describe right hand screw propellers. (8 marks)
ii. Write short notes on following auxiliary, machinery used onboard ships.
a) Steering Gear
b) Windlass
c) Derricks

(4 marks each)

5) i. Write short notes on following
   a) International Maritime Organization (IMO)
   b) International Chamber of Shipping (5 marks each)

   ii. Describe Classification societies and name 5 members of International Association of classification societies (IACS)

(20 marks)

End.

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DEPARTMENT OF NAVIGATION

EDUCATION & TRAINING COURSE : NAVIGATION OFFICER CADET TRAINING COURSE – FOUNDATION

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FINAL REPEATS EXAMINATION – QUESTION PAPER

PHYSICS

- *Answer 4 questions only*
- *Speed of light and EM waves in a vacuum* (C)=$3x10^8 ms^{-1}$
- *velocity of sound = 340 m/s*
- *g=10m/s²*

Date: 10.10.2015 *Pass mark 50%* *Time allocated: 03 Hours*

1.

a) Define Simple Harmonic Motion (SHM) (5 marks)

b) A 2.0 kg object is attached to a horizontal spring of force constant k = 5 kNm^{-1}. The spring is stretched 10 cm from the equilibrium position and released. Find

i. the period
ii. the frequency
iii. the amplitude of the motion
iv. What is its maximum speed?
v. What is its maximum acceleration?
vi. When does the object first reach the equilibrium position?
vii. What is the acceleration at this time?

(5× 3 = 15 marks)

2.

i. Define followings

a) Transverse waves

b) Longitudinal waves

(2× 3 = 06 marks)

ii. Sound waves travel with a speed of 330 m/s. What is the wavelength of sound, whose frequency is 520 Hz? (02 marks)

iii. The wavelength of a beam of green light propagating in a vacuum is 545 nm. Find the frequency of green light in vacuum. (Velocity of light = 3.0×10^8 m/s)

(02 mark

iv. A sinusoidal wave traveling in the positive x direction has a frequency of 8 Hz as shown in the figure. Find

(Keep your answers with SI units)

a. The wave length

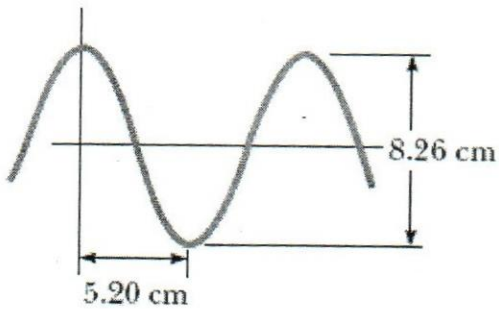
b. The angular velocity

c. The wave number (k)

d. Period

e. Speed of the wave

(2× 5 = 10 marks)



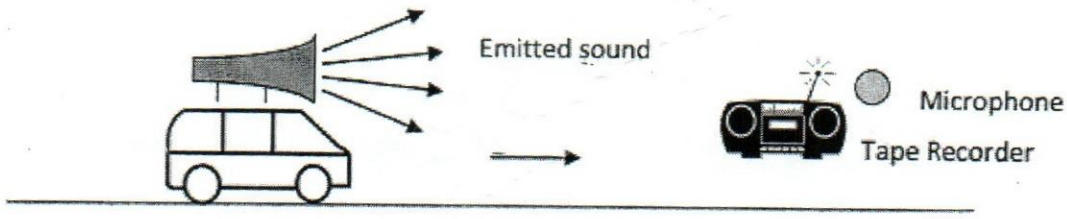
3.

a) How does sound travel?

(05 marks)

a) Standing on a platform, you hear a frequency of 560 Hz from the siren of an approaching train. After the train passes, the observed frequency of the siren is 480 Hz. Determine the train's velocity from these observations?

i. During an experiment to determine the speed of sound, learners are given a siren that sounds a single note of frequency 426 Hz. They attach it to a remote controlled car and move it at constant speed past a stationary tape recorder which is mounted in the middle of a runway. Ignore the effects of friction. The tape recorder records the sound of the siren.



The learners make the following observation:

The pitch of the sound from the siren as it moved towards the tape recorder was higher than the pitch as the siren moved away from the recorder.

a. Name the effect which explains this observation. (2 marks)

In one of the trials the speed of the remote controlled car was noted as 31 kmh^{-1} two notes from the siren were recorded: one with a frequency of 437 Hz and the other note with a frequency lower than 426 Hz.

b. Convert 31 kmh^{-1} to ms^{-1} (2 marks)

c. Determine the speed of sound in air (5 marks)

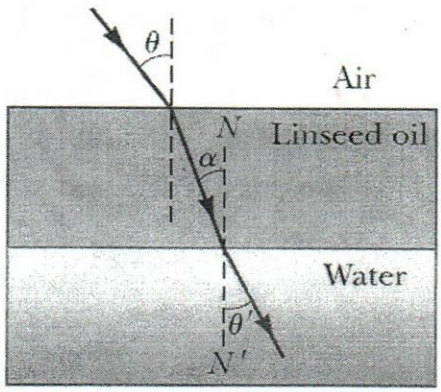
d. Give a reason why the observed frequencies are respectively higher and lower than the frequency of the source (426 Hz)

(2 marks)

4.

i. State Snell's law of refraction (6 marks)

ii. The figure shows a refracted light beam in linseed oil, making an angle of a $\alpha = 30.0°$ with the normal line *NN'*. The index of refraction of linseed oil, water and air is 1.48, 1.33 and 1.



Determine the angles

(a) θ?

(b) θ'?

(2× 4= 8marks)

iii. What is Critical angle?

iv. Calculate the critical angle of an optical fibre. (Refractive index of glass and air is 1.56 and 1)

(2× 3= 6 marks)

5.

i. Write lens equation and define terms. (4 marks)

ii. What image is produced by placing an object 5 cm away from a convex lens of focal length 3 cm? (Draw the ray diagram and write properties of image)

(6 marks)

iii. What image is produced by placing an object 4 cm away from a convex lens of focal length 8 cm? (Draw the ray diagram and write properties of image)

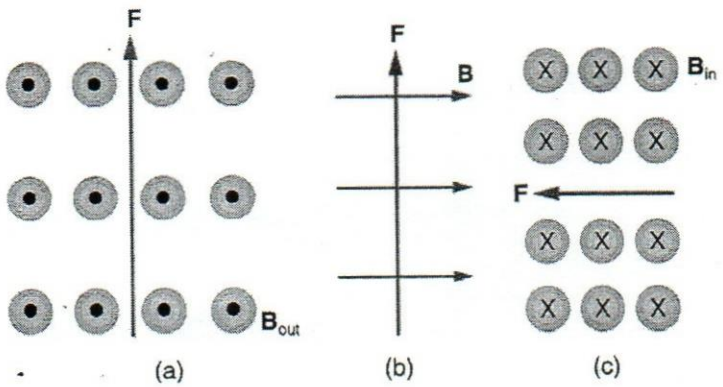
(6 marks

iv. Give a practical applications of this two incidents. (4 marks)

6.

i. Two equal like charges are 1.0 m apart in vacuum. Find the magnitude of the charges if the force acting between them is 0.025 N. Explain if this is a force of attraction or repulsion $\left(\frac{1}{4\Pi\varepsilon} = 9 \times 10^9\right)$ (4 marks)

ii. What is the direction of a current that experiences the magnetic force shown in each of the three cases in Figure, assuming the current runs perpendicular to B?



(3 × 2 = 6 marks)

iii. A wire carrying a current of 10A and 2 m in length is placed in a field of flux density 0.15 T. What is the force on the wire if it is placed

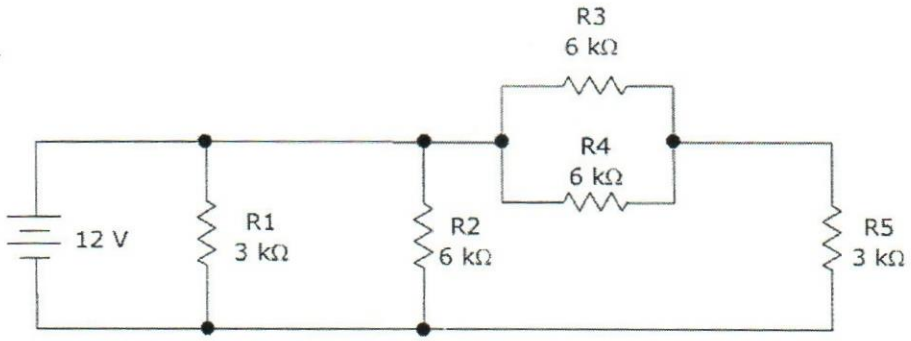
a. At right angled to the field

b. At 45^0 to the field

c. Along the field

(3 × 2 = 6 marks

iv. Determine total resistance of the circuit?



(4 marks)

7.

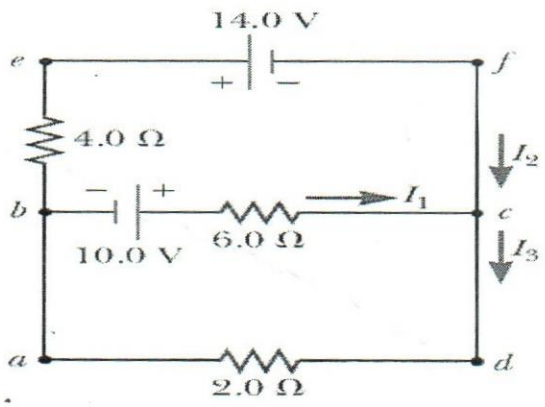
i. When a 6 V battery is connected across a lamp with a resistance of 3.4 Ω, the PD across the lamp is 5.1 V. Find,

a. The current through the lamp.

b. The internal resistance of the battery.

(2 × 2 = 4 marks)

ii. Find the currents I_1, I_2 and I_3 in the circuit shown in Figure.



(10 marks)

iii. Draw the simplified circuit of an op amp when it using as non-inverting amplifier. And draw input and output wave forms (6 marks)

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CINEC CAMPUS

Faculty of Maritime Sciences

Department of Navigation

EDUCATION & TRAINING COURSE : Navigation Officer Cadet Training Course – Foundation

COURSE CODE : ND- 199 - BATCH 014

FINAL REPEAT EXAMINATION – QUESTION PAPER

MATHEMATICS

- *Answer any 04 questions only*
- *Total Marks - 100*

Date: 04.10.2015 *Pass mark 50%* *Time allocated: 02 Hours*

Q.1 Simultaneous Equations : Find x & y .

i. $3x - 2y = 5$,

$\frac{2x}{3} + \frac{y}{2} = \frac{-7}{9}$ (50 marks)

ii. $\log_2 x - \log_2 y = 3$,

$\log_y x = 2$ (50 marks)

Q.2 Solve the following Quadratic equations using the formula;

i. $3x^2 - 2x - 8 = 0$ (50 marks)

ii. $x^2 - 5x - 12 = 0$ (50 marks)

Q.3 Logarithms :

i. Show that $(\log_b a) \cdot (\log_a b) = 1$ (40 marks)

ii. If $\log 2 = a$, $\log 3 = b$ and $\log 5 = c$

Express following values in a, b & c

a. log 6 b. log 600 c. log 1.5 (60 marks)

Q.4 Factorisation : Factorise the following;

i. $3x^3 + 2x^2y + 6xy^2 + 4y^3$ (25 marks)

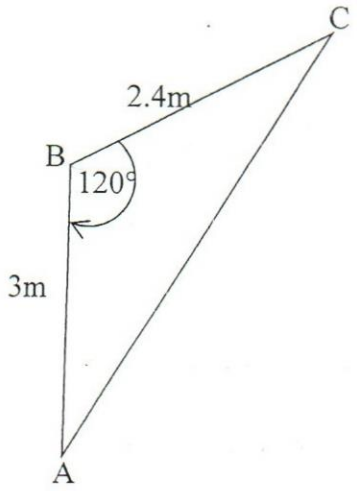
ii. $2x^2 + 2xy + 3y(x + y)$ (25 marks)

iii. $(x + 3y)^2 - (2x - y)^2$ (25 marks)

iv. $\frac{a^3}{b^3} - \frac{b^3}{a^3}$ (25 marks)

Q.5 Trignometric Ratios :

i. The figure is a simplified diagram of a crane, with Mast 'AB' and tie 'BC'. Calculate the length 'AC'.



(50 marks)

ii. Show that

$\sin 2\theta = \frac{2\tan\theta}{1+\tan^2\theta}$ and $\cos 2\theta = \frac{1-\tan^2\theta}{1+\tan^2\theta}$

[*Hint*: $\sin 2A = \sin A \cos A$, $\cos 2A = \cos^2 A - \sin^2 A$]

(50 marks)

Q.6 i. The sum of the first 6 terms of a GP is 9 times the sum of the first 3 terms. Find the common ratio.

(50 marks)

ii. Simplify $9x^6 y^4 \times 2x^5yz^3 \div 6(x^5y^2z)^2$

(50 marks)

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FINAL REPEATS EXAMINATION – QUESTION PAPER

ELECTRONICS

- Answer QUESTION (1) and any other 5 questions.
- *Total Marks - 100*

Date: 04.10.2015 *Pass mark 50%* *Time allocated: 02.5 Hours*

(1) i. The Transistor Circuit shown in the diagram (1) is on structed with Silicon. Calculate the Base Current , Collector Current

ii. What is the action of the transistor and what it is doing.

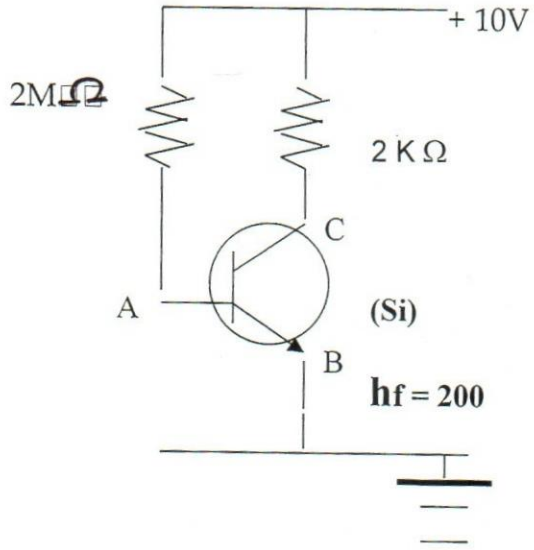

Diagram (1)

(20 marks)

(2) Calculate the current flowing through the diode , shown in the diagram (2)

(16 marks)

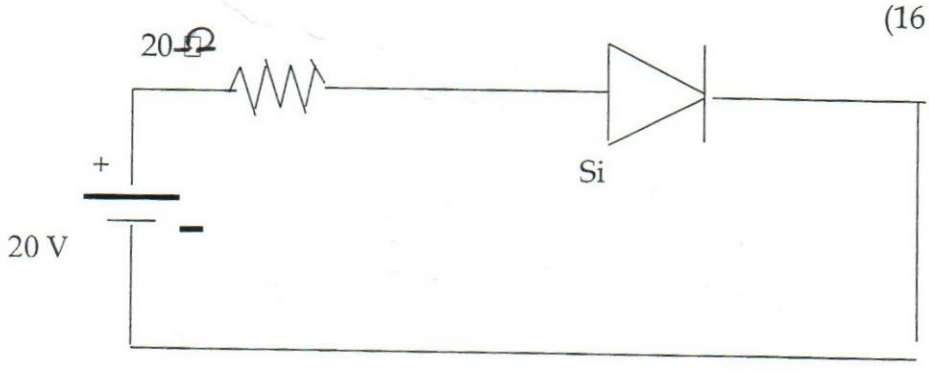

Diagram (2)

(3) A capacitor has been charged to 50 volts by a constant current of 20 mA flowing through it for a period of 40 seconds. Find the value of capacitance in Micro Farads. (16 marks)

(4) A two plate capacitor (Diagram 3) has each plate of length 50 mm and width of 20 mm as shown. The dielectric is filled with a material having relativy permittivity of 100 and distance between the plates is 2 mm. Find the value of the capacitor in Pico Farads. (16 marks)

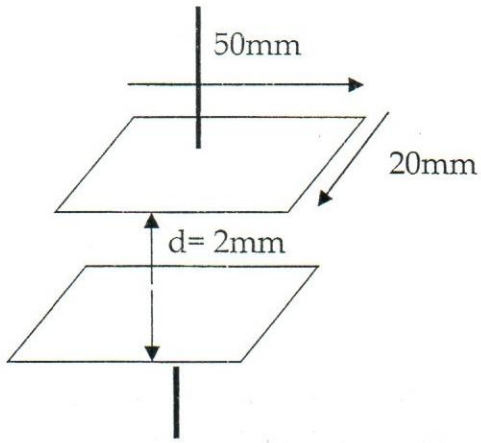

Diagram (3)

(5) With reference to the diagram (4) Calculate

(i) Current flowing through the battery
(ii) Voltage across each of the resitros.
(iii) Power dessipated as heat in each of the resistors.

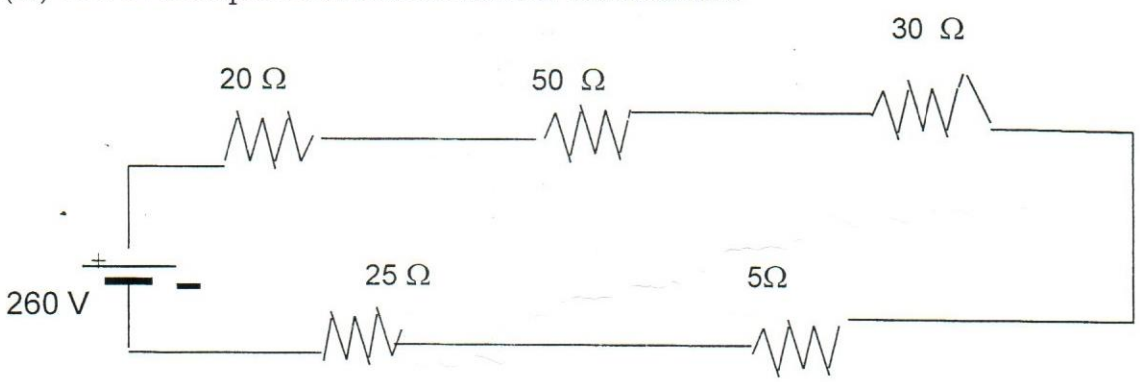

Diagram (4)

(16 marks)

(6) (i) a 2 microfarads and 8 microfarads capacitors are in series. What is their total series capacitance ?

(ii) a 10 microfarads and 20 microfarads capacitors are in parallel. What is their total parallel capacitance ?

(16 marks)

(7) An AC voltage has a peak value of 200V. Calculate,

(i)Peak to Peak Value

(ii)Average Value and

(iii) R.M.S Value

(16 marks)

End.

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END-TERM REPEAT EXAMINATION – QUESTION PAPER

INDUSTRIAL CHEMISTRY

- *Answer ANY 5 questions only*
- *Formulae and all intermediate steps taken in reaching your answer should be clearly shown*
- *Total Marks : 100*

Date: 03.10.2015 *Pass mark 50%* *Time allocated: 03 Hours*

Avogadro Constant (N_A) – 6.022 × 1023 mol-1

H – 1.0, He – 4.0, Li – 6.9, Be – 9.0, B – 10.8, C – 12.0, N –14.0 , O – 16.0, F – 18.9, Ne – 20.2, Na – 23.0, Mg – 24.3, Al – 27.0, Si – 28.1, P – 31.0, S – 32.1, Cl – 35.5, Ar – 40.0, K – 39.1, Ca – 40.1, Ag- 108.0, Cu – 63.5, Fe – 56.0, Co – 58.9, Zn = 65.4, Au – 197, Sn = 117.8

1)

a) Write down the correct chemical formula

i) Butane
ii) Silicon dioxide
iii) Ammonia
iv) Sodium Chloride

(1×4= 04 marks)

b) Name the three particles of the atom; and their respective charges. (6 marks)

c) Define the term

i) Auto ignition temperature
ii) Flammability
iii) Heterogeneous mixture
iv) Volatility
v) isomers

(2×5= 10 marks)

2)

a) How many grams of gold (Au) are there in 15.3 moles of Au? (03 marks)

b) How many atoms are present in 3.14 g of copper (Cu)? (05 marks)

c) A hydrate of magnesium sulfate has a mass of 13.52 g. This sample is heated until no water remains. The $MgSO_4$ has a mass of 6.60 g. find the formula and name of the hydrate.

(06 marks)

d) Ascorbic acid (vitamin C) cures scurvy. It is composed of 40.92 percent carbon (C), 4.58 percent hydrogen (H), and 54.50 percent oxygen (O) by mass. Determine its empirical formula

(6 marks)

3)

a) Define the p^H and p^{OH} and express their equations. (04 marks)

b) Briefly explain the terms of Acidic solution and Basic solution at 25^0 C ($k_w = 1 \times 10^{-14}$ mol^2dm^{-6}).

(04 marks)

c) The concentration of H^+ ions in a Vinegar solution is 0.0035 M. Find the pH value.

(04 marks)

d) Find the concentration of OH^- ions in a Sodium hydroxide (NaOH) solution of pH = 10.5 at 25 ^{0}C

(04 marks)

e) Write down the solubility product expression (K_{sp}) and these solutions

i) AgCl

ii) $Ca_3(PO_4)_2$

(04 marks)

4)

a)

$Ag^+ + e^- \rightarrow Ag$ $\quad E^\circ = 0.80$ V

$Mg^{2+} + 2e^- \rightarrow Mg$ $\quad E^\circ = -2.37$ V

Using above Standard Reduction Potentials,

i) Give the anode and cathode half-reactions. (06 marks)

ii) Write the overall equation for the chemical reaction. (04 marks)

iii) Represent the cell using standard notation. (04 marks)

iv) Calculate the cell potential (e.m.f.) of the electrochemical cell. (03 marks)

b) What are the standard for temperature, Concentration and pressure? (03 marks)

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5)

a) Explain the meaning of corrosion with examples. (04 marks)

b) Explain how nature of medium influencing corrosion? (06 marks)

c) Explain why rusting occurs so rapidly in salt water? (04 marks)

d) Write two corrosion control method and explain it. (06 marks)

6)

a) How does Crude oil form?

b) What is meant by ''Fractional Distillation''?

c) Write four function of lubricant.

d) What are the three types of lubricants?

e) Write a short note aboutFluid film lubrication.

(5 x 4= 20 marks)

7)

a) What is monomer?

b) Classified polymers according to its method of synthesis. (4 marks)

c) Explain how rubber is vulcanized. (3 marks)

d) Polythene is a useful polymer. (CH_2CH_2)

i. Write its monomer structure
ii. Polymer structure
iii. Give two Uses and applications (4 marks)

e) Mention 3 general properties of metals (6 marks)

f) What are the Raw materials of extraction of Iron? (3 marks)

Colombo International Nautical and Engineering College

CINEC CAMPUS

FACULTY OF MARITIME SCIENCES

DEPARTMENT OF NAVIGATION

EDUCATION & TRAINING COURSE : NAVIGATION OFFICER CADET TRAINING COURSE – FOUNDATION

COURSE CODE : ND- 0199 - BATCH 015

MID TERM EXAMINATION – QUESTION PAPER

INTRODUCTION TO INDUSTRIAL SHIPPING

- *Answer ALL questions*
- *Total Marks : 100*

Date: 14.10.2015 *Pass mark 70%* *Time allocated: 02 Hours*

1) i. Sketch and identify parts of a general cargo ship (10 marks)
ii. Identify and write the specialties of 5 different types of ships. (10 marks)

2) Describe 5 types of containers and elaborate using sketches. (20 marks)

3) i. Identify 3 major fuel oil types used onboard ships and write short notes on them. (12 marks)
ii. Describe how Sulphur content in fuel oil take part in air pollution and contribution of MARPOL Annex in prevention of such pollution (08 marks)

4) Write short notes on the following.
   a. Latitude
   b. Longitude
   c. GMT
   d. International Maritime Dangerous Goods Code (IMDG Code) (05 marks each)

5) i. Write short notes on following
   a. International Maritime Organization (IMO)
   b. International Chamber of Shipping (05 marks each)
ii. Describe Classification societies and name 5 members of International Association of classification societies (IACS) (20 marks)

End.

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Colombo International Nautical and Engineering College

CINEC CAMPUS

Faculty of Maritime Sciences

Department of Navigation

EDUCATION & TRAINING COURSE : Navigation Officer Cadet Training Course – Phase 1

COURSE CODE : ND- 100 P1 - BATCH 032

MID-TERM EXAMINATION - QUESTION PAPER

APPLIED SCIENCE

- *Answer any 04 questions*
- *Total Marks 100 – (each question carries 25 marks)*
- *Electronic storing devices are NOT allowed*
- *($g = 10\ ms^{-2}$)*

Date: 2015.10.14 *Pass mark 55%* *Time allocated: 2.5 Hours*

1.

a) Define **acceleration** and **velocity** (5 marks)

b) A body starts from rest travels for 20 s with a constant acceleration of 6 ms^{-2}. Then it travels with that velocity for 1 minute. After that it travels with constant retardation and comes to rest in 5 s. **Draw velocity time graph**

Find, (5 marks)

i) Maximum velocity.

ii) Displacement while accelerating.

iii) Displacement with constant velocity.

iv) Constant retardation.

v) Displacement while retarding.

vi) Total displacement.

(2.5 × 6 =15 marks)

2.

a) Man through a ball at **u** ms^{-1} at angle θ to horizontal .(gravitational acceleration as **g** ms^{-2}).show that horizontal range of projectile (R) is

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

(Show your work out) (10 marks)

b) A golfer hits a golf ball up ward at 50.0m/s at an angle of 30° relative to the ground. Shortly thereafter, the ball lands on the same level ground some distance from where it was hit.

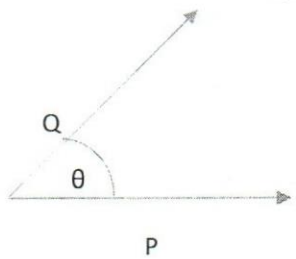
i. Determine the time of flight of the ball.

ii. Determine the maximum height of the ball.

iii. Determine the range of the ball (15 marks)

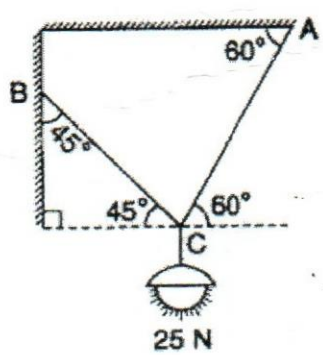
3.

a) P and Q are two forces acting with θ angle. Find the resultant force and direction of resultant force by force parallelogram method?



(10 marks)

b) An electric light fixture weighing 25 N hangs from a point C, by two strings AC and BC. The string AC is inclined at 60° to the horizontal and BC at 45° to the vertical; as shown in figure. Determine the forces in the strings AC and BC.



(15 marks)

4.

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a) State Newton's first law of motion (7 marks)

b) A light string passes over a smooth pulley, and carries box of masses 4kg and 7kg at each end. If the system moves freely;

i. Mark all the forces acting on them system

ii. Acceleration of each box

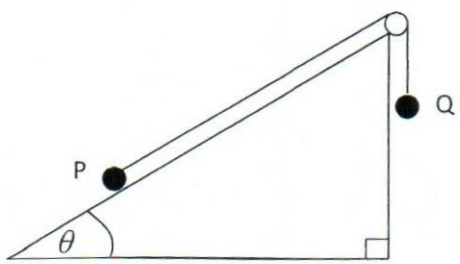
iii. Tension in the string (12 marks)

c) A ball of mass 200 g is attached to the upper end of a vertical light rod. Find the trust in the rod when it raises the ball vertically with an acceleration of 1.5 ms^{-2} (6 marks)

5.

a) Draw a graph to illustrate the variation of frictional force (F) with applied force. Mention limiting frictional force, Static region and Kinetic region on the graph. (10 marks)

b) A cord running over a pulley connects two objects. The coefficient of static friction between the object and the table is 0.33, The coefficient of dynamic friction is 0.25. If P = 3.0 kg , Q = 8 kg $\theta = 30^0$



i) Mark all the force acting on the each object of the system (4 marks)

ii) Find Limiting frictional force. (3 marks)

iii) Find acceleration of the system. (5 marks)

iv) Find tension of the string. (3 marks)

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CINEC CAMPUS

FACULTY OF MARITIME SCIENCES

DEPARTMENT OF NAVIGATION

EDUCATION & TRAINING COURSE : NAVIGATION OFFICER CADET TRAINING COURSE – FOUNDATION

COURSE CODE : ND- 0199 - BATCH 015

MID-TERM EXAMINATION – QUESTION PAPER

PHYSICS

- *Answer 4 questions only*
- *Speed of light and EM waves in a vacuum* (C)=$3x10^8 ms^{-1}$
- *velocity of sound = 340 m/s*
- *g=10m/s²*

Date: 14.10.2015 *Pass mark 50%* *Time allocated: 2.5 Hours*

1.

a) Define Simple Harmonic Motion (SHM). (09 marks)

b) A 0.500kg mass is vibrating in a system in which the restoring constant is 100 N/m; the amplitude of vibration is 0.200 m. Find

i. the total energy of the system
ii. the maximum kinetic energy and maximum velocity
iii. the PE and KE when x= 0.100 m
iv. the maximum acceleration
v. the equation of motion if x= A at t=0

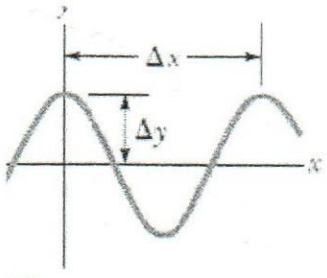
(16 marks)

2.

a) Draw a graph to illustrate Kinetic energy, Potential energy and Total energy variation with displacement of the mass

(7 marks)

b) A wave traveling in the positive x-direction is pictured in Figure (a). Find the amplitude, wavelength, speed, and period of the wave if it has a frequency of 8.35 Hz. In Figure (a), Δx = 44.0 cm and Δy = 15.0 cm.



i. Amplitude
ii. Wave length
iii. Period
iv. Speed of the wave.

(3× 4 = 12 marks)

c) The position of a particle in SHM is given by $x = (7\ cm)\sin(4\pi t)$. What is;

i. The frequency
ii. The period and
iii. The amplitude of the particle's motion? (2×3= 06 marks)

3.

a) Illustrate the differences between Constructive interference and Destructive interference
(3× 2= 06 marks)

b) Define the following ;

i. Transverse waves
ii. Mechanical waves
iii. Longitudinal waves

(3× 3= 09 marks)

c) A sound wave of wave length 0.332 m has a time period of 10^{-3} s. If the time period is decreased to 10^{-4} s. Calculate the wavelength and frequency of the new wave

(07 marks)

d) The wavelength of a beam of red light propagating in a vacuum is 740 nm. Find the frequency of red light in vacuum.

(03 marks)

4.

a) You are stationed at a particular point. Discuss the effects of the sound of the horn of an approaching train towards you from 2 miles ahead to until the train had traveled to a distance of 2 miles behind you.

(5 marks)

b) A bird is flying directly toward a stationary bird-watcher and emits a frequency of 1250 Hz. The bird-watcher, however, hears a frequency of 1290 Hz. What is the speed of the bird?

(8 marks)

c) An ambulance sirens with the frequency of 3100 Hz and moving with 108 kmh^{-1} , towards a wall. What is the frequency observed by the driver?

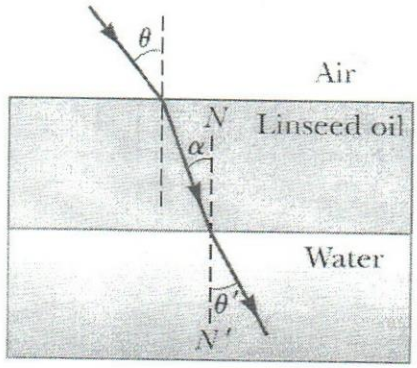
(8 marks)

d) What is ultrasound and infrasound

(2× 2= 04 marks)

5.

a) The figure shows a refracted light beam in linseed oil, making an angle of $\alpha = 30.0°$ with the normal line NN'. The index of refraction of linseed oil, water and air is 1.48, 1.33 and 1.



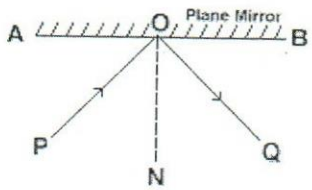
Determine the angles

(a) θ?

(b) θ'?

(11 marks)

d) Fill in the blanks.



i. The angle of reflection is given by the angle _____.
ii. The line NO that is perpendicular to the plane mirror surface and drawn at the point of incidence is called the _____.
iii. The line OQ is called the _____.
iv. The line PO is called the _____.
v. The angle between the incident and reflected rays is 90°. If the plane mirror is rotated by 10° about O in the anti-clockwise direction, then the angle between the incident and reflected rays will be _____°.
vi. The angle between the incident and reflected rays is 90°. If the plane mirror is rotated by 10° about O in the clockwise direction, then the angle between the incident and reflected rays will be _____°.
vii. The angle of incidence is given by the angle _____.

(2× 7= 14 marks)

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CINEC CAMPUS

Faculty of Maritime Sciences

Department of Navigation

EDUCATION & TRAINING COURSE : Navigation Officer Cadet Training Course – Foundation

COURSE CODE : ND- 0199 - BATCH 015

MID-TERM EXAMINATION – QUESTION PAPER

MATHEMATICS

- Answer any 04 questions only
- Total Marks - 100

Date: 2015.10.13 Pass mark 50% Time allocated: 02 Hours

Q.1 Solve the Simultaneous Equations:

i. $x - 3y = 6$

$3xy + x = 24$ (50 marks)

ii. $\log_2 x + \log_2 y = 3$,

$\log_y x = 2$ (50 marks)

Q.2 i. Express $(5 + \sqrt{2})^2$ in the form $m + n\sqrt{2}$

Simplify $(5 + \sqrt{2})^2 - (5 - \sqrt{2})^2$ (40 marks)

ii. Express in partial functions

$\frac{(a-b)}{(x-a)(x-b)}$ (30 marks)

iii. Simplify

$(9x^6y^4).(2x^5yz^3) \div 6(x^5y^2z)^2$ (30 marks)

Q.3 i. Solve for x

$5(2^x) - 4^x - 4 = 0$ (50 marks)

ii. If roots of the equation

$2x^2 - 7x + 4 = 0$ are $\propto$ and β,

find the values of $\frac{1}{\propto} + \frac{1}{\beta}$ and $\frac{1}{\propto\beta}$ (50 marks)

Q.4 i. A *GP* has its first term as 5. The common ratio is 4/5 Calculate ;

a. The 20th term to 3 decimal places. (25 marks)

b. The sum to infinity of the series. (25 marks)

ii. A sequence $a_1, a_2, a_3, \ldots, a_n$ is defined by $a_1 = 2,\ a_{n+1} = 2a_n - 1$, write down the values of a_2, a_3 and a_4 . (50 marks)

Q.5 i. Prove the following

i. $\cos^4 A - \sin^4 A + 1 = 2\cos^2 A$ (30 marks)

ii. $\frac{\sin A}{(1+\cos A)} + \frac{(1+\cos A)}{\sin A} = 2\text{cosec } A$ (30 marks)

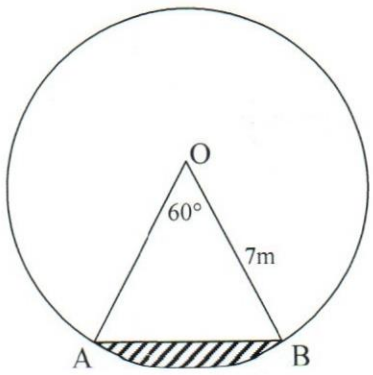
iii. $\frac{1-\cos 2A}{(1+\cos 2A)} = \tan^2 A$ (40 marks)

Q.6 i. Draw the graph of the quadratic equation $y = x^2 - 3x - 6$, and find the solution to the equation $x^2 - 3x - 10 = 0$, with the help of the graph.

(50 marks)

ii. Refer to the diagram and find the area of the shaded part of the circle.

(50 marks)



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CINEC CAMPUS

FACULTY OF MARITIME SCIENCES

DEPARTMENT OF NAVIGATION

EDUCATION & TRAINING COURSE : NAVIGATION OFFICER CADET TRAINING COURSE – FOUNDATION

COURSE CODE : ND- 0199 - BATCH 015

MID-TERM EXAMINATION – QUESTION PAPER

ELECTRONICS

- *Answer question no.07 and any (5) questions*
- *Total Marks : 100*

Date: 13.10.15 *Pass mark 50%* *Time allocated: 02 Hours*

1. Find equivalent resistance of the following circuits. (15 marks)

(i)

(ii)

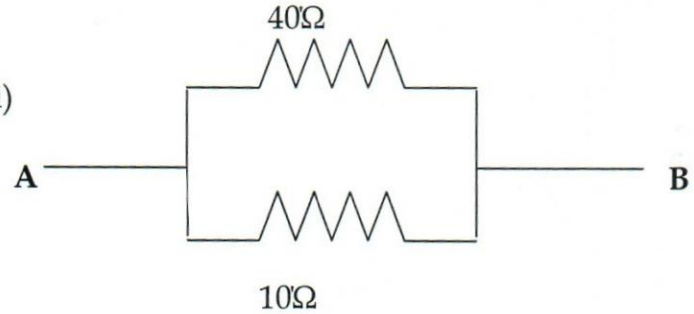


Diagram (1)

2. With reference to the diagram (2) Calculate (15 marks)

   i. Current flowing through the battery
   ii. Voltage across each of the resitros.

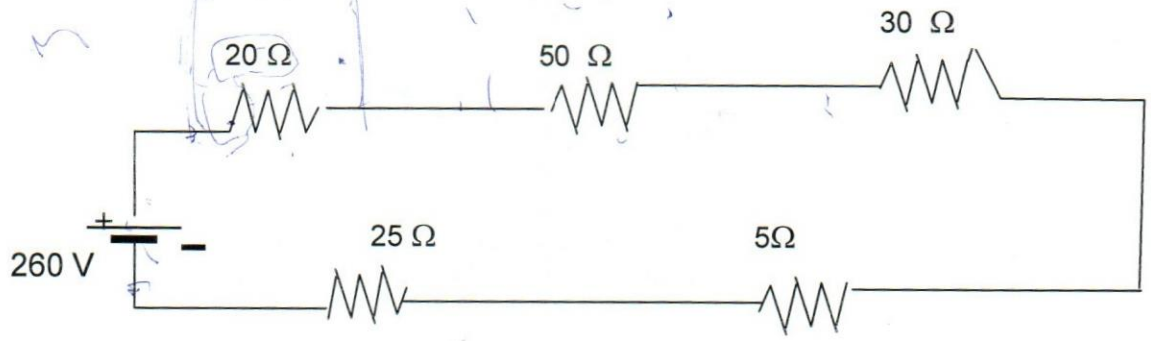


Diagram (2)

3. A capacitor has been charged to 50 volts by a constant current of 20 mA flowing through it for a period of 40 seconds. Find the value of capacitance in Micro Farads.

(15 marks)

4. A two plate capacitor (Diagram 3) has each plate of length 50 mm and width of 20mm as shown. The dielectric is filled with a material having relative permittivity of 100 and distance between the plates is 2 mm. Find the value of the capacitor in Pico Farads.

(15 marks)

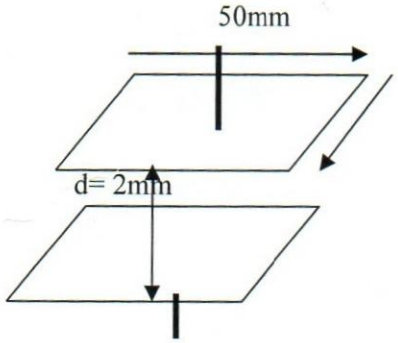
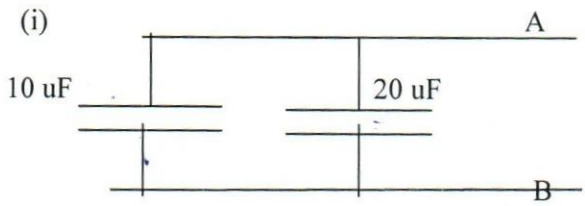


Diagram (3)

5. Find equivalent capacitance of the following capacitor combinations shown in the diagram (3), (i) and (ii) below.

(15 marks)



(ii)

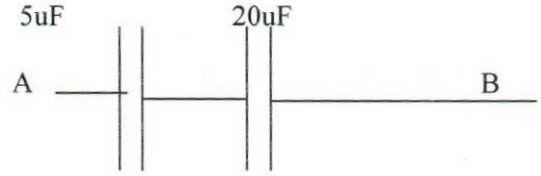


Diagram (4)

6. A sinusoidal AC Voltage has aPeak Value of 100V Find

   i. Peak-toPeak Valiue
   ii. R.M.S. Value and
   iii. Average Value (15 marks)

7. Indicate biasing of Diagrams (5) and draw the internal structure as a cross section. (25 marks)

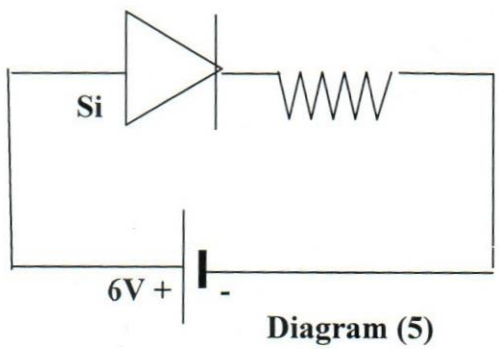


Diagram (5)

Colombo International Nautical and Engineering College
CINEC CAMPUS
Faculty of Maritime Sciences
Department of Navigation
EDUCATION & TRAINING COURSE: Navigation Officer Cadet Training Course – Foundation
COURSE CODE: ND- 199 - BATCH 015

MID EXAMINATION – QUESTION PAPER

APPLIED MECHANICS

- Answer any 04 questions only
- Total Marks – 100
- $g = 10\ ms^{-2}$

Date: 15.10.2015 Pass mark 50% Time allocated: 2.5 Hours

1)

i. Define **velocity** and **acceleration** (2× 3= 6 marks)

ii. A particle starting from rest moves with a constant acceleration of 5 ms^{-2} and covers a distance of 10 m. Then it moves with constant acceleration of 10 ms^{-2} and moves a distance of 20 m. Finally it moves with a constant acceleration of 15 ms^{-2} and moves a distance of 30 m.

(a). Draw a **velocity – time graph** for the particle's motion. (5 marks)

(b). Determine the **velocity** when its displacement is 10 m and **time taken (t_1)?**

(c). Determine the **velocity** when its displacement is 30 m from the origin point?

(d). Find the **time taken (t_2)** which it accelerates with 10 ms^{-2}?

(e). determine the **velocity** when its displacement is 60 m?

(f). Find the **time taken (t_3)** which it accelerates with 15 ms^{-2}?

(g). Find the **total time T** ($t_1 + t_2 + t_3$)?

(7×2=14 marks)

2)

i. Man through a ball at **u** ms^{-1} at angle θ to horizontal .(gravitational acceleration as **g** ms^{-2}).show that horizontal range of projectile (R) is

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

(Show your work out) (8 marks)

ii. In Pirates of the Caribbean, A cannon was fired at an enemy ship. The muzzle velocity was 60.0 m/s. At what angle above the horizontal must the cannon have been aimed in order to hit the enemy ship 320 m away?

(12 marks)

iii. An aircraft is travelling along a runway at a velocity of 25m/s. It accelerates at a rate of $4m/s^2$ for a distance of 750m before taking off. Calculate its take-off speed.

(5 marks)

3)

i. State Newton's laws of motion (3 ×4 =12 marks)

ii. A light string passes over a smooth pulley, and carries particles of masses 6 kg and 11 kg at each end.

a) Mark all the force acting on the system (5 marks)

If the system moves freely find;

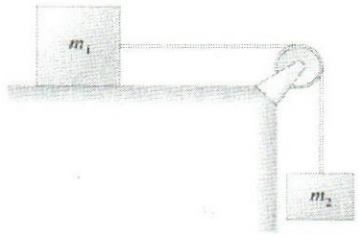
b) find the acceleration of masses and tension of the string

(8 marks)

4)

i. Draw a graph to illustrate the variation of frictional force (F) with applied force. Mention limiting frictional force, Static region and Kinetic region on the graph. (7 marks)

ii. A cord running over a pulley connects two objects. The coefficient of static friction between the object and the table is 0.3, The coefficient of



dynamic friction is 0.25. If $m_1 = 4.0$ kg and $m_2 = 8$ kg Find,

a. Limiting frictional force.
b. Acceleration of the system.
c. Tension of the string. (6 × 3 = 18 marks)

5)

i. Define period and frequency of circular motion. (4 marks)

ii. A biker travels once around a circular track of radius 40.0m in 6s. Calculate:

a) the period of time
b) the frequency
c) the angular velocity
d) the average linear velocity (2× 4 = 8 marks)

iii. A force of 20 N is applied perpendicular to the end of a bar of length 0.5 m. Calculate the torque produced by the force

(4 marks)

iv. A torque of 30 Nm is applied to a disk that has a moment of inertia of 5.0 kg m^2. What is the resulting angular acceleration of the disk?

(4 marks)

v. A force of 5.0 N is applied tangent to the edge of a disk of radius 0.8 m and mass 3.0 kg. Calculate the torque produced by this force and the resulting angular acceleration of the disk. (5 marks)

6)

i. What is the impulse of a force of 10 N acting on a ball for 2 seconds?

(6 marks)

ii. A freight train is being assembled in a switching yard, and Figure shows two boxcars. Car 1 has a mass of $m_1 = 65\times10^3$ kg and moves at a velocity of v_{01} = +0.80 m/s. Car 2, with a mass of $m_2 = 92\times10^3$ kg and a velocity of v_{02} = +1.3

m/s, overtakes car 1 and couples to it. Neglecting friction, find the common velocity v_f of the cars after they become coupled.

(a) Before (b) After

(8 marks)

iii. A 5 Kg Cart is pushed by a 30 N force against friction for a distance of 10m in 5 seconds. Determine the Power needed to move the cart.

(4 marks)

iv. How much potential energy is lost by a 5Kg object to kinetic energy due a decrease in height of 4.5 m (4 marks)

v. How fast should a man of mass 50 kg run, so that his kinetic energy is 625 J

(4 marks)

End.

Colombo International Nautical and Engineering College

CINEC CAMPUS

Faculty of Maritime Sciences

Department of Navigation

EDUCATION & TRAINING COURSE: Navigation Officer Cadet Training Course – Foundation

COURSE CODE: ND- 0199 - BATCH 014

FINAL EXAMINATION – QUESTION PAPER

APPLIED MECHANICS

- Answer any 5 questions only
- $g=10m/s^2$
- Give your answer to two decimal points

Date: 2015.07.17 Pass mark 50% Time allocated: 03 Hours

1.

a) Define **acceleration** and **velocity** (04 marks)

b) A particle starting from rest moves with a constant acceleration of a ms^{-2} and covers a distance of x (m) . Then it moves with constant acceleration of 2a ms^{-2} and moves a distance of 2x (m). Finally it moves with an constant acceleration of 3a ms^{-2} and moves a distance of 3x (m).

i. Draw a velocity – time graph for the particle's motion.

ii. Determine the velocity when its displacement is x (m) and time taken (t_1)

iii. Determine the velocity when its displacement is 3x (m) (2x + x) from the origin point.

iv. Find the time taken (t_2) which it accelerates with 2a ms^{-2}

v. Determine the velocity when its displacement is 6x (m) (3x + 2x + x).

vi. Find the time taken (t_3) which it accelerates with 3a ms^{-2}

vii. Find the total time T ($t_1 + t_2 + t_3$)

(8 × 2=16 marks)

2.

a) A 0.5 kg ball moves in a circle that is 4.0 m in radius at a speed of 40.0 m/s. Calculate,

i. Angular velocity

ii. Period of time

iii. Frequency

iv. Its centripetal acceleration.

v. The centripetal force on the ball. (3 x 4 = 12 marks)

b) A mass of 2.0 kg, which may be considered to be a point mass, is attached to a string of length 0.3 m and is rotated at 8.0 rad / s.

i. Calculate the moment of inertia of the mass about the axis

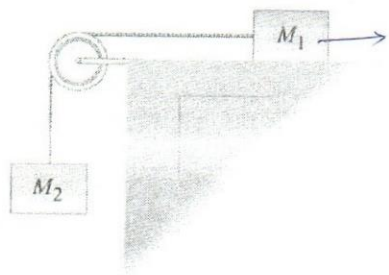
ii. Calculate its angular momentum. (08 marks)

3.

a) Write the Newton's first law of motion.

(4 marks)

b) The two masses of the system shown in the figure are M_1 = 5 kg and M_2 = 8 kg. You may assume that the string is inextensible, coefficient of kinetic friction between the crate and the floor is 0.25 and the coefficient of static friction is 0.3 and the pulley is a mass less smooth one.



i. Find the limiting friction force

ii. Find the acceleration of the system.

iii. Find the tension of the system. (3 × 4 = 12 marks)

c) A parachutist of mass 55 kg falls out of an airplane at a height of 1,000 m.

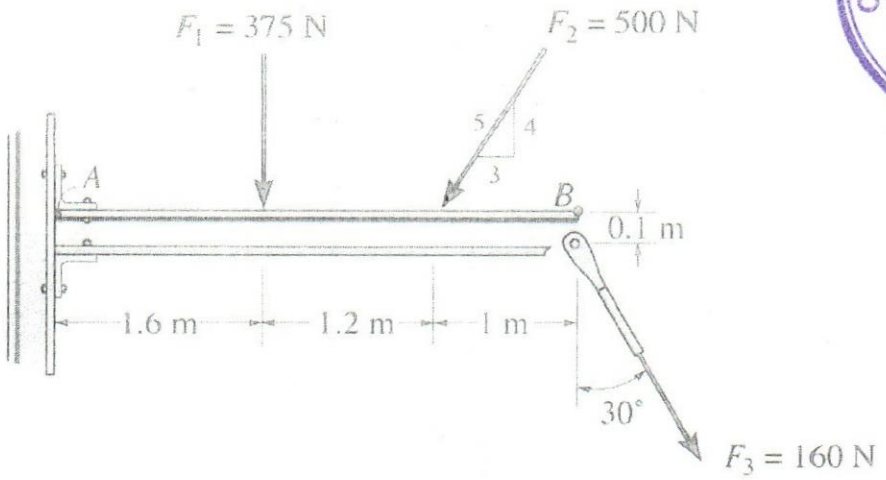
i. What is his speed on hitting the ground assuming no air resistance? If he actually hits the ground at 5 m / s,

ii. how much mechanical energy was lost to air resistance?

(2 × 2 = 4 marks)

4. 70

a) Determine the total moment about point A



(10 marks)

b) If the angle between the ceiling and the string A is 60^0 ($\theta = 60^0$)

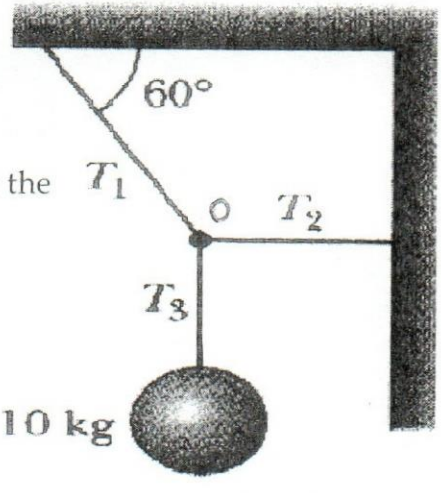
i. Find the weight of the hanging object

ii. Resolve forces in x direction and y directions at the point O.

iii. Find the tension of the C string T_3.

iv. Find the tension of the B string T_2.

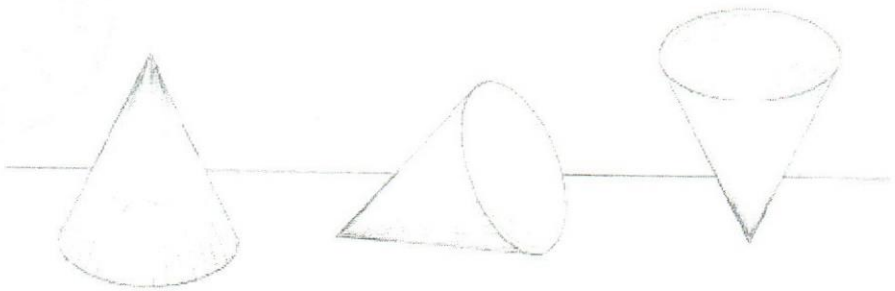
v. Find the tension of the A string T_1.



(10 marks)

5.

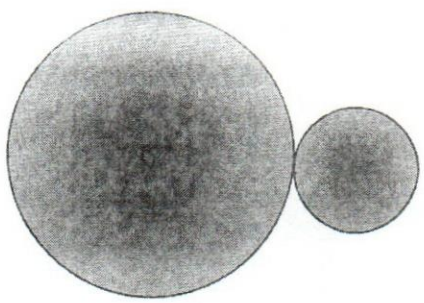
a) Determine equlibrium state of these cones.



(a) (b) (c)

(2 ×3 =06 marks)

b) Two solid spheres made up from same material have 6 cm and 3 cm radius. If these spheres welded together find the center of gravity of combined object from the center of gravity of bigger sphere's center (Volume of sphere = $\frac{4}{3}\pi r^3$)



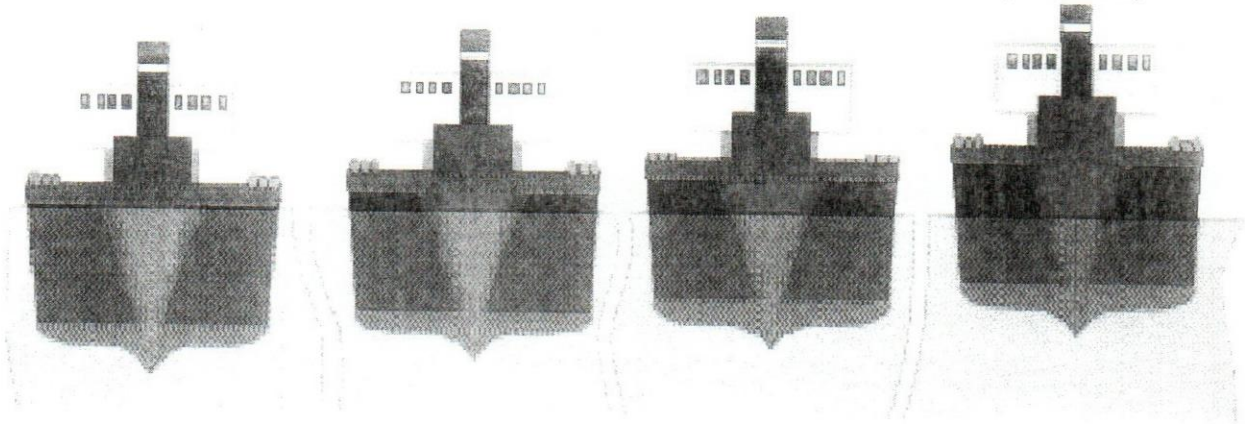
(12 marks)

6.

a) State Archimedes' principle and law of floatation. (06 marks)

b) Explain why the depth of ship immersed in the water different?

(04 marks)



warm fresh water | cold fresh water | warm sea water | cold sea water

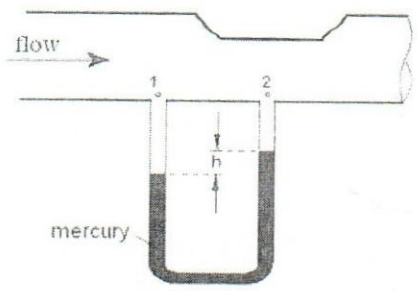
c) Elisabeth purchases a "gold" crown at a market. After she gets home, she hangs it from a scale and finds its weight in air to be 7.84 N. She then weighs the crown while it is immersed in water (density of water is 1000 kg/m^3) and now the scale reads 6.86 N. Is the crown made of pure gold if the density of gold is 19.3 x 10^3 kg/m3?

(10 marks)

7.

a) State Bernoulli's Principle (08 marks)

b) The Venturi tube shown in the figure has a restriction in the cross section, so the speed of the air flow at point "2" is 15 m/s, while the speed at point "1" is 10 m/s. Calculate the difference in the level of water in the U-tube under these conditions. [Take the density of air=1.29kg/m^3 and mercury=13500 kg/m^3]



(12 marks)

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Colombo International Nautical and Engineering College
CINEC CAMPUS
Faculty of Maritime Sciences
Department of Navigation
EDUCATION & TRAINING COURSE : Navigation Foundation Program
COURSE CODE : ND- 0199 - BATCH 014

FINAL EXAMINATION - QUESTION PAPER

INTRODUCTION TO SHIPPING INDUSTRY

- *Answer all questions.*
- *Total Marks : 100*

Date: 16.07.2015 *Pass mark 70%* *Time allocated: 03 Hours*

1. Define following nautical terms

i. Aft
ii. Keel
iii. Trim
iv. Overboard
v. Bunkers
vi. Cargo
vii. Ballast
viii. Draught
ix. Helm
x. Course

(20 marks)

2. Write short notes on following types of ships

i) General Cargo ships
ii) Tankers
iii) Container ships
iv) Heavy lift ships

(20 marks)

3. i) Explain in detail different types of propulsion systems used on ships.

ii) List the advantages & disadvantages of the controllable pitch propeller.

iii) Compare the Low speed diesel engines with medium speed diesel engines.

iv) State the types of fuel used in marine engines.

(20 marks)

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4. Write short notes on following auxiliary equipments (machinery) of ships

i) Mooring winches

ii) Steering gears

iii) Oily water separator

iv) Derricks

(20 marks)

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5. Briefly explain followings

i) Flag of registry

ii) IMO

iii) ICS

iv) Classification societies

(20 marks)

Colombo International Nautical and Engineering College

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Department of Navigation

EDUCATION & TRAINING COURSE : NAVIGATION OFFICER CADET TRAINING COURSE FOUNDATION

COURSE CODE : ND- 0199 – BATCH 14

FINAL EXAMINATION – QUESTION PAPER

PHYSICS

- Answer 05 Questions Only
- Total Marks 100
- $g = 10\ ms^{-2}$

Date: 2015.07.16 Pass mark 50% Time allocated: 03 Hours

1.

i. 1. Define Simple Harmonic Motion (SHM) (5 marks)

ii. A 0.500kg mass is vibrating in a system in which the restoring constant is 100 N/m; the amplitude of vibration is 0.200 m. Find the Total energy of the system

a. the maximum kinetic energy and maximum velocity

b. the PE and KE when x= 0.100 m

c. the maximum acceleration

d. the equation of motion if x= A at t=0

(5× 3 = 15 marks)

2. i. Define followings

a. Transverse waves

b. Longitudinal waves

(2× 3 = 06 marks)

ii. Sound waves travel with a speed of 330 m/s. What is the wavelength of sound, whose frequency is 530 Hz?

(02 marks)

iii. The wavelength of a beam of green light propagating in a vacuum is 545 nm. Find the frequency of green light in vacuum. (Velocity of light = 3.0×10^8 m/s)

(02 marks)

iv. A sinusoidal wave traveling in the positive x direction has a frequency of 8 Hz as shown in the figure. Find

(Keep your answers with SI units)

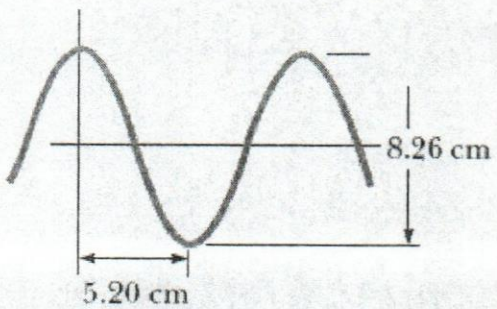
a. The wave length

b. The angular velocity

c. The wave number (k)

d. Period

e. Speed of the wave (2× 5 = 10 marks)



3. How does sound travel? (4 marks)

i. A cop car drives at 30 m/s toward the scene of a crime, with its siren blaring at a frequency of 2000 Hz. (The speed of sound in the air is 343 m/s.)

a. At what frequency do people hear the siren as it approaches?

b. At what frequency do they hear it as it passes?

(2× 4 = 8 marks)

ii. Submarine (sub A) travels through water at a speed of 8.00 m/s, emitting a sonar wave at a frequency of 1 200 Hz. The speed of sound in the water is 1 533 m/s. A second submarine (sub B) is located such that both submarines are travelling directly toward each other. The second submarine is moving at 9.00 m/s.

a. What frequency is detected by an observer riding on sub B as the subs approach each other?

b. While the subs are approaching each other, some of the sound from sub A reflects from sub B and returns to sub A. If this sound were to be detected by an observer on sub A, what is its frequency?

(2×4 = 8 marks)

4. State Snell's law of refraction (6 marks)

i. If the angle of incidence of a substance is 50.0° and the angle of refraction is 40.0°, what is the index of refraction? (4 marks)

ii. From the sonar equipment a navigator found the sea bed is 8m deep. Find the apparent depth he observes. (n_{water} = 1.33) (4 marks)

iii. What is Critical angle? (3 marks)

iv. Calculate the critical angle of an optical fibre. (3 marks)
(Refractive index of glass and air is 1.56 and 1)

5. i. Write lens equation and define terms. (4 marks)

ii. What image is produced by placing an object 6 cm away from a convex lens of focal length 3 cm? (Draw the ray diagram and write properties of image)

(6 marks)

iii. What image is produced by placing an object 4 cm away from a convex lens of focal length 8 cm?(Draw the ray diagram and write properties of image)

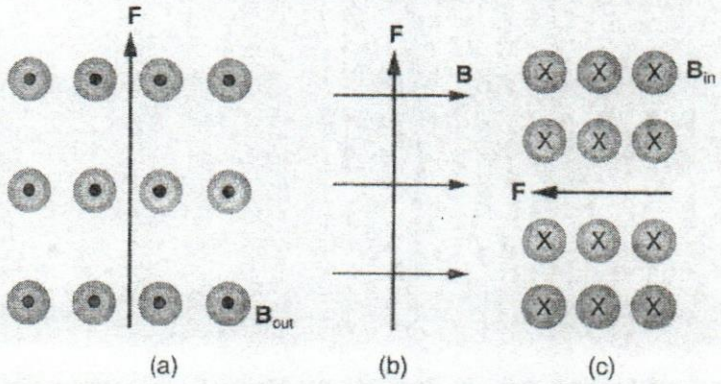
(6 marks)

iv. What are the Near point and Far point of human eye?

(4 marks)

6. i. Two equal like charges are 1.0 m apart in vacuum. Find the magnitude of the charges if the force acting between them is 0.025 N. Explain if this is a force of attraction or repulsion$\left(\frac{1}{4\Pi\varepsilon} = 9 \times 10^9\right)$ (4 marks)

ii. What is the direction of a current that experiences the magnetic force shown in each of the three cases in Figure, assuming the current runs perpendicular to B?



(3 × 2 = 6 marks)

iii. A wire carrying a current of 10A and 2 m in length is placed in a field of flux density 0.15 T. What is the force on the wire if it is placed

a. At right angled to the field
b. At 45^0 to the field
c. Along the field

(3 × 2 = 6 marks)

2. Calculate the current flowing through the diode, shown in the diagram (2)

(16 marks)

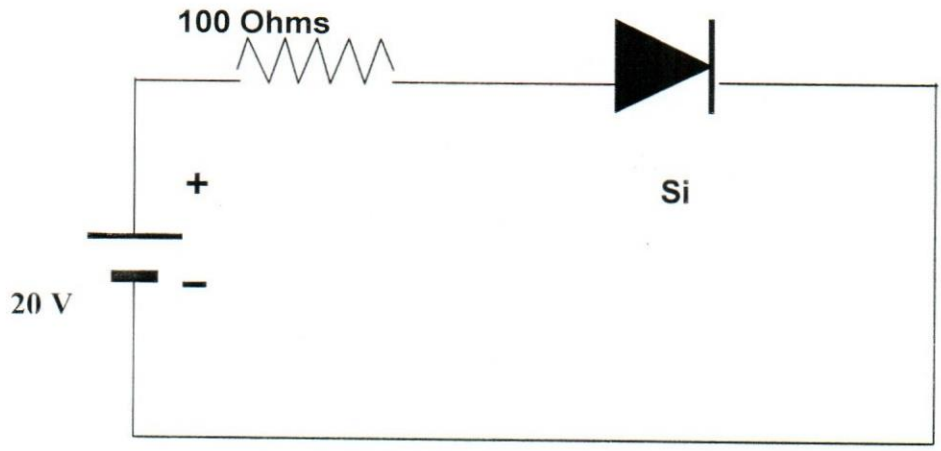


Diagram (2)

3. A capacitor has been charged to 100 volts by a constant current of 40 mA flowing through it for a period of 25 seconds. Find the value of capacitance in Micro Farads.

(16 marks)

4. A two plate capacitor has each plate of length 30 mm and width of 10mm. The dielectric is filled with a wax material having a relative permittivity of 1000. Distance between the plates are 0.5mm. Find the value of the capacitor in Pico Farads.

(16 marks)

5. i. With reference to the diagram (3) Calculate (16 marks)

   a. Current flowing through the battery

   b. Voltage across each of the resistors

   c. Power dessipated as heat in each of the resistors.

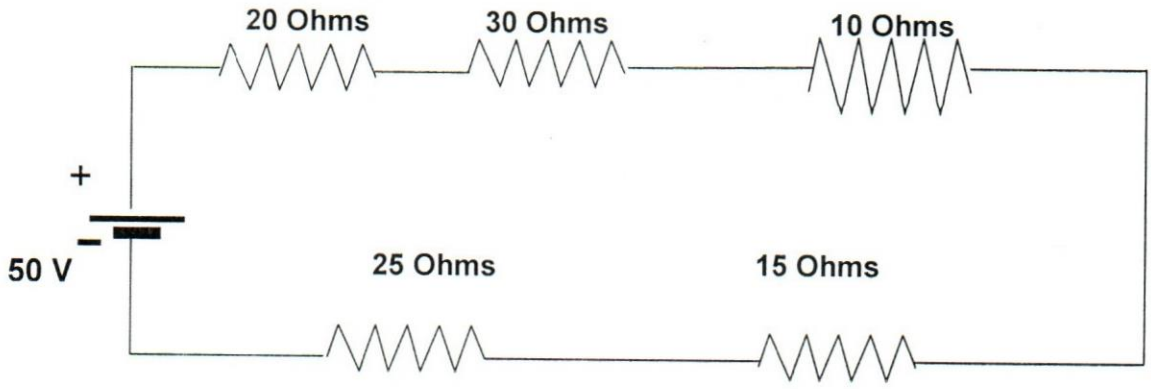
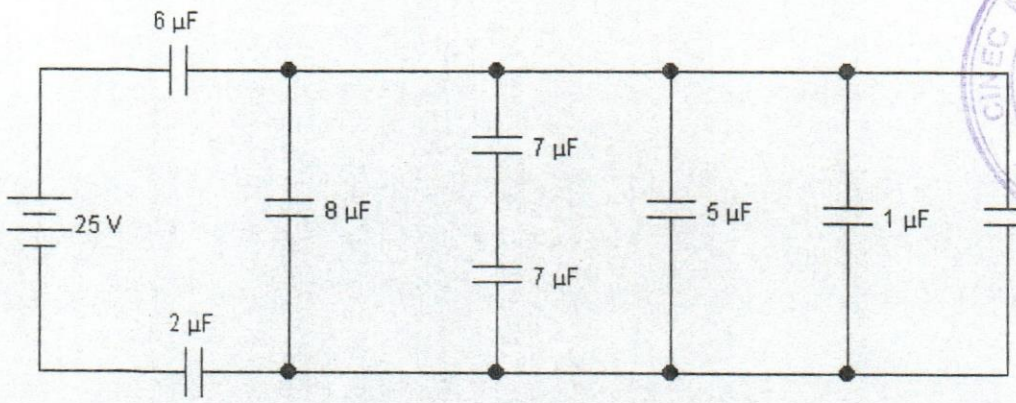


Diagram (3)

iv. Determine total capacitance of the circuit?



(4 marks)

7.

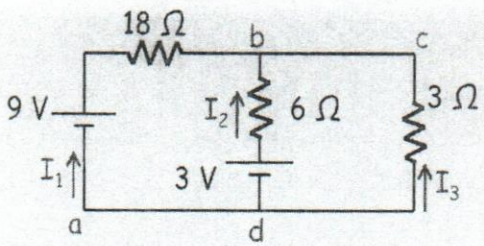
i. When a 6 V battery is connected across a lamp with a resistance of 3.4 Ω, the PD across the lamp is 5.1 V. Find,

   a. The current through the lamp.

   b. The internal resistance of the battery.

(2 × 2 = 4 marks)

ii. Find the currents I_1, I_2 and I_3 in the circuit shown in Figure.



(10 marks)

iii. Draw the simplified circuit of an op amp when it using as non-inverting amplifier. And draw input and output wave forms (6 marks)

End.

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EDUCATION & TRAINING COURSE : NAVIGATION OFFICER CADET TRAINING COURSE FOUNDATION

COURSE CODE : ND- 0199 – BATCH 14

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FINAL EXAMINATION – QUESTION PAPER

ELECTRONICS

- *Answer question no (1) & other any (5) questions*
- *Total Marks 100*

Date: 2014.07.14 *Pass mark 50%* *Time allocated: 02 Hours*

1. i. The Transistor Circuit shown in the diagram (1) is onstructed with Silicon. Calculate the Base Current , Collector Current, (10 marks)

ii. What is the action of the transistor and what it is doing. (10 marks)

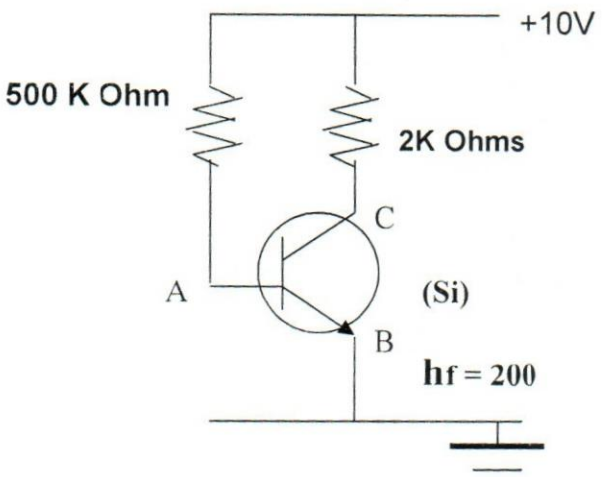


Diagram (1)

2. Calculate the current flowing through the diode, shown in the diagram (2)

(16 marks)

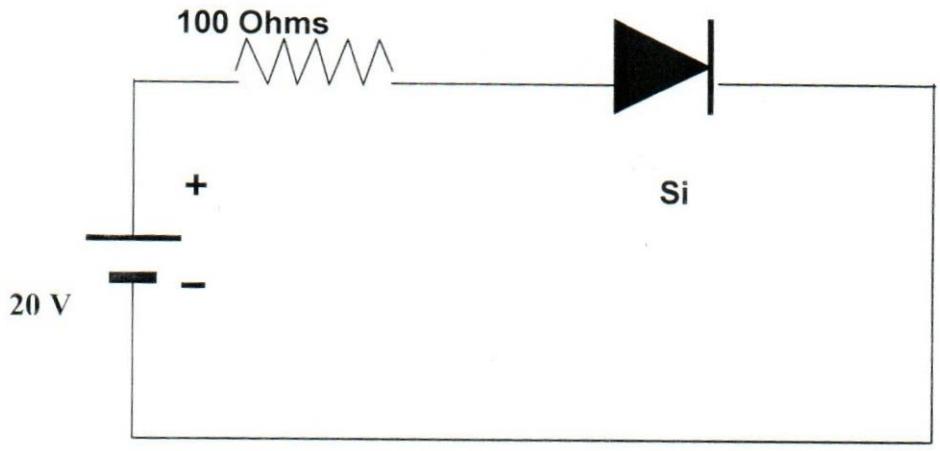


Diagram (2)

3. A capacitor has been charged to 100 volts by a constant current of 40 mA flowing through it for a period of 25 seconds. Find the value of capacitance in Micro Farads.

(16 marks)

4. A two plate capacitor has each plate of length 30 mm and width of 10mm. The dielectric is filled with a wax material having a relative permittivity of 1000. Distance between the plates are 0.5mm. Find the value of the capacitor in Pico Farads.

(16 marks)

5. i. With reference to the diagram (3) Calculate (16 marks)

   a. Current flowing through the battery

   b. Voltage across each of the resistors

   c. Power dessipated as heat in each of the resistors.

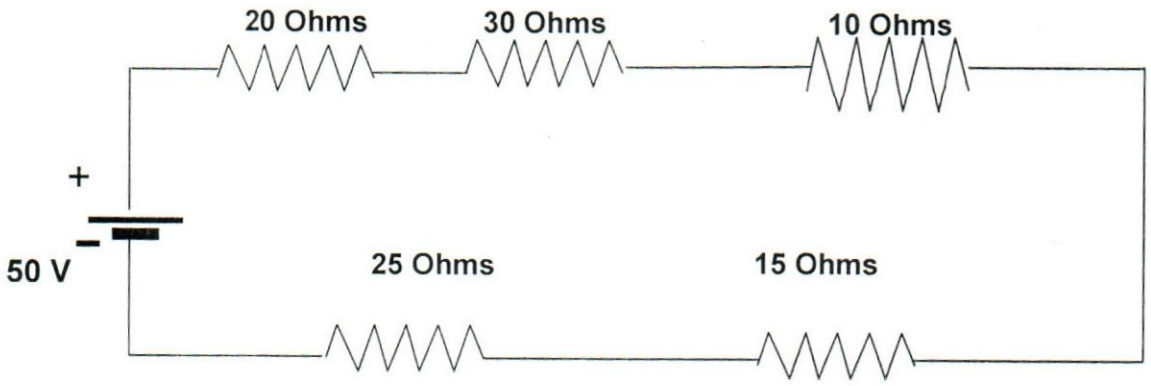
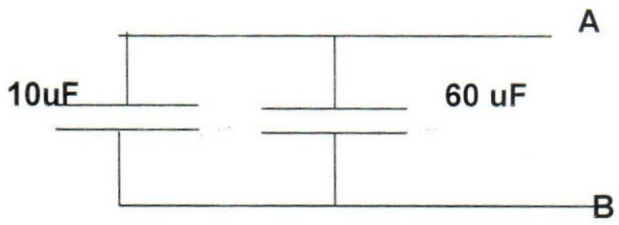


Diagram (3)

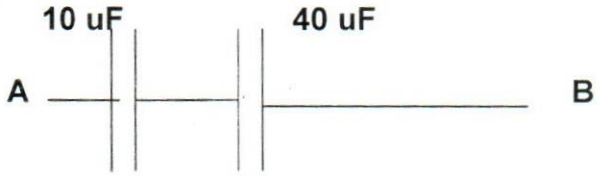
6 Calculate total equivalent capacitance between points A and B in each circuit shown below.

(16 marks)

(i)



(ii)



7. A sinusoidal AC voltage has a Peak value 100V. Calculate the

(16 marks)

i. Peak to Peak Value
ii. R.M.S. Value
iii. Average Value

End.

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Department of Navigation

EDUCATION & TRAINING COURSE: Navigation Officer Cadet Training Course – Foundation

COURSE CODE: ND- 0199 - BATCH 014

FINAL EXAMINATION – QUESTION PAPER

MATHEMATICS

- Answer any 04 questions only
- Total Marks - 400

Date: 2015.07.15 | Pass mark 50% | Time allocated: 02 Hours

1. a) i. John is 12 years older than Peter. Six years ago, John was 3 times as old as Peter what are their ages now.

(30 marks)

ii. $\log_2 x + \log_2 y = 3$, and $\log_y x = 2$ find x and y

(30 marks)

b) Find the value of x,

$2^{(2x+1)} = 3(2^x) - 1$ (40 marks)

---

2. a) The r^{th} term of a series is 2+3r. Find the first 3 terms.

(40 marks)

b) A GP has $4^{th\ term}$ as 40, and 9^{th} term as 1.25

i. Find the first term and common ratio of the series.

(30 marks)

ii. Show that sum S_n is, $S_n = 640\left[1 - \left(\frac{1}{2}\right)^n\right]$

(30 marks)

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3. a) Find $\frac{dy}{dx}$ using first principals.

i. x^2 ii. $\sqrt{x}$

(40 marks)

b) Find $\frac{dy}{dx}$, when $y = x^3 sin2x$ (30 marks)

c) If $y = x^n lnx$, prove that $x = \frac{dy}{dx} = x^n + ny$ (30 marks)

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4. a) Evaluate the following

i. $\int_2^4 3x^5 dx$ (20 marks)

ii. $\int_0^{\pi/2} (\sin x - \cos x)\, dx$ (20 marks)

b) The gradient of a curve is given by $\frac{dy}{dx} = \frac{(x^2+3)^2}{x^2}$, $x \neq 0$

i. Show that $\frac{dy}{dx} = x^2 + 6 + 9x^{-2}$ (20 marks)

ii. If the point (3,20) lies on curve, find an equation for it in the form $y = f(x)$

(40 marks)

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5. a) At a certain point A, the angle of elevation of a tower is $\tan^{-1}\left(\frac{5}{12}\right)$, on walking 240m nearer to the tower angle changes to $\tan^{-1}\left(\frac{3}{4}\right)$. What is the height of the tower.

(40 marks)

b) Prove the following.

i. $cos^4A - sin^4A + 1 = 2cos^2A$ (30 marks)

ii. $\frac{1-COS\,2A}{1+COS\,2A} = tan^2A$ (30 marks)

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6. Solve the following quadratic equations using formula.

a) $3x^2 - 2x - 8 = 0$ (50 marks)

b) $x^2 - 5x - 12 = 0$ (50 marks)
