



PAST PAPERS

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

Past Papers

Faculty of maritime science
Department of Marine Engineering

Engineering Foundation

2016-2022

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| Document Control & Approving Authority | Senior Director – Quality Management & Administration |
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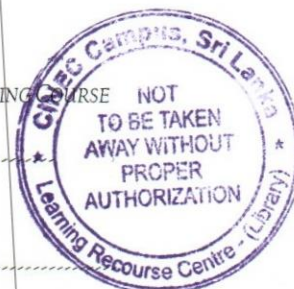
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CINEC CAMPUS (PVT) LTD

Faculty of Marine Engineering
Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE:



1ST SEMESTER EXAMINATION QUESTION PAPER
Introduction to the Shipping

- This question paper consists of Five questions.
- Answer All Questions

Date: 2022.06.15

Pass mark 50%

Time allocated: 03 Hrs

1. With an aid of a sketch show following principle parts and areas of a ship.
Superstructure, portholes, main deck, bow thruster, astern thruster, anchor, stern, propeller, rudder, bulbus bow, draft, depth(air draft), port beam, stbd beam, athwart ship, navigation lights, Christmas tree, starboard side and port side. (20 marks)
2. Explain following abbreviations (complete word each letter is standing for.
eg: HR = Human Resources)
 - i. LSA, FFA, BA, ETA, ETD, EEBD, PPE, ROB, (8 marks)
 - ii. Make short notes on following operations.
Ballasting and DE ballasting, Anchoring, Tank Sounding, Berthing, Loading and Discharging. (2marks each)
3.
 - a) List 10 types of trading ship widely available at sea. (10 marks)
 - b) Explain following terms using suitable sketches where necessary
(i) Trim (ii) List (iii) Rolling iv. Pitching v. Anchoring (2marks each)
4.
 - a) List 5 type of LSA items available on merchant ships. (5marks)
 - b) What are the most suitable PPE, you should be wearing when performing work in following areas.
 - (i) Working aloft (3marks)
 - (ii) Cleaning scavenge space. (3 marks)
 - (iii) Handling chemicals (3 marks)
 - (iv) Painting ship side. (3marks)

5. Write short notes on following part of a ship.

- a) Twin deck (2 marks)
- b) Double bottom tank. (2 marks)
- c) Water tight Bulk head. (2 marks)
- d) Stern thruster (2 marks)
- e) Anchor Locker(2 marks)
- f) Watertight doors(2 marks)
- g) Void space(2 marks)
- h) Propeller(2 marks)
- i) Emergency Fire pump. (2 marks)
- j) Emergency Generator. (2 marks)



CINEC CAMPUS(PVT)LTD

Faculty of Marine Engineering

Department of Marine Engineering

EDUCATION & TRAINING COURSE: NAVIGATION/ ENGINEERING OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340



FINAL EXAMINATION QUESTION PAPER
Electronics

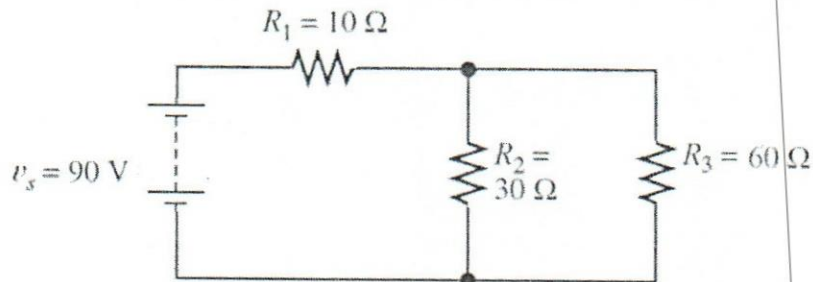
- This question paper consists of five questions.
 - Answer ALL(05) Questions
- Date: 2022.06.16

Pass mark 50%
Time allocated: 03 Hrs

➤ **Some helpful Data:**

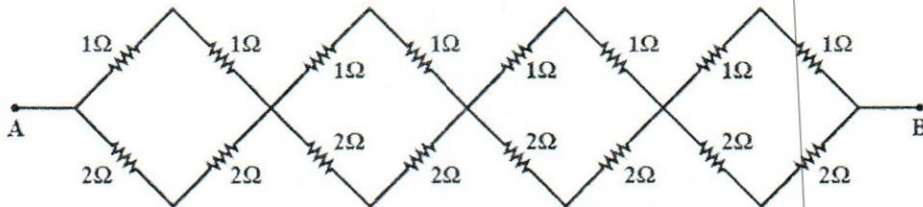
- * Barrier potential across a 'Si' Diode – 0.7 V | across a "Ge" Diode 0.3 V
- * Air permittivity $\epsilon_0 = 8.854 \times 10^{-12} \text{ F} \cdot \text{m}^{-1}$

1. a) i. State Ohm's law (3 marks)
ii. Draw the circuit diagrams for voltage divider and current divider. (4 marks)
- b) The circuit consists of a battery with an insignificant internal resistance connected to three resistors.

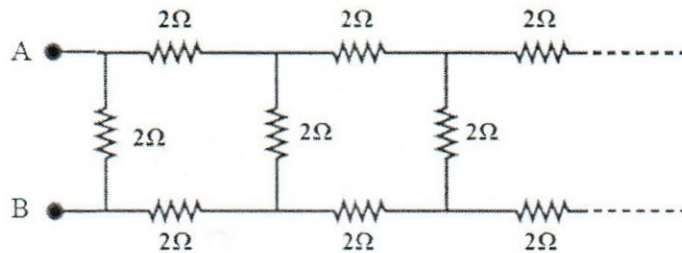


- i. Calculate the potential difference across the 10 Ω resistor.
ii. Calculate the current I_1 through the 30 Ω resistor.
iii. Calculate the current I_2 through the 60 Ω resistor. (9 marks)
- c) Calculate the power consumption of above resistor network. (4 marks)
2. a) Define resistance and resistivity. (6 marks)
- b) The resistance of a 2 m length of cable is 2.5 Ω . Determine,
i. the resistance of 7 m length of the same cable
ii. the length of the same wire when the resistance is 6.25 Ω (6 marks)

- c) i. Find the equivalent resistance (R_{AB}) of following resistor network. (4 marks)



- ii. Evaluate the equivalent resistance (R_{AB}) of the following infinite network of resistance. (4 marks)

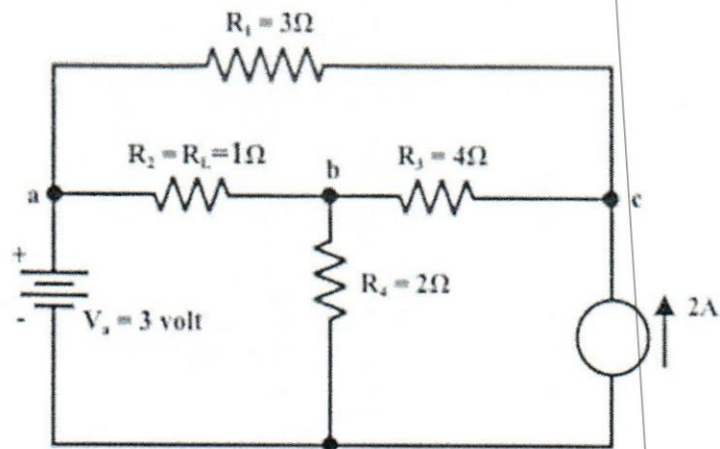


3. a) State Kirchhoff current law and Kirchhoff voltage law. (06 marks)

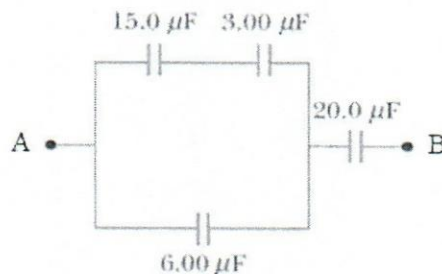
- b) The figure below shows currents in a part of electric circuit. Find value of current 'i'. (04 marks)



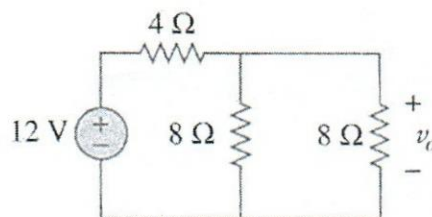
- c) Find the current through $R_L = R_2 = 1\Omega$ resistor (I_{a-b} branch) using Kirchhoff's laws and hence calculate the voltage across the current source. (10 marks)



4. a) Define the term capacitance. (3 marks)
- b) Calculate the capacitance of two metal plates of area 30 m^2 and separated by a dielectric 2 mm thick and relative permittivity 6. ($\epsilon_0 = 8.854 \times 10^{-12} \text{ F} \cdot \text{m}^{-1}$) (6 marks)
- c) i. Determine the equivalent capacitance between A and B for the group of capacitors shown in below. (6 marks)



- ii. Find charge on $20.0 \mu\text{F}$ capacitor if $V_{AB} = 15 \text{ V}$. (5 marks)
5. a) What is the difference between ideal voltage source and real voltage source. (4 marks)
- b) Explain transformation of real voltage source and real current source. (6 marks)
- c) Using source transformation, determine V_o . (10 marks)



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Faculty of Marine Engineering
Department of Marine Engineering
EDUCATION & TRAINING COURSE: ENGINEER & NAVIGATION OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE: ED 0340

MIDTERM EXAMINATION QUESTION PAPER
Mathematics

- This question paper consists of Five questions.
- Answer Six Questions Only

Date: 2022.06.18

Pass mark 50%

Time allocated: 03 Hrs

1. Factorize the given expressions.

- i. $x^2 + 7x + 12$ (25 marks)
- ii. $x^2 - 20x + 100$ (25 marks)
- iii. $x^2 - 49$ (25 marks)
- iv. $6x^2 + x - 12$ (25 marks)

2.

- 2.1. Solve $x^2 - 40x - 6000 = 0$ (50 marks)
- 2.2. Use the quadratic formula to solve $3x^2 - 6x + 2 = 0$ (50 marks)

3.

Standard equations of the arithmetic progression $T_n = a + (n - 1)d$,

$$S_n = \frac{n\{2a + (n - 1)d\}}{2}$$

- 3.1. How many terms are there in the sequence 11, 15, 19,....., 643 (50 marks)
- 3.2. Find the sum of the first 100 terms of the progression $1, 1\frac{1}{4}, 1\frac{1}{2}, 1\frac{3}{4}, \dots$ (50 marks)

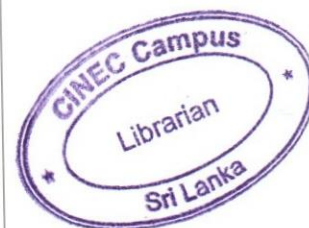
4.
Standard equations of the geometric progression $T_n = ar^{n-1}$, $S_n = \frac{a(r^n-1)}{(r-1)}$
- 4.1.1. Find the 7th term in the geometric sequence 8, 24, 72, 216, (50 marks)
- 4.1.2. The first 3 terms of an infinite geometric progression are 16, 12 and 9
- (a) Write down the common ratio. (25 marks)
- (b) Find the sum of the terms of the progression. (25 marks)
- 5.
- 5.1. Differentiate $f(x) = \frac{(x^2+1)(x-5)}{x}$ (50 marks)
- 5.2. Given that $y = \sqrt{x} - \frac{8}{x^2}$, find
- (a) $\frac{dy}{dx}$ (25 marks)
- (b) The gradient of the curve at the point $(4, 1\frac{1}{2})$ (25 marks)
- 6.
- 6.1. Prove the identity $\cos^2 x - \sin^2 x = 2 \cos^2 x - 1$ (50 marks)
- 6.2. Prove the identity $\frac{\cos x}{1-\sin x} - \frac{1}{\cos x} = \tan x$ (50 marks)
- 7.
- 7.1 Sketch the curve $y = x^2 - 4$. (25marks)
- 7.2 Write down the co-ordinates of the points where the curve crosses the x axis. (25marks)
- 7.3 Differentiate $y = x^2 - 4$ with respect to x. (25marks)
- 7.4 Find the Gradients of the curve where the points it crosses the x axis. (25marks)
- 8.
- 8.1 Differentiate the curve $y = 2x^2 + 5x - 12$ with respect to x. (25marks)
- 8.2 Find the Gradient of the curve at the point (1, -5). (25marks)
- 8.3 Find the equation of the Tangent of the curve at the point (1, -5). (25marks)
- 8.4 Find the equation of the Normal of the curve at the point (1, -5). (25marks)



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Department of Marine Engineering

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COURSE CODE: ED 0340



FINAL EXAMINATION QUESTION PAPER
Physics

- This question paper consists of NINE questions.
- Answer Any SIX Questions

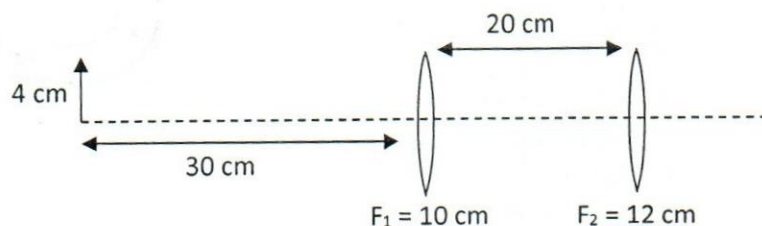
Date: 2021.12.16

Pass mark 50%

Time allocated: 03 Hrs

$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2$, $\mu_0 = 4\pi \times 10^{-7} \text{ H/m}$, $m_e = 9.11 \times 10^{-31} \text{ kg}$, $m_p = 1 \text{ amu} = 1.6726 \times 10^{-27} \text{ kg}$, $e = 1.6 \times 10^{-19} \text{ C}$

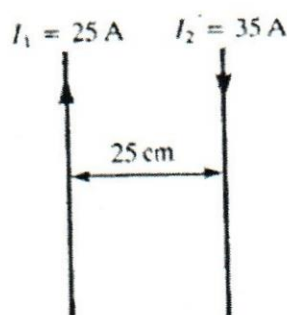
1.
 - a. Define the linear magnification and angular magnification (5 marks)
 - b. Describe the Normal and Abnormal adjustment of a microscope (5 marks)
 - c. An opera glass has an objective focal length of **250 cm** and an eyepiece focal length of **-15 cm**. with the eye close to the eyepiece, an observer sees clearly the final image of a star at the infinity from the lens (normal adjustment).
 - i. Draw the ray diagram of the opera glass for the condition given (5 marks)
 - ii. Find the separation between the lenses (5 marks)
2.
 - a. Describe the image formed by a thin convex lens when a real object is placed
 - i. At 2F
 - ii. Between focal point F and 2F
 - iii. At the focal point
 - iv. Between focal point F and the centre of the lens (12 marks)
 - b. An object **4 cm** high is placed **30 cm** from a thin convex lens of **10 cm** focal length. A second convex lens of **12 cm** focal length is placed **20 cm** from the first lens as shown in figure. Find the position, size, and characters of the final image. (8 marks)



- 3.
- Briefly describe the diffraction of light using their application (4 marks)
 - A diffraction grating is ruled with **4000 lines per centimeter**. The first order of a spectral line is observed to be diffracted at an angle of 30° . What is the wavelength of this radiation? (6 marks)
 - A grating having **3000 lines per centimeter** produces spectra of mercury arc. The green line of the mercury spectrum has a wavelength of **5461 Å**. What is the angular separation between the first-order green line and the second-order green line? (Hint $1 \text{ Å} = 10^{-10} \text{ m}$) (10 marks)
- 4.
- A standard radio broadcasting station has an assigned frequency between **535** and **1605 kHz**. The VHF television stations have frequencies between **54** and **216 MHz**. While the UHF have frequencies between **470** and **890 MHz**. What is the wavelength corresponding to each of the frequencies mentioned? (9 marks)
 - Ultra violet-light ranges in wavelength roughly from violet at **360 nm** to **70 nm**. Its speed in vacuum is about $3 \times 10^8 \text{ m/s}$, as is the case for all electromagnetic waves. Determine the corresponding frequency range. (4 marks)
 - A radar set for determining the speed of approaching cars sends out waves of frequency **1000 MHz**. If the beat frequency observed is **180 Hz**, what is the speed of the car? (7 marks)
- 5.
- Write an expression for the magnetic field produced by an element of current, ΔI from the law of Biot and Sarvat. (5 marks)
 - What is the magnetic field near the center of a circular coil of N loops having radius a ? (5 marks)
 - A circular coil of radius **42 mm** consists of **1000 turns** of wire in which the current is **20 mA**. What is the magnetic field in the center of the coil? (5 marks)
 - A solenoid **0.5 m** long has **2000 turns**. The magnetic induction near the center of the solenoid is **0.08 T**. What is the current in the solenoid? (5 marks)

6.

- a. A positively charged particle is moving with velocity, v in a magnetic field, B write an expression for the force, F act on the charge particle and describe the motion of particle (3 marks)
- b. An electron is moving with a speed of $2 \times 10^6 \text{ m/s}$ at right angle to a magnetic field of 5000 G. What is magnetic force on the electron? What is the radius of the circle in which the electron moves? (6 marks)
- c. Write an expression for the net force, F on a conductor of length L carrying current I in a uniform field B (3 marks)
- d. What is the force per unit length between the wires in the figure (4 marks)



- e. A rectangular loop 10 cm high and 4 cm wide is placed in a magnetic field of 0.04 T . If the loop contains 200 turns and carries a current of 50 mA , what is the torque on it? Assume that the face of the loop is parallel to the field. (4 marks)

7.

- a. Describe the Fleming's Right hand rule (3 marks)
- b. Write an expression for the induced EMF of a conductor of length L moving at a velocity V in a magnetic field, B . (3 marks)
- c. A 100 -loop circular coil has a radius of 42 mm . It is oriented so that the field lines of a magnetic field are parallel to a normal to the area of the coil. Suppose that the magnetic field is varied so that B increases from 0.12 to 0.48 T in a time of 4 ms . Find the average induced emf in the coil. (6 marks)
- d. The armature of a separately excited generator has a resistance of 0.16Ω . When run at its rated speed, it yields 240 V on open circuit and 225 V on full load. What is the current at full load? How much power is delivered to the external circuit? What power is needed to drive the generator if the overall efficiency is 85% ? (8 marks)

- 8.
- a. Write down *Fleming's left hand rule*. (2 marks)
 - b. Describe the *back EMF* generated in DC motor. (4 marks)
 - c. A shunt motor has an armature resistance 0.5Ω and field resistance 100Ω . It is connected across $110 V$ mains and is generating a back EMF of $100 V$. Determine
 - i. The *armature current, the field current and total current* (4 marks)
 - ii. The *total power* taken by the motor (2 marks)
 - iii. The *power lost in the armature and field windings* (4 marks)
 - iv. The *mechanical power* of the motor and the *torque* on shaft if the speed is 3000 rpm . (4 marks)
- 9.
- a. Describe what is meant by self-inductance and mutual inductance (4 marks)
 - b. An emf of $10 V$ is induced in a coil when the current in it changes at the rate of $32 A/s$. Compute the inductance of the coil. (3 marks)
 - c. A hollow solenoid has a self-inductance of $3 mH$ when it is air-filled. But when a soft iron rod is slipped into it so as to fill its interior, the self-inductance rises to $1.5 H$. What is the relative permeability, μ_r for the iron being used? (4 marks)
 - d. When the current in a coil is changing at a rate of $3 A/s$, it is found that an emf of $7 mV$ is induced in a nearby coil. What is the mutual inductance of the combination? (3 marks)
 - e. The secondary of an ideal transformer has 200 times as many turns as the primary. It is used in a $240 V$ circuit. What is the voltage across the secondary? If the current in a secondary is $100 mA$. What is the primary current? (6 marks)



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Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340

2ND SEMESTER EXAMINATION QUESTION PAPER

Engineering Drawing

- Answer All Questions

Date: 17/12/2021

Pass mark 50%

Time allocated: 02Hrs

Marking System

Q 1

- | | |
|---------------------------|----------|
| a. Front elevation from A | 25 Marks |
| b. End elevation from B | 20 Marks |
| c. Plan view | 20 Marks |

Q 2 Geometric constructions of the given figure 25 Marks

Titles and Lettering 5 Marks

Boundaries, Lines, and overall neatness 5 Marks

Q1. Using *first angle orthographic projection*, draw the cast iron block as per the given detail in a suitable scale. Following views are required;

- I. Front elevation from A
- II. End elevation from B
- III. Plan view

*assume any missing dimensions

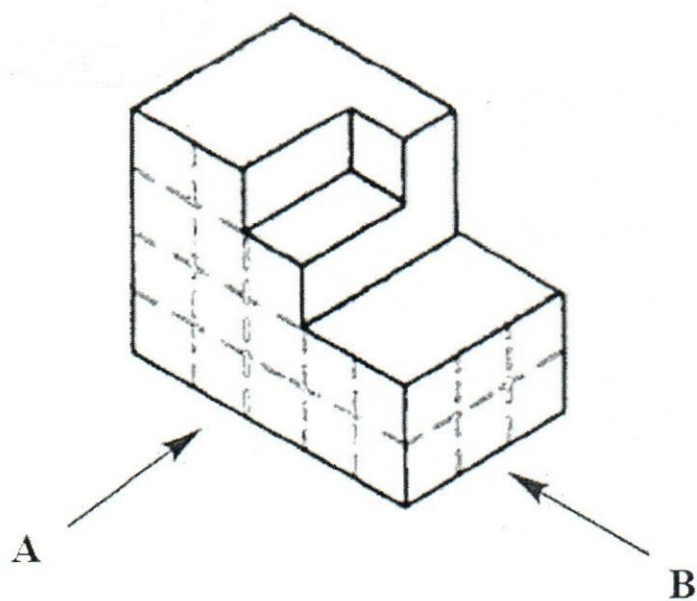
*Dimensioning is not required

Q2. Reproduce the given figure of a machine part using suitable drawing tools and geometric construction techniques

*assume any missing dimensions

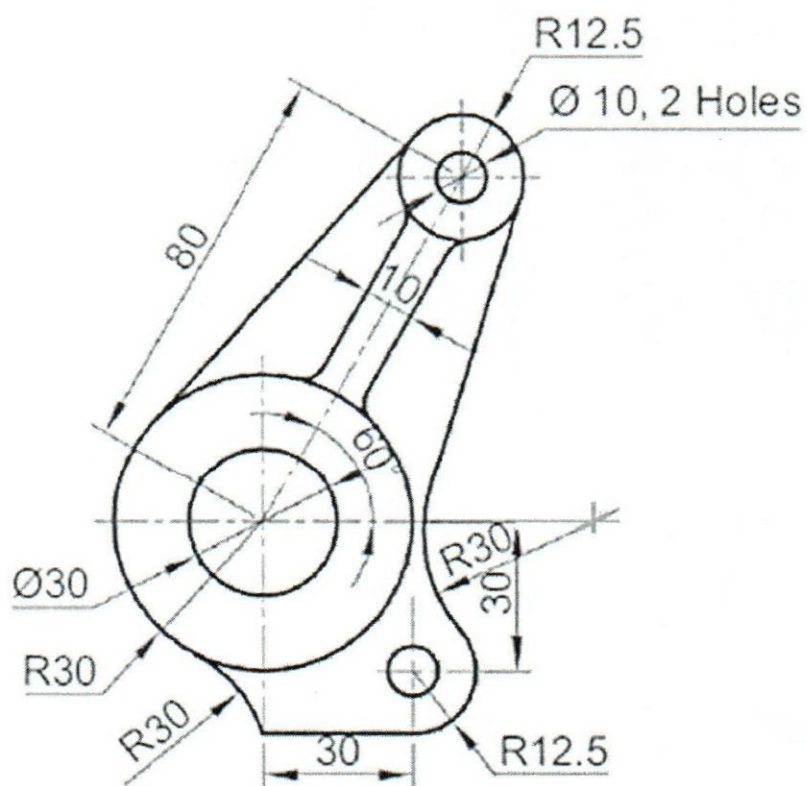
*Dimensioning is not required

Q1



*Assume the object is formed using 10mmX10mmX10mm cubes as indicated

Q2



* All dimensions are in mm

* Assume any missing dimensions



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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE:



FINAL EXAMINATION QUESTION PAPER
Introduction to the Shipping

- This question paper consists of Five questions.
- Answer All Questions

Date: 2021.12.14

Pass mark 50%

Time allocated: 03 Hrs

1. Make a detailed sketch of a ship clearly showing following principle parts.
Superstructure, portholes, main deck, bow thruster, astern thruster, anchor, stern, propeller, rudder, bulbous bow, draft, depth(air draft), port beam, stbd beam, athwart ship, navigation lights, Christmas tree, starboard side and port side. (20 marks)
2. (a) List 10 types of trading ship widely available at sea. (10 marks)
(b) Write short notes on five types of above ships. (10 marks)
3. Explain following abbreviations (complete word each letter is standing for;
eg: **HR = Human Resources**)
- (a) **LSA, FFA, IMO, SOLAS, IOPP, EEBD, PPE, ROB,** (8 marks)
(b) List down most suitable PPE, which you should be wearing when performing work
- In following areas.
- (i) Working top of the cargo crane. (3marks)
(ii) Cleaning scavenge space. (3 marks)
(iii) Handling chemicals (3 marks)
(iv) Changing main engine cylinder head. (3 marks)

4. (a) List 5 type of FFA items available on merchant ships. (5marks)
- (b) Explain following terms using suitable sketches where necessary
- (i) Trim (ii) List (iii) Rolling iv. Pitching v. Anchoring (3 marks each)
5. Write short notes on following part of a ship.
- a) Main deck (2 marks)
 - b) Double bottom tank. (3 marks)
 - c) Navigation Bridge. (2 marks)
 - d) Anchor (3 marks)
 - e) Cofferdam (2 marks)
 - f) Propeller (2 marks)
 - g) Emergency Fire pump. (3 marks)
 - h) Emergency Generator. (3 marks)



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FINAL EXAMINATION QUESTION PAPER
 Electronics

- Answer Six (6) Questions only

Date: 2021.04.06

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 – 1.602×10^{19} C

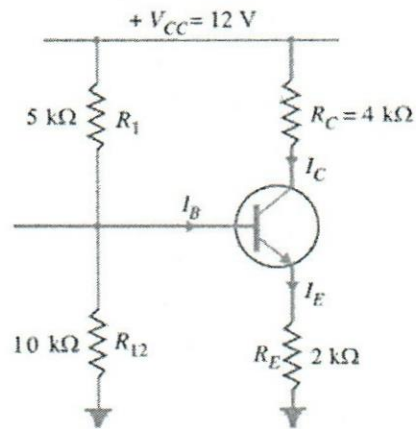
Barrier potential across a 'Si' Diode – 0.7 V | across a "Ge" Diode 0.3 V

* Resistor Colour Codes:

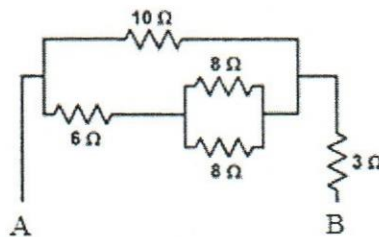
Black -0, Brown -1, Red -2, Orange -3, Yellow -4, Green -5, Blue -6, Purple -7, Grey -8, White -9,
 Gold – 5%, Silver -10%, No Colour -20%

1. a) What are the SI units of following electric quantities? (8 marks)
- | | |
|-------------------|-----------------|
| i. Electric power | ii. Current |
| iii. Voltage | iv. Capacitance |
- b) Calculate the resistance of 2 m length of wire having a uniform cross sectional area of 0.7 cm^2 if the wire is made of copper having a resistivity of $1.7 \times 10^{-6} \Omega \text{ cm}$. (6 marks)
- c) What colour bands will be found on a resistor with a nominal value of 1 M Ω and tolerance of $\pm 5\%$? (6 marks)

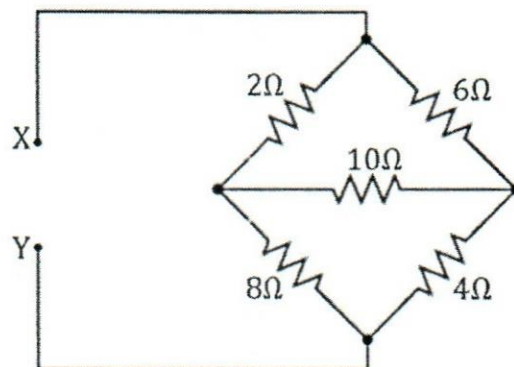
2. a) Draw schematic diagrams of npn and pnp transistors. (6 marks)
- b) Describe the various methods used for transistor biasing. (6 marks)
- c) The amplifier circuit is shown in below, Find the operating point. Given that $V_{BE} = 0.7V$. (8 marks)



3. a) Define the term Resistance and Resistivity (6 marks)
- b) Find the equivalent resistance between point A and B. (6 marks)

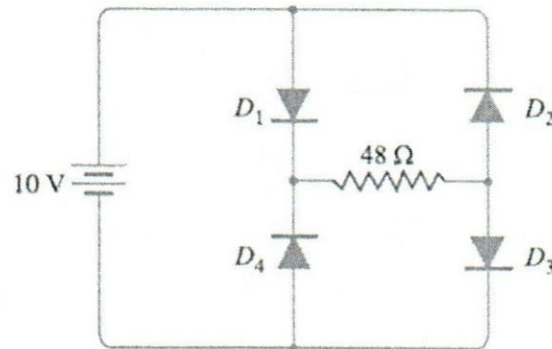


- c) Using star - delta transformation, Find the equivalent resistance between point X and B. (8 marks)

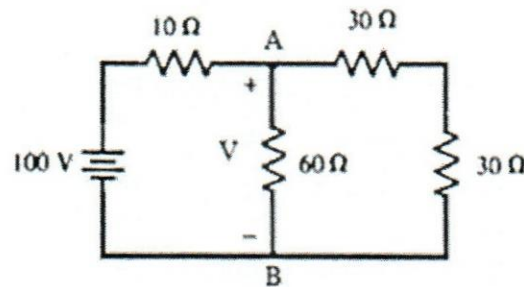


4. a) Explain behavior of p-n junction with forward and reverse bias current. (6 marks)
 b) Draw circuit diagrams of the full wave and half wave rectifier circuits. (6 marks)
 c) Calculate the current through $48\ \Omega$ resistor in the circuit shown in below. (8 marks)

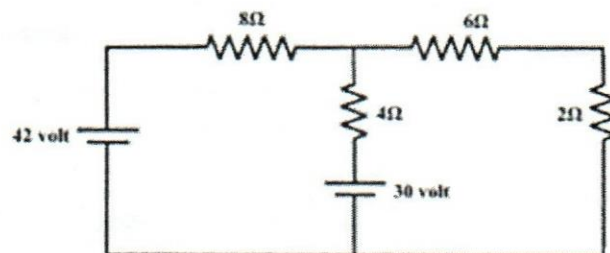
Assume the diodes to be of silicon and forward resistance of each diode is $1\ \Omega$.



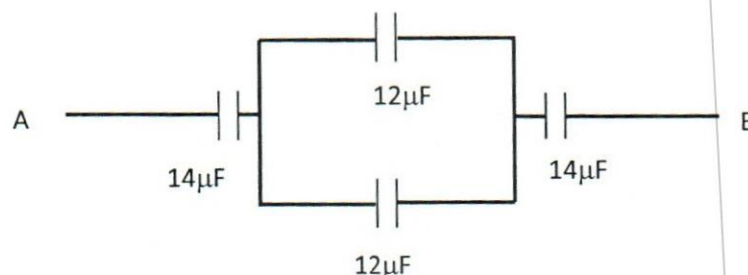
5. a) State ohm's law. (6 marks)
 b) Draw the voltage divider circuit and current divider circuit. (6 marks)
 c) Find value of V and the current through $60\ \Omega$ resistor. Given that the battery has internal resistance of zero. (8 marks)



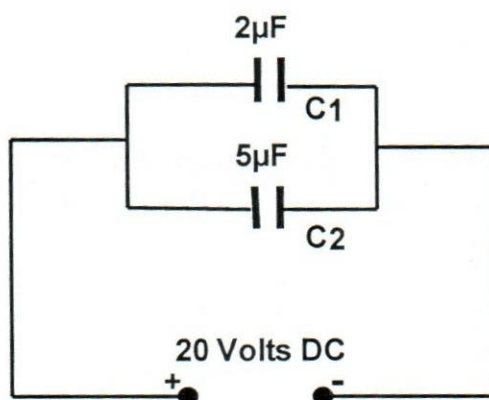
6. a) Explain Thevenin's theorem for complex circuit. (8 marks)
 b) If all voltage source is ideal, find the current through $4\ \Omega$ resistor using Thevenin's theorem. (12 marks)



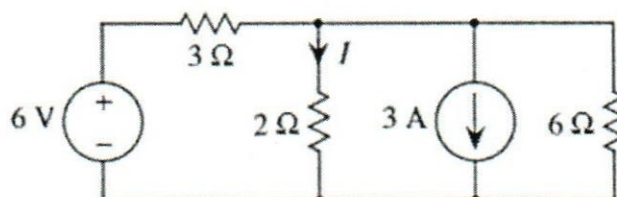
7. a) Four capacitors are connected as in following diagram. What is the equivalent capacitance between A and B? (8 marks)



- b) Two capacitors of capacitance $2\mu\text{F}$ and $5\mu\text{F}$ are connected in parallel to a 20V DC supply. Calculate: (12 marks)



- i. The equivalent capacitance of the group
 - ii. The total charge
 - iii. The charge on each capacitor.
8. a) Draw the circuit diagrams for real voltage source and real current source. (6 marks)
- b) If real voltage source is equivalent to the real current source, express the voltage of voltage source in terms of internal resistance and current of current source. (6 marks)
- c) Using current and voltage source transformation, find the current through 2Ω . (8 marks)





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 Faculty of Marine Engineering
 Department of Marine Engineering
 EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
 COURSE CODE: ED 0340

FINAL EXAMINATION QUESTION PAPER
 Mathematics

• Answer Six (6) Questions only

Date: 2021.04.08

Pass mark 50%

Time allocated: 03 Hrs

1. a) Evaluate the value of $\sin 15^\circ$. (4 marks)
- b) Prove that (8 marks)
- i. $\tan x \cdot \sin x + \cos x = \sec x$
- ii. $\frac{\cos x}{1 + \sin x} + \frac{1 + \sin x}{\cos x} = 2 \sec x$
- c) i. Express the function $f(x) = \sqrt{3} \sin x + \cos x - 1$ in form of $f(x) = a \sin(bx + c) + d$. (4 marks)
- ii. Hence, sketch the graph of $f(x) = \sqrt{3} \sin x + \cos x - 1$. (4 marks)
2. a) Evaluate $(243)^{\frac{3}{5}}$ (6 marks)
- b) Simplify (6 marks)
- $\frac{1}{1+x^{b-a}} + \frac{1}{1+x^{a-b}}$
- c) Solve for x, $5(2^x) - 4^x - 4 = 0$ (8 marks)

3. a) Evaluate $\log_5 625$ (6 marks)
- b) If $\log_{10} 2 = p$, express $\log_{512} 5$ in terms of p . (6 marks)
- c) The equation has $x^{\left[(\log_5 x)^2 - \frac{9}{2}(\log_5 x) + 5\right]} = 5\sqrt{5}$ exactly three real roots. (8 marks)
- i. Substituting $\log_5 x = q$, express above equation in term of q
- ii. Hence, Determine the value of x .
4. a) A straight-line pass through the points $A = (0, 5)$ and $B = (3, 17)$. (10 marks)
- i. Find the equation of the straight line.
- ii. If BC is perpendicular to AB , Find equation of the straight-line BC .
- b) The function is given by $y = \frac{1}{(x-1)(x+3)}$
- i. Find the coordinate of turning points. (2 marks)
- ii. Find the coordinate of x and y intercepts. (2 marks)
- iii. Hence, sketch $y = \frac{1}{(x-1)(x+3)}$ graph. (6 marks)
5. a) Evaluate following limits. (6 marks)
- i. $\lim_{x \rightarrow 0} \frac{\sin 2x}{x}$ ii. $\lim_{x \rightarrow 0} \frac{3\sin x - \sin^3 x}{x^3}$
- b) Differentiate $y = x^2 \tan x$ with respect to x . (6 marks)
- c) Given that $y = x - \tan^{-1}x$, prove that $\frac{d^2y}{dx^2} - 2x \left(1 - \frac{dy}{dx}\right)^2 = 0$ (8 marks)
6. a) Integrate with respect to x (8 marks)
- i. $\int \left(2x^3 + \frac{4}{x^2} - \frac{1}{x} + 1\right) dx$ ii. $\int (3\sin x - 5e^x + \operatorname{cosec}^2 x) dx$
- b) Determine the partial fractions of $\frac{x-1}{(x+1)(x+3)}$ (6 marks)
- c) Hence, Evaluate $\int \frac{x-1}{(x+1)(x+3)} dx$ (6 marks)

7. a) Solve the quadratic equation $3x^2 - 2x - 1 = 0$. (6 marks)
- b) Determine the nature of roots of quadratic equation $nx^2 - mx - n = 0$. (8 marks)
- c) Determine the range of value of k for which the quadratic equation $kx^2 + 6(k-2)x + 3(k+2) = 0$ has real distinct roots. (6 marks)
8. In the binomial expansion of $\left(x^2 - \frac{1}{x}\right)^{12}$, Find
- a) the coefficient of x^9 (10 marks)
- b) the term independent of x . (10 marks)
9. a) Divide $x^3 + 4x^2 - 5x - 8$ by $x + 3$ (6 marks)
- b) Simplify $\frac{2 - \sqrt{3}}{2 + \sqrt{3}} + \frac{2 + \sqrt{3}}{2 - \sqrt{3}}$ (6 marks)
- c) If $x = 9 + 4\sqrt{5}$, find the value of $\sqrt{x} - \frac{1}{\sqrt{x}}$. (8 marks)



Colombo International Nautical and Engineering College

CINECAMPUS

Department of Marine Engineering

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

COURSE CODE: ED 340

MID EXAMINATION (REPEAT) – QUESTION PAPER
APPLIED MECHANICS

- Answer any 04 questions only
- Total Marks – 100
- $g = 10 \text{ ms}^{-2}$

Date: 19/01/2020

Pass mark 50%

Time allocated: 2.5 Hours

1)

- Define **Speed** and **acceleration** (2 × 3 = 6 marks)
- 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; (5 marks)
 - His acceleration from O to A.
 - His retardation (deceleration) from B to C.
 - The total distance traveled from O to C.(9 marks)
- Sanali has just arrived at the airport and is dragging her suitcase to the luggage check-in desk. She pulls on the strap with a force of 190 N at an angle of 35° to the horizontal to displace it 45 m to the desk. Determine the work done by Sanali on the suitcase. (5 marks)

2)

- i. A man throws a ball at $u \text{ ms}^{-1}$ at angle θ to horizontal. (gravitational acceleration as $g \text{ ms}^{-2}$). 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° 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.

(12 marks)

- iii. An aircraft is travelling along a runway at a velocity of 25 m/s . It accelerates at a rate of 4 m/s^2 for a distance of 750 m before taking off. Calculate its take-off speed.

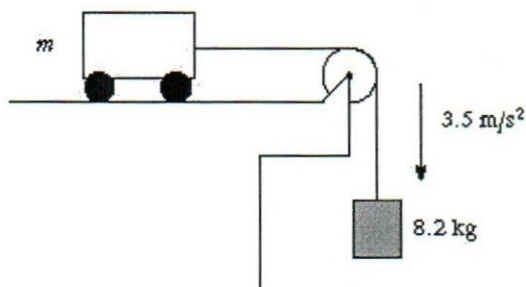
(8 marks)

3)

- i. State Newton's second law of motion

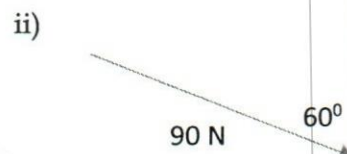
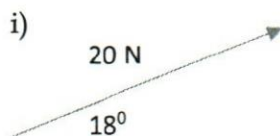
(3 marks)

ii.

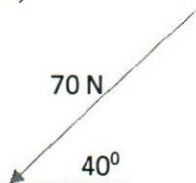


- iii. Mark all the forces acting on the system
- iv. Find the mass of car and tension of the string
(10 marks)

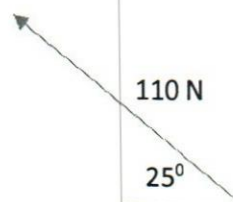
- v. Resolve following forces into their rectilinear components



iii)



iv)



(3 × 4 = 12 marks)

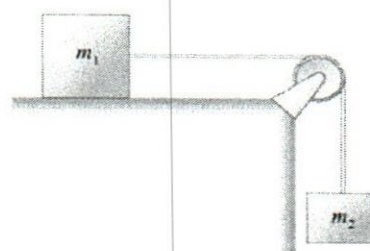
4)

- 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 0.24. If $m_1 = 8.0$ kg and $m_2 = 12$ kg Find,

- Limiting frictional force.
- Acceleration of the system.
- Tension of the string.



(6 × 3 = 18 marks)

5)

- State conservation of linear momentum (5 marks)
- Define types of collision (8 marks)
- 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.
 - Find the speed of the entangled cars after the collision.
 - Find the change in the velocity of each car.
 - Find the change in the kinetic energy of the system consisting of both cars.

(12 marks)

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Department of Marine Engineering
EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE: ED 0340

2ND SEMESTER EXAMINATION QUESTION PAPER
ELECTRONICS

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

Date: 2020.07.12

Pass mark 50%

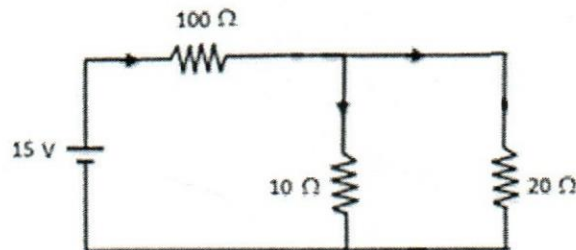
Time allocated: 03 Hrs

➤ **Some helpful Data:**

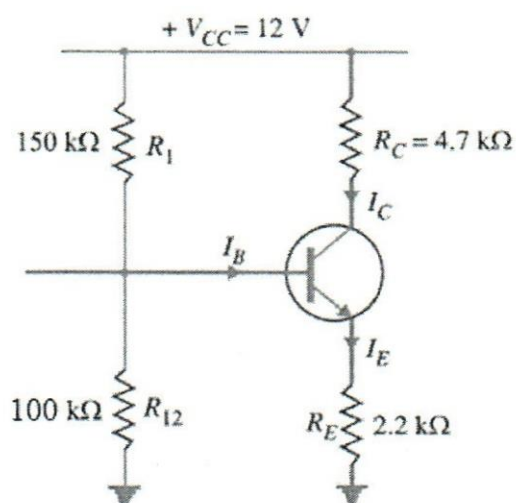
* Barrier potential across a 'Si' Diode – 0.7 V | across a "Ge" Diode 0.3 V

* 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%

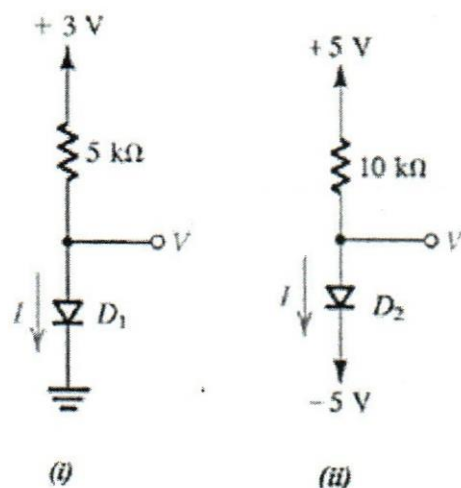
- a) State Ohm's law (4 marks)
- b) i. Draw schematic circuit diagrams for the voltage divider and the current divider with two resistors.
ii. Express voltage and current of each resistor in voltage divider and current divider circuits respectively. (6 marks)
- c) Find the current in each resistor in the circuit shown in below. (10 marks)



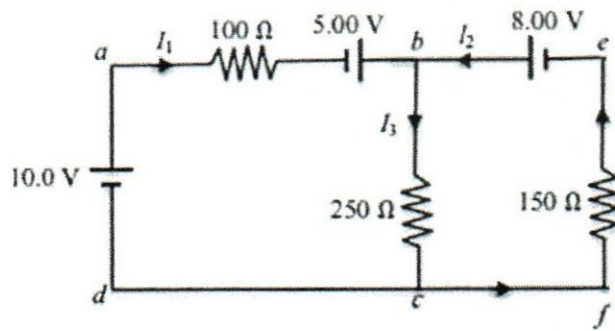
- a) Define resistance and resistivity. (8 marks)
 - b) Determine the nominal resistance values of these resistors, given their band colors, and express the allowable tolerance in ohms. (6 marks)
 - Orange, Red, Red, Gold
 - Red, Black, Green, Silver
 - c) If 10 m of manganin wire, 0.14 cm in diameter has a resistance of 3.4 Ω , find the specific resistance of the material. (6 marks)
- a) Draw schematic diagrams of npn and pnp transistors. (6 marks)
 - b) Describe the various methods used for transistor biasing. (6 marks)
 - c) The amplifier circuit is shown in below, Find the operating point. Given that $\beta = 50$ and $V_{BE} = 0.7V$. (8 marks)



4. a) What are the difference between intrinsic semiconductor and extrinsic semiconductor. (6 marks)
- b) Explain forward biasing and reverse biasing of diodes. (6 marks)
- c) Assume that the diodes in the figure are ideal. Find the values of the labeled currents and voltages (8 marks)



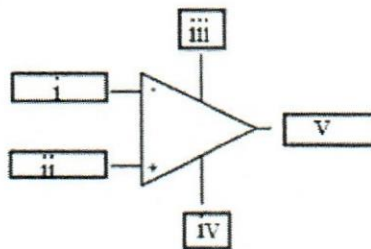
5. a) Express Kirchhoff current and voltage laws. (6 marks)
- b) Consider the DC circuit shown in below and note that the direction of the currents shown in the figure are arbitrary. (14 marks)



- i. Find each branch current.
- ii. What is the direction of the current through 250Ω resistor? (from b to c or from c to b)
- iii. Determine the potential difference of 'ef', with the appropriate sign.

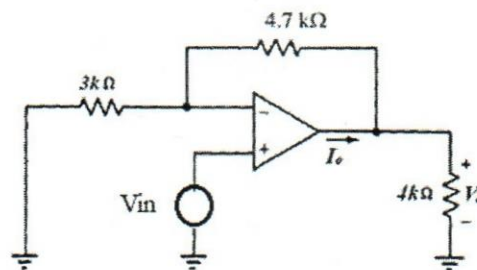
6. a) Identify the terminals in the following op - amp.

(8 marks)



b) A non-inverting amplifier feedback resistance and input resistance are $4.7 \text{ k}\Omega$ and $3 \text{ k}\Omega$ respectively. Determine V_o and I_o , if $v_m = 0.1 \sin \omega t$

(12 marks)

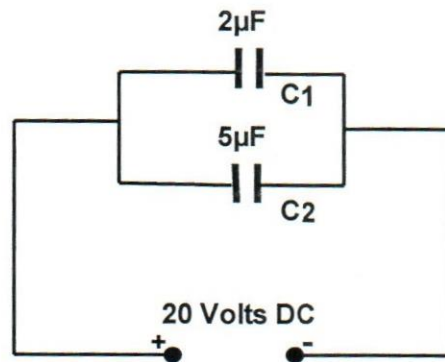


7. a) Draw electrical *symbol* of *variable capacitor*.

(3 marks)

b) A two parallel capacitors of capacitance $2 \mu\text{F}$ and $5 \mu\text{F}$ are connected in series with a 20V DC supply. Calculate:

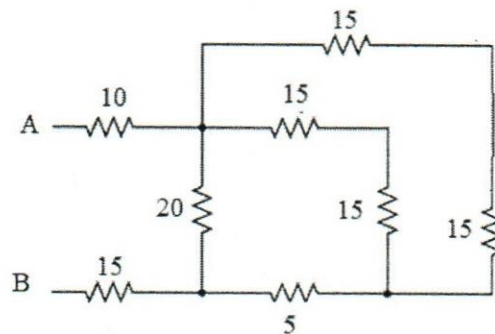
(9 marks)



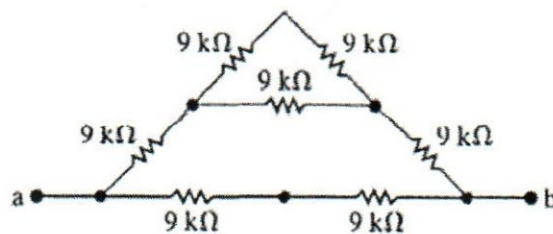
- i. The equivalent capacitance of the group
- ii. The total charge
- iii. The charge on each capacitor.

c) Express two applications of capacitor, and explain one (8 marks)

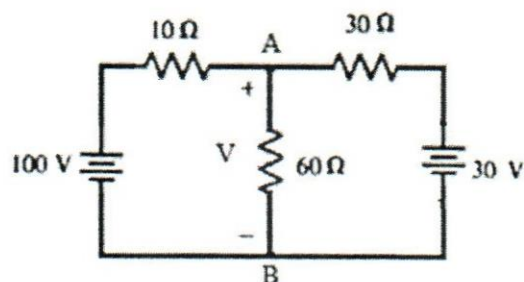
8. a) Evaluate the equivalent resistance between A and B. (6 marks)



b) Using star delta transformation find equivalent resistance between a and b. (6 marks)



c) Find value of V and the current through 60 Ω resistor. Given that the battery has internal resistance of zero. (8 marks)



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Faculty of Marine Engineering
Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE: ED 0340

2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
Physics

- This question paper consists of six questions.
- Answer Any SIX Questions

Date: 2020.03.17

Pass mark 50%

Time allocated: 03 Hrs

$$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2, \mu_0 = 4\pi \times 10^{-7} \text{ H/m}, m_e = 9.11 \times 10^{-31} \text{ kg}, m_p = 1 \text{ amu} = 1.6726 \times 10^{-27} \text{ kg}, e = 1.6 \times 10^{-19} \text{ C}$$

1.

- Write the lens formula specifying the sign convention. (6 marks)
- Draw the ray diagram for an object in front of a convex lens
 - When the object is placed at infinity
 - When the object is placed between the focus and mirror (6 marks)
- An object **5 mm** high is placed **1 m** from a convex lens with a focus of **0.5 m**. find the location, height, and orientation of the image? (8 marks)

2.

- Write down the laws of refractions. (4 marks)
- What is the speed and wave length of **red light (660 nm)** in Cubic Zirconia? Assume the index of refraction of Cubic Zirconia to be **2.176** and speed of light in free space to be **$3.0 \times 10^8 \text{ ms}^{-1}$** . (6 marks)
- 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 **42°** , and critical angle of incidence for Moissanite - water interface. (10 marks)

3.

- Describe the interference of light (4 marks)
- A diffraction grating is ruled with **150 lines per millimeter**. The second order of a spectral line is observed to be diffracted at angle of **18°** . What is the wavelength of the radiation? (6 marks)

- c. A grating having **200 lines per in millimeter** produces spectra of mercury arc. The blue line of the mercury spectrum has a wavelength of **486 nm**. What is the angular separation between the first-order blue line and the second-order blue line? (10 marks)

4.

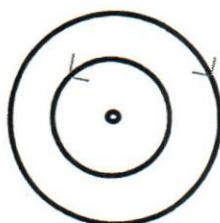
- a. Write an expression for the force (F) acting on a charge (q) which is moving in a magnetic field (B) with a velocity of V . Hence derive an expression for the radius of the path of the electron (6 marks)
- b. Doubly charged Helium, He^{2+} ion (atomic mass of **Helium 4 amu**) is moving with speed of $1.6 \times 10^6 \text{ m/s}$ at right angles to a magnetic field **1.75 T**.
- What is the force on the ion? (4 marks)
 - What is the centripetal acceleration of the ion? (6 marks)
 - What is the radius of the circle in which the ion moves? (4 marks)

5.

- a. The source of sound **S** is moving towards a stationary observer with a velocity **10 m/s**. The observer measures the frequency of the source as **1050 Hz**. The velocity of sound in the medium is **340 m/s**.
- What is the actual frequency of the source (6 marks)
 - What will be the apparent frequency of the source when it is moving away from the observer? (6 marks)
- b. A car, sounding a horn producing a note of **400 Hz**, approaches and then passes a stationary observer **O** at a steady speed of **60 km/h** calculate the change in frequency of the note heard by **O**. speed of sound in air = **340 m/s**. (8 marks)

6.

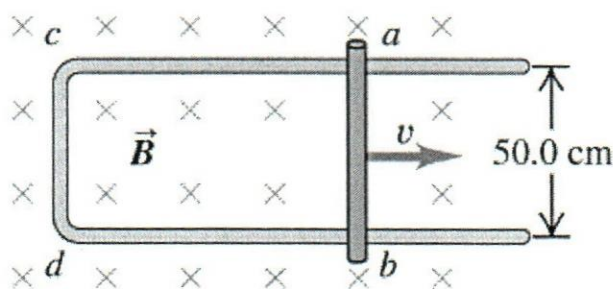
- a. State the **Biot-Sarvart** law (4 marks)
- b. Write an expression for the **magnetic flux density (B)** at the center of a current (I) carrying circular loops whose radius is R and number of turns is N (4 marks)
- c. Two current carrying circular loops whose radius are **14 mm** (loop 1) and **21 mm** (loop 2) with **400** and **200** turns bear a current of **300 mA** and **100 mA** in opposite directions. Determine



- The flux density at the center of the circular loops (6 marks)
- The current in the loop 2 which produces the flux density at the center is zero (6 marks)

- 7.
- States the *Ampere's law*. (4 marks)
 - Write an expression for the *magnetic field* produced by an infinitely long current carrying conductor. (4 marks)
 - Two long parallel wires separated by distance **50 mm**. There is current of **10 mA** in wire 1 and a current of **100 mA** in wire 2 in opposite directions.
 - 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)
 - Find the force acting on each wire per unit length (6 marks)

- 8.
- 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)
 - 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



- The induced EMF (4 marks)
 - The current pass through the circuit (6 marks)
 - The force is required to move the rod with a constant speed of $v = 5 \text{ m/s}$. (6 marks)
- 9.
- States the *Lens's law* and *Faraday's law* in electromagnetic induction (6 marks)
 - 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 **20 A** is delivered to an external circuit. Determine
 - The *current* in the field coils (2 marks)
 - The *armature* current (4 marks)
 - The *power lost* in the field windings and armature windings (4 marks)
 - The *induced emf* (4 marks)



CINEC CAMPUS

Faculty of Marine Engineering

Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340

 2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
 Mathematics

- This question paper consists of Nine questions.

- Answer Any Six(06) Questions

Date: 2020.03.16

Pass mark 50%

Time allocated: 03 Hrs

1. a) Differentiate with respect to x, $y = (4x - 3)(x^2 + 1)$ (4 marks)
- b) Differentiate with respect to x, $y = \frac{3x^2 - 2}{x^3 + 1}$ (6 marks)
- c) Evaluate (10 marks)
- i. $\lim_{x \rightarrow -2} \frac{x^5 + 32}{x + 2}$
- ii. $\lim_{x \rightarrow -32} \frac{x^{\frac{1}{5}} + 2}{x + 32}$
2. a) Sketch the curve $y = x^2 - 4$. (5*4 = 20 marks)
- b) Write down the co-ordinates of the points where the curve crosses the x axis.
- c) Differentiate $y = x^2 - 4$ with respect to x.
- d) Find the Gradients of the curve where the points it crosses the x axis.
3. a) Sketch the curve $y = x^2 - 6x$. (5*4 = 20 marks)
- b) Show that the point (3, -9) lies on the curve $y = x^2 - 6x$
- c) Find the Gradient of the curve at the point (3, -9)
- d) Find the equation of the Tangent to the curve $y = x^2 - 6x$ at the point (3, -9).
4. a) Differentiate the curve $y = 2x^2 + 5x - 12$ with respect to x. (5*4 = 20 marks)
- b) Find the Gradient of the curve at the point (1, -5).
- c) Find the equation of the Tangent of the curve at the point (1, -5).
- d) Find the equation of the Normal of the curve at the point (1, -5).

5. Integrate with respect to x

(5*4 = 20 marks)

a) $\int (6x^2 - 4x + 8) dx$ b) $\int \left(3x^{\frac{1}{2}} - e^{-3x} + \frac{1}{\sqrt{x}} \right) dx$
 c) $\int_0^4 (2 - \sqrt{x}) dx$ d) $\int_{\frac{\pi}{6}}^{\frac{\pi}{4}} \cot x dx$

6. Integrate with respect to x

(5*4 = 20 marks)

a) $\int \frac{3x^3 - 2x^2 + 6}{x^2} dx$ b) $\int (3 \cos x - 5 \sec^2 x) dx$
 c) $\int_{-2}^1 (x - x^{-2}) dx$ d) $\int_0^1 (e^x - 2)^2 dx$

7. a) Simplify

(8 marks)

(i) $\frac{3^{\frac{1}{2}} \times 81^{-\frac{1}{4}}}{3^{-\frac{4}{3}} \times 3^0}$ (ii) $\frac{2^{\frac{1}{4}} \times 2^0}{16^{-\frac{1}{4}} \times 4^{\frac{1}{2}}}$

b) Solve

(12 marks)

(i) $\log_x 8 = \frac{1}{3}$ (ii) $2^{2x} - 6 * 2^x + 8 = 0$

8. a) Simplify

(8 marks)

i. $(3x - 5y)(5x + 3y)$ ii. $(2\sqrt{x} - 3)(3 - 2\sqrt{x})$

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

(12 marks)

i. $\frac{2}{\sqrt{3}-1}$ ii. $\frac{27}{2+\sqrt{5}}$

9. Show that

a) $\frac{1 + \sin x}{\cos x} + \frac{\cos x}{1 + \sin x} = \frac{2}{\cos x}$ (5 marks)

b) $\frac{2 \sin x \cos x - \cos x}{1 - \sin x - \cos^2 x + \sin^2 x} = \cot x$ (5 marks)

c) $(\sec x - \cos x)(\operatorname{cosec} x - \sin x)(\tan x - \cot x) = 1$ (5 marks)

d) $\frac{1 + \tan^2 x}{1 + \cot^2 x} = \tan^2 x$ (5 marks)



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Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340

2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
ELECTRONICS

- This question paper consists of six questions.
- Answer Any Six (06) Questions

Date: 2020.03.16

Pass mark 50%

Time allocated: 03 Hrs

➤ **Some helpful Data:**

* Permittivity of free air/ vacuum (ϵ_0) – 8.854×10^{-12} F/m

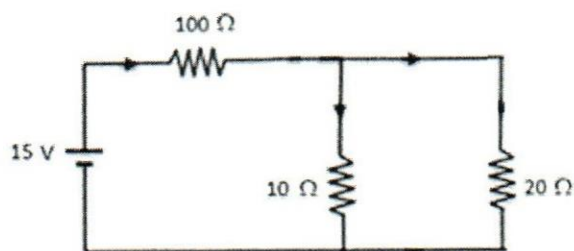
* Charge of electron – 1.602×10^{-19} C

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

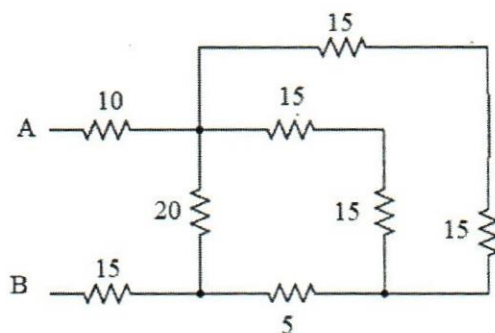
* Resistor Colour Codes:

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%

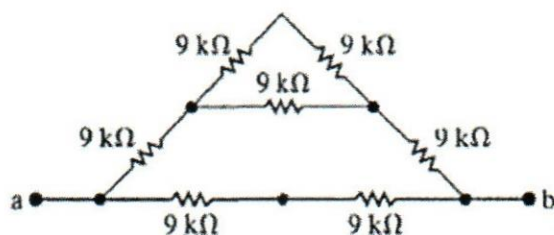
1. a) Define resistance and resistivity. (8 marks)
 - b) Determine the nominal resistance values of these resistors, given their band colors, and express the allowable tolerance in ohms. (6 marks)
 - i. Orange, Red, Red, Gold
 - ii. Red, Black, Green, Silver
 - c) If 10 m of manganin wire, 0.13 cm in diameter has a resistance of 3.4Ω , Find the specific resistance of the material. (6 marks)
-
2. a) Draw schematic circuit diagrams for the voltage divider and the current divider. (6 marks)
 - b) Find the current in various resistors in the circuit shown in below. (12 marks)



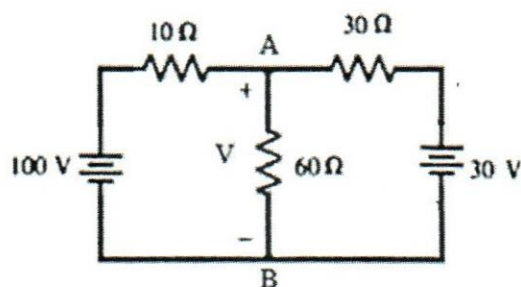
3. a) Evaluate the equivalent resistance between A and B. (6 marks)



- b) Using star delta transformation find equivalent resistance between a and b. (6 marks)

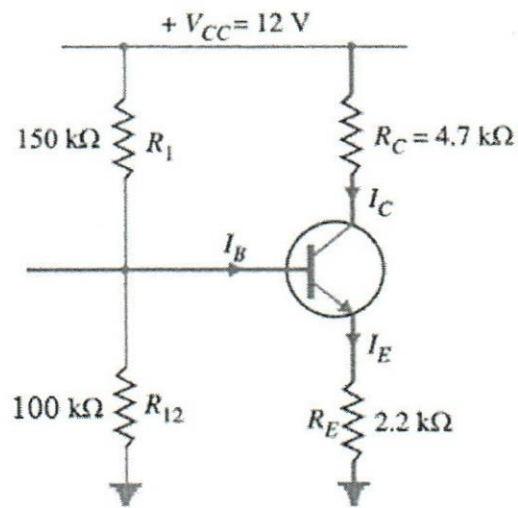


- c) Find value of V and the current through 60Ω resistor. Given that the battery has internal resistance of zero. (8 marks)

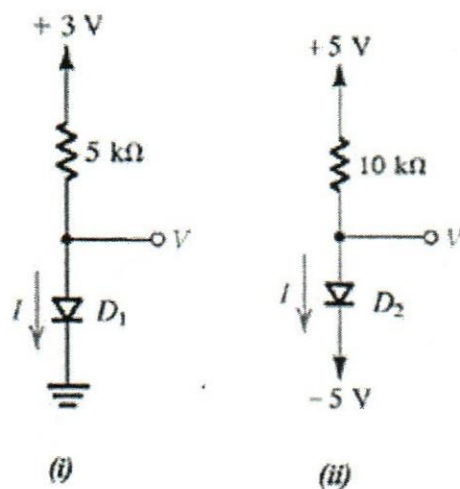


4. a) Draw schematic diagrams of npn and pnp transistors. (6 marks)
- b) Describe the various methods used for transistor biasing. (6 marks)

- c) The amplifier circuit is shown in below, Find the operating point. Given that $\beta = 50$ and $V_{BE} = 0.7V$. (8 marks)

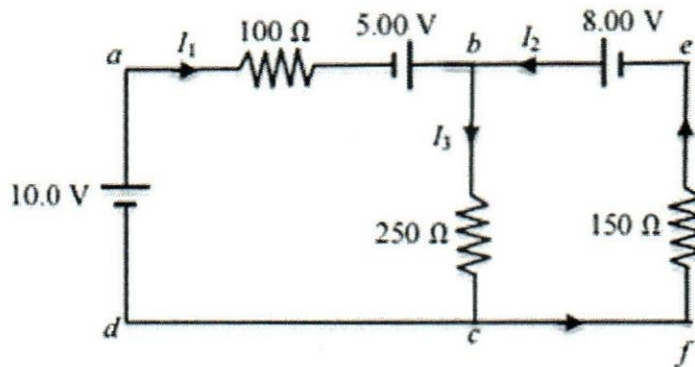


5. a) What are the difference between intrinsic semiconductor and extrinsic semiconductor. (6 marks)
- b) Explain forward biasing and reverse biasing of diodes. (6 marks)
- c) Assume that the diodes in the figure are ideal. Find the values of the labeled currents and voltages (8 marks)



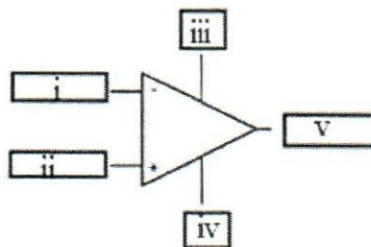
6. a) Express Kirchhoff current and voltage laws. (6 marks)

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

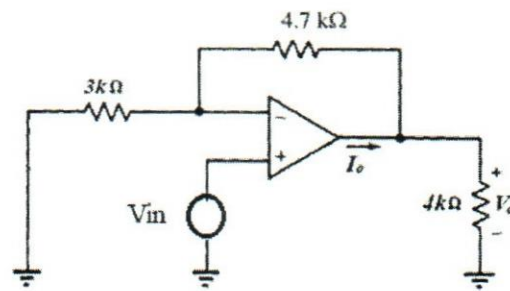


- Find each branch current.
- What is the direction of the current through 250Ω resistor? (from b to c or from c to b)
- Determine the potential difference of 'ef', with the appropriate sign.

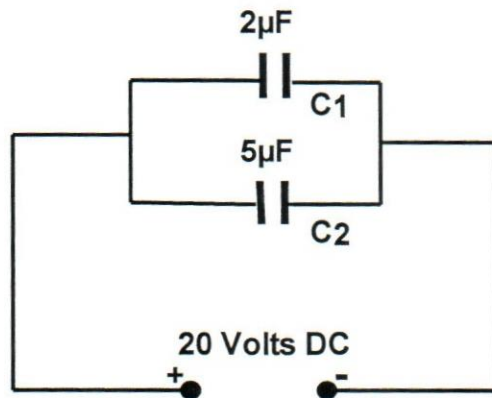
7. a) Identify the terminals in the following op - amp. (6 marks)



b) A non-inverting amplifier feedback resistance and input resistance are $4.7 \text{ k}\Omega$ and $3 \text{ k}\Omega$ respectively. Determine V_o and I_o , if $v_{in} = 0.1 \sin \omega t$



8. a) Draw electrical symbol of *variable capacitor*.
- b) A two parallel capacitors of capacitance $2\mu\text{F}$ and $5\mu\text{F}$ are connected in series with a 20V DC supply. Calculate:



- i. The equivalent capacitance of the group
- ii. The total charge
- iii. The charge on each capacitor.

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FACULTY OF MARITIME SCIENCES

DEPARTMENT OF MARINE ENGINEERING

EDUCATION & TRAINING COURSE: MARINE ENGINEERING OFFICER CADET TRAINING COURSE – FOUNDATION

COURSE CODE: ED-0340 - BATCH 022

2ND SEMESTER 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: 2020.03.15

Pass mark 50%

Time allocated: 03 Hours

Avogadro Constant (N_A) – $6.022 \times 10^{23} \text{ mol}^{-1}$

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 CH_4 are present in 6.07 g of CH_4 ?

(05 marks)

- c) When 5.00 g of $\text{FeCl}_3 \cdot x\text{H}_2\text{O}$ 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 (06 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°C ($k_w = 1 \times 10^{-14} \text{ mol}^2\text{dm}^{-6}$). (04 marks)
- c) Indicate whether solutions with each of the following ion concentrations are neutral, acidic, or basic: (show your work out)
- $[\text{H}^+] = 5 \times 10^{-8} \text{ M}$
 $[\text{OH}^-] = 1 \times 10^{-7} \text{ M}$
 $[\text{OH}^-] = 4 \times 10^{-13} \text{ M}$ (08 marks)
- d) Write down the solubility product expression (K_{sp}) and these solutions
- i) CaSO_4
 ii) $\text{Ca}_3(\text{PO}_4)_2$ (04 marks)
-
- 4)
- a) $\text{Ag}^+ + e^- \rightarrow \text{Ag} \quad E^\circ = 0.80 \text{ V}$
 $\text{Mg}^{2+} + 2e^- \rightarrow \text{Mg} \quad E^\circ = -2.37 \text{ V}$
- 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. (04 marks)
- b) Explain how polymer structure determines its characteristics. (04 marks)
- c) Teflon is a useful polymer. (CH_2CH_2)
 - i. Write its monomer structure
 - ii. Polymer structure
 - iii. Give two Uses and applications (04 marks)
- d) Mention 4 general properties of metals (04 marks)
- e) What are the Raw materials of extraction of Iron? (04 marks)



Colombo International Nautical and Engineering College

CINEC CAMPUS

Faculty of Marine Engineering

Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340

2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER

Engineering Drawing

- Answer All Questions

Date: 2020.03.15

Pass mark 50%

Time allocated: 03 Hrs

Marking System

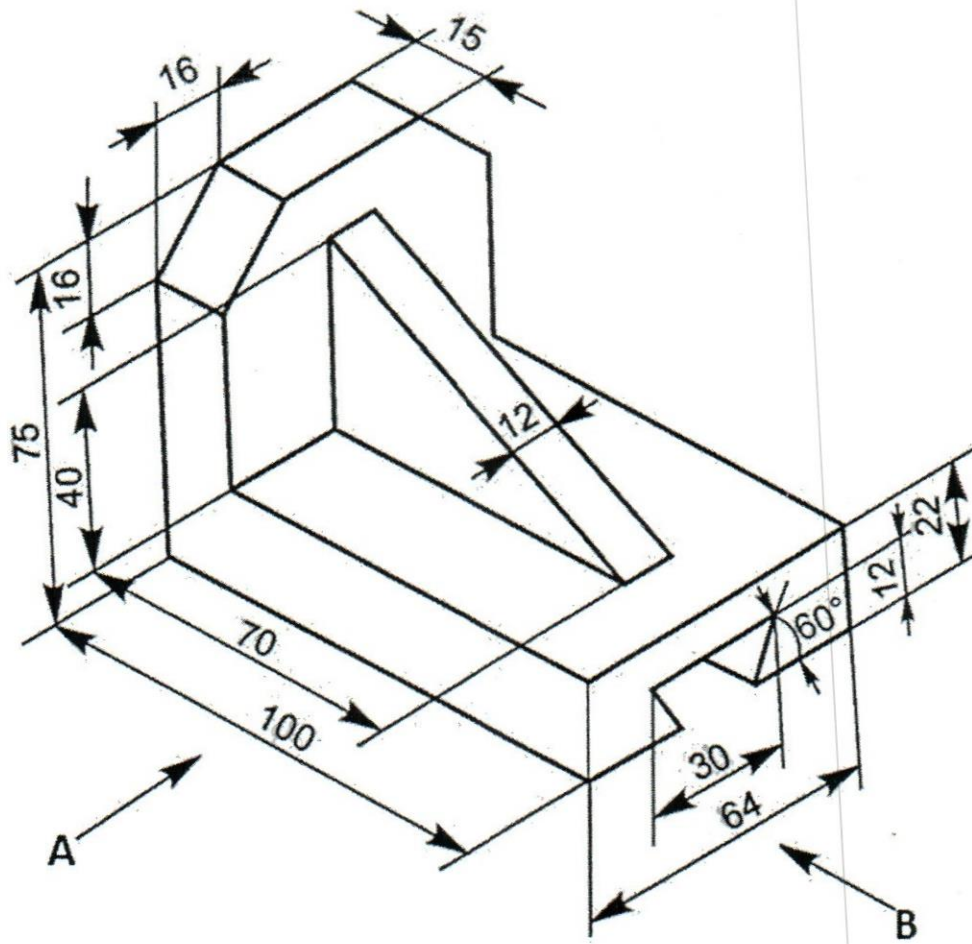
- | | |
|---|----------|
| (1) Q 1 | |
| a. Front elevation from A | 30 Marks |
| b. End elevation from B | 25 Marks |
| c. Plan view | 25 Marks |
| (2) Dimensioning | 10 Marks |
| (3) Titles and Lettering | 05 Marks |
| (4) Boundaries, Lines, and overall neatness | 05 Marks |

Q1. Using first angle orthographic projection, draw the *SHAFT END SUPPORT* as per the given detail in full scale and fully dimension the drawing. Following views are required;

- I. Front elevation from A
- II. End elevation from B
- III. Plan view

**assume any missing dimensions*

Q1



All dimensions are in millimeters



Colombo International Nautical and Engineering College

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Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE:

FINAL EXAMINATION QUESTION PAPER

Introduction to the Shipping

- This question paper consists of Five questions.
- Answer All Questions

Date: 14.03.2020

Pass mark 50%

Time allocated: 03 Hrs

1. Write short notes on following part and component of a ship.

- | | |
|---------------------------|-----------|
| a) Navigation lights | (2 marks) |
| b) Double bottom tank. | (2 marks) |
| c) Water tight Bulk head. | (2 marks) |
| d) Emergency escape | (2 marks) |
| e) Anchor Locker | (2 marks) |
| f) Watertight doors | (2 marks) |
| g) Cofferdam | (2 marks) |
| h) Propeller | (2 marks) |

2. Explain following shipping terms with suitable sketches where necessary.

- | | |
|---------------|-----------|
| a) Trim | (4 marks) |
| b) List | (4 marks) |
| c) Pitching | (4 marks) |
| d) Rolling | (4 marks) |
| e) Anchoring. | (4 marks) |

3. Make a list of safety gears which should be worn when performing following jobs.

- a) Painting bridge front (4 marks)
- b) Changing bulbs in the Christmas tree. (4 marks)
- c) Performing a welding work on main deck (4 marks)
- d) Removing cylinder head of main engine (4 marks)
- e) Entering double bottom tank. (4 marks)

4. Explain the meaning of following abbreviation (a shortened form of a word)

Example: OT = over time

- a) IMO, ETA, ETD, SOLAS, MARPOL, LSA, FFA, ROB, SOPEP, EEBD (10 marks)
- b) Name 5 FFA items and 5 LSA items. (10 marks)

5. With an aid of a suitable sketch show following principle parts of a ship.

Keel, Propeller, Rudder, Hull, Bow thruster, Main deck, Double bottom tank, After peak tank, Fore peak tank, Life boat, Cargo hold, Navigation bridge, Navigation lights, Main mast, Windless, Anchor, Anchor locker, Cargo crane, Accommodation ladder, Poop deck, Monkey island, Engine room, Port hole, Hatch cover, Funnel. (20 marks)



Faculty of Marine Engineering
Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE: ED 0340

2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
Applied Mechanics

- This question paper consists of seven questions.
- Answer Any Five Questions

Date: 2020.03.14

Pass mark 50%

Time allocated : 03 Hrs

Gravitational acceleration, $g = 9.81 \text{ m/s}^2$

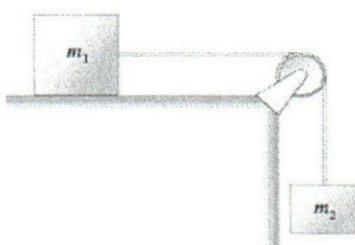
- Define **acceleration** and **velocity** (4 marks)
 - A cyclist leaves home O and rides along a straight road with a constant acceleration. After 10 seconds he has reached point A with a speed 15m/s and he maintains this speed for a further 20 seconds until he reaches B before retarding (decelerating) uniformly to rest at C. The whole journey takes 45 seconds. Sketch the **velocity- time graph** for the journey and find; (4 marks)
 - His acceleration from O to A.
 - His retardation (deceleration) from B to C.
 - The total distance traveled from O to C. (3×4=12 marks)
- 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,
 - Angular velocity
 - Period of time
 - Frequency
 - Its centripetal acceleration.
 - The centripetal force on the ball. (3 × 4 = 12 marks)
 - A disk of moment of inertia $5 \times 10^{-4} \text{ kgm}^2$ 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,



- Limiting frictional force.
- Acceleration of the system.
- Tension of the string.

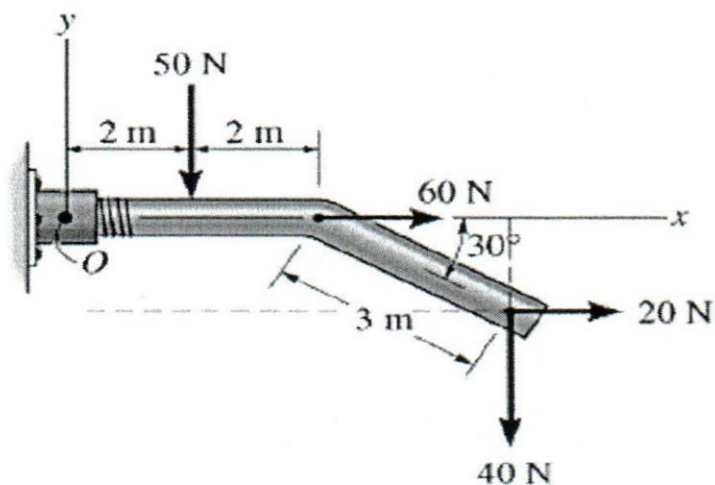
(16 marks)

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?

(4 marks)

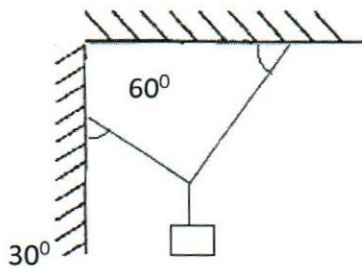
4.

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?

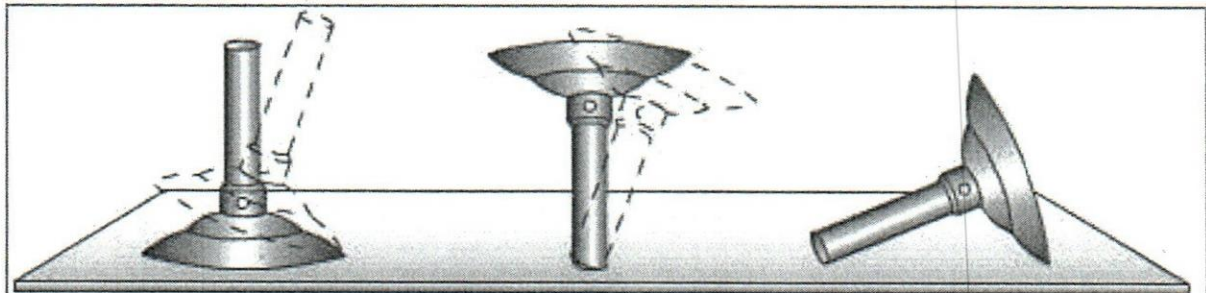


200 N

(10 marks)

5.

- a) Determine equilibrium state of these cones.



(a)

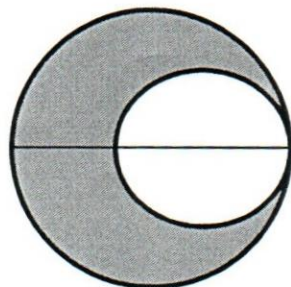
(b)

(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 kg m^{-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)

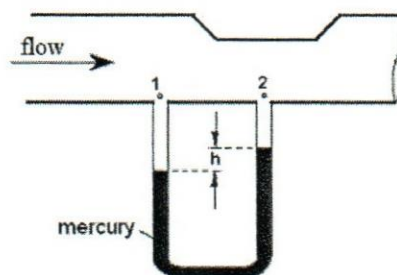
7.

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 = 1.29 kg/m^3 and mercury = 13500 kg/m^3]

(12 marks)



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CINEC CAMPUS

Faculty of Marine Engineering

Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340

1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER

Physics

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

Date: 2020.02.16

Pass mark 50%

Time allocated: 03 Hrs

$$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2, \mu_0 = 4\pi \times 10^{-7} \text{ H/m}, m_e = 9.11 \times 10^{-31} \text{ kg}, m_p = 1 \text{ amu} = 1.6726 \times 10^{-27} \text{ kg},$$
$$e = 1.6 \times 10^{-19} \text{ C}$$

1. a. Describe the Simple Harmonic Motion (4 marks)
 - b. A certain load hangs from a helical spring. The load is pulled down **40 mm** from its equilibrium position and then released from rest. The frequency of oscillation is **5 Hz**.
 - i. Determine the angular frequency and the magnitude of the acceleration at the instant it is released from rest. (6 marks)
 - ii. Write down the general expression for displacement, speed and acceleration of the motion. (6 marks)
 - iii. Sketch a graph of the acceleration of the mass against time during the first **0.4 s** of its motion (4 marks)
-
2. a. Sketch graphs for the variation of kinetic energy, potential energy and total energy with displacement of a simple pendulum (6 marks)
 - b. Write an expression for the periodic time of simple harmonic motion of a simple pendulum (4 marks)
 - c. A simple pendulum which has **0.05 kg** of bob and string with **1.2 m** length oscillates. The amplitude of the motion is **0.02 m**. Calculate
 - i. Periodic time of the oscillation (4 marks)
 - ii. The speed at the center of oscillation (3 marks)
 - iii. The speed of the bob at **0.01 m** away from the center of oscillation (3 marks)

- 3.
- Write down an expression for the speed of sound in solids (2 marks)
 - Find the speed of sound in stainless steel core. Hint: density of iron and modulus of elasticity are 7.56 g/cm^3 and 174 GPa . (4 marks)
 - Write an expression for the speed of a wave appear in stretched wire (2 marks)
 - A stainless steel wire of 90 cm length and 30 g is stretched under 45 N of tension. Find the speed of wave in the wire, the fundamental frequency, first and second overtones. (12 marks)

- 4.
- Write expressions for the frequencies of fundamental and of the first two overtones produced in an open organ pipe (4 marks)
 - An organ pipe 0.84 m long is opened at both ends. If the velocity of sound is 340 m/s , what are the frequencies of the fundamental and of the first two overtones? (8 marks)
 - Two opened organ pipes, one 1.4 m and 1.45 m in length, are sounded simultaneously. How many beats per second will be produced between the fundamental tones if the velocity of sound is 340 m/s ? (8 marks)

5. A sound-progressive wave in air is represented by the equation

$$P(x, t) = 0.73 \text{ Sin}(784\pi t - 0.7339\pi x)$$

Where P is the pressure in Pascals, t is in seconds and x is the distance from a fixed origin O in metres (m). Determine

- The amplitude (4 marks)
 - The frequency of the wave (4 marks)
 - Its wave length (4 marks)
 - Its speed (4 marks)
 - The audible pressure of the wave when $x = 5 \text{ m}$ and $t = 2 \text{ s}$. (4 marks)
6. A standing wave appear on a Nylon thread is given by

$$y(x, t) = 10 \text{ Cos}(4\pi x) \text{ Sin}(512\pi t)$$

Where y is the displacement in millimeters, t in seconds and x is in meters. Determine

- Amplitude of the string (2 marks)
- The frequency of the standing wave (4 marks)
- The wave length (4 marks)
- The speed of the wave (4 marks)
- The tension of the string if the density 0.0090 g/cm (6 marks)

- 7.
- 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 **20 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/m²) (8 marks)
- 8.
- a. Describe the occurrence of beats of two sound source with closer frequencies (3 marks)
 - b. Write down the beat formula for two tuning-forks of slightly different frequencies of f_1 and f_2 are sounded together. (3 marks)
 - c. 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 and briefly state your answer (6 marks)
 - d. 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)



Colombo International Nautical and Engineering College

CINECAMPUS

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Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340

1ST SEMESTER 2ND REPEAT EXAMINATION QUESTION PAPER

Physics

- This question paper consists of six questions.
- Answer Any SIX Questions

Date: 2020.01.21

Pass mark 50%

Time allocated: 03 Hrs

$$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2, \mu_0 = 4\pi \times 10^{-7} \text{ H/m}, m_e = 9.11 \times 10^{-31} \text{ kg}, m_p = 1 \text{ amu} = 1.6726 \times 10^{-27} \text{ kg}, e = 1.6 \times 10^{-19} \text{ C}$$

1.
 - 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 **10 mm** high is placed **2 m** from a concave 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 **$3.0 \times 10^8 \text{ ms}^{-1}$** . (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°** , 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 ruled with **300 lines per millimeter**. The first order of a spectral line is observed to be diffracted at an angle of **10°** . What is the wavelength of the radiation? (6 marks)

- c. A grating having **200 lines per in millimeter** produces spectra of mercury arc. The green line of the mercury spectrum has a wavelength of **5461 Å**. What is the angular separation between the first-order green line and the second-order green line? (10 marks)

$$1\text{Å} = 10^{-10}\text{ m}$$

4.

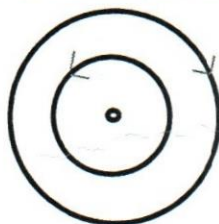
- a. Write an expression for the force (F) acting on a charge (q) which is moving in a magnetic field (B) with a velocity of V . Hence derive an expression for the radius of the path of the electron (6 marks)
- b. Singly charge Helium, He^{1+} ion (atomic mass of **Helium 4 amu**) is moving with speed of $8 \times 10^5 \text{ m/s}$ at right angles to a magnetic field **0.25 T**.
- What is the force on the ion? (4 marks)
 - What is the centripetal acceleration of the ion? (6 marks)
 - What is the radius of the circle in which the ion moves? (4 marks)

5.

- a. The source of sound S is moving away with a velocity **10 m/s** from a stationary observer. The observer measures the frequency of the source as **1000 Hz**. The velocity of sound in the medium is **340 m/s**.
- What is the actual frequency of the source (6 marks)
 - What will be the apparent frequency of the source when it is moving towards the observer? (6 marks)
- b. A car, sounding a horn producing a note of **400 Hz**, approaches and then 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.

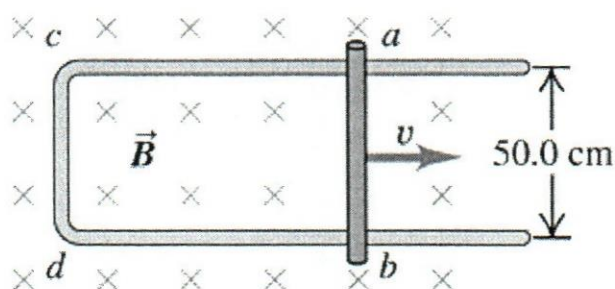
- a. State the **Biot-Sarvart** law (4 marks)
- b. Write an expression for the **magnetic flux density (B)** at the center of a current (I) carrying circular loops whose radius is R and number of turns is N (4 marks)
- c. Two current carrying circular loops whose radius are **10 mm** (loop 1) and **16 mm** (loop 2) with **400** and **200** turns bear a current of **300 mA** for each in opposite directions. Determine



- The flux density at the center of the circular loops (6 marks)
- The current in the loop 2 which produces the flux density at the center is zero (6 marks)

- 7.
- States the *Ampere's law*. (4 marks)
 - Write an expression for the *magnetic field* produced by an infinitely long current carrying conductor. (4 marks)
 - Two long parallel wires separated by distance **50 mm**. There is current of **10 mA** in wire 1 and a current of **100 mA** in wire 2 in opposite directions.
 - 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)
 - Find the force acting on each wire per unit length (6 marks)

- 8.
- 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)
 - 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



- The induced EMF (4 marks)
 - The current pass through the circuit (6 marks)
 - The force is required to move the rod with a constant speed of $v = 5 \text{ m/s}$. (6 marks)
- 9.
- States the *Lens's law* and *Faraday's law* in electromagnetic induction (6 marks)
 - 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 **20 A** is delivered to an external circuit. Determine
 - The *current* in the field coils (2 marks)
 - The *armature* current (4 marks)
 - The *power lost* in the field windings and armature windings (4 marks)
 - The *induced emf* (4 marks)



Colombo International Nautical and Engineering College
CINEC CAMPUS

Faculty of Marine Engineering
Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE: ED 0340

FIRST SEMESTER REPEAT EXAMINATION QUESTION PAPER
Industrial Chemistry

- This question paper consists of Five questions.
- Answer All Five (05) Questions

Date: 2020.01.19

Pass mark 50%

Time allocated: 03 Hrs

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 - 39.0, Ca - 40.1, Ag - 108.0, Cu - 63.5, Fe - 56.0, Co - 58.9, Zn = 65.4, Ag = 107.9, Sn = 117

1)

a) Write down the correct chemical formula

- Ozone
- ethanol
- Potassium permanganate
- Iron (ii) oxide
- Carbon dioxide
- Ammonia
- Butane

(1×6= 6 marks)

b) Draw the electron structure for

- P
- N₂
- Mg
- NaCl

(2×4= 8 marks)

c) Identify the Following Elements.

- i) An element having atomic number 16.
- ii) An element having 11 protons in its nucleus.
- iii) An element having mass number 27 and 14 neutrons.
- iv) An element denoted as ${}_{19}^{39}X$
- v) An element having 18 electrons and -2 charge

(1×5= 5 marks)

d) Give one example for followings

- i) Alloy
- ii) Metalloid
- iii) Heterogeneous Mixture
- iv) Metal
- v) Covalent bonds
- vi) Chemical compound

(1×6= 6 marks)

2)

a) Define these terms,

- a. Acid base reaction
- b. Metallic bond
- c. Homogeneous Mixture
- d. Atomic numbers
- e. Ionic Bond
- f. diprotic acid

(3×6=18 marks)

b) Balance Following equation



(7 marks)

3)

a) How many moles of Ca are there in 31.27 g of Ca?

(4 marks)

b) How many atoms are present in 3.28 g of copper (Cu)?

(5 marks)

c) Calculate the percent composition by mass of each of the elements in sulfuric acid (H_2SO_4).

(2×3= 6 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

(10 marks)

4)

- a) What is Atomic Mass Unit (amu) (5 marks)
- b) Peroxyacetyl nitrate (PAN) is one of the components of smog. It is a compound of C, H, N, and O. Determine the percent composition of oxygen and the empirical formula from the following percent composition by mass: 19.8 percent C, 2.50 percent H, 11.6 percent N. What is its molecular formula given that its molar mass is about 120 g?

(10 marks)

- c) When 5.00 g of $\text{FeCl}_3 \cdot x\text{H}_2\text{O}$ 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) How do you identify an acidic or basic solution by using litmus papers? (4 marks)
- b) Calculate the pH of
- i) $0.05 \text{ mol dm}^{-3} \text{ HNO}_3$ solution (3 marks)
 - ii) $0.015 \text{ mol dm}^{-3} \text{ NaOH}$ solution at 25°C . (3 marks)
- c) Lactic acid ($\text{CH}_3\text{CH}(\text{OH})\text{COOH}$) has one acidic hydrogen. A 0.10 M solution of lactic acid has a pH of 2.44. Calculate K_a . (9 marks)

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

- d) Indicate whether solutions with each of the following ion concentrations are neutral, acidic, or basic: (show your work out)
- i. $[\text{H}^+] = 2 \times 10^{-8} \text{ M}$
 - ii. $[\text{OH}^-] = 1 \times 10^{-7} \text{ M}$
 - iii. $[\text{OH}^-] = 4 \times 10^{-13} \text{ M}$ (6 marks)



Colombo International Nautical and Engineering College
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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE: ED 0340

IST SEMESTER REPEAT EXAMINATION QUESTION PAPER
Mathematics

- This question paper consists of Nine questions.
- Answer All Six(06) Questions

Date: 2020.01.20

Pass mark 50%

Time allocated: 03 Hrs

-
1. a) Differentiate with respect to x , $y = (4x - 3)(x^2 + 1)$ (4 marks)
- b) Differentiate with respect to x , $y = \frac{3x^2 - 2}{x^3 + 1}$ (6 marks)
- c) Evaluate (10 marks)
- i. $\lim_{x \rightarrow -2} \frac{x^5 + 32}{x + 2}$
- ii. $\lim_{x \rightarrow -32} \frac{1}{x^5 + 2x + 32}$
2. a) Sketch the curve $y = x^2 - 4$. (5*4 = 20 marks)
- b) Write down the co-ordinates of the points where the curve crosses the x axis.
- c) Differentiate $y = x^2 - 4$ with respect to x .
- d) Find the Gradients of the curve where the points it crosses the x axis.
3. a) Sketch the curve $y = x^2 - 6x$. (5*4 = 20 marks)
- b) Show that the point (3, -9) lies on the curve $y = x^2 - 6x$
- c) Find the Gradient of the curve at the point (3, -9)
- d) Find the equation of the Tangent to the curve $y = x^2 - 6x$ at the point (3, -9).
4. a) Differentiate the curve $y = 2x^2 + 5x - 12$ with respect to x . (5*4 = 20 marks)
- b) Find the Gradient of the curve at the point (1, -5).
- c) Find the equation of the Tangent of the curve at the point (1, -5).
- d) Find the equation of the Normal of the curve at the point (1, -5).

5. Integrate with respect to x

(5*4 = 20 marks)

a) $\int (6x^2 - 4x + 8) dx$ b) $\int \left(3x^{\frac{1}{2}} - e^{-3x} + \frac{1}{\sqrt{x}} \right) dx$
 c) $\int_0^4 (2 - \sqrt{x}) dx$ d) $\int_{\frac{\pi}{6}}^{\frac{\pi}{4}} \cot x dx$

6. Integrate with respect to x

(5*4 = 20 marks)

a) $\int \frac{3x^3 - 2x^2 + 6}{x^2} dx$ b) $\int (3 \cos x - 5 \sec^2 x) dx$
 c) $\int_{-2}^1 (x - x^{-2}) dx$ d) $\int_0^1 (e^x - 2)^2 dx$

7. a) Simplify

(08 marks)

(i) $\frac{3^{\frac{1}{2}} \times 81^{-\frac{1}{4}}}{3^{-\frac{4}{3}} \times 3^0}$ (ii) $\frac{2^{\frac{1}{4}} \times 2^0}{16^{-\frac{1}{4}} \times 4^{\frac{1}{2}}}$

b) Solve

(12 marks)

(i) $\log_x 8 = \frac{1}{3}$ (ii) $2^{2x} - 6 * 2^x + 8 = 0$

8. a) Simplify

(08 marks)

i. $(3x - 5y)(5x + 3y)$ ii. $(2\sqrt{x} - 3)(3 - 2\sqrt{x})$

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

(12 marks)

i. $\frac{2}{\sqrt{3}-1}$ ii. $\frac{27}{2+\sqrt{5}}$

9. Show that

a) $\frac{1 + \sin x}{\cos x} + \frac{\cos x}{1 + \sin x} = \frac{2}{\cos x}$

(05 marks)

b) $\frac{2 \sin x \cos x - \cos x}{1 - \sin x - \cos^2 x + \sin^2 x} = \cot x$

(05 marks)

c) $(\sec x - \cos x)(\operatorname{cosec} x - \sin x)(\tan x - \cot x) = 1$

(05 marks)

d) $\frac{1 + \tan^2 x}{1 + \cot^2 x} = \tan^2 x$

(05 marks)



Colombo International Nautical and Engineering College

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Faculty of Marine Engineering

Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340/ND-0199

FINAL REPEAT EXAMINATION QUESTION PAPER
ELECTRONICS

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

Date: 2019.10.09

Pass mark 50%

Time allocated: 03 Hrs

➤ **Some helpful Data:**

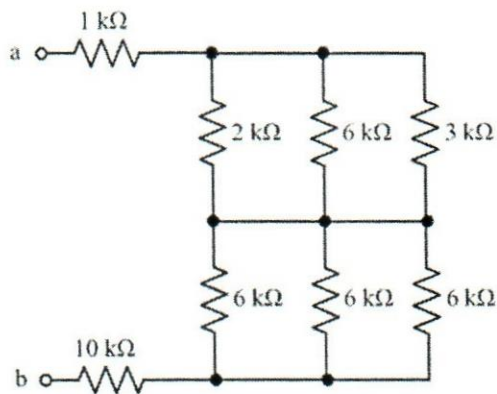
* Permittivity of free air/ vacuum (ϵ_0) – 8.854×10^{-12} F/m

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

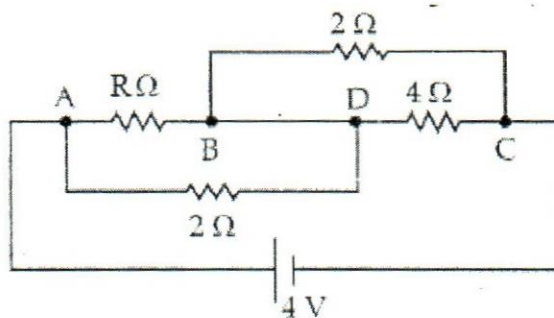
* Resistor Colour Codes:

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%

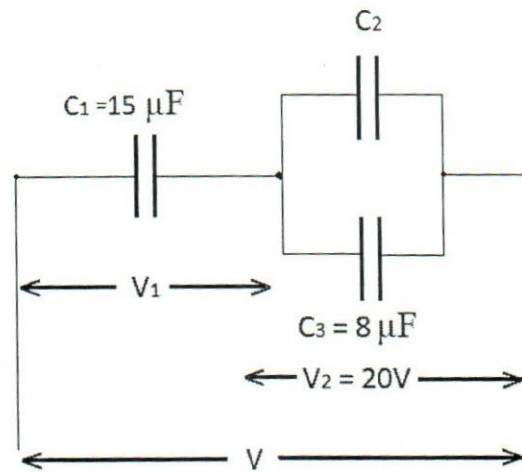
- a) What are the SI unit of resistance and resistivity. (4 marks)
 - b) What are the factors affecting the resistance of an electrical conductor? (4 marks)
 - c) Determine the nominal resistance values of these resistors, given their band colors, and express the allowable tolerance in ohms. (6 marks)
 - i. Blue, Red, Yellow, Gold
 - ii. Orange, Black, Green, Silver
 - d) Determine the colour code following resistances. (6 marks)
 - i $74\Omega \pm 10\%$
 - ii. $10k\Omega \pm 5\%$
- a) If resistors R_1 and R_2 and 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)



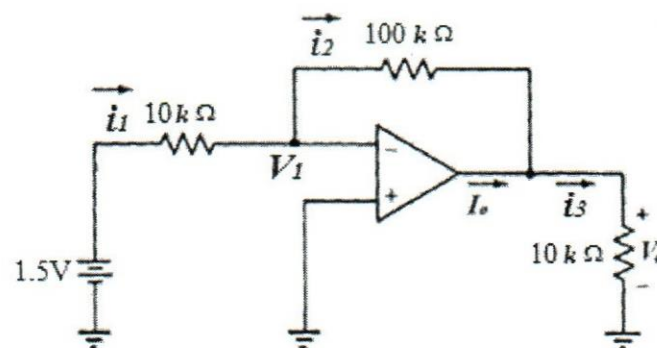
- c) *i.* Calculate equivalent resistance of following resistor network, if current drawn from the battery is 2A. (5 marks)
- ii.* Hence, find the value of resistance R. (3 marks)



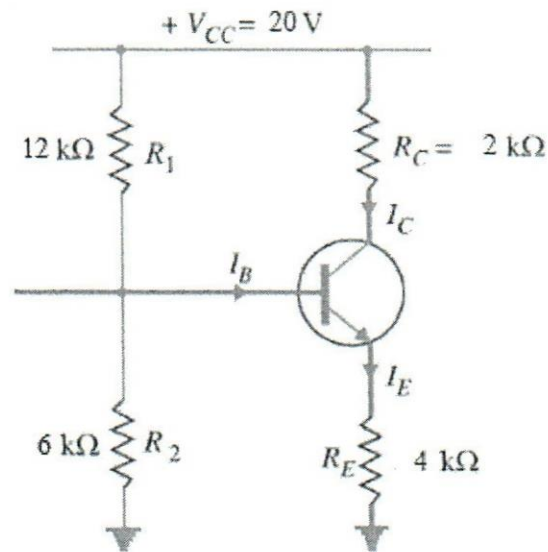
3. a) What is the SI unit of capacitance (4 marks)
- b) Three capacitors of capacitance $1\mu F$, $3\mu F$ and $5\mu F$ are connected in series to a 200V supply. Find the total capacitance and charge on each capacitor. (6 marks)
- c)
- i.* Calculate the capacitance of two metal plates of area 40m^2 separated by a dielectric 3mm thick and of relative permittivity 12. (4 marks)
- ii.* In the circuit shown in below, total charge is $750\mu C$. Determine the values of V_1 , V and C_2 . (6 marks)



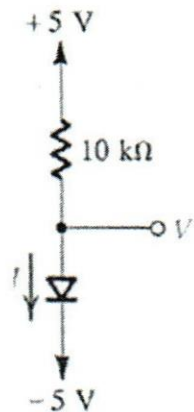
4. a) What are the properties of an ideal op amp? (3 marks)
 b) Draw schematic diagram of summing amplifier. (6 marks)
 c) For the circuit in below determine the value of v_1, i_1, i_2, v_o, i_3 and i_o . (9 marks)



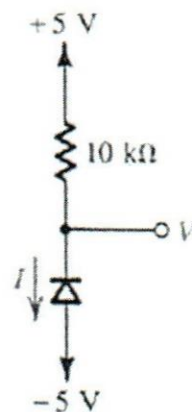
- d) Hence, find the voltage gain. (2 marks)
5. a) Draw schematic diagrams of npn and pnp transistors. (6 marks)
 b) Describe the various methods used for transistor biasing. (6 marks)
 c) Following circuit shows the voltage divider bias method. Draw the load line and determine the operating point. Assume $V_{BE} = 0.7\text{V}$. (8 marks)



6. 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)

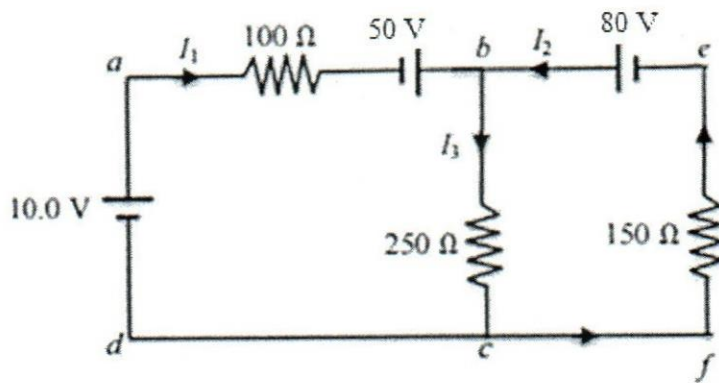


(i)



(ii)

7. 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 $V_e - V_f$, with the appropriate sign.
8. 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 $1.7 \times 10^{-6} \text{ } \Omega\text{cm}$. (8 marks)
- c) Calculate power consumption of above resistor if 5A current flows through it. (6 marks)

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Faculty of Marine Engineering
Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE: ED 0340

FINAL EXAMINATION QUESTION PAPER
Engineering Drawing

Answer All Questions

Date: 2018.09.19

Pass mark 50%

Time allocated: 03 Hrs

Marking System

| | |
|---|----------|
| i. Q 1 | 60 Marks |
| ii. Q 2 | 30 Marks |
| iii. Titles and Lettering | 05 Marks |
| iv. Boundaries, Lines, and overall neatness | 05 Marks |

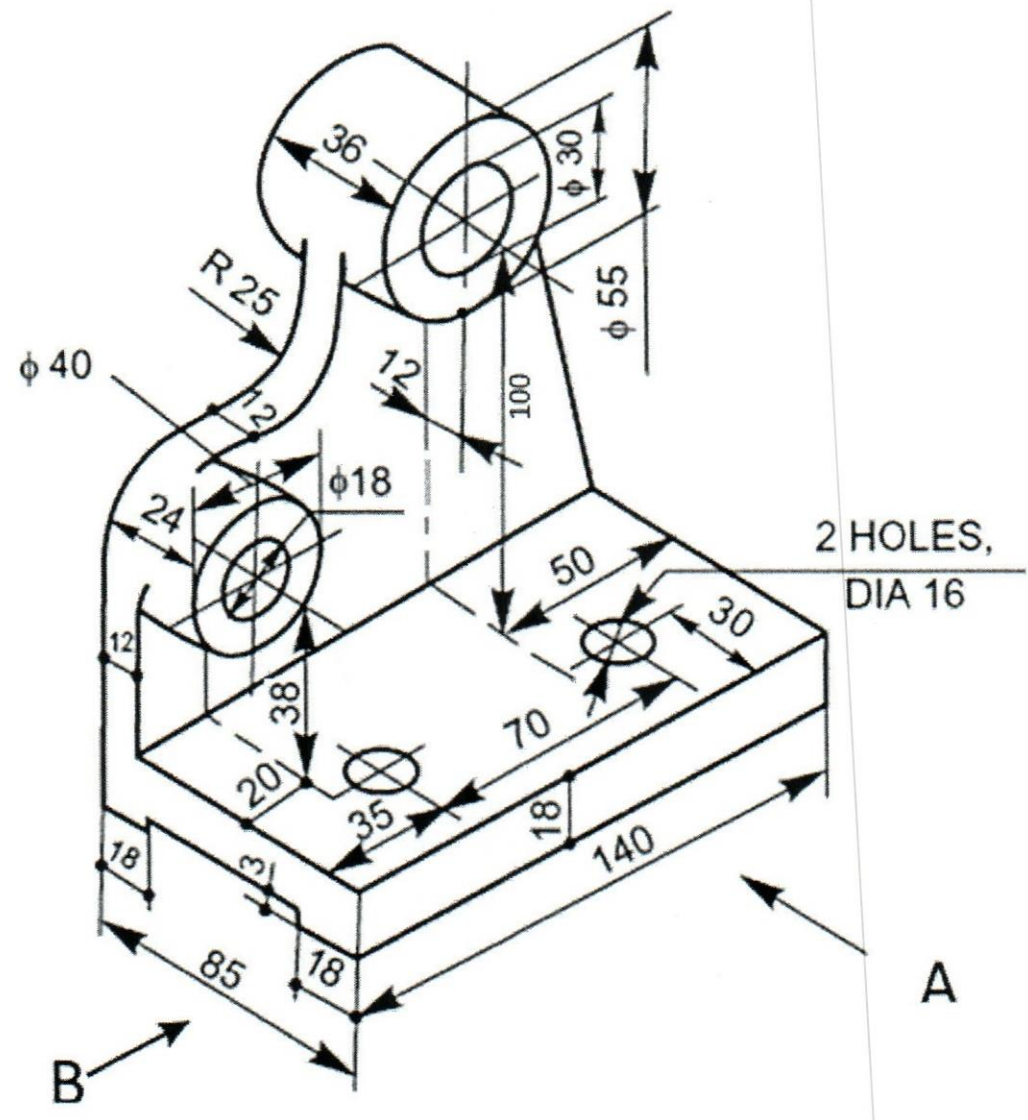
Q1. Using first angle orthographic projection, draw the *cast-iron bracket* as per the given detail in full scale and fully dimension the drawing. (All dimensions are in mm) Following views are required;

- i. Front elevation from A
- ii. End elevation from B
- iii. Plan view

**assume any missing dimensions*

Q2. Draw ellipse by **concentric circle method**. Take major axis 100 mm and minor axis 70 mm long

Q1





Colombo International Nautical and Engineering College

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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340

1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
ELECTRONICS

- This question paper consists of five questions.
- Answer All Questions

Date: 2019.09.01

Pass mark 50%

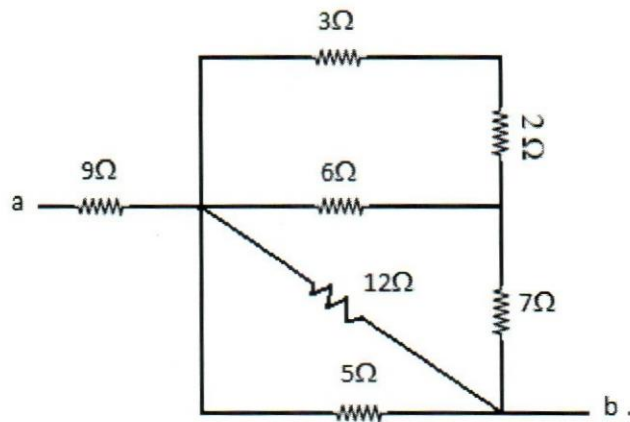
Time allocated: 03 Hrs

➤ **Some helpful Data:**

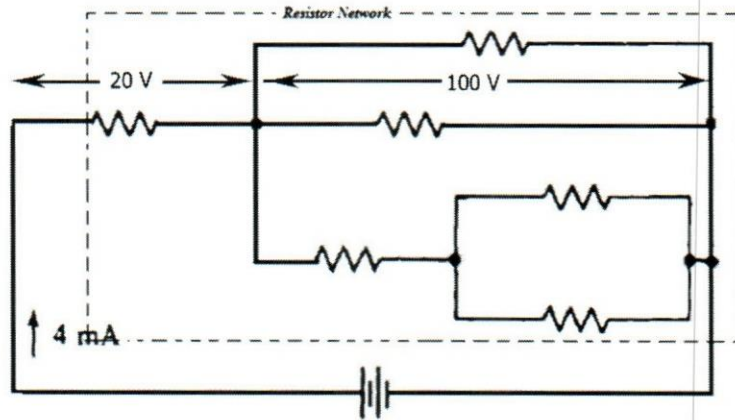
* Resistor Colour Codes:

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%

- 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. Red, Orange, Blue, Gold
 - ii. Brown, Black, Green, Silver
 - d) Determine the colour code following resistances. (6 marks)
 - i $47k\Omega \pm 5\%$
 - ii. $10M\Omega \pm 5\%$
- a) If resistors R_1 and R_2 are (i) in series and (ii) in parallel. Derive the formula for the equivalent resistance R_{eq} of each network. (6 marks)
 - b) Find the equivalent resistance between point a and b. (7 marks)

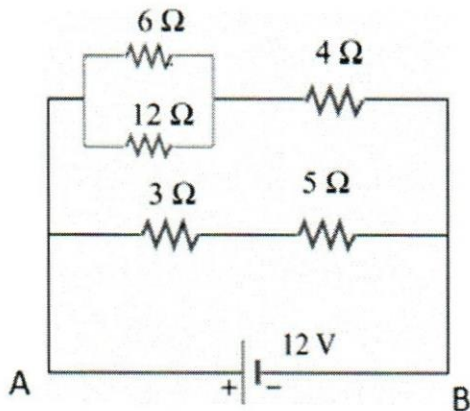


c) Calculate equivalent resistance of following resistor network. (7 marks)



3. a) State Ohm's law. (4 marks)

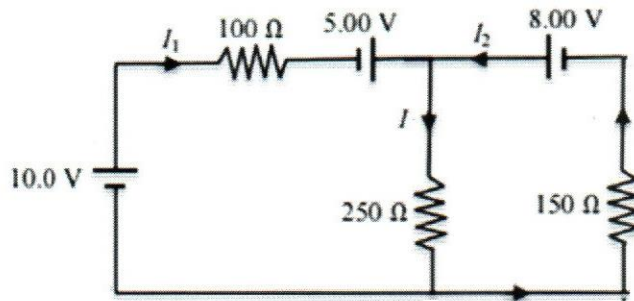
b) Five resistors are connected as shown circuit. If a battery having an e.m.f. of 12 V and internal resistance of 1Ω is connected to the terminal A and B.



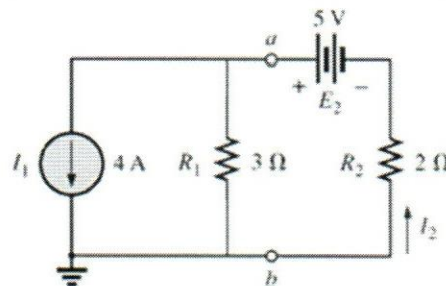
Find

- i. Equivalent resistance between A and B. (4 marks)
- ii. the current from the battery (4 marks)
- iii. Potential difference across $3\ \Omega$ and $5\ \Omega$ resistors (4 marks)
- iv. the current taken from the battery if a conductor of negligible resistance is connected in parallel with $6\ \Omega$ and $12\ \Omega$ resistor. (4 marks)

4. a) Express Kirchoff current and voltage laws. (4 marks)
- b) Consider the DC circuit shown in below and note that the direction of the currents shown in the figure are arbitrary. (4 marks)



- i. Find each branch current. (8 marks)
 - ii. What is the power consumption of $250\ \Omega$ resistor? (4 marks)
 - iii. Determine the potential difference across $150\ \Omega$. (4 marks)
5. a) Draw schematic diagram of real voltage source and real current source. (6 marks)
 - b) What are the difference between ideal voltage source and real voltage source. (6 marks)
 - c) Using Source Conversion, determine the current I_2 in the circuit shown below. (8 marks)





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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340

FIRST REPEAT SEMESTER EXAMINATION QUESTION PAPER
Industrial Chemistry

- This question paper consists of Five questions.
- Answer All Five (05) Questions

Date: 2019.09.01

Pass mark 50%

Time allocated: 03 Hrs

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 - 39.0, Ca - 40.1, Ag - 108.0, Cu - 63.5, Fe - 56.0, Co - 58.9, Zn = 65.4, Ag = 107.9, Sn = 117

1)

a) Write down the correct chemical formula

- Ozone
- ethanol
- Potassium permanganate
- Iron (ii) oxide
- Carbon dioxide
- Ammonia
- Butane

(1×6= 6 marks)

b) Draw the electron structure for

- P
- N₂
- Mg
- NaCl

(2×4= 8 marks)

c) Identify the Following Elements.

- i) An element having atomic number 16.
- ii) An element having 11 protons in its nucleus.
- iii) An element having mass number 27 and 14 neutrons.
- iv) An element denoted as ${}_{19}^{39}X$
- v) An element having 18 electrons and -2 charge

(1×5= 5 marks)

d) Give one example for followings

- i) Alloy
- ii) Metalloid
- iii) Heterogeneous Mixture
- iv) Metal
- v) Covalent bonds
- vi) Chemical compound

(1×6= 6 marks)

2)

a) Define these terms,

- a. Acid base reaction
- b. Metallic bond
- c. Homogeneous Mixture
- d. Atomic numbers
- e. Ionic Bond
- f. diprotic acid

(3×6=18 marks)

b) Balance Following equation



3)

a) How many moles of Ca are there in 31.27 g of Ca? (4 marks)

b) How many atoms are present in 3.28 g of copper (Cu)? (5 marks)

c) Calculate the percent composition by mass of each of the elements in sulfuric acid (H_2SO_4). (2×3= 6 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 (10 marks)

4)

- a) What is Atomic Mass Unit (amu) (5 marks)
- b) Peroxyacetyl nitrate (PAN) is one of the components of smog. It is a compound of C, H, N, and O. Determine the percent composition of oxygen and the empirical formula from the following percent composition by mass: 19.8 percent C, 2.50 percent H, 11.6 percent N. What is its molecular formula given that its molar mass is about 120 g?

(10 marks)

- c) When 5.00 g of $\text{FeCl}_3 \cdot x\text{H}_2\text{O}$ 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) How do you identify an acidic or basic solution by using litmus papers?

(4 marks)

- b) Calculate the pH of

i) $0.05 \text{ mol dm}^{-3} \text{ HNO}_3$ solution

(3 marks)

ii) $0.015 \text{ mol dm}^{-3} \text{ NaOH}$ solution at 25°C .

(3 marks)

- c) Lactic acid ($\text{CH}_3\text{CH}(\text{OH})\text{COOH}$) has one acidic hydrogen. A 0.10 M solution of lactic acid has a pH of 2.44. Calculate K_a .

(9 marks)

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

- d) Indicate whether solutions with each of the following ion concentrations are neutral, acidic, or basic: (show your work out)

i. $[\text{H}^+] = 2 \times 10^{-8} \text{ M}$

ii. $[\text{OH}^-] = 1 \times 10^{-7} \text{ M}$

iii. $[\text{OH}^-] = 4 \times 10^{-13} \text{ M}$

(6 marks)



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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE: ED 0340



1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
Physics

- This question paper consists of six questions.
- Answer Any SIX Questions

Date: 2019.09.01

Pass mark 50%

Time allocated: 03 Hrs

$$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2, \mu_0 = 4\pi \times 10^{-7} \text{ H/m}, m_e = 9.11 \times 10^{-31} \text{ kg}, m_p = 1 \text{ amu} = 1.6726 \times 10^{-27} \text{ kg},$$

$$e = 1.6 \times 10^{-19} \text{ C}$$

1.

- Describe the Simple Harmonic Motion (4 marks)
- A certain mass hangs from a light spring. The mass is pulled down **20 mm** from its equilibrium position and then released from rest. The frequency of oscillation is **1.25 Hz**.
 - Determine the angular frequency and the magnitude of the acceleration at the instant it is released from rest. (6 marks)
 - Write down the general expression for displacement, speed and acceleration of the motion. (6 marks)
 - Sketch a graph of the acceleration of the mass against time during the first 2.4 s of its motion (4 marks)

2.

- Sketch graphs for the variation of kinetic energy, potential energy and total energy with displacement in a simple harmonic motion (6 marks)
- A spring is stretched **4 cm** when a mass of **40 g** is hung on it. If a total of **120 g** is hung on the spring and the mass is started in a vertical oscillation, what will the period of the oscillation? (6 marks)
- Write an expression for the periodic time of simple harmonic motion of a simple pendulum (4 marks)
- Find the period of oscillation of a simple pendulum which has **0.5 kg** of mass and string with **1.2 m** length. (4 marks)

3.

- a. Write down an expression for the speed of sound in solids (4 marks)
- b. Find the speed of sound in iron core. Hint: density of iron and modulus of elasticity are 7.86 g/cm^3 and 170 GPa . (4 marks)
- c. Write down an expression for the speed of sound in air (4 marks)
- d. Find the speed of sound in air if the pressure and density of the atmosphere at 30°C are 101.3 kPa and 1.225 kg/m^3 respectively. Hint $\gamma = 1.4$ for air (4 marks)
- e. The speed of sound in air at 30°C is 340 m/s . Find the speed of the sound in air at 0°C (4 marks)

4.

- a. Write an expression for the speed of a wave appear in stretched wire (4 marks)
- b. Write down expressions for the fundamental frequency, first and second overtones of an oscillating string. (6 marks)
- c. A wire of 60 cm length and 120 g is stretched under 150 N of tension. Find the speed of wave in the wire, the fundamental frequency, first and second overtones. (10 marks)

5.

- 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 1.25 ft long is closed at one end. If the velocity of sound is 1100 ft/s , what are the frequencies of the fundamental and of the first two overtones? (8 marks)
- c. Two closed organ pipes, one 1.25 ft and 1.24 ft in length, are sounded simultaneously. How many beats per second will be produced between the fundamental tones if the velocity of sound is 1100 ft/s ? (8 marks)

6. A sound-progressive wave in air is represented by the equation

$$P(x, t) = 6.8 \text{ Sin}(512\pi t - 1.5058\pi x)$$

Where P is the pressure in Pascals, t is in seconds and x is the distance from a fixed origin O in metres (m). Determine

- a. The amplitude (4 marks)
- b. The frequency of the wave (4 marks)
- c. Its wave length (4 marks)
- d. Its speed (4 marks)
- e. The audible pressure of the wave when $x = 0.25 \text{ m}$ and $t = 10 \text{ s}$. (4 marks)

7. A standing wave appear on a string is given by

$$y(x, t) = 0.02 \text{ Cos}(12.5\pi x) \text{ Sin}(220\pi t)$$

Where y is the displacement in millimeters, t in seconds and x is in meters. Determine

- a. Amplitude of the string (2 marks)
- b. The frequency of the standing wave (4 marks)
- c. The wave length (4 marks)
- d. The speed of the wave (4 marks)
- e. The tension of the string if the density 0.524 g/cm (6 marks)

8.

- a. Write down the beat formula for two tuning-forks of slightly different frequencies of f_1 and f_2 are sounded together. (2 marks)
- b. A tuning fork of frequency 256 Hz is sounded with a fork of unknown frequency $f \text{ Hz}$, 45 beats per minute are heard. When a little plasticine is added to the prongs of the unknown fork, the beats decrease in number. Find the value of f . (4 marks)
- c. At a distance 15 m from a small loudspeaker of 100 W , the amplitude of the sound heard is 0.018 mm .
 - i. Find the amplitude at a distance 30 m from the loudspeaker (4 marks)
 - ii. Find the sound intensity at each distances (4 marks)
 - iii. Find the loudness change (dB) when the distance changes from 15 m to 30 m . Hint: threshold of hearing is 10^{-12} W/m^2 . (6 marks)

9. The following four waves are sent along strings with the same linear densities (x is in meters and t is in seconds) rank the waves according to

a. Their wave speed (10 marks)

b. The tension in the string along which they travel (10 marks)

$$y_1 = (3\text{mm})\sin(x - 3t) \quad y_2 = (6\text{mm})\sin(2x - t) \quad y_3 = (1\text{mm})\sin(4x - t)$$

$$y_4 = (2\text{mm})\sin(x - 2t)$$



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1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
 Mathematics

- This question paper consists of Nine questions.
- Answer All Six(06) Questions

Date: 2019.08.31

Pass mark 50%

Time allocated: 03 Hrs

1. Show that

a) $\frac{1 + \sin x}{\cos x} + \frac{\cos x}{1 + \sin x} = \frac{2}{\cos x}$ (5 marks)

b) $\frac{\sin^2 x - 3\cos^2 + 1}{\sin^2 x - \cos^2} = 2$ (5 marks)

c) $\frac{\sin x}{1 - \sin x} + \frac{\sin x}{1 + \sin x} = 2\tan^2 x$ (5 marks)

d) $\frac{1 - \tan^2 x}{1 + \tan^2 x} = 1 - 2\sin^2 x$ (5 marks)

2. a) Sketch the curve $y = 2x - x^2$. (8 marks)

b) Differentiate $y = 2x - x^2$ with respect to x . (4 marks)

c) Find the Gradient of $y = 2x - x^2$ at the point (5,10).

d) Find the equation of the Tangent to the curve $y = 2x - x^2$ at the point (5,10). (4 marks)

e) Find the equation of the Normal to the curve $y = 2x - x^2$ at the point (5,10). (4 marks)

3. a) Simplify

i. $(5 - 2x^2)(3x^2 + 4)$

ii. $(3\sqrt{x} - 2)(2\sqrt{x} + 3)$ (10 marks)

b) Express following expression in form of $a\sqrt{b} + c$

i. $\frac{3}{\sqrt{2}-1}$

ii. $\frac{6\sqrt{2}-4}{7+5\sqrt{2}}$

(10 marks)

4. a) Integrate with respect to $x \int (4x^2 - 6x^{\frac{1}{2}} + 8) dx$

(5 marks)

b) Integrate with respect to $x \int_1^4 \frac{1}{(x+3)^2} dx$

(5 marks)

c) Integrate with respect to $x \int_0^{\frac{\pi}{2}} \cos x dx$

(5 marks)

d) Integrate by parts with respect to $x \int e^x \sin x dx$

(5 marks)

5. a) i. Simplify $\frac{5^{\frac{1}{2}} \times 125^{\frac{1}{3}}}{25^{-\frac{1}{2}} \times 5^0}$

ii. Simplify $\frac{x^{\frac{1}{3}} \times x^{\frac{2}{3}}}{x^{-4}}$

(8 marks)

b) Solve $\log_5 125 = x$

(6 marks)

c) Evaluate $\frac{1}{3} \log_{10} 8 - \frac{1}{2} \log_{10} 100$

(6 marks)

6. a) Differentiate with respect to $x, y = (1 + 2x)(x^2 - 3)$

(4 marks)

b) Differentiate with respect to $x, y = \frac{5+4x}{8-3x^2}$

(4 marks)

c) Evaluate

(12 marks)

i. $\lim_{x \rightarrow 8} \frac{(x+1)^{\frac{1}{2}} - 3}{x-8}$

ii. $\lim_{x \rightarrow 9} \frac{x^{\frac{3}{2}} - 9^{\frac{3}{2}}}{x-9}$



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2ND SEMESTER EXAMINATION QUESTION PAPER
Engineering Drawing

- Answer All Questions

Date: 2019.06.29

Pass mark 50%

Time allocated: 03 Hrs

Marking System

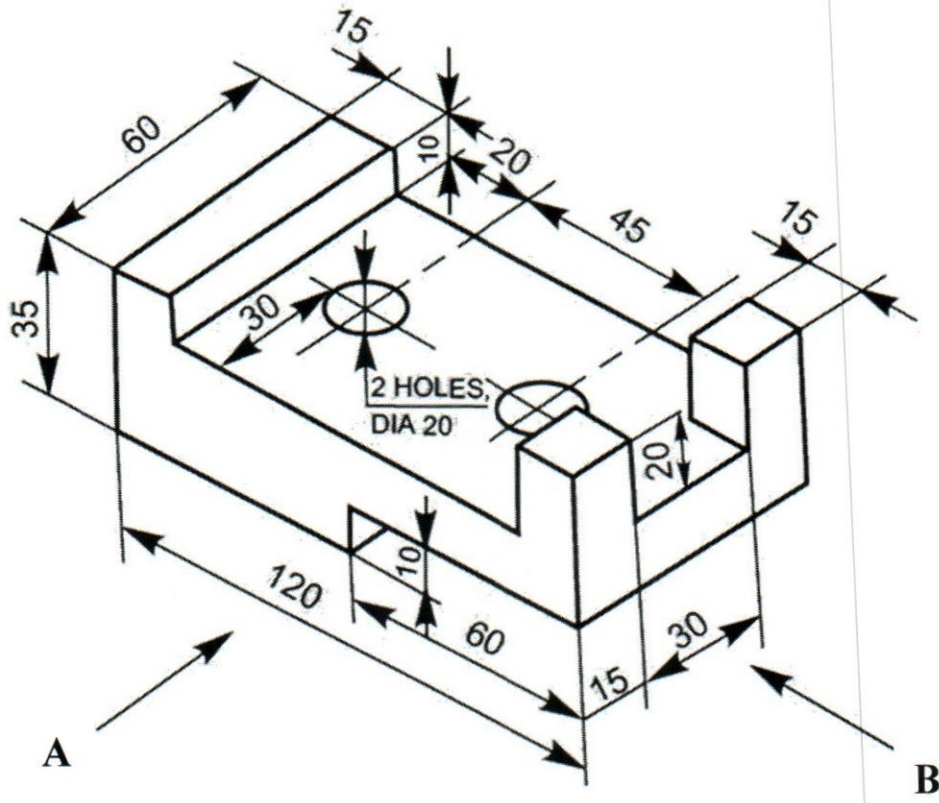
- | | |
|---|----------|
| (1) Q 1 | |
| a. Front elevation from A | 30 Marks |
| b. End elevation from B | 25 Marks |
| c. Plan view | 25 Marks |
| (2) Dimensioning | 10 Marks |
| (3) Titles and Lettering | 05 Marks |
| (4) Boundaries, Lines, and overall neatness | 05 Marks |

Q1. Using first angle orthographic projection, draw the cast iron block as per the given detail in full scale and fully dimension the drawing. Following views are required;

- I. Front elevation from A
- II. End elevation from B
- III. Plan view

**assume any missing dimensions*

Q1



All dimensions are in millimeters



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1ST SEMESTER EXAMINATION QUESTION PAPER
 Introduction to the Shipping

- This question paper consists of Five questions.
- Answer All Questions

Date: 2019.06.25

Pass mark 50%

Time allocated: 03 Hrs

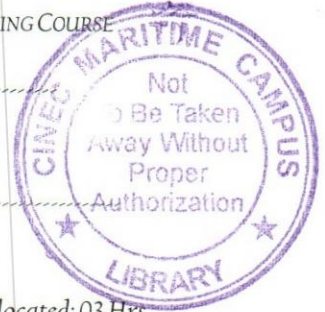
1. Make a detailed sketch of a merchant ship and mark following parts. (20 marks)
 Accommodation, stbd side, port side, anchor, forecastle, navigation light, main mast, keel, double bottom tank, bow thruster, navigation bridge, fore peak tank, aft peak tank, funnel, propeller, rudder, draft, length overall, beam and air draft.
2. a. Give 10 kind of safety gears widely used on board. (10marks)
 b. Explain 5 of above safety gears. (10marks)
3. a. List 10 types of trading ship widely available at sea. (10 marks)
 b. Explain following terms using suitable sketches where necessary
 i) Trim ii) List iii) Rolling iv) Pitching v) Anchoring (2marks each)
4. a. Explain the Following Nautical terms briefly.
 i. Bunkering ii. Bilge iii. Cat walk iv. Manhole v. Monkey Island
 vi. List vii. Chain locker viii. Cofferdam ix. Derrick x. Accommodation (20 marks)
5. a. Dry docking is very important to old motor vessel, Why? (10marks)
 b. Explain three special jobs which are carried out in dry docking Period? (10marks)



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FINAL EXAMINATION QUESTION PAPER
PHYSICS



- This question paper consists of nine questions.
- Answer Any Six (06) Questions

Date: 2019.04.06

Pass mark 50%

Time allocated: 03 Hrs

$$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2, \mu_0 = 4\pi \times 10^{-7} \text{ H/m}, m_e = 9.11 \times 10^{-31} \text{ kg}, m_p = 1 \text{ amu} = 1.6726 \times 10^{-27} \text{ kg}, e = 1.6 \times 10^{-19} \text{ C}$$

1.

- Explain what is meant by *SHM* (2 marks)
- Sketch graphs for the variation of kinetic energy, potential energy and total energy with displacement in a simple harmonic motion (6 marks)
- A particle moving with simple harmonic motion has amplitude of **2.1 m** and an angular frequency of **6.28 rad/s**. Determine
 - The frequency and period of the oscillation (4 marks)
 - The acceleration at the middle and end of an oscillation (4 marks)
 - The kinetic and potential energy when the object is **2.0 m** away from the origin (4 marks)

2.

- Write down the laws of refractions. (4 marks)
- 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 **$3.0 \times 10^8 \text{ ms}^{-1}$** . (4 marks)
- 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°** , and critical angle of incidence for Moissanite - water interface. (12 marks)

3.

- a. Write an expression for the speed of light by using the permeability and permittivity of the medium. Hence find the experimental speed of propagation of light in free space

Hint: use the permittivity and permeability of free space given in the above information bar (5 marks)

- b. Bluetooth is a wireless technology standard for exchanging data between fixed and mobile devices over short distances using short-wavelength UHF radio waves in the industrial, scientific and medical radio bands, from **2.400** to **2.485 GHz**, and building personal area networks. Determine the corresponding wavelength range. (5 marks)

- c. Ultra violet-light ranges in wavelength roughly from violet at **360 nm** to **70 nm**. Determine the corresponding frequency range. (5 marks)

- d. Infrared light ranges in wavelength roughly from red at **700 nm** to **1 mm**. Determine the corresponding frequency range. (5 marks)

The speed in vacuum is about 3×10^8 m/s, for all electromagnetic waves.

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. Singly charge Carbon, C^{1+} ion (atomic mass of **Carbon 12 amu**) is moving with speed of 3×10^6 m/s at right angles to a magnetic field **0.87 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.

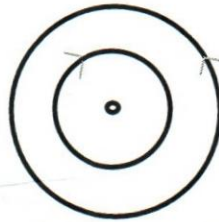
- a. Write expressions for the frequencies of fundamental and of the first two overtones produced in an closed organ pipe (6 marks)

- b. An organ pipe **1.21 m** long is closed at one end. If the velocity of sound is **340 m/s**, what are the frequencies of the fundamental and of the first two overtones? (6 marks)

- c. Two closed pipes, one **0.25 m** and **0.255 m** in length, are sounded simultaneously. How many beats per second will be produced between the fundamental tones if the velocity of sound is **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 **5 mm** (loop 1) and **10 mm** (loop 2) with **100** and **200** turns bear a current of **100 mA** for each to opposite directions. Determine



- i. The flux density at the center of the circular loops (4 marks)
- ii. The flux density at the center if the current in the loop 2 has increased to **200 mA** (4 marks)
- iii. The current in the loop 1 which produces the flux density at the center is zero (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 **200 mm** from a wire carrying a current of **10 A**. (4 marks)
- d. Two long parallel wires separated by distance **200 mm**. There is current of **500 mA** in wire 1 and a current of **1000 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 **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)

8.

- a. Describe the *Fleming's left 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. 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**. (4 marks)

c. A motor running at full load on a 120 V develops a back emf of 112 V and draws a current of 10 A through the armature.

i. What is the mechanical power output of the motor, disregarding the frictional losses? (4 marks)

ii. What is the armature resistance? (4 marks)

iii. What is the torque developed in the armature when running at 2000 rev/min ? (4 marks)

9.

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

b. A shunt wound generator has an armature resistance of $2\ \Omega$ and the field coils have a resistance of $300\ \Omega$. Its terminal potential difference is 110 V when a current of 10 A 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)

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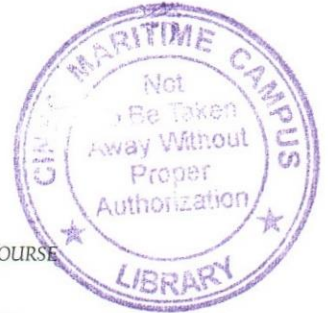
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COURSE CODE: ED 0340



2ND SEMESTER EXAMINATION QUESTION PAPER
ELECTRONICS

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

Date: 2019.04.05

Pass mark 50%

Time allocated: 03 Hrs

➤ **Some helpful Data:**

* Permittivity of free air/ vacuum (ϵ_0) – 8.854×10^{-12} F/m

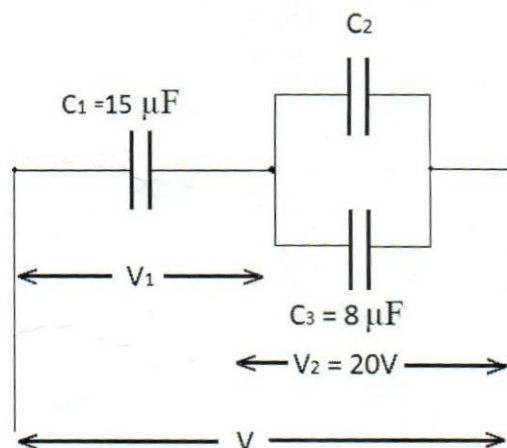
* Charge of electron – 1.602×10^{-19} C

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

* Resistor Colour Codes:

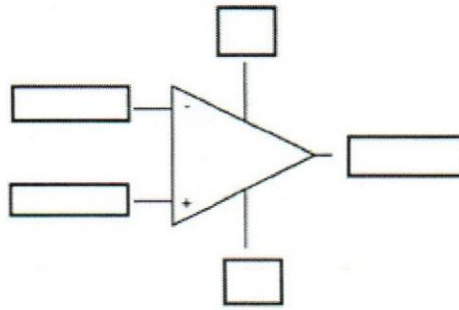
Black -0, Brown -1, Red -2, Orange -3, Yellow -4, Green -5, Blue -6, Purple -7, Grey -8, White -9,
Gold – 5%, Silver -10%, No Colour -20%

- a) Define capacitance (4 marks)
- b) Draw and name essential parts of parallel plate capacitor. (4 marks)
- c)
 - Calculate the capacitance of two metal plates of area 30m^2 separated by a dielectric 2mm thick and of relative permittivity 6. (6 marks)
 - In the circuit shown in below, total charge is $750 \mu\text{C}$. Determine the values of V_1 , V and C_2 . (6 marks)



2. a) Identify the terminals in the following op – amp.

(6 marks)

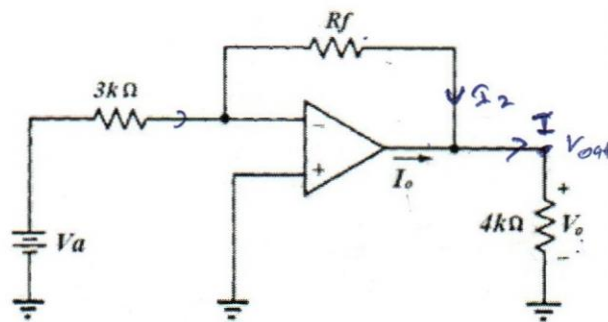


b) Draw schematic diagram of weighted summer amplifier.

(6 marks)

c) In following circuit, feedback resistor R_f , dc voltages V_a connected with operational amplifier. If $R_f = 12k\Omega$, $V_a = 2V$ and $V_b = 0V$. Determine V_o and I_o .

(6 marks)



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

(6 marks)

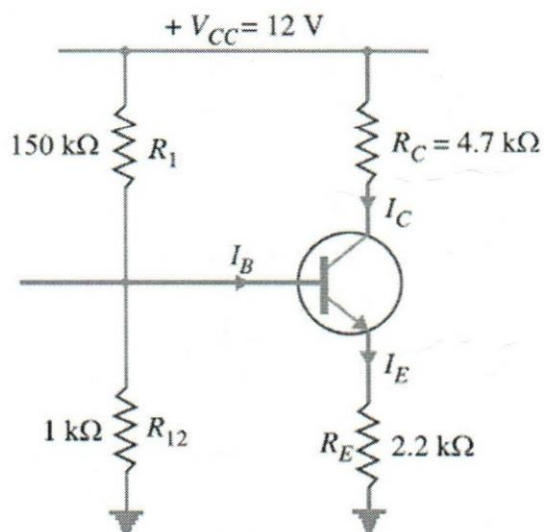
b) Describe the various methods used for transistor biasing.

(6 marks)

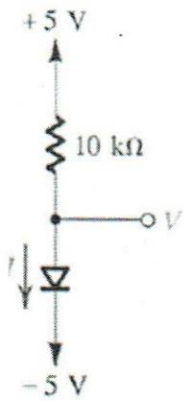
c) The amplifier circuit is shown in below, Find the operating point. Given that $\beta = 50$ and

$V_{BE} = 0.7V$.

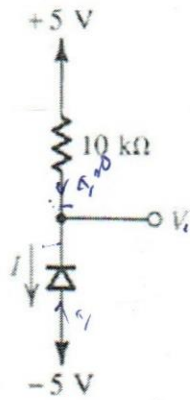
(8 marks)



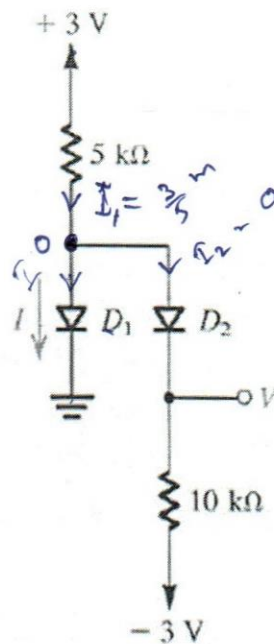
4. a) Describe formation of diode from pure silicon crystal to P-N junction diode. (6 marks)
 b) Draw schematic diagrams of the full wave and half wave rectifier circuits. (6 marks)
 c) Assume that the diodes in the figure are ideal. Find the values of the labeled currents and voltages. (8 marks)



(i)



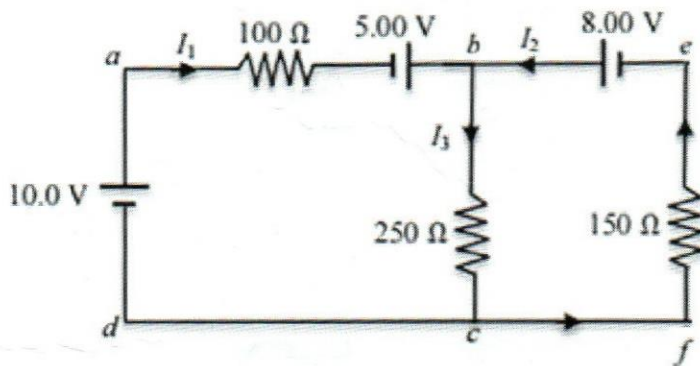
(ii)



(iii)

Handwritten notes:
 $I_1 = \frac{3}{5} \text{ mA}$
 $I_2 = 0.5 \text{ mA}$
 $I = I_1 + I_2 = \frac{3}{5} + 0.5 = 1 \text{ mA}$

5. a) Express Kirchoff 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)

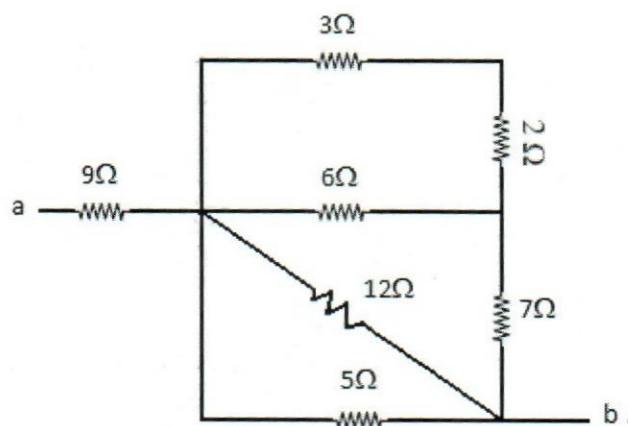


- i. Find each branch current.
 ii. What is the direction of the current through 250 Ω resistor? (from b to c or from c to b)
 iii. Determine the potential difference $V_e - V_f$, with the appropriate sign.

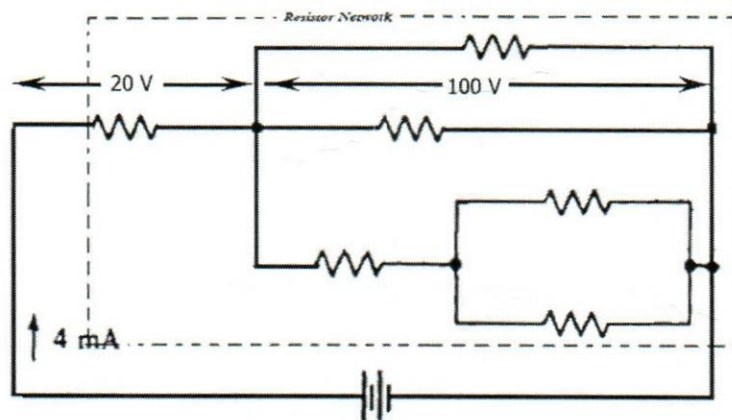
6. In a pure resistive circuit, the instantaneous voltage and current are given by:
 $v = 250 \sin 314t$; $i = 10 \sin 314t$.

Determine

- RMS Voltage and Current.
 - Frequency.
 - Power consumption.
7. a) Define resistance and resistivity. (8 marks)
 b) What are the factors affecting the resistance of an electrical conductor? (6 marks)
 c) Determine the nominal resistance values of these resistors, given their band colors, and express the allowable tolerance in ohms. (6 marks)
- Red, Orange, Blue, Gold
 - Brown, Black, Green, Silver
8. a) If resistors R_1 and R_2 and R_3 are (i) in series and (ii) in parallel. Derive the formula for the equivalent resistance R_{eq} of each network. (6 marks)
 b) Find the equivalent resistance between point a and b. (7 marks)

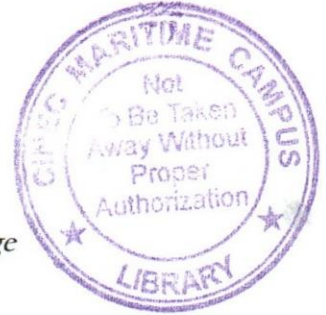


- c) Calculate equivalent resistance of following resistor network. (7 marks)



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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE:

2ND SEMESTER EXAMINATION QUESTION PAPER
Engineering Drawing

- This question paper consists of two questions.
 - Answer All Questions
 - Date: 2019.04.04
- Pass mark 50% Time allocated: 03 Hrs

Marking System

| | | | |
|-----|---|---|----------|
| I | Q: 1 | a | 50 Marks |
| II | Q: 1 | b | 20 Marks |
| III | Q: 1 | c | 20 Marks |
| IV | Titles and Lettering | | 05 Marks |
| V | Boundaries, Lines, and overall neatness | | 05 Marks |

Q1 Figure below shows the pictorial view of a cast-iron Bracket. Using first angle projection, draw the following views assuming full scale and fully dimension the elevations

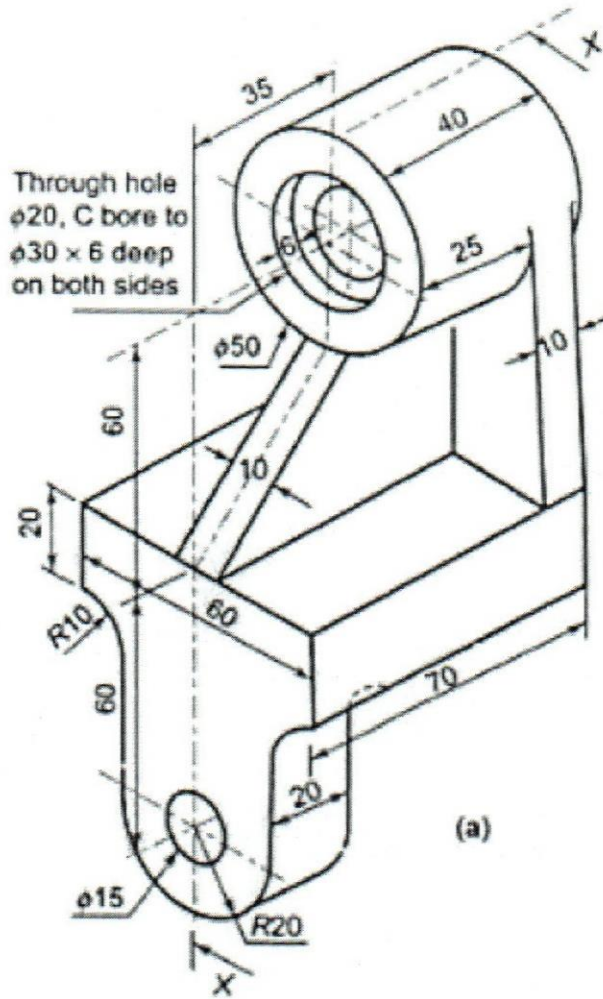
- a. Sectional front elevation X- X looking from the direction of arrow 'A'
- b. Side elevation looking from the direction of arrow 'B'
- c. Plan view

Note:

All dimensions are in millimeters

Assume any missing dimensions

Q1



B

A

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COURSE CODE: ED 0340



2ND SEMESTER EXAMINATION QUESTION PAPER
MATHEMATICS

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

Date: 2019.04.05

Pass mark 50%

Time allocated: 03 Hrs

1. a) Simplify $\frac{2-\sqrt{3}}{2+\sqrt{3}} + \frac{2+\sqrt{3}}{2-\sqrt{3}}$ (6 marks)
- b) Calculate i. $64^{1/3}$ ii. $125^{2/3}$ iii. $32^{-3/5}$ (6 marks)
- c) Solve $27^{2x-1} = 81$ (8 marks)
2. A function f is defined by $f : x \mapsto 2x^2 - 3$, $x \in X = \{-\sqrt{2}, 0, \sqrt{2}, 2\}$
- a) Find $f(-\sqrt{2})$, $f(0)$, $f(\sqrt{2})$ and $f(2)$. (5 marks)
- b) Write down the range of f . (5 marks)
- c) Write down all the ordered pairs of f . (5 marks)
- d) Is f a one-to-one function? Give reasons. (5 marks)
3. a) If $p(x) = 3 - 2x$ and $q(x) = x^2 - 12$, find $p(q(x))$ and $q(p(2))$. (7 marks)
- b) If $f(x) = 1 - \frac{1}{x}$, show that $f \circ f(x) = f^{-1}(x)$. (7 marks)
- c) Sketch the graph of $y = \frac{1}{x}$. (6 marks)
4. a) i. Express the following angles in radians, in terms of π . (3 marks)
- $15^\circ, 40^\circ, 240^\circ$

- ii. Express the following angles in degrees. (3 marks)
- $$\frac{\pi}{3}, \frac{3\pi}{10}, \frac{5\pi}{8}$$
- b) i. Prove that $\frac{\sin(A-B)}{\cos A \cos B} = \tan A - \tan B$. (8 marks)
- ii. Hence show that $\frac{\sin(A-B)}{\cos A \cos B} + \frac{\sin(B-C)}{\cos B \cos C} + \frac{\sin(C-A)}{\cos C \cos A} = 0$ (6 marks)
5. The function is given by $y = \frac{2x-1}{(x+1)^2}$
- b) Find the coordinate of turning points. (6 marks)
- c) Find the coordinate of x and y intercepts. (8 marks)
- d) Sketch $y = \frac{2x-1}{(x+1)^2}$ graph. (6 marks)
6. a) Find $\lim_{x \rightarrow 1} \frac{x^2-x+3}{3x+1}$ (6 marks)
- b) Find $\lim_{x \rightarrow 4} \frac{x^2-3x-4}{2x^2-9x+4}$ (6 marks)
- c) Evaluate $\lim_{x \rightarrow \pi/4} \frac{\sin x - \cos x}{x - \pi/4}$ (8 marks)
7. a) Differentiate with respect to x, (6 marks)
- i. $y = x^2 - 7x + 3$ ii. $y = \frac{3x^2-2}{3-2x}$
- b) Find $\frac{dy}{dx}$ in terms of the parameter t, if $y = 6t$ and $x = 3t^2$. (6 marks)
- c) Given that $y = x - \tan^{-1}x$, prove that $\frac{d^2y}{dx^2} - 2x \left(1 - \frac{dy}{dx}\right)^2 = 0$ (8 marks)
8. a) Integrate with respect to x (8 marks)
- i. $\int (2x^3 + \frac{4}{x^2} - \frac{1}{x} + 1) dx$ ii. $\int (3\sin x - 5e^x + \operatorname{cosec}^2 x) dx$
- b) Determine the partial fractions of $\frac{x-1}{(x+1)(x+3)}$ (6 marks)
- c) Hence, Evaluate $\int \frac{x-1}{(x+1)(x+3)} dx$ (6 marks)
9. a) Solve the quadratic equation $2x^2 - 3x - 3 = 0$. (6 marks)
- b) Determine the nature of roots of quadratic equation $nx^2 - mx - n = 0$. (8 marks)
- c) Determine the range of value of k for which the quadratic equation $kx^2 + 6(k-2)x + 3(k+2) = 0$ has real distinct roots. (6 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: ED-0340 - BATCH 021

2ND SEMESTER EXAMINATION – QUESTION PAPER
INDUSTRIAL CHEMISTRY

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

Date: 2019.04.04

Pass mark 50%

Time allocated: 03 Hours

Avogadro Constant (N_A) – $6.022 \times 10^{23} \text{ mol}^{-1}$

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

- Propane
- Ammonia
- Ozone
- Calcium carbonate

(1×4= 04 marks)

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

(6 marks)

c) Define the term

- Atomic number
- Hydrate
- Mixture
- Valence electrons
- 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?

(06 marks)

3)

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

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

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

(06 marks)

- a) Calculate the pH of each of these solutions:

(a) 0.003 M HCl ,

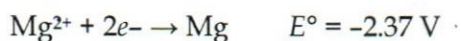
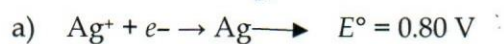
(b) $1.3 \times 10^{-4} \text{ M Ba(OH)}_2$,

(04 marks)

- b) Calculate the solubility of Cu(OH)_2 in 1 g l^{-1} ? K_{sp} of Cu(OH)_2 2.2×10^{-20}

(06 marks)

4)



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)

5)

- 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)

6)

- 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)

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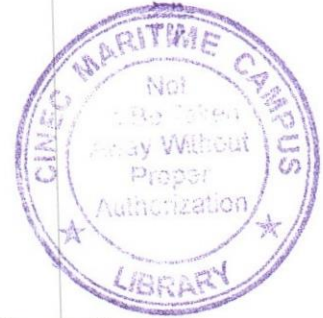
06



Colombo International Nautical and Engineering College
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Faculty of Marine Engineering
Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE: ED 0340



FINAL TERM EXAMINATION QUESTION PAPER
INTRODUCTION TO SHIPPING

- This question paper consists of five questions.
- Answer All (05) Questions

Date: 2019.04.03

Pass mark 50%

Time allocated: 03 Hrs

1. Make a detailed sketch of a ship showing following principle parts. (name each part)
Hull, Bow thruster, Main deck, Double bottom tank, After peak tank, Fore peak tank, Main mast, Windless, Keel, Propeller, Rudder, Anchor, Anchor locker, Cargo crane, Accommodation ladder, Poop deck, Monkey island, Engine room, Port hole, Hatch cover, Life boat, Cargo hold, Navigation bridge, Navigation lights, Funnel. (20 marks)
2. a) Name six different types of ships and explain the trade (use) of each type mentioned above. (12 Marks)
b) Explain the purpose of having following parts and component for a ship.
 - i. Double bottom tank (04 marks)
 - ii. Anchor (04 marks)
3. Explain the use (job) of following equipment and parts of a motor ship.
 - i. Rudder (02 marks)
Bow-thruster (02 marks)
Rescue boat (02 marks)
Life Buoy (02 marks)
Pilot Ladder (02Marks)
 - ii. Briefly explain the purpose of following navigation equipment available on Navigation Bridge.
Echo sounder (02 marks)
Speed log. (02 marks)
Voyage recorder (02 marks)
Navigation chart (02 marks)
Engine order Telegraph (02 marks)

4. (a) What is meant by LSA and FFA (04marks)
- (b) List 5 types of items fall into each of above category. (10 marks)
- (c) Make a list of most essential items which should be carrying in a life boat? (06marks)

5. Write short notes on following emergency equipment with their application.

- a) i. Emergency fire pump (03 marks)
- ii. Emergency generator (03 marks)
- iii. Emergency air compressor (03 marks)
- b) i. What is meant by fire Triangle? (04 marks)
- ii. List four types of portable fire extinguishers widely used on board ship. (04 marks)
- iii. Name most suitable fire extinguisher for each of following fires.
Electric fire, Oil Fire and Scavenge fire. (03 marka)



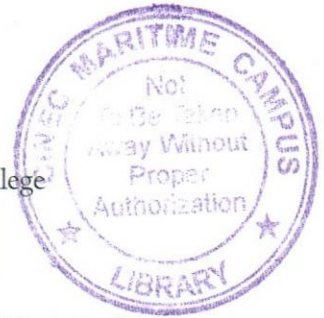
Colombo International Nautical and Engineering College
CINEC Campus

Faculty of Marine Engineering

Department of Marine Engineering

Education & Training COURSE: Engineer Officer Cadet Foundation Training Course

Course CODE: ED 0340



Final examination Question paper
Applied Mechanics

- This question paper consists of Eight questions.
- Answer Any Six (06) Questions

Date: 2019.04.03

Pass mark 50%

Time allocated: 03 Hrs

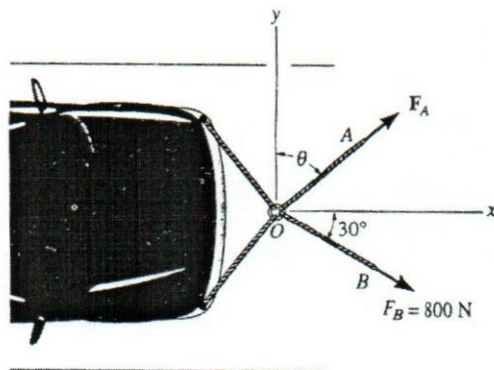
1.

- 1.1 A truck is been towed using two ropes as shown in the diagram. Determine the magnitude and direction of θ of F_A so that the resultant force is directed along the positive X axis and has a magnitude of 1250N.

(10 marks)

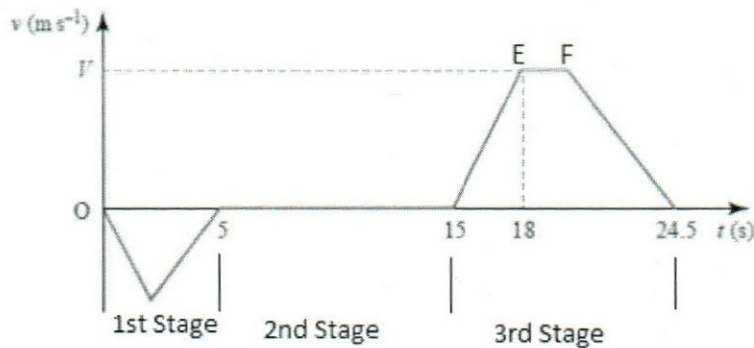
- 1.2 If F_A is equal to 750N and $\theta = 45^\circ$, determine the direction and magnitude of the resultant force acting on the ring at "O" measured counterclockwise from the positive X axis.

(10 marks)

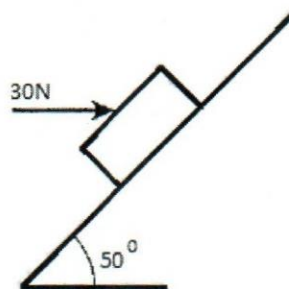


2

- 2.1 The diagram shows the velocity–time graph for a lift moving between floors in a building. In the first stage the lift travels downwards from the ground floor for 5 s, coming to rest at the basement after travelling 10 m.



- a. Find the greatest speed reached during this stage. (05 marks)
- 2.2 The second stage consists of a 10 s wait at the basement. In the third stage, the lift travels upwards until it comes to rest at a floor 34.5 m above the basement, arriving 24.5 s after the start of the first stage. The lift accelerates at 2 ms^{-2} for the first 3 s of the third stage, reaching a speed of $V \text{ ms}^{-1}$. Find;
- b. Value of V , (05 marks)
- c. Time during the third stage for which the lift is moving at constant speed (EF) (05 marks)
- d. Deceleration of the lift in the final part of the third stage. (05 marks)
- 3.
- 3.1 Write the factors affecting friction between two surfaces. Briefly describe the impact of contact area to the magnitude of friction. (06 marks)
- 3.2 The diagram shows a horizontal force of magnitude 30N acting on a block of mass 2g which is at rest on a plane inclined at 50° to the horizontal. Find the magnitude and direction of the frictional force on the block (14 marks)



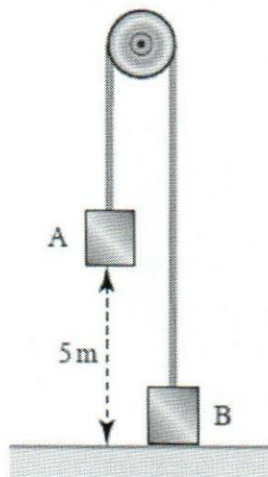
4.

4.1 Two particles A and B, of masses 0.6 kg and 0.4 kg respectively, are connected by a light inextensible string which passes over a smooth fixed pulley. The particles hang freely, as shown in the diagram, and are released from rest.

a. Find the acceleration of A, B and the tension in the string. (10 marks)

4.2 After 2 seconds the string is cut and in the subsequent motion both particles move freely under gravity.

b. Find the height of both particles at the instant that the string is cut. (10 marks)



5.

5.1 A ball is thrown from a point at ground level with velocity 20 ms^{-1} at 30° to the horizontal. The ground is level and horizontal and you should ignore air resistance.

a. Find the horizontal and vertical components of the ball's initial velocity. (05 marks)

b. Find the horizontal distance travelled by the ball before its first bounce. (05 marks)

c. Find how long the ball takes to reach maximum height. (05 marks)

d. Find the maximum height reached by the ball. (05 marks)

6

6.1 A block of mass 50 kg is pulled up a straight (vertical) hill and passes through points A and B along the hill with speeds 7 ms^{-1} and 3 ms^{-1} respectively. The distance AB is 200 m and B is 15 m higher than A. For the motion of the block from A to B, find;

- a. the loss in kinetic energy of the block, (06 marks)
- b. The gain in potential energy of the block. (06 marks)

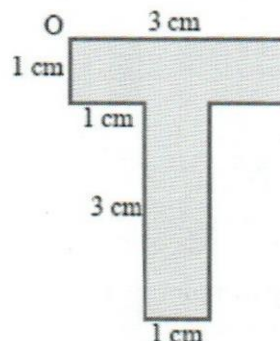
6.2 Consider the resistance to motion of the block to be 7.5 N.

- c. Find the work done by the pulling force acting on the block. (08 marks)

7.

7.1 What is center of mass? (06 marks)

7.2 The following shape is made out of cardboard with uniform thickness. Find the co-ordinates of the center of mass relative to O. (14 marks)



8.

8.1 Define radian, and derive an expression for the relationship between angular velocity measured in rad/s and rpm. (08 marks)

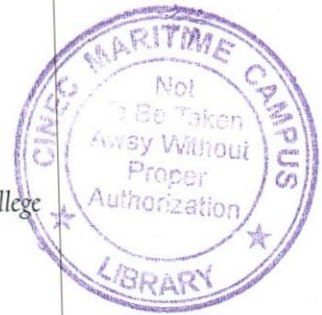
8.2 A wheel rotating for 5s with a constant angular acceleration and describes (makes) 100 radians. It then rotates with constant angular velocity and during the next 5 seconds it describes (makes) 80 radians. Find the initial angular velocity and angular acceleration. (12 marks)



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COURSE CODE: ED 0340



02

01ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
APPLIED MECHANICS

- This question paper consists of eight questions.
- Answer Any Five (05) Questions
- Date: 2019.03.17

Pass mark 50%

Time allocated: 03 Hrs

1.

1.1 State three Newton's laws

(6 marks)

1.2 On a particular journey the resistance to motion of a car of mass 1000kg is proportional to its speed. The car is travelling at a constant speed of 15m/s with a driving force of 870N. The driving force is instantaneously increased to 1200N.

- I Find the instantaneous acceleration produced (6 marks)
- II Find the resistance to motion and the acceleration when the car is moving at 20m/s (8 marks)

2.

2.1 A stone is thrown upwards with an initial velocity of 25m/s from a point **30m above ground**.

- I Find the maximum height of the stone above ground. (5 marks)
- II Find the time when the stone hits the ground (5 marks)
- III Display (t,v) graph for the motion of the stone (up to the time when it hits the ground) (5 marks)
- IV Display a graph showing the change in height of the stone as a function of time (t,s) (5 marks)

3.

A man of mass M kg and his son of mass m kg are standing in a lift. When the lift is accelerating upward with magnitude 1m/s^2 the magnitude of the normal contact force exerted on the man by the lift floor is 880N. When the lift is moving with constant speed the combined magnitude of the normal contact forces exerted on the man and the boy by the lift floor is 1000N. Find the values of M and m. (20 marks)

4.

4.1 Two runners A and B are leading the field in a long distance race. They are both running at 5m/s with A 10m behind B. When B is 50m from the finishing tape, A accelerates but B doesn't. What is the least acceleration A must produce to overtake B? (10 marks)

4.2 If instead B accelerates at 0.1 m/s^2 up to the tape, what is the least acceleration A must produce? (10 marks)

5.

5.1 A particle of weight 10N is placed on a smooth plane inclined at 55° to the horizontal. Find the magnitude of the force required to keep the particle in equilibrium if it acts;

- I Parallel to the plane (5marks)
- II Horizontally (5 marks)
- III Upwards at an angle of 25° to a line of greatest slope of the plane (5 marks)

5.2 Without making any calculations state, with reason, which of the three cases has the greatest normal contact force. (5 marks)

6.

6.1 A force of magnitude 20N acting downwards at 25° to the horizontal on a block of mass 4kg, which is at rest in limiting equilibrium on a horizontal surface. Calculate the coefficient of friction between the block and the surface. (10 marks)

6.2 Calculate the acceleration with which the block starts to move if the direction of the force of magnitude 20N is reversed. (Consider a "pull" of magnitude 20N, acting 25° upward to the horizontal) (10 marks)

7.

7.1 Explain the concept of *conservation of energy*? (6 marks)

7.2 A particle is projected with speed 4m/s up and along a surface (ramp) inclined at 30° to the horizontal. It reaches the top ramp with speed 1.2 m/s. If the inclined surface is smooth (frictionless), what is the length of the ramp. (14 marks)

8.

8.1 Explain the relationship between Work-done and Energy (6 marks)

8.2 A tractor of mass 500kg pulls a trailer of mass 200 kg up a rough slope inclined at 17° to the horizontal. The resistance to the motion is 4N per kg. Calculate the work done by the tractor engine, given that the vehicle travels at a constant speed of 1.4 m/s for 2 minutes. (14 marks)

03
Am



Colombo International Nautical and Engineering College
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Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE: ED 0340



1ST SEMESTER REPEAT EXAMINATION QUESTION PAPER
ELECTRONICS

- This question paper consists of six questions.
- Answer Any Five (05) Questions

Date: 2019.03.16

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 – 1.602×10^{19} C

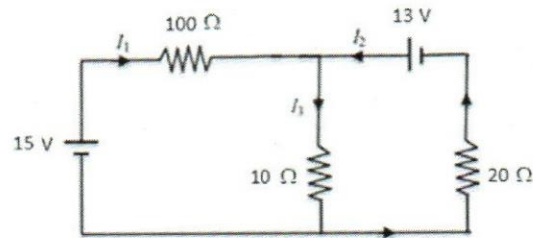
Barrier potential across a 'Si' Diode – 0.7 V | across a "Ge" Diode 0.3 V

* Resistor Colour Codes:

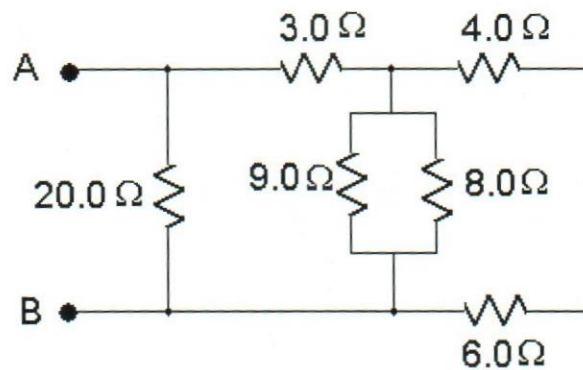
Black -0, Brown -1, Red -2, Orange -3, Yellow -4, Green -5, Blue -6, Purple -7, Grey -8, White -9, Gold – 5%, Silver -10%, No Colour -20%

1. a) Explain the effect of temperature on semiconductors. (6 marks)
b) What are the difference between intrinsic semiconductor and extrinsic semiconductor. (6 marks)
c) Explain the behavior of p-n junction with V-I characteristics (8 marks)
2. a) Define resistance and resistivity. (8 marks)
b) What are the factors affecting the resistance of an electrical conductor? (6 marks)
c) Determine the nominal resistance values of these resistors, given their band colors, and express the allowable tolerance in ohms. (6 marks)
 - i. Red, Orange, Blue, Gold
 - ii. Brown, Black, Green, Silver
3. a) Define Ideal voltage source and ideal current source. (6 marks)
b)
 - i. Draw schematic circuit diagrams for the real voltage source and the real current source.

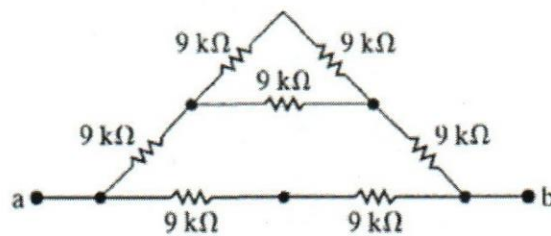
- ii. If the real voltage source and real current source are equivalent, express current through current source in terms of e.m.f (E) and internal resistance (R_{int}) of voltage source. (6 marks)
- c) Find the current in various resistors in the circuit shown in below by converting voltage sources into currents sources. (8 marks)



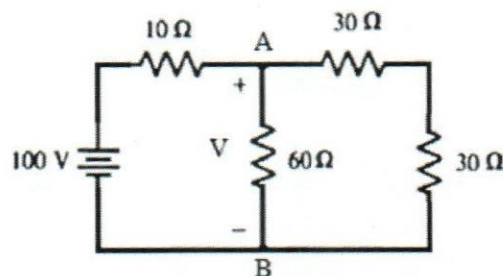
4. a) Evaluate the equivalent resistance between A and B. (6 marks)



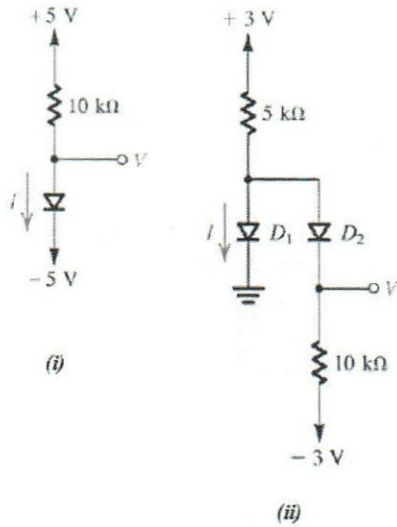
- b) Using star delta transformation find equivalent resistance between a and b. (6 marks)



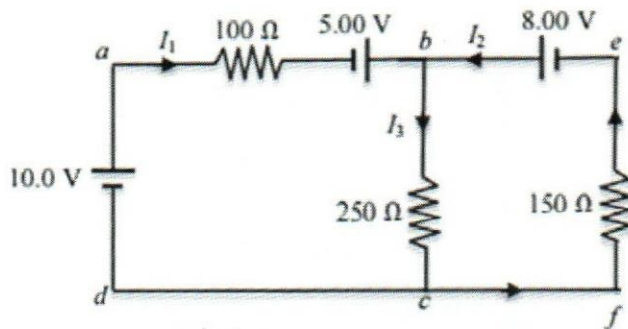
- c) Find value of V and the current through 60Ω resistor. Given that the battery has internal resistance of zero. (8 marks)



5. a) Explain forward biasing and reverse biasing of diodes. (6 marks)
- b) Draw the full wave rectifier and the half wave rectifier circuit diagrams. (6 marks)
- c) Assume that the diodes in the figure are ideal. Find the values of the labeled currents and voltages (8 marks)



6. 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 250Ω resistor? (from b to c or from c to b)
- iii. Determine the potential difference $V_e - V_f$, with the appropriate sign.

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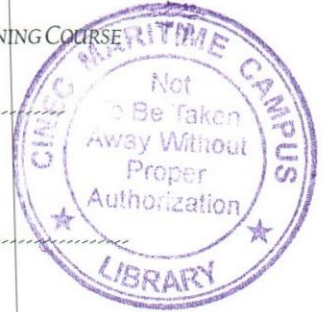
Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340

IST SEMESTER REPEAT EXAMINATION QUESTION PAPER

Physics



- This question paper consists of Nine questions.
- Answer Any SIX Questions

Date: 2019.03.16

Pass mark 50%

Time allocated: 03 Hrs

$$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2, \mu_0 = 4\pi \times 10^{-7} \text{ H/m}, m_e = 9.11 \times 10^{-31} \text{ kg}, m_p = 1 \text{ amu} = 1.6726 \times 10^{-27} \text{ kg}, e = 1.6 \times 10^{-19} \text{ C}$$

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. A particle moving with simple harmonic motion has amplitude of **2.0 m** and a angular frequency of **3.14 rad/s**. 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 **1.8 m** away from the origin (4 marks)
2. A block whose mass m is **0.25 kg** is vertically fastened to a spring whose spring constant k is **20 N/m**. The block is pulled under gravity a distance $x = 10 \text{ cm}$ from its equilibrium position at $x = 0$ 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.
- Write down the laws of refractions. (4 marks)
 - 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 $3.0 \times 10^8 \text{ ms}^{-1}$. (4 marks)
 - 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° , and critical angle of incidence for Moissanite - water interface. (12 marks)
- 4.
- Describe the Doppler effect (4 marks)
 - Write expressions for the apparent frequency heard by an observer:
 - When he is stationary and a source of sound is moving towards him
 - When he is moving towards a stationary source of sound (6 marks)
 - A toddler running towards 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 whistle steadily. An observer toward whom the toddler is walking hears **5** beats per second. If the speed of sound of sound is **330 m/s**, what is the frequency of the whistle (10 marks)
- 5.
- Define pitch, loudness, quality and intensity (8 marks)
 - Write an expression for the sound level change using Intensity or power of source relative to the threshold of hearing (4 marks)
 - A remotely operated machine gives rise to an average sound level of **110 dB** at a distance of **10 m** from the operating room. What is the acoustic power output of the machine (threshold of hearing = 10^{-12} W/m^2) (8 marks)
Assume that the machine radiates sound equally into a hemisphere.
- 6.
- Describe the interference of light and their application (4 marks)
 - A diffraction grating is ruled with **200 lines per millimeter**. The wave length of a yellow color light source is **586 nm**. What is the angle of the first order of a spectral line is observed? (6 marks)
 - A grating having **300 lines per in millimeter** produces spectra of mercury arc. The blue line of the mercury spectrum has a wavelength of **4358 Å**. What is the angular separation between the first-order blue line and the second-order blue line? (10 marks)
 $1\text{Å} = 10^{-10} \text{ m}$

7.

- a. Write expressions for the frequencies of fundamental and of the first two overtones produced in an open organ pipe (4 marks)
- b. An organ pipe 1.34 m long is opened at both ends. If the velocity of sound is 330 m/s , what are the frequencies of the fundamental and of the first two overtones? (6 marks)
- c. Two closed pipes, one 1.2 m and 1.21 m in length, are sounded simultaneously. How many beats per second will be produced between the fundamental tones if the velocity of sound is 330 m/s ? (6 marks)

8.

- a. Describe the followings
- Refractive index of a medium
 - Total internal reflection (4 marks)
- b. Light is passing from air into a transparent oil and is deviated 12° when the angle of incidence is 47° . Under what conditions will total reflection occur for the interface? (6 marks)
- c. A beam of sodium light passes from air into certain oil and then into flint glass, all with parallel surfaces. If the angle of incidence in the air is 27° , what are the angles of refraction in the oil and the glass? ($n = 1.35$ and 1.63 for oil and flint glass, respectively) (10 marks)

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

$$y(x,t) = 100 \sin\left(330\pi t + \frac{40\pi}{21}x\right)$$

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

- The amplitude (2 marks)
- The frequency of the wave (4 marks)
- Its wave length (4 marks)
- Its speed (4 marks)
- The phase difference in radians between a point 0.7 m from O and 1.05 m from the origin O (6 marks)



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Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE: ED 0340

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1ST SEMESTER EXAMINATION QUESTION PAPER
Physics

- This question paper consists of six questions.
- Answer Any SIX Questions

Date: 2018.01.21

Pass mark 50%

Time allocated: 03 Hrs

$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2$, $\mu_0 = 4\pi \times 10^{-7} \text{ H/m}$, $m_e = 9.11 \times 10^{-31} \text{ kg}$, $m_p = 1 \text{ amu} = 1.6726 \times 10^{-27} \text{ kg}$,
 $e = 1.6 \times 10^{-19} \text{ C}$

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. A particle moving with simple harmonic motion has amplitude of **1.5 m** and a angular frequency of **1.46 rad/s**. 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 **1.2 m** away from the origin (4 marks)
2. A block whose mass m is **0.5 kg** is vertically fastened to a spring whose spring constant k is **50 N/m**. The block is pulled under gravity a distance $x = 12 \text{ cm}$ from its equilibrium position at $x = 0$ 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.
- Write down the laws of refractions. (4 marks)
 - What is the speed of light in crystalline quartz? Assume the index of refraction of quartz to be 1.553 and speed of light in free space to be $3.0 \times 10^8 \text{ ms}^{-1}$. (4 marks)
 - The index of refraction of a flint glass is 1.64 . Find the speed of light in the glass, the angle of refraction in glass if light is incident from water at an angle of 50° , and critical angle of incidence for glass- water interface. (12 marks)
- 4.
- Describe the Doppler effect (4 marks)
 - Write expressions for the apparent frequency heard by an observer:
 - When he is stationary and a source of sound is moving towards him
 - When he is moving towards a stationary source of sound (6 marks)
 - A boy walking towards a wall at a speed of 0.25 m/s in a direction at right angles to the wall. When he walks, he blows a whistle steadily. An observer toward whom the boy is walking hears 3 beats per second. If the speed of sound of sound is 340 m/s , what is the frequency of the whistle? (10 marks)
- 5.
- Define pitch, loudness, quality and intensity (8 marks)
 - Write an expression for the sound level change using Intensity or power of source relative to the threshold of hearing (4 marks)
 - A remotely operated machine gives rise to an average sound level of 100 dB at a distance of 8 m from the operating room. What is the acoustic power output of the machine (threshold of hearing = 10^{-12} W/m^2) (8 marks)
Assume that the machine radiates sound equally into a hemisphere.
- 6.
- Describe the interference of light and their application (4 marks)
 - A diffraction grating is ruled with $300 \text{ lines per millimeter}$. The wave length of a yellow color light source is 580 nm . What is the angle of the first order of a spectral line is observed? (6 marks)
 - A grating having $200 \text{ lines per in millimeter}$ produces spectra of mercury arc. The blue line of the mercury spectrum has a wavelength of 4358 \AA . What is the angular separation between the first-order blue line and the second-order blue line? (10 marks)
 $1 \text{ \AA} = 10^{-10} \text{ m}$

7.

- a. Write expressions for the frequencies of fundamental and of the first two overtones produced in an open organ pipe (4 marks)
- b. An organ pipe 1.4 m long is closed at one end. If the velocity of sound is 340 m/s , what are the frequencies of the fundamental and of the first two overtones? (6 marks)
- c. Two open pipes, one 1.25 m and 1.23 m in length, are sounded simultaneously. How many beats per second will be produced between the fundamental tones if the velocity of sound is 340 m/s ? (6 marks)

8.

- a. Describe the followings
- Refractive index of a medium
 - Total internal reflection (4 marks)
- b. Light is passing from air into a liquid and is deviated 19° when the angle of incidence is 52° . 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 35° , 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

$$y(x,t) = 25 \sin\left(180\pi t - \frac{60\pi}{25}x\right)$$

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

- The amplitude (2 marks)
- The frequency of the wave (4 marks)
- Its wave length (4 marks)
- Its speed (4 marks)
- The phase difference in radians between a point 0.55 m from O and 1.10 m from the origin O (6 marks)

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Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE:

FOUNDATION IST SEMESTER EXAMINATION QUESTION PAPER
Engineering Drawing

- This question paper consists of two questions.
- Answer All Questions
- Date: 2018.01.21

Pass mark 50%

Time allocated: 03 Hrs

Marking System

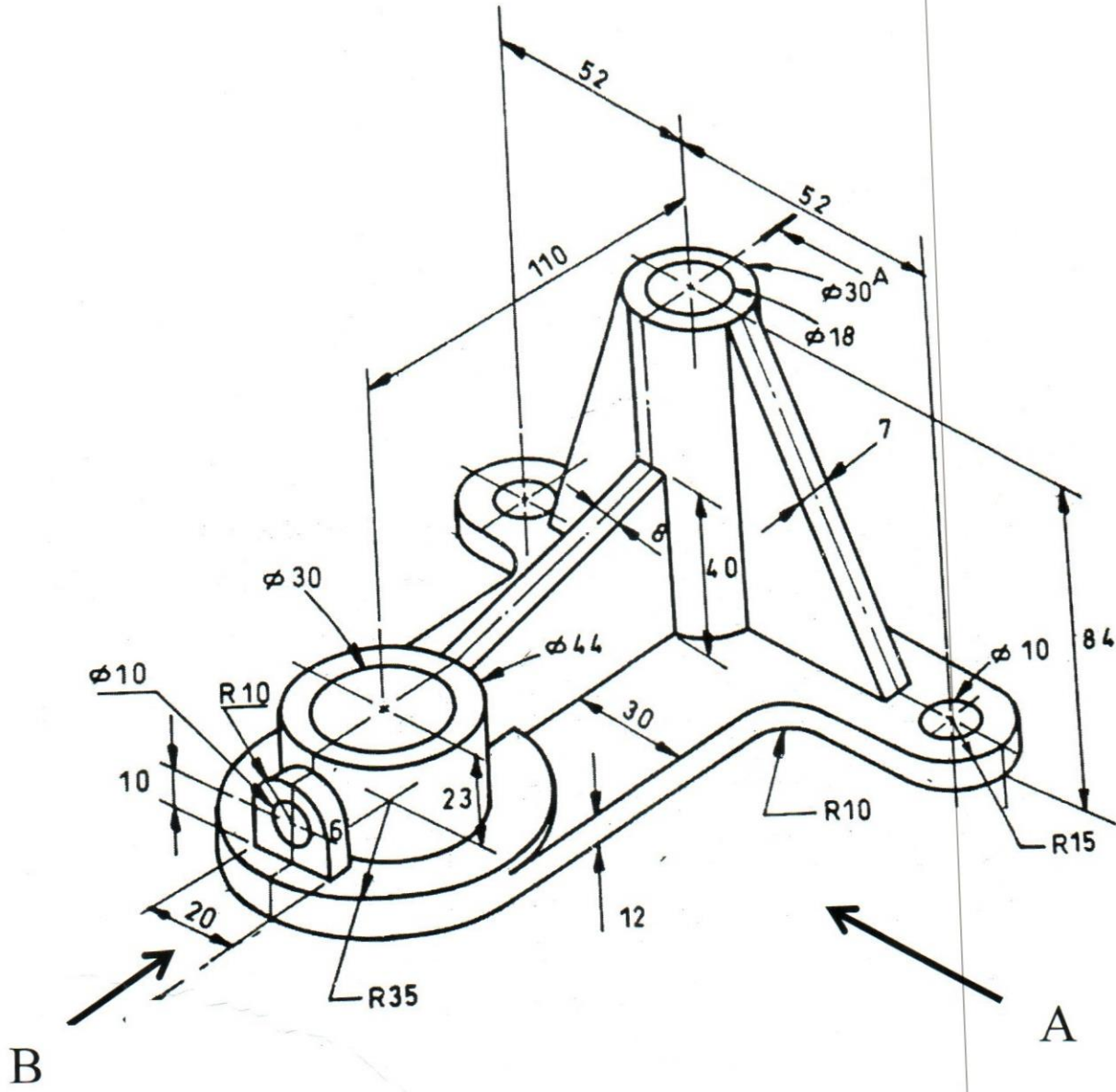
| | | | |
|-----|---|---|----------|
| I | Q: 1 | a | 30 Marks |
| II | Q: 1 | b | 20 Marks |
| III | Q: 1 | c | 20 Marks |
| IV | Q: 2 | | 20 Marks |
| V | Titles and Lettering | | 05 Marks |
| VI | Boundaries, Lines, and overall neatness | | 05 Marks |

- Q1 Figure below shows the pictorial view of horizontal cast-iron Bracket.
Using first angle projection, draw the following views assuming full scale.
- Front view looking from the direction of arrow 'A'
 - Side view looking in the direction of arrow 'B'
 - Top view

Assume. Missing dimensions

- Q2. Using geometrical construction methodologies, mark circumferential length of a circle of 80 mm diameter on a straight horizontal line and divide the line in to five equal parts.

Q1



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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340

IST SEMESTER EXAMINATION QUESTION PAPER
ELECTRONICS

- This question paper consists of six questions.
- Answer Any Five(05) Questions

Date: 2019.01.18

Pass mark 50%

Time allocated: 03 Hrs

➤ **Some helpful Data:**

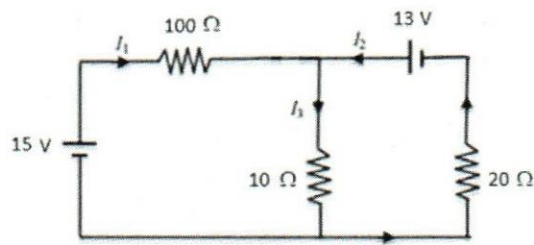
- * Permittivity of free air/ vacuum (ϵ_0) – 8.854×10^{-12} F/m
- * Charge of electron – 1.602×10^{-19} C

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

- * Resistor Colour Codes:

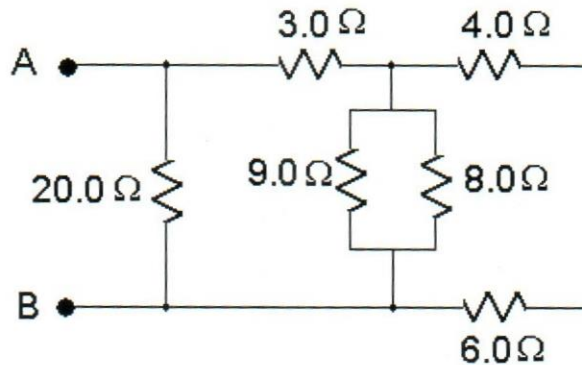
Black -0, Brown -1, Red -2, Orange -3, Yellow -4, Green -5, Blue -6, Purple -7, Grey -8, White -9, Gold – 5%, Silver -10%, No Colour -20%

1. a) Define resistance and resistivity. (8 marks)
b) What are the factors affecting the resistance of an electrical conductor? (6 marks)
c) Determine the nominal resistance values of these resistors, given their band colors, and express the allowable tolerance in ohms. (6 marks)
 - i. Red, Orange, Blue, Gold
 - ii. Brown, Black, Green, Silver
2. a) Define Ideal voltage source and ideal current source. (6 marks)
b)
i. Draw schematic circuit diagrams for the real voltage source and the real current source.
ii. If the real voltage source and real current source are equivalent, express current through current source in terms of e.m.f (E) and internal resistance (R_{int}) of voltage source. (6 marks)
c) Find the current in various resistors in the circuit shown in below by converting voltage sources into currents sources. (8 marks)



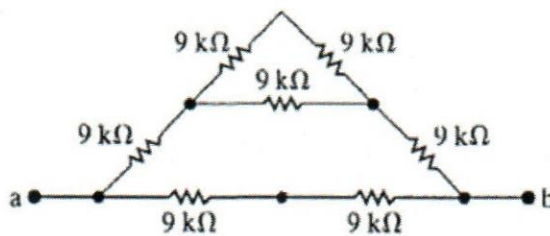
3. a) Evaluate the equivalent resistance between A and B.

(6 marks)



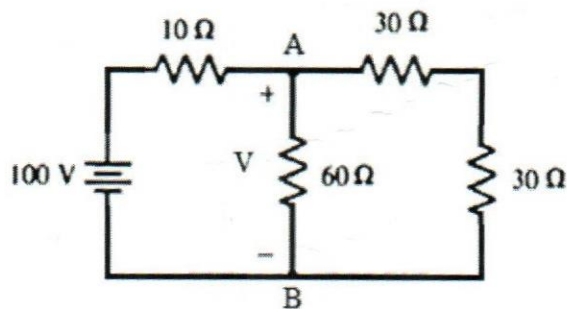
b) Using star delta transformation find equivalent resistance between a and b.

(6 marks)



c) Find value of V and the current through $60\ \Omega$ resistor. Given that the battery has internal resistance of zero.

(8 marks)



4. a) Explain the effect of temperature on semiconductors.

(6 marks)

b) What are the difference between intrinsic semiconductor and extrinsic semiconductor.

(6 marks)

c) Explain the behavior of p-n junction with V-I characteristics

(8 marks)

5. a) Explain forward biasing and reverse biasing of diodes.

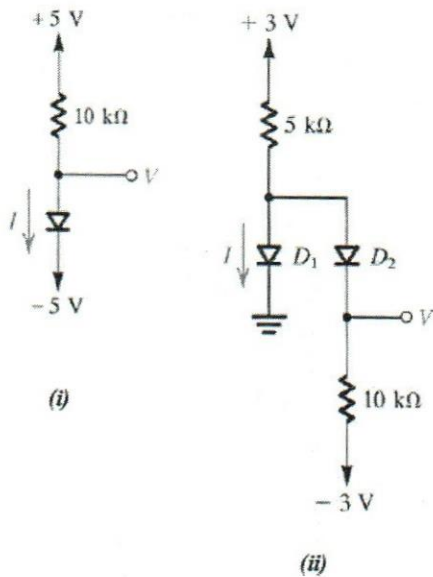
(6 marks)

b) Draw the full wave rectifier and the half wave rectifier circuit diagrams.

(6 marks)

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

(8 marks)

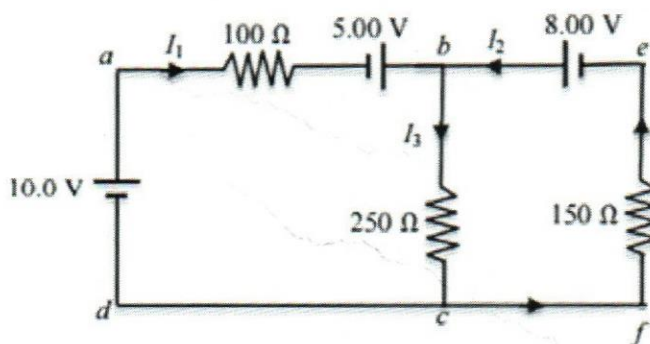


6. a) Express Kirchoff current and voltage laws.

(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 $V_e - V_f$, with the appropriate sign.

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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340

IST SEMESTER EXAMINATION QUESTION PAPER
MATHEMATICS

• This question paper consists of Nine questions.

• Answer Any Six (06) Questions

Date: 2019.01.18

Pass mark 50%

Time allocated: 03 Hrs

1.

- a. A function f is defined by $f : x \mapsto \sqrt{x+5}$, $x \in X = \{-4, -1, 3, 4\}$
- Write down the range of f (2 marks)
 - Write down all the ordered pairs of f (2 marks)
 - Is f one-to-one function? Give reasons (2 marks)
- b. If $g(x) = 2x^3 - x + 1$, $x \in R$, find the followings: $g(x^2)$, $g(2x-1)$, $g(1/x)$ (6 marks)
- c. If $f(x) = 2x^2 - 1$ and $g(x) = x + 2$, find : $f(x) \circ g(x)$, $g(x) \circ f(x)$, $f(x) \circ f(x)$, $g(x) \circ g(x)$ (8 marks)

2.

- a. Show that $\frac{\log 27 + \log 8 - \log 125}{\log 6 - \log 5} = 3$ without logarithmic tables (6 marks)
- b. If $a = \log\left(\frac{10}{9}\right)$, $b = \log\left(\frac{25}{24}\right)$, $c = \log\left(\frac{81}{80}\right)$, show that $\log 2 = 7a - 2b + 3c$ (6 marks)
- c. Solve the equation $2 \log_3 x - 2 \log_x 3 = 3$ (8 marks)

3.

a. Sketch the rough graphs of the following function

i. $f(x) = x^2 - x$ (4 marks)

ii. $f(x) = 2|x| - 1$ (4 marks)

iii. $f(x) = \frac{2x-1}{x+1}$ (6 marks)

b. If $f(x) = \frac{x+1}{x-1}$, show that $f(x) \circ f^{-1}(x) = f^{-1}(x) \circ f(x) = x$ (6 marks)

4.

a. Divide $3x^4 - x^2 + 7x - 1$ by $x^2 + 2$ (5 marks)

b. Find the constant A,B and such that:

i. $x^2 - 7x + 12 \equiv A(x+2)^2 + B(x+2) + C$ (5 marks)

ii. $2x^2 - 6x + 5 \equiv A(x-B)^2 + C$ (5 marks)

c. Show that $f(x) = 2x^3 - 3x^2 - 8x - 3$ is divisible by $(x+1)$ completely and hence find the factor of the expression. (5 marks)

5.

a. Resolve the followings into partial fraction

i. $\frac{8x+1}{x^2+x-2}$ (5 marks)

ii. $\frac{x^2+x-1}{(x^2+2)(x-2)}$ (5 marks)

iii. $\frac{2x^2+3x+3}{(x+2)(x-1)^2}$ (5 marks)

b. Solve the inequality $x+3 < x(x-1)$ (5 marks)

6.

a. If n is any positive integer, prove that $\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a} = na^{n-1}$ (4 marks)

b. Evaluate following limits (8 marks)

i. $\lim_{x \rightarrow 1} \frac{x^7 - 1}{x - 1}$

ii. $\lim_{x \rightarrow -2} \frac{x^5 + 32}{x + 2}$

c. Prove that $\lim_{x \rightarrow 0} \frac{\sin(\pi \cos^2 x)}{x^2} = \pi$ (8 marks)

7.

a. $f'(x)$ is called the derived function of $f(x) = \sin x$ and the process of obtaining the derivative function is called differentiation. Prove that $f'(x) = \cos x$. (6 marks)

b. Differentiate $x^2 \sin x$ with respect to x . (6 marks)

c. If $y = x \sin x$, prove that $x \frac{dy}{dx} = y + x\sqrt{x^2 - y^2}$ (8 marks)

8.

a. Calculate following trigonometric ratios without using tables. (6 marks)

i. $\sin 15^\circ$

ii. $\tan 105^\circ$

b. Prove that $\frac{\sin A}{1 - \cos A} = \frac{1 + \cos A}{\sin A}$ (7 marks)

c. Show that $\tan^{-1}\left(\frac{6}{17}\right) + \tan^{-1}\left(\frac{11}{23}\right) = \frac{\pi}{4}$ (7 marks)

9.

a. Find the general solution of $\sin\left(2x - \frac{\pi}{2}\right) = \frac{1}{2}$ (8 marks)

b. Hence, Sketch the trigonometric function $f(x) = 2 \sin\left(2x - \frac{\pi}{2}\right) - 1$, in between -2π and 2π (12 marks)



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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE: ED 0340

FIRST SEMESTER EXAMINATION QUESTION PAPER
Industrial Chemistry

- This question paper consists of six questions.
- Answer Five (05) Questions

Date: 2018.01.17

Pass mark 50%

Time allocated: 03 Hrs

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 - 39.0, Ca - 40.1, Ag - 108.0, Cu - 63.5, Fe - 56.0, Co - 58.9, Zn = 65.4, Ag = 107.9, Sn = 117

1.

i. Name the three particles of the atom with their respective charges.

(2 × 6 = 12 marks)

ii. Explain what is meant by saturated solution.

(04 marks)

iii. How many grams of potassium chloride (KCl) are required to prepare a 250 mL solution whose concentration is 2.16 mol dm⁻³?

(04 marks)

2. Write down the correct chemical name.

- i. KMnO₄
- ii. FeO
- iii. NaCl
- iv. H₂SO₄
- v. CaCl₂

- vi. HCl
- vii. CuSO₄
- viii. CO₂
- ix. CH₄
- x. TiO

(2 × 10 = 20 marks)

3. i. Zinc, is a metallic chemical element. It has the chemical symbol Zn and atomic number 30 with mass number 65. Find,
- The number of protons (p)
 - The number of electrons (e)
 - The number of neutrons (n)
 - Naturally occurring most abundant Zinc forms are ^{64}Zn and ^{68}Zn . What are these substances? Explain,

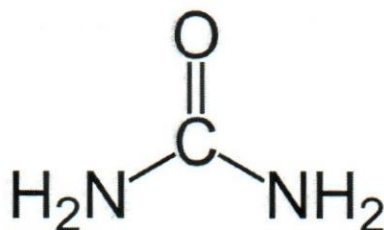
(2 × 4 = 08 marks)

ii. Define these terms.

- Chemical element
- Compound
- Metalloid
- Mixture
- Mole
- Atom

(2 × 6 = 12 marks)

4.



- i. Urea $[(\text{NH}_2)_2\text{CO}]$ is used for fertilizer and many other things. The molar mass of the compound is 60.00 g mol^{-1} . Calculate,
- The percent composition of H by mass.
 - The percent composition of N by mass.
 - The percent composition of C by mass in this compound.

(5 × 3 = 15 marks)

- ii. Zinc (Zn) is a silvery metal that is used in making brass (with copper) and in plating iron to prevent corrosion. How many moles of Zn are there in 23.3 g of Zn?

(05 marks)

5. i. 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)

i. 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.

(10 marks)

6.

i. Define the pH and pOH and express their equations.

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

iii. The pH of rainwater collected in a certain region of the northeastern United States on a particular day was 4.82. Calculate the H^+ ion concentration of the rainwater.

iv. In a NaOH solution $[\text{OH}^-]$ is $2.9 \times 10^{-4} \text{ M}$. Calculate the pH of the solution at 25 ^oC.

(5 x 4= 20 marks)

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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE: ED 0340

2ND SEMESTER EXAMINATION QUESTION PAPER
APPLIED MECHANICS

- This question paper consists of six questions.
 - Answer Any Five (05) Questions
 - Date: 2019.01.16
- Pass mark 50% Time allocated: 03 Hrs

1.

1.1 Two runners A and B are leading the field in a long distance race. They are both running at 5m/s with A 10m behind B. When B is 50m from the finishing tape, A accelerates but B doesn't. What is the least acceleration A must produce to overtake B? (10 marks)

1.2 If instead B accelerates at 0.1 m/s^2 up to the tape, what is the least acceleration A must produce? (10 marks)

2.

2.1 State Newton's second laws (6 marks)

2.2 On a particular journey the resistance to motion of a car of mass 1000kg is proportional to its speed. The car is travelling at a constant speed of 15m/s with a driving force of 870N. The driving force is instantaneously increased to 1200N.

- Find the instantaneous acceleration produced (6 marks)
- Find the resistance to motion and the acceleration when the car is moving at 20m/s (8 marks)

3.

A man of mass M kg and his son of mass m kg are standing in a lift. When the lift is accelerating upward with magnitude 1 m/s^2 the magnitude of the normal contact force exerted on the man by the lift floor is 880N. When the lift is moving with constant speed the combined magnitude of the normal contact forces exerted on the man and the boy by the lift floor is 1000N. Find the values of M and m. (20 marks)

4.

4.1 A particle of weight 10N is placed on a smooth plane included at 55° to the horizontal. Find the magnitude of the force required to keep the particle in equilibrium if it acts;

- Parallel to the plane (5marks)

II Horizontally

(5 marks)

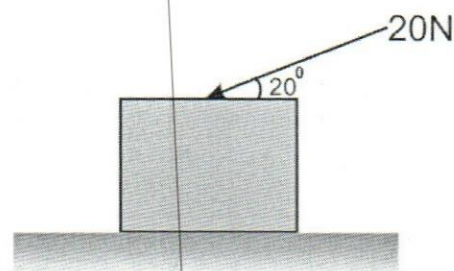
III Upwards at an angle of 25° to a line of greatest slope of the plane

(5 marks)

4.2 Without making any calculations state, with reason, which of the three cases has the greatest normal contact force. (5 marks)

5.

5.1 The diagram shows a force of magnitude 20N acting downwards at 25° to the horizontal on a block of mass 4kg, which is at rest in limiting equilibrium on a horizontal surface. Calculate the coefficient of friction between the block and the surface. (10 marks)



5.2 Calculate the acceleration with which the block starts to move if the direction of the force of magnitude 20N is reversed. (Consider a "pull" of magnitude 20N, acting 25° upward to the horizontal) (10 marks)

6.

6.1 A stone is thrown upwards with an initial velocity of 25m/s from a point **30m above ground**.

I Find the maximum height of the stone above ground.

(5 marks)

II Find the time when the stone hits the ground

(5 marks)

III Display (t,v) graph for the motion of the stone (up to the time when it hits the ground)

(5 marks)

IV Display a graph showing the change in height of the stone as a function of time (t,s) (5 marks)

7.

7.1 Explain the relationship between Work-done and Energy

(6 marks)

7.2 A tractor of mass 500kg pulls a trailer of mass 200 kg up a rough slope inclined at 17° to the horizontal. The resistance to the motion is 4N per kg. Calculate the work done by the tractor engine, given that the vehicle travels at a constant speed of 1.4 m/s for 2 minutes. (14 marks)

8.

8.1 What is meant by conservation of energy?

(6 marks)

8.2 A particle is projected with speed 4m/s up and along a surface (ramp) inclined at 30° to the horizontal. It reaches the top ramp with speed 1.2 m/s. If the inclined surface is smooth (frictionless), what is the length of the ramp. (14 marks)



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 1ST SEMESTER EXAMINATION QUESTION PAPER
 Introduction to the Shipping

- This question paper consists of Five questions.
- Answer All Questions

Date: 2019.01.16

Pass mark 50%

Time allocated: 03 Hrs

-
1. With an aid of a suitable sketch show following principle parts of a ship.
 Keel, Propeller, Rudder, Hull, Bow thruster, Main deck, Double bottom tank, After peak tank, Fore peak tank, Life boat, Cargo hold, Navigation bridge, Navigation lights, Main mast, Windlass, Anchor, Anchor locker, Cargo crane, Accommodation ladder, Poop deck, Monkey island, Engine room, Port hole, Hatch cover, Funnel. (20 marks)
 2. Make a list of safety gears which should be worn when performing following jobs.
 - i. Painting bridge front (04 marks)
 - ii. Changing bulbs in the Christmas tree. (04 marks)
 - iii. Performing a welding work on main deck (04 marks)
 - iv. Removing cylinder head of main engine (04 marks)
 - v. Entering double bottom tank. (04 marks)
 3. Explain the meaning of following abbreviation (a shortened form of a word)
 Example: OT = over time
 - i. IMO, ETA, ETD, SOLAS, MARPOL, LSA, FFA, ROB, SOPEP, EEBD, (10 marks)
 - ii. Name 5 FFA items and 5 LSA items. (10 marks)
 4. (a) Make a list of different type of ships widely used in shipping industry for transporting Cargo, vehicles and passengers. (10 marks)
 (b) Briefly describe 5 of them. (10 marks)
 5. (a) Explain following terms using suitable sketches where necessary
 - (i) Trim (ii) List (iii) Pitching (iv) rolling (10marks)
 - (b) (i) Explain what is the purpose of sounding tape? (04 marks)
 - (ii) Briefly explain how to use a sounding tape? (06 marks)

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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE: ED 0340

FINAL EXAMINATION QUESTION PAPER
Engineering Drawing

- Answer All Questions

Date: 2018.09.06

Pass mark 50%

Time allocated: 03 Hrs

Marking System

| | | |
|-------|---|----------|
| (i) | Q 1 | 60 Marks |
| (ii) | Q 2 | 30 Marks |
| (iii) | Titles and Lettering | 05 Marks |
| (iv) | Boundaries, Lines, and overall neatness | 05 Marks |

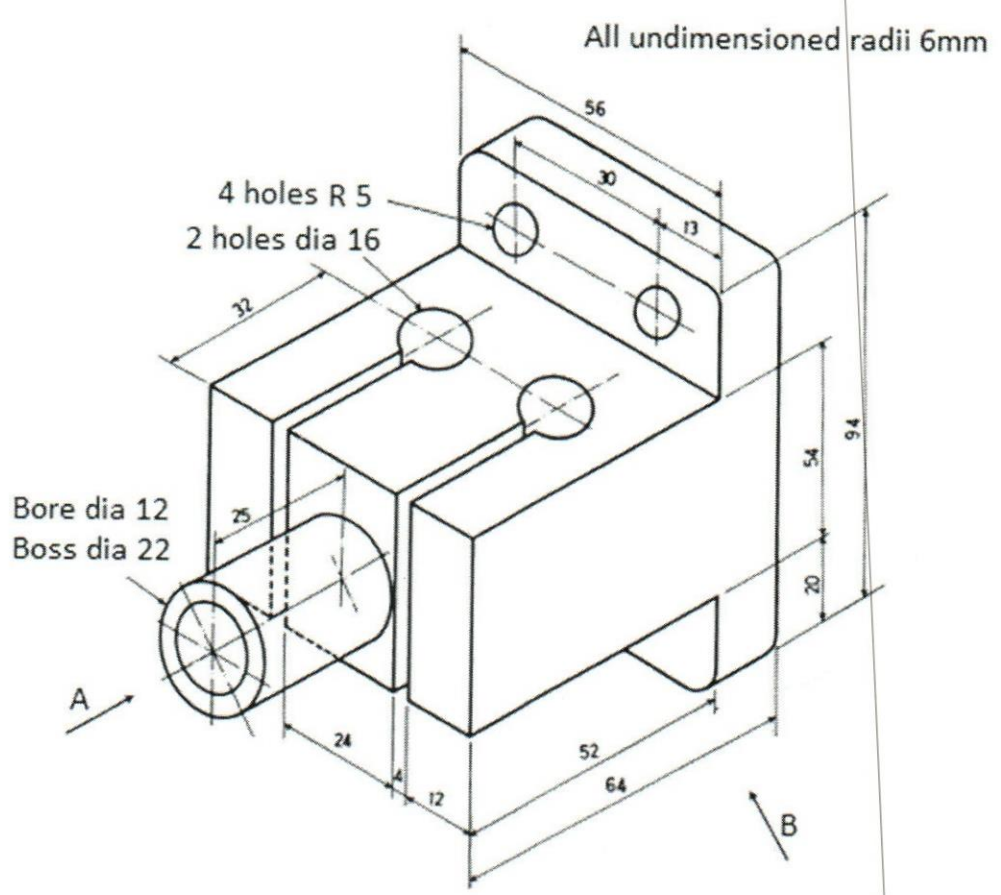
Q1. Using third angle orthographic projection, draw the machined steel casting as per the given detail in full scale and fully dimension the drawing. (All dimensions are in mm) Following views are required;

- I. Front elevation from A
- II. End elevation from B
- III. Plan view

Q2. Construct an ellipse using rectangular method having an 80 mm major axis and 50 mm minor axis.

4

Q1





Colombo International Nautical and Engineering College

CINEC CAMPUS

Faculty of Marine Engineering

Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340

103

FINAL EXAMINATION QUESTION PAPER

Physics

- This question paper consists of six questions.

- Answer Any SIX Questions

Date: 2018.09.05

Pass mark 50%

Time allocated: 03 Hrs

$$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2, \mu_0 = 4\pi \times 10^{-7} \text{ H/m}, m_e = 9.11 \times 10^{-31} \text{ kg}, m_p = 1 \text{ amu} = 1.6726 \times 10^{-27} \text{ kg}, e = 1.6 \times 10^{-19} \text{ C}$$

1.

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

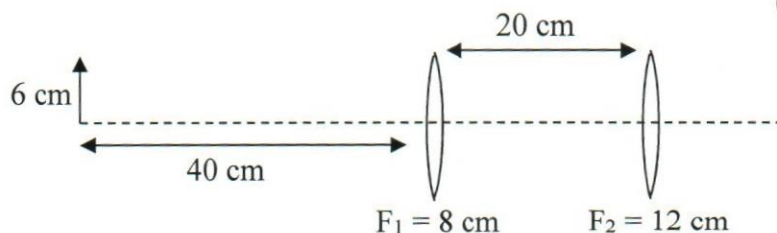
i. Outside the front focal point F

ii. Inside the front focal point F

(8 marks)

- b. An object 6 cm high is placed 40 cm from a thin converging lens of 8 cm focal length. A second converging lens of 12 cm focal length is placed 20 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 **535** and **1605 kHz**. The VHF television stations have frequencies between **54** and **216 MHz**. While the UHF have frequencies between **470** and **890 MHz**. What is the wavelength corresponding to each of the frequencies mentioned? (6 marks)

- b. Ultra violet-light ranges in wavelength roughly from violet at **360 nm** to **70 nm**. Its speed in vacuum is about 3×10^8 m/s, as is the case for all electromagnetic waves. Determine the corresponding frequency range. (4 marks)

- c. Ultra violet-light ranges in wavelength roughly from violet at **360 nm** to **70 nm**. Its speed in vacuum is about 3×10^8 m/s, as is the case for all electromagnetic waves. Determine the corresponding frequency range. (4 marks)

- d. Radar set for determining the speed of approaching cars sends out waves of frequency **1000 MHz**. If the beat frequency observed is **180 Hz**, what is the speed of the car?

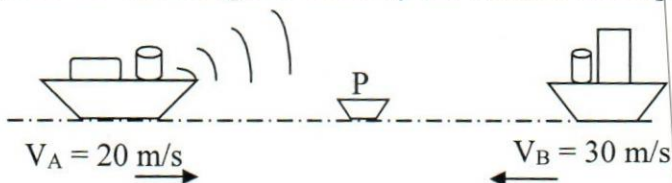
(6 marks)

3. As shown in figure, an observer P on a boat is standing between two parallel ship paths when the ships approach from opposite direction. Ship A has a speed 20 ms^{-1} . It blows its horn, which has frequency 200 Hz . The ship B has a speed 30 ms^{-1} . The speed of sound in the air is 340 ms^{-1} , and no breeze is blowing.

- a. Find the wavelength and frequency of the sound waves observer P receives from ship A (10 marks)

- b. Write an equation for the apparent frequency which heard by the watcher on ship B (5 marks)

- c. Find the frequency and the wavelength is heard by the watcher on ship B (5 marks)



4.

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

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

- a. A solenoid with **500** turns is wound on an iron ring **80 mm^2** In cross-sectional area, of **6 cm** length and of **2000** relative permeability. If the windings carry **300 mA**, determine

- i. The permeability of iron (4 marks)

- ii. The flux density in the iron core (4 marks)

- iii. Total flux inside the solenoid (4 marks)

5.

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

- b. What is the speed of light in crystalline quartz? Assume the index of refraction of quartz to be **1.553** and speed of light in free space to be **$3.0 \times 10^8 \text{ ms}^{-1}$** . (5 marks)

- c. The index of refraction of a flint glass is **1.64**. Find the speed of light in the glass, the angle of refraction in glass if light is incident from water at an angle of **50°** , and critical angle of incidence for glass- water interface. (12 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. Hence find the **magnetic field** at appoint **100 mm** from a wire carrying a current of **5 A**. (6 marks)

- c. Two long parallel wires separated by distance 100 mm . There is current of 5 A in wire 1 and a current of 10 A in wire 2 in same directions.
- Find the magnetic total magnetic field at the point which is on the line joining the wire and 30 mm from wire 1 and 70 mm from wire 2. (5 marks)
 - At what *point* on the line joining the wires is the *magnetic field zero*? (5 marks)

7.

- 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 (4 marks)
- He 2^+ ion travels at right angles to a magnetic field of 0.8 T with a velocity of 10^5 m/s . Find the magnitude of the magnetic force on the ion. (4 marks)
- An electron is moving with a speed of $5 \times 10^7 \text{ m/s}$ at right angle to a magnet field of 0.5 T . What is the magnetic force on the electron? What is the radius of the electron moves? (8 marks)
- A proton beam is bent in a circle of radius 2 m by a uniform field with 10 T . what is the speed of the proton? (4 marks)

8.

- Describe the *Fleming's left hand rule* (5 marks)
- Write an expression for the force on a current carrying conducting rod in a magnetic field (5 marks)
- Determine the force act on a current carrying conductor of 0.5 m long which is kept in a magnetic field of 0.2 T if the current in the conductor is 2 A . (5 marks)
- A coil of 20 turns has an area of 800 mm^2 and bears a current of 0.5 A . It is placed with its plane parallel to a magnetic field of intensity 0.3 T . Determine the torque on the coil. (5 marks)

9.

- Describe the *Faraday law* and *Lenz's law* of electromagnetic induction (6 marks)
- A horizontal wire 0.5 m long is falling at a speed of 10 m/s perpendicular to a uniform magnetic field of 1.1 T , which is directed from east to west. Calculate the magnitude of the induced emf (4 marks)
- Describe the Fleming's right hand rule (4 marks)
- The perpendicular component of the external magnetic field through a 20 turn coil of radius 21 mm increases from 0 to 20 T in 4 s . If the resistance of the coil is 4Ω ,
 - What is the magnitude of the induced current? (4 marks)
 - What is the direction of current (2 marks)



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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340

FINAL EXAMINATION QUESTION PAPER

Physics

- This question paper consists of NINE questions.
- Answer Any SIX Questions

Date: 2018.09.05

Pass mark 50%

Time allocated: 03 Hrs

$$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2, \mu_0 = 4\pi \times 10^{-7} \text{ H/m}, m_e = 9.11 \times 10^{-31} \text{ kg}, m_p = 1 \text{ amu} = 1.6726 \times 10^{-27} \text{ kg}, e = 1.6 \times 10^{-19} \text{ C}$$

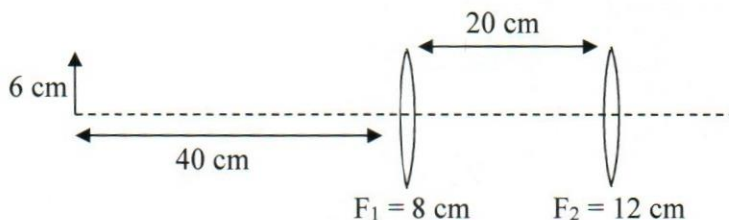
1.

- a. Describe the image formed by a thin converging lens when a real object is situated
- Outside the front focal point F
 - Inside the front focal point F

(8 marks)

- b. An object 6 cm high is placed 40 cm from a thin converging lens of 8 cm focal length. A second converging lens of 12 cm focal length is placed 20 cm from the first lens as shown in figure. Find the position, size, and characters of the final image.

(12 marks)



2.

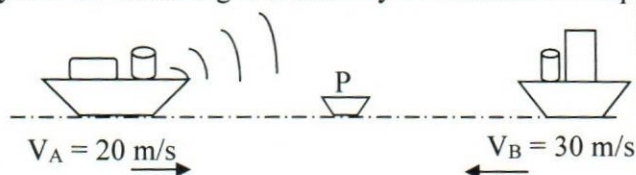
- a. A standard radio broadcasting station has an assigned frequency between **535** and **1605 kHz**. The VHF television stations have frequencies between **54** and **216 MHz**. While the UHF have frequencies between **470** and **890 MHz**. What is the wavelength corresponding to each of the frequencies mentioned? (6 marks)
- b. Ultra violet-light ranges in wavelength roughly from violet at **360 nm** to **70 nm**. Its speed in vacuum is about 3×10^8 m/s, as is the case for all electromagnetic waves. Determine the corresponding frequency range. (4 marks)
- c. Ultra violet-light ranges in wavelength roughly from violet at **360 nm** to **70 nm**. Its speed in vacuum is about 3×10^8 m/s, as is the case for all electromagnetic waves. Determine the corresponding frequency range. (4 marks)

- d. Radar set for determining the speed of approaching cars sends out waves of frequency 1000 MHz . If the beat frequency observed is 180 Hz , what is the speed of the car?

(6 marks)

3. As shown in figure, an observer P on a boat is standing between two parallel ship paths when the ships approach from opposite direction. Ship A has a speed 20 ms^{-1} . It blows its horn, which has frequency 200 Hz . The ship B has a speed 30 ms^{-1} . The speed of sound in the air is 340 ms^{-1} , and no breeze is blowing.

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- 4.
- State the *Biot-Sarvart* law (4 marks)
 - Write an expression for the *magnetic flux density (B)* inside a current (*I*) carrying solenoid whose length is *L* and number of turns is *N* (4 marks)
 - A solenoid with **500** turns is wound on an iron ring 80 mm^2 in cross-sectional area, of **6 cm** length and of **2000** relative permeability. If the windings carry **300 mA**, determine
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 - Total flux inside the solenoid (4 marks)

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 - What is the speed of light in crystalline quartz? Assume the index of refraction of quartz to be 1.553 and speed of light in free space to be $3.0 \times 10^8 \text{ ms}^{-1}$. (5 marks)
 - The index of refraction of a flint glass is 1.64 . Find the speed of light in the glass, the angle of refraction in glass if light is incident from water at an angle of 50° , and critical angle of incidence for glass- water interface. (12 marks)

- 6.
- States the *Amperes' law*. (4 marks)
 - Write an expression for the *magnetic field* produced by an infinitely long current carrying conductor. Hence find the *magnetic field* at appoint *100 mm* from a wire carrying a current of *5 A*. (6 marks)
 - Two long parallel wires separated by distance *100 mm*. There is current of *5 A* in wire 1 and a current of *10 A* in wire 2 in same directions.
 - Find the magnetic total magnetic field at the point which is on the line joining the wire and *30 mm* from wire 1 and *70 mm* from wire 2. (5 marks)
 - At what *point* on the line joining the wires is the *magnetic field zero*? (5 marks)
- 7.
- 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 (4 marks)
 - He 2^+ ion travels at right angles to a magnetic field of *0.8 T* with a velocity of *10^5 m/s*. Find the magnitude of the magnetic force on the ion. (4 marks)
 - An electron is moving with a speed of *5×10^7 m/s* at right angle to a magnet field of *0.5 T*. What is the magnetic force on the electron? What is the radius of the electron moves? (8 marks)
 - A proton beam is bent in a circle of radius *2 m* by a uniform field with *10 T*. what is the speed of the proton? (4 marks)
- 8.
- Describe the *Fleming's left hand rule* (5 marks)
 - Write an expression for the force on a current carrying conducting rod in a magnetic field (5 marks)
 - Determine the force act on a current carrying conductor of *0.5 m* long which is kept in a magnetic field of *0.2 T* if the current in the conductor is *2 A*. (5 marks)
 - A coil of *20* turns has an area of *800 mm^2* and bears a current of *0.5 A*. It is placed with its plane parallel to a magnetic field of intensity *0.3 T*. Determine the torque on the coil. (5 marks)
- 9.
- Describe the *Faraday law* and *Lenz's law* of electromagnetic induction (6 marks)
 - A horizontal wire *0.5 m* long is falling at a speed of *10 m/s* perpendicular to a uniform magnetic field of *1.1 T*, which is directed from east to west. Calculate the magnitude of the induced emf (4 marks)

- c. Describe the Fleming's right hand rule (4 marks)
- d. The perpendicular component of the external magnetic field through a **20 turn** coil of radius **21 mm** increases from 0 to **20 T** in **4 s**. If the resistance of the coil is **4 Ω** ,
- i. What is the magnitude of the induced current? (4 marks)
 - ii. What is the direction of current (2 marks)

Litronics



Colombo International Nautical and Engineering College

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Faculty of Marine Engineering

Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340

115

FINAL EXAMINATION QUESTION PAPER
ELECTRONICS

- This question paper consists of SIX questions.
- Answer Any FIVE(05) Questions

Date: 2018.09.04

Pass mark 50%

Time allocated: 03 Hrs

* Permittivity of free air/ vacuum (ϵ_0) – 8.854×10^{-12} F/m

* Resistor Color 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 Color -20%

01. a) Draw the circuit symbols of npn and pnp transistors. (4 marks)

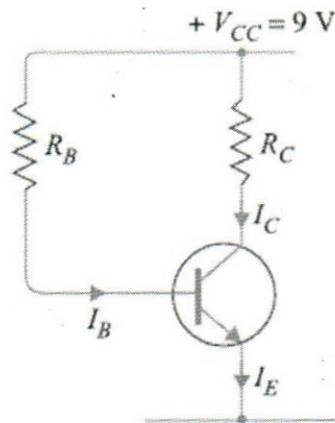
b) What are the types of transistor configurations and write current gain equations each type? (6 marks)

c) Draw the circuit diagrams for the method of feedback resistor biasing transistor. (2 marks)

d) Following circuit shows biasing by base resistor method. If it is required to set the operating point at 1mA, 6 V, find the values of R_C , R_B and draw load line.

Given $\beta = 150$, $V_{BE} = 0.3$ V.

(8 marks)



02. a) Draw inverting and non-inverting voltage operational amplifier circuits. (5 marks)

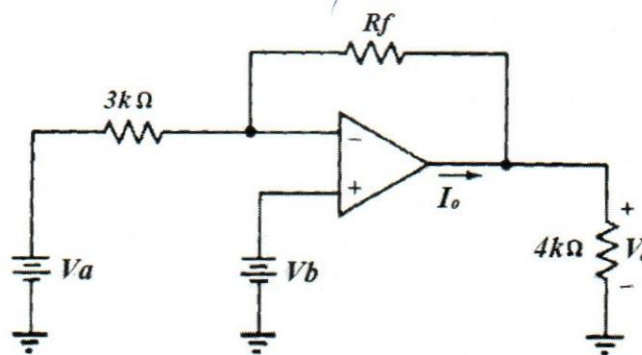
b) In following circuit, feedback resistor R_f , dc voltages V_a and V_b are connected with operational amplifier. Assuming no saturation for part i. and ii.

(10 marks)

i. If $R_f = 12k\ \Omega$, $V_a = 2V$ and $V_b = 0V$. Determine V_o and I_o

ii. Repeat part i. for $R_f = 9k\ \Omega$, $V_a = 4V$ and $V_b = 2V$.

c) If $V_a = 5V$ and $V_b = 3V$ and determine the minimum value of R_f that will produce saturation if the saturation voltage levels are $V_o = \pm 14V$ (5 marks)

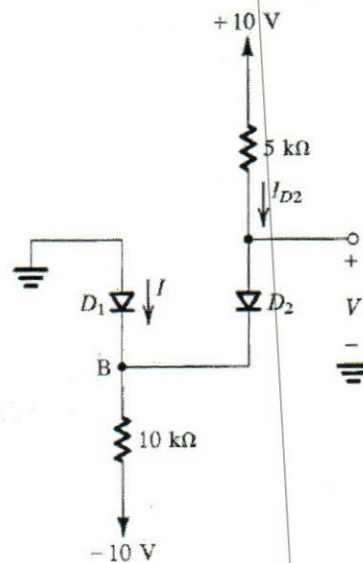
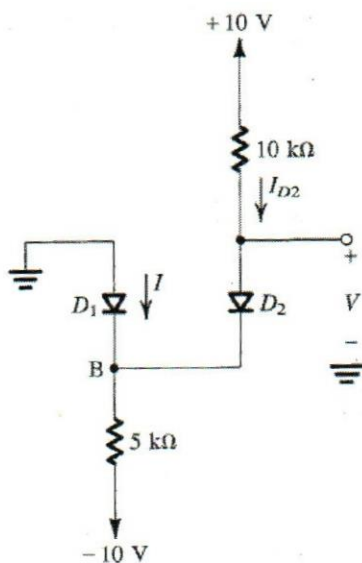


03. a) Explain forward biasing and reverse biasing of real diode. (6 marks)

(6 marks)

b) Assuming diodes to be Ideal find the values of I and V in the circuits below.

(8 marks)



c) Explain the behavior of full wave rectifier circuit when applying alternating current?

(6 marks)

04. a) Define capacitance

(5 marks) 05

b) Calculate the capacitance of two metal plates of area 30 m^2 and separated by a dielectric 2 mm thick, relative permittivity 6 and $\epsilon_0 = 8.854 \times 10^{-12}$.

(5 marks) n

c) Three capacitors of capacitance $2 \mu\text{F}$, $4 \mu\text{F}$ and $6 \mu\text{F}$ respectively are connected in series to a 220 V d.c. supply.

(10 marks)

- Find
- the total capacitance
 - charge on each capacitor
 - potential difference across each capacitor.

05. a) State Ohm's law.

(5 marks)

b) Six resistors are connected as shown circuit. If a battery having an e.m.f. of 24 V and internal resistance of 1Ω is connected to the terminal A and B.

- Find
- Equivalent resistance between A and B.
 - the current from the battery
 - Potential difference across 8Ω and 4Ω resistors
 - the current taken from the battery if a conductor of negligible resistance is connected in parallel with 8Ω resistor.

(15 marks)

06 a) Express Kirchhoff current and voltage laws.

(4 marks)

a) Consider the DC circuit shown in Figure 1 and note that the direction of the currents shown in the figure are arbitrary.

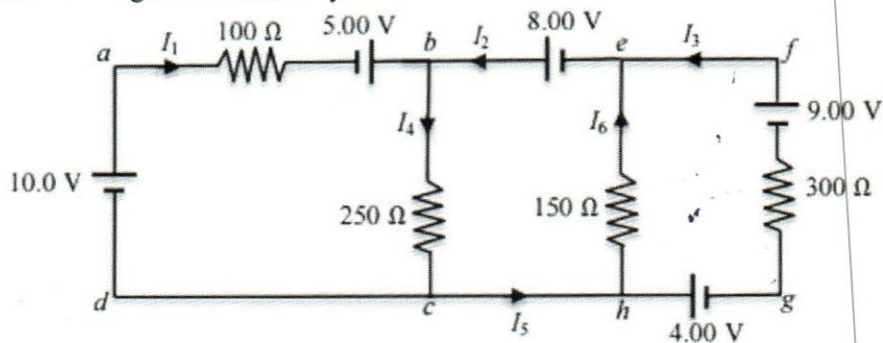


Figure 1

- Find each branch current.
- What is the direction of the current through 250Ω resistor? (from b to c or from c to b)

(8 marks)

(4 marks)

- Determine the potential difference $V_d - V_f$, with the appropriate sign.

(4 marks)

Library



2 5

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FACULTY OF MARINE ENGINEERING
DEPARTMENT OF MARINE ENGINEERING
EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE: ED 0340 BATCH 020

MID-TERM EXAMINATION - QUESTION PAPER
PHYSICS



- Answer any 6 questions only
- Total Marks - 120

Date: 2018.06.23

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 $x = 10 \text{ cm}$ 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
- When the object is placed at infinity
 - 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:
- When he is stationary and a source of sound is moving towards him
 - 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 ruled with **3000 lines per centimeter**. The first order of a spectral line is observed to be diffracted at an angle of **20°**. What is the wavelength of the radiation? (6 marks)
- c. A grating having **2300 lines per centimeter** produces spectra of mercury arc. The green line of the mercury spectrum has a wavelength of **5461 Å**. What is the angular separation between the first-order green line and the second-order green line? (10 marks)

$$1 \text{ Å} = 10^{-10} \text{ m}$$

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.
- Write expressions for the frequencies of fundamental and of the first two overtones produced in an closed organ pipe (4 marks)
 - 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)
 - 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.
- Describe the followings
 - Refractive index of a medium
 - Total internal reflection (4 marks)
 - Light is passing from air into a liquid and is deviated 19° when the angle of incidence is 52° . Under what conditions will total reflection occur at this interface. (6 marks)
 - 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° , 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

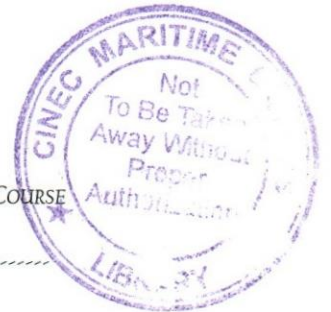
- The amplitude (2 marks)
- The frequency of the wave (4 marks)
- Its wave length (4 marks)
- Its speed (4 marks)
- The phase difference in radians between a point 0.1 m from O and 1.10 m from the origin O (6 marks)

END.

Lebrary



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1ST SEMESTER EXAMINATION QUESTION PAPER
Introduction to Shipping

- This question paper consists of five questions.
- Answer All Questions

Date: 2018.06.20

Pass mark 50%

Time allocated: 03 Hrs

1. Indicate following areas and parts of a merchant ship with an aid of a sketch.
 - a) Accommodation, navigation bridge, engine room, draft, beam, bow, stbd side, port side, out board, inboard, keel, D.B. tank, Anchor, chain locker, propeller, rudder and main mast, (16 marks)
 - b) Explain the meaning of knot and nautical mile. (4 marks)
2.
 - a) Give 10 kind of safety gear widely used on board. (10marks)
 - b) Explain most important 5 gears from above list. (10marks)
3.
 - a) List 10 types of trading ship widely available at sea. (10 marks)
 - b) Explain following terms using suitable sketches where necessary
(i) Trim (ii) List (iii) Pitching (iv) rolling (10marks)
4. Explain the use of following components of a motor ship.
Steering gear, Bow-thruster, Ballast tank, Emergency fire pump and Life boat (20 marks)
5.
 - a) Explain what stands for each letter of word "FIRE" (4 marks)
 - b) What is fire triangle and what are the principle methods of fighting a fire (6 marks)
 - c) Sketch and describe any type of portable fire extinguisher. (10 marks)



05-16

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COURSE CODE: ED 0340

IST SEMESTER EXAMINATION QUESTION PAPER
Engineering Drawing

- Answer All Questions

Date: 2018.06.19

Pass mark 50%

Time allocated: 03 Hrs

Marking System

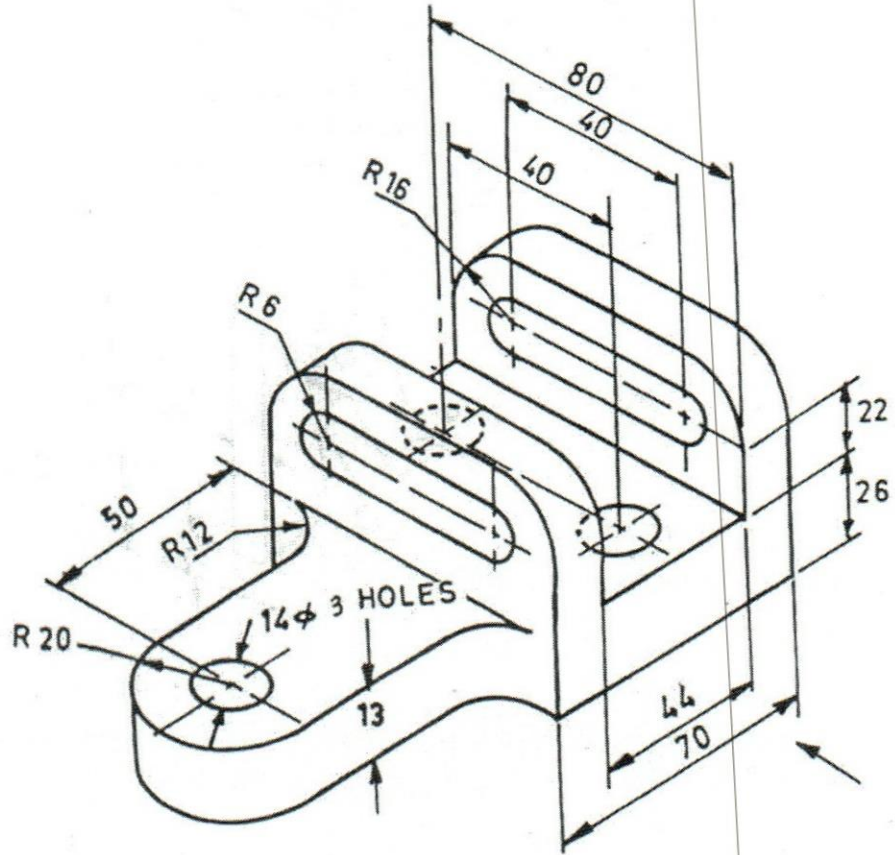
| | | |
|-------|---|----------|
| (i) | Q 1 | 60 Marks |
| (ii) | Q 2 | 30 Marks |
| (iii) | Titles and Lettering | 05 Marks |
| (iv) | Boundaries, Lines, and overall neatness | 05 Marks |

Q1. Using third angle orthographic projection, draw the cast steel bracket as per the given detail in full scale and fully dimension the drawing. Following views are required;

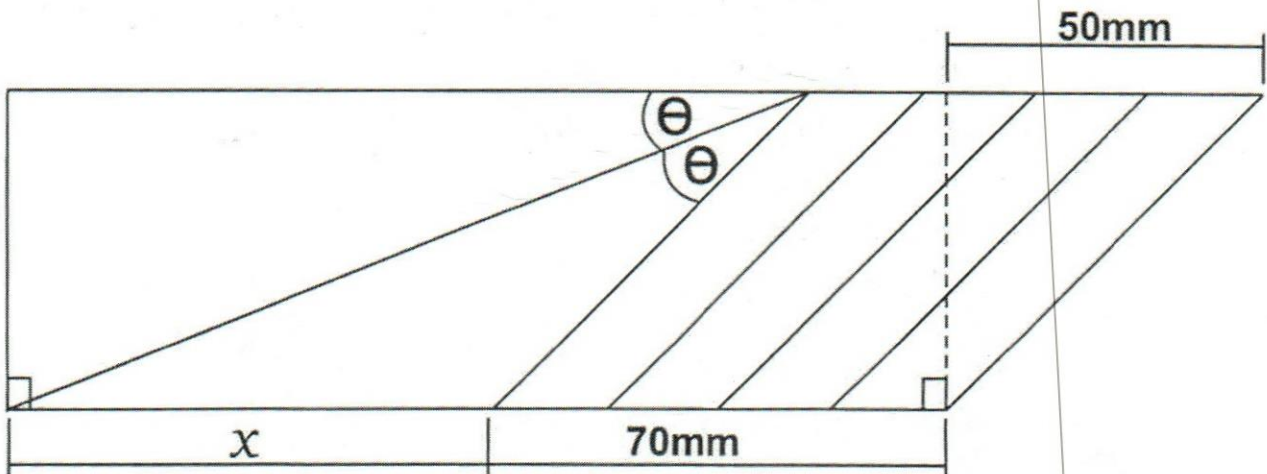
- I. Front elevation from A
- II. End elevation from B
- III. Plan view

Q2. Construct the geometric figure as per the given figure in full scale and mark an approximate dimension value for "x" in the figure.

Q 1



Q 2





COLOMBO INTERNATIONAL NAUTICAL AND ENGINEERING COLLEGE
CINEC CAMPUS
FACULTY OF MARINE ENGINEERING
DEPARTMENT OF MARINE ENGINEERING
EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE: ED 0340

MID EXAMINATION – QUESTION PAPER
APPLIED MECHANICS

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

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)
- His acceleration from O to A.
 - His retardation (deceleration) from B to C.
 - The total distance traveled from O to C.
- (9 marks)
- c) A tractor exerts a force of $5 \times 10^3 \text{ N}$ 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 $4.9 \times 10^3 \text{ J}$ of work. How deep is the well?

(6 marks)

2)

- i. A particle is projected with a velocity of $u \text{ ms}^{-1}$ at an angle θ to the horizontal. (gravitational acceleration is $g \text{ ms}^{-2}$). Show that the horizontal range of the 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° with the horizontal. Determine the velocity of another body thrown at an angle of elevation of 45° which will have
- Equal time of flight
 - Equal maximum height

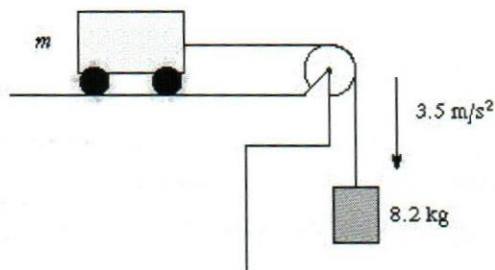
(2 × 10 = 20 marks)

3)

- i. State Newton's second law of motion

(4 marks)

ii.



- Mark all the forces acting on the system
- Find the mass of the car and the tension in the string

(13 marks)

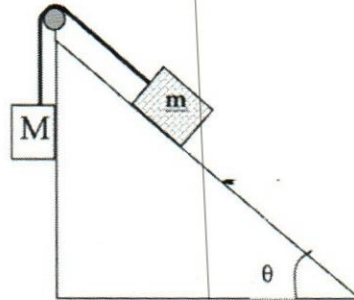
- iii. An SUV with mass $1.80 \times 10^3 \text{ kg}$ is traveling eastbound at 15.0 m/s , while a compact car with mass $9.00 \times 10^2 \text{ kg}$ is traveling westbound at 15.0 m/s . The cars collide head-on, becoming entangled.

- Find the speed of the entangled cars after the collision.
- Find the change in the velocity of each car.
- 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 $M = 8.0 \text{ kg}$ $m = 6 \text{ kg}$ and $\theta = 30^\circ$. (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 kgm^2 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 $4.00 \times 10^2 \text{ m}$. 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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CINEC CAMPUS

Faculty of Marine Engineering

Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340

2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
Mathematics

- This question paper consists of Nine questions.
- Answer Any Six(06) Questions

Date: 2018.02.01

Pass mark 50%

Time allocated: 03 Hrs

-
1. a) Find $\lim_{x \rightarrow 1} \frac{x^2 - x + 3}{3x + 1}$ (6 marks)
- b) Find $\lim_{x \rightarrow 4} \frac{x^2 - 3x - 4}{2x^2 - 9x + 4}$ (6 marks)
- c) Evaluate $\lim_{x \rightarrow \pi/4} \frac{\sin x - \cos x}{x - \pi/4}$ (8 marks)
2. a) Differentiate with respect to x, (6 marks)
- i. $y = 2x^3 + x^3 - 7x + 3$ ii. $y = \frac{3-2}{\sin x}$
- b) Find $\frac{dy}{dx}$ in terms of the parameter t, if $y = \sin(t)$ and $x = 3t^2$. (6 marks)
- c) Given that $y = x - \tan^{-1}x$, prove that $\frac{d^2y}{dx^2} - 2x \left(1 - \frac{dy}{dx}\right)^2 = 0$ (8 marks)
3. a) Integrate with respect to x (6 marks)
- i. $\int (2x^3 + \frac{4}{x^2} - \frac{1}{x} + 1) dx$ ii. $\int (3\sin x - 5e^x + \operatorname{cosec}^2 x) dx$
- b) Determine the partial fractions of $\frac{x-1}{(x+1)(x+3)}$ (6 marks)
- c) Hence, Evaluate $\int \frac{x-1}{(x+1)(x+3)} dx$ (6 marks)
4. In the binomial expansion of $(x^2 - \frac{1}{x})^{12}$, Find
- a) the coefficient of x^9 (10 marks)
- b) the term independent of x. (10 marks)

5. a) Without using tables or calculator, evaluate (6 marks)
 i. $\sin 15^\circ \cos 15^\circ$ ii. $\cos^2 22.5^\circ - \sin^2 22.5^\circ$
- b) Prove that (8 marks)
 i. $\frac{\cos x - \sin x}{\cos x + \sin x} = \frac{1 - \sin 2x}{\cos 2x}$ ii. $\sin 3x = 3 \sin x - 4 \sin^3 x$
- c) Given that $0 \leq x \leq 2\pi$, solve the equation $\sqrt{3} \sin x + \cos x = 1$ (6 marks)
6. a) Solve the quadratic equation $2x^2 - 3x - 3 = 0$. (6 marks)
 b) Determine the nature of roots of quadratic equation $nx^2 - mx - n = 0$. (8 marks)
 c) Determine the range of value of k for which the quadratic equation $kx^2 + 6(k-2)x + 3(k+2) = 0$ has real distinct roots. (6 marks)
7. The function is given by $y = (x-3)^2 - 4$
 a) Find the coordinate of turning points. (6 marks)
 b) Find the coordinate of x and y intercepts. (8 marks)
 c) Sketch $y = (x-3)^2 - 4$ graph. (6 marks)
8. a) Find numerical value of the followings (6 marks)
 i. $(-128)^{\frac{3}{7}}$ ii. $\log_2 16$
 b) If $\log_{10} 2 = x$, express $\log_{512} 5$ in terms of x . (6 marks)
 c) solve $\log_2(3^{2x-2} + 7) = 2 + \log_2(3^{x-1} + 1)$ (8 marks)
9. a) Divide $x^3 + 4x^2 - 5x - 8$ by $x + 3$ (6 marks)
 b) Factorize $x^3 - 7x^2 + 7x + 15$ using factor theorem. (6 marks)
 c) When $px^4 + qx^3 + 3x^2 - 2x + 3$ is divided by $x^2 - 3x + 2$ the remainder is $2x - 1$. Find the value of p and q . (8 marks)



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FINAL EXAMINATION QUESTION PAPER
ELECTRONICS

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

Date: 2018.01.10

Pass mark 50%

Time allocated: 03 Hrs

➤ **Some helpful Data:**

* Permittivity of free air/ vacuum (ϵ_0) – 8.854×10^{-12} F/m

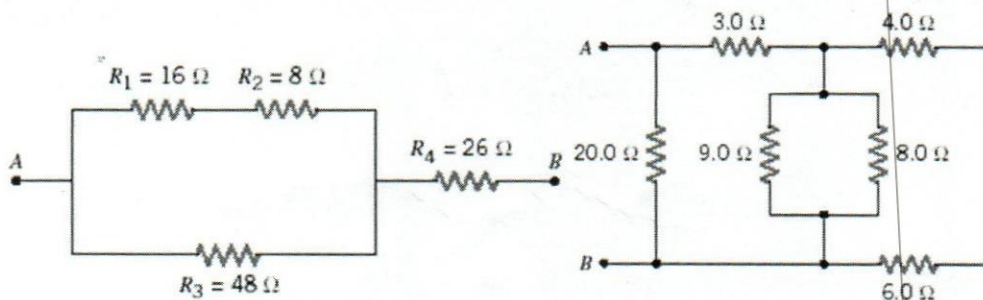
* Charge of electron – 1.602×10^{19} C

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

* Resistor Colour Codes:

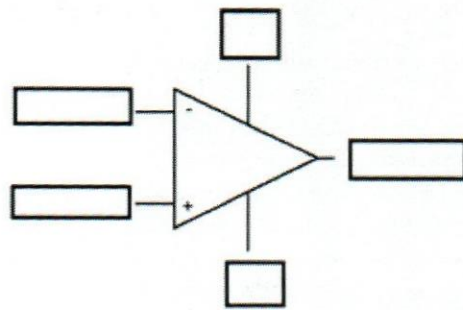
Black -0, Brown -1, Red -2, Orange -3, Yellow -4, Green -5, Blue -6, Purple -7, Grey -8, White -9, Gold – 5%, Silver -10%, No Colour -20%

- a) What colour bands will be found on a resistor with a nominal value of $1 \text{ M}\Omega$ and tolerance of $\pm 5\%$? (6 marks)
- b) A length of wire has a resistance of 4.5Ω . Find the resistance of another wire of the same material two times as long and twice the cross-sectional area. (6 marks)
- c) Find the equivalent resistance between point A and B. (8 marks)



2. a) Identify the terminals in the following op – amp.

(6 marks)



b) Draw schematic diagram of weighted summer amplifier.

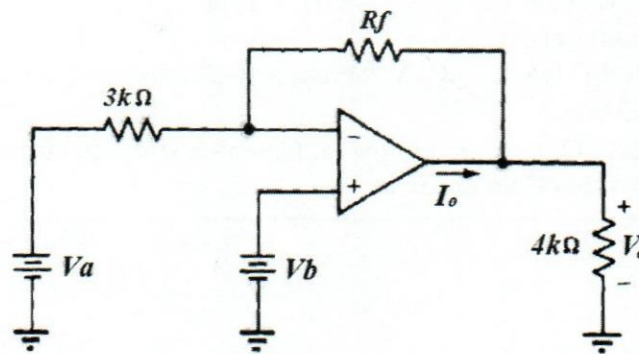
(6 marks)

c) In following circuit, feedback resistor R_f , dc voltages V_a and V_b are connected with operational amplifier. Assuming no saturation for part i. and ii.

(8 marks)

i. If $R_f = 12k\ \Omega$, $V_a = 2V$ and $V_b = 0V$. Determine V_o and I_o

ii. Repeat part i. for $R_f = 9k\ \Omega$, $V_a = 4V$ and $V_b = 2V$.



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

(6 marks)

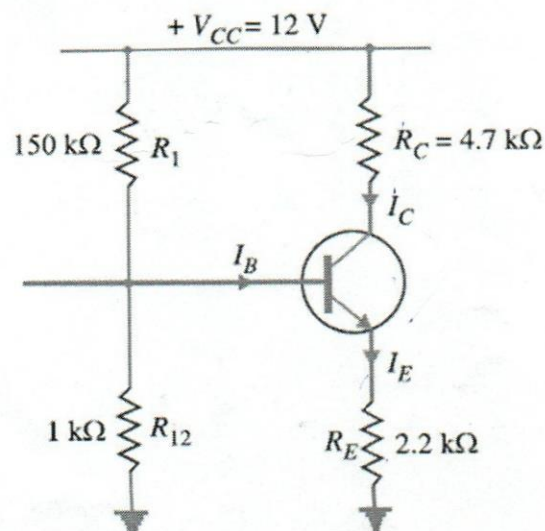
b) Describe the various methods used for transistor biasing.

(6 marks)

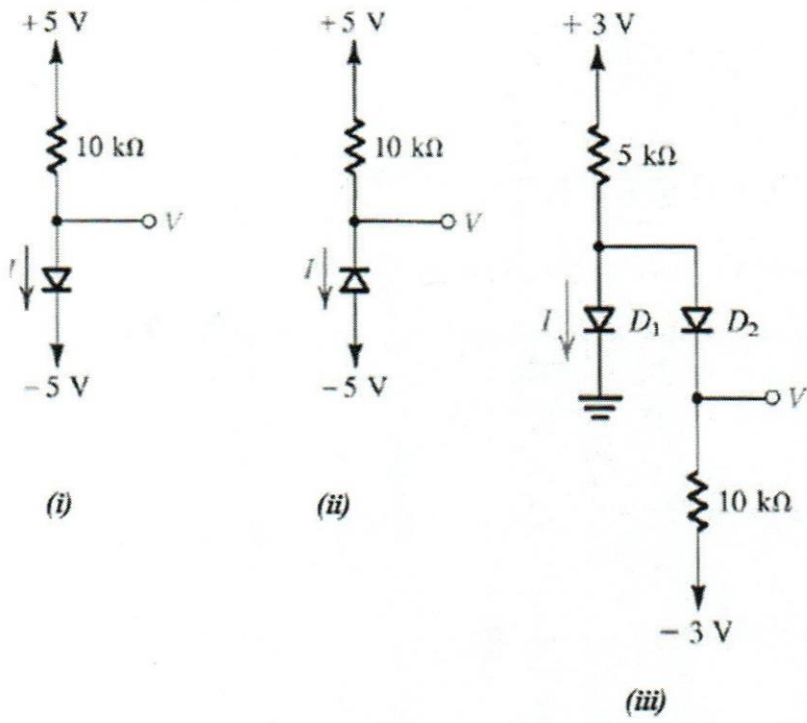
c) The amplifier circuit is shown in below, Find the operating point. Given that $\beta = 50$ and

$V_{BE} = 0.7V$.

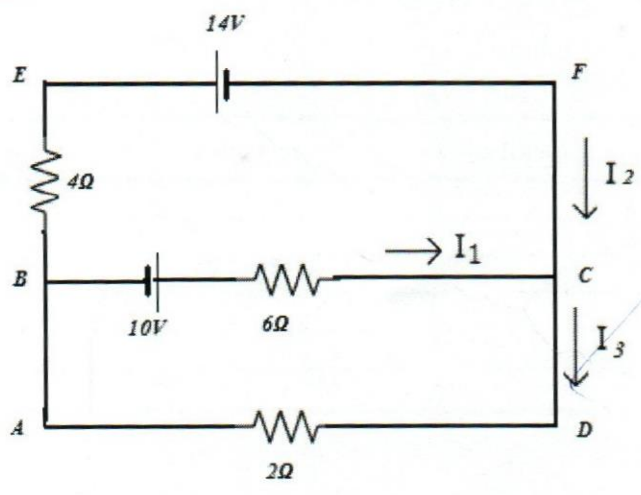
(8 marks)



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)

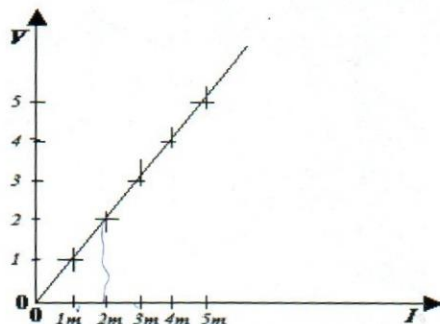


5. a) State the Kirchhoff's current law and voltage law. (4 marks)
 b) Following circuit contains three loops. Find each branch current. (8 marks)



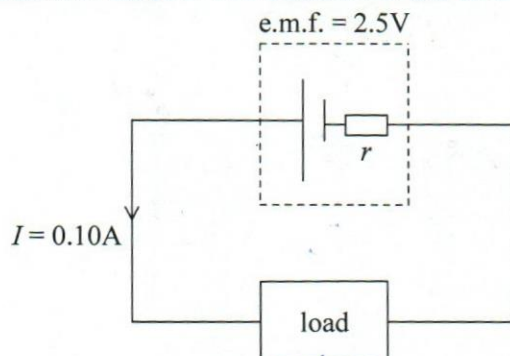
- c) Find the potential difference between junctions B and C. (4 marks)
 d) Calculate the total power generated by the voltage sources. (4 marks)

6. a) State Ohm's law. (4 marks)
 b) The graph below shows the I-V characteristic of a particular electrical component.



Calculate the resistance of that electrical component. (6 marks)

- c) In the circuit below an electrical device (load) is connected in series with a cell of emf 2.5 V and internal resistance r . The current I in the circuit is 0.10 A.



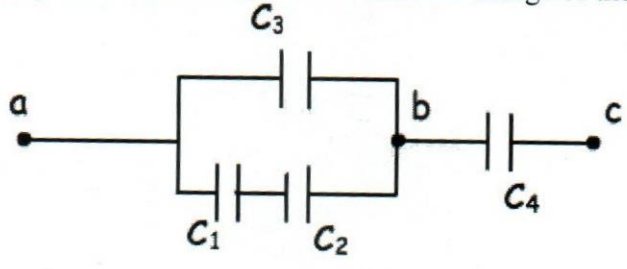
If the power ($P=VI$) dissipated in the load is 0.23 W. Calculate

- the total power of the cell; (4 marks)
- the resistance of the load; (4 marks)
- the internal resistance r of the cell. (2 marks)

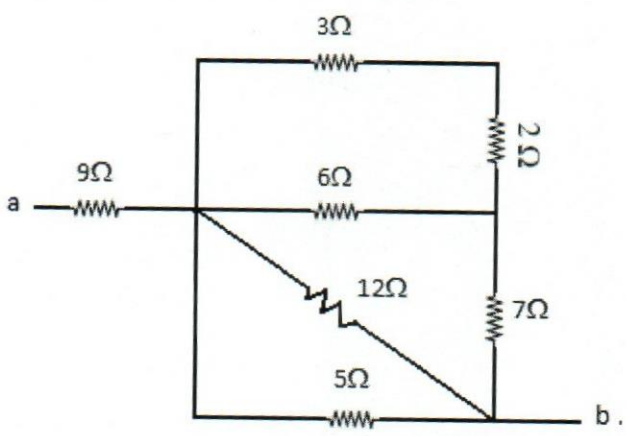
7. a) Fill the spaces in following table. (10 marks)

| Characteristic | Symbol | Units | Name of the Units |
|----------------|--------|-------|-------------------|
| Charge | Q | C | |
| | V | | volts |
| | P | W | |
| Current | | | Amperes |
| | | F | |
| Voltage gain | | | |

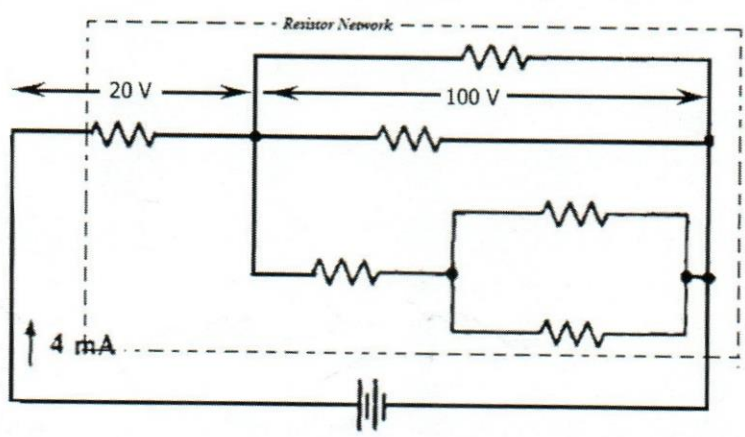
- b) In the circuit given below, $C_1=60\mu\text{F}$, $C_2=20\mu\text{F}$, $C_3=9\mu\text{F}$ and $C_4=12\mu\text{F}$. If the potential difference between points a and b $V_{ab}=120\text{V}$ find the charge of the second capacitor. (10 marks)



8. a) If resistors R_1 and R_2 and R_3 are (i) in series and (ii) in parallel. Derive the formula for the equivalent resistance R_{eq} of each network. (6 marks)
 b) Find the equivalent resistance between point a and b. (7 marks)



- c) Calculate equivalent resistance of following resistor network. (7 marks)



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Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340

FIRST SEMESTER EXAMINATION REPEAT QUESTION PAPER
Industrial Chemistry

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

Date: 2018.01.09

Pass mark 50%

Time allocated: 03 Hrs

➤ Some helpful Data:

* Avogadro Constant (N) – $6.022 \times 10^{23} \text{ mol}^{-1}$

* Charge of electron – $1.602 \times 10^{-19} \text{ C}$ | * Faraday Constant – 96500 Cmol^{-1}

Mass Numbers of first 20 Elements:

H – 1, He – 4, Li – 7, Be – 9, B – 10.8, C – 12, N – 14, O – 16, F – 19, Ne – 20, Na – 23, Mg – 24, Al – 27, Si – 28, P – 31, S – 32, Cl – 35.5, Ar – 40, K – 39, Ca – 40, Ag – 108, Mn – 55, Sr – 88.

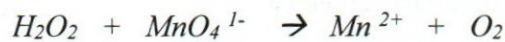
- a) Give an example of a homogeneous mixture and an example of a heterogeneous mixture. (4 marks)
 - b) Name following compounds i. KMnO_4 ii. $\text{Cu}(\text{NO}_3)_2$ iii. FeCl_2 (6 marks)
 - c) Indicate the number of protons, neutrons and electrons in each of following species
i. $^{15}_7\text{N}$ ii. $^{33}_{16}\text{S}$ iii. $^{63}_{29}\text{Cu}$ (5 marks)
 - d) All alkali metals react with water to produce hydrogen gas and the corresponding alkali metal hydroxide. A typical reaction is that between lithium and water:
$$2\text{Li}_{(s)} + 2\text{H}_2\text{O}_{(l)} \rightarrow 2\text{LiOH}_{(aq)} + \text{H}_{2(g)}$$

How many grams of Li are needed to produce 9.89g of $\text{H}_{2(g)}$ (5 marks)
- a) Write chemical formulas that correspond to the following names. (6 marks)
 - lithium fluoride
 - Lead (II) hydroxide
 - Potassium oxide
 - Sodium carbonate
 - chromium(III) chloride
 - sodium hydrogen phosphate

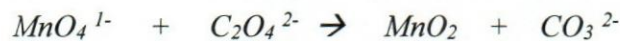
b) Determine the oxidation number of each elements in the following compounds. (3 marks)



c) Balance following chemical equation in acidic medium. (6 marks)

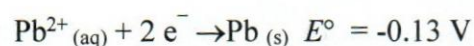
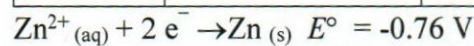


d) Balance following chemical equation in basic medium. (5 marks)

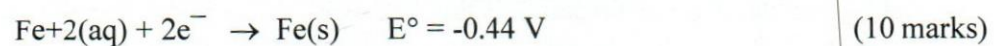


3. a) Complete the following table with the observed reactions for the electrochemical cells. Write the correct oxidation and reduction half-reaction in the appropriate column for each.

| <i>Cells</i> | <i>Anode Reaction</i> | <i>Cathode Reaction</i> | <i>Overall Cell Reaction</i> |
|--------------|-----------------------|-------------------------|------------------------------|
| Mg-Zn | | | |
| Cu-Pb | | | |
| Pb-Mg | | | |

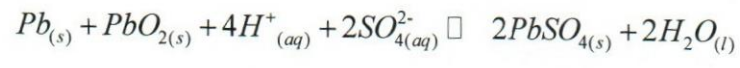


b) Consider the following two reduction reactions and their standard electrode potentials:



- Write the balanced overall cell reaction for a voltaic cell based on these two half-reactions
- Calculate the standard cell potential.
- Write the standard notation of Fe-Ni galvanic cell
- Draw and label the schematic diagram of Fe-Ni galvanic cell.

4. a) Draw named diagram of Lead storage battery. (6 marks)
 b) The overall discharging and charging cell reaction are



Write anode and cathode half ionic reaction when battery is discharge. (4 marks)

- c) The white substance deposited around lead storage battery terminals, Explain the formation of white substance. (4 marks)
 d) Discuss the advantages and disadvantages of Lead storage battery. (6 marks)

5. a) Explain formation of rust. (6 marks)
 b) How does the tendency of iron to rust depend on the pH of solution. (6 marks)
 c) What are the advantage and disadvantage of Impress Current Cathodic Protection method. (8 marks)

6. a) What are the chemical and physical difference between petrol and diesel? (6 marks)
 b) Calculate AFR of 90-Octane petrol. (8 marks)
 c) Name three harmful exhaust gases and explain harmfulness with AFR. (6 marks)

7. a) Define a weak acid, strong acid. (2 x 3 marks)
 b) Give two examples each of following acids and base (2 x 4 marks)
 i. weak acid ii. strong acid
 iii. weak base iv. strong base.

- c) Calculate the pH of each of the following solutions. (3 x 2 marks)
 i. $2.8 \times 10^{-4} \text{ mol.dm}^{-3} \text{ Ba(OH)}_2$ ii. $5.2 \times 10^{-4} \text{ mol.dm}^{-3} \text{ HNO}_3$

8. a) Derive $pH + pOH = 14$ (6 marks)

b) A 0.0560 g quantity of acetic acid (CH_3COOH) is dissolved in enough water to make 50.0 ml of solution. Calculate the concentration at equilibrium. ($K_a = 1.8 \times 10^{-5}$)

- i. H^+ ii. CH_3COO^- iii. CH_3COOH (2 x 4 marks)

- c) Calculate pH value of above solution. (6 marks)

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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE:

FOUNDATION 2ND SEMESTER EXAMINATION QUESTION PAPER
Engineering Drawing

- This question paper consists of two questions.
- Answer All Questions
- Date: 2018.01.08

Pass mark 50%

Time allocated: 03 Hrs

Marking System

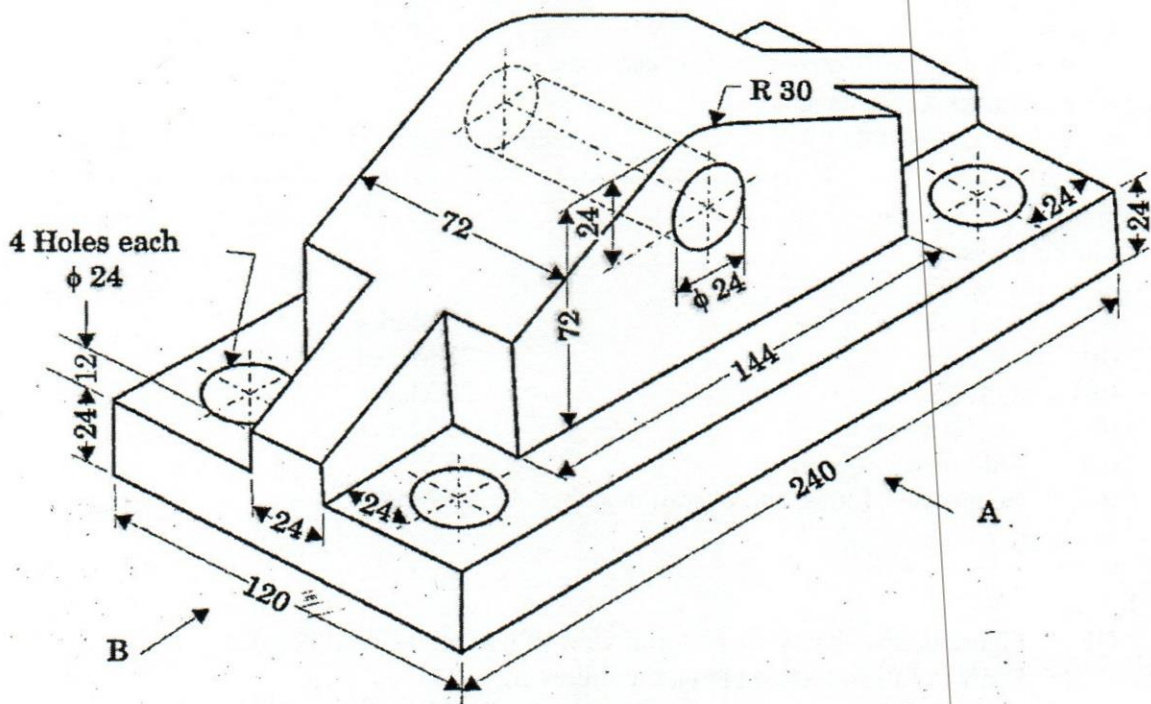
| | | |
|-------|---|----------|
| (i) | Q: 1 a | 30 Marks |
| (ii) | Q: 1 b | 20 Marks |
| (iii) | Q: 1 c | 20 Marks |
| (iv) | Q: 2 a or b | 20 Marks |
| (v) | Titles and Lettering | 05 Marks |
| (vi) | Boundaries, Lines, and overall neatness | 05 Marks |

Q1. Figure below shows the pictorial view of horizontal Wall Bracket. Draw to full size scale (1: 1), the following views.

- a) Front view looking in the direction of arrow 'A'
- b) Side view looking in the direction of arrow 'B'
- c) Top view

Use first angle projection.

- Q2. a) Draw a regular octagon side length 50 mm
or
b) Draw a rectangle whose length is 80 mm (X - direction) and breadth is 120 mm. Construct a parabola inside it.



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Department of Marine Engineering
EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE: ED 0340

FINAL EXAMINATION QUESTION PAPER
Mathematics

- This question paper consists of Nine questions.
- Answer Any Six(06) Questions

Date: 2018.01.10

Pass mark 50%

Time allocated: 03 Hrs

- Find $\lim_{x \rightarrow 1} \frac{x^2 - x + 3}{3x + 1}$ (6 marks)
 - Find $\lim_{x \rightarrow 4} \frac{x^2 - 3x - 4}{2x^2 - 9x + 4}$ (6 marks)
 - Evaluate $\lim_{x \rightarrow \pi/4} \frac{\sin x - \cos x}{x - \pi/4}$ (8 marks)
- Differentiate with respect to x, (6 marks)
 - $y = x^2 - 7x + 3$
 - $y = \frac{3x^2 - 2}{3 - 2x}$
 - Find $\frac{dy}{dx}$ in terms of the parameter t, if $y = 6t$ and $x = 3t^2$. (6 marks)
 - Given that $y = x - \tan^{-1}x$, prove that $\frac{d^2y}{dx^2} - 2x \left(1 - \frac{dy}{dx}\right)^2 = 0$ (8 marks)
- Integrate with respect to x (6 marks)
 - $\int (2x^3 + \frac{4}{x^2} - \frac{1}{x} + 1) dx$
 - $\int (3\sin x - 5e^x + \operatorname{cosec}^2 x) dx$
 - Determine the partial fractions of $\frac{x-1}{(x+1)(x+3)}$ (6 marks)
 - Hence, Evaluate $\int \frac{x-1}{(x+1)(x+3)} dx$ (6 marks)
- In the binomial expansion of $(x^2 - \frac{1}{x})^{12}$, Find
 - the coefficient of x^9 (10 marks)
 - the term independent of x. (10 marks)

5. a) Without using tables or calculator, evaluate (6 marks)
 i. $\sin 15^\circ \cos 15^\circ$ ii. $\cos^2 22.5^\circ - \sin^2 22.5^\circ$
- b) Prove that (8 marks)
 i. $\frac{\cos x - \sin x}{\cos x + \sin x} = \frac{1 - \sin 2x}{\cos 2x}$ ii. $\sin 3x = 3 \sin x - 4 \sin^3 x$
- c) Given that $0 \leq x \leq 2\pi$, solve the equation $\sqrt{3} \sin x + \cos x = 1$ (6 marks)
6. a) Solve the quadratic equation $2x^2 - 3x - 3 = 0$. (6 marks)
 b) Determine the nature of roots of quadratic equation $nx^2 - mx - n = 0$. (8 marks)
 c) Determine the range of value of k for which the quadratic equation $kx^2 + 6(k-2)x + 3(k+2) = 0$ has real distinct roots. (6 marks)
7. The function is given by $y = \frac{2x-1}{(x+1)^2}$
- a) Find the coordinate of turning points. (6 marks)
 b) Find the coordinate of x and y intercepts. (8 marks)
 c) Sketch $y = \frac{2x-1}{(x+1)^2}$ graph. (6 marks)
8. a) Find numerical value of the followings (6 marks)
 i. $(-32)^{\frac{3}{5}}$ ii. $\log_{16} 2$
 b) If $\log_{10} 2 = 0.3010$, find the value of $\log_{512} 5$ (6 marks)
 c) solve $\log_2(3^{2x-2} + 7) = 2 + \log_2(3^{x-1} + 1)$ (8 marks)
9. a) Divide $2x^3 - 5x^2 + 7x + 3$ by $x - 2$ (6 marks)
 b) Factorize $x^3 - 7x^2 + 7x + 15$ using factor theorem. (6 marks)
 c) When $px^4 + qx^3 + 3x^2 - 2x + 3$ is divided by $x^2 - 3x + 2$ the remainder is $2x - 1$. Find the value of p and q. (8 marks)



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CINEC CAMPUS

Faculty of Marine Engineering

Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340

14

FINAL EXAMINATION QUESTION PAPER

Applied Mechanics

- This question paper consists of Nine questions.
- Answer Any SIX Questions

Date: 2018.01.08

Pass mark 50%

Time allocated : 03 Hrs

Gravitational acceleration, $g = 9.81 \text{ m/s}^2$

1.

- Describe the terms: Moment of inertia (I), Angular velocity (ω) and Angular acceleration (α) (4 marks)
- Write down three equations of motion along a circular path (4 marks)
- A flywheel is rotating at **150 r.p.m.** and after **8** seconds it is rotating at **200 r.p.m.** If the acceleration is uniform, determine
 - The uniform acceleration (3 marks)
 - Total angular displacement (3 marks)
 - The number of revolution made by the flywheel to reach **200 r.p.m.** (3 marks)
 - The torque acts on the flywheel during the acceleration if the moment of inertia of the flywheel is 0.004 kgm^2 (torque, $\tau = I \alpha$) (3 marks)

2.

- Describe the SHM (4 marks)
- Write an expression for the velocity of a simple harmonic motion using angular speed (ω), amplitude (A) and displacement (x) from the mid-point. (4 marks)
- A body performing simple harmonic motion has a velocity **12 m/s** when the displacement is **50 mm** and **3 m/s** when the displacement is **100 mm**, the displacement being measured from the mid-point.
 - Calculate the amplitude and frequency of the motion (8 marks)
 - What is the acceleration when the displacement is **75 mm**? (4 marks)

3.

a. Describe the followings

i. Mass

ii. Weight

iii. Momentum

(6 marks)

b. Describe Newton's second law of motion

(4 marks)

c. A man weighing 637 N dives into a swimming pool from a tower of height 19.6 m . He was found to go down in water by 2 m and then started rising. Find

i. The final velocity of the man, when he reaches the water surface

(4 marks)

ii. The average resistance of the water

(6 marks)

4. A train weighing 200 kN moves down a slope of $1\text{ in }150$ at 18 km/h and engine develops 3.5 kW .

a. Find the force exerted by engine

(5 marks)

b. What is the force of friction in the opposite direction of motion?

(5 marks)

c. What power will be required to pull the train up the slope at the same speed?

(5 marks)

d. If the weight of the train increases by an additional weight of 50 kN under the same power during the climbing up, what is the new speed of the train?

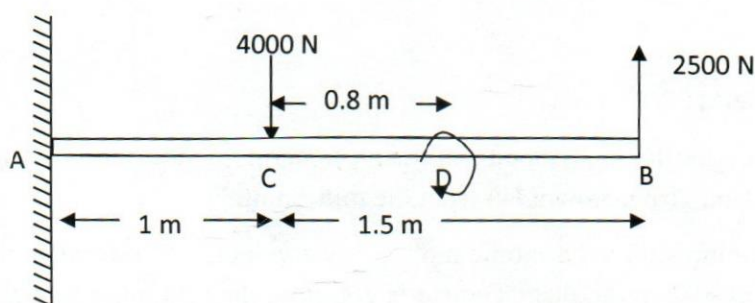
(5 marks)

5.

a. Show that a force acting on a body can be replaced by an equal force and a couple at any point on the body

(5 marks)

b. Figure shows two vertical forces and a couple of moment 2000 Nm acting on a horizontal rod which is fixed at end A.



Determine

i. The resultant of the system

(8 marks)

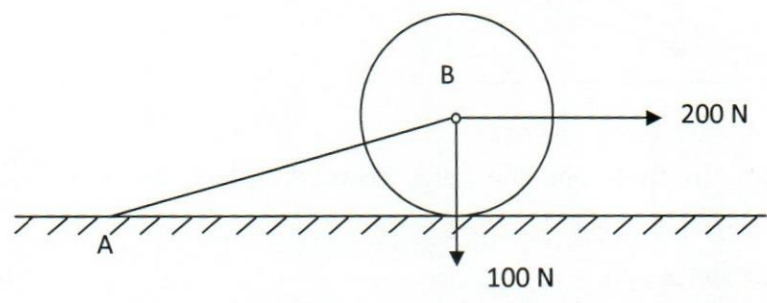
ii. A single resultant force and single moment through A

(7 marks)

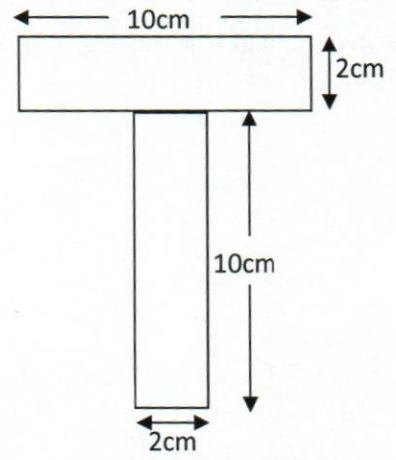
6.

- a. Write down the equations of equilibrium for
 - i. Concurrent force system (4 marks)
 - ii. Non-concurrent force system (4 marks)

- b. A circular roller of radius 5 cm and weight 100 N rests on a smooth horizontal surface and is held in position by an inclined bar AB of length 10 cm as shown in figure. A horizontal force of 200 N is acting at B. Find the tension in the bar and the vertical reaction at C (12 marks)



- 7. Figure shows a T-section made by joining two rectangular sections of dimension $10 \times 2\text{ cm}$.



Determine

- a. The centre gravity (6 marks)
- b. The moment of inertia of the section about the horizontal and vertical axes, passing through the centre of gravity of the section (14 marks)

- 8. A uniform ladder of weight 200 N of length 5 m rests on a horizontal ground and leans against a rough vertical wall. The coefficient of friction between the ladder and floor is 0.4 and between the ladder and the wall is 0.2 . When a man with weight of 800 N is placed on the ladder at a distance of 2 m from the top of the ladder, the ladder is at the point of sliding. Find:

- a. Reaction at the foot of the ladder (6 marks)

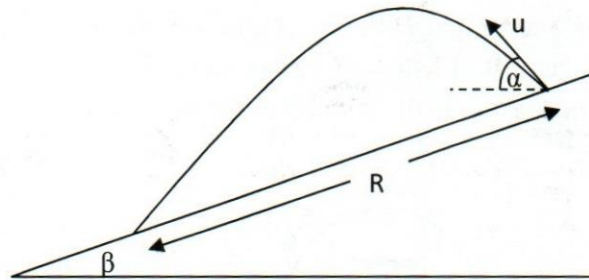
b. Reaction at the top of the ladder

(6 marks)

c. The angle made by the ladder with horizontal

(8 marks)

9. A projectile is projected from the top of a inclined plane towards the bottom of the plane. If the inclination of the plane is β with the horizontal,



- a. Show that the time of flight and the range down the plane are $T = \frac{2u \sin(\alpha + \beta)}{g \cos \beta}$ and

$$R = \frac{2u^2}{g \cos^2 \beta} \cos \alpha \sin(\alpha + \beta)$$

(12 marks)

- b. Hence, determine the maximum range down the plane

(8 marks)

Where u is the velocity of the projection and α is the angle of projection with horizontal



Colombo International Nautical and Engineering College

Winner - World Class - Global Performance Excellence Award 2012 - Education Organization
Winner - International Asia Pacific Quality Award - 2010 - Best in Class - Education Organization
Winner - Sri Lanka National Quality Award 1999 - 2004 - 2009 - 2014
Approved for Quality Management System

EDUCATION & TRAINING COURSE: ENGINEERING OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340

SUBJECT: ENGLISH

| | |
|--|---------------------------------|
| Faculty | Department / Section / Division |
| Management, Humanities and Social Sciences | Education and Languages |

| | |
|---|--|
| INSTRUCTIONS TO CANDIDATES | <i>Date of the examination = 21.12.2017</i> |
| <i>Answer all questions.</i> | <i>Duration of the examination = 02 ½ hours</i> |
| <i>Candidates are not allowed to communicate with and disturb fellow candidates during the examination.</i> | <i>Candidates could be disqualified if you violate examination rules</i> |
| | <i>Pass Mark = 60 marks</i> |

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

Read the text and write complete answers for the following questions.

(10 Marks)

The Suez Canal, Egypt

The Suez Canal is one of the world's most important waterways and its Sumed pipeline is considered a significant geographic oil transit chokepoints from the Red Sea to the Mediterranean Sea. The Suez Canal is west of the Sinai Peninsula and serves as a two-way water transport route between Europe and Asia. It is 190 km long and 300 meters wide. The canal supports approximately 8% of the world's shipping traffic with almost fifty vessels traveling through the canal daily.

In 1967, the canal was closed due to the outbreak of the Six-Day War. At the time, Israel has taken over the Sinai Peninsula which resulted in the Suez Canal becoming a buffer zone between the forces of fighting. The Suez Canal was reclaimed by the Egyptians in the 1973 Arab-Israeli War and was reopened in 1975. Since its reopening, the canal has been widened twice.

The Suez Canal is considered a geographic "chokepoint" due to its influence in the world oil trade and because its narrow-width could be easily blocked, causing disruption to oil transport.

In 2001, the Suez Canal transported approximately 1.3 million bbl/d of petroleum. The Sumed Pipeline has the ability to transport around 2.5 million bbl/d from the Ain Sukhna terminal at the Gulf of Suez to the Sidi Kerir at the Mediterranean Sea. Oil from the Sumed Pipeline is exported mainly to Europe and the United States. The pipeline consists of two parallel 42-inch lines and is owned by the Arab Petroleum Pipeline Company. By 2010, the Egyptian government hopes to have widened and deepened the Suez Canal enough to accommodate the passage of very large crude carriers (VLCCs) and ultra large crude carriers (ULCCs).

1. What are the two seas connected by the Suez Canal?
.....
2. Where is the Suez Canal situated?
.....
3. How does the Suez Canal facilitate international transportation?
.....
4. How many vessels use this canal on daily basis?
.....
5. Why was the canal closed in 1967?
.....
6. Who reclaimed the Suez Canal in the Arab-Israeli war?
.....
7. Why is the Suez Canal considered as a geographic “chokepoint”?
.....
8. Who owns the Sumed Pipeline?
.....
9. What plans did the Egyptian government have about the Suez Canal in 2010?
.....
10. Give the main idea of the third paragraph in two sentences.
.....
.....
.....
.....

Question 02

Fill in the blanks with *a/ an/ the* where necessary.

(10 Marks)

- Children like to play cricket.
- I bought an umbrella to go out in the rain.
- My daughter is learning to play the violin at her school.
- Please give me a cake that is on the counter.
- I lived on Main Street when I first came to town.
- Albany is the capital of the New York State.
- My husband's family speaks Polish.
- An apple a day keeps the doctor away.
- The ink in my pen is red.
- Our neighbours have a cat and a dog.

Question 03

Underline the correct answer to fill in the blank.

(10 Marks)

- I don't find basketball very (interested/interesting).
- The stadium was full of (audience/spectators).
- The plane..... (took off/took up) on time but arrived half an hour late.
- We enjoyed our..... (flight/flying).
- My sister met with (an accident/ a situation) but fortunately she was not hurt.
- I cannot see how your plan is going to work in..... (practice/practise).
- I would like to go one world tour. But I find the ----- (money/cost) of travel too expensive.
- The boy ----- (jumped/came down) from the tree into the river.
- How many members are there in your ----- (family/ class)?
- Deepa is fond of ----- (plants/animals) and so requested her parents to get her a pet.

Question 04

Fill in the blanks with the correct form of the adjective given in brackets.

(10 Marks)

- My brother has a (tidy) tidier room than me.
- Australia is (big) bigger than England.
- I'm (good) better now than yesterday.
- She's got a (beautiful) more house than you.
- He thinks Chinese is (difficult) most language in the world
- Valencia played (bad) worse than Real Madrid yesterday.
- Cats are not (intelligent) intelligent as dogs.
- Show me the (good) best restaurant downtown.
- The (hot) most desert of all is the Sahara and it's in Africa.
- Who is the (talkative) most person in your family?

Question 05Fill in the blanks with the correct form of the verb given in brackets

(10 Marks)

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

Question 06

Fill in the gaps with an appropriate Wh-question word

(10 Marks)

1. time is it?
2. old are you?
3. do you live with?
4. is your birthday?
5. is your favorite subject?
6. book is yours?
7. do you have English classes?
8. is your name?
9. are your parents now?
10. are you studying English?

Question 07

Complete the conditional sentences using the verb given in brackets.

(10 Marks)

1. If you switched on the lights, you (fall / not) over the chair.
2. She will come to our party if she (be / not) on holiday.
3. It (surprise / not) me if he does not know the answer.
4. I (buy) these shoes if they fit.
5. If we listen to the radio, we (hear) the news.
6. If I hadn't studied, I (fail) the exam.
7. If you go out with your friends tonight, I (watch) the cricket match on TV.
8. If he tries harder, he (reach) his goals.
9. I (earn) a lot of money if I get that job.
10. If she (hurry / not), we will miss the bus.

Question 08

Fill in the blanks using the correct preposition 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 the road.

Question 09

Write a letter congratulating a friend for his outstanding achievement at the Sea Cadets' Phase I exam. (10 Marks)

Question 10

Write an essay on one of the following in 150 words. (10 Marks)

1. Types of ships
2. Why I want to be a seafarer



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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE: ED 0340

FINAL EXAMINATION QUESTION PAPER
Physics

- This question paper consists of six questions.
 - Answer Any SIX Questions
- Date: 2017.01.11 Pass mark 50%

Time allocated: 03 Hrs

$$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2, \mu_0 = 4\pi \times 10^{-7} \text{ H/m}, m_e = 9.11 \times 10^{-31} \text{ kg}, m_p = 1 \text{ amu} = 1.6726 \times 10^{-27} \text{ kg}, e = 1.6 \times 10^{-19} \text{ C}$$

1.

- A standard radio broadcasting station has an assigned frequency between **535** and **1605 kHz**. The VHF television stations have frequencies between **54** and **216 MHz**. While the UHF have frequencies between **470** and **890 MHz**. What is the wavelength corresponding to each of the frequencies mentioned? (6 marks)
- Ultra violet-light ranges in wavelength roughly from violet at **360 nm** to **70 nm**. Its speed in vacuum is about 3×10^8 m/s, as is the case for all electromagnetic waves. Determine the corresponding frequency range. (4 marks)
- Radar set for determining the speed of approaching cars sends out waves of frequency **1000 MHz**. If the beat frequency observed is **180 Hz**, what is the speed of the car? (10 marks)

2.

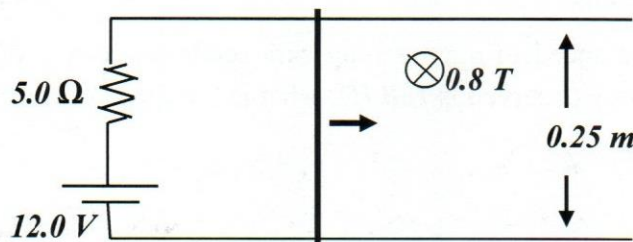
- Write an expression for the magnetic flux density (B) and the magnetizing field (H) inside a toroid which carries a current (I) and length (L) and N of number of turns (6 marks)
- A toroid of mean circumference **0.6 m** has **600** turns, each bearing a current of **300 mA**. The cross section area of the toroid is **300 mm²**. Determine
 - The magnetizing field (H), the magnetic flux density (B) and the magnetic flux (Φ) (6 marks)
 - The magnetizing field (H), the magnetic flux density (B) and the magnetic flux (Φ) If the core is filled with iron of relative permeability **2000** (8 marks)

3.

- a. State the **Biot-Sarvart** law and **Amperes'** law (4 marks)
- b. Describe the relative permeability of a medium (3 marks)
- c. Write an expression for the **magnetic flux density (B)** inside a current (**I**) carrying solenoid whose length is **L** and number of turns is **N** (3 marks)
- c. A solenoid with **500** turns is wound on an iron ring **80 mm²** In cross-sectional area, of **6 cm** length and of **2000** relative permeability. If the windings carry **300 mA**, determine
 - i. The permeability of iron (3 marks)
 - ii. The flux density in the iron core (4 marks)
 - iii. Total flux inside the solenoid (3 marks)

4.

- a. Describe the **Fleming's right hand rule**. (3 marks)
- b. Write an equation for the EMF generated by conductor whose length is **L**, moving in a magnetic field, **B** with a speed of **V**. (3 marks)
- c. A metal wire slides on a horseshoe-shaped loop of width **0.25 m**. These have negligible resistance, but there is a **5.0 Ω** resistor in the circuit as well as a **12.0 V** battery. There is a uniform magnetic field directed into the plane of the page of magnitude of **0.8 T**. The slide wire is pushed to the right by the magnetic force. A force of **0.5 N** to the left is required to keep it moving with constant speed to the right.



- i. What is the current in the circuit? (4 marks)
- ii. What is the voltage drop across the **5.0 Ω** resistor? (4 marks)
- iii. What is the back **EMF** generated by the moving wire? (4 marks)
- iv. What is the speed of the wire (2 marks)

5.

- a. Describe the followings
- i. The back EMF generated in DC motor (4 marks)
 - ii. The eddy current (4 marks)
- b. A shunt motor has an armature resistance 0.5Ω and field resistance 100Ω . It is connected across $110 V$ mains and is generating a back EMF of $95 V$. Determine
- i. The *armature current, the field current* (6 marks)
 - ii. The *total power* taken by the motor (2 marks)
 - iii. The *power lost in the armature and field windings* (4 marks)

6.

- a. Describe the *Fleming's left hand rule* (4 marks)
- b. 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 (4 marks)
- c. He 2^+ ion travels at right angles to a magnetic field of $0.8 T$ with a velocity of $10^5 m/s$. Find the magnitude of the magnetic force on the ion. (4 marks)
- d. An electron is moving with a speed of $5 \times 10^7 m/s$ at right angle to a magnet field of $0.5 T$. What is the magnetic force on the electron? What is the radius of the electron moves? (8 marks)

7.

- a. States the *Lenz's law* and *Faraday's law* in electromagnetic induction (6 marks)
- b. A shunt wound generator has an armature resistance of 0.5Ω and the field winding has a resistance of 100Ω . Its terminal potential difference is $240 V$ when a current of $10A$ 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)

- 8.
- a. Describe the *self inductance* and the *mutual inductance* (4 marks)
 - b. Write an expression for the *back EMF* generated by a solenoid (2 marks)
 - c. An emf of 110 V is induced in a solenoid when the current in it changes at the rate of 0.5 A/s . Compute the self inductance of the solenoid. (4 marks)
 - d. When the current in a certain coil is changing at a rate of 100 mA/s , it is found that an emf of 20 mV is induced in a nearby coil. What is the mutual inductance of the combination? (4 marks)
 - e. An ideal transformer has 550 turns on the primary and 30 turns on the secondary. If the primary voltage is 3.3 kV , what is the voltage across the secondary? What primary current is required if the current drawn by the secondary is 11 A ? (6 marks)
9. A coil has an inductance of 0.12 H and resistance of $10\ \Omega$. It is connected to a $110\text{ V}, 60\text{ Hz}$ power source. Determine
- a. The reactance of the coil (4 marks)
 - b. The impedance of the coil (4 marks)
 - c. The current through the coil (4 marks)
 - d. The phase angle between the current and supply voltage (4 marks)
 - e. The average power developed (4 marks)



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Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE:

FINAL EXAMINATION QUESTION PAPER
Introduction to the Shipping

- This question paper consists of Five questions.
- Answer All Questions

Date: 2017.01.09

Pass mark 50%

Time allocated: 03 Hrs

1. With an aid of a sketch show following principle parts and areas of a ship.
Bridge, Superstructure, Main deck, Bow thruster, Crane, Anchor, Forecastle, Funnel, Hull, Propeller, Rudder, Bulbous bow, Draft, Port beam, Stbd beam, Athwart ship, Navigation lights, Christmas tree, starboard side and port side. (20 marks)
2. (a) What is meant by LSA and FFA (04marks)
(b) List 5 types of items fall into each of above category. (10 marks)
(c) What are the most essential items which should be carrying in a life boat?(06marks)
3. (a) List 05 types of emergency drills should be carried on board? (10 marks)
(b) Explain following terms using suitable sketches where necessary
(i) Trim (ii) List (iii) Rolling iv. Pitching v. Anchoring (2marks each)
4. (a) Make ten types of ship widely available for trading in maritime industry (10 marks)
(b) Make short notes on five types of ship listed above. (10 marks)
5. Write short notes on following emergency equipment with their application.
 - a) i. Emergency fire pump (03 marks)
ii. Emergency generator (03 marks)
iii. Emergency air compressor (03 marks)
 - b) i. What is meant by fire Triangle? (04 marks)
ii. List four types of portable fire extinguishers widely used on board ship. (04marks)
iii. Name most suitable fire extinguisher for each of following fires.
Electric fire, Oil Fire and Scavenge fire. (03 marks)



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Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: 340



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MID TERM EXAMINATION QUESTION PAPER
Engineering Drawing

- This question paper consists of six questions.
- Answer All Questions

Date: 2017.10.30

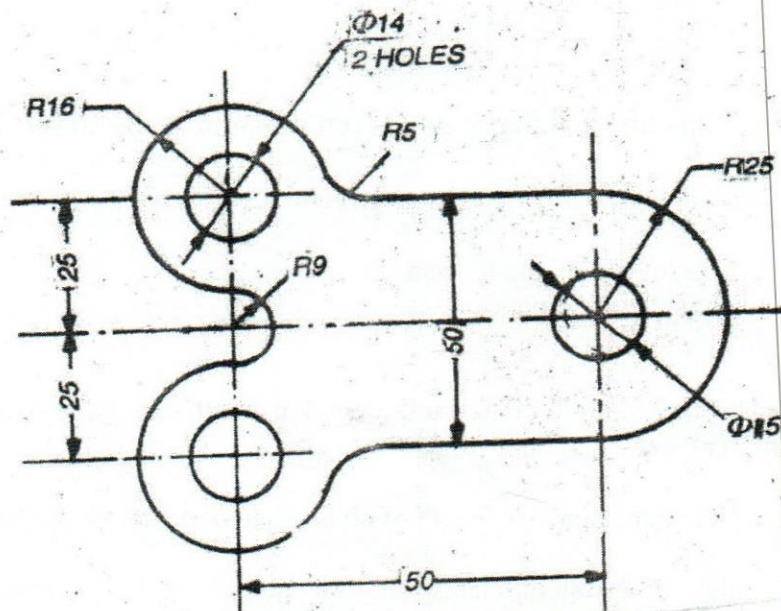
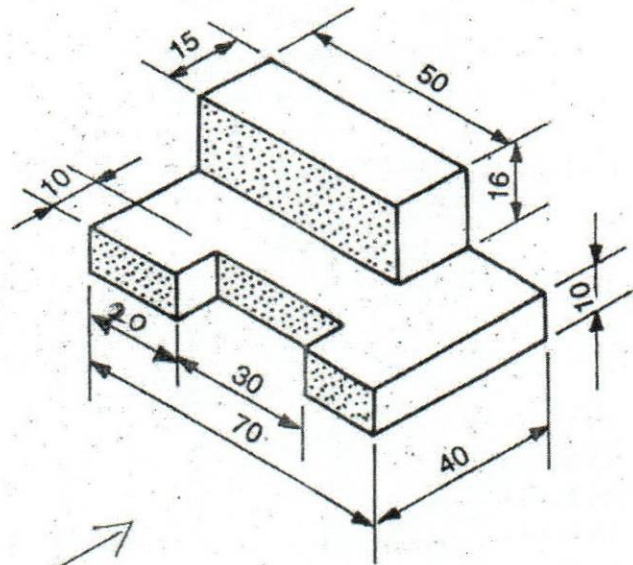
Pass mark 50%

Time allocated: 03 Hrs

Marking System

- (i) Q: 1 15 Marks
- (ii) Q: 2 15 Marks
- (iii) Q: 3 15 Marks
- (iv) Q: 4 15 Marks
- (v) Q: 5 15 Marks
- (vi) Q: 6 15 Marks
- (vii) Titles and Lettering 5 Marks
- (viii) Boundaries, Lines, and overall neatness 5 Marks

- Q1. Construct an ellipse of major axis is 100 mm and minor axis is 70 mm.
- Q2. Draw following orthographic view of given block (figure 1) in 1st angle projection.
 - I. Front elevation looking from 'F'
 - II. Right side elevation
 - III. Plan
- Q3. Make a construction to find the circumferential length of a circle diameter 50 mm. Verify your answer by calculating it.
- Q4. Draw a regular pentagon side length of 60 mm and a regular hexagon side length of 50 mm.
- Q5. Divide straight line of 85 mm length into six equal parts. Locate three points on the paper and draw an arc through those points.
- Q6. Draw the given figure (figure 2) and mark all the dimensions.



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Colombo International Nautical and Engineering College

CINEC CAMPUS

Faculty of Marine Engineering

Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340



MID TERM EXAMINATION QUESTION PAPER

Physics

• This question paper consists of six questions.

• Answer Any SIX Questions

Date: 2017.11.02

Pass mark 50%

Time allocated: 03 Hrs

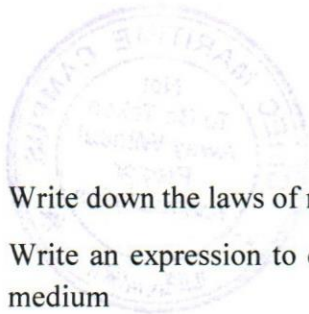
Speed of sound in air 340 m/s, speed of light in air 3×10^8 m/s

1.

- a. A spring is stretched **10 cm** when a mass of **100g** is hung on it. If a total **200 g** is hung on the spring and the mass is started in vertical oscillation. Find the spring constant and period of the oscillation. (8 marks)
- b. A ball moves in a circular path of **0.2 m** diameter with a constant speed of **20 rev/min**. Its shadow performs simple harmonic motion on the wall behind it. Find the acceleration and speed of the shadow
 - i. At a turning point of the motion (4 marks)
 - ii. At the equilibrium position (4 marks)
 - iii. At a point 6 cm from the equilibrium position (4 marks)

2.

- a. A wire of **1 m** long and with mass per unit length of **0.1 g/m** vibrates under a tension of **10 N**. find the fundamental frequency (6 marks)
- b. A **200 cm** long string has two adjacent resonances at frequencies of **80** and **98 Hz**. Estimate the fundamental frequency and the speed of the wave on the string (6 marks)
- c. The equation of a particular standing wave on a string is given by the equation,
 $y(x, t) = 0.26 \cos 2x \sin 390 t$ in meters.
Find the amplitude, wave length, frequency and speed of the wave. (8 marks)



- 3.
- a. Write down the laws of refraction (4 marks)
 - b. Write an expression to define the absolute refractive index using the speed of light in each medium (2 marks)
 - c. Light passes from air into a liquid and is deviated 19° when the angle of incidence is 52° .
 - i. What is the index of refraction of the liquid (3 marks)
 - ii. What is the speed of light in the liquid (3 marks)
 - d. Light enters a glass prism having a refracting angle of 50° . If the angle of incidence is 27° and the index of refraction of the glass is 1.5 , estimate the angle the ray leaving the prism makes with the normal and angle of deviation. (8 marks)
- 4.
- a. A plane mirror lies face up, making an angle of 15° with the horizontal. A ray of light shines down vertically on the mirror. What is the angle of incidence? What will the angle between the reflected ray and horizontal be? (6 marks)
 - b. Describe the total internal reflection (3 marks)
 - c. The brilliance of diamonds is attributable to total internal reflection. Calculate the critical angle for a diamond-air surface. Refractive index of diamond is 2.42 (3 marks)
 - d. A ray of light is incident on the left vertical face of a glass cube of refractive index 1.6 . The cube is surrounded by water (refractive index, 1.333). What is the largest angle of incidence for which total internal reflection occurs at the top surface? (8 marks)
- 5.
- a. An underwater sonar operating at a frequency of 60 kHz directs its beam toward the surface. What is the wave length of the beam in the air above? What frequency sound does a bird flying above the water hear? (4 marks)
 - b. Define the pitch, loudness, quality and beats of sound (8 marks)
 - c. Two open organ pipes sounded simultaneously give $4\text{ beats per second}$ between the fundamentals. If the longer pipe is 1.3 m long, find the length of the shorter pipe. (4 marks)
 - d. Assume that the average sound level in a lecture theatre due to one person speaking is 40 dB . What will be the sound level when 100 people are speaking? Assume each of the 100 people speaks at the same level as did the single person. (4 marks)

- 6.
- Describe the Doppler effect of sound (4 marks)
 - Write an equation to change in frequency due to the movement of a sound source towards a stationary observer. (4 marks)
 - A traffic police officer is standing between two parallel lanes when two vehicles approach from opposite directions. Vehicle 1 has a speed of 20 m/s and it blows its horn which has a frequency of 300 Hz . The vehicle 2 has a speed of 30 m/s .
 - Find the wavelength and frequency of the horn blow received by the police officer (6 marks)
 - What frequency is heard by the driver on the vehicle 2? (6 marks)
- 7.
- Briefly describe the diffraction of light using their application (4 marks)
 - A diffraction grating is ruled with $4000 \text{ lines per centimeter}$. The first order of a spectral line is observed to be diffracted at an angle of 30° . What is the wavelength of this radiation? (6 marks)
 - A grating having $3000 \text{ lines per centimeter}$ produces spectra of mercury arc. The green line of the mercury spectrum has a wavelength of 5461 \AA . What is the angular separation between the first-order green line and the second-order green line? (Hint $1 \text{ \AA} = 10^{-10} \text{ m}$) (10 marks)
- 8.
- Describe the image formed by a thin concave mirror when a real object is placed
 - At the centre
 - Between focal point F and centre C
 - At the focal point
 - Between focal point F and the mirror (12 marks)
 - An object of 5 cm high is placed 40 cm from a thin concave mirror of 8 cm focal length. Describe the image formed by the mirror (8 marks)



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COURSE CODE: ED 0340



1ST SEMESTER EXAMINATION QUESTION PAPER
Electronics

- This question paper consists of five questions.
- Answer All (05) Questions

Date: 2017.11.01

Pass mark 50%

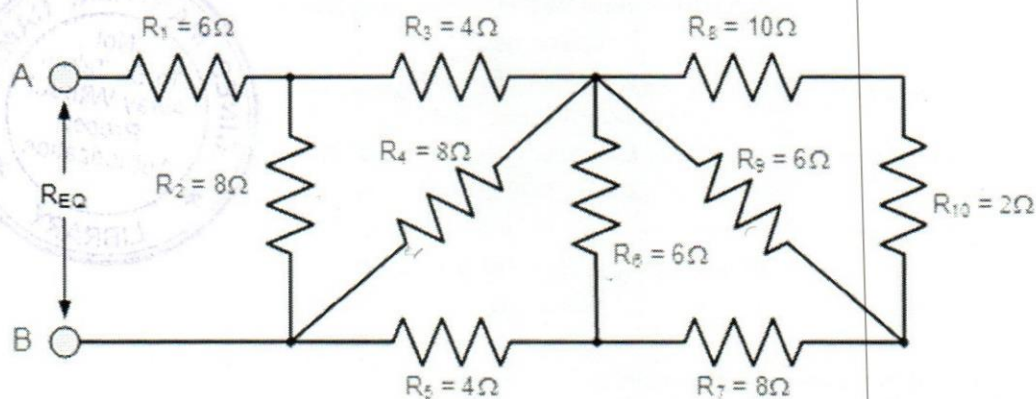
Time allocated: 03 Hrs

* Permittivity of free air/ vacuum (ϵ_0) – 8.854×10^{-12} F/m

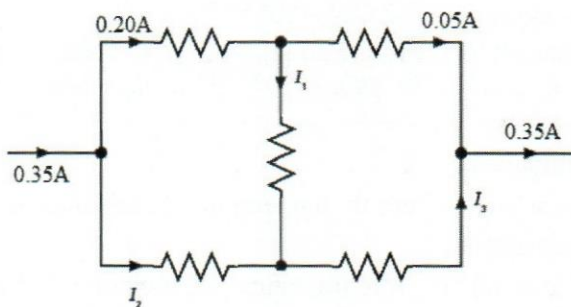
* Resistor Color Codes: Black -0, Brown -1, Red -2, Orange -3, Yellow -4, Green -5, Blue -6, Purple -7, Grey -8, White -9, Gold – 5%, Silver -10%, No Color -20%

1. a) Define resistivity of material. (5 marks)
b) if 10 m of manganin wire, 0.13 cm in diameter has a resistance of 3.4Ω at 15°C , find the resistivity of the material. (10 marks)
c) What is its resistance at 60°C , if temperature coefficient of resistance of manganin is $0.00403/^\circ\text{C}$ at 15°C . (5 marks)
2. a) State Ohm's law. (5 marks)
b) Six resistors are connected as shown circuit. If a battery having an e.m.f. of 24 V and internal resistance of 1Ω is connected to the terminal A and B.
Find i. Equivalent resistance between A and B.
ii. the current from the battery
iii. Potential difference across 8Ω and 4Ω resistors
iv. the current taken from the battery if a conductor of negligible resistance is connected in parallel with 8Ω resistor. (15 marks)
3. a) Define capacitance (5 marks)
b) Calculate the capacitance of two metal plates of area 30 m^2 and separated by a dielectric 2 mm thick, relative permittivity 6 and $\epsilon_0 = 8.854 \times 10^{-12}$. (5 marks)
c) Three capacitors of capacitance $2 \mu\text{F}$, $4 \mu\text{F}$ and $6 \mu\text{F}$ respectively are connected in series to a 220V d.c. supply. (10 marks)
Find i. the total capacitance
ii. charge on each capacitor
iii. potential difference across each capacitor.
4. a) A resistor has the following order of colour bands: (6 marks)
Red, Red, Red, Gold
Find the nominal resistance and its range of resistance values.
b) Two coils connected in series have a resistance of 18Ω and when connected in parallel have a resistance of 4Ω . Find value of resistances. (8 marks)

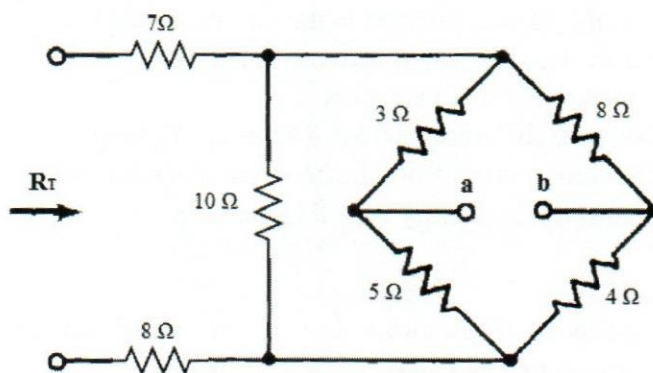
- c) Find equivalent resistance of following resistors network. (6 marks)



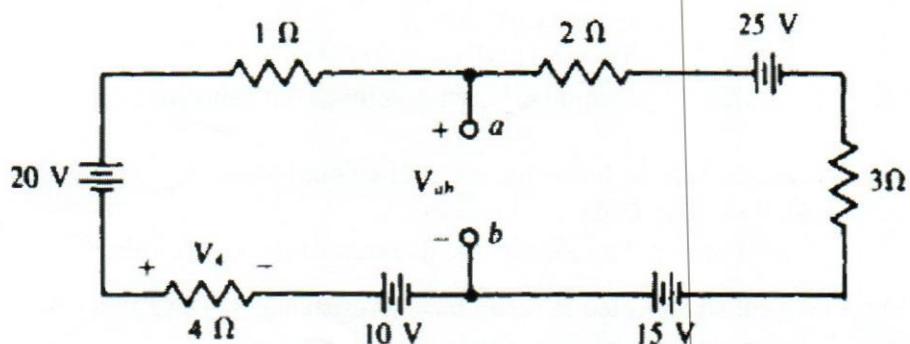
5. a) State Kirchoff's laws. (5 marks)
 b) Determine the currents I_1, I_2 and I_3 in the circuit below. (5 marks)



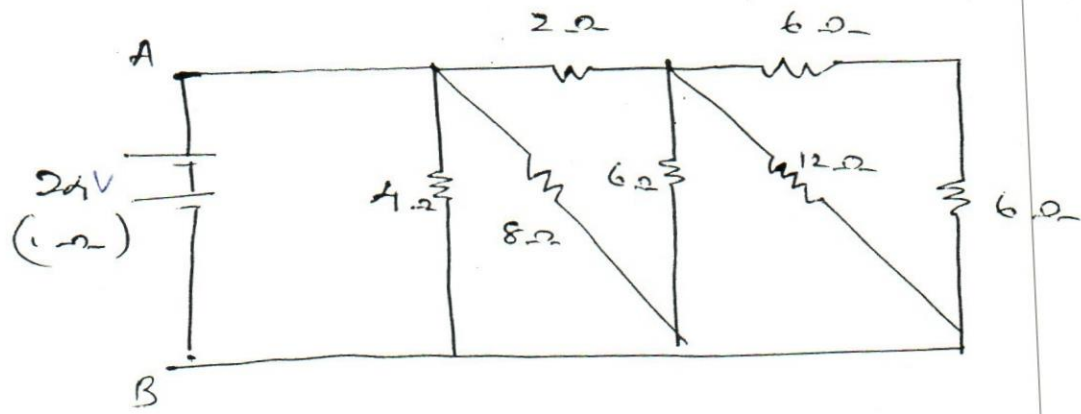
- c) i. In the circuit shown in figure, find R_T with terminals a and b (A) open-circuited and (B) short-circuited. (5 marks)



- ii. Find V_{ab} in the circuit shown in figure. (5 marks)



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26

IST SEMESTER EXAMINATION QUESTION PAPER
Mathematics

- This question paper consists of five questions.
- Answer All (05) Questions

Date: 2017.11.01

Pass mark 50%

Time allocated: 03 Hrs

1. a) Prove that (6 marks)
- $$\lim_{x \rightarrow a} \frac{x^n - a^n}{x - a} = na^{n-1}$$
- b) Evaluate following limits (6 marks)
- i. $\lim_{x \rightarrow 1} \frac{x^7 - 1}{x - 1}$ ii. $\lim_{x \rightarrow 25} \frac{\sqrt{x} - 5}{x - 25}$ iii. $\lim_{x \rightarrow 2} \frac{x^4 - 16}{x - 2}$
- c) Evaluate (8 marks)
- $$\lim_{x \rightarrow 0} \frac{\sin(\pi \cos^2 x)}{x^2}$$
2. a) Using first principles differentiate $f(x) = x^3$ and $f(x) = \sin x$. (6 marks)
- b) Differentiate with respect to x (6 marks)
- i. $y = x^3 - 7x^2 + 3$ ii. $y = 2\sqrt{x} + \frac{4}{\sqrt{x}}$ iii. $y = (2x + 3)^2$
- c) If $y = e^x + \sin x$, Prove that $\frac{d^2y}{dx^2} + y = 2e^x$ (8 marks)
3. a) Using the trigonometric ratios of 45° and 60° evaluate, (6 marks)
- i. $\cos 15^\circ$ ii. $\tan 105^\circ$ iii. $\sin(-15^\circ)$
- b) Prove that $\frac{\sin(A - B)}{\cos A \cos B} = \tan A - \tan B$. (8 marks)
- c) Hence show that $\frac{\sin(A - B)}{\cos A \cos B} + \frac{\sin(B - C)}{\cos B \cos C} + \frac{\sin(C - A)}{\cos C \cos A} = 0$ (6 marks)

4. a) Express $\cos 2A$, $\sin 2A$ and $\tan 2A$ in single angle. (6 marks)

b) Show that $\tan A = \frac{1 - \cos 2A}{\sin 2A}$ and hence find the value of $\tan 22.5^\circ$ (6 marks)

c) Solve the equation $\sin x + \sqrt{3} \cos x = 1$ (8 marks)

5. a) Solve the following equations (6 marks)

i. $x^2 + 5x + 6 = 0$ ii. $2x^2 + 2x - 7 = 0$

b) Determine the discriminant of quadratic equation $kx^2 + 2x - (k - 2) = 0$. (8 marks)

Hence prove that above quadratic equation has real roots for any value of k .

c) If α and β are roots of quadratic equation $x^2 - px + q = 0$. (6 marks)

Determine

i. $\alpha + \beta$

ii. $\alpha \beta$

iii. $\alpha^2 + \beta^2$



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COURSE CODE:

MID TERM EXAMINATION QUESTION PAPER
Introduction to the Shipping

- This question paper consists of six questions.
- Answer All Questions

Date: 2017.10.31

Pass mark 50%

Time allocated: 03 Hrs

1. Make a detailed sketch of a merchant ship and mark following parts. (20 marks)
Accommodation, stbd side, port side, anchor, forecandle, navigation light, main mast, keel, double bottom tank, bow thruster, navigation bridge, fore peak tank, aft peak tank, funnel, propeller, rudder, draft, length overall, beam and air draft.
2. (a) Give 10 kind of safety gears widely used on board. (10marks)
(b) Explain 5 of above safety gears. (10marks)
3. (a) Make a list of different types of ships widely used in shipping industry. (10 marks)
(b) Briefly describe 5 of them. (10 marks)
4. (a) What is meant by LSA and FFA (04 marks)
(b) List 5 types of items fall into each of above category. (10 marks)
(c) Sketch and describe any type of portable fire extinguisher. (06 marks)
5. (a) Make a list of 10 navigation equipment available on bridge for safe navigation. (10 marks)
(b) Write brief notes on 5 of above items. (10 marks)

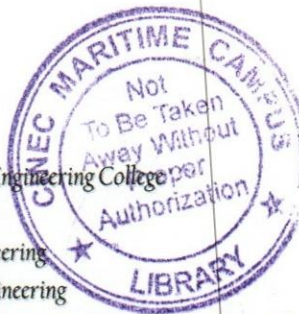


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COURSE CODE: ED 0340



38

1ST SEMESTER EXAMINATION QUESTION PAPER
Industrial Chemistry

- This question paper consists of five questions.
- Answer All (05) Questions

Date: 2017.10.31

Pass mark 50%

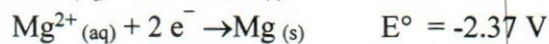
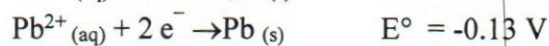
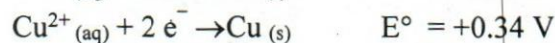
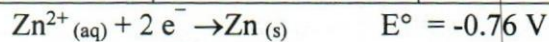
Time allocated: 03 Hrs

1. a) Define and express the equation for p^H . (4 marks)
- b) The concentration of OH^- ions in a certain household ammonia cleaning solution is $0.0025 \text{ mol dm}^{-3}$. Calculate the concentration of H^+ ions. (6 marks)
- c) Calculate the p^H of a $0.036 \text{ mol dm}^{-3}$ nitrous acid (HNO_2) solution: the ion product constant is $k_a = 4.5 \times 10^{-4}$. (6 marks)
What percentage of the acid is dissociated? (4 marks)
2. a) Define the following terms, (6 marks)
i. Oxidation
ii. Reduction
- b) Evaluate the oxidation number to all element of following substance (6 marks)
 I_2 , MnO_2 , $KMnO_4$, H_2O and $Na_2Cr_2O_7$
- c) Write a balanced ionic equation to represent the oxidation of Iodide ion (I^-) by permanganate ion (MnO_4^-) in basic solution to yield molecular iodine (I_2) and manganese(iv) oxide (MnO_2). (8 marks)



3. 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. (6 marks)

| Cells | Anode Reaction | Cathode Reaction | Overall Cell Reaction |
|-------|----------------|------------------|-----------------------|
| Mg-Zn | | | |
| Cu-Pb | | | |
| Pb-Mg | | | |



- b) Consider an electrochemical cell with a nickel electrode immersed in $1.0 \text{ mol/dm}^3 \text{ NiSO}_4$ solution and a iron electrode immersed in $1.0 \text{ mol/dm}^3 \text{ FeSO}_4$ solution and Ni-Fe voltaic cell half-reactions are:
- $$\text{Fe}^{2+}_{(\text{aq})} + 2\text{e}^{-} \rightarrow \text{Fe}_{(\text{s})} \quad E^{\circ} = -0.44 \text{ V}$$
- $$\text{Ni}^{2+}_{(\text{aq})} + 2\text{e}^{-} \rightarrow \text{Ni}_{(\text{s})} \quad E^{\circ} = -0.25 \text{ V}$$
- Identify anode and cathode half cells of above cell. (3 marks)
 - Calculate the standard electromotive force of Ni/Fe cell. (4 marks)
- c) Briefly describe discharging and charging cycles of Lead-acid battery. (7 marks)
4. a) Define acid and base
 b) Describe properties of acids and bases. (6 marks)
 c) Identify the following as strong acid, strong base, weak acid and weak base. $\text{Al}_2(\text{OH})_3$, HCN, HF, H_2SO_3 , H_3PO_4 , KOH, NH_3 , (6 marks)
 d) 2.00 L of $0.800 \text{ mol/dm}^3 \text{ HNO}_3$ must be prepared from a solution known to be 1.50 mol/dm^3 in concentration. Briefly explain producing steps of dilute acid sample. (8 marks)
5. a) What is corrosion? (6 marks)
 b) Briefly describe formation of rust with chemical reactions. (8 marks)
 c) Explain impress cathodic corrosion protection (ICCP). (6 marks)

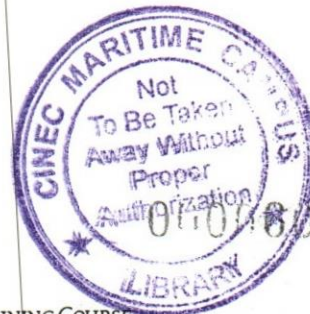
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FINAL TERM EXAMINATION QUESTION PAPER
INDUSTRIAL CHEMISTRY

- This question paper consists of six questions.
- Answer Any Five (05) Questions Including Question No 1

Date: 2016.09.21

Pass mark 50%

Time allocated: 03 Hrs

Some helpful Data:

* Avogadro Constant (N) – $6.022 \times 10^{23} \text{ mol}^{-1}$

* Density of Water – 1 g/cm^3 | * Faraday constant – 96500 C/mol

Mass Numbers of first 20 Elements:

H – 1, He – 4, Li – 7, Be – 9, B – 10.8, C – 12, N – 14, O – 16, F – 19, Ne – 20, Na – 23, Mg – 24.3, Al – 26.9, Si – 28, P – 31, S – 32, Cl – 35.5, Ar – 40, K – 39, Ca – 40, $\frac{54}{25}\text{Mn}$.

- 1) i. If p^{H} of solution is 2.5 then p^{OH} is
- a) 11.5 b) 2 c) 3 d) 3.16×10^{-12}
- ii. The isotope Mg contains ___ electrons, ___ protons, and ___ neutrons.
- a) 11e, 11p, 12n b) 12e, 11p, 12n c) 12e, 12p, 12n
- d) 11e, 12p, 11n
- iii. SI unit of concentration
- a) mol/dm^3 b) dm^3/mol c) mol/dm d) dm/mol .
- iv. Calculate the number of moles of calcium in 12×10^{24} atoms of Ca.
- a) 50 mol Ca b) 20 mol Ca c) $3.0 \times 10^2 \text{ mol Ca}$
- d) 25 mol Ca
- v. Identify the ions in KMnO_4 .
- a) H^+ , Mn^{4+} and O^{2-} b) K^{3-} , H^- , Mn^{7+} and O^{2-} c) K^+ and HMnO_4
- d) K^+ and MnO_4^{1-}
- vi. What is the mass percent of Oxygen in water?
- a) 10% b) 33% c) 73% d) 89%

vii. What mass of the excess reactant remains after reacting 8.51 g of magnesium with 3.45 g of nitrogen gas? $3 \text{Mg}(s) + \text{N}_2(g) \rightarrow \text{Mg}_3\text{N}_2(s)$

- a) 5.52 g Mg b) 0.18 g N_2 c) 5.06 g Mg d) 0.061 g N_2

viii. This equation is unbalanced: $\text{PCl}_3 + \text{H}_2\text{O} \rightarrow \text{H}_3\text{PO}_3 + \text{HCl}$ When it is correctly balanced, the coefficients are, respectively

- a) 1,3,1,1 b) 1,1,1,3 c) 1,3,1,3 d) 2,3,2,3

ix. What is the mass of $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ in 60.0 mL of 0.0880 M solution?

- a) 0.181 g b) 1.81 g c) 5.02 g d) 5.28 g

x. If the formula for potassium chlorate is KClO_3 and the formula for magnesium fluoride is MgF_2 , then what is the formula for magnesium chlorate?

- a) MgClO_3 b) Mg_2ClO_3 c) $\text{Mg}(\text{ClO}_3)_2$ d) $\text{Mg}_2(\text{ClO}_3)_3$

(2×10 marks)

2) a) Categorize synthetic polymers by which they are formed.

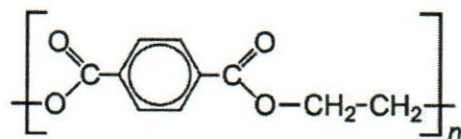
(6 marks)

b) Draw the polymer chains of polyethylene, Teflon and polyvinylchloride.

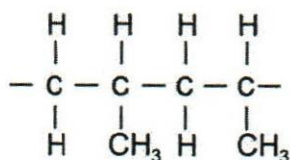
(6 marks)

c) Deduce the monomer(s) of following synthetic polymers.

(8 marks)



i)



ii)

3) a) Explain formation of rust using oxygen concentration cells.

(6 marks)

b) Explain chemically "Metallic corrosion is very rapid in acidic medium, both in the presence and absence of oxygen".

(6 marks)

c) What are the advantage and disadvantage of Impress Current Cathodic Protection method.

(8 marks)

4) a) Briefly explain refinery process of Diesel from crude oil.

(5 marks)

b) What are the chemical difference between petrol and diesel?

(5 marks)

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- c) Calculate AFR of 90-Octane petrol. (5 marks)
- d) Name three harmful exhaust gases and explain harmfulness with AFR. (5 marks)
- 5) a) Explain differences of lubricant and other petroleum fuel in terms their property. (6 marks)
- b) What are the purposes of use lubricant oil in engine? (6 marks)
- c) The BN is often referred to as "alkalinity" of lubricant oils, what is main additive of BN- 70 lubricant oil. (8 marks)
- 6) a) Define the coagulation. (6 marks)
- b) What are the coagulation agents? (6 marks)
- c) Explain water hardness. (8 marks)



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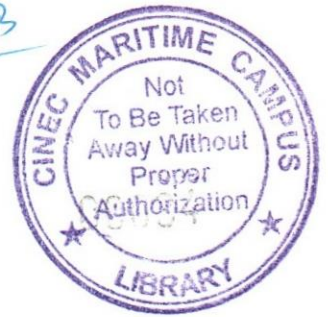
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COURSE CODE: ED 0340



FINAL EXAMINATION QUESTION PAPER
ELECTRONICS

- This question paper consists of six questions.
- Answer Any Five (05) Questions Including Question No 1

Date: 2016.09.21

Pass mark 50%

Time allocated: 03 Hrs

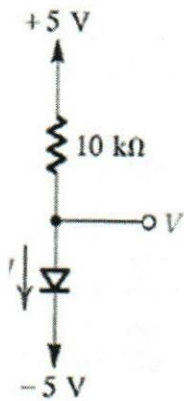
- 1) i) A wire has a resistance of 12Ω . It is bent in the form of circle. The effective resistance between the two points on any diameter of the circle is
- a) 6Ω b) 12Ω c) 24Ω d) 3Ω
- ii) An n-type semi-conductor is
- a) positively charged b) electrically neutral
c) negatively charged d) none of above
- iii) A semi-conductor has temperature co-efficient of resistance.
- a) negative b) positive c) zero d) none of above
- iv) In a N-P-N transistor, P region is called.....
- a) collector b) emitter c) base d) none of above
- v) The emitter of a transistor is doped.
- a) heavily b) lightly c) moderately d) none of above
- vi) In a transistor amplifier circuit, $V_{CE} = V_{CB} + \dots$
- a) V_{BE} b) $2V_{BE}$ c) $1.5V_{BE}$ d) none of the above
- vii) If biasing is not done in an amplifier circuit, it results in.....
- a) decrease in base current b) unfaithful amplification
c) excessive collector bias d) none of the above
- viii) Operating point represents.....



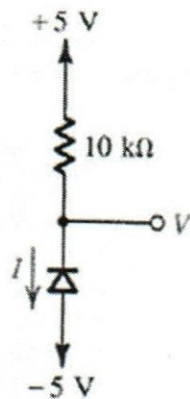
- a) values of I_C and V_{CE} when signal is applied
 - b) the magnitude of signal
 - c) zero signal values of I_C and V_{CE}
 - d) none of the above
- ix) The output frequency of a half-wave rectifier is the input frequency.
- a) one-half b) twice c) equal to d) none of the above
- x) The output frequency of a full-wave rectifier is the input frequency.
- a) one-half b) equal to c) twice d) one-quarter

(2×10 marks)

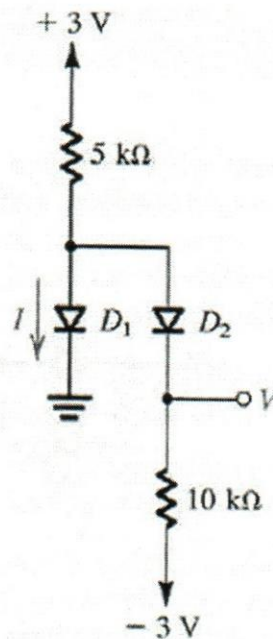
- 2) a) Describe formation of diode from pure silicon crystal to P-N junction diode. (6 marks)
- b) Draw schematic diagrams of the full wave and half wave rectifier circuits. (6 marks)
- c) Assume that the diodes in the figure are ideal. Find the values of the labeled currents and voltages (8 marks)



(i)



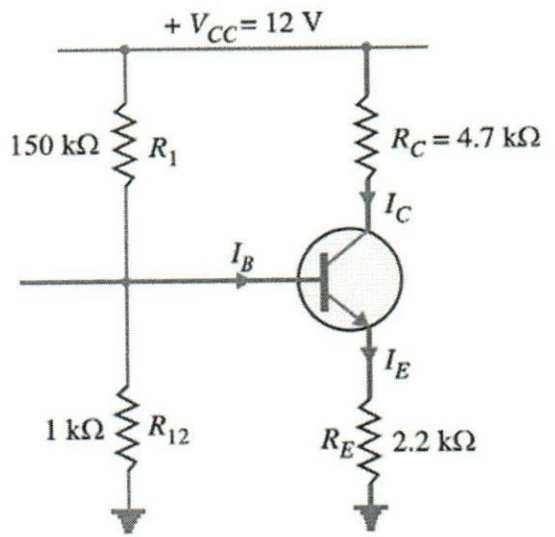
(ii)



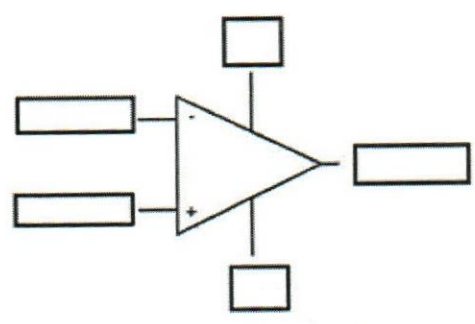
(iii)



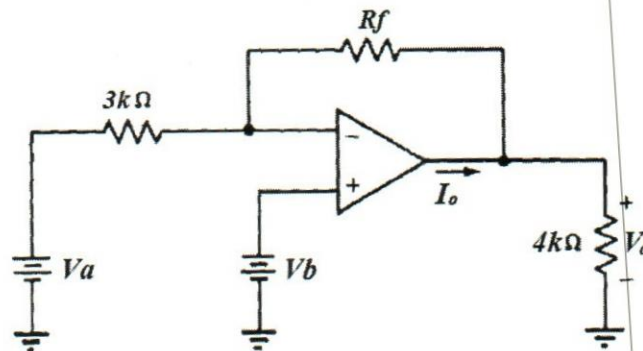
- 3) a) Draw schematic diagrams of npn and pnp transistors. (6 marks)
- b) Describe the various methods used for transistor biasing. (6 marks)
- c) The amplifier circuit is shown in below, Find the operating point. Given that $\beta = 50$ and $V_{BE} = 0.7V$. (8 marks)



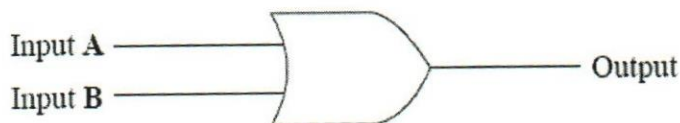
- 4) a) Identify the terminals in the following op - amp. (6 marks)



- b) Draw schematic diagram of weighted summer amplifier. (6 marks)
- c) In following circuit, feedback resistor R_f , dc voltages V_a and V_b are connected with operational amplifier. Assuming no saturation for part i. and ii. (8 marks)
- i. If $R_f = 12k \Omega$, $V_a = 2V$ and $V_b = 0V$. Determine V_o and I_o
 - ii. Repeat part i. for $R_f = 9k \Omega$, $V_a = 4V$ and $V_b = 2V$.



5) a) The diagram shows the symbol for one type of logic gate.



- i) What is this type of logic gate? (4 marks)
- ii) Draw complete truth table for this logic gate (4 marks)
- b) Draw XNOR and XOR logic gates using AND, OR and NOT LOGIC gates. (6 marks)
- c) Simplify the Boolean expression $F = abc\bar{c} + a\bar{b}c + abc$, Hence Draw logic gate circuit diagram for function F. (6 marks)
- 6) a) What is the difference between active and passive sensors? (6 marks)
- b) List three type of temperature sensors. (6 marks)
- c) Describe working principle of Linear Variable Differential Transformer (LVDT). (8 marks)



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FINAL TERM EXAMINATION QUESTION PAPER
MATHEMATICS

- This question paper consists of six questions.
- Answer Any five(05) Questions

Date: 2016.09.21

Pass mark 50%

Time allocated: 03 Hrs

- 1) a) Convert following decimals into fractions. (6 marks)
- 0.121212.....
 - 4.242424.....
- b) Divide $\frac{x^3 - 4x^2 + 2x + 3}{x + 2}$ (6 marks)
- c) Split the function $\frac{x+1}{x(x^2-4)}$ into partial fractions (8 marks)
- 2) a) Calculate $4!$ and 4C_3 (6 marks)
- b) The expression $(1-2x)^4$ can be written in the form (8 marks)
- $$1 + px + qx^2 - 32x^3 + 16x^4$$
- By using the binomial expansion, or otherwise, find the values of the integers p and q.
- c) If the coefficient of x^2 in the expansion of $(b+2x)^6$ is equal to the coefficient of x^5 in the expansion of $(2+bx)^8$. Find non-zero value of 'b'. (6 marks)
- 3) a) Differentiate the following function
- $y = x^3 + 5x^2 - 3x + 2$ (5 marks)
 - $y = \frac{\sin x}{1 + \cos x}$ (5 marks)
 - $y = \ln(\sin x + e^x)$ (5 marks)
- b) If $y = \frac{2 + \ln(1+x)}{x^2}$, show that $x(1+x)\left(x\frac{dy}{dx} + 2y\right) = 1$ (5 marks)

4) a) Integrate the followings

(6 marks)

i) $\int (x^3 - 5x^2 + 4x - 3) dx$

ii) $\int (e^x + \sin 3x) dx$

b) Integrate the followings using integrate by parts

(8 marks)

i) $\int x.e^x dx$

ii) $\int e^x \sin x dx$

c) $\int_1^3 \frac{x+7}{(x+2)(x+3)} dx$

(6 marks)

5) a) i) Draw the lines

$$y = 2x + 1;$$

$$y = 3x - 1;$$

On the same grid for the interval $-2 \leq x \leq 3$

ii) Then show the angle between them is given by, $\theta = \tan^{-1} \left[\frac{1}{7} \right]$

(6 marks)

b) A quadratic function is defined by $f(x) = x^2 + x - 6$. Find

i) gradient at any instant.

ii) X and Y intercept

iii) turning point

(6 marks)

c) Sketch the graphs of above $f(x) = x^2 + x - 6$ and $g(x) = \frac{1}{x}$ on same graph paper.

(8 marks)

6) a) i) Solve quadratic equation $x^2 - 2x + 3 = 0$.

(6 marks)

ii) If above equation roots are α and β , Find $\frac{\beta}{\alpha}$

b) If two complex numbers are $z_1 = 2 + 3i$ and $z_2 = 8 - 5i$, Evaluate

(8 marks)

i) $z_1 + z_2$ ii) $z_1 z_2$ iii) $z_1 - 3z_2$

c) Find square root of $35 - 12i$

(6 marks)

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Colombo International Nautical and Engineering College

CINEC CAMPUS

Faculty of Marine Engineering

Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340



FINAL TERM EXAMINATION QUESTION PAPER
INTRODUCTION TO SHIPPING

- This question paper consists of five questions.
- Answer All (05) Questions

Date: 2016.09.20

Pass mark 50%

Time allocated: 03 Hrs

1. With an aid of a sketch show following principle parts and areas of a ship Superstructure, portholes, main deck, bow thruster, astern thruster, anchor, stern, propeller, rudder, bulbous bow, draft, depth (air draft), port beam, stbd beam, athwart ship, navigation lights, Christmas tree, starboard side and port side. **(20 marks)**
2. Explain following abbreviations (complete word each letter is standing for; eg: HR = Human Resources) **(8 marks)**
 - i. LSA, FFA, BA, ETA, ETD, EEED, PPE, ROB,
 - ii. Make short notes on following operations.
Ballasting and DE ballasting, Anchoring, Tank Sounding, Berthing, Loading and Discharging. **(2 marks each)**
3. a) List 10 types of trading ship widely available at sea. **(10 marks)**
b) Explain following terms using suitable sketches where necessary
 - i) Trim
 - ii) List
 - iii) Rolling
 - iv) Pitching
 - v) Anchoring **(2 marks each)**
4. a) List 5 type of LSA items available on merchant ships. **(8 marks)**
b) What are the most suitable PPE, you should be wearing when performing work in following areas.
 - i) Working aloft **(4 marks)**
 - ii) Cleaning scavenge space. **(4 marks)**
 - iii) Handling chemicals **(4 marks)**
 - iv) Painting ship side. **(4 marks)**

5. Write short notes on following part of a ship.

- a) Twin deck
- b) Double bottom tank.
- c) Water tight Bulk head.
- d) Stern thruster
- e) Anchor Locker
- f) Watertight doors
- g) Void space
- h) Propeller
- i) Emergency Fire pump.
- j) Emergency Generator.

(2 marks)

(2 marks)

(2 marks)

(2 marks)

(2 marks)

(2 marks)

(2 marks)

(2 marks)

(2 marks)

(2 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 016



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: 2016.09.19

Pass mark 50%

Time allocated: 03 Hours

Avogadro Constant (N_A) - $6.022 \times 10^{23} \text{ mol}^{-1}$

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

- Butane
- Ammonia
- Ozone
- Calcium carbonate

(1×4= 04 marks)

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

(06 marks)

c) Define the term

- Mass number
- Flammability
- Mixture
- Ionic bond
- Auto ignition temperature

(2×5= 10 marks)

2)

a) How many moles are in 72.9 g of HCl?

(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?

(06 marks)

3)

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

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

(04 marks)

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

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

(06 marks)

- c) Calculate the pH of each of these solutions:

(a) 0.003 M HCl ,

(b) $1.3 \times 10^{-4} \text{ M Ba(OH)}_2$,

(04 marks)

- d) Calculate the solubility of Cu(OH)_2 in 1 g l^{-1} . K_{sp} of Cu(OH)_2 2.2×10^{-20}

(06 marks)

4)



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)
- f) What is Standard hydrogen electrode? (03 marks)

5)

- g) Explain the meaning of corrosion with examples.
- h) Explain the factors affect speed of electrolyte corrosion?
- i) Explain how nature of medium influencing corrosion?
- j) Explain what is cathodic protection
- k) Write two corrosion control method and explain it.

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6)

- a) How does Petroleum form?
- b) What is meant by "Fractional Distillation"?
- c) Write four function of lubricants.
- d) What are the three types of lubrications?
- e) Write a short note about thick film lubrication.

(5 x 4 = 20
marks)

7)

- a) Categorized polymers according to their structural arrangement. (04 marks)
- b) Explain what is vulcanization of rubber? (04 marks)
- c) ~~Teflon~~ ^{Styrene} is a useful polymer. ($\text{CH}_2=\text{CHC}_6\text{H}_5$)
 - i. Write its monomer structure
 - ii. Polymer structure
 - iii. Give two Uses and applications (04 marks)
- d) What are the ways of extraction metals (04 marks)
- e) What are the Raw materials of extraction of Iron? (04 marks)

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Colombo International Nautical and Engineering College
Cinec Campus
Faculty of Marine Engineering
Department of Marine Engineering
Education & Training COURSE: Engineer Officer Cadet Foundation Training Course
Course CODE: ED 0340

Final examination Question paper
Applied Mechanics

- This question paper consists of Eight questions.
- Answer Any Six (06) Questions

Date: 2016.09.19

Pass mark 50%

Time allocated: 03 Hrs

Q.1 (a) Define

- Resolution of a Force
- Principle of Resolution.

(b) ABC is an isosceles triangle, AB and AC 5 m, BC 8 m. D is the centre of BC. The forces acting on the sides BA, BC, CA and DA are P N, 9 N, 10 N, and 3 N respectively. The resultant of these forces intersects BC at N. The length of BN is 5 m. Find the value of 'P' and magnitude and direction of the resultant.

Q.2 a) Define Principles of Equilibrium.

b) The length of a homogeneous rod AB is 8m and weight is 30 kg. The rod is resting on two knife edges of which are 4 meters apart and one of the knife edges are 3 m from the A. The weight of 20 kg is hung from A and 40 kg is hung from the B. Find the reactions at the knife edges. Also find the position of which should be placed 20 kg on the rod, from the end B, so that the reactions at the knife edges are equivalent.

Q.3 (a) What do you understand by the term Friction and explain why it comes in to play.

(b) An inclined plane whose gradient is 1.2 to 2.4 meters is used to unload slowly a safe weighing 400 N from a truck 1.2 m high in to the ground. The coefficient of friction between the underside of the safe and the plank is 0.3. State whether it is necessary to push the safe down or hold it back from sliding down. What minimum force is required parallel to the plane for this purpose.

Q 4 a) How would you explain the frictional force between a ladder and the floor and a wall

b) A homogeneous ladder of weight W and length AB is resting against a wall such that the end 'A' is resting on the wall and the other end 'B' is resting on the ground. The coefficient of friction between wall and the ladder is $1/3$ and the ladder is resting at an angle of $\tan^{-1}(3/4)$ with the horizontal. Find the friction between the ladder and the floor.

Q5. (a) Define change of velocity due to change of direction or speed or both.

(b) A body moving at 20m/s due north is acted upon by a force for 4 seconds which causes the velocity to change to 20 m/s due east. Find the change of velocity and the average acceleration.

Q6 (a) Define relative velocity.

(b) Two ships leave at the same time from the same port, one travels at south east at 22 knots and the other due east at 14 knots. Find the apparent speed and the direction of the fast ship to the slow ship.

Q 7 (a) Define angular motion.

(b) An electric motor comes to rest from operational speed in 1.5 minutes and turns 1800 revolutions while slowing down. Find the operational speed in rev/min and the retardation in rad/s^2 .

Q 8 (a) Define,

- i) Accelerating force
- ii) Momentum

(b) The tractive resistance of a vehicle of 2 tons mass is 155 N per tonne. If a total pull of 1 KN is applied to the vehicle, find,

- (i) The acceleration
- (ii) The speed in KM/hour , after travelling for one minute from the rest.

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Faculty of Marine Engineering

Department of Marine Engineering

Education & Training COURSE: Engineer Officer Cadet Foundation Training Course
Course CODE: ED 0340



Final Examination Question paper
Engineering Drawing

- Answer All Questions

Date: 2016.09.19

Pass mark 50%

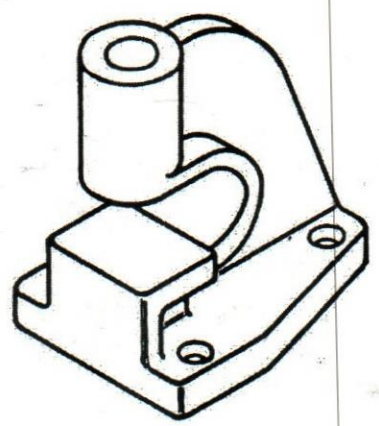
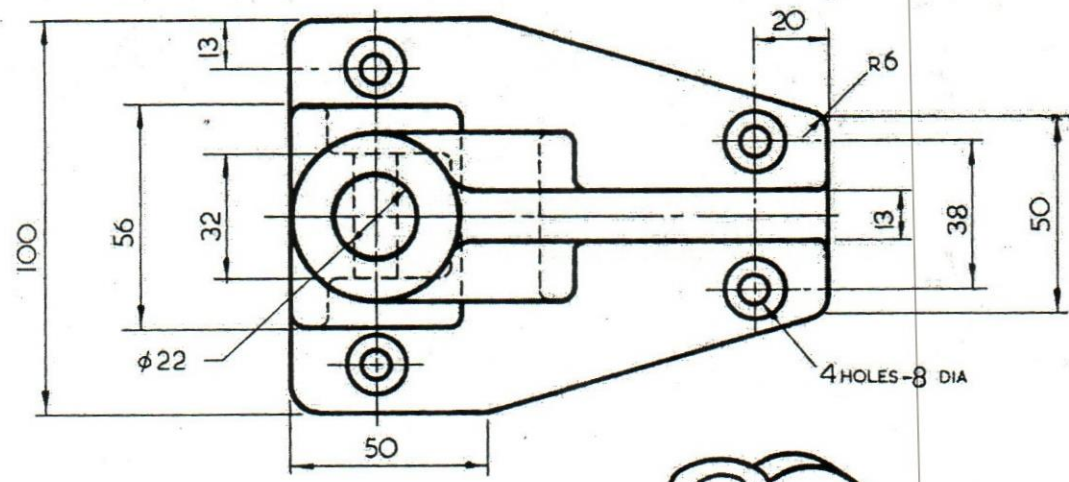
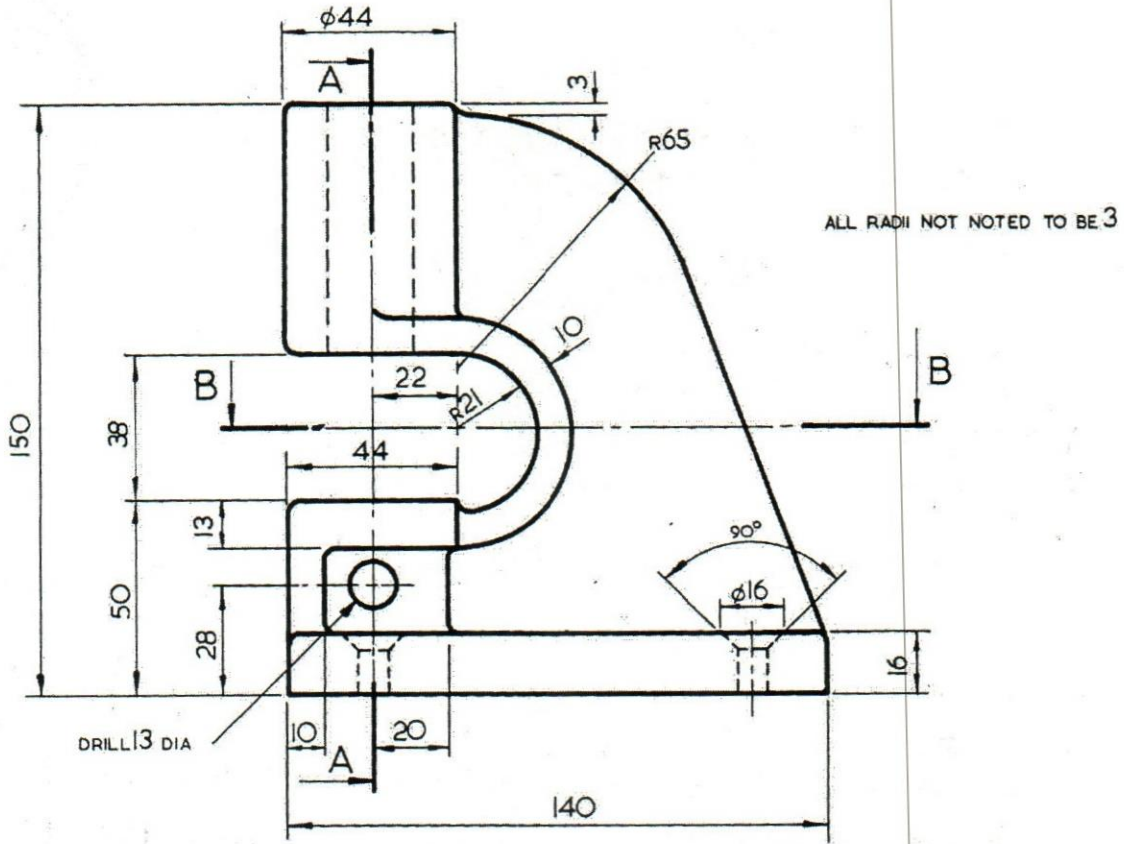
Time allocated: 03 Hrs

Marking System

- | | | |
|-------|---|----------|
| (i) | Q: 1 | 80 Marks |
| (ii) | Titles and Lettering | 10 Marks |
| (iii) | Boundaries, Lines, and overall neatness | 10 Marks |

Q1. Figure shows the elevation and plan of a machined casting. Draw full size 1st angle projection, the following views.

- The elevation as shown (20)
- The sectional end elevation taken on the line AA, looking in the direction of the arrows. (30)
- The sectional plan, the section being taken on the line BB. (30)



| | | |
|------------------|------------------------|--|
| MACHINED CASTING | DATE | |
| | FIRST ANGLE PROJECTION | |
| | ALL DIMENSIONS IN MM | |



Colombo International Nautical and Engineering College

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Faculty of Marine Engineering

Department of Marine Engineering

EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0340



MID TERM REPEAT EXAMINATION QUESTION PAPER
Physics

- This question paper consists of nine questions.
- Answer any Six(06) Questions

Date: 2016.07.16

Pass mark 50%

Time allocated: 03 Hrs

Speed of sound in air 340 m/s, refractive index of water 1.333

1.
 - a. Define the index of refraction of a material medium. (3 marks)
 - b. What is the speed of light in crystalline quartz? Assume the index of refraction of quartz to be 1.553 and speed of light in free space to be $3.0 \times 10^8 \text{ ms}^{-1}$. (5 marks)
 - c. The index of refraction of a flint glass is 1.64. Find the speed of light in the glass, the angle of refraction in glass if light is incident from water at an angle of 50° , and critical angle of incidence for glass- water interface. (12 marks)
2.
 - a. Define the following terms
 - i. Pitch
 - ii. Loudness
 - iii. Quality
 - iv. Beats
 - v. Supersonic velocity (10 marks)
 - b. A 200 cm long string has two adjacent resonances at frequencies of 80 and 105 Hz. Determine the fundamental frequency of the string and the speed of the waves on the string. (5 marks)
 - c. Two closed organ pipes sounded simultaneously give five beats per second between the fundamentals if the longer pipe is 1.1 m long, find the length of the shorter pipe (5 marks)

3.

- a. Describe the occurrence of beats of two sound source with closer frequencies
(3 marks)
- b. Write down the beat formula for two tuning-forks of slightly different frequencies of f_1 and f_2 are sounded together.
(3 marks)
- c. 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 and briefly state your answer
(6 marks)
- d. 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)

4.

- a. Briefly explain the Doppler Effect for sound waves.
(8 marks)
- b. A hawk is flying directly away from a stationary birdwatcher and directly toward a distant cliff at a speed of 20 m/s. The hawk produces a shrill cry whose frequency is 1000 Hz.
- i. What is the frequency in the sound that the birdwatcher hears directly from the bird?
(6 marks)
- ii. What is the frequency that the birdwatcher hears in the echo that is reflected from the cliff?
(6 marks)

5. The excess pressure in a traveling sound wave is given by the equation ,

$$P = 2.5 \sin \left\{ \left[\frac{2\pi}{\lambda} \right] (x - 330t) \right\}$$

where x and λ are in meters t in seconds, P is in Pascal.

- i. What is the velocity of the wave?
- ii. If $\lambda = 2$ m, what is the frequency of the wave?
- iii. What is the maximum pressure?
- iv. What is the pressure at $x = 0.5$ m and $t = 2$?
(20 marks)

6. The equation for a particular standing wave on a string is

$$y = 0.35 \sin 4x \cos 340 t \text{ m}$$

Find the

- i. Amplitude of vibration at the anti-node,
 ii. Distance between nodes
 iii. Wavelength
 iv. Frequency and speed of the wave (20 marks)
- 7.
- a. Describe the Simple Harmonic Motion (3 marks)
 b. Find the length of a pendulum which has a period of 2.4 s. (3 marks)
 c. A stone is swinging in a horizontal circle 0.8 m in diameter, at 30 rev/min. A distant light causes a shadow of the stone to be formed on a nearby wall. What is the amplitude of the motion of the shadow? What is the frequency? What is the period? (6 marks)
 d. A 0.2 kg mass suspended from a spring describes a simple harmonic motion with a period of 3 s and amplitude of 10 cm. At $t = 0$ the mass passes upward through the equilibrium position. Find
 i. The spring constant (4 marks)
 ii. The displacement, velocity and acceleration of the mass when $t = 1$ s (4 marks)
8. The following four waves are sent along strings with the same linear densities (x is in meters and t is in seconds) rank the waves according to
 a. Their wave speed (10 marks)
 b. The tension in the string along which they travel (10 marks)
- $$y_1 = (3\text{mm})\sin(x - 3t) \quad y_2 = (6\text{mm})\sin(2x - t) \quad y_3 = (1\text{mm})\sin(4x - t)$$
- $$y_4 = (2\text{mm})\sin(x - 2t)$$
- 9.
- a. Describe diffraction, and express the formula for a thin slit. (4 marks)
 b. A light source emits a mixture of wavelength from 450 to 600 nm. When a diffraction grating is illuminated normally by this source, it is noted that two adjacent spectra barely overlap at an angle of 30° . How many lines per meter are ruled on the grating? (8 marks)
 c. A grating having 15000 lines per inch produces spectra of a mercury arc. The green line of the mercury spectrum has a wavelength of 5461 Å. What is the angular separation between the first-order green line and the second-order green line? (8 marks)

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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE: ED 0340

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MID TERM REPEAT EXAMINATION QUESTION PAPER
Mathematics

- This question paper consists of five questions.
- Answer **All (05) Questions**

Date: 2016.07.16

Pass mark 50%

Time allocated: 03 Hrs

- Solve $3x^2 - 8x = 5$ (6 marks)
 - Prove that $kx^2 + 2x - (k - 2) = 0$ has real roots for any value of k. (6 marks)
 - If α and β are the roots of quadratic equation $ax^2 + 2bx + c = 0$, prove that the equation whose roots are $\alpha + \frac{1}{\beta}$ and $\beta + \frac{1}{\alpha}$ is $acx^2 + 2b(a + c)x + (a + c)^2 = 0$. (8 marks)
- Evaluate the value of following trigonometric ratios. (6 marks)
 - $\sin 75^\circ$
 - $\tan 22.5^\circ$
 - Prove that $\frac{1 + \cot^2 \theta}{\sec \theta} = \operatorname{cosec} \theta \cdot \cot \theta$ (8 marks)
 - If $\sin x \cos y = 1/4$ and $3 \tan x = 4 \tan y$, Evaluate the value of $\sin(x + y)$ (6 marks)
- Evaluate $\lim_{x \rightarrow 0} \frac{\tan^{-1} x}{x}$ (6 marks)
 - Evaluate $\lim_{x \rightarrow 0} \frac{\cos(\sin x) - \cos x}{x^4}$ using L'Hopital rule or otherwise (6 marks)
 - Differentiate y with respect to x. (8 marks)

$$y = \frac{x+2}{\sin x} + 2x^3 + \sqrt{x}$$

4. a. Evaluate the following: (6 marks)

i. $49^{-\frac{1}{2}}$ ii. $8^{-\frac{1}{3}}$ iii. $(256)^{0.16} \times (256)^{0.09}$

b. If $3^{(x-y)} = 27$ and $3^{(x+y)} = 243$, Find the value of x and y. (6 marks)

c. Express each of the following in the form $+q\sqrt{5}$, where p and q are real numbers. (8 marks)

i. $(2 - \sqrt{5})(4 + \sqrt{5})$

ii. $(3 + \sqrt{5})^2$

iii. $(6 + \sqrt{20})$

iv. $(\sqrt{45} - \sqrt{4})^2$

5. a. Simplify i. $\log_2 128$ (6 marks)

ii. $\log_3(27 \times 243)$

iii. $\log_3(0.111111111111 \dots \dots \dots)$

b. Find the value of (6 marks)

$$\frac{1}{\log_5 210} + \frac{1}{\log_6 210} + \frac{1}{\log_7 210}$$

c. The equation has
 $x^{[(\log_5 x)^2 - \frac{9}{2}(\log_5 x) + 5]} = 5\sqrt{5}$ exactly three real roots

Substituting $\log_5 x = q$,

i. Express above equation in term of q

ii. Hence, Determine the value of x. (8 marks)

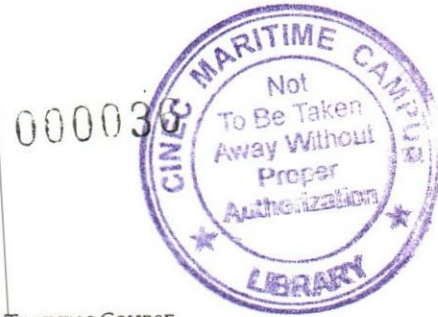
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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE: ED 0340



MID TERM REPEAT EXAMINATION QUESTION PAPER
ELECTRONICS

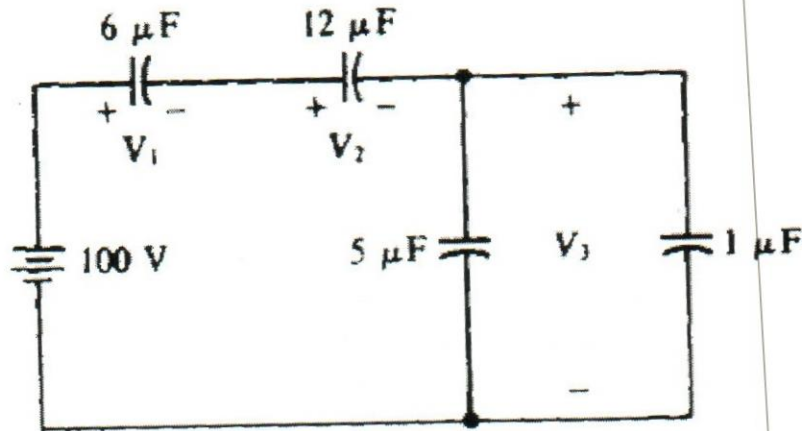
- This question paper consists of five questions.
- Answer All(05) Questions

Date: 2016.07.15

Pass mark 50%

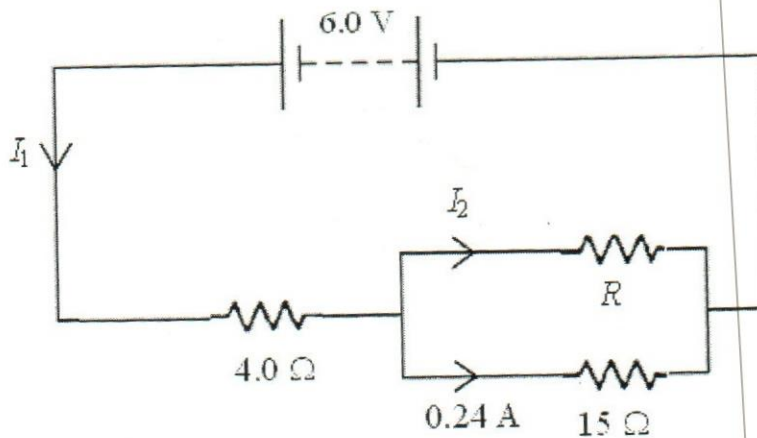
Time allocated: 03 Hrs

- 1) a) Define capacitance and capacitor. (4 marks)
b) What is the charge stored on a 2pF capacitor with 10 V across it? (6 marks)
c) Find each capacitor voltage V_1 , V_2 and V_3 in following capacitor network. (10 marks)

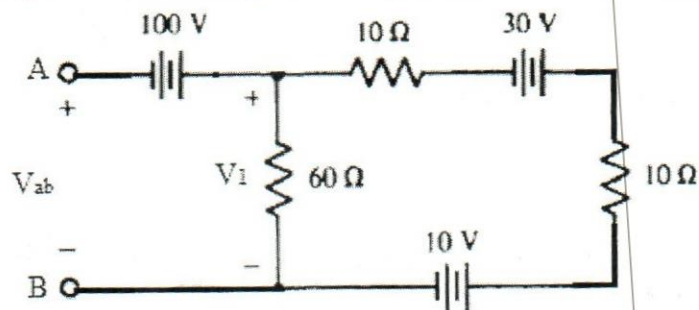


- 2) a) What are the SI unit of resistance, voltage and current? (5 marks)

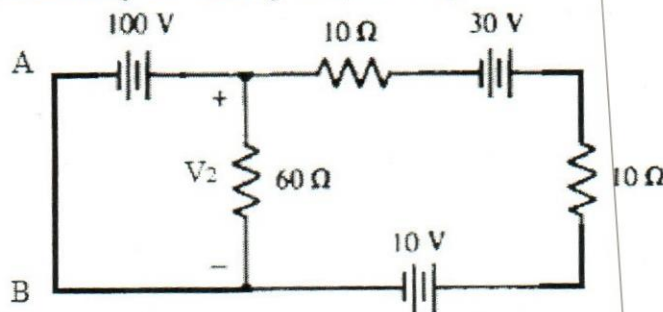
The circuit shows a battery of negligible internal resistance connected to three resistors.



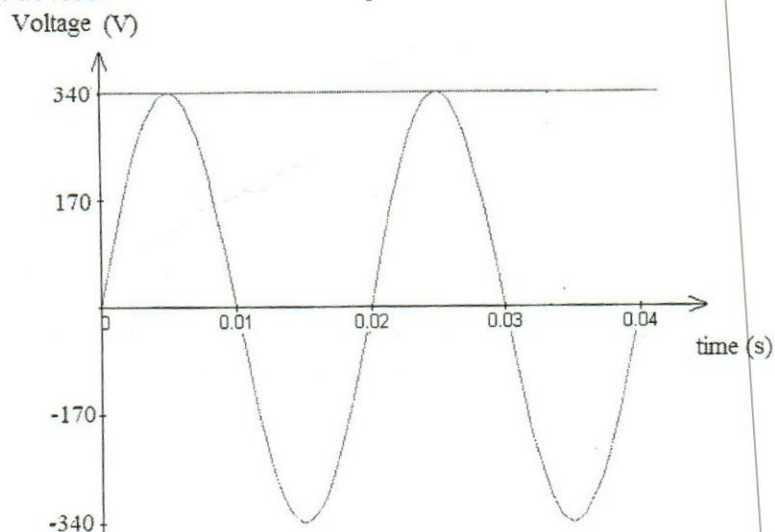
- b) Calculate the potential difference across the 15Ω resistor. (5 marks)
- c) Calculate the current I_1 in the 4.0Ω resistor. (5 marks)
- d) Calculate the current I_2 and the resistance R . (5 marks)
- 3) a) State Kirchhoff current law and Kirchhoff voltage law with applicable circuit diagrams (5 marks)
- b) In the DC circuit, V_{ab} and V_1 are voltage across open circuit and 60Ω resistor respectively.



- i. Calculate the voltage V_{ab} across the open circuit and V_1 in the circuit shown in above Figure. (5 marks)
- ii. Calculate power consumption of 60Ω resistor. (5 marks)
- c) When A and B are connected by conducting wire, Find V_2 . (5 marks)



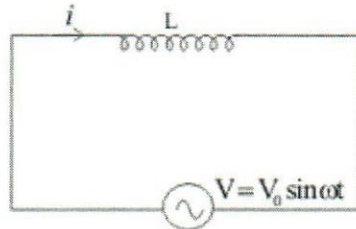
- 4) The graph below shows how a sinusoidal alternating voltage varies with time, when voltage source is connected across a device.



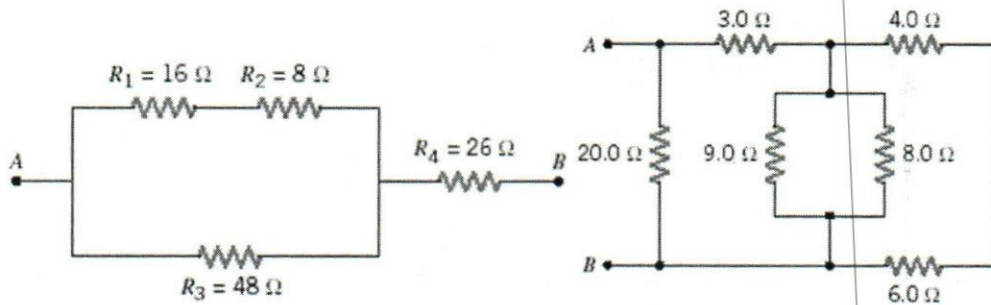
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- a) Determine peak voltage and V_{rms} . (5 marks)
 b) Find the frequency (F) and angular velocity (ω) of above waveform.

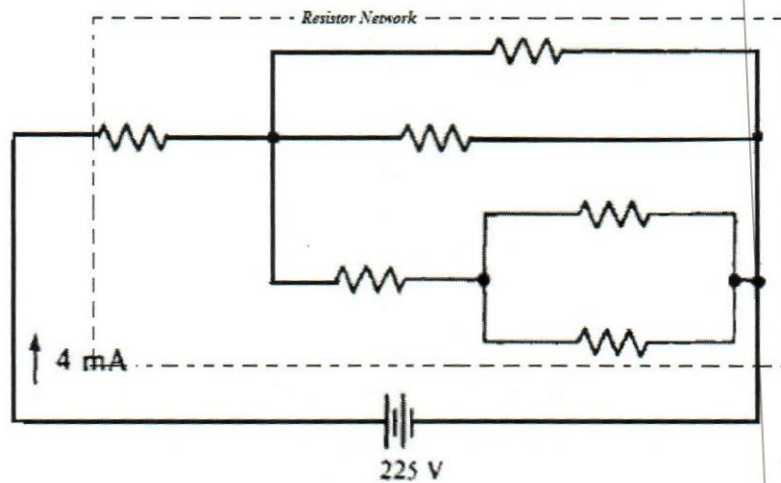
A pure inductive coil (inductor) allows a current of 10A to flow from a 230V, 50Hz supply. (5 marks)



- c) Calculate the inductive reactance (5 marks)
 d) Write equation for the circuit current. (5 marks)
- 5) a) If resistors R_1 and R_2 and R_3 are (i) in series and (ii) in parallel. Derive the formula for the equivalent resistance R_{eq} of each network. (6 marks)
 b) Find the equivalent resistance between point A and B. (8 marks)



- c) Calculate equivalent resistance of following resistor network. (6 marks)





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MID TERM REPEAT EXAMINATION QUESTION PAPER
INDUSTRIAL CHEMISTRY

- This question paper consists of five questions.
- Answer All(05) Questions

Date: 2016.07.15

Pass mark 50%

Time allocated: 03 Hrs

Some helpful Data:

* Avogadro Constant (N) – $6.022 \times 10^{23} \text{ mol}^{-1}$

* Density of Water – 1 g/cm^3 | * Faraday constant – 96500 C/mol

Mass Numbers of first 20 Elements:

H – 1, He – 4, Li – 7, Be – 9, B – 10.8, C – 12, N – 14, O – 16, F – 19, Ne – 20, Na – 23, Mg – 24.3, Al – 26.9, Si – 28, P – 31, S – 32, Cl – 35.5, Ar – 40, K – 39, Ca – 40, $^{54}_{25}\text{Mn}$.

1. a) Define the terms homogeneous mixture heterogeneous mixture. (4 marks)
- b) Name following compounds (6 marks)
- i. KClO_4 ii. CuSO_4 iii. FeCl_3
- c) Indicate the number of protons, neutrons and electrons in each of following species (5 marks)
- i. $^{54}_{25}\text{Mn}$ ii. $^{33}_{16}\text{S}$ iii. $^{63}_{29}\text{Cu}$
- d) Consider the reaction (5 marks)
- $$\text{MnO}_2 + 4\text{HCl} \rightarrow \text{MnCl}_2 + \text{Cl}_2 + 2\text{H}_2\text{O}$$
- If 0.86 mole of MnO_2 and 48.2g of HCl react, which reagent will be used up first? How many grams of Cl_2 will be produced? (4 marks)
2. a) List the general properties of acids and bases. (4 marks)
- b) Identify the following as a weak or strong acid or base: (6 marks)
- i. NH_3 ii. HNO_2 iii. LiOH iv. CH_3COOH
v. H_2SO_4 vi. HF vii. Ba(OH)_2 viii. HNO_3

- c) Describe how to prepare 1.00 dm^3 of $0.646 \text{ mol dm}^{-3}$ HCl solution, starting with a 2.00 mol dm^{-3} HCl solution. (5 marks)
- d) Calculate the pH of a $0.036 \text{ mol dm}^{-3}$ nitrous acid (HNO_2) solution. ($K_a = 4.5 \times 10^{-4}$) (5 marks)
3. a) Write a balanced ionic equation to represent the oxidation of iodide ion (I^-) by permanganate ion (MnO_4^-) in basic solution to yield molecular iodine (I_2) and manganese(IV) oxide (MnO_2). (6 marks)
- b) A galvanic cell consists of a Mg electrode in a $1.0 \text{ mol}^{-1} \text{ dm}^3$ $\text{Mg}(\text{NO}_3)_2$ solution and Ag electrode in a $1.0 \text{ mol}^{-1} \text{ dm}^3$ AgNO_3 solution. Calculate the standard emf of this cell at 25°C . (8 marks)
- c) If above cell $\text{Mg}(\text{NO}_3)_2$ solution and AgNO_3 solution concentrations are $0.2 \text{ mol}^{-1} \text{ dm}^3$ and $0.5 \text{ mol}^{-1} \text{ dm}^3$ respectively. Find emf of cell at 36°C . (6 marks)
($\text{Mg}/\text{Mg}^{+2} = -2.37 \text{ V}$, $\text{Ag}/\text{Ag}^+ = 0.80 \text{ V}$)
4. a) Draw named diagram of Lead storage battery. (6 marks)
- b) The overall discharging and charging cell reaction are

$$\text{Pb}_{(s)} + \text{PbO}_{2(s)} + 4\text{H}^+_{(aq)} + 2\text{SO}_4^{2-}_{(aq)} \rightleftharpoons 2\text{PbSO}_{4(s)} + 2\text{H}_2\text{O}_{(l)}$$
 Write anode and cathode half ionic reaction when battery is discharge. (4 marks)
- c) The white substance deposited around lead storage battery terminals, Explain the formation of white substance. (4 marks)
- d) Discuss the advantages and disadvantages of Lead storage battery. (6 marks)
5. a) What are the difference between a galvanic cell and an electrolytic cell? (5 marks)
- b) The half reaction at an electrode is

$$\text{Mg}^{2+}_{(molten)} + 2e \rightarrow \text{Mg}_{(s)}$$
 Calculate the number of grams of magnesium that can be produced by supplying 0.50 A for 30 min . (5 marks)
- c) Describe process of electrolysis of water. (5 marks)
- d) List the application of electrolysis. (5 marks)



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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE
COURSE CODE: ED 0340

MID TERM REPEAT EXAMINATION QUESTION PAPER
Introduction to Shipping

- This question paper consists of five questions.

- **Answer All (Five) Questions**

Date: 2016.07.15

Pass mark 50%

Time allocated: 03 Hrs

1. With an aid of a sketch show following parts and areas of a ship.
Bow, Astern, accommodation, navigation lights, hatch covers, cargo hatch, twin deck, double bottom tank, anchor, anchor locker, astern thruster, bow thruster, air draft, forward draft, aft draft, navigation bridge, beam, starboard side, port side, engine room, main deck, stem, rudder and propeller. (20 marks)
2. a) List 10 types of trading ships widely available at sea. (10 marks)
a) Briefly explain 5 types of above ships. (10marks)
3. Briefly explain use of following parts and components of a ship. You may use sketches where necessary
a) Double bottom tank. (5marks)
b) Void space (5marks)
c) Anchor (5marks)
d) Bow thruster (5marks)
4. a) Make a list of safety gears use in engine room and deck. (5 marks)
b) Make a list of 5 types of LSA (lifesaving appliances). (5 marks)
c) Make a list of 5 types of FFA (Fire fighting appliances). (5 marks)
d) Make a list of 4 types of portable fire extinguishers use in engine room. (5 marks)
5. a) What is the meaning of (i) PPE (ii) KNOT (iii) LOA (iv) EEBD (v) BA (5marks)
b) What are the most suitable PPE, you should be wearing when performing work in following areas.
i) Working aloft (3marks)
ii) Working in the engine room (3 marks)
iii) Handling chemicals (3 marks)
iv) Performing a welding job (3marks)
v) During fire fighting (3 marks)

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COURSE CODE: ED 0340



MID TERM REPEAT EXAMINATION QUESTION PAPER
Engineering Drawing

- This question paper consists of ~~five~~ ^{two} questions.
- Answer All Questions

Date: 2016.07.14

Pass mark 50%

Time allocated: 03 Hrs

Marking System

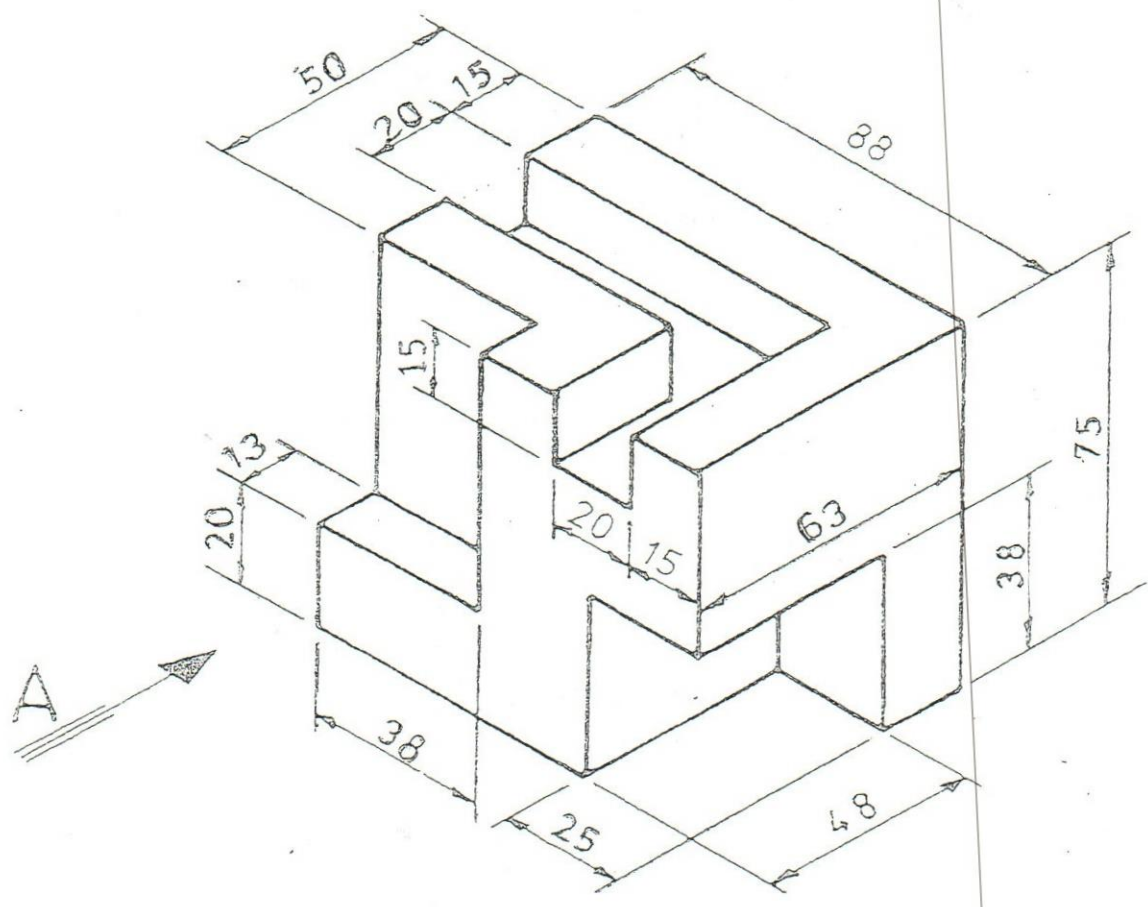
- (i) Q: 1 50 Marks
- (ii) Q: 2 40 Marks
- (iii) Titles and Lettering 5 Marks
- (iv) Boundaries, Lines, and overall neatness 5 Marks

Q1. Draw an isometric view of C.I. Bench Block as per given dimensions and Drawing looking from 'A'.
Use Reducing Scale as ; 0.5: 1

Q2. Draw an orthographic view of C.I. Bench Block in 1st angle projection as under,
Use Reducing Scale as; 0.75: 1

- I. Front Elevation looking from 'A'
- II. Left Side Elevation
- III. Plan

C. I. BENCH BLOCK



Q1. Draw in Isometric Projection.



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MID TERM REPEAT EXAMINATION QUESTION PAPER
APPLIED MECHANICS

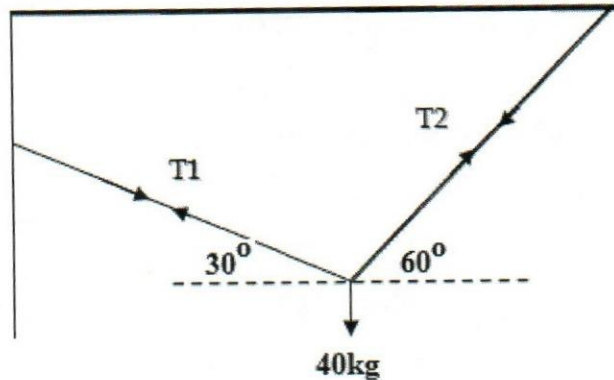
- This question paper consists of eight questions.
- Answer Any(06) Questions

Date: 2016.07.14

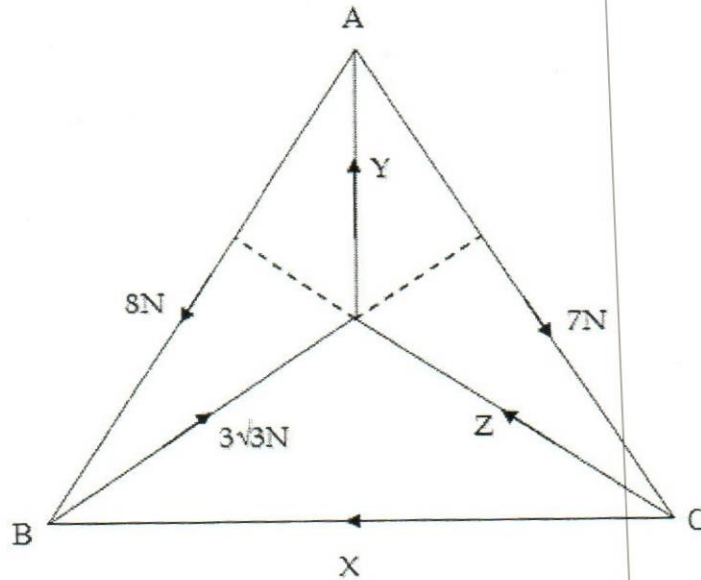
Pass mark 50%

Time allocated: 03 Hrs

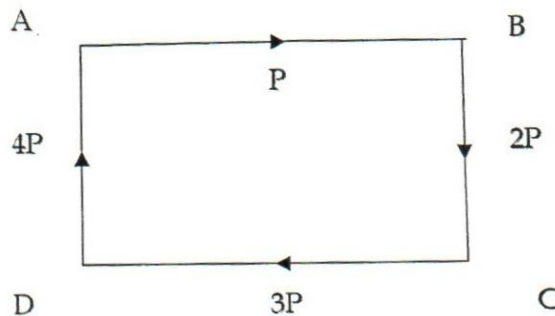
1. a) Define Lami's Theorem.



- b) Picture shows a weight of 40 Kg hung by two strings; Find the tension in each string.
(Consider $g = 10 \text{ms}^{-2}$)
2. a) Define resolution of Forces.
b) ABCDEF is a regular hexagon. The forces 1, 2, 3, 4, 5, 6 and 7 Newton are acting along AB, AC, AE, AF, BC, CE and DC. The forces are in equilibrium. Find the resultant of all the forces and the angle of which the resultant make with AB.
3. a) Describe, System of Forces.
b) ABC is a isosceles triangle of a side is equivalent to 2 meters. O is the centre of the triangle. The forces 8, $7\sqrt{3}$, x, y, and z are acting along the sides of the triangle as shown in the picture. The system is in equilibrium, find the value of x, y, and z.



4. a) Explain the method of resolution for the resultant force..
- b) Four forces equal to P , $2P$, $3P$, and $4P$ are respectively acting along the four sides of square ABCD taken in order. Find the magnitude, direction and position of the resultant force.



5. a) Describe like and unlike parallel Forces.
- b) Two unlike and parallel forces are acting at a distance of 500 mm from each other. The forces equivalent to a single force of 100N which act at a distance of 200 mm from the greater of the forces. Find the magnitude of the forces.
6. a) Define limiting Friction.
- b) Find the horizontal force required to drag a body of weight 100 N along a horizontal plane, if the plane when gradually raised up to ~~150~~, the body will begin to slide.

15°

7. A ladder 5 meters long rests on a horizontal ground and leans against a smooth vertical wall at an angle ~~70°~~ 70° with the horizontal. The weight of the ladder is 900N and acts at its middle. The ladder is at the point of sliding, when the mass of weight 750 N stands on a rung 1.5 meter from the bottom of the ladder. Calculate the co-efficient of friction between the ladder and the floor.
8. A lift goes up to a height of 900 m with a constant acceleration and then the next 300 meters with a constant retardation and comes to rest.
Find,
I. Maximum velocity of the lift, if the time taken to travel is 30 seconds.
II. A acceleration of the lift
III. Retardation of the lift
Take the acceleration of the lift as $\frac{1}{3}$ of its retardation.



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MID TERM EXAMINATION QUESTION PAPER
INDUSTRIAL CHEMISTRY

- This question paper consists of five questions.
- Answer All(05) Questions

Date: 2016.06.04

Pass mark 50%

Time allocated: 03 Hrs

Some helpful Data:

* Avogadro Constant (N) – $6.022 \times 10^{23} \text{ mol}^{-1}$

* Density of Water – 1 g/cm^3 | * Faraday constant – 96500 C/mol

Mass Numbers of first 20 Elements:

H – 1, He – 4, Li – 7, Be – 9, B – 10.8, C – 12, N – 14, O – 16, F – 19, Ne – 20, Na – 23, Mg – 24.3, Al – 26.9, Si – 28, P – 31, S – 32, Cl – 35.5, Ar – 40, K – 39, Ca – 40, $^{54}_{25}\text{Mn}$.

- a) Give an example of a homogeneous mixture and an example of a heterogeneous mixture. (4 marks)
 - b) Name following compounds (6 marks)
 - KMnO_4
 - $\text{Cu}(\text{NO}_3)_2$
 - FeCl_2
 - c) Indicate the number of protons, neutrons and electrons in each of following species (5 marks)
 - $^{15}_7\text{N}$
 - $^{33}_{16}\text{S}$
 - $^{63}_{29}\text{Cu}$
 - d) All alkali metals react with water to produce hydrogen gas and the corresponding alkali metal hydroxide. A typical reaction is that between lithium and water:
$$2\text{Li}_{(s)} + 2\text{H}_2\text{O}_{(l)} \rightarrow 2\text{LiOH}_{(aq)} + \text{H}_{2(g)}$$

How many grams of Li are needed to produce 9.89g of $\text{H}_{2(g)}$ (5 marks)
- a) List the general properties of acids and bases. (4 marks)
 - b) Identify the following as a weak or strong acid or base: (6 marks)
 - NH_3
 - H_3PO_4
 - LiOH
 - HCOOH
 - H_2SO_4
 - HF
 - $\text{Ba}(\text{OH})_2$
 - HNO_3

- c) Describe how to prepare 1.00 dm^3 of 0.646 moldm^{-3} HCl solution, starting with a 2.00 moldm^{-3} HCl solution. (5 marks)
- d) Calculate the pH of a 0.036 moldm^{-3} nitrous acid (HNO_2) solution. ($K_a = 4.5 \times 10^{-4}$) (5 marks)
3. a) Write a balanced ionic equation to represent the oxidation of iodide ion (I^-) by permanganate ion (MnO_4^-) in basic solution to yield molecular iodine (I_2) and manganese(IV) oxide (MnO_2). (6 marks)
- b) A galvanic cell consists of a Mg electrode in a $1.0 \text{ mol}^{-1} \text{ dm}^3$ $\text{Mg}(\text{NO}_3)_2$ solution and Ag electrode in a $1.0 \text{ mol}^{-1} \text{ dm}^3$ AgNO_3 solution. Calculate the standard emf of this cell at 25°C . (8 marks)
- c) If above cell $\text{Mg}(\text{NO}_3)_2$ solution and AgNO_3 solution concentrations are $0.2 \text{ mol}^{-1} \text{ dm}^3$ and $0.5 \text{ mol}^{-1} \text{ dm}^3$ respectively. Find emf of cell at 36°C . (6 marks)
($\text{Mg}/\text{Mg}^{+2} = -2.37 \text{ V}$, $\text{Ag}/\text{Ag}^+ = 0.80 \text{ V}$)
4. a) Draw named diagram of Lead storage battery. (6 marks)
- b) The overall discharging and charging cell reaction are

$$\text{Pb}_{(s)} + \text{PbO}_{2(s)} + 4\text{H}^+_{(aq)} + 2\text{SO}_4^{2-}_{(aq)} \rightleftharpoons 2\text{PbSO}_{4(s)} + 2\text{H}_2\text{O}_{(l)}$$
 Write anode and cathode half ionic reaction when battery is discharge. (4 marks)
- c) The white substance deposited around lead storage battery terminals, Explain the formation of white substance. (4 marks)
- d) Discuss the advantages and disadvantages of Lead storage battery. (6 marks)
5. a) What are the difference between a galvanic cell and an electrolytic cell? (5 marks)
- b) The half reaction at an electrode is

$$\text{Mg}^{2+}_{(molten)} + 2e \rightarrow \text{Mg}_{(s)}$$
 Calculate the number of grams of magnesium that can be produced by supplying 0.50 A for 30 min . (5 marks)
- c) Describe process of electrolysis of water. (5 marks)
- d) List the application of electrolysis. (5 marks)

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MID TERM EXAMINATION QUESTION PAPER
ENGINEERING DRAWING

• Answer All Questions

Date: 2016.06.03

Pass mark 50%

Time allocated: 03 Hrs

Marking System

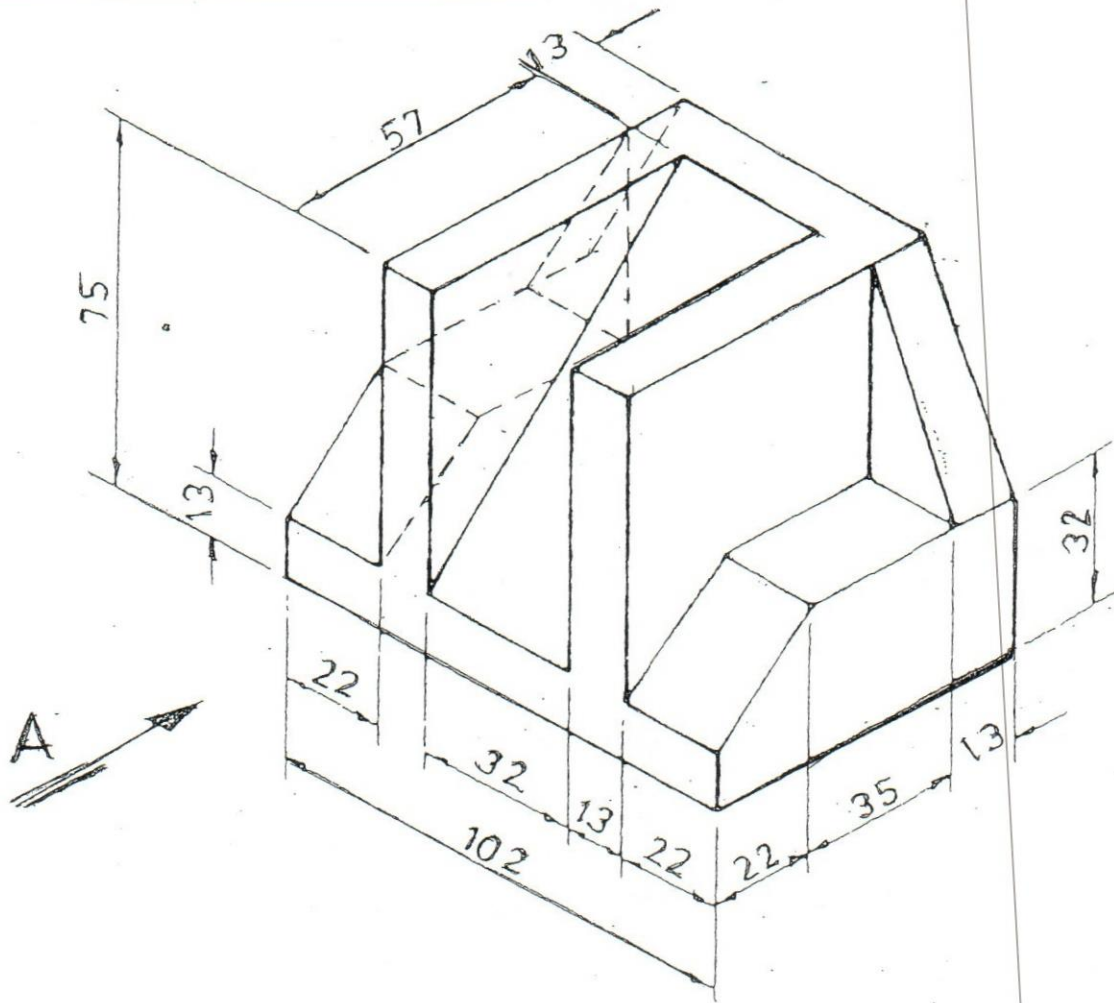
- (i) Q: 1 50 Marks
- (ii) Q: 2 40 Marks
- (iii) Titles and Lettering 5 Marks
- (iv) Boundaries, Lines, and overall neatness 5 Marks

Q1. Draw an isometric view of the Brass Step as per given dimensions and Drawing looking from 'A'.

Q2. Draw an orthographic view of the Brass Step in 1st angle projection as under,

- i. Front Elevation looking from 'A'
- ii. Left Side Elevation
- iii. Plan

BRASS STEP





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COURSE CODE: ED 0340

MID TERM EXAMINATION QUESTION PAPER

APPLIED MECHANICS

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

Date: 2016.06.03

Pass mark 50%

Time allocated: 03 Hrs

Q.1 (a) Define resolution of a force

(b) The following forces act at a point,

- 20 N inclined at 30° towards north of east.
- 25 N towards north.
- 30 N towards north west and,
- 35 N inclined at 40° towards south of west.

Find the magnitude and direction of the resultant force.

Q.2 (a) Define principle of physical independence of forces

(b) A triangle ABC has its side AB, 40 mm along positive x-axis and side BC, 30 mm along positive y-axis. Three forces of 40 N, 50 N and 30 N acts along the sides AB, BC and CA respectively. Determine magnitude of the resultant of such system of forces.

Q3. The lengths of the vertical post, jib and tie of a jib cranes are 8, 13, and 9 m respectively. Find the forces in the jib and tie when a load of 20 KN hangs from the crane head.

Q.4. (a) Describe, like parallel Forces and unlike parallel Forces.

(b) Two unlike parallel forces are acting at a distance of 450 mm from each other. The forces are equivalent to a single force of 90 N which act at a distance of 200 mm from the greater of the two forces. Find the magnitude of the Forces.

Q.5. (a) With the help of a sketch define velocity- time graph.

(b) A train starts from rest and reaches a speed of 90 km/h in 25 seconds; it runs at this speed for 1.5 minutes and then reduces speed to come to rest in 20 seconds. Assume acceleration and retardation to be uniform, draw a speed time graph, Find the total distance travelled and express the acceleration and retardation in m/s^2 .

Q.6. (a) Define Friction.

(b) A body of weight 400 N is lying on a rough horizontal plane having a coefficient of friction as 0.3. Find the magnitude of the force which can move the body which acts at an angle of 25° with the horizontal.

Q.7. a) Define

- i. Normal Reaction.
- ii. Angle of Friction.

b) An effort of 200 N is required just to move a body up an inclined plane of angle 15° the force acting parallel to the plane. If the angle of inclination of the plane is made 20° the effort required, again applied parallel to the plane, is found to be 230 N. Find the weight of the body and the coefficient of friction.

Q.8. An oil drum of 500 mm diameter and 1.5 m long is to be rolled across a footstep of 100 mm high. Find the minimum push required at the top of the drum. Take density of the oil as 1 Kg per liter. Neglect weight of the drum.



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COURSE CODE: ED 0340



MID TERM EXAMINATION QUESTION PAPER
ELECTRONICS

- This question paper consists of five questions.
- Answer All(05) Questions

Date: 2016.06.02

Pass mark 50%

Time allocated: 03 Hrs

- 1) Fig.1 shows two capacitors, A of capacitance $2\mu\text{F}$, and B of capacitance $4\mu\text{F}$, connected in parallel. Fig. 2 shows them connected in series. A two-way switch S can connect the capacitors either to a d.c. supply, of e.m.f. 6 V, or to a voltmeter.

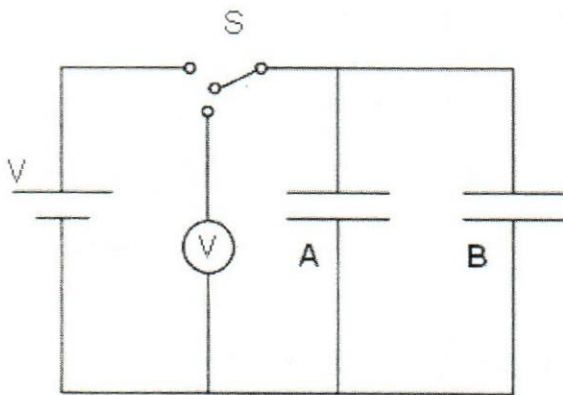


Fig. 1

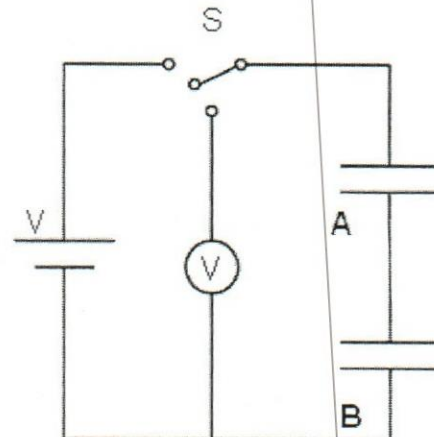


Fig. 2

- Calculate the total capacitance of the capacitors
 - When connected as in Fig. 1 (2 marks)
 - When connected as in Fig. 2 (3 marks)
- The switch in the circuit shown in Fig. 1 is then connected to the battery. Calculate
 - The potential difference across capacitor A. (3 marks)
 - The total charge stored on the capacitors. (2 marks)
- The switch in the circuit shown in Fig.2 is then connected to the battery. Calculate the total energy stored in the two capacitors. (5 marks)
- The switch S in the circuit of Fig. 1 is moved to connect the charged capacitors to the voltmeter. The voltmeter has an internal resistance of $12\text{M}\Omega$. (5 marks)

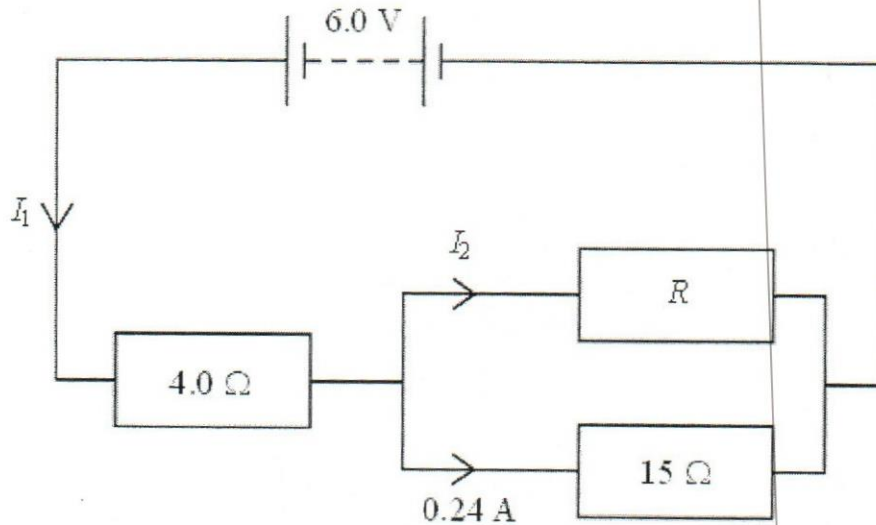
- i. Explain why the capacitors will discharge, although very slowly.
- ii. Calculate the time t taken for the voltmeter reading to fall to a quarter of its initial reading.

2)

- a) What are the SI unit of resistance, voltage and current?

(5 marks)

The circuit shows a battery of negligible internal resistance connected to three resistors.



- b) Calculate the potential difference across the 15Ω resistor.
- c) Calculate the current I_1 in the 4.0Ω resistor.
- d) Calculate the current I_2 and the resistance R .

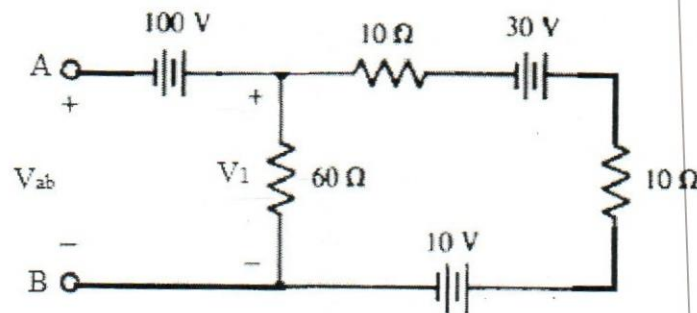
(5 marks)

(5 marks)

(5 marks)

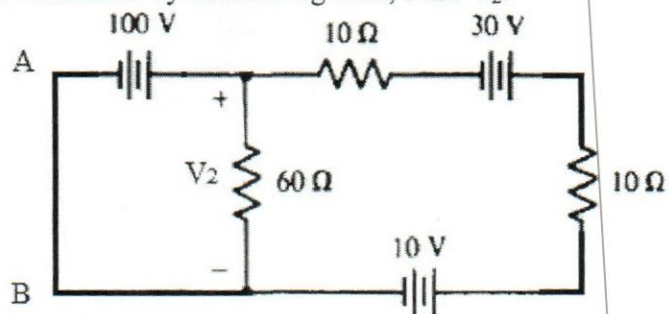
3)

- a) State Kirchhoff current law and Kirchhoff voltage law with applicable circuit diagrams (5 marks)
- b) In the DC circuit, V_{ab} and V_1 are voltage across open circuit and 60Ω resistor respectively.

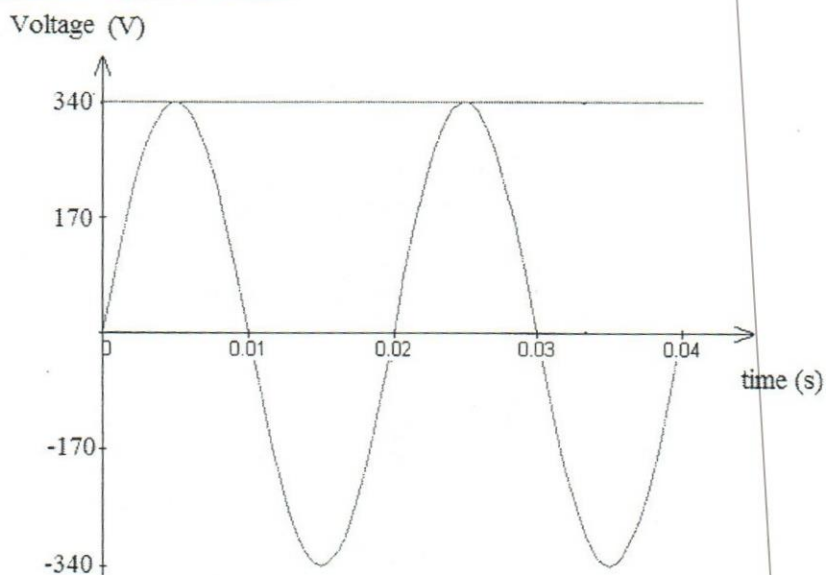


- i. Calculate the voltage V_{ab} across the open circuit and V_1 in the circuit shown in above Figure. (5 marks)
- ii. Calculate power consumption of 60Ω resistor. (5 marks)

c) When A and B are connected by conducting wire, Find V_2 . (5 marks)

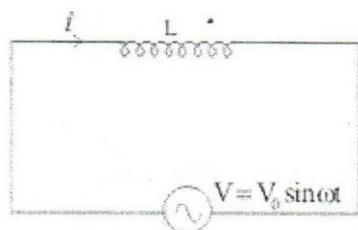


4) The graph below shows how a sinusoidal alternating voltage varies with time, when voltage source is connected across a device.



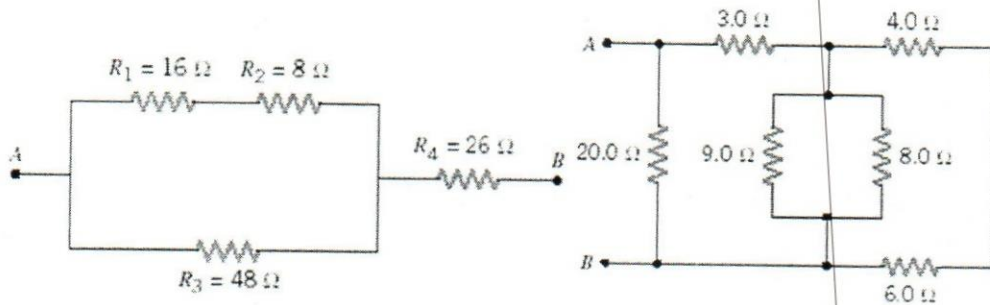
- a) Determine peak voltage and V_{rms} . (5 marks)
- b) Find the frequency (F) and angular velocity (ω) of above waveform.

A pure inductive coil (inductor) allows a current of 10A to flow from a 230V, 50Hz supply. (5 marks)

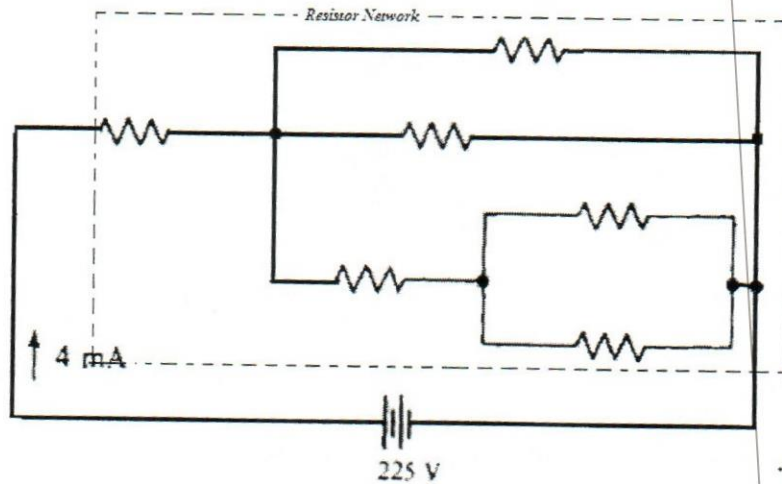


- c) Calculate the inductive reactance (5 marks)
- d) Write equation for the circuit current. (5 marks)

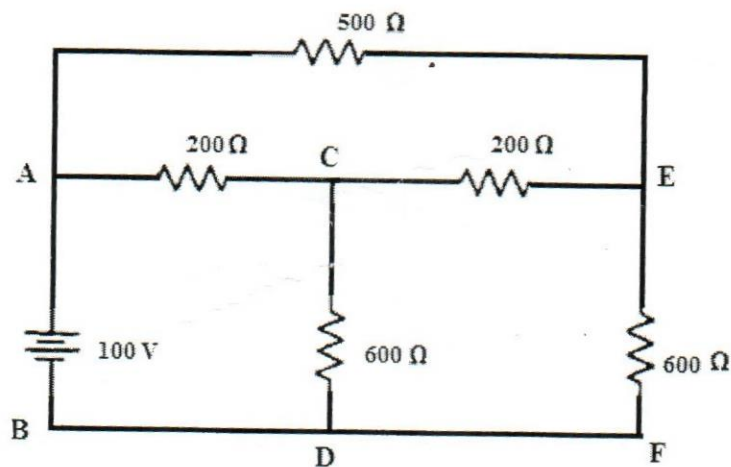
- 5) a) If resistors R_1 and R_2 and R_3 are (i) in series and (ii) in parallel. Derive the formula for the equivalent resistance R_{eq} of each network. (5 marks)
- b) Find the equivalent resistance between point A and B. (5 marks)



- c) Calculate equivalent resistance of following resistor network. (5 marks)



- d) Determine the load current in branch EF in the circuit. (5 marks)





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COURSE CODE: ED 0340



MID TERM EXAMINATION QUESTION PAPER
PHYSICS

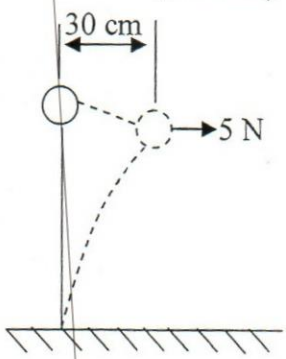
- This question paper consists of nine questions.
- Answer Any(06) Questions

Date: 2016.06.02

Pass mark 50%

Time allocated: 03 Hrs

Speed of sound in air 340 m/s, refractive index of water 1.333

- 1.
- Find the length of a pendulum which has a period of 3.5 s. (5 marks)
 - The period of a simple pendulum 35.9 cm long is $T = 1.2$ s. find the value of gravitational acceleration at this location. (5 marks)
 - As shown in the figure, a long light piece of spring steel is clamped at its lower end and a 2 kg ball is fastened to its top end. A force of 5 N is required to displace the ball 30 cm to one side as shown. Assume the system undergo simple harmonic motion when released. Find
 - The force constant of the spring (5 marks)
 - The period with which the ball will vibrate back and forth. (5 marks)
- 
- 2.
- Define the index of refraction of a material medium. (3 marks)
 - Write an expression for the refractive index using the speed of light in each medium. (3 marks)
 - What is the speed of light in crystalline quartz? Assume the index of refraction of quartz to be 1.553 and speed of light in free space to be $3.0 \times 10^8 \text{ ms}^{-1}$. (4 marks)

- d. The index of refraction of a flint glass is 1.64. if light is incident from water at an angle of 50° , Find the speed of light in the glass, the angle of refraction in glass and critical angle of incidence for glass- water (1.33) interface. (10 marks)

3.

- a. Briefly describe the Simple Harmonic motion (4 marks)
- b. A mass of 0.5 kg is attached to one end of a helical spring and produces an extension of 15 mm. The mass is now pulled down 10 mm and set into vertical oscillation of amplitude 10 mm. Compute
- The period of oscillation (4 marks)
 - The maximum kinetic energy of the mass (4 marks)
 - The potential energy of the spring when the mass is 5 mm below the centre of the oscillation (4 marks)
- c. Describe three types of damping oscillations by illustrating its nature. (4 marks)

4.

- a. Describe the occurrence of beats of two sound source with closer frequencies (3 marks)
- b. Write down the beat formula for two tuning-forks of slightly different frequencies of f_1 and f_2 are sounded together. (3 marks)
- c. 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 and briefly state your answer (6 marks)
- d. 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)

5.

- a. A wire has length of 2.3 m and a mass of 0.16 kg/m. If the tension in the string is 140 N, what are the three lowest frequencies it produces when plucked? (4 marks)
- b. The density variation through the air of a traveling sound wave is given by the equation,

$$\rho(x,t) = 1.034 \sin \left\{ \frac{2\pi}{\lambda} (x - 290t) \right\}$$

where x and λ are in meters, t is in seconds, ρ and is in kg/m^3 .

- i. What is velocity of the wave? (4 marks)
- ii. If $\lambda = 5$ m, what is the frequency of the wave? (4 marks)
- iii. What is the maximum density? (4 marks)
- iv. What is the density at $x = 0.24$ m and $t = 1.4$ s? (4 marks)
- 6.
- a. Write expressions for the frequency heard by an observer
- i. When he is stationary and a source of sound is moving towards him (5 marks)
- ii. When he is moving towards a stationary source of sound (5 marks)
- Explain your reasoning carefully in each case
- b. A car travelling at 10 m/s sounds its horn, which has a frequency of 500 Hz, and this is heard in another car which is travelling behind the first car, in the same direction, with a velocity of 20 m/s. The sound can also be heard in the second car by reflection from a bridge head. What frequencies will the driver of the second car hear? (10 marks)
- 7.
- a. Describe the occurrence of the standing wave (5 marks)
- b. Write a general expression for standing wave (5 marks)
- c. The equation of a particular standing wave on a string is

$$y(x,t) = 0.2 \sin 5x \cos 312t$$
Determine the
- i. Amplitude of vibration at the anti-node
- ii. Distance between nodes
- iii. Wavelength
- iv. Frequency
- v. Speed of wave (5*2 marks)

8.

- a. Write expressions for the frequencies of fundamental and of the first two overtones produced in an open organ pipe and closed pipe (4 marks)
- b. Pipe A, which is 1.2 m long and open at both ends, oscillates at its third lowest harmonic frequency. It is filled with air for which the speed of sound is 343 m/s. pipe B which is closed at one end, oscillates at its second lowest harmonic frequency. This frequency of B happens to match the frequency of A. an x axis extends along the interior of B, with $x = 0$ at the closed end.
- How many nodes are along that axis? (4 marks)
 - What are the smallest and second smallest values of x locating those nodes? (6 marks)
 - What is the fundamental frequency of B? (6 marks)

9.

- a. Briefly describe the diffraction of light using their application (4 marks)
- b. A diffraction grating is ruled with 6000 lines per centimeter. The first order of a spectral line is observed to be diffracted at an angle of 30° . What is the wavelength of this radiation? (6 marks)
- c. A grating having 2300 lines per centimeter produces spectra of mercury arc. The green line of the mercury spectrum has a wavelength of 5461 Å. What is the angular separation between the first-order green line and the second-order green line? (Hint $1 \text{ Å} = 10^{-10} \text{ m}$) (10 marks)

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34

MID TERM EXAMINATION QUESTION PAPER
Mathematics

- This question paper consists of five questions.
- Answer All (05) Questions

Date: 2016.06.01

Pass mark 50%

Time allocated: 03 Hrs

1. a. Describe nature of roots in each quadratic equation. (6 marks)
- i. $2x^2 - 5x + 6 = 0$
ii. $x^2 - 4x + 7 = 0$
- b. If $\tan A$ and $\tan B$ are roots of the quadratic equation $x^2 - px + q = 0$,
- i. Express $(\tan A + \tan B)$ in terms of p and q
ii. Express $(\tan A \cdot \tan B)$ in terms of p and q
iii. Express $\tan(A+B)$ (3 X 3 marks)
- c. If l and m are real, $l + m \neq 0$, Discuss the nature of roots of following equation
 $(l + m)x^2 - 3(l - m)x - 2(l + m) = 0$ (5 marks)
2. a. Evaluate the value of following trigonometric ratios.
- i. $\sin 75^\circ$ ii. $\tan 22.5^\circ$
- b. Prove that $\frac{1 + \cot^2 \theta}{\sec \theta} = \operatorname{cosec} \theta \cdot \cot \theta$
- c. If $\sin x \cos y = 1/4$ and $3 \tan x = 4 \tan y$, Evaluate the value of $\sin(x + y)$
- d. Prove the identity $\tan^{-1} \frac{1}{2} + \tan^{-1} \frac{1}{3} = \frac{\pi}{4}$ (5 X 4 marks)
3. a. Evaluate $\lim_{x \rightarrow 0} \frac{\tan^{-1} x}{x}$

b. Evaluate $\lim_{x \rightarrow 0} \frac{\cos(\sin x) - \cos x}{x^4}$ using L'Hopital rule or otherwise

c. Differentiate y with respect to x.

$$y = \frac{x+2}{\sin x} + 2x^3 + \sqrt{x}$$

d. If $y = \sin^{-1} x$ for $0 < x < 1$, find $\frac{dy}{dx}$ and show that $(1-x^2) \frac{d^2y}{dx^2} - x \frac{dy}{dx} = 0$.

(5 X 4 marks)

4. a. Evaluate the following:

i. $49^{-\frac{1}{2}}$

ii. $8^{-\frac{1}{3}}$

iii. $(256)^{0.16} \times (256)^{0.09}$

b) If $3^{(x-y)} = 27$ and $3^{(x+y)} = 243$, Find the value of x and y.

c) Express each of the following in the form $+q\sqrt{5}$, where p and q are real numbers.

i. $(2-\sqrt{5})(4+\sqrt{5})$

ii. $(3+\sqrt{5})^2$

iii. $(6+\sqrt{20})$

iv. $(\sqrt{45}-\sqrt{4})^2$

d) Solve $3^{2x+1} + 3^2 = 3^{x+3} + 3^x$

(5 X 4 marks)

5. a. Simplify i. $\log_2 128$

ii. $\log_3(27 \times 243)$

iii. $\log_3(0.111111111111 \dots \dots \dots)$

b) Find the value of

$$\frac{1}{\log_4 24} + \frac{1}{\log_3 24} + \frac{1}{\log_2 24}$$

c) The equation has

$$x^{[(\log_5 x)^2 - \frac{9}{2}(\log_5 x) + 5]} = 5\sqrt{5} \text{ exactly three real roots}$$

Substituting $\log_5 x = q$,

i. Express above equation in term of q

ii. Hence, Determine the value of x.

d) If $x = \log_a bc$, $y = \log_b ca$ and $z = \log_c ab$ Show that $xyz = x+y+z+2$.

(5 X 4 marks)



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55

MID TERM EXAMINATION QUESTION PAPER
INTRODUCTION TO SHIPPING

- This question paper consists of five questions.
- Answer All Questions

Date: 2016.06.01

Pass mark 50%

Time allocated: 03 Hrs

1. Name following parts of the ship using a suitable diagram. (20 marks)
Accommodation, draft, air draft, length overall, beam, stbd side, port side, anchor, forecastle, astern, navigation light, main mast, keel, double bottom tank, bow thruster, navigation bridge, steering flat, propeller, rudder.
2. (a) Explain following terms using suitable sketches where necessary
(i) Trim (ii) List (iii) Pitching (iv) rolling (10marks)
(b) (i) Explain what is the purpose of sounding tape? (4 marks)
(ii) Briefly explain how to use a sounding tape? (6 marks)
3. (a) What is meant by LSA and FFA (4marks)
(b) List 5 types of items fall into each of above category. (10 marks)
(c) Make a list of items which should be carried in the life boat in case of abandoned the ship (6marks)
4. (a) Give 10 kind of safety gear widely used on board. (10marks)
(b) Explain 5 of above safety gears. (10marks)
5. (a) Make a list of different types of ships widely used in shipping industry. (10 marks)
(b) Briefly describe 5 of them. (10 marks)

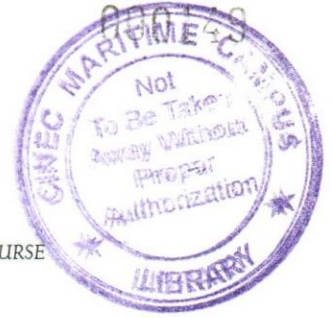
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2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
INDUSTRIAL CHEMISTRY

- This question paper consists of nine questions.
- Answer Any Six (06) Questions

Date: 2016.01.30

Pass mark 50%

Time allocated: 03 Hrs

Some helpful Data:

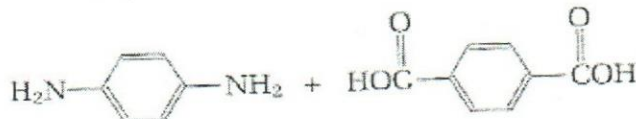
* Avogadro Constant (N) – $6.022 \times 10^{23} \text{ mol}^{-1}$

* Density of Water – 1 g/cm^3 * Faraday constant – 96500 C/mol

Mass Numbers of first 20 Elements:

H – 1, He – 4, Li – 7, Be – 9, B – 10.8, C – 12, N – 14, O – 16, F – 19, Ne – 20, Na – 23, Mg – 24.3, Al – 26.9, Si – 28, P – 31, S – 32, Cl – 35.5, Ar – 40, K – 39, Ca – 40, $^{54}_{25}\text{Mn}$, $^{52}_{24}\text{Cr}$, $^{137}_{56}\text{Ba}$.

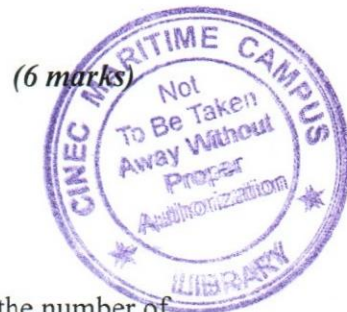
- Give the number of protons and electrons in each of ions (6 marks)
i. Na^+ ii. O^{2-} iii. N^{3-}
 - Name following compounds (6 marks)
i. KMnO_4 ii. Fe_2O_3
 - Write electrons configuration of Mn and Cr. (8 marks)
- Define following terms (6 marks)
i. monomer
ii. polymer
 - Deduce monomer for polymer with the following repeating unit. (6 marks)
 $-(\text{CH}_2 - \text{CF}_2)_n$
 - Kevlar is a polymer used in bullet-proof vests. It is formed reaction between the following two monomers. (8 marks)



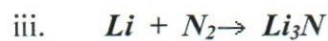
Sketch a portion of the polymer chain showing several monomer units. Write the overall equation for the condensation reaction.

- What are the physical and chemical water treatment methods? (6 marks)
 - Briefly describe coagulation and flocculation. (8 marks)
 - What are coagulant agents? (6 marks)

4. a) Explain formation of petrol from crude oil. (6 marks)
- b) What are the chemical compositions of petrol? Draw structural formulas for major compositions. (7 marks)
- c) Find the value of air fuel ratio (AFR) for Octane 95 petrol sample. (7 marks)
5. a) What is corrosion? (6 marks)
- b) Briefly describe formation of rust with chemical reactions. (8 marks)
- c) Explain impress cathodic corrosion protection (ICCP). (6 marks)
6. a) Write a balanced ionic equation to represent the oxidation of iodide ion (I^-) by permanganate ion (MnO_4^-) in basic solution to yield molecular iodine (I_2) and manganese(IV) oxide (MnO_2). (6 marks)
- b) A galvanic cell consists of Mg electrode in a $1.0 \text{ mol}^{-1} \text{ dm}^3$ $Mg(NO_3)_2$ solution and Ag electrode in a $1.0 \text{ mol}^{-1} \text{ dm}^3$ $AgNO_3$ solution. Calculate the standard emf of this cell at $25^\circ C$. (8 marks)
- c) If above cell $Mg(NO_3)_2$ solution and $AgNO_3$ solution concentrations are $0.2 \text{ mol}^{-1} \text{ dm}^3$ and $0.5 \text{ mol}^{-1} \text{ dm}^3$ respectively. Find emf of cell at $36^\circ C$. (6 marks)
($Mg/Mg^{+2} = -2.37 \text{ V}$, $Ag/Ag^+ = 0.80 \text{ V}$)
7. a) What are the difference between a galvanic cell and electrolytic cell? (6 marks)
- b) Consider the electrolysis of molten barium chloride ($BaCl_2$). (8 marks)
- i. Write the half reactions.
- ii. How many grams of barium metal can be produced by supplying 50 A for 30 minute.
- c) What are the industrial usages of electrolysis? (6 marks)
8. a) i. List the general properties of acids and bases. (6 marks)
- ii. Identify the following as a weak or strong acid or base:
 NH_3 , H_3PO_4 , $LiOH$, $HCOOH$, H_2SO_4 , HF , $Ba(OH)_2$
- b) Calculate the pH of each of the following solution (7 marks)
- i. $2.8 \times 10^{-4} \text{ mol}^{-1} \text{ dm}^3$ $Ba(OH)_2$
- ii. $5.2 \times 10^{-4} \text{ mol}^{-1} \text{ dm}^3$ HNO_3
- c) Calculate the pH of a $0.036 \text{ mol}^{-1} \text{ dm}^3$ nitrous acid (HNO_2) solution, if ion product constant of nitrous acid is 4.5×10^{-4} . (7 marks)

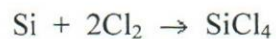


9. a) Balance the following chemical reaction.



b) Chalcopyrite (CuFeS_2) is a principal mineral of copper. Calculate the number of kilograms of Cu in 3700 kg of Chalcopyrite. (6 marks)

c) Consider the following balanced equation:



In one reaction, 0.507 mole of SiCl_4 is produced. How many moles of molecular chlorine were used in the reaction. (8 marks)



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2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
Physics

- This question paper consists of nine questions.
- Answer Any 6 Questions

Date: 2016.01.30

Pass mark 50%

Time allocated: 03 Hrs

$$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2, \mu_0 = 4\pi \times 10^{-7} \text{ H/m}, m_e = 9.11 \times 10^{-31} \text{ kg}, m_p = 1 \text{ amu} = 1.6726 \times 10^{-27} \text{ kg}, e = 1.6 \times 10^{-19} \text{ C}$$

- 1.
- State the **Biot-Sarvart** law. (5 marks)
 - Write an expression for the **magnetic flux density(B)** at the center of a circular current loop whose radius is **R** and N number of turns (5 marks)
 - A circular loop of **168 mm** radius and **100 turns** carries of **0.2 A**. Find the magnetic field at the center of the loop (5 marks)
 - An arc shaped wire segment with radius **2 m** subtends an angle of **$2\pi/3 \text{ rad}$** (60°) at the center. If the current in wire is **10 A**, find the magnetic field at the center. (5 marks)
- 2.
- Describe the following terms (6 marks)
 - Diamagnetic materials
 - Paramagnetic materials
 - Ferromagnetic materials
 - A toroid with **800** turns is wound on an iron ring **50 mm²** In cross-sectional area, of **400 mm** mean circumference and of **1600** relative permeability. If the windings carry **10 mA**, determine
 - The magnetizing field(H) (2 marks)
 - Magneto motive force (MMF) (3 marks)
 - The magnetic flux density(B) (3 marks)
 - The magnetic flux(Φ) (3 marks)
 - The reluctance of the circuit(R) (3 marks)

- 3.
- Describe the followings for *induction motors*
 - Synchronous speed
 - Base speed
 - Slip

(6 marks)
 - Describe the working principle of an *induction motor*

(8 marks)
 - Write an expression for the *synchronous speed* of an induction motor

(2 marks)
 - An induction motor with **50** poles is connected to **60 Hz** power line. Its slip percentage is **10 %**. Determine the synchronous speed and base speed

(4 marks)
4. A shunt motor has an armature resistance **0.3Ω** and field resistance **150Ω** . It is connected across **240 V** mains and is generating a *back emf* of **215 V**. Calculate
- The armature current, field current and total current

(5 marks)
 - The total power taken by the motor

(5 marks)
 - The power lost in the armature and field circuit

(5 marks)
 - The electric efficiency of the motor

(5 marks)
- 5.
- 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)
 - Cl^{-1} ion (atomic mass of *Chlorine 36 amu*) travels at right angles to a magnetic field of **0.18 T** with a velocity of **10^5 m/s**. Find the magnitude of the magnetic force on the ion.

(6 marks)
 - An *electron* is moving with a speed of **4×10^6 m/s** at right angle to a magnet field of **1.6 T**. What is the magnetic force on the proton? What is the radius of the proton moves?

(8 marks)
- 6.
- Describe the *self inductance*

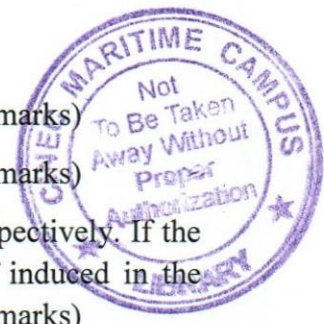
(3 marks)
 - Write an expression for the *back EMF* generated by a solenoid

(3 marks)
 - An emf of **10 V** is induced in a solenoid when the current in it changes at the rate of **0.1 A/s**. Compute the self inductance of the solenoid.

(4 marks)
 - A solenoid of **0.12 H** and **10 Ω** resistance is connected to **240 V** source.
 - At what rate will the current in the solenoid grow at the instant the solenoid is connected to the source?

(5 marks)
 - What is the current when it is growing at rate of **100 A/s**

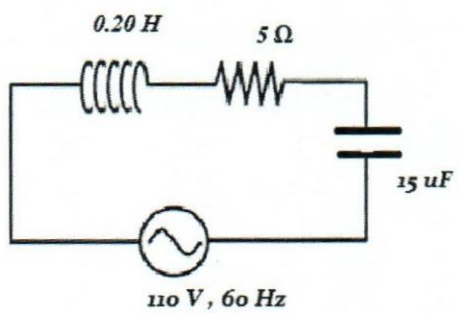
(5 marks)



7.

- a. Discuss the working principles of an ideal transformer (6 marks)
- b. Write down four Energy losses in transformers (8 marks)
- c. The primary and secondary of an ideal transformer have **2000** and **100** turns respectively. If the maximum primary voltage is **120 V**, what is the maximum value of the **emf** induced in the secondary? (6 marks)

8. A simple AC circuit consists with an inductor of **0.20 H**, resistance of **5 Ω** and capacitor of **15 μF**. The circuit is connected to a **110 V, 60 Hz** line. Determine



- a. The **impedance** of the circuit (4 marks)
- b. The **current** through the circuit (4 marks)
- c. The **phase angle** between current and supply voltage (4 marks)
- d. The **power consumption** by the circuit (4 marks)
- e. The **power loss** through the resistor (4 marks)

9.

- d. State the **Ampere's law** (4 marks)
- e. Write an expression for magnetic field produced by an infinitely long current carrying conductor. (4 marks)
- f. the A vertical conductor carries a downward current of **10 A**
 - i. Draw the pattern of the magnetic flux in a horizontal plane round the conductor (4 marks)
 - ii. What is the flux density due to the current alone at a point, **100 cm** from the conductor? (4 marks)
 - iii. If the earth's horizontal magnetic flux density has a value **$4 \times 10^{-5} T$** , calculate the resultant flux density (4 marks)



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2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
 INDUSTRIAL CHEMISTRY

- This question paper consists of nine questions.
- Answer Any Six (06) Questions

Date: 2016.01.13

Pass mark 50%

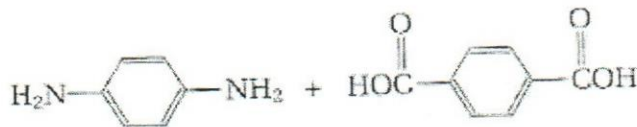
Time allocated: 03 Hrs

Some helpful Data:

* Density of Water -1 g/cm^3 * Faraday constant -96500 C/mol
 Mass Numbers of first 20 Elements: $H-1, He-4, Li-7, Be-9, B-10.8, C-12, N-14, O-16, F-19, Ne-20,$
 $Na-23, Mg-24.3, Al-26.9, Si-28, P-31, S-32, Cl-35.5, Ar-40, K-39, Ca-40, {}^{54}_{25}\text{Mn}, {}^{52}_{24}\text{Cr}.$

- Describe the two major mechanisms of organic polymer synthesis. (6 marks)
 - Deduce monomer for polymer with the following repeating unit. (6 marks)

$$\text{-(CH}_2\text{-CF}_2\text{)}_n$$
 - Kevlar is a polymer used in bullet-proof vests. It is formed reaction between the following two monomers. (8 marks)



Sketch a portion of the polymer chain showing several monomer units. Write the overall equation for the condensation reaction.

- What is 'hard water'? (6 marks)
 - Briefly describe the process of coagulation and flocculation. (8 marks)
 - What are coagulant agents? (6 marks)
- Explain formation of petrol from crude oil. (6 marks)
 - What are the chemical compositions of petrol? Draw structural formulas for major compositions. (7 marks)
 - Find the value of air fuel ratio (AFR) for Octane 90 petrol sample. (7 marks)
- What is corrosion? (6 marks)
 - Briefly describe formation of rust with chemical reactions. (8 marks)
 - Explain impress cathodic corrosion protection (ICCP). (6 marks)

5. a) Balance the following equation for the reaction in an acidic medium by the ion-electron method: (6 marks)

$$Fe^{2+} + MnO_4^- \rightarrow Fe^{3+} + Mn^{2+}$$
- b) A galvanic cell consists of a *Mg* electrode in a $1.0 \text{ mol}^{-1}dm^3$ $Mg(NO_3)_2$ solution and *Ag* electrode in a $1.0 \text{ mol}^{-1}dm^3$ $AgNO_3$ solution. Calculate the standard emf of this cell at $25^\circ C$. (8 marks)
- c) If above cell $Mg(NO_3)_2$ solution and $AgNO_3$ solution concentrations are $0.2 \text{ mol}^{-1}dm^3$ and $0.5 \text{ mol}^{-1}dm^3$ respectively. Find emf of cell at $36^\circ C$. (6 marks)
 ($Mg/Mg^{+2} = -2.37 \text{ V}$, $Ag/Ag^+ = 0.80 \text{ V}$)
6. a) What are the difference between a galvanic cell and electrolytic cell? (6 marks)
- b) Consider the electrolysis of molten barium chloride ($NaCl$). (8 marks)
- Write the half reactions.
 - How many grams of barium metal can be produced by supplying 0.50 A for 30 minute.
- c) What are the industrial usages of electrolysis? (6 marks)
7. a)
 - List the general properties of acids and bases. (6 marks)
 - Identify the following as a weak or strong acid or base:
 NH_3 , H_3PO_4 , $LiOH$, $HCOOH$, H_2SO_4 , HF , $Ba(OH)_2$
- b) Calculate the *pH* of each of the following solution (7 marks)
- $2.8 \times 10^{-4} \text{ mol}^{-1}dm^3$ $Ba(OH)_2$
 - $5.2 \times 10^{-4} \text{ mol}^{-1}dm^3$ HNO_3
- c) Calculate the *pH* of a $0.036 \text{ mol}^{-1}dm^3$ nitrous acid (HNO_2) solution, if ion product constant of nitrous acid is 4.5×10^{-4} . (7 marks)
8. a) Give the number of protons and electrons in each of ions (6 marks)
- Na^+
 - O^{2-}
 - N^{3-}
- b) Name following compounds (6 marks)
- $KMnO_4$
 - Fe_2O_3
- c) Write electrons configuration of Mn and Cr. (8 marks)
9. a) Balance the following chemical reaction. (6 marks)
- $NaOH + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$
 - $H_2C_2O_4 + NaOH \rightarrow Na_2C_2O_4 + H_2O$
 - $Li + N_2 \rightarrow Li_3N$
- b) Chalcopyrite ($CuFeS_2$) is a principal mineral of copper. Calculate the number of kilograms of Cu in 3700 kg of Chalcopyrite. (6 marks)
- c) Consider the following balanced equation:
- $$Si + 2Cl_2 \rightarrow SiCl_4$$
- In one reaction, 0.507 mole of $SiCl_4$ is produced. How many moles of molecular chlorine were used in the reaction? (8 marks)

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2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
Engineering Drawing

- Answer All Questions

Date: 2016.01.13

Pass mark 50%

Time allocated: 03 Hrs

Marking System

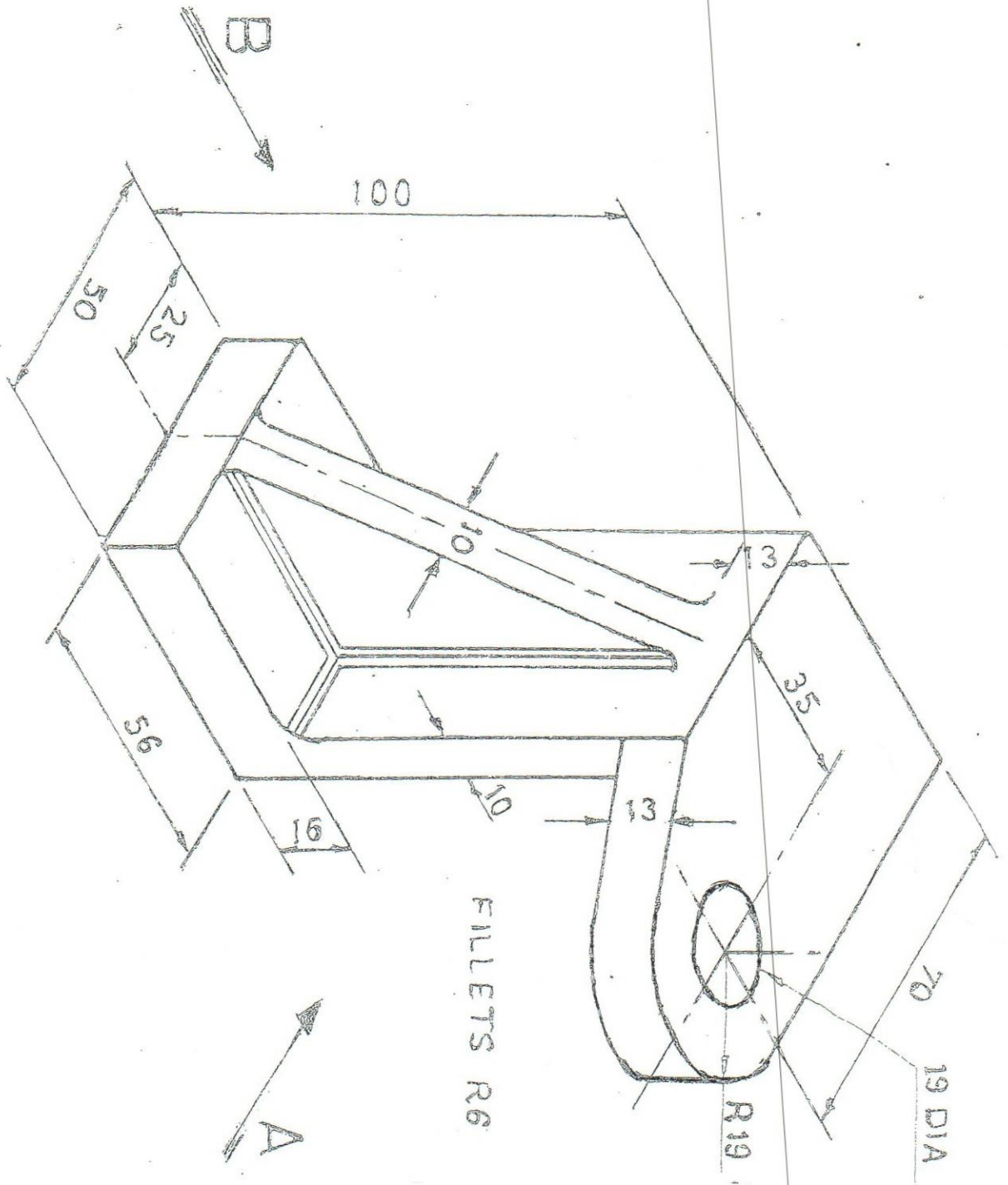
- (i) Q: 1 50 Marks
- (ii) Q: 2 40 Marks
- (iii) Titles and Lettering 5 Marks
- (iv) Boundaries, Lines, and overall neatness 5 Marks

Q1. Draw in third angle orthographic projection of M S Support as per the given Drawing. The following views *are required*.

- I. An elevation from A
- II. An end elevation from B
- III. A plan

Q2. (i) Draw a transverse common line tangent (cross belt drive) to two circles whose radii are 20 mm and 40 mm respectively and their centers are 120 mm apart.

(ii) Draw an Ellipse whose major axis is 100 mm and minor axis is 80 mm.





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COURSE CODE: ED 0340

2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
ELECTRONICS

- This question paper consists of nine questions.
- Answer Any Six (06) Questions

Date: 2016.01.13

Pass mark 50%

Time allocated: 03 Hrs

Some helpful Data:

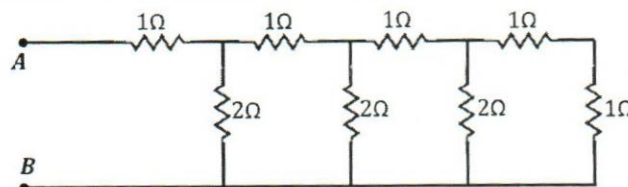
* Permittivity of free air/ vacuum (ϵ_0) – 8.854×10^{-12} F/m

* Charge of electron – 1.602×10^{19} C

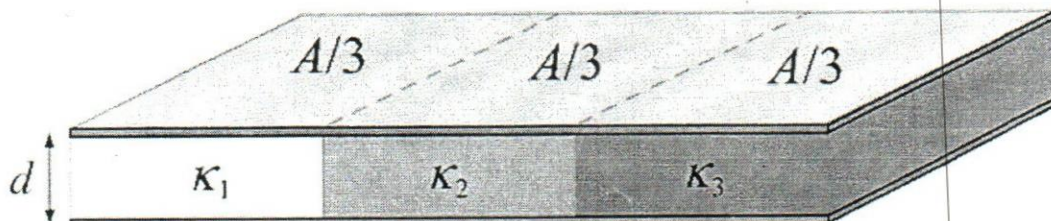
* Resistor Color Codes:

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 Color -20%

1. a) i. What is the color code for a 4.7 k Ω resistor with 5% tolerance? (6 marks)
 ii. What is the nominal resistance of a resistor with color code brown-green-black-silver?
 b) Calculate the resistance between A and B? (8 marks)



- c) Find the current drawn from the battery when 10V battery is connected between A and B. (6 marks)
2. a) A parallel plate capacitor of area A and spacing d is filled with three dielectrics as shown in the figure below. Each occupies 1/3 of the volume. What is the capacitance of this system in between top and bottom plate?



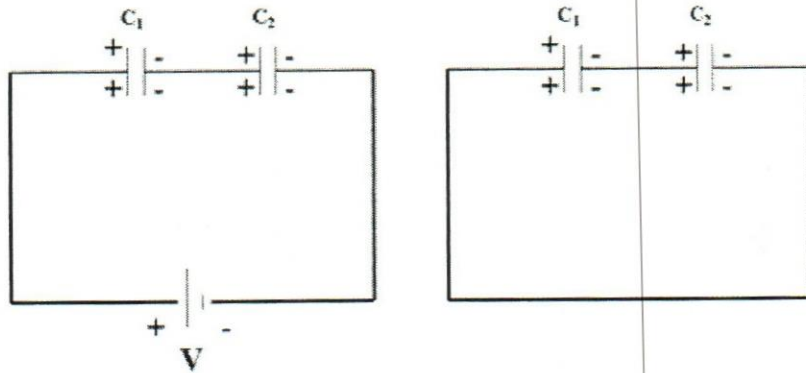
(8 marks)

b) What is the combined capacitance of:

(6 marks)

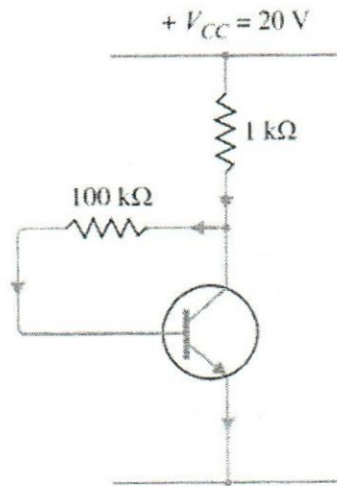
- i. A $2.2 \mu\text{F}$ capacitor and a $4.7 \mu\text{F}$ capacitor in parallel?
- ii. Two $100 \mu\text{F}$ capacitors in series?

c) Two capacitors, $C_1 = 3 \mu\text{F}$ and $C_2 = 6 \mu\text{F}$, are connected in series and charged by connecting a battery of voltage $V = 10 \text{ V}$ in series with them. They are disconnected from battery, and the loose wires are connected together. What is final charge on each capacitor? (6 marks)



3. a) If a bipolar junction transistor is operating in the active region, write the biasing mode of each junction. (5 marks)

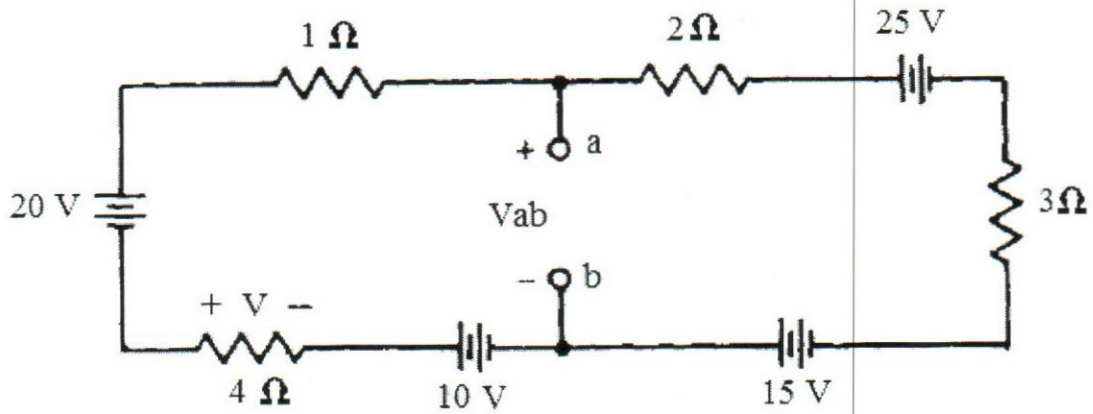
b) Following circuit shows a silicon transistor biased by collector feedback resistor method. Determine the operating point. Given that $\beta = 100$, $V_{BE} = 0.7 \text{ V}$. (10 marks)



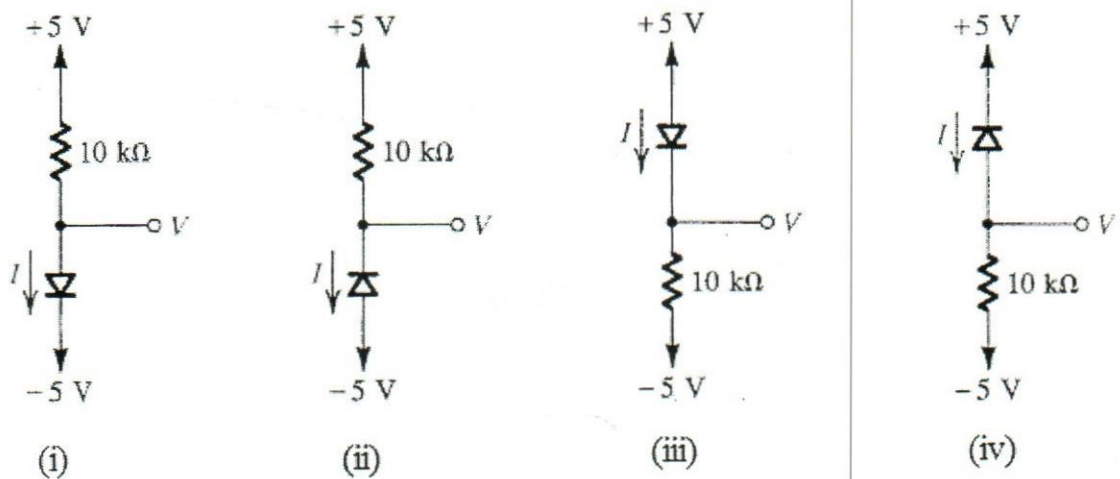
c) What are the applications of transistors? (5 marks)

(5 marks)

4. a) Find the value of V_{ab} as shown in the figure below. (8 marks)



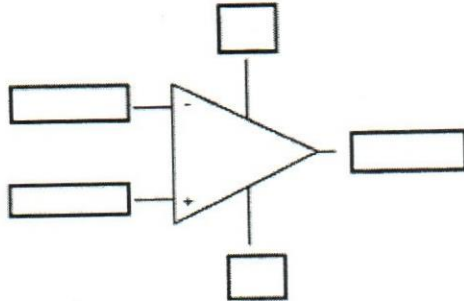
- b) Find each branch current when a and b are connected by a wire. (8 marks)
- c) Hence, find the value of V . (4 marks)
5. a) What is the difference between active and passive sensors? (6 marks)
- b) List three type of temperature sensors. (6 marks)
- c) Describe working principle of Linear Variable Differential Transformer (LVDT). (8 marks)
6. a) **What is an Ideal Diode?** Draw its V-I characteristics and identify the regions analogous to Switch. (6 marks)
- b) Assuming diodes to be Ideal find the values of I and V in the circuits below. (8 marks)



- c) What are the applications of diode? (6 marks)

7. a) Identify the terminals in the following op – amp.

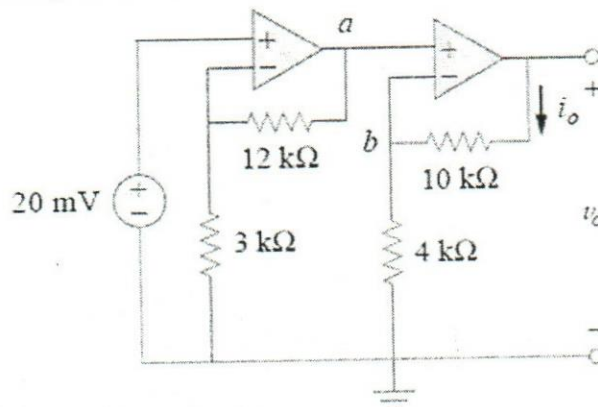
(6 marks)



- b) Draw non-inverting and inverting amplifier circuit diagrams.
 c) Find v_o and i_o in the circuit.

(6 marks)

(8 marks)



8. a) Identify the units for the following properties.

(8 marks)

- i. Resistance
- ii. Capacitance
- iii. Conductance
- iv. Voltage

- b) Define resistance with standard symbols.
 c) Identify the color code of a 330Ω ceramic resistor.

(6 marks)

(6 marks)

9. a) Draw the circuit diagram of RC low pass filter.

(8 marks)

b) Draw frequency spectrum of low pass filter.

(6 marks)

c) What are the applications of low pass filter?

(6 marks)



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2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
Physics

- This question paper consists of nine questions.
- Answer Any 6 Questions

Date: 2016.01.12

Pass mark 50%

Time allocated: 03 Hrs

$$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2, \mu_0 = 4\pi \times 10^{-7} \text{ H/m}, m_e = 9.11 \times 10^{-31} \text{ kg}, m_p = 1 \text{amu} = 1.6726 \times 10^{-27} \text{ kg}, e = 1.6 \times 10^{-19} \text{ C}$$

1.

- State the *Ampere's law* (4 marks)
- Write an expression for magnetic field produced by an infinitely long current carrying conductor. (4 marks)
- the A vertical conductor carries a downward current of **5 A**
 - Draw the pattern of the magnetic flux in a horizontal plane round the conductor (4 marks)
 - What is the flux density due to the current alone at a point, **10 cm** from the conductor? (4 marks)
 - If the earth's horizontal magnetic flux density has a value **$4 \times 10^{-5} \text{ T}$** , calculate the resultant flux density (4 marks)

2.

- Write an expression for the speed of an electromagnetic wave using the permeability and permittivity of the medium of propagation. Hence find the speed of an EM wave in a medium which relative permeability (μ_r) and permittivity (ϵ_r) are **300** and **10** respectively. (6 marks)
- A standard radio broadcasting station has an assigned frequency between **535** and **1605 kHz**. The VHF television stations have frequencies between **54** and **216 MHz**. While the UHF have frequencies between **470** and **890 MHz**. What is the wavelength corresponding to each of the frequencies mentioned? (6 marks)
- A radar set for determining the speed of approaching jets sends out waves of frequency **1000 MHz**. If the beat frequency observed is **200 Hz**, what is the speed of the car? (8 marks)

3.

a. Describe the following terms

- i. Diamagnetic materials
- ii. Paramagnetic materials
- iii. Ferromagnetic materials

(6 marks)

b. A toroid with **1000** turns is wound on an iron ring **200 mm** ² In cross-sectional area, of **0.1 m** mean circumference and of **1200** relative permeability. If the windings carry **0.12 A**, determine

- i. The magnetizing field(H)
- ii. Magneto motive force (MMF)
- iii. The magnetic flux density(B)
- iv. The magnetic flux(Φ)
- v. The reluctance of the circuit(R)

(2 marks)

(3 marks)

(3 marks)

(3 marks)

(3 marks)

4.

a. State the **Biot-Sarvart** law.

(5 marks)

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

(5 marks)

c. A circular loop of **168 mm** radius and **100 turns** carries of **0.2 A**. Find the magnetic field at the center of the loop

(5 marks)

d. An arc shaped wire segment with radius **2 m** subtends an angle of **$\pi/3$ rad** (**60⁰**) at the center. If the current in wire is **5 A**, find the magnetic field at the center.

(5 marks)

5.

a. Describe the **impedance of an electric circuit.**

(4 marks)

b. A circuit consists of a capacitor of **15 μF** and a resistor of **500 Ω** . An alternating EMF of **15 V**(r.m.s) and frequency **60 Hz** is applied. Find

- i. The current in the circuit?
- ii. The voltage drop across the capacitor
- iii. The phase angle between the applied EMF and current
- iv. The average power supplied

(4 marks)

(4 marks)

(4 marks)

(4 marks)

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6.

- a. Describe the followings for *induction motors*
- Synchronous speed (6 marks)
 - Base speed (8 marks)
 - Slip (2 marks)
- b. Describe the working principle of an *induction motor* (4 marks)
- c. Write an expression for the *synchronous speed* of an induction motor (2 marks)
- d. An induction motor with **20** poles is connected to **50 Hz** power line. Its slip percentage is **15 %**. Determine the synchronous speed and base speed (4 marks)

7.

- a. Write down *Fleming's left hand rule*. (2 marks)
- b. Describe the working principle of DC motor. (4 marks)
- c. A shunt motor has an armature resistance **2.5 Ω** and field resistance **50 Ω** . It is connected across **240 V** mains and is generating a back EMF of **190 V**. Determine
- The *armature current, the field current* and *total current* (4 marks)
 - The *total power* taken by the motor (2 marks)
 - The *power lost in the armature* and *field windings* (4 marks)
 - The *mechanical power* of the motor and the *torque* on shaft if the speed is **2000 rpm**. (4 marks)

8.

- a. Describe the *self inductance* (3 marks)
- b. Write an expression for the *back EMF* generated by a solenoid (3 marks)
- c. A back EMF of **15 V** is induced in a solenoid when the current in it changes at the rate of **0.3 A/s**. Compute the self inductance of the solenoid. (4 marks)
- d. A coil of **0.10 H** and **20 Ω** resistance is connected to **120 V** source.
- At what rate will the current in the coil grow at the instant it is connected to the source? (5 marks)
 - What is the current when it is growing at rate of **100 A/s** (5 marks)

9.

- a. Describe *the mutual inductance* (3 marks)
- b. When the current in a certain coil is changing at a rate of 3 A/s , it is found that an emf of 7 mV is induced in a nearby coil. What is the mutual inductance of the combination? (4 marks)
- c. Discuss the working principles of an ideal transformer (3 marks)
- d. The mutual inductance between the primary and secondary of a transformer is 0.3 H . compute the induced EMF in the secondary when the primary current changes at the rate of 4 A/s . (4 marks)
- e. An ideal transformer has 600 turns on the primary and 90 turns on the secondary. What is the maximum output potential difference if the maximum input voltage is 3.3 kV ? If the transformer is assumed to have an efficiency of 100% , what maximum primary current is required if a maximum current of 11 A is drawn from the secondary? (6 marks)

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 COURSE CODE: ED 0340

2ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
 Mathematics

- This question paper consists of nine questions.
- Answer Any Six (06) Questions

Date: 2016.01.12

Pass mark 50%

Time allocated: 03 Hrs

1. a) Simplify (6 marks)
- i. $\frac{(\sqrt{2} + 2\sqrt{5})}{(\sqrt{5} - \sqrt{2})}$
- ii. $\frac{(\sqrt{6} + \sqrt{3})}{(\sqrt{6} - \sqrt{3})} - \frac{(\sqrt{6} - \sqrt{3})}{(\sqrt{6} + \sqrt{3})}$
- b) Solve the inequality (6 marks)
- i. $2x + 5 > 5x - 4$
- ii. $\frac{1}{x-1} \geq \frac{1}{x-3}$
- c) If a is real number and $\frac{1}{a} + a = 2$. Evaluate $\frac{1}{a^{2015}} + a^{2015} = 2$ (8 marks)
2. a) Solve $3x^2 - 8x = 5$ (6 marks)
- b) Prove that $kx^2 + 2x - (k-2) = 0$ has real roots for any value of k . (6 marks)
- c) If α and β are the roots of quadratic equation $ax^2 + 2bx + c = 0$, prove that the equation whose roots are $\alpha + \frac{1}{\beta}$ and $\beta + \frac{1}{\alpha}$ is $acx^2 + 2b(a+c)x + (a+c)^2 = 0$. (8 marks)
3. a) Divide $2x^3 - 5x^2 + 4x + 7$ by $2x - 1$. (6 marks)
- b) Find the value of α in the following expression given that, $x^3 - \alpha x^2 + 3x - 5$ has remainder -3 when divided by $x - 2$ (6 marks)
- c) Express $\frac{4x^2 - 3x + 5}{(x+2)(x-1)^2}$ in partial fractions. (8 marks)

4. a) Evaluate (6 marks)
- i. $\lim_{x \rightarrow 1} \frac{x^2 - x + 3}{3x + 1}$
- ii. $\lim_{x \rightarrow 2} \frac{x^4 - 16}{x - 2}$
- b) Differentiate with respect to x. (6 marks)
- i. $y = \frac{3x^2 - 2}{x^3 + 1}$
- ii. $y = (x^2 + 1)(4x - 3)$
- c) If $y = \frac{x}{\sqrt{1+x^2}}$, prove that $(1+x^2) \frac{d^2y}{dx^2} + 3x \frac{dy}{dx} = xy$. (8 marks)
5. a) Integrate $3x^5 - 4x^3 - 5$ with respect to x. (6 marks)
- b) Find $\int \cos 4x \cos^2 x dx$. (6 marks)
- c) Evaluate (8 marks)
- i. $\int_{-1}^2 \frac{x^2}{\sqrt{1+x^2}} dx$
- ii. $\int_1^e x \ln x dx$
6. a) Calculate $\frac{10!}{4! \times 6!}$. (6 marks)
- b) Expand $(1+2x)^9$. (6 marks)
- c) Hence calculate 1.02^9 correct to 5 places of decimals (8 marks)
7. a) Prove that $\sum_{r=1}^n r = \frac{n}{2}(n+1)$ and $\sum_{r=1}^n r^2 = \frac{n}{6}(n+1)(2n+1)$. (6 marks)
- b) Evaluate $\sum_{r=11}^{20} (6r^2 + 4r + 3)$ (6 marks)
- c) Given that $T_r = \frac{2r+1}{r(r+1)(r+2)}$ and $V_r = \frac{k(4r+1)}{r(r+1)}$, (8 marks)
- i. Find the constant k such that $T_r = V_r - V_{r+1}$
- ii. Hence evaluate $\sum_{r=1}^n T_r$

8. a) If θ is a positive acute angle such that $\tan \theta = \frac{5}{12}$. Find $\sin \theta$ and $\cos \theta$. (6 marks)

b) Prove that following identities

i.
$$\frac{1}{1 + \sin A} + \frac{1}{1 - \sin A} = 2 \sec^2 A$$

ii.
$$\tan^2 A - \sin^2 A = \sin^4 A \sec^2 A$$
 (8 marks)

c) If $x = r \sin \theta \cos \phi$, $y = r \sin \theta \sin \phi$ and $z = r \cos \theta$, Prove that $x^2 + y^2 + z^2 = r^2$ (6 marks)

9. a) Evaluate $27^{\frac{2}{3}}$. (6 marks)

b) Express $\sqrt{72} - \sqrt{2} - \sqrt{50}$ as a surd in its simplest form. (6 marks)

c) Solve $3^x \times \left(\frac{1}{3}\right)^{x-3} = \left(\frac{1}{27}\right)^x$. (8 marks)

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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0350 PI

000035

02ND SEMESTER EXAMINATION QUESTION PAPER
ELECTRO-TECH

- Answer all Six Questions

Date: 2016.01.06

Pass mark 50%

Time allocated: 03 Hrs

1. (a). State the Kirchoff's Current law(KCL) and Voltage law(KVL). (06 Marks)
(b). Calculate the followings in **figure- 01**.
 - (i) Current in 2Ω resistor. (04 Marks)
 - (ii) Power loss in the 2Ω resistor . (02 Marks)
 - (iii) Find out status of $7V$ battery charged or discharged. Justify your answer. (04 Marks)

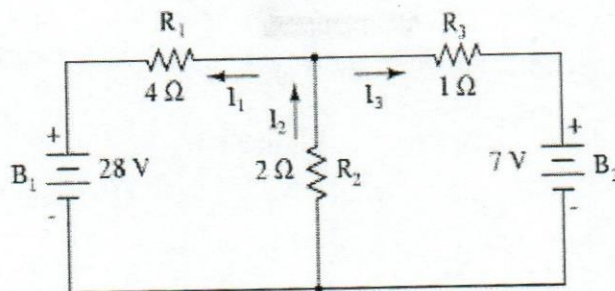
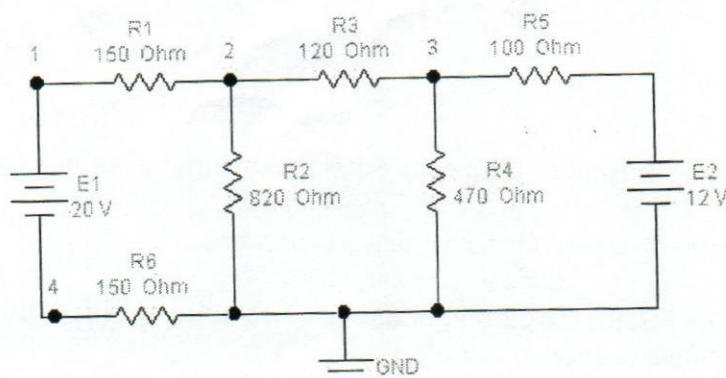


Figure-01

2. (a) Using Thevenin,s theorem find the current in the 120 Ohm resistor in network shown in **figure-02**. (10 Marks)

Figure-02



(b) With reference to marine type batteries

(i) What is the fully charge voltage & specific gravity of a lead acid cell?

(04 Marks)

(ii) State the four applications four essential routine power supplies using marine type batteries.

(04 Marks)

3. (i) Using Delta/Star transformation, find the current through the **160V** battery in **figure-03**.

(10 Marks)

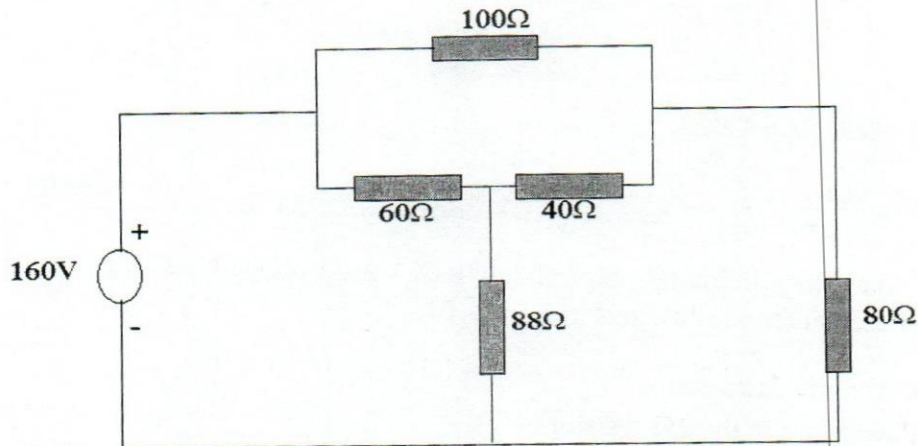
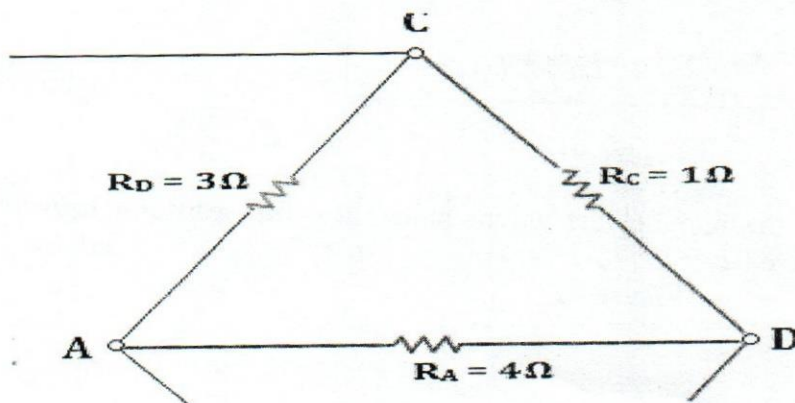


Figure-03

(ii) Convert the Delta network shown in **figure-04** in to Star network.

(06 Marks)

Figure-04



4. (a) An alternating current of frequency **50Hz** has maximum value of **90A**.

(i) Write down the equation for the instantaneous value.

(03 Marks)

(ii) Time from the instant the current is zero and becoming positive, find the instantaneous value after **0.002seconds**.

(03 Marks)

- (iii) Time taken to reach **75A** for the first time. (03 Marks)
- (b) An alternating voltage $V = 135 \sin 314t$ is applied to a device which offers an ohmic resistance of **12Ω** to the flow of current in one direction while entirely preventing the flow of current in the opposite direction. Calculate the followings.
- (i) r.m.s. value (03 Marks)
 - (ii) average value (03 Marks)
 - (iii) form factor. (03 Marks)
5. (a) What are the personal protective equipments(PPE) required for electrical safety? (04 Marks)
- (b) List the active safety measures and passive safety measures. (06 Marks)
- (c) Make the essential list of Do's and Don'ts when working with electrical equipment. (06 Marks)
6. (a) A balanced delta connected load takes line current of **17.5A** at power factor of **0.8** leading from a **440V, 3-phase, 50Hz** supply. Calculate the resistance of each leg of the load. (06 Marks)
- (b) List the disadvantages of low power factor. (04 Marks)
- (c) What are the equipments used to improve the power factor? (06 Marks)



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EDUCATION & TRAINING COURSE: ENGINEER OFFICER CADET FOUNDATION TRAINING COURSE

COURSE CODE: ED 0350 PI

02ND SEMESTER REPEAT EXAMINATION QUESTION PAPER
THERMODYNAMICS

- Answer Any Six Questions

Date: 2015.12.14

Pass mark 50%

Time allocated: 03 Hrs

For air $c_p = 1.005 \text{ kJ/kg K}$, $c_v = 0.717 \text{ kJ/kg K}$, $\gamma = 1.4$

Composition of air (mass proportions): 77 % of Nitrogen and 23 % of Oxygen

Specific heat capacity of water 4.2 kJ/kg K

1. The coal supplied to a furnace contains 82% Carbon, 10% Hydrogen, 7% Oxygen, 1% ash by mass as fired. The air supplied is 70 % in excess of that is required for theoretically correct combustion. Calculate
 - a. Calorific value of the fuel (4 marks)
 - b. Stoichiometric air/fuel ratio (4 marks)
 - c. Total mass of flue gas per kilogram of fuel (4 marks)
 - d. Mass of coal required to produce 1kg of steam at 10 bar and 250 °C from the feed water at 50 °C (8 marks)Assume that the thermal efficiency of the boiler is 100 % and calorific values of C and H are 33MJ/kg and 144 MJ/kg respectively.
2. The walls of a cold room consists of an outer layer of wood of thickness 30mm and thermal conductivity 0.18 W/mK, and a cork lining of thickness 70 mm and thermal conductivity 0.05 W/mK. If the rate of heat transfer from and to each exposed surface is 10 W/m² K and the heat flow through the wall is 24 W/m². Determine
 - a. The overall heat transfer coefficient (5 marks)
 - b. The temperature differences across the thickness of the wood and cork (5 marks)
 - c. The total temperature difference between the outside atmosphere and inside of room (5 marks)
 - d. The temperature of the room when the external ambient temperature is 20 °C. (5 marks)

3.

a. Define the following terms for water

- i. Saturation temperature
- ii. Saturated liquid
- iii. Dry steam
- iv. Wet steam
- v. Superheated steam

(10 marks)

b. Find the **temperature, the enthalpy and volume** of **5 kg** of wet saturated steam at a pressure of **10 bar** and dryness fraction **0.98**, find also the **additional heat energy** required to completely dry the steam.

(10 marks)

4.

a. Describe the Dalton's Partial pressure law

(4 marks)

b. A vessel of volume **8.0 m³** contains air and dry saturated steam at a total pressure of **0.20 bar** and temperature **40 °C**. Determine

- i. Partial pressure of steam
- ii. Partial pressure of air
- iii. Mass of steam in the vessel
- iv. Mass of air in the vessel

(4 marks)

(4 marks)

(4 marks)

(4 marks)

5.

a. Describe the followings

- i. Specific heat capacity of a substance
- ii. Latent heat of fusion
- iii. Latent heat of evaporation

(6 marks)

b. A **0.15 kg** of copper vessel contains **0.22 kg** of water, both at **20 °C**. A very hot **0.3 kg** of copper cylinder is dropped into the water, causing the water to boil, with **0.005 kg** being converted to steam. The final temperature of the system is **100 °C**. Neglect the losses to surrounding.

- i. How much energy is transferred to the water and vessel as heat? (8 marks)
- ii. What is the original temperature of the cylinder? (6 marks)

6.

a. Discuss the sign convention for the work transfer and heat transfer.

(4 marks)

b. A closed system having a cycle of four processes, heat and work interactions are follows:

Process 1 – 2 : adiabatic compression $Q_{12} = 0$, $W_{12} = -1100 \text{ kJ}$

Process 2 – 3 : constant volume heating $Q_{23} = +2800 \text{ kJ}$, $W_{23} = 0$

Process 3 – 4 : adiabatic expansion $Q_{34} = 0$, $W_{34} = +2200 \text{ kJ}$

Process 4 – 1 : constant volume heat rejection Q_{41} , $W_{41} = 0$

- i. Draw the PV diagram for the cyclic process
- ii. Calculate the rejection of heat (Q_{41})
- iii. Determine the cycle efficiency

(6 marks)

(5 marks)

(5 marks)

- 7.
- Derive an expression for gas constant(R) using specific heat capacities of the gas. (4 marks)
 - In a process of an air compression, **0.5 kg** of air at a pressure of **200 kPa** occupies **0.10 m³** and from this condition it is compressed to **1.8 MPa** according to the law **$PV^{1.35} = \text{constant}$** . Determine
 - The initial and final temperatures (4 marks)
 - The change of internal energy of the air (4 marks)
 - The work done on the air (4 marks)
 - The heat received or rejected by the air (4 marks)
8. A certain quantity of air initially at a pressure of **5 bar** and **127 °C** has a volume of **0.05m³**. It undergoes the following processes in the following sequence in a cycle:
- Expands at constant pressure to **0.1m³**
 - Expands using adiabatic process with $\gamma = 1.4$ until the temperature becomes **127 °C**
 - Compresses using isothermal process (which complete the cycle)
- Draw a schematic **P-V** diagram for the cycle (4 Marks)
- Determine the followings
- The **mass** of air (4 Marks)
 - The **temperature** after constant pressure process (4 Marks)
 - The **final volume** and **pressure** of the cycle (8 Marks)
- 9.
- Briefly explain the following terms
 - Boyle's law
 - Charles' law
 - Characteristic gas equation (6 marks)
 - A sample of air in a piston connected cylinder has an initial pressure of **1.34 MPa**, volume **0.019 m³** and temperature **315 °C**. Then it is expanded until its final pressure becomes **520 kPa** and its volume becomes **0.24 m³**. Determine
 - The **mass of air** (4 marks)
 - The **final temperature** (4 marks)
 - The **polytropic index** (6 marks)