BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2024 Examinations

Programme: **Engineering & Technology**

Subject: **Engineering Maths-I (GC102) [Rat]**

Time Duration: **3 Hrs.** Max. Marks: **75**

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions: **5 x 3 = 15**

a) Solve the quadratic equation $3x^2+7x+1=0$ and comment on the nature of its roots.

b) Find the slope, x-intercept and y-intercept of the line $2x-y+4=0$.

c) Obtain the centre and radius of the circle $x^2+y^2-4x+2y+3=0$.

d) Find the volume of a prism whose height is 12m and whose base is an equilateral triangle of sides 5m.

e) Use the elimination method to solve the equations $3x+2y=1$; $x-y=2$.

f) Find the arc length of the sector of a circle of radius 4cms which subtends an angle of 20° at the centre of the circle.

g) Differentiate $\sin x + 3^x + \log x$ with respect to x.

Q.No.2. Answer any three of the following Questions: **3 x 4 = 12**

a) Obtain the equation of the line passing through the point (1,-1) and which is parallel to the line $5x+y-3=0$.

b) If A(2,1), B(5,-1), C(3,-3) are the vertices of a triangle ABC, find the equation of the median AM of the triangle ABC.

c) Find the angle between the lines $x-2y-4=0$ and $x+2y+5=0$.

d) Write the equation the circle with centre (2,3) and passing through the point (4,1).

e) Find the equation of the circle whose centre is (1,3) and which touches the line $3x-4y-6=0$.

Q.No.3. Answer any three of the following Questions: **3 x 4 = 12**

a) Divide x^3-2x^2+3x+1 by $x-1$.

b) Prove that $\dfrac{\cos 3A-\cos 5A}{\sin 3A+\sin 5A}=\tan A$.

c) Find $\sin(A+B)$, given $\sin A=-\dfrac{1}{2}$, $\cos B=\dfrac{\sqrt{3}}{2}$ and A, B lie in the 4^{th} quadrant.

d) In the triangle ABC, a=8cms, b=10cms, c=7cms. Solve the triangle.

e) Prove that $\cot^2\theta-\cos^2\theta=\cot^2\theta.\cos^2\theta$.

Q.No.4. Answer any three of the following Questions: **3 x 4 = 12**

a) Find the value of x if

i) $\log_{10}(x+3)=2$ ii) $\log_{10}2x+\log_{10}4=\log_{10}16$

b) Evaluate $\lim\limits_{x\to 4}\dfrac{x^2-6x+8}{x^2-3x-4}$

c) Find the total surface area of a pyramid with a square base of sides 24m. The slant height of the pyramid is 13m.

d) A Frustum of a cone has its ends as circles of diameters 12cms and 8cms. If the height of the frustum is 10cms, find its volume.

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e) A series of offsets measured from a survey line to a curved boundary of a plot are as given.

Distance from one end to survey line (m)	6	15	24	33	42	51	60	69	78
Offsets (m)	7	8	10	12	13	15	14	9	6

Calculate the area of the plot using Simpson's rule.

Q.No.5. Answer any three of the following Questions: **3 x 4 =**

a) Evaluate $\lim_{\theta \to 0} \frac{1-\cos 4\theta}{1-\cos 2\theta}$

b) Evaluate $\lim_{x \to 0} \left(\frac{e^{-4x}-1}{e^{2x}-1} \right)$

c) Find $\frac{d}{dx}\left(\frac{\cos 3x}{6x+1}\right)$

d) If $x^2+4xy+y^2=0$, find $\frac{dy}{dx}$.

e) Differentiate $y=(\tan x)^x$ with respect to x.

Q.No.6. Answer any three of the following Questions: **3 x 4 =**

a) Find $\frac{dy}{dx}$ if $y=e^{4x+1}+(3x+1)^2-\tan 2x+x$.

b) If $x=\sin^2\theta$, $y=\cos^2\theta$, find $\frac{dy}{dx}$.

c) Obtain the maxima and minima for the function $y=x^3-3x^2-9x$.

d) The displacement 's' of a particle in time 't' seconds is given by $s=t^3-6t^2+9t+5$. When does the acceleration of a particle become 0 m/s²?

e) Write the equation of the tangent to the curve $y=4e^{5x}$ at the point (0,4).

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2024 Examinations

Programme: **Engineering & Technology**

Subject: **Applied Physics-I (GC103) [Rat]**

Time Duration: **3 Hrs.** Max. Marks: **75**

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable additional data if required.

Q.No.1. Sub-question (a) is compulsory, answer any 7 from the remaining questions: **(1)**

a) Write the dimensions of Acceleration. **(2)**

b) Define least count of Vernier Caliper. **(2)**

c) State the relation between β & γ, being coefficient of areal and cubic expansion respectively. **(2)**

d) Define vector quantities. **(2)**

e) Define uniform acceleration. **(2)**

f) Define power. **(2)**

g) The Blades of a table fan rotate at the rate of 25 radians per second. If the radius of the dial is 0.25m, then calculate the linear velocity. **(2)**

h) Name any two types of satellites. **(2)**

i) Convert 120 rpm into redians per second. **(2)**

j) Define Young's modulus. **(2)**

k) State Charle's law. **(2)**

Q.No.2. Answer any three of the following Questions: **3 x 4 = 12**

a) Check, by using dimensional analysis, the correctness of the given equation $v = u + at$, where v & u are velocities, a is acceleration & t is time.

b) State the principle of Homogeneity.

c) Name the seven fundamental quantities.

d) Explain positive and negative error in a Vernier Caliper with a neat diagram.

e) A car moving with an initial velocity of 20 m/s, attains a velocity of 30 m/s in 5 seconds. Calculate its acceleration.

Q.No.3. Answer any three of the following Questions: **3 x 4 = 12**

a) Define Kinetic energy and Potential energy.

b) A force of 50N acting at an angle of 30° to the directions of the force on a wooden block moves it by 30m. Calculate the work done.

c) A cricket ball is thrown vertically upward with an initial velocity of 40 m/s. Calculate the maximum height reached. Take $g=10\ m/s^2$.

d) Give three points of difference between distance and displacement.

e) Define the following terms: i) Steady state ii) Time period of a satellite.

Q.No.4. Answer any three of the following Questions: **3 x 4 = 12**

a) Give two uses each of centripetal and centrifugal force.

b) Derive an expression for the superelevation of road.

c) Calculate the acceleration due to gravity on the surface of a planet having a mass of 5.9×10^{20} Kg and radius of 6.4×10^4m. Take $G= 6.67 \times 10^{-11}\ Nm^2/Kg^2$.

d) Write an expression for critical velocity (also known as orbital velocity) and indicate what each term in the expression stands for.

e) Define the following terms: i) Banking of Road ii) Factor of safety.

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Q.No.5. Answer any three of the following Questions: **3 x 4 =**

a) Write an expression for Young's modulus and indicate what each term in the expression stands for.

b) The Young's modulus of wire is $2x10^{11}$ N/m^2. When a mass of 75 kg is hung by it, the extension produced in the wire is $3x10^{-3}$m. Calculate the original length of the wire, if the radius of the wire is $5x10^{-3}$ m. Take g=10 m/s^2.

c) Define longitudinal stress and yield point.

d) A glass capillary tube of diameter $0.03x10^{-2}$ m is dipped into a liquid of density $0.85x10^{3}$ kg/m^3. The liquid rises to a height of 0.14m. Find the angle of contact given that the surface tension of the liquid is $59.5x10^{-3}$ N/m. Take g=10 m/s^2.

e) State Stoke's law and write an expression for it, indicating what each term in the expression stands for.

Q.No.6. Answer any three of the following Questions: **3 x 4 =**

a) Define the following terms: i) Angle of contact ii) Ideal gas.

b) State the three modes of transfer of heat and define them.

c) A gas at 13°C occupies a volume of $40x10^{-6}$ m^3. At what temperature its volume will be $75x10^{-6}$ m^3.

d) State Boyle's law. Define latent heat of fusion.

e) A certain mass of a gas occupies $40x10^{-6}$ m^3 at 27°C and $280x10^{-3}$ m of pressure. Find its volume at 47°C and $680x10^{-3}$ m of pressure.

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II

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2024 Examinations

Programme: **Common**

Subject: **Environmental Studies (GC203)**

Time Duration: **3 Hrs.** Max. Marks: **75**

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions: **5 x 3 = 15**

a) What are the objectives of environmental studies?
b) What is ecological footprint?
c) With suitable example explain Food Chain & Food Web.
d) How has excessive use of synthetic fertilizers in modern agriculture caused problems?
e) What is Eutrophication?
f) State the effects of ozone layer depletion.
g) What are the functions of the Central Pollution Control Board to prevent water pollution?
h) Mention any six rules of Motor Vehicle Act to be followed by the citizens.

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) i) Write a note on flow of energy in an ecosystem. **(3)**
ii) Draw the pyramid of number for Grassland Ecosystem and pyramid of Biomass for Pond Ecosystem. **(3)**
b) Explain In situ method of conservation of Biodiversity.
c) Discuss the various threats to Biodiversity.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) Explain the drawbacks of construction of dams.
b) Discuss the causes of land degradation and methods to control land degradation.
c) i) Discuss the effects of deforestation. **(3)**
ii) Discuss any two alternate sources of energy. **(3)**

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) Discuss the various means to control air pollution.
b) Give an account of any three water pollutants and their effects.
c) State the effects of noise pollution on human health. What are the means of noise pollution control?

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) i) State the sources of radioactive pollution. **(3)**
ii) What are the effects of nuclear radiations on human health? **(3)**
b) i) Why is separation of dry waste and wet waste important? **(3)**
ii) With suitable examples explain the methods of waste utilization. **(3)**
c) What is Acid Rain? Explain the causes & effects of Acid Rain.

Q.No.6. Answer any two of the following Questions: **2 x 6 = 12**

a) Write short notes on: i) Value education ii) Population growth & its effects.
b) i) What is the need for Rain Water Harvesting? **(3)**
ii) Discuss the methods of Roof Top Rain Water Harvesting. **(3)**
c) Explain the various schemes of central and state government for women and child welfare.

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2024 Examinations

Programme: **Common**

Subject: **Engineering Materials (GC205)**

Time Duration: **3 Hrs.** Max. Marks: **75**

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions: **5 x 3 = 15**

a) What is linear coefficient of expansion?
b) What are Alloy steels?
c) What are copper-tin alloys?
d) Explain composition and uses of fly ash bricks.
e) State applications of veneer and plywood.
f) What are the applications of semiconductors?
g) List various high conductivity materials.

Q.No.2. Answer any two of the following Questions: **2 x 6 = 12**

a) Explain any six electrical properties of engineering materials.
b) State and define chemical properties of engineering materials.
c) State the composition, properties and the uses of high carbon steel.

Q.No.3. Answer any two of the following Questions: **2 x 6 = 12**

a) What are the stainless steels? How do they acquire the stainless properties? Give any two engineering uses of stainless steel.
b) List down the various constituents of Aluminium alloys. Explain the effect of these constituents on properties of metal.
c) State the properties and uses of Duralumin, Y-alloy and Al-Si alloy.

Q.No.4. Answer any two of the following Questions: **2 x 6 = 12**

a) List common building stones. Also state applications of any four building stones.
b) Write short notes on any three types of cement. Also mention their uses.
c) List various natural and synthetic abrasive materials. Also give properties and uses of abrasive materials.

Q.No.5. Answer any two of the following Questions: **2 x 6 = 12**

a) Write short notes on:
i) Borosilicate glass ii) Fibre Glass
b) State and explain properties and applications of any three high resistivity materials.
c) Name solid insulating materials. Also state characteristics and application of solid insulating materials.

Q.No.6. Answer any two of the following Questions: **2 x 6 = 12**

a) Explain with examples classification of magnetic materials.
b) State function of matrix used in composite materials.
c) Explain types and application of lubricants.

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II

BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2024 Examinations

Programme: **Engineering & Technology**

Subject: **Engineering Maths-II (GC201) [Rat]**

Time Duration: **3 Hrs.** Max. Marks: **75**

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions: **5 x 3 = 15**

a) Find 'x', if $\begin{vmatrix} x-4 & 2 \\ x+1 & 3 \end{vmatrix} = 0$.

b) Find a, b, if $\begin{bmatrix} a+3b & 4 \\ 6 & 2a-b \end{bmatrix} = \begin{bmatrix} 1 & 4 \\ 6 & 9 \end{bmatrix}$.

c) Find $|2\bar{a}+\bar{b}|$, if $\bar{a} = 2\bar{i} - \bar{j} + \bar{k}$ and $\bar{b} = \bar{i} + 4\bar{j} + \bar{k}$.

d) If $\bar{a} = 5\bar{i} + \bar{j} + 3\bar{k}$, $\bar{b} = 2\bar{i} + \bar{j} - \bar{k}$, then find $\bar{a} \cdot \bar{b}$ and $\bar{a} \times \bar{b}$.

e) Find $\int \frac{x^4 + 3x^2 + 4}{x} dx$

f) Evaluate $\int_0^{\pi/4} \sec^2 x dx$

Only for Mechanical Engg. and allied branches:

g) Find mean, median and mode for 15, 12, 13, 15, 19, 18.

h) Find the standard deviation of the numbers
1, 3, 2, 5, 4

Only for Electronics Engg. and allied branches:

g) Find 'a' and 'b' if 2a + ib = (2-5i) (1+4i).

h) If $z_1 = 2 + i$, $z_2 = 3 + i$, find $|3z_1 + 2z_2|$

Q.No.2. Answer any three of the following Questions: **3 x 4 = 12**

a) Solve using Cramer's rule
$x + 2y - z = 6$
$2x - 3y + z = 1$
$x + y - 3z = 2$

b) If $A = \begin{bmatrix} 4 & 5 & 3 \\ 3 & 2 & 1 \\ 1 & 1 & 0 \end{bmatrix}$, find A^{-1}.

c) Solve by matrix method
$4x - y = 9$
$2x + 5y = -3$

d) If $A = \begin{bmatrix} 4 & 2 \\ 3 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 1 \\ 0 & 3 \end{bmatrix}$
Show that AB # BA.

e) If $A = \begin{bmatrix} 3 & 1 \\ 2 & -1 \end{bmatrix}$, find $A^2 - 2A + 4I$.

Q.No.3. Answer any three of the following Questions: **3 x 4 = 12**

a) Find angle between $\bar{a}$ and $\bar{b}$, if $\bar{a} = 4\bar{i} - 3\bar{j}$ and $\bar{b} = \bar{i} - 2\bar{j} + 2\bar{k}$.

b) If $\bar{a} = \bar{i} + 2\bar{j} - 3\bar{k}$, $\bar{b} = 3\bar{i} - \bar{j} + 2\bar{k}$, show that $(\bar{a}+\bar{b})$ and $(\bar{a}-\bar{b})$ are perpendicular to each other.

c) Find projection of $4\bar{a} - \bar{b}$ on $\bar{b}$, if $\bar{a} = 2\bar{i} + \bar{j} - 3\bar{k}$ and $\bar{b} = \bar{i} + \bar{j} + 2\bar{k}$.

d) Find area of triangle ABC, with vertices
A (2, 1, 1), B (-1, 5, 2), C (3, -1, 1).

e) Show that $\bar{a} = 2\bar{i} + \bar{j} + 4\bar{k}$, $\bar{b} = \bar{i} + 3\bar{j} + 2\bar{k}$ and $\bar{c} = -\bar{i} + 2\bar{j} - 2\bar{k}$ are coplanar.

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Q.No.4. Answer any three of the following Questions: 3 x 4 =

a) Find $\int\left(2\sin 7x+\tan x+3^x+\frac{1}{x^2+16}\right)dx$

b) Find $\int\frac{e^x}{4e^x+3}dx$

c) Find $\int x\cos 8x\,dx$

d) Find $\int\frac{1}{24-2x-x^2}dx$

e) Find $\int\frac{3x^2+4x+5}{x+1}dx$

Q.No.5. Answer any three of the following Questions: 3 x 4 =

a) Find $\int\frac{\cos x}{\sqrt{9-\sin^2 x}}dx$

b) Find $\int_1^4\frac{\sqrt{x-4}}{\sqrt{x-4}+\sqrt{1-x}}dx$

c) Find $\int_0^1\frac{1}{x^2+4x+3}dx$

d) Find the area enclosed by $y^2=9x$ and the lines x=0, x=4 and X-axis in first quadrant.

e) Find the volume generated by rotating area enclosed by y=4x-3, x=1, x=2 and X-axis.

Only for Mechanical Engg. and allied branches:

Q.No.6. Answer any three of the following Questions: 3 x 4 =

a) Find the mode value from the given distribution.

Class interval	5-9	10-14	15-19	20-24	25-29
Frequency	4	13	20	17	6

b) Find the median value for the following data.

Class interval	0-10	10-20	20-30	30-40	40-50
Frequency	12	16	30	14	8

c) Find the mean deviation from given data.

Class interval	3-5	5-7	7-9	9-11	11-13
Frequency	3	7	10	8	2

d) Find standard deviation.

Class marks (x_i)	2	6	10	14	18
Frequency	4	7	11	5	3

e) Find the mean deviation of the numbers
15, 19, 17, 12, 16, 11

Only for Electronics Engg. and allied branches:

Q.No.6. Answer any three of the following Questions: 3 x 4 =

a) Express in Polar form i) $z_1=1+\sqrt{3}i$ ii) $z_2=-2+2i$.

b) If $z_1=1+2i$, $z_2=3+4i$ and $z_3=2-i$ find $\frac{z_1+z_2}{z_3}$ in $a+ib$ form.

c) Find 'a' and 'b', if (2a - b) + (a + 2b)i = 3 + 4i

d) Express in a + ib form $\frac{3i^{17}+i^{13}-2i^6}{i^8+i^5}$

e) Simplify using De Moivres's Theorem

$$\frac{(\cos 8\theta+i\sin 8\theta)\left(\cos\frac{2}{3}\theta-i\sin\frac{2}{3}\theta\right)^6}{\left(\cos\frac{\theta}{4}+i\sin\frac{\theta}{4}\right)^{-4}(\cos 2\theta-i\sin 2\theta)^2}$$

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April, 20

Programme: **Engineering &**

Subject: **Engineering Math**

Time Duration: **3 Hrs.**

Instructions: 1) All questions a
2) Figures to the
3) Assume suitab

Q.No.1. Answer any five of

a) Find 'x', if $\begin{vmatrix} x-4 & 2 \\ x+1 & 3 \end{vmatrix}$

b) Find a, b, if $\begin{bmatrix} a+3b \\ 6 \end{bmatrix}$

c) Find $|2\bar{a}+\bar{b}|$, if $\bar{a}=$

d) If $\bar{a}=5\bar{i}+\bar{j}+3\bar{k}$, $\bar{b}$

e) Find $\int\frac{x^4+3x^2+4}{x}$

f) Evaluate $\int_0^{\pi/4}\sec^2 x$

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g) Find mean, med

h) Find the standa
1, 3, 2, 5, 4

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g) Find 'a' and 'b'

h) If $z_1 = 2 + i$, z_2

Q.No.2. Answer any t

a) Solve using C

b) If $A=\begin{bmatrix} 4 & 5 \\ 3 & 2 \\ 1 & 1 \end{bmatrix}$

c) Solve by ma

d) If $A=\begin{bmatrix} 4 & 2 \\ 3 & 1 \end{bmatrix}$

Show that

e) If $A=\begin{bmatrix} 3 \\ 2 \end{bmatrix}$

Q.No.3. Answer

a) Find ang

b) If $\bar{a}=\bar{i}+$
are perp

c) Find
$\bar{b}=\bar{i}+\bar{j}$

d) Find a
A (2, 1

e) Show
copla

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2024 Examinations

Programme: **Engineering & Technology**

Subject: **Applied Physics-I (GC103) [Rat]**

Time Duration: **3 Hrs.** Max. Marks: **75**

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable additional data if required.

Q.No.1. Sub-question (a) is compulsory, answer any 7 from the remaining questions:

a) Write the dimensions of Acceleration. **(1)**
b) Define least count of Vernier Caliper. **(2)**
c) State the relation between β & γ, being coefficient of areal and cubic expansion respectively. **(2)**
d) Define vector quantities. **(2)**
e) Define uniform acceleration. **(2)**
f) Define power. **(2)**
g) The Blades of a table fan rotate at the rate of 25 radians per second. If the radius of the dial is 0.25m, then calculate the linear velocity. **(2)**
h) Name any two types of satellites. **(2)**
i) Convert 120 rpm into redians per second. **(2)**
j) Define Young's modulus. **(2)**
k) State Charle's law. **(2)**

3 x 4 = 12

Q.No.2. Answer any three of the following Questions:

a) Check, by using dimensional analysis, the correctness of the given equation $v = u + at$, where v & u are velocities, a is acceleration & t is time.
b) State the principle of Homogeneity.
c) Name the seven fundamental quantities.
d) Explain positive and negative error in a Vernier Caliper with a neat diagram.
e) A car moving with an initial velocity of 20 m/s, attains a velocity of 30 m/s in 5 seconds. Calculate its acceleration.

3 x 4 = 12

Q.No.3. Answer any three of the following Questions:

a) Define Kinetic energy and Potential energy.
b) A force of 50N acting at an angle of 30° to the directions of the force on a wooden block moves it by 30m. Calculate the work done.
c) A cricket ball is thrown vertically upward with an initial velocity of 40 m/s. Calculate the maximum height reached. Take $g=10\ m/s^2$.
d) Give three points of difference between distance and displacement.
e) Define the following terms: i) Steady state ii) Time period of a satellite.

3 x 4 = 12

Q.No.4. Answer any three of the following Questions:

a) Give two uses each of centripetal and centrifugal force.
b) Derive an expression for the superelevation of road.
c) Calculate the acceleration due to gravity on the surface of a planet having a mass of 5.9×10^{20} Kg and radius of 6.4×10^{4}m. Take $G= 6.67 \times 10^{-11}\ Nm^2/Kg^2$.
d) Write an expression for critical velocity (also known as orbital velocity) and indicate what each term in the expression stands for.
e) Define the following terms: i) Banking of Road ii) Factor of safety.

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Q.No.5. Answer any three of the following Questions: 3 x 4 =

a) Write an expression for Young's modulus and indicate what each term in the expression stands for.

b) The Young's modulus of wire is $2x10^{11}$ N/m^2. When a mass of 75 kg is hung by it, the extension produced in the wire is $3x10^{-3}$m. Calculate the original length of the wire, if the radius of the wire is $5x10^{-3}$ m. Take g=10 m/s^2.

c) Define longitudinal stress and yield point.

d) A glass capillary tube of diameter $0.03x10^{-2}$ m is dipped into a liquid of density $0.85x10^3$ kg/m^3. The liquid rises to a height of 0.14m. Find the angle of contact given that the surface tension of the liquid is $59.5x10^{-3}$ N/m. Take g=10 m/s^2.

e) State Stoke's law and write an expression for it, indicating what each term in the expression stands for.

Q.No.6. Answer any three of the following Questions: 3 x 4 =

a) Define the following terms: i) Angle of contact ii) Ideal gas.

b) State the three modes of transfer of heat and define them.

c) A gas at 13°C occupies a volume of $40x10^{-6}$ m^3. At what temperature its volume will be $75x10^{-6}$ m^3.

d) State Boyle's law. Define latent heat of fusion.

e) A certain mass of a gas occupies $40x10^{-6}$ m^3 at 27°C and $280x10^{-3}$ m of pressure. Find its volume at 47°C and $680x10^{-3}$ m of pressure.

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2024 Examinations

Programme: **Engineering & Technology**

Subject: **Applied Physics-II (GC202)**

Time Duration: **3 Hrs.** Max. Marks: **75**

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable additional data if required.

Q.No.1. Sub Question (a) is compulsory. Answer any seven from Sub Question (b) to (k):

a) What is the potential inside a charged hollow sphere? **(1)**

b) 200J of work is done in bringing a charge of 4C from one point to other. Find the electric potential. **(2)**

c) State Ohm's law. **(2)**

d) Convert 1KWh to joules. **(2)**

e) State Ampere's Right hand thumb rule. **(2)**

f) Define Mutual Induction. **(2)**

g) What is an electromagnet? **(2)**

h) State 2 uses of UV light. **(2)**

i) Write full form of LASER. **(2)**

j) The velocity of light in air is $3x10^8$ m/s and velocity of light in glass is $2x10^8$ m/s. Find the refractive index of water. **(2)**

k) State two applications of ultrasonic waves. **(2)**

Q.No.2. Answer any three of the following Questions: **3 x 4 = 12**

a) Define electric line of force. Draw electric line of force due to positive and negative charge.

b) Calculate the distance at which potential due to a charge of 0.0036 microcoulomb is 36 volt when placed in air.

c) Write the expression for effective capacitance for 3 capacitors connected in series. Calculate the effective capacitance of 2 capacitors each of capacitance 10 microfarad connected in parallel.

d) A sphere of radius 0.5m is charged with 40 microcoulomb. Calculates the intensity of electric field at 1m from the centre of the sphere when placed in air.

e) State Joule's law of heating. Write an expression for heat generated in a current carrying conductor and state what each term in the expression indicates.

Q.No.3. Answer any three of the following Questions: **3 x 4 = 12**

a) Draw a neat circuit diagram for comparing emf of two cells by sum and difference method using potentiometer. Write the equation for comparing emf using this method.

b) A wire of length 10m and cross-sectional area $4x10^{-6}$ m^2 has specific resistance $10x10^{-7}$ ohm.m. Determine the resistance of the wire.

c) Show that potential difference along the length of the wire is directly proportional to its length.

d) The copper wire has a resistance of 6 ohm at 0°C. Determine its resistance at 50°C if temperature coefficient of copper is 0.00426/°C.

e) i) Define internal resistance of a cell. **(2)**
ii) The emf of a cell with internal resistance 5 ohm is 30 volt. Calculate the current through the cell if an external resistance of 10 ohm is connected. **(2)**

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Q.No.4. Answer any three of the following Questions: 3 x 4 =

a) State Faraday's laws of Electromagnetic Induction Write an expression for induced emf.

b) An ideal 200W transformer has an input current of 10A and output voltage of 25V. Determine i) Input voltage ii) Output current.

c) Write an expression for force acting on a straight conductor carrying current when placed in a magnetic field and also state what each term in the expression indicates.

d) The magnetic induction at the centre of a current carrying circular coil of 300 turns, current 0.2A is 1.8×10^{-4} wb/m^2. Find the radius of the coil. (μ=1, $\mu_0 = 4\pi \times 10^{-7}$ H/m)

e) Explain the working principle of Induction heating. State two uses of Induction heater.

Q.No.5. Answer any three of the following Questions: 3 x 4 =

a) Explain total internal reflection with a neat ray diagram.

b) A lamp of 9 candela is placed at a distance of 2m from the lamp of 81 candela. Find the position of the screen to be place between them so that it is equally illuminated on both sides.

c) Define Intensity of Illumination. State two uses of optical fibre.

d) A ray of light is travelling from air to glass. The angle of incidence is 45° and the RI of glass is 1.5. Determine the angle of refraction.

e) Draw a ray diagram showing refraction through a prism with necessary labelling. Write an expression for refractive index in minimum deviation position.

Q.No.6. Answer any three of the following Questions: 3 x 4 = 12

a) What is Resonance? State an application each where resonance is useful and resonance should be avoided.

b) i) Define Reverberation. (2)
ii) Write the relation between wavelength, frequency and velocity of a wave. (2)

c) Explain free and forced vibration giving one example each.

d) Define loudness of a sound. Draw a waveform to represent loud and soft sound.

e) The balancing length of the potentiometer wire for a cell with internal resistance 6 ohm is 300cm when the cell is in open circuit. Calculate the value of resistance that must be included in the circuit so that balancing length is 100cm.

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BOARD OF TECHNICAL EDUCATION

PORVORIM-GOA

April, 2024 Examinations

Programme: **Engineering & Technology**

Subject: **Applied Chemistry (GC104)/(GN104) [Rat/Rev]**

Time Duration: **3 Hrs.** Max. Marks: **75**

Instructions: 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Assume suitable additional data if required.

Q.No.1. Answer any five of the following Questions: **5 x 3 = 15**

a) State Pauli's Exclusion Principle. Write the maximum number of electrons, s-subshell and p-subshell can hold.

b) What is meant by hard and soft water?

c) Define electrolysis. What are the products of electrolysis of fused sodium chloride using carbon electrodes?

d) Write two points of difference between galvanizing and tinning.

e) Write how you will control corrosion by dearation or deactivation.

f) What are polymers? Write equation for polymerization of ethene to polyethene. **(Only for Students of Rationalised Scheme)**

f) Write in brief in oiliness or saponification of lubricants. **(Only for Students of Revised Scheme)**

Q.No.2. Answer any three of the following Questions: **3 x 4 = 12**

a) State and explain Hund's rule of maximum multiplicity giving examples.

b) Distinguish between orbit and orbital.

c) Write the significance, two points each of Azimuthal and Spin quantum number.

d) Write four points of difference between electrovalent and covalent compounds.

Q.No.3. Answer any three of the following Questions: **3 x 4 = 12**

a) Write the disadvantages of using hard water in sugar industry and textile industry.

b) Explain the reverse osmosis process of water softening.

c) Define pH. Write the significance of pH.

d) In the ion-exchange process of water softening:
i) Write the reaction for removal of cations in the cation exchanger
ii)Write the reaction for removal of anions in the anion exchanger

Q.No.4. Answer any three of the following Questions: **3 x 4 = 12**

a) Schematically represent the process of electrolysis of aqueous copper sulphate using copper electrodes.

b) Write any two factors affecting degree of ionization.

c) Write any two points of significance of electro-chemical series.

d) You are given sodium chloride solution and you are asked to electrolyze it:
i) Write the ions present in the solution
ii) Write the reactions occurring at the cathode

.....2/-

Q.No.5. Answer any three of the following Questions: 3 x 4

a) Explain how you will control corrosion by proper designing.
b) Explain the process of galvanizing for protection of metal from corrosion.
c) Write a short note on corrosion due to other gases.
d) Explain electrochemical corrosion by Hydrogen evolution mechanism.

Q.No.6. Answer any three of the following Questions: 3 x 4

a) Explain metal-ion concentration cell corrosion.

Only for Students of Rationalized Scheme

b) What is Addition Polymerization and Condensation Polymerization?
c) What are plastics? What are rubbers?
d) Why is natural rubber vulcanized? Explain any one property of synthetic rubber.

Only for Students of Revised Scheme

b) Write short notes on: i) Cloud point and Pour point ii) Flash point and Fire point.
c) Explain fluid-film lubrication.
d) Write any four functions of lubricants.

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