



ELIZADE UNIVERSITY

ILARA-MOKIN

FACULTY: BASIC AND APPLIED SCIENCES

DEPARTMENT: MATHEMATICS AND COMPUTER SCIENCE

1st SEMESTER EXAMINATION

2017 / 2018 ACADEMIC SESSION

COURSE CODE: MTH 101

COURSE TITLE: General Mathematics I

COURSE LEADER: Dr. I. A. Olopade & Mrs. T. Akinwumi

DURATION: 2 Hours

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HOD's SIGNATURE

INSTRUCTION: Candidates should answer any FOUR Questions.

Students are warned that possession of any unauthorized materials in an examination is a serious offence.

Question One

1a) In MTH 101 tutorial group of 30 students, 17 study Physics, 15 study Mathematics while 10 study neither Mathematics nor Physics. (i) How many student study both Physics and Mathematics (ii) How many students study only Mathematics (iii) ii) How many students study only Physics. (6 marks)

1b) The coefficient of the Fourth, Fifth and Sixth terms in the expansion $(1+2x)^6$, in ascending power of x , form a linear sequence (A.P). Find the common difference. (4 marks)

1c) If the roots of $2x^2 - 5x + 3 = 0$ are α and β , what is the value of $\frac{1}{\alpha} + \frac{1}{\beta}$ (3 marks)

1d) What is the sum of 4th and 6th term of the sequence with nth term $n^3 - 2(n-1)$. (2 marks)

Question Two

2a) If α and β are the roots of $6x^2 - 5x + 9 = 0$. Find the value of $(\alpha + 1)(\beta + 1)$ (4 marks)

2b) Expand $(3x + 2a)^4$ using Pascal triangle. (4 marks)

2c) Find the coefficient of y^4 in $(2x + 3y)^4$ (4 marks)

2d) If α and β are the roots of $4x^2 - 9x - 16 = 0$. Find $\alpha + \beta$ and $\alpha\beta$ (3 marks)

Question Three

3a) If $A = \{2, 3, 5, 6, 8, 9, 11, 13, 14, 15\}$. List the member of the following subsets

- i) $P = \{\text{Odd numbers of } A\}$. (1 mark) ii) $Q = \{\text{Even numbers of } A\}$. (1 mark)
ii) $R = \{\text{Prime numbers of } A\}$. (1 mark) iv) $S = \{\text{Numbers divisible by 3 in } A\}$. (1 mark)

Hence, find;

- v) $(P^1 \cap Q^1) \cap R$ (1 mark) vi) $P \cap Q^1 \cap R \cap S^1$ (1 mark)
vi) $(P \cap Q) \cup (P \cup Q)^1$ (1 mark)

3b) Derive the formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ from general quadratic equation

$ax^2 + bx + c = 0$ using completing the square method. (4 marks)

3c) Solve for x and y in $x - y = 1$ and $3 = y - 2x$ (2 marks)

3d) If $\frac{2}{x^2 - 4} = \frac{P}{x - 2} + \frac{Q}{x + 2}$, find the values of P and Q (2 marks)

Question four

4a) Resolve $\frac{14x^2 + 31x + 5}{(x - 1)(2x + 3)}$ into partial fraction (5 marks)

4b) Prove that $\frac{2 \cos^3 \theta - \cos \theta}{\sin \theta \cos^2 \theta - \sin^3 \theta} = \cot \theta$ (3 marks)

4c) Solve by completing the square method, equation $x^2 + 4x + 1 = 0$. (4 marks)

4d) Write the expression $\frac{2}{5 - 3i}$ in the form $a + ib$ (3 marks)

Question five

5a) If $\begin{pmatrix} y + z & 0 & 4 \\ 3 & 3x - y - z & 2 \\ x + y - 3z & 6 & 5 \end{pmatrix} = \begin{pmatrix} 6 & 0 & 4 \\ 3 & -7 & 2 \\ -13 & 6 & 5 \end{pmatrix}$ find x, y and z (6 marks)

5b) P and Q are two sets such that $n(P) = 22, n(Q) = 18$ and $n(P \cap Q) = 10$. Find $n(P \cup Q)$ (3 marks)

5c) Show that $\frac{\tan \theta}{\sec \theta} = \sin \theta$ (3 marks)

5d) Calculate the sum to infinity of $1 + \frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \dots$ (3 marks)

Question six

6a) Express $\cos 3\theta$ and $\sin 3\theta$ in terms of powers of $\cos \theta$ and $\sin \theta$ respectively. (Hint: Using De Moivre's Theorem) (5 marks)

6b) Find the value of $\begin{pmatrix} 2 & 3 & 1 \\ 0 & 1 & 2 \end{pmatrix} \begin{pmatrix} 1 \\ 3 \\ -2 \end{pmatrix}$ (3 marks)

6c) Write the expression $\frac{2}{5 - 3i}$ in the form $a + ib$ (4 marks)

6d) Find the sum of the first 2 terms of the G.P. $2, -6, 18, -54, \dots$ (3 marks)

- iii. $\text{MnO}_4^- + \text{H}^+ + \text{Fe}^{2+} \longrightarrow \text{Mn}^{2+} + \text{H}_2\text{O} + \text{Fe}^{3+}$
- iv. $\text{Cr}_2\text{O}_7^{2-} + \text{H}^+ \longrightarrow \text{Cr}^{2+} + \text{H}_2\text{O}$
- D. A can of malt beer is bottled at 25°C under a CO₂ pp of 3.0 × 10⁻⁴ atm. What is the concentration of CO₂ in the beer? [Henry's constant for CO₂ in water at 25°C is 3.1 × 10⁻² mol / L. atm
- E. Discuss the environmental effect of temperature on the solubility of dissolved oxygen on aquatic life.

QUESTION TWO

- A. State the factors that affect the rates of chemical reactions.
- B.
- Write an expression for the rate of reaction of $\text{H}_2(\text{g}) + \text{I}_2(\text{g}) \rightarrow \text{HI}(\text{g})$
 - Derive the unit of rate constant K for a third order reaction.
 - Calculate the average rate of J when the initial concentration is 0.750M and the concentration after 30 seconds is 0.250M
- C. Determine the activation energy for the reaction $\text{X} + \text{Y} \rightarrow \text{XY}$ at 298K given that the initial rate of reaction is 2.15 × 10⁻⁴ MS⁻¹ and the concentrations of X is 0.03M and Y is 0.075M. The collision factor A is 9.1 × 10⁵ S⁻¹

QUESTION THREE

- A.
- Given the following, $E^0_{\text{red}} \text{Sn}^{4+} / \text{Sn}^{2+} = 0.15\text{V}$ and $E^0_{\text{red}} \text{Hg}^{2+} / \text{Hg}_2^{2+} = 0.90\text{V}$ at 298K. Determine the number of electrons transferred in the reaction and calculate the standard free energy and the equilibrium constant for the reaction. (Faraday constant = 96500 C/M, R = 8.314J/K/mol)
 - Write balanced chemical equations to show the cathodic and anodic processes of rusting of iron.
 - Explain why zinc and magnesium are suitable metals for galvanization of iron.
- B. Given the following data,
- $$\text{C}_{(\text{graphite})} \longrightarrow \text{C atoms} = \Delta\text{H} = 713.6 \text{ kJ}$$
- $$\text{H}_2(\text{g}) \longrightarrow \text{H atoms} = \Delta\text{H} = 432.2 \text{ kJ}$$
- $$\text{C} + 2\text{H}_2(\text{g}) \longrightarrow \text{CH}_4 = \Delta\text{H} -74.7 \text{ kJ}$$
- Calculate the heat of formation of methane from its atoms
- C. State the differences between a galvanic (voltaic) cell and an electrolytic cell.