FEDERAL UNIVERSITY OF PETROLEUM RESOURCES, EFFURUN, COLLEGE OF SCIENCE

2024/2025 First Semester Examination COURSE CODE: MTH 101

COURSE TITTLE: General Mathematics TIME ALLOWED: 1hr 15mins

TYPE: B INSTRUCTION: Answer all questions

1. Given that set $A = \{1, 10, 20\}$, what are the possible subsets of set A? (A) 6 (B) 7 (C) 8 (D) 10
2. What is difference of set A and set B i.e $A - B$? Given that $A = \{-1, 0, 1, 2, 3\}$ and $B = \{1, 2, 3\}$ (A) $A = \{-3, -2, -1, 0, 1, 2, 3\}$ (B) $A = \{-3, -2, -1, 0, 1, 2, 3\}$ (C) $A = \{-3, -2, 2, 3\}$ (D) $A = \{-3, -2, -1, 0\}$
3. If set $A = \{x : x \leq 3\}$ and $B = \{x : x \geq 3\}$, find $A - B$? (A) $A - B = \{-2, -1, 0\}$ (B) $A - B = \{1, 2, 3, 4\}$ (C) $A - B = \{0, 1, 2, 3, \dots\}$ (D) $A - B = \{\dots, -3, -2, -1, 0, 1, 2, 3\}$
4. The set of natural numbers N includes .....? (A) $N = \{-3, -2, 0, 1\ 3\}$ (B) $= \{\dots, -3, -2, 0, 1\ 2, 3, \dots\}$ (C) $N = \{1, 2, 3, 4, 5, 6, 7, \dots\}$ (D) $A = \{\dots, 6, -5, -4, -3, -2, -1\}$
5. What is the union of the set $N = 1, 2, 3, 4, \dots$ and $Z = \dots, -2, -1, 0, 1, 2 \dots$ (A) $(0, 1, 3 \dots)$ (B) $\{\dots -3, -2, -1, 0\}$ (C) $\{\dots -3, -2, -1, 0, 1, 2, \dots\}$ (D) $\{\dots -3, -2, -1\}$
6. A set of natural $N = \{1, 2, 3, 4, \dots\}$ is said to be a .....? (A) Bounded set (B) Countable set (C) Infinite set (D) Finite set.
7. The universal set $U = \{x : 2 \leq x \leq 12\}$ with subsets $A = \{2, 4, 6, 8, 10, 12\}$, $B = \{2, 3, 5, 7, 11\}$ and $C = \{3, 5, 7, 9, 11\}$ what is $A' \cap B' \cap C'$? (A) {8} (B) {9} (C) $\emptyset$ (D) {2, 4,}
8. Proving by Mathematical induction, for all $n \in Z^+, 1 + \frac{1}{4} + \cdots + \frac{1}{n^2} \leq 2 - \frac{1}{n}$. The inequality $\forall\ k$, becomes: (A) $k^2 + k \leq (k+1)^2$ (B) $k^2 + k \leq (k-1)^2$ (C) $k^2 + k \leq k^2 - 2k - 1$
9. Prove by Mathematical induction $s_n = \frac{a(1-r^n)}{1-r}$ (A) $\frac{a(1-r^{k+1})}{1-r}$ (B) $\frac{a(1-r^{k-1})}{1-r}$ (C) $\frac{a(1-r^{k+1})}{1+r}$
10. Show that the expression $5^{2n} + 3n - 1$ is a multiple of 9 using the principle of mathematical induction (A) $9(25M - 8k + 3)$ (B) $9(25M + 8k - 3)$ (C) $25(9M - 8k + 3)$
11. Find the first term and common difference of the sequence whose 6th term is 75 and the 20th term is 39 (A) $a = 96, d = -3$ (b) $a = -96, d = 3$ (c) $a = -96, d = -3$
12. The 10th term of a sequence (AP) is six times the 6th term. How is a related to d? (A) $-5a = 21d$ (B) $-5a + 21d = 0$ (C) $5a = 21d$ (D) $-5a = -21d$
13. Find the formula for nth term of the sequence 64,32,16, ... (A) 2^{7-n} (B) 2^{n-7} (C) 2^{7+n} (D) 2^{1-n}
14. Find the sum s_n of the first nth terms of the sequence $\left(\frac{1}{2}\right)^2$ (A) $1 - \left(\frac{1}{2}\right)^n$ (B) $1 + \left(\frac{1}{2}\right)^{2n}$ (C) $1 - \left(\frac{1}{2}\right)^2$
15. A quadratic equation is an expression of the form (A) $ax + by + c$ (B) $ax^2 + bx + c$ (C) $ax^2 - bx^3$ (D) $ax - b$
16. What are the roots of the equation $x^2 - 9 = 0$ (A) 3 (B) -3 (C) ± 9 (D) ± 3
17. Which of these describes the principle of zero product? (A) If $ab = 0$, $a = 0$ or $b = 0$ (B) If $ab = 0$, $a = 1$ or $b = -1$ (C) If $ab = 0$, $a = 2$ or $b = -2$ (D) If $ab = 0$, $a = 3$ or $b = -3$
18. Solve the equation $2x^2 - 3x = 3$ (A) $x = 1$ or $x = \frac{3}{2}$ (B) $x = -1$ or $x = \frac{3}{2}$ (C) $x = 1$ or $x = -\frac{3}{2}$ (D) $x = -1$ or $x = -\frac{3}{2}$
19. If the roots of $2x^2 - x - 2 = 0$ are α and β. Find $\alpha + \beta$ and $\alpha\beta$ (A) $x = \frac{1}{2}$ or $x = -1$ (B) $x = -\frac{1}{2}$ or $x = -1$ (C) $x = -\frac{1}{2}$ or $x = 1$ (D) $x = \frac{1}{2}$ or $x = -?$
20. Find the equation whose roots are -4 and -3 (A) $x^2 + 7x + 12$ (B) $2x^2 + 7x + 12$ (C) $x^2 - 7x + 12$ (D) $x^2 + 7x - 12$
21. Find the equivalence of the expression $e^{\frac{1}{2}i\theta}$ (A) $cos\theta + isin\frac{\theta}{2}$ (B) $cos\frac{\theta}{2} - isin\frac{\theta}{2}$ (C) $cos\frac{\theta}{2} + isin\frac{\theta}{2}$ (D) $cos2\theta - isin2\theta$
22. Express $z = 3(cos30 + isin30)$ in exponential form (A) $z = 3e^{i\frac{\pi}{6}}$ (B) $z = 3e^{i\frac{\pi}{3}}$ (C) $z = 3e^{i\frac{\pi}{3}}$ (D) $z = 3e^{i\frac{\pi}{4}}$
23. Suppose $x^2 - 5x + 9 = A(x+3)(x+2) + B(x-1) - C$, Find the values of A, B and C (A) $A = 1, B = -10, C = 7$ (B) $A = 1, B = 10, C = -7$ (C) $A = -1, B = -7, C = 13$ (D) $A = -2, B = 7, C = 3$
24. Find the partial fraction decomposition of the function; $\frac{4x^3 - 28}{x^4 + x^2 - 6}$. (A) $\frac{8}{x^2+3} - \frac{4}{x^2-2}$ (B) $\frac{8}{x^2-2} + \frac{3}{x^2-3}$ (C) $\frac{4}{x^2+3} + \frac{9}{x^2-2}$ (D) $\frac{2}{x^2+3} + \frac{5}{x-2}$
25. Express in partial fractions; $\frac{x^2+x+1}{(x^2+1)(x^2+3)}$. (A) $\frac{x}{2(x^2+1)} - \frac{x+2}{2(x^2+3)}$ (B) $\frac{x}{2(x^2+1)} + \frac{x+2}{2(x^2+3)}$ (C) $\frac{2x+5}{x^2+1} + \frac{3}{x^2+3}$ (D) $\frac{2x+3}{x^2+1} - \frac{5}{x^2+3}$
26. Express $\frac{2x+5}{(x+4)^2(x-2)}$ in partial fractions. (A) $\frac{-1}{4(x+4)} + \frac{1}{2(x+4)^2} + \frac{1}{4(x-2)}$ (B) $\frac{-1}{4(x-2)} - \frac{1}{4(x+4)} + \frac{1}{(x+4)^2}$ (C) $\frac{3}{2(x+4)} - \frac{1}{2(x+4)^2} + \frac{3}{(x-2)}$ (D) $\frac{-1}{(x+4)} + \frac{1}{2(x+4)^2} - \frac{1}{(x-2)}$
27. Solve the partial fraction; $\frac{3x^3 - 10x^2 + 15x + 5}{(x+2)(x-1)^3}$. (A) $\frac{89}{9(x-1)} + \frac{13}{3(x-1)^3}$ (B) $\frac{89}{27(x-1)} + \frac{8}{27(x+2)} - \frac{13}{3(x-1)^3}$ (C) $\frac{89}{27(x+2)} - \frac{13}{3(x-1)^3} - \frac{1}{9(x-1)^2}$ (D) $\frac{89}{27(x+2)} - \frac{8}{27(x-1)} - \frac{1}{9(x-1)^2} + \frac{13}{3(x-1)^3}$
28. Find the partial fraction decomposition of the rational fraction; $\frac{x^2 - 4x - 15}{(x+2)^3}$ (A) $\frac{1}{x+2} - \frac{8}{(x+2)^2} - \frac{3}{(x+2)^3}$ (B) $\frac{x+8}{(x+2)} - \frac{3}{(x+2)^2}$ (C) $\frac{1}{x+2} + \frac{3}{(x+2)^2}$ (D) $\frac{1}{x+2} + \frac{3}{(x+2)^2} - \frac{8}{(x+2)^3}$
29. Solve the Partial fraction; $\frac{x^2+1}{(x+1)(x-2)}$. (A) $\frac{2}{3(x+1)} + \frac{5}{3(x-2)}$ (B) $\frac{5}{3(x-2)} - \frac{2}{3(x+1)}$ (C) $1 + \frac{2}{3(x+1)} - \frac{5}{3(x+2)}$ (D) $1 - \frac{2}{3(x+1)} + \frac{5}{3(x-2)}$
30. Find the partial fraction decomposition of the function; $\frac{x^2}{x^2-1}$. (A) $1 + \frac{1}{2(x-1)} - \frac{1}{2(x+1)}$ (B) $1 - \frac{1}{2(x-1)} + \frac{1}{2(x+1)}$ (C) $\frac{1}{2(x-1)} - \frac{1}{2(x+1)}$ (D) $\frac{1}{2(x-1)} + \frac{1}{2(x+1)}$
31. At what values will the equation $x^2 - 5x + 6 = 0$ be true (A) $x = 2, x = 3$ (B) $x = 6, x = 5$ (C) $x = 3, x = 3$ (D) $x = 4, x = 6$

32. The set $B = \{x: x - 2 \leq x \leq 2\}$ is interpreted as (A) $B = \{-2, -1, 0, 1, 2\}$ (B) $B = \{-2, -1, 0, 1, 2, 3\}$ (C) $B = \{-1, 0, 1\}$ (D) $B = \{0, 1, 2, 3, 4, 5\}$
33. Given that $A = \{1, 2, 3, 4, 5, 6, 7, 8\}$. What is the cardinality of set A? (A) 6 (B) 7 (C) 8 (D) 10
34. Given that the universal set $U = \{x: -10 \leq x \leq 10\}$ such that $A = \{1, 2, 3, 4, \ldots, 8\}$ and $B = \{-10, -9, -8, \ldots, 6\}$. What is B^c? (A) $\{7, 8, 9, 10\}$ (B) $\{-10, -9, -8, \ldots, 0, 9, 10\}$ (C) $\{1, 2, 4, 8, 10\}$ (D) $\{-10, -9, -8, 0, 1\}$
35. In a class of 45 students, 30 students offer chemistry, 20 students offer Mathematics. How many students offers both subjects? (A) 5 (B) 2 (C) 3 (D) 7
36. Given that the universal set $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 15\}$ such that $A = \{2, 4, 6, 8\}$, $B = \{1, 4, 9\}$ and $C = \{4, 6, 8, 9, 15\}$. Find $n(AUBUC)$. (A) 7 (B) 6 (C) 10 (D) 11
37. 120 students enrolled in a program, 60 students speak French, 55 students speak German and only 5 students speaks both French and German. Find the number of students who neither speaks French nor German? (A) 10 (B) 5 (C) 60 (D) 55
38. The universal set $U = \{x: 2 \leq x \leq 12\}$ with subsets $A = \{2, 4, 6, 8, 10, 12\}$, $B = \{2, 3, 5, 7, 11\}$ and $C = \{3, 5, 7, 9, 11\}$ what is $B' \cap A'$? (A) $\{8\}$ (B) $\{9\}$ (C) $\{3, 6\}$ (D) $\{2, 4, \}$
39. What law supports the algebra of set A and B such that $A \cap B = B \cap A$ (A) Associative law (B) Commutative law (C) Identity law (D) Distributive law
40. The set algebra that supports the relation $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$ is called the ..... law? (A) Associative (B) Commutative (C) Distributive (D) Identity
41. In proving the principle of mathematical induction, the 3rd step is to check if..... (A) the previous hypothesis in 2nd step is true (B) the LHS=RHS (C) the 3rd step = 1st step
42. Prove by Mathematical induction that $5^n - 1$ is an integer multiple of 2 (A) $2(2M + 2)$ (B) $(8M + 4)$ (C) $2(2M - 2)$ (D) $(2M - 2)$
43. A sequence is an arrangement of numbers in a particular order (A)True (B) False
44. A series is the summation of elements in a sequence (A)True (B) False
45. Find the sum of the sequence $\sum_{T=1}^{4} T^2$ (A)30 (B) 35 (C) 40 (D) 45
46. Find the sum of the sequence $\sum_{T=1}^{n} T!$ (A) $1! + 2! + 3! + \cdots + n!$ (B) $n!$ (C) $1! - 2! + 3! - \cdots + n!$ (D) $1! - 2! - 3! - \cdots - n!$
47. Find the 13th term of AP sequence; 2,6,10,14,18, ... (A)50 (B) 40 (C) 45 (D) 55
48. What is the common ratio of the GP sequence? 2,4,8,16, ... (A) 2^n (B) 2 (C) $\frac{1}{2}$ (D) 5
49. The 4th term of a GP is 40 and its first term is 5. Find the 7th term (A)640 (B) 140 (C) 100 (D) 64
50. The 3rd term of a GP is 32 and the 6th term is 4, what is the common ratio? (A) $r = 0.5$ (B) $r = \frac{3}{4}$ (C) $r = \frac{3}{2}$ (D) $r = 1$
51. Evaluate $\binom{4}{1}$ (A) 5 (B) 4 (C) 3 (D) 2
52. Simplify $\binom{4}{2} - \binom{5}{6}$ (A) 2 (B) 3 (C) 4 (D) 5
53. What is the pascal coefficient in the expansion of $(x + y)^3$ (A) 1 3 2 1 (B) 1 4 3 2 (C) 1 3 3 1 (D) 2 1 5 6
54. What is the coefficient of x^2 in the expansion of $(x - 1)^4$. (A) 6 (B) 5 (C) 7 (D) 8
55. Given that $A = 3 - 6i$ and $B = 4 - 5i$. Find $A + B$ (A) $8 + 11i$ (B) $7 - 11i$ (C) $7 + 11i$ (D) $2 - i$
56. Let $P = 3 + i$ and $Q = -7 + 3i$. Find $P - Q$ (A) $10 + 2i$ (B) $11 - 2i$ (C) $10 - 2i$ (D) $11 + 2i$
57. Simplify $(2 + 5i)(3 + 4i)$ (A) $14 - 23i$ (B) $-14 - 23i$ (C) $-14 + 23i$ (D) $17 - 20i$
58. Which of the following is equivalent to the expression $\cos\theta - i\sin\theta$ (A) $e^{i\theta}$ (B) $e^{i2\theta}$ (C) $e^{-i2\theta}$ (D) $e^{-i\theta}$
59. Simplify $\frac{3-6i}{4-5i}$ (A) $\frac{42-9i}{41}$ (B) $\frac{42+9i}{41}$ (C) $\frac{42+10i}{43}$ (D) $\frac{47-10i}{41}$
60. Suppose $r = 3 + 4i$. Find $|r|$ (A) 10 (B) -10 (C) -5 (D) 5
61. Resolve into partial fraction: $\frac{x+2}{7x^2-7x-15}$; (A) $\frac{-1}{13(2x+3)} + \frac{7}{13(x-5)}$ (B) $\frac{11}{8(x-5)} + \frac{5}{4(x+3)}$ (C) $\frac{1}{13(x-5)} - \frac{7}{4(2x+3)}$ (D) $\frac{5}{8(x-5)} + \frac{7}{13(2x+3)}$
62. Resolve fractional function, $\frac{7x^2-25x+6}{(x^3-2x-1)(3x-2)}$; into partial fraction. (A) $\frac{5+x}{x^2-2x-1} + \frac{4}{3x-2}$ (B) $\frac{2}{3(x+3)} + \frac{3}{2(2x+1)} - \frac{1}{(x-2)}$ (C) $\frac{x-5}{x^2-2x-1} + \frac{4}{3x-2}$ (D) $\frac{x+5}{x^2-2x+1} + \frac{4}{3x-2}$
63. Write sin p, in terms of; $t = \tan\frac{p}{2}$. (A) $\frac{t}{1+t^2}$ (B) $\frac{t}{1-t^2}$ (C) $\frac{2t}{1+t^2}$ (D) $\frac{2t}{1-t^2}$
64. Express; $\sin 3\theta \cos\theta$, as a sum or difference of two sin. (A) $\frac{1}{2}(\sin 4\theta + \sin 2\theta)$ (B) $\frac{1}{2}(\sin 4\theta + \sin\theta)$ (C) $\frac{1}{2}(\sin 4\theta - \sin\theta)$ (D) $\sin\theta + \sin 2\theta$
65. Compute the expression; $\cos 57\frac{1}{2}$. (A) $\pm\sqrt{1 + \frac{\cos 57}{2}}$ (B) $\pm\sqrt{1 - \frac{\cos 57}{2}}$ (C) $\sqrt{1 + \frac{\cos 57}{2}}$ (D) $-\sqrt{1 - \frac{\cos 57}{2}}$
66. Evaluate the identity; $\tan(P + Q)$; (A) $\frac{\tan P - \tan Q}{1 + \tan p \tan Q}$ (B) $\frac{\tan P + \tan Q}{1 - \tan p \tan Q}$ (C) $\frac{1 + \cos P \cos Q}{\sin P - \sin Q}$ (D) $\frac{1 - \sin p \sin Q}{\cos p + \cos Q}$
67. Simplify the Expression: $3\sin P - 4\sin^3 P$. (A) $\sin 3P$ (B) $3\sin p - 1$ (C) $\sin 3P - 1$ (D) $\sin P - 1$
68. The following are features of a *sin* function except..... (A) The *sin* function is a periodic function with a period of 2π (B)The *sin* function is an odd function is an odd function since; $\sin(-x) = -\sin x$ (C)The *sin* function varies between -1 and 1 for every value of x. (D)The *sin* function is symmetric over the Origin.
69. The tangent function is positive in the ..... Quadrant (A) 1st (B) 2nd (C) 3rd (D) 4th
70. Suppose $s = \sin\theta$, then simplify the expression; $\frac{1-s^2}{s^2}$. (A) $\cot^2\theta$ (B) $\cot\theta$ (C) $\operatorname{cosec}^2\theta$ (D) $\operatorname{cosec}\theta$