

SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Sum the series

$$\frac{1}{1 \cdot 3} + \frac{1}{1 \cdot 2 \cdot 3 \cdot 5} + \frac{1}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 7} + \dots \text{ to } \infty.$$

17. Solve $x^3 - 15x^2 + 71x - 105 = 0$ given that the roots of the equation are in A.P.

18. Find the adjoint of the matrices $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 2 & -3 \\ 2 & -1 & 3 \end{bmatrix}$.

19. Expand $\cos^5 \theta \sin^7 \theta$ in a series of sines of multiple of θ .

20. Separate into real and imaginary parts of the expression $(x + iy)^{a+ib}$.



NOVEMBER/DECEMBER 2018

BAEL12 — BASIC MATHEMATICS — I

Time : Three hours

Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL questions.

1. State Binomial theorem for rational index.

2. Sum the series

$$s = \frac{2ax}{a^2 + x^2} + \frac{1}{3} \left(\frac{2ax}{a^2 + x^2} \right)^3 + \frac{1}{5} \left(\frac{2ax}{a^2 + x^2} \right)^5.$$

3. Remove the fractional co-efficients from the equation $x^3 - \frac{1}{4}x^2 + \frac{1}{3}x - 1 = 0$.

4. If α, β, γ are the roots of $x^3 + px^2 + qx + r = 0$ find the condition if $\alpha + \beta = 0$.

5. Evaluate $[2 \ 3 \ 4 \ 5] + [1 \ -7 \ 8 \ 6]$.

6. Find the inverse of the matrix $A = \begin{bmatrix} 4 & -3 \\ -1 & 2 \end{bmatrix}$.

7. If $\cos^5 \theta = A \cos \theta + B \cos 3\theta + C \cos 5\theta$ prove that $\sin^5 \theta = A \sin \theta - B \sin 3\theta + C \sin 5\theta$.

8. Write the expansion of $\tan n\theta$.

9. Find general and principal logarithms of $(1-i)$.

10. Prove $i^n = e^{-\frac{(4n+1)\pi}{2}}$ where n is any integer.

SECTION B — ($5 \times 5 = 25$ marks)

Answer ALL questions.

11. (a) Find the general term in the expansion of $(9-4x)^{5/2}$. When is this expansion valid?

Or

(b) Show that

$$s = 1 + \frac{n}{1!} \left(1 - \frac{1}{x}\right) + \frac{n(n+1)}{2!} \left(1 - \frac{1}{x}\right)^2 + \dots$$

$$\infty = x^n.$$

12. (a) Find the roots of the equation

$$x^5 + 4x^4 + 3x^3 + 3x^2 + 4x + 1 = 0.$$

Or

(b) Increase by 7 the roots of the equation $3x^4 + 7x^3 - 15x^2 + x - 2 = 0$.

13. (a) If $A = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 2 & 1 \\ 1 & 1 & 2 \end{bmatrix}$ show that

$$(A-I)(A-4I) = 0.$$

Or

(b) If $A = \begin{bmatrix} 1 & 2 & -1 \\ 3 & 0 & 2 \\ 4 & 3 & 0 \end{bmatrix}$ $B = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 1 & 0 \\ 0 & 1 & 3 \end{bmatrix}$ prove that

$$(AB)^T = B^T A^T.$$

14. (a) If $x = 2\cos \theta$ prove that

$$2(1 + \cos 8\theta) = (x^4 - 4x^2 + 2^2).$$

Or

(b) Prove $\sin^5 \theta = \frac{1}{6} (\sin 5\theta - 5 \sin 3\theta + 10 \sin \theta)$.

15. (a) If $\cosh x = \sec \alpha$, express $\sinh x$ and $\tanh x$ in terms of α .

Or

(b) If $\tan \frac{x}{2} = \tanh \frac{y}{2}$. Prove that $\cosh x = \cosh y$.