

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Bachelor of Technology (Civil Engineering) SEMESTER - 2 Winter 2025 (Supply.)

Course :Bachelor of Technology (Civil Engineering) Branch : Engineering and Technology

Semester : SEMESTER - 2

Subject Code & Name: 24AF1000BS201 - ENGINEERING MATHEMATICS – II

Time : 3 Hours]

[Total Marks : 60

Instructions to the Students:

1. Each question carries 12 marks.
2. Question No. 1 will be compulsory and include objective-type questions.
3. Candidates are required to attempt any four questions from Question No. 2 to Question No.6
4. Use of non-programmable scientific calculators is allowed.
5. Assume suitable data wherever necessary and mention it clearly.

Q1. Objective type questions. (Compulsory Question)

12

- 1 **The modulus of a complex number $z = x + iy$ is**
A) $x^2 + y^2$ B) $\sqrt{x^2 + y^2}$ C) $x + y$ D) $|x - y|$
- 2 **$\cos(x + iy)$ is equal to**
A) $\cos x \cosh y - i \sin x \sinh y$ B) $\cos x \cos h y + i \sin x \sinh y$
C) $\sin x \sinh y + i \cos x \cosh y$ D) $\cos x \sin h y + i \sin x \cosh y$
- 3 **The general form of $\log z$ is**
A) $\log|z|$ B) $\log|z| + i \arg z$
C) $\log|z| + i(\arg z + 2k\pi)$ D) $\arg z + i \log|z|$
- 4 **The integrating factor of the linear equation $\frac{dy}{dx} + P(x)y = Q(x)$ is**
A) $e^{\int Q(x)dx}$ B) $e^{-\int P(x)dx}$ C) $e^{\int P(x)dx}$ D) $P(x)e^x$
- 5 **The order of a differential equation is determined by**
A) Highest power of the variable B) Highest derivative present
C) Number of constants D) Degree of equation
- 6 **Two families of curves are orthogonal if their tangents at the point of intersection have slopes**
A) Equal B) Reciprocal C) Negative reciprocals D) Zero
- 7 **If the auxiliary equation has real and distinct roots, then the complementary function (C.F) is**
A) Polynomial B) Exponential
C) Trigonometric D) Logarithmic

- 8 **The complementary function of $(D^2 - 5D + 6)y = 0$ is**
 A) $C_1 e^{-2x} + C_2 e^{-3x}$ B) $C_1 e^{2x} + C_2 e^{3x}$
 C) $C_1 \sin x + C_2 \cos x$ D) $C_1 + C_2 x$
- 9 **If $f(x)$ is an even function, then**
 A) $b_n = 0$ B) $a_n = 0$
 C) Both a_n and b_n are zero D) Series does not exist.
- 10 **For $f(x) = |x|$, the Fourier series contains**
 A) Only sine terms B) Only cosine terms
 C) Both sine and cosine terms D) No constant term
- 11 **The gradient of a scalar field is always a**
 A) Scalar B) Constant C) Tensor D) Vector
- 12 **If the curl of a vector field is zero, the field is**
 A) Solenoidal B) Irrotational C) Compressible D) Rotational
- Q2. Solve the following.
- A) Solve $x^6 - i = 0$. 6
 B) If $\tan \frac{x}{2} = \tanh \frac{u}{2}$ prove that 6
 i) $\sinh u = \tan x$
 ii) $\cosh u = \sec x$.
- Q3. Solve the following.
- A) Solve $(1 - x^2) \frac{dy}{dx} + 2xy = x\sqrt{1 - x^2}$. 6
 B) Solve $y(1 + xy)dx + x(1 + xy + x^2 y^2)dy = 0$. 6
- Q4. Solve Any Two of the following.
- A) Solve $\frac{d^3 y}{dx^3} - 3 \frac{d^2 y}{dx^2} + 3 \frac{dy}{dx} - y = e^x + 2$. 6
 B) Solve by the method of variation of parameters the equations 6
 $y'' - 2y' + 2y = e^x \tan x$.
 C) Solve $x^2 \frac{d^2 y}{dx^2} - 3x \frac{dy}{dx} + 5y = x^2 \sin(\log x)$. 6
- Q5. Solve Any Two of the following.
- A) Find the Fourier series for $f(x) = \frac{\pi - x}{2}$ in the range $(0, 2\pi)$. 6
 B) Find the Fourier series for $f(x) = 9 - x^2$ in the range $(-3, 3)$. 6
 C) Find half range cosine Fourier series for $f(x) = x$ in the range $(0, 2)$. 6

Q6. Solve Any Two of the following.

- A) If $\vec{a}$ is a constant vector field and $\vec{r} = xi + yj + zk$, prove that $curl(\vec{a} \times \vec{r}) = 2\vec{a}$. 6
- B) Prove that $\vec{F} = (x + 2y + az)i + (bx - 3y - z)j + (4x + cy + 2z)k$ is solenoidal and determine the constants a, b, c if $\vec{F}$ is irrotational. 6
- C) Verify Green's Theorem in the plane for $\int_C (xy + y^2)dx + x^2 dy$ where C is the closed curve of the region bounded by $y = x$ and $y = x^3$. 6

*** End ***