

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

Bachelor of Technology (Civil Engineering) SEMESTER - 2 Summer 2026 (Regular)

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)

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- 1 If z_1 and z_2 are two complex numbers then $|z_1 z_2| = \dots\dots\dots$
a) $|z_1| + |z_2|$ b) $|z_1| - |z_2|$ c) $|z_1| \cdot |z_2|$ d) $\frac{|z_1|}{|z_2|}$
- 2 The real part of $\sin(x + iy)$ is.....
a) $\sinh x \cos y$ b) $\sin x \cosh y$ c) $\sinh x \cosh y$ d) $\sin x \cos y$
- 3 If x is a real or complex number then $\cosh x = \dots\dots\dots$
a) $\frac{e^x + e^{-x}}{2}$ b) $\frac{e^x - e^{-x}}{2}$ c) $\frac{e^{ix} + e^{-ix}}{2}$ d) $\frac{e^{ix} - e^{-ix}}{2}$
- 4 The necessary & sufficient condition for the differential equation
 $M(x, y) dx + N(x, y) dy = 0$ to be exact is.....
a) $\frac{dM}{dx} = \frac{dN}{dy}$ b) $\frac{dM}{dy} = \frac{dN}{dx}$ c) $\frac{\partial M}{\partial x} = \frac{\partial N}{\partial y}$ d) $\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$
- 5 The integrating factor (I. F.) of the differential equation,
 $\frac{dy}{dx} + \frac{y}{x} = x^2$ is.....
a) e^x b) e^{-x} c) $-x$ d) x

- 6 If an equation $M(x, y) dx + N(x, y) dy = 0$ is of the form $f_1(xy) y dx + f_2(xy) x dy = 0$ then the integrating factor (I. F.) of the equation is.....
- a) $\frac{1}{Mx+Ny}$; $Mx + Ny \neq 0$ b) $\frac{1}{Mx-Ny}$; $Mx - Ny \neq 0$
c) $\frac{1}{My+Nx}$; $My + Nx \neq 0$ d) $\frac{1}{My-Nx}$; $My - Nx \neq 0$
- 7 The general solution (G. S.) of the differential equation $(D^2 + 6D + 9)y = 0$ is equal to.....
- a) $y = C_1 e^{3x} + C_2 e^{-3x}$ b) $y = (C_1 + C_2 x^2) e^{-3x}$
c) $y = (C_1 + C_2 x) e^{3x}$ d) $y = (C_1 + C_2 x) e^{-3x}$
- 8 The particular integral (P. I.) of $(D^2 + 4)y = \cos 2x$ is
- a) $\frac{x}{2} \sin 2x$ b) $\frac{x}{2} \cos 2x$ c) $\frac{x}{4} \sin 2x$ d) $\frac{x}{4} \cos 2x$
- 9 The Fourier series of an even function in the range $(-\pi, \pi)$ contains only.....
- a) sine terms b) cosine terms
c) both sine and cosine terms d) exponential terms
- 10 If $f(x)$ is an odd function in $(-l, l)$ then the value of Fourier coefficients a_0 and a_n are
- a) $2l$ b) l c) 1 d) 0
- 11 If $\vec{F} = (x + 3y)\hat{i} + (y - 2z)\hat{j} + (x + \lambda z)\hat{k}$ is a solenoidal vector then the value of λ is.....
- a) 0 b) 1 c) 2 d) -2

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If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, $r = |\vec{r}|$ then ∇r^n is equal to

a) $\vec{r}$

b) $n r^{n-2} \vec{r}$

c) $\frac{\vec{r}}{r}$

d) r

Q2. Solve the following.

A)

Find all the values of $\left(\frac{1}{2} + i\frac{\sqrt{3}}{2}\right)^{3/4}$. Also show that the continued product of these values is 1.

6

B)

If $(a + ib)^p = m^{x+iy}$, prove that one of the values of $\frac{y}{x}$ is $\frac{2\tan^{-1}(b/a)}{\log(a^2+b^2)}$.

6

Q3. Solve the following.

A)

$$\text{Solve } \frac{dy}{dx} + \frac{y \cos x + \sin y + y}{\sin x + x \cos y + x} = 0.$$

6

B)

When a switch is closed in a circuit containing a battery E , a resistance R and an inductance L , the current i builds up at a rate given by $L \frac{di}{dt} + Ri = E$. Find current i as a function of t . How long will it be, before the current has reached one-half its maximum value if $E = 6$ volts, $R = 100$ ohms and $L = 0.1$ henry?

6

Q4. Solve Any Two of the following.

A)

$$\text{Solve } (D^2 - 2D)y = e^x \sin x.$$

6

B)

Apply the method of variation of parameters to solve,
 $(D^2 + 1)y = \operatorname{cosec} x$

6

C)

Solve the following differential equation,

6

$$x^2 \frac{d^2 y}{dx^2} - 2x \frac{dy}{dx} + 2y = x^2$$

Q5. Solve Any Two of the following.

A)

Obtain the Fourier series for $f(x) = e^{-x}$ in the interval $(0, 2\pi)$.

6

B)

Express the function $f(x) = |x|$ in terms of Fourier series for the range $-\pi < x < \pi$.

6

- C) Find half range Fourier cosine series of the function $f(x) = \pi - x$ in $0 < x < \pi$. 6

Q6. Solve Any Two of the following.

- A) If $\vec{F} = (x + y + 1)\hat{i} + \hat{j} - (x + y)\hat{k}$ then prove that $\vec{F} \cdot \text{curl } \vec{F} = 0$. 6

- B) If $\vec{a} = a_1\hat{i} + a_2\hat{j} + a_3\hat{k}$ is a constant vector and $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, prove that: (i) $\text{grad}(\vec{a} \cdot \vec{r}) = \vec{a}$. 6
(ii) $\text{div}(\vec{a} \times \vec{r}) = 0$.

- C) Using Gauss-Divergence theorem, show that $\iiint_V \frac{dV}{r^2} = \iint_S \frac{\vec{r} \cdot \hat{n}}{r^2} dS$, 6
where V is the volume bounded by closed surface S .

*** End ***