DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY,
LONERE – RAIGAD 402 103
End Semester Examination – 2022

Branch: B. Tech. **Semester: II**

Subject with Subject Code: Engineering Mathematics – II (BTBS 201) **Marks: 60**

Date: 17/8/2022 **Time: 3 Hrs.**

Instructions to the Students

1. Illustrate your answers with neat sketches, diagrams, etc., wherever necessary.
2. If some part or parameter is noticed to be missing, you may appropriately assume it and should mention it clearly.

Q. 1

(a) Find all the values of $(i)^{1/4}$. [4 *Marks*]

(b) If $\sin(A + iB) = x + iy$, then prove that

(i) $\frac{x^2}{\cosh^2 B} + \frac{y^2}{\sinh^2 B} = 1$ (ii) $\frac{x^2}{\sin^2 A} - \frac{y^2}{\cos^2 A} = 1$. [4 *Marks*]

(c) Find the general value of $\log_e(-3)$ [4 *Marks*]

Q. 2 Solve any THREE:

(a) Solve: $\cos^2 x \frac{dy}{dx} + y = \tan x$. [4 *Marks*]

(b) Solve: $x \frac{dy}{dx} + y = x^3 y^6$. [4 *Marks*]

(c) Solve: $(x^2 - 4xy - 2y^2)dx + (y^2 - 4xy - 2x^2)dy = 0$. [4 *Marks*]

(d) Solve: $(x^2y^2 + xy + 1)ydx + (x^2y^2 - xy + 1)x\,dy = 0$. [4 *Marks*]

Q. 3 Solve any THREE:

(a) Solve: $(D^3 - 6D^2 + 11D - 6)y = e^{-2x} + e^{-3x}$.. [4 *Marks*]

(b) Solve: $\frac{d^3y}{dx^3} - 3\frac{d^2y}{dx^2} + 4\frac{dy}{dx} - 2y = e^x + \cos x$. [4 *Marks*]

(c) Solve: $(D^3 - D^2 - 6D)y = 1 + x^2; D \equiv \frac{d}{dx}$. [4 *Marks*]

(d) Solve by the method of variation of parameters: $\frac{d^2y}{dx^2} + y = \operatorname{cosec} x$. [4 *Marks*]

Q. 4

(a) Find the Fourier series of the function $\boldsymbol{f(x) = x^2}$ in the interval $\boldsymbol{(0, 2\pi)}$. [6 *Marks*]

(b) Find the Fourier series expansion for the function $\boldsymbol{f(x) = x - x^2}$ in $\boldsymbol{-1 < x < 1}$. [6 *Marks*]

Q. 5 Solve any THREE

(a) If $\vec{r}$ is the position vector $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ with $|\vec{r}| = r$, then evaluate

(i) ∇r^m

(ii) ∇r [4 *Marks*]

(b) Find the value of the constant λ such that the vector field defined by

$\vec{F} = (2x^2y^2 + z^2)\hat{i} + (3xy^3 - x^2z)\hat{j} + (\lambda xy^2z + xy)\hat{k}$ is solenoidal. [4 *Marks*]

(c) If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$, then show that

(i) $\nabla \cdot \vec{r} = 3$

(ii) $\nabla \times \vec{r} = 0$ [4 *Marks*]

(d) If $\vec{F} = (x + y + 1)\hat{i} + \hat{j} - (x + y)\hat{k}$, prove that $\vec{F} \cdot \mathbf{Curl}\, \vec{F} = 0$. [4 *Marks*]

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