## K. J. Somaiya Institute of Technology, Sion, Mumbai-22
### (Autonomous College Affiliated to University of Mumbai)

July/Aug 2024

Program: FY B.Tech Scheme : II

Supplementary Examination: FY   Semester: II

Course Code: BSC201 and   Course Name: Engineering Mathematics-II

Date of Exam: 08/08/2024          Duration: 2.5 Hours          Max. Marks: 60

Instructions:
(1) All questions are compulsory.
(2) Draw neat diagrams wherever applicable.
(3) Assume suitable data, if necessary.

| | | Max. Marks | CO | BT level |
|---|---|---|---|---|
| Q 1 | **Solve any six questions out of eight:** | 12 | | |
| i) | Determine whether the differential equation $(y \log y)dx + (x - \log y)dy = 0$ is exact or not? | 02 | CO1 | 3 |
| ii) | Solve the differential equation $(D^4 + 6D^2 + 9)y = 0$ | 02 | C02 | 3 |
| iii) | Find the particular integral of the differential equation $(D^3 + D)y = \cos x + 3$ | 02 | C02 | 3 |
| iv) | Evaluate $\int_0^{\pi/2} \cos^3 \theta \sin^2 \theta \, d\theta$ | 02 | C03 | 3 |
| v) | Find the length of the arc of the curve $y = \log \sec x$ from $x = 0$ to $x = \pi/3$. | 02 | C03 | 3 |
| vi) | Evaluate $\int_0^1 \int_0^{\sqrt{1+x^2}} \frac{1}{1+x^2+y^2} dy \, dx$ | 02 | C04 | 3 |
| vii) | Evaluate $\int_0^{\pi/2} \int_0^{1-\sin\theta} r^2 \cos\theta \, dr d\theta$ | 02 | C04 | 3 |
| viii) | Given the following values of $e^x$, evaluate $\int_0^{2.5} e^x \, dx$ , using Trapezoidal rule. | 02 | C06 | 3 |

| X | 0 | 0.5 | 1 | 1.5 | 2 | 2.5 |
|---|---|---|---|---|---|---|
| $y = e^x$ | 1 | 1.65 | 2.72 | 4.48 | 7.39 | 12.18 |

| | | Max. Marks | CO | BT level |
|---|---|---|---|---|
| O.2 | **Solve any four questions out of six.** | 16 | | |
| i) | Solve $(1 + y^2)dx = (e^{\tan^{-1} y} - x)dy$ | 04 | C01 | 3 |
| ii) | Solve $(D^2 + 4D + 4)y = xe^{-x} \sinh x$ | 04 | C02 | 3 |

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|---|---|---|---|---|
| iii) | Prove that $\int_3^7 \sqrt[4]{(x-3)(7-x)}\,dx = \dfrac{2\left(\gamma\left(\frac{1}{4}\right)\right)^2}{3\sqrt{\pi}}$ | 04 | C03 | 3 |
| iv) | Find the length of the perimeter $r = a(1+\cos\theta)$. | 04 | C03 | 3 |
| v) | Evaluate $\iint_R \sin\theta\, dA$ where $R$ is the region in the first quadrant that is outside the circle $r=2$ and inside the cardioid $r = 2(1+\cos\theta)$. | 04 | C04 | 3 |
| vi) | Using Euler's method find the approximate value of $y$ when $\dfrac{dy}{dx} = \dfrac{y-x}{\sqrt{xy}}$ and $y(1) = 2$, at $x = 1.5$ in 5 steps taking $h = 0.1$. | 04 | C06 | 3 |
| **Q.3** | **Solve any two questions out of three.** | 16 | | |
| i) | Solve $\dfrac{dy}{dx} - \dfrac{\tan y}{1+x} = (1+x)e^x \sec y$ | 08 | CO1 | 3 |
| ii) | Solve by method of variation of parameters $(D^2 - 6D + 9)y = \dfrac{e^{3x}}{x^2}$ | 08 | CO2 | 3 |
| iii) | Change the order of integration and evaluate $\int_0^a dy \int_0^{a-\sqrt{a^2-y^2}} \dfrac{xy\log(x+a)}{(x-a)^2}\,dx$ | 08 | CO4 | 3 |
| **Q.4** | **Solve any two questions out of three.** | 16 | | |
| i) | Assuming the validity of differentiation under the integral sign prove that $\int_0^\infty x e^{-ax} \sin bx\, dx = \dfrac{2ab}{(a^2+b^2)^2}$. | 08 | CO3 | 3 |
| ii) | $\iint \sqrt{xy(1-x-y)}\,dx\,dy$ over the area bounded by $x = 0$, $y = 0$ and $x + y = 1$ | 08 | CO4 | 3 |
| iii) | Using Euler's Modified method find the value of $y$ satisfying the equation $\dfrac{dy}{dx} = x + 3y$, $y(0) = 1$, for $x = 0.2$ correct up to 4 decimal places by taking $h = 0.1$. | 08 | CO6 | 3 |

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