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

April – May 2022-23
Program: B.Tech. Scheme: II
Examination: FY Semester: II
Course Code: BSC201 and Course Name: Engineering Mathematics II

Date of Exam: 02-06-23 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) | Check whether the differential equation given below is exact or not? $2(1+x^2\sqrt{y})ydx+(x^2\sqrt{y}+2)xdy=0.$ | 02 | CO1 | 3 |
| ii) | Find the complete solution of the following differential equation $(D^4+2D^2+1)y=0.$ | 02 | C02 | 3 |
| iii) | Find the particular integral of the differential equation $(D^3-2D^2-5D+6)y=e^{3x}+8$ | 02 | C02 | 3 |
| iv) | Evaluate $\int_0^1 (x\,logx)^4 dx.$ | 02 | C03 | 3 |
| v) | Find the total length of the curve $x^{\frac{2}{3}}+y^{\frac{2}{3}}=a^{\frac{2}{3}}.$ | 02 | C03 | 3 |
| vi) | Find the limit of $\iint x^2\,dxdy$ over the region R in the first quadrant bounded by $xy=16, y=x, y=0$ and $x=8.$ | 02 | C04 | 3 |
| vii) | Evaluate $\int_0^{\pi}\int_0^{asin\,\theta} r\,drd\theta$ . | 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 |
| **Q.2** | **Solve any four questions out of six.** | 16 | | |
| i) | Solve $(x^4+y^4)dx-xy^3dy=0$ | 04 | C01 | 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 |

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

April – May 2022-23
Program: B.Tech. Scheme: II
Examination: FY Semester: II
Course Code: BSC201 and Course Name: Engineering Mathematics II

Date of Exam: 02-06-23 Duration: 2.5 Hours Max. Marks: 60

| | | | | |
|---|---|---|---|---|
| ii) | Solve $(D^2 - 4D + 4)y = e^{2x} + x^3 + \cos 2x$ | 04 | C02 | 3 |
| iii) | Prove that $\beta(m,m).\beta\left(m+\frac{1}{2}, m+\frac{1}{2}\right) = \frac{\pi}{m}.2^{1-4m}$ | 04 | C03 | 3 |
| iv) | Find the length of the arc of the curve $y = \log \sec x$ from $x = 0$ to $x = \pi/3$. | 04 | C03 | 3 |
| v) | Evaluate $\int_0^{\pi/4} \int_0^{\sqrt{\cos 2\theta}} \frac{r}{(1+r^2)^2} dr d\theta$ | 04 | C04 | 3 |
| vi) | Find the value of $\int_0^1 \frac{1}{1+x^2} dx$ by dividing the interval in 6 equal parts using Simpson's 1/3rd Rule. | 04 | C06 | 3 |
| Q.3 | **Solve any two questions out of three.** | 16 | | |
| i) | Solve $(1 + y^2)dx = (e^{\tan^{-1} y} - x)dy$ | 08 | CO1 | 3 |
| ii) | Solve by method of variation of parameters, $(D^2 - 6D + 9)y = \frac{e^{3x}}{x^2}$ | 08 | CO2 | 3 |
| iii) | Evaluate $\iint x(x-y)\, dxdy$ over the region R which is triangle whose vertices are (0,0), (1,2), (0,4) | 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 $\int_0^\infty \frac{\tan^{-1} ax - \tan^{-1} bx}{x} dx = \frac{\pi}{2} \log\left(\frac{a}{b}\right)$. | 08 | CO3 | 3 |
| ii) | Change the order of integration and evaluate $\int_0^a \int_{x^2/a}^{2a-x} xy\, dx\, dy$. | 08 | CO4 | 3 |
| iii) | Using Runge - Kutta method of 4th order find the value of $y$ satisfying the equation $\frac{dy}{dx} = \frac{(y^2-x^2)}{(y^2+x^2)}$, $y(0) = 1$, for $x = 0.2$ and $x = 0.4$. | 08 | CO6 | 3 |

**********