

Regular

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

May 2024
Program: B.Tech. Scheme: III
Examination: FY Semester: II
Course Code: BSC201 and Course Name: Engineering Mathematics II

Date of Exam: 15/05/2024 Duration: 2.5 Hours Max. Marks: 60

Instructions:
(1) All questions are compulsory.
(2) Assume suitable data, if necessary.

		Max. Marks	CO	BT level																
Q 1	Solve any six questions out of eight:	12																		
i)	Check the exactness of the following differential equation $\left[y \left(1 + \frac{1}{x} \right) + \cos y \right] dx + (x + \log x - x \sin y) dy = 0$.	2	CO1	A																
ii)	If the following differential equation is non-exact find its corresponding integrating factor $\frac{dy}{dx} + \left(\frac{1-2x}{x^2} \right) y = 1$	2	CO1	A																
iii)	Solve $\{(D - 1)^4(D^2 + 2D + 2)^2\}y = 0$	2	CO2	A																
iv)	Find Particular integral of $(6D^2 + 17D + 12)y = 2^x$.	2	CO2	A																
v)	Evaluate $\int_0^\infty \frac{x^5(1+x^4)}{(1+x)^{16}} dx$	2	CO3	A																
vi)	Evaluate $\int_0^{\pi/4} \int_0^{\sqrt{\cos 2\theta}} \frac{r dr d\theta}{(1+r^2)^2}$	2	CO4	A																
vii)	Evaluate $\int_0^1 \int_0^2 \int_1^2 x^2 y z dx dy dz$	2	CO5	A																
viii)	Using Trapezoidal Rule compute $\int_{20}^{26} f(x) dx$.	2	CO6	A																
	<table border="1" style="width: 100%; border-collapse: collapse; margin: 5px 0;"> <tr> <td style="width: 5%;">x</td> <td>20</td> <td>21</td> <td>22</td> <td>23</td> <td>24</td> <td>25</td> <td>26</td> </tr> <tr> <td>f(x)</td> <td>95.90</td> <td>96.85</td> <td>97.77</td> <td>98.68</td> <td>99.56</td> <td>100.41</td> <td>101.24</td> </tr> </table>	x	20	21	22	23	24	25	26	f(x)	95.90	96.85	97.77	98.68	99.56	100.41	101.24			
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f(x)	95.90	96.85	97.77	98.68	99.56	100.41	101.24													
Q.2	Solve any four questions out of six.	16																		
i)	Solve $(y - xy^2)dx - (x + x^2y)dy = 0$	4	CO1	A																
ii)	Solve $(D^2 + 4)y = x \sin^2 x$	4	CO2	A																
iii)	Find the length of cardioid $r = a(1 - \cos)\theta$ lying inside the	4	CO3	A																

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	circle $r = a \cos \theta$.			
iv)	Evaluate $\iint xy \, dx \, dy$ over the area bounded by $y = x^2$ and $x = -y^2$.	4	CO4	A
v)	Find the area of smallest region bounded by $x^2 + y^2 = a^2$ and $x + y = a$, ($a > 0$).	4	CO5	A
vi)	Find the approximate value of $\int_0^6 e^x dx$ by dividing the interval into 7 ordinates using Simpson's (3/8) rule.	4	CO6	A
Q.3	Solve any two questions out of three.	16		
i)	Solve $(x^3 y^3 + xy)dy = dx$	8	CO1	A
ii)	Use the method of variation of parameter to solve the equation $(D^2 - 1)y = \frac{2}{1 + e^x}$	8	CO2	A
iii)	Assuming the validity of differentiation under integral sign show that $\int_0^\pi \frac{\log(1 + \alpha \cos x)}{\cos x} dx = \pi \sin^{-1} \alpha, 0 \leq \alpha \leq 1$	8	CO3	A
Q.4	Solve any two questions out of three.	16		
i)	Change the order of integration and evaluate $\int_0^a \int_{x^2/a}^{2a-x} xy \, dy \, dx$	8	CO4	A
ii)	Evaluate $\iiint_V (x^2 + y^2) \, dv$ where v is the solid bounded by the surface $x^2 + y^2 = z^2$ and the planes $z = 0, z = 2$.	8	CO5	A
iii)	Use Runge-Kutta method of second order to find y satisfying the equation $\frac{dy}{dx} = \log(x + y)$, $y(1) = 2$, at $x = 1.4$ correct up to four decimal places by taking $h = 0.2$.	8	CO6	A