K. J. Somaiya Institute of Engineering and Information Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)
End Semester Exam
April - May 2021-22 held in July 2022
Program: B.Tech
Examination: FY Semester: II
Course Code: 1UBSC201 and Course Name: Engineering Mathematics II
Duration: 03 Hours
Max. Marks: 60

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

<table>
<tr><th></th><th></th><th>Max. Marks</th><th>CO</th><th>BT level</th></tr>
<tr><td>Q 1</td><td>Solve any six questions out of eight:</td><td>12</td><td></td><td></td></tr>
<tr><td>i)</td><td>Determine whether the differential equation given below is exact or not? $(\tan y + x)dx + (x\sec^2 y - 3y)dy = 0$.</td><td>02</td><td>CO1</td><td>3</td></tr>
<tr><td>ii)</td><td>Find the complete solution of the differential equation $(D^4 + 2D^2 + 1)y = 0$.</td><td>02</td><td>C02</td><td>3</td></tr>
<tr><td>iii)</td><td>Find the particular integral of the differential equation $(D^2 + 4)y = \cos 2x$.</td><td>02</td><td>C02</td><td>3</td></tr>
<tr><td>iv)</td><td>Prove that $\beta(m,m).\beta\left(m+\frac{1}{2}, m+\frac{1}{2}\right) = \frac{\pi}{m}.2^{1-4m}$</td><td>02</td><td>C03</td><td>3</td></tr>
<tr><td>v)</td><td>Find the length of the arc of the curve $y = \log\sec x$ from $x = 0$ to $x = \pi/3$.</td><td>02</td><td>C03</td><td>3</td></tr>
<tr><td>vi)</td><td>Evaluate $\int_0^1 \int_0^{\sqrt{a^2-x^2}} xy\ dydx$</td><td>02</td><td>C04</td><td>3</td></tr>
<tr><td>vii)</td><td>Evaluate $\int_0^{\pi/2} \int_0^{a(1+\sin\theta)} r^2 \cos\theta\ drd\theta$</td><td>02</td><td>C04</td><td>3</td></tr>
<tr><td>viii)</td><td>Given the following values of e^x, evaluate $\int_0^{2.5} e^x\,dx$, using Trapezoidal rule.
<table>
<tr><td>X</td><td>0</td><td>0.5</td><td>1</td><td>1.5</td><td>2</td><td>2.5</td></tr>
<tr><td>$y = e^x$</td><td>1</td><td>1.65</td><td>2.72</td><td>4.48</td><td>7.39</td><td>12.18</td></tr>
</table>
</td><td>02</td><td>C06</td><td>3</td></tr>
<tr><td>Q.2</td><td>Solve any four questions out of six.</td><td>16</td><td></td><td></td></tr>
<tr><td>i)</td><td>Solve $(e^y + 1)\cos x\,dx + e^y \sin x\ dy = 0$.</td><td>04</td><td>C01</td><td>3</td></tr>
<tr><td>ii)</td><td>Solve $(D^2 + D - 6)y = e^{2x}\sin 3x$</td><td>04</td><td>C02</td><td>3</td></tr>
</table>

iii)	Prove that $\int_0^{2\pi} \sin^2\theta\,(1+\cos\theta)^4 d\theta = \frac{21\pi}{8}$	**04**	**C03**	**3**
iv)	Assuming the validity of differentiation under the integral sign prove that $\int_0^{\infty} \frac{e^{-\alpha x}\sin x}{x}\,dx = \cot^{-1} x$.	**04**	**C03**	**3**
v)	Evaluate $\iint x(x-y)\,dxdy$ over the region R which is triangle whose vertices are (0,0), (1,2), (0,4).	**04**	**C04**	**3**
vi)	Using Euler's modified method find the approximate value of y when $\frac{dy}{dx} = \log_e(x+y)$ and $y(1) = 2$, at $x = 1.2$ taking $h = 0.2$.	**04**	**C06**	**3**
Q.3	**Solve any two questions out of three.**	**16**		
i)	Solve $y(xy+e^x)dx - e^x dy = 0$	**08**	**CO1**	**3**
ii)	Solve by method of variation of parameters, $\frac{d^2y}{dx^2} + y = \sec x \tan x$	**08**	**CO2**	**3**
iii)	Change the order of integration and evaluate $\int_0^1 \int_x^{\sqrt{2-x^2}} \frac{x}{\sqrt{x^2+y^2}}\,dx\,dy$	**08**	**CO4**	**3**
Q.4	**Solve any two questions out of three.**	**16**		
i)	Prove that $\int_0^1 \sqrt{1-\sqrt{x}}\,dx \int_0^{1/2} \sqrt{2y-4y^2}\,dy = \frac{\pi}{30}$	**08**	**CO3**	**3**
ii)	Evaluate $\iint x^2\,dxdy$ over the region R in the first quadrant bounded by $xy = 16, y = x, y = 0$ and $x = 8$.	**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 $x = 0.4$ taking $h = 0.2$.	**08**	**CO6**	**3**