

Semester: February 2021 – June 2021 Examination: ESE Examination		
Programme code: 01 Programme: B.TECH	Class: FY	Semester: II (SVU 2020)
Name of the Constituent College: K. J. Somaiya College of Engineering		Name of the Department COMP/ETRX/EXTC/IT/MECH
Course Code: 116U06C108	Name of the Course: Applied Mathematics – II	
Duration : 1 Hour 45 Minutes	Maximum Marks : 50	
Instructions: 1)Draw neat diagrams 2) Assume suitable data if necessary		

Question No.		Max Marks
Q1 (A)	Choose One correct Option for the following Questions (2 marks Each)	10
(i)	If t^n is an integrating factor for the differential equation $(t^2 + y^2 + 1)dt - 2ty dy = 0$ then value of n is (a) 2 (b) -2 (c) 3 (d) -3	
(ii)	Expansion of $2x^3 + 7x^2 + x - 1$ in powers of $(x - 2)$ is (a) $45 + 53(x - 2) + 19(x - 2)^2 + 2(x - 2)^3 + \dots$ (b) $45 - 53(x - 2) + 19(x - 2)^2 - 2(x - 2)^3 + \dots$ (c) $45 + 53(x - 2) - 19(x - 2)^2 + 2(x - 2)^3 + \dots$ (d) $45 + 53(x - 2) + 19(x - 2)^2 - 2(x - 2)^3 + \dots$	
(iii)	$\int_0^\infty \frac{y^3}{3^y} dy = \dots$ (a) $\frac{3}{(\log 3)^4}$ (b) $\frac{3!}{(\log 3)^4}$ (c) $\frac{3}{(\log 3)^3}$ (d) $\frac{3!}{(\log 3)^3}$	
(iv)	Which of the following expresses the total perimeter of the curve $(x^2 + y^2)^2 = a^2(x^2 - y^2)$? (a) $s = \int_0^{\frac{\pi}{4}} \frac{a}{\sqrt{\cos 2\theta}} d\theta$ (b) $s = \int_0^{\frac{\pi}{2}} \frac{a}{\sqrt{\cos 2\theta}} d\theta$ (c) $s = 4 \int_0^{\frac{\pi}{4}} \frac{a}{\sqrt{\cos 2\theta}} d\theta$ (d) $s = 2 \int_0^{\frac{\pi}{4}} \frac{a}{\sqrt{\cos 2\theta}} d\theta$	
(v)	Value of $\int_{x=0}^1 \int_{y=2}^5 x^2 y^2 dx dy$ is (a) $\frac{125}{3}$ (b) $\frac{125}{9}$ (c) 13 (d) 15	
Q1 (B)	Attempt any FIVE questions out of the following (2 marks Each)	10
(i)	Solve $2(1 + x^2\sqrt{y})ydx + (x^2\sqrt{y} + 2)x dy = 0$	
(ii)	Solve $x^2 \frac{d^2y}{dx^2} + 2x \frac{dy}{dx} - 12y = 0$	

(iii)	Find n^{th} derivatives of $\sin^2 x \cos^3 x$.	
(iv)	Evaluate $\int_0^{\pi/6} \sin^7 3\theta \, d\theta$	
(v)	Evaluate $\iint x^2 dx dy$ over the area of the triangle whose vertices are (0, 1), (1, 1), (1, 2).	
(vi)	Find the area of the smaller region bounded by $x^2 + y^2 = 4$ and $x + y = 2$.	
(vii)	Evaluate $\int_0^{2\pi} \int_0^1 \int_0^r r^2 \sin \theta \, dz \, dr \, d\theta$	
Q. 2	Attempt any TWO questions out of the following (5 marks Each)	10
(a)	The differential equation of a circuit is $R \frac{dq}{dt} + \frac{q}{C} = 40e^{-3t} + 20e^{-6t}$. If $R = 20$ ohms, $C = 0.01$ farad and $q = 0$ at $t = 0$ show that the minimum charge on the capacitor is 0.25 coulombs.	
(b)	Solve $(D^2 - D - 2)y = 2 \log x + \frac{1}{x} + \frac{1}{x^2}$	
(c)	If $y = \cos^{-1} \left(\frac{x-x^{-1}}{x+x^{-1}} \right)$, prove that $y_n = 2(-1)^{n-1}(n-1)! \sin^n \theta \sin n \theta$, where $\theta = \tan^{-1}(1/x)$.	
Q. 3	Attempt any TWO questions out of the following (5 marks Each)	10
(a)	Prove that $B(n, n+1) = \frac{1}{2} \cdot \frac{(\overline{n})^2}{ \overline{2n} }$. Hence, deduce that $\int_0^{\pi/2} \left(\frac{1}{\sin^3 \theta} - \frac{1}{\sin^2 \theta} \right)^{1/4} \cos \theta \, d\theta = \frac{(\overline{1/4})^2}{2\sqrt{\pi}}$	
(b)	Prove that $\int_0^\infty \frac{e^{-x} - e^{-ax}}{x \sec x} dx = \frac{1}{2} \log \left(\frac{\alpha^2 + 1}{2} \right)$ Using DUIS	
(c)	Find the total length of the loop of the curve $9y^2 = (x+9)(x+6)^2$	
Q. 4	Attempt any TWO questions out of the following (5 marks Each)	10
(a)	Find the volume of the triangular prism formed by the planes $2y = 3x, y = 0, x = 2$ from $z = 0$ to $z = 4 + xy$.	
(b)	Evaluate $\iint \sqrt{\frac{36-9x^2-4y^2}{36+9x^2+4y^2}} dx dy$ where R is the region bounded by the ellipse $\frac{x^2}{4} + \frac{y^2}{9} = 1$	
(c)	Evaluate $\int_0^5 \int_{2-x}^{2+x} x \, dy \, dx$ by changing the order of integration.	