SRN

PES UNIVERSITY, BANGALORE
(Established under Karnataka Act 16 of 2013)

UE18MA151/
UE19MA151

END SEMESTER ASSESSMENT B. Tech. II SEMESTER– May 2022
UE18/19MA151 – Engineering Mathematics - II

Time: 3 Hrs **Answer All Questions** **Max Marks: 100**

1.	a)	Find the directional derivative of the function $f = x^2yz + 4xz^2$ at $P(1,-2,-1)$ in the direction of the vector $2\hat{\imath} - \hat{\jmath} - 2\hat{k}$.	6
	b)	Show that $\vec{F} = 2x(y^2 + z^3)\hat{\imath} + 2x^2y\hat{\jmath} + 3x^2z^2\hat{k}$ is conservative force field and find the scalar potential $\emptyset$ and work done in moving a particle from (-1,2,1) to (2,3,4).	7
	c)	Using Greens theorem, evaluate $\int_C x^2ydx + x^2\,dy$ where C is the boundary describing counter-clockwise of the triangle with vertices (0,0), (1,0) (1,1).	7
2.	a)	Prove that $\int_0^\infty xe^{-x^8}dx \;\; X \;\; \int_0^\infty x^2e^{-x^4}dx = \frac{\pi}{16\sqrt{2}}$	7
	b)	Establish the Jacobi series and hence prove that $J_n(x) = \frac{1}{\pi}\int_0^\pi \cos(n\theta - xsin\theta)\,d\theta$ where n is a positive integer.	7
	c)	Express $J_{5/2}(x)$ interms of sine and cosine functions.	6
3.	a)	Find the Laplace transform of $te^{-2t}cos3t + \frac{sinat}{t} + 5^t + t^4\delta(t-5)$	6
	b)	A periodic function f(t) with period 2a is defined by $f(t) = \left\{\begin{matrix} a & 0 \le t \le a \\ -a & a < t \le 2a \end{matrix}\right\}$. Show that $L\{f(t)\} = \frac{a}{s}tanh\left(\frac{as}{2}\right)$	7
	c)	Express the following function f(t) in terms of unit step function and hence find the Laplace transform $f(t) = \begin{cases} t-1 & 1 < t < 2 \\ 3-t & 2 < t < 3 \end{cases}$	7
4.	a)	Evaluate $L^{-1}\left\{\frac{3s+7}{(s^2+6s+10)^2}\right\}$, $L^{-1}\left\{tan^{-1}\left(\frac{2}{s^2}\right)\right\}$	6
	b)	Solve the differential equation $y'' - 6y' + 9y = 0, if\ y(0) = 2,\ y'(0) = 9$ using Laplace transform.	7
	c)	Using convolution theorem find $L^{-1}\left[\frac{1}{(s+1)(s^2+1)}\right]$	7
5.	a)	Find the Fourier Series of f(x) = $x + x^2$ in $(-\pi, \pi)$ and hence deduce that $\sum_{n=1}^{\infty}\frac{1}{n^2} = \frac{\pi^2}{6}$	7
	b)	Find the Fourier half range Cosine series of $f(x) = \begin{cases} x, & 0 < x < 1 \\ 2-x, & 1 < x < 2 \end{cases}$	6
	c)	Express y as a Fourier series up to first harmonics.	7

x	0	$\pi/3$	$2\pi/3$	π	$4\pi/3$	$5\pi/3$
y	7.9	7.2	3.6	0.5	0.9	6.8

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