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PES UNIVERSITY

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

UE20MA151

END SEMESTER ASSESSMENT B. Tech. II SEMESTER– Dec 2021
UE20MA151 – Engineering Mathematics - II

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

1.	a)	Find the average value of the function $\sqrt{xy - y^2}$ over the triangle with vertex (0,0), (10, 1), (1,1).	6
	b)	Change the order of integration in $\int_0^1 \int_{x^2}^{2-x} xy\, dy\, dx$ and hence evaluate.	7
	c)	Find the volume of the cylinder $x^2 + y^2 = 2ax$ intercepted between the paraboloid $z = \frac{x^2+y^2}{2a}$ and the xyplane.	7
2.	a)	Find the constants a, b if the directional derivative of the function $\varphi = ay^2 + 2bxy + xz$ at $P(1, 2, -1)$ is maximum in the direction of the tangent to the curve, $\vec{r} = (t^3 - 1)\hat{\imath} + (3t - 1)\hat{\jmath} + (t^2 - 1)\hat{k}$ at the point (0, 2, 0).	6
	b)	Show that $\vec{F} = (x^2 + xy^2)\hat{\imath} + (y^2 + x^2y)\hat{\jmath}$ is conservative force field and find the scalar potential $\emptyset$ such that $\vec{F} = \nabla\emptyset$.	7
	c)	Using divergence theorem, evaluate $\iint_S \vec{A}.\hat{n}\, dS$ where $\vec{A} = x^3\hat{\imath} + y^3\hat{\jmath} + z^3\hat{k}$ and S is the surface of the sphere $x^2 + y^2 + z^2 = a^2$.	7
3.	a)	Find the Laplace transform of $t.u(t-4) + t^2.\delta(t-4) + t.cos2t + \sqrt{t}.e^{4t} + \frac{sinat}{t} + 5^t$	6
	b)	Sketch the graph of f(t) as a periodic function and show that $L\{f(t)\} = \frac{1}{s^2}tanh\left(\frac{as}{2}\right)$ $f(t) = \begin{cases} t & 0 \le t \le a \\ 2a - t & a < t \le 2a \end{cases}$, $f(t + 2a) = f(t)$	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 $ty'' + 2y' + ty = cost, if\ y(0) = 1,\ y'(0) = 0$ using Laplace transform.	7
	c)	Using convolution theorem find $L^{-1}\left[\frac{1}{(s+1)(s^2+1)}\right]$	7

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5.	a)	Find the Fourier Series expansion of f(x)= $2x - x^2$ in the interval $0 < x < 3$ and hence deduce that $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \cdots = \frac{\pi}{12}$	7
	b)	By using the sine series for f(x) = 1 in $0 < x < \pi$, show that $\frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \cdots = \frac{\pi^2}{8}$.	6
	c)	Find the direct current part and the first two harmonics from the following table consisting of the variations of periodic current over a period T.	7

t sec	0	$T/6$	$T/3$	$T/2$	$2T/3$	$5T/6$	T
A amp	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98