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PES UNIVERSITY

PES University, Bangalore
(Established under Karnataka Act 16 of 2013)

UE14MA151

END SEMESTER ASSESSMENT (ESA) B.Tech. II SEMESTER- MAY 2015

UE14MA151- ENGINEERING MATHEMATICS -II

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

1.	a)	Find $L\left\{\sin 5t + cosh3t + \sqrt{t} + \frac{e^{-2t}-e^{-4t}}{t} + t\,e^{4t}\,cos2t\right\}$	7
	b)	Derive the Laplace transform for the unit step function $u(t-a)$	5
	c)	A rectifier sine wave is given by a periodic function $f(t) = f(t+2\pi) = \begin{cases} sint & 0<t<\pi \\ -sint & \pi<t<2\pi \end{cases}$ Obtain the Laplace transform of the periodic function.	5
2.	a)	Find $L^{-1}\left\{\frac{2}{(s^2-4)(s+1)^2}\right\}$ using convolution theorem.	6
	b)	Solve the following differential equation using Laplace transform $y'' + 4y' + 9y = 2\,\delta(t-1) + e^t;\ y(0) = 0,\ y'(0) = -1$	10
3.	a)	A point moves along the intersection of the surfaces $z = x^2 + y^2$ with the plane $x + y = 2$ from the point **(2,0,4)** to the point **(0,2,4)** in such a way that **x = 2-t**. Find the unit tangent vector and the unit normal vector at the final point.	7
	b)	Find the Directional derivative of $f(x,y,z) = x^2y^2z^2$ at the point **(1,1,-1)** in the direction of the tangent to the curve $x = e^t, y = 1 + 2sint,\ z = t - cost$, where $-1 \le t \le 1$.	5
	c)	Show that $r^n.\vec{r}$ is an irrotational vector for any value n but is solenoidal if $n + 3 = 0$, where $\vec{r} = xi + yj + zk$ and r is the magnitude of $\vec{r}$	5
4.	a)	Verify Green's theorem for $\oint(2x - y^3)dx - xy\,dy$ over a curve c, where c is the boundary of the region bounded by the circles $x^2 + y^2 = 1$ and $x^2 + y^2 = 4$.	7
	b)	Let $\vec{F} = -yi + xj + zk$. Let S be the part of the paraboloid $z = 7 - x^2 - 4y^2$ that lies above the plane $z = 3$, oriented with upward pointing normal. Evaluate $\iint curl\,\vec{F}.\hat{n}\,ds$ by finding the work done in moving once around the boundary of the surface in the counter clockwise direction (use Stoke's theorem)	5
	c)	Find the flux of the vector field $\vec{F}$ given by $\vec{F} = ye^z i + y^2 j + x\,e^y\,k$ over the boundary of the region enclosed by the cylinder $x^2 + y^2 = 9,\ z = 0$ and $z = y - 3$ using Gauss divergence theorem.	5
5.	a)	Find the Fourier Series for the function $f(x) = \begin{cases} 1, & 0<x<\pi \\ 2, & \pi<x<2\pi \end{cases}$ and hence find the sum of the infinite series $1 + \frac{1}{3^2} + \frac{1}{5^2} + \frac{1}{7^2} + \cdots$,	7
	b)	Compute half range cosine series expansion for the function $f(x) = \begin{cases} 0, & 0 \le x \le 1 \\ x-1, & 1 \le x \le 2 \end{cases}$	5
	c)	Find the direct current part and Amplitude of the first harmonic from the following table consisting of the variations of periodic current	5

t (secs)	0	T/6	T/3	T/2	2T/3	5T/6	T
A amps)	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

6.	a)	Prove that $x^2 J''_n(x) = (n^2 - n - x^2)J_n(x) + x J_{n+1}(x)$ where $n = 0,1,2,3,\ldots$	6
	b)	Using the Jacobi series Prove that $J_n(x) = \frac{1}{\pi}\int_0^{\pi} cos(n\theta - xsin\theta)\,d\theta$, where n is an integer	5
	c)	Show that $y = \sqrt{x}\,J_1(x)$ is a solution of the differential equation $y'' + \left(1 - \frac{3}{4x^2}\right)y = 0$	5