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PES University, Bangalore

(Established under Karnataka Act 16 of 2013)

UE14MA151

END SEMESTER ASSESSMENT (ESA) BTech. II SEMESTER
SUMMER TERM - JULY 2015

UE14MA151 – ENGINEERING MATHEMATICS - II

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

1. a) Evaluate $\int_0^\infty \frac{\cos 4t - \cos 5t}{t}\,dt$. 6

b) Find (i) $L[e^{2t}\sin 3t\cos 2t]$ (ii) $L[\cosh 3t\ \delta(t-4)]$. 5

c) Express $f(t)$ in terms of the Heaviside unit step function and find its Laplace transform, where
$$f(t)=\begin{cases} t^2 & \text{for } 0<t\le 2 \\ 4t & \text{for } 2<t\le 4. \\ 8 & \text{for } t>4 \end{cases}$$ 5

2. a) Find $L^{-1}\left[\log\left(1+\frac{1}{s^2}\right)\right]$. 6

b) By employing the Convolution theorem, evaluate $L^{-1}\left[\frac{s}{\left(s^2+a^2\right)^2}\right]$. 6

c) Solve by using Laplace transform method $y''-2y'+y=e^{2t}$, $y(0)=0,\ y'(0)=-1$. 6

3. a) Find the angle between the tangents to the curve $x=t^2+1, y=4t-3, z=2t^2-6t$ at $t=1$ and $t=2$. 6

b) Prove that $\nabla^2\left(r^n\right)=n(n+1)r^{n-2}$. 5

c) Find the constants a and b so that $\bar{F}=\left(axy+z^3\right)\hat{i}+\left(3x^2-z\right)\hat{j}+\left(bxz^2-y\right)\hat{k}$ is irrotational and find ϕ such that $\bar{F}=\nabla\phi$. 5

4. a) By using Green's theorem, evaluate $\int_c \left(2x^2-y^2\right)dx+\left(x^2+y^2\right)dy$, where c is the boundary of the region in the xy-plane enclosed by the x-axis and the upper half of the circle $x^2+y^2=a^2$. 6

b) Verify the divergence theorem for $\bar{F}=\left(x^2-yz\right)\hat{i}+\left(y^2-zx\right)\hat{j}+\left(z^2-xy\right)\hat{k}$ over the rectangular parallelopiped $0\le x\le a, 0\le y\le b, 0\le z\le c$. 12

5. a) Obtain the Fourier series for the function $f(x)=e^{-ax}$, $a>0$ in the interval $(0,2\pi)$. 6

b) Find the half range sine series for the function $f(x)=\begin{cases} x & 0<x\le\pi/2 \\ \pi-x & \pi/2\le x<\pi \end{cases}$. 5

c) For the periodic function $f(x)$ of period 6 specified by the following table over the interval $(0,6)$, find the Fourier coefficients a_0, a_1 and b_1. 5

x	0	1	2	3	4	5	6
$f(x)$	9	18	24	28	26	20	9

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6.	a)	Prove that $J_n'(x)=\frac{1}{2}[J_{n-1}(x)-J_{n+1}(x)]$.	6
	b)	Prove that $\int_0^a xJ_n(\alpha x)J_n(\beta x)dx=\begin{cases}0 & \text{if } \alpha=\beta\\ \frac{a^2}{2}\left[J_{n+1}(\alpha a)\right]^2 & \text{if } \alpha\neq\beta\end{cases}$, where α and β are the roots of $J_n(ax)=0$.	1

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