SE Electrical Engg. Choice Base 08/05/2018 1/2
App. Maths - III

Q.P. Code: 24962

Duration: 3 Hours **Max. Marks: 80**

Note: 1. Questions No. 1 is compulsory.
2. Attempt any 3 Questions from the remaining questions.
3. Figures to the right indicate carries full marks.

Que. 1 a. Find Laplace transform of $e^{-t}tcos2t.sin4t$ 5

b. Find Fourier expansion for $f(x) = |x|$ in $(-\pi, \pi)$ 5

c. Prove that $\bar{F} = \frac{\bar{r}}{r^3}$ is solenoidal. 5

d. If $f(z) = (r^2 \cos 2\theta + ir^2 \sin p\theta)$ is analytic find p. 5

Que. 2 a. Prove that $u = e^{2x}\cos 2y$ is harmonic function, hence find it's corresponding harmonic conjugate orthogonal 6

b. By using convolution theorem, find the inverse Laplace Transform of $\frac{s}{(s^2+4)(s^2+9)}$ 6

c. Find Fourier series for $f(x) = x\sin x$ in $(0, 2\pi)$ 8

Que. 3 a. Prove that a vector field $\bar{F}$ is given by $\bar{F} = (ysinz - sinx)i + (xsin z + 2yz)j + (xycosz + y^2)k$ is irrotational, hence find its scalar potential. 6

b. Find analytic function f(z), whose real part is $u = \frac{\sin 2x}{\cosh 2y + \cos 2x}$ 6

c. By using Laplace transform, solve $y''+2y'+5y = e^{-t}\sin t$; $y(0)=0, y'(0)=1$ 8

Que. 4 a. Prove that $J_{1/2}(x) = \sqrt{\frac{2}{\pi x}}\, sinx$ 6

b. Evaluate $\int_C \bar{F}.d\bar{r}$ where $\bar{F} = (2x-y)i - yz^2j - y^2zk$, where C is the boundary of the surface of hemisphere $x^2 + y^2 + z^2 = a^2$ lying above the xy – plane. 6

c. Find inverse Laplace Transform of i. $\frac{(s+1)e^{-\pi s}}{s^2+2s+5}$ ii. $\frac{1}{s}\log\left(\frac{s+2}{s+1}\right)$ 8

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Que 5 a. Show that the functions { sin x , sin 3x , sin 5x ,. . . . . } are orthogonal in $[0, \frac{\pi}{2}]$ and find the corresponding set of orthonormal functions. 6

b. Show that under the transformation $w=\frac{1}{z}$ the circle $(x-3)^2+y^2=2$ the circle is mapped to the circle $(u-\frac{3}{7})^2+v^2=\frac{2}{49}$ 6

c. Verify Green's Theorem in the plane for $\oint(x^2-y)dx+(2y^2+x)dy$ around the boundary of the region defined by $y=x^2$ and $y=x$. 8

Que 6 a. By using Laplace transform, evaluate $\int_0^\infty e^t \frac{\sin^2 t}{t} dt$ 6

b. Find a bilinear transformation which maps z=1, i, -1 into w= 0,i, -∞ and hence find the fixed points 6

c. Find the Fourier integral representation of $f(x)=\begin{cases} e^{ax}, & x \le 0 \\ e^{-ax}, & x \ge 0 \end{cases}$ 8

and hence S.T. $\int_0^\infty \frac{\cos \lambda x}{\lambda^2+a^2} d\lambda = \frac{\pi}{2a} e^{-ax}$; x > 0, a > 0

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