SE/Sem III / Biomed / Choice Based

Paper / Subject Code: 50501 / Applied Mathematics-III

08/05/19

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Max. Marks 80

Duration: 3 hours

N. B.: 1. Question No. 1 is Compulsory.

2. Attempt any 3 Questions from Question no. 2 to 6.

3. Figures to the right indicate the full Marks.

Que. 1

a Find Laplace transform of $e^{-3t}t\sin 4t$ 5

b Expand Fourier series for $f(x)=x^3$ in $(-\pi,\pi)$ 5

c If $\overline{F}(x,y,z)=(2x+y)i-6yj+azk$ is Solenoidal, find a and find curl of $\overline{F}$. 5

d Show that $f(z)=z^n$ is analytic, hence find $f'(z)$ 5

Que.2.

a Find Fourier series for $f(x)=1-x^2$ in $(-1,1)$ 6

b Prove that $J_{3/2}(x)=-\sqrt{\frac{2}{\pi x}}\left[\frac{\sin x}{x}-\cos x\right]$ 6

c By using Laplace transform, Solve $\frac{d^2y}{dt^2}-3\frac{dy}{dt}+2y=4e^{-4t}$, where $y(0)=0, y'(0)=1$ 8

Que. 3.

a Evaluate $\int_0^\infty e^{-2t}\frac{\cos 4t-\cos 5t}{t}dt$, by using Laplace transform 6

b Find analytic function whose real part is $u=\frac{\sin 2x}{\cosh 2y+\cos 2x}$ 6

c Verify Green's theorem $\int_C F.\overline{dr}$ where $F=(x^2-xy)i+(x^2-y^2)j$ and C is the closed curve bounded by $x^2=2y$ and x=y 8

Que. 4.

a Show that $\overline{F}=(y^2\cos x+z^3)i+(2y\sin x-4)j+(3xz^2+2)k$ is irrotational, hence find its scalar potential. 6

b Find complex form of Fourier series $f(x)=\cosh 2x+\sinh 2x$ in (-1, 1) 6

C Find bilinear transformation which maps the points 2, -i, -2 onto the points 1, i, -1, hence find its fixed points. 8

Que. 5

a Evaluate $\int_C F.\overline{dr}$ where $F=(y^2+z^2-x^2)i+(z^2+x^2-y^2)j+(x^2+y^2-z^2)$ over the boundary of the surface. $x^2+y^2-2ax+az=0$. 6

b Find inverse Laplace transform of i. $\frac{1}{s}\tan^{-1}\left(\frac{2}{s}\right)$ ii. $\frac{e^{-as}}{(s^2+2s+2)}$ 6

c Find Fourier integral representation for $f(x)=\begin{cases}-e^{kx} & for\ x<0\\ e^{-kx} & for\ x>0\end{cases}$ 8

Hence prove that $\int_0^\infty \frac{\omega\sin\omega x}{\omega^2+k^2}d\omega=\frac{\pi}{2}e^{kx}$ if k >0, x > 0.

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Que. 6.

a. Show that the set of functions $\{\sin x, \sin 3x, \sin 5x, \ldots\ldots\ldots\}$ is orthogonal over $[0,2\pi]$. Construct orthonormal set of functions.

b. Find inverse Laplace transform of $\frac{s}{(s^2+4)(s^2+9)}$ by using convolution theorem

c. Find the images of the infinite strips i. $\frac{1}{2b}<y<\frac{1}{2a}$ ii. $0<y<\frac{1}{2a}$ under transformation $w=\frac{1}{z}$. Show the regions graphically where a>0, b>0 and a<b.