JSS ACADEMY OF TECHNICAL EDUCATION, NOIDA
DEPARTMENT OF MATHEMATICS
SUBJECT: ENGINEERING MATHEMATICS-II (BAS-203)
QUESTION BANK FOR CIA-II

UNIT-2 (LAPLACE TRANSFORM)	
Short Answer Type Questions	
1.	Find the Inverse Laplace Transform of $\frac{p}{p^2+9}$
2.	Find the Inverse Laplace Transform of $\frac{e^{-\pi p}}{(p+3)}$
3.	Find the Inverse Laplace Transform of $\frac{p+2}{(p+2)^2-25}$
4.	Find the Inverse Laplace Transform of $\frac{1}{p(p^2+1)}$
5.	Find the Inverse Laplace Transform of $\frac{1}{(p+2)^5}$
Long Answer Type Questions	
1.	Find the Inverse Laplace transform of (i) $\frac{6}{2p-3}-\frac{3+4p}{9p^2-16}+\frac{8-6p}{16p^2+9}$ (ii) $\frac{p+8}{p^2+4p+5}$
2.	Find the Inverse Laplace transform of (i) $\left(\frac{e^{-p}}{\sqrt{p+1}}\right)$ (ii) $\left(\frac{e^{-2\pi p}}{p(p^2+1)}\right)$
3.	Find the Inverse Laplace transform of (i) $\frac{p-1}{p^2(p-7)}$ (ii) $\frac{4}{(p^2+2\text{p}+5)}$
4.	Find the Inverse Laplace transform of (i) $\log\left(1+\frac{1}{p^2}\right)$ (ii) $\cot^{-1}\left(\frac{p+3}{2}\right)$
5.	Find the Inverse Laplace transform of (i) $\frac{1}{p^3(p^2+a^2)}$ (ii) $\frac{p^2-a^2}{(p^2+a^2)^2}$

6.	Apply Heaviside's expansion formula to find (i) $L^{-1}\left\{\dfrac{p+5}{(p+1)(p^2+1)}\right\}$ (ii) $L^{-1}\left\{\dfrac{2p^2+5p-4}{p^3+p^2-2p}\right\}$
7.	State and prove Convolution Theorem and hence evaluate $L^{-1}\left\{\dfrac{p}{(p^2+1)(p^2+4)}\right\}$
8.	By using convolution theorem evaluate $L^{-1}\left\{\dfrac{p^2}{(p^2+a^2)(p^2+b^2)}\right\}$.
9.	Using Laplace transform, solve the differential equation $\dfrac{d^2x}{dt^2}+9x=\cos 2t$, Given that $x(0)=1,\ x\left(\dfrac{\pi}{2}\right)=-1$
10.	Using Laplace transform, solve the differential equation $\dfrac{d^2x}{dt^2}+2\dfrac{dx}{dt}+5x=e^{-t}\sin t$, Given that $x(0)=0,\ x'(0)=1$
11.	Using Laplace transform, solve the differential equation $\dfrac{d^3y}{dt^3}-3\dfrac{d^2y}{dt^2}+3\dfrac{dy}{dt}-y=e^t t^2$, Given that $y(0)=1,\ \left(\dfrac{dy}{dt}\right)_{t=0}=0,\ \left(\dfrac{d^2y}{dt^2}\right)_{t=0}=-2$
12.	Using Laplace transform, solve the differential equation $\dfrac{d^2y}{dt^2}+y=t\cos 2t$, Given that $y(0)=0,\ \left(\dfrac{dy}{dt}\right)_{t=0}=0$
13.	Solve the following simultaneous differential equation by using Laplace Transform : $\dfrac{dx}{dt}-y=e^t,\ \dfrac{dy}{dt}+x=\sin t;\ x(0)=1,\ y(0)=0$
14.	Solve the following simultaneous differential equation by using Laplace Transform : $\dfrac{dx}{dt}+\dfrac{dy}{dt}+x+y=1,\ \dfrac{dy}{dt}=2x+y;\ x(0)=0,\ y(0)=1$

UNIT-3 (SEQUENCE AND SERIES)

Short Answer Type Questions

1.	Discuss the convergence or divergence of the sequence $a_n=\dfrac{n}{n^2+1}$
2.	Discuss the convergence or divergence of the sequence $a_n=\dfrac{n+1}{n}$
3.	Discuss the convergence or divergence of the sequence $a_n=1+\dfrac{1}{3}+\dfrac{1}{3^2}+\dfrac{1}{3^3}+.......+\dfrac{1}{3^n}$.

4.	Test the convergence of the series $\sum (-1)^{n+1} \frac{1}{\sqrt{n}}$.
5.	Test the convergence of the series $\frac{2}{1}+\frac{3}{8}+\frac{4}{27}+\frac{5}{64}+..........$
6.	Test the convergence of the series $1+\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+..........$
7.	Find the Fourier coefficient a_0 for the function $f(x)=x\sin x,\ 0<x<2\pi$
8.	Find the Fourier coefficient b_1 for the function $f(x)=x\sin x,\ 0<x<2\pi$
	Long Answer Type Question
1.	Test for convergence or divergence of the series $\sum_{n=1}^{\infty} \frac{\sqrt{2n-1}}{(2n+1)(2n+4)}$
2.	Test the series $1+\frac{x}{2}+\frac{x^2}{5}+\frac{x^3}{10}+..........+\frac{x^n}{n^2+1}+......$
3.	Test the series $\sum_{n=1}^{\infty} \frac{\sqrt{2n-1}}{(2n+1)(2n+4)}$
4.	Test for convergence or divergence of the series $\frac{3}{7}x+\frac{3.6}{7.10}x^2+\frac{3.6.9}{7.10.13}x^3+.............(x>0)$
5.	Test for convergence or divergence of the series $\frac{2}{1}+\frac{2.5.8}{1.5.9}+\frac{2.5.8.11}{1.5.9.13}+.............$
6.	Test the series $1+\frac{2^2}{2!}+\frac{3^2}{3!}+\frac{4^2}{4!}+..........$
7.	Test the convergence of the series $1+\frac{1+2}{1+2^2}+\frac{1+3}{1+3^2}+.........$
8.	Test the convergence of the series $\left(\frac{2^2}{1^2}-\frac{2}{1}\right)^{-1}+\left(\frac{3^3}{2^3}-\frac{3}{2}\right)^{-2}+\left(\frac{4^4}{3^4}-\frac{4}{3}\right)^{-3}+..........$
9.	Test the series $1+\frac{x^2}{2}+\frac{x^4}{4}+\frac{x^6}{6}+.............,(x>0)$
10.	Test for convergence or divergence of the series $1+\frac{1}{2}.\frac{x^2}{4}+\frac{1.3.5}{2.4.6}.\frac{x^4}{8}+\frac{1.3.5.7.9}{2.4.6.8.10}.\frac{x^6}{12}+........$
11.	Obtain the Fourier series for the function $f(x)=x^2,\ -\pi\le x\le\pi$. Also show that $\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\frac{1}{4^2}+..........=\sum_{n=1}^{\infty}\frac{1}{n^2}=\frac{\pi^2}{6}$

12.	Find the Fourier series for the function $f(x)=\begin{cases}1+\frac{2x}{\pi}, & -\pi\le x\le 0\\ 1-\frac{2x}{\pi}, & 0\le x\le \pi\end{cases}$
13.	Obtain the Fourier series expansion of the function $f(x)=\begin{cases}\pi x, & 0\le x\le 1\\ \pi(2-x), & 1\le x\le 2\end{cases}$
14.	Expand $f(x)=\sin x$ in a half-range cosine series in the interval $(0,\pi)$. Also prove that $\frac{\pi}{4}=1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+..........$
15.	Find the half-range Fourier cosine series for the function $f(x)=\begin{cases}kx, & 0\le x\le \frac{l}{2}\\ k(l-x), & \frac{l}{2}\le x\le l\end{cases}$ Also prove that $\frac{\pi^2}{8}=\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+..........$
16.	Find the half-range sine series for the function $f(x)=\begin{cases}x, & 0<x<2\\ 4-x, & 2<x<4\end{cases}$
UNIT-4 (Complex variable-Differentiation)	
Short Answer Type Questions	
1.	Show that $f(z)=\lvert z\rvert^2$ is differentiable only at the origin.
2.	Evaluate the line integral $\int_0^{1+i}(x^2-iy)dz$ along the path $y=x$
3.	Find p such that the function $f(z)$ expressed in polar coordinate as $f(z)=r^2\cos 2\theta+ir^2\sin p\theta$ is analytic.
4.	Write the Cauchy's Riemann equation in polar coordinate.
Long Answer Type Question	
1.	Find the value of c_1 and c_2 such that the function $f(z)=x^2+c_1y^2-2xy+i(c_2x^2-y^2+2xy)$ is analytic. Also find $f'(z)$
2.	Examine the nature of function $f(z)=\begin{cases}\frac{x^3(1+i)-y^3(1-i)}{x^2+y^2}, & z\ne 0\\ 0, & z=0\end{cases}$ in the region including origin.
3.	Show that the function $f(z)=\sqrt{\lvert xy\rvert}$ is not analytic at the origin, although Cauchy-Riemann equations are satisfied there.

4.	Verify if $f(z)=\begin{cases} \dfrac{xy^2(x+iy)}{x^2+y^4}, & z\neq 0 \\ 0, & z=0 \end{cases}$ is not analytic at the origin or not.
5.	Show that the function defined by $f(z)=\begin{cases} \dfrac{x^3y^5(x+iy)}{x^6+y^{10}}, & z\neq 0 \\ 0, & z=0 \end{cases}$ is not analytic at the origin even though it satisfies Cauchy's Riemann equations at the origin.

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