Exam No. ____________

GANPAT UNIVERSITY

B. Tech. Semester – III (EE) CBCS (NEW) Examination, Nov – 2016

Sub : (2HS303) Mathematics for Electrical Engineering

TIME: 03 HRS **TOTAL MARKS: 60**

Instructions : (1) All questions are compulsory.

(2) Write answer of each sections in separate answer books.

(3) Figures to the right indicate marks of questions.

SECTION – I

Que – 1

(A) Evaluate : (i) $L\left\{\frac{e^{-at}-e^{-bt}}{t}\right\}$ (ii) $L^{-1}\left\{\frac{s+7}{s^2+2s+2}\right\}$ (04)

(B) Using Convolution theorem ; evaluate $L^{-1}\left\{\frac{1}{(s-1)(s+6)}\right\}$. (03)

(C) Evaluate : (i) $L\{\cos(at+b)\}$ (ii) $L\{t\,e^{-t}\sin t\}$ (03)

OR

Que – 1

(A) If $L\{f(t)\} = \bar{f}(s)$ then Prove that $L\{t^n f(t)\} = (-1)^n \frac{d^n}{ds^n}\left[\bar{f}(s)\right]$ (04)

(B) Evaluate : $L^{-1}\left\{\log\left(\frac{s-7}{s+2}\right)\right\}$ (03)

(C) Define Unit step Function . Express the given function in terms of unit step function and hence obtain its Laplace transform : $f(t) = \begin{cases} 0 \;;\; t < 7 \\ t \;;\; t \geq 7 \end{cases}$ (03)

Que – 2

(A) Find a Fourier series for the function $f(x) = x + x^2$; $[-\pi, \pi]$ (04)

Hence show that $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \cdots\cdots\cdots$

(B) Find the fourier expansion of $f(x) = \begin{cases} \pi + x \;;\; -\pi \leq x \leq 0 \\ \pi - x \;;\; 0 \leq x \leq \pi \end{cases}$ (03)

Hence show that $\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \cdots\cdots\cdots$

(C) Find a Fourier series for the function $f(x) = 1 - x^2$; $[-1, 1]$. (03)

OR

Que – 2

(A) Find the fourier expansion of $f(x) = \begin{cases} x \; ; & -1 \le x \le 0 \\ 2 \; ; & 0 \le x \le 1 \end{cases}$ **(04)**

(B) Obtain Half range Cosine series for $f(x) = 2x - 1 \; ; \; [0, 1]$. **(03)**

(C) Expand $f(x) = e^{-x}$ as a Fourier series in $[-l, l]$. **(03)**

Que – 3

(A) Find the Fourier transform of : $f(x) = \begin{cases} 1 \; ; & |x| < 1 \\ 0 \; ; & |x| > 1 \end{cases}$. **(05)**

Hence evaluate : $\int_0^\infty \frac{\sin x}{x} \, dx$.

(B) Use transform method to solve : $\frac{dy}{dt} - 2y = 4$; where $y(0) = 1$. **(05)**

OR

(B) Evaluate : $L^{-1}\left\{ \frac{2s^2 - 4}{(s+1)(s-2)(s-3)} \right\}$ **(05)**

<u>**SECTION – II**</u>

Que – 4

(A) Evaluate : $\int_0^{1+i} (x^2 + iy) \, dz$; along (i) the line $y = x$ and (ii) $y = x^2$. **(04)**

(B) Determine Analytic function whose Real part is : $e^{2x}(x\cos 2y - y \sin 2y)$ **(03)**

(C) Find the bilinear transformation which maps the points $Z = 2, i, -2$ onto the points $W = 1, i, -1$ **(03)**

OR

Que – 4

(A) If $f(z) = u + iv$ is an Analytic function of z then find f (z) *If* : **(04)**

$u - v = e^x(\cos y - \sin y)$

(B) If f(z) is Analytic function of z then Prove that : **(03)**

$$\left[\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} \right] |f(z)|^2 = 4 \, |f'(z)|^2 .$$

(C) Evaluate : $\int_C \frac{4 - 3z}{z(z-1)(z-2)} \, dz$; where C is the circle : $|z| = \frac{3}{2}$. **(03)**

Que – 5

(A) Apply the method of variation of parameters to solve : $\frac{d^2y}{dx^2} + 4y = \sec 2x$ **(04)**

(B) Solve : $[D^3 + 2D^2 + D]\,y = e^{2x} + x^2 + x$ **(03)**

(C) Solve : $[D^2 - 2D + 1]\,y = x\,e^x \sin x$. **(03)**

OR

Que – 5

(A) Solve Cauchy's homogeneous equation : $x^2 \frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = \log x$. **(04)**

(B) Solve : $[D^4 + 16]\,y = 0$. **(03)**

(C) Solve : $[D^2 - 1]\,y = \cos x \cosh x$. **(03)**

Que – 6 **Attempt any two** **(10)**

(A) A microchip company has two machines that produce the chips. Machine 1 produce 65% of the chips but 5% of its chips are defective. Machine 2 produce 35% of the chips but 15% of its chips are defective. A chip is selected at random and found to be defective. what is the probability that it came from machine 1 .

(B) Define Z – transform. Prove that : (i) $Z(\cos n\theta) = \frac{z(z - \cos\theta)}{z^2 - 2z\cos\theta + 1}$

(ii) $Z(\sin n\theta) = \frac{z\sin\theta}{z^2 - 2z\cos\theta + 1}$

(C) Prove that : (i) $Z(a^n) = \frac{z}{z - a}$ (ii) $Z(n^p) = (-z)\frac{d}{dz}\{Z(n^{p-1})\}$ where $p \in Z^+$

END OF PAPER