Seat No. ______________

Ganpat University

B. Tech Semester – III (EC)Regular Examination Nov – Dec 2014

Subject : (2HS301) Engineering Mathematics -III

Time: 3 hrs. Marks: 70

1. All questions are compulsory.
2. Write answer of each section in separate answer books.
3. Figures to the right indicate marks of questions.

Section – I

Que: 1

(A) If $L\{f(t)\} = \overline{f}(s)$ then Prove that $L\{t^n f(t)\} = (-1)^n \frac{d^n}{ds^n}\{\overline{f}(s)\}$ [4]

(B) Find : (1) $L\{e^{-t}\cos 5t \cos t\}$ (2) $L\{t e^{-t} \sinh t\}$ [4]

(C) State Convolution theorem and apply it to evaluate $L^{-1}\left\{\frac{1}{(s^2+a^2)^2}\right\}$ [4]

OR

Que: 1

(A) Evaluate : (1) $L\left\{\frac{1-e^{2t}}{t}\right\}$ (2) $L^{-1}\left\{\frac{3s-2}{s^2-4s+20}\right\}$ [4]

(B) Find $L^{-1}\left\{\log\left(\frac{s-4}{s+7}\right)\right\}$ [4]

(C) Solve : $\frac{dy}{dt} - 4y = 2e^{2t} + e^{4t}$; where $y(0) = 0$. [4]

Que: 2

(A) Find a Fourier series for the function $f(x) = x - x^2$; $[-\pi, \pi]$ [4]

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 $f(x) = 1 + \sin x$; $-1 \le x \le 1$ [4]

(C) Find a Fourier series for the f^{ns} $f(x) = e^{-x}$; $0 < x < 2\pi$ [3]

OR

Que: 2

(A) Expand $f(x) = \sqrt{1-\cos 2x}$ as a Fourier series for $[0, 2\pi]$ [4]

(B) Obtain a Fourier series for the f^{ns} $f(x)$ defined as [4]

$$f(x) = \begin{cases} 1 + \frac{2x}{\pi} \ ; & -\pi \le x \le 0 \\ 1 - \frac{2x}{\pi} \ ; & 0 \le x \le \pi \end{cases}$$

(C) Obtain Half range Cosine series for $f(x) = \pi - x \ ; \ [0, \pi]$ [3]

Que: 3 Attempt any Three

(A) If $\emptyset = x^3 + y^3 + z^3 - 3xyz$ Then Prove that : $r \cdot \nabla\emptyset = 0$ [4]

(B) Find the Directional derivative of $f(x,y,z) = x^2yz + 4xz^2$ at $(1,-2,-1)$ in the direction of the vector $2I - J - 2K$. [4]

(C) Show that $\bar{F} = (2xy\,e^z)\,i + (x^2 e^z)\,j + (x^2 y\,e^z)\,k$ is ir – rotational also find a corresponding scalar point function $\bar{F}$ s.t. $\bar{F} = \nabla\emptyset$. [4]

(D) Prove that : $\text{div.}(\text{grad. } r^n) = n(n+1)\,r^{n-2}$. [4]

Section – II

Que: 4

(A) Check the analyticity of (i) $f(z) = |z|^2$ (ii) $f(z) = z^3$ [4]

(B) If $w = T_1(z) = \frac{z-2}{z+3}$ & $w = T_2(z) = \frac{z}{z+2}$ then find fixed points for T_1 and T_2. [4]

(C) State and prove Cauchy's theorem for contour integration. [4]

OR

Que: 4

(A) Evaluate $\oint_C \frac{e^{3z}}{(z-1)(z-2)}\,dz$ where $C: |z| = 3$ [4]

(B) Find $\int_C |z|^2\,dz$ along the sides of squares with vertices $(0,0), (1,0), (1,1)$ & $(0,1)$ [4]

(C) Determine the analytic function whose real part is $e^x \cos y$. [4]

Que: 5

(A) Apply Newton's forward formula for finding y at x = 82 for given data [4]

x	80	85	90	95	100
y = f(x)	5026	5674	6361	7088	7854

(B) Use Lagrange's formula for finding cubic polynomial for given data. [3]

x	−1	0	1	3
y = f(x)	2	1	0	−1

(C) Find first and second order derivative at x = 1.2 for following data. [4]

x	1.0	1.2	1.4	1.6	1.8	2.0
y = f(x)	0	0.128	0.544	1.296	2.432	4.00

OR

Que: 5

(A) Evaluate with $h = 1$ (i) $\Delta(\log f(x))$ (ii) $\frac{\Delta^2(x^3)}{E(x^3)}$ [5]

(B) Solve the following defference equations. [6]

(1) $u_{n+2} - 2u_{n+1} + 6u_n = 4$ (2) $u_{n+2} - 2u_{n+1} + u_n = n \cdot 2^n$

Que: 6 Attempt any Three

(A) Using Bisection method find real root of $x^3 - 3x - 5 = 0$ in $(2, 3)$ upto fifth approximation [4]

(B) Use Euler's method to solve $y' = x + y^2$, where $y(0) = 1$ find $y(0.5)$ with $h = 0.1$ [4]

(C) Evaluate $\sqrt{38}$ correct upto three decimal places using N – R Method. [4]

(D) Solve: $2x + y + z = 10$, $3x + 2y + 3z = 18$, $x + 4y + 9z = 16$ by Gauss elimination method. [4]

End of Paper