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S. Y. B.TECH. (E&TC ENGINEERING) (SEMESTER – III)

COURSE NAME: ENGINEERING MATHEMATICS III

COURSE CODE: ES20181ET

(PATTERN 2018)

Time: [2 Hours] [Max. Marks: 50]

(*) Instructions to candidates:

1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of scientific calculator is allowed.
4) Assume suitable data where ever required.

Q.1 Attempt any **one**

a) Solve the following differential equation $\frac{d^2y}{dx^2}-4\frac{dy}{dx}+4y=xe^{2x}\cos 2x$ [4]

b) Solve the following differential equation $x^2\frac{d^2y}{dx^2}-3x\frac{dy}{dx}+5y=x^2\sin(\log x)$ [4]

Q.2 Attempt any **one**

a) Find Z Transform of $f(k)=k3^k \ ,k\geq 0$ [4]

b) Find Fourier Transform of $f(x)=\begin{cases}1-x^2 & |x|\leq 1\\ 0 & |x|\geq 1\end{cases}$ [4]

Q.3 Attempt any **one**

a) Given that $\frac{dy}{dx}=\frac{y-x}{y+x}$ with boundary conditions y (0) =1, find approximately y for x=0.1 by modified Euler's method, perform two iterations. [6]

b) Apply Runge-Kutta Fourth order method to find an approximate value of y when x=0.2, Given that $\frac{dy}{dx}=\frac{y^2-x^2}{y^2+x^2}$ and y=1 when x=0. [6]

Q.4 Attempt any **one**

a) Show that the function $u=x^4-6x^2y^2+y^4$ is harmonic, Find harmonic conjugate 'v' of u such that f(z)=u +iv is analytic function, hence determine analytic function f(z) in terms of z.&

Evaluate $\oint_C \frac{z+2}{z^2+1}dz$, where 'C' is the contour $|z-i|=\frac{1}{2}$ [10]

b) Apply Residue Theorem to evaluate $\oint_C \frac{z^3-5}{(z+1)^2(z-2)}dz$, where 'C' is the circle |z|=3.

Find the Bilinear transformation which maps the points –i , 0 , 2+i of the Z- plane on to the points 0, -2i , 4 of the W- plane. [10]

Q.5 Attempt any **one**

a) Define Linearly dependent and independent vectors, Basis and dimensions of the vector space and hence show that the following set of vectors $S=\{(4,2,1),(2,1,0),(2,0,1)\}$ forms a basis to the vector space V= $\Re^3$ .also find dimensions of given vector space. [13]

b) Define Subspace and hence show that $W=\left\{\begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix} / a,b\in\Re\right\}$ is subspace of the vector space V = set of all 2 X 2 matrices

Using Gramsmidtorthogonalization process find set of orthogonal vectors from the set S={ (2,1,0), (4,0,1) (0,1,3)} . [13]

Q.6 Attempt any **one**

a) Define algebraic multiplicity and geometric multiplicity of the Eigen value and hence find algebraic multiplicity and geometric multiplicity of all Eigen values of the following matrix

$$A=\begin{bmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{bmatrix}$$ [13]

b) Using Eigen valuesEigen vectors solve the following differential equations simultaneously

$$\frac{dx}{dt}=x+y \quad , \qquad x(0)=0$$

$$\frac{dy}{dt}=x+y+e^{3t} \quad , \quad y(0)=0$$ [13]