Hemchandracharya North Gujarat University, Patan

B.E. SEMESTER – III (IT)

IT301: MATHEMATICS-III

Teaching Scheme		Examination Scheme	
Theory	03 Hrs/Week	Theory	100 Marks
Tutorial	02 Hrs/Week	Practical	-
Practical	-	Term work	-
Total	05 Hrs/Week	Total	100 Marks

1. **First order ODE**: Methods for solving them, homogeneous equations, exactness, methods for finding integrating factors, Linear and Bernoulli's equation.
2. **Higher order ODE:** Linear ODEs (generalities) complimentary function as and particular int egrals, linear dependence and independence of functions, Wronskians, Abel -Liouville formula, use of a known solution (for reduction of order) method of variation of parameter.
3. Linear ODEs with constant coefficient and the Cauchy Euler equation. The cha racteristic polynomial and indicial polynomial, discussion of the case of complex roots and repeated roots, extracting the real form of the solution via Euler's formula $e^{i\Theta} = \cos\theta + i \sin\theta$, method of undetermined coefficient for finding the particular integral for special right hand sides. (forcing functions) both for constant coefficient ODEs as well as Cauchy Euler ODEs.
4. Beta Gamma functions and their basic properti es, statement of Euler's reflection formula, duplication formula via beta gamma.
5. **Laplace transforms**: Definition of functions of exponential type with examples. Definition of the Laplace transform and its basic properties as well as examples of Laplace transforms of exponential function, polynomials and trigonometric functions. Statement of the Riemann Lebesgue lemma. Finding the inverse transform. Laplace transform of $d^n y/dt^n$ and $t^n y(t)$ Heaviside unit step function and shifting theorems. Convolution and the convolutions theorem. Beta gamma identity. Use of Laplace transform for solving IVP for ODEs and systems of ODEs. Computing certain important integrals via Laplace transforms.
6. Series solution of ODEs, Illustrative examples as the equations of Leg endre, Tchebychev etc., Legendre polynomials, their Orthogonality and completeness.
7. Ordinary differential equations with regular singular points and the method of Frobenious. Detailed discussion of Bessel's equations and Bessels' functions of first kin d only. Basic properties of Jp(x) , the recurrence relation between $J_{p-1}(x)$, $J_p(x)$ and $J_{p+1}(x)$. Integral representation of $J_n(x)$ (where n is a non negative integer).
8. Fourier series and Fourier transforms Basic formulae in Fourier series. Statement of the theorem on pointwise convergence of Fourier series. Parsevals formula (statement only) and Bessel's inequality with examples. Mean convergence of Fourier series. Fourier transforms and its basic properties. Fourier transform of the Gaussian and the Fou rier inversion theorem (statement only). Riemann Lebesgue lemma for Fourier series and Fourier transforms (statement only).
9. Basic partial differential equations of mathematical physics and their origins (vibrating strings, vibrating membrances heat conduction in solids etc.). Solving PDEs via the method of separation of variables. The Laplace operator in cylindrical and spherical polar coordinates. Brief discussion of Fourier Bessel series. Solution via Fourier series/Fourier -Bessel series for rectangular and circular domains in R^2 and spherical and cylindrical domains in R^3.

Reference Books:

1. E.Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley (1999).
2. W. E. Boyce and R. DiPrima, Elementary Differential Equations (8th Ed ition), John Wiley (2005).
3. R. V. Churchill and J. W. Brown, Fourier series and boundary value problems (7th Edition), McGraw - Hill (2006).
4. T.M.Apostol, Calculus, Volume -2 (2nd Edition), Wiley Eastern, 1980