LOK JAGRUTI UNIVERSITY (LJU)

INSTITUTE OF ENGINEERING & TECHNOLOGY

Department of Mechanical Engineering (710)

Bachelor of Technology (B.Tech.) – Semester – III

Course Code:	**017101391**
Course Name:	**Mathematics-III**
Category of Course:	Basic Science Course (BSC)
Prerequisite Course:	Mathematics 1(017101191), Mathematics 2 (017101291)

Teaching Scheme				
Lecture (L)	**Tutorial (T)**	**Practical (P)**	**Credit**	**Total Hours**
3	**2**	**0**	**5**	**50**

Syllabus

Unit No.	Topic	Prerequisite Topic	Successive Topic	Teaching Hours
01	**Interpolation**			**5 (10%)**
	1.1 Finite differences	---	Use of steam tables and Mollier's chart (017103301 -Unit-1.3). Carnot vapor cycle(017103301 -Unit-7.1)	
	1.2 Forward, backward and central operators	---		
	1.3 Interpolation by polynomials: newton forward and backward interpolation formulae	---		
	1.4 Stirling's central difference	---		
	1.5 Newton's divided difference formulae	---		
	1.6 Lagrange's interpolation formulae for unequal interval	---		
02	**Numerical Integration**			**3 (6%)**
	2.1 Newton-cotes formulae	---	---	
	2.2 Trapezoidal and Simpson's formulae	---	---	
	2.3 Gaussian-quadrature formulae	---	---	
03	**Solution of a System of Linear Equations**			**4 (8%)**
	3.1 Gauss elimination and partial pivoting	---	---	
	3.2 Gauss-Jacobi method	---	---	
	3.3 Gauss-Seidel method	---	---	
04	**Roots of Algebraic and Transcendental Equations**			**4 (8%)**
	4.1 Bisection method	---	---	
	4.2 False position method	---	---	
	4.3 Secant method	---	---	

	4.4 Newton-Raphson methods	---	---	
05	**Numerical Solution of Ordinary Differential Equations**			**4 (8%)**
	5.1 Euler method	---	---	
	5.2 Modified Euler method	---	---	
	5.3 Runge-Kutta methods (Second and Fourth order)	---	---	
06	**First Order Ordinary Differential Equations**			**6 (12%)**
	6.1 Geometric meaning of y' = f(x,y) direction fields	---	Euler's equation of motion along a stream line(017103491-Unit-5.2) Continuity of flow, continuity equations for 2-D and 3-D flow in Cartesian coordinates of system(017103491-Unit-9.3) Flow of viscous fluid through circular pipe- Hagen Poiseuille formula(017103491-Unit-10.2)	
	6.2 Exact differential equations and integrating factor	Basic integration (017101191 -Unit-03), Partial derivatives (017101191-Unit-06)		
	6.3 Linear differential equations	Basic integration (017101191-Unit-03)		
	6.4 Bernoulli equations			
07	**Higher Order Ordinary Differential Equations**			**8 (16%)**
	7.1 Linear differential equations of second and higher order	---	---	
	7.2 Homogeneous linear differential equations of higher order	---	---	
	7.3 Higher order non-homogeneous equations	---	---	
	7.4 Solution by undetermined coefficients	Basic differentiation (017101191-Unit-03)	---	
	7.5 Solution by variation of parameters	Basic differentiation and integration (017101191-Unit-03)	---	
	7.6 Solution by [1/f(D)] r(x) method for finding particular integral.	---	---	
	7.7 Ordinary differential equations with variable coefficient (Reducible to constant coefficient) (Cauchy and Legendre differential Equation)	Solution by undetermined coefficients (017101391-Unit-7.4), Solution by [1/f(D)] r(x) method for finding particular integral (017101391-Unit-7.6)	---	
08	**Modeling of Ordinary Differential Equations**			**4 (8%)**
	8.1 Orthogonal trajectories of curves	First order ordinary differential equations (017101391-Unit-6.1 to 6.4)	---	
	8.2 Oscillations resonance	---	---	
	8.3 Modeling: Mechanical vibration system	Higher order ordinary differential	---	

	(Undamped Oscillations)	equations(017101191-Unit-07), Oscillations resonance (017101191-Unit-8.2)		
09	**Partial Differential Equations**			**8 (16%)**
	9.1 Formation of partial differential equations	Partial derivatives (017101191Unit-06)	---	
	9.2 First order linear partial differential equations	First order ordinary differential equations (017101191-Unit-06)	---	
	9.3 First order non-linear partial differential equations			
	9.4 Homogeneous linear partial differential equations with constant coefficients	---	---	
	9.5 Non-homogeneous linear partial differential equations with constant coefficients	Homogeneous linear partial differential equations with constant coefficients (017101191-Unit-9.4)	---	
	9.6 Classification of second order linear partial differential equations	---	---	
10	**Application of Partial Differential Equations**			**4 (8%)**
	10.1 Method of separation of variables	First order ordinary differential equations(017101191-Unit-06), Homogeneous linear differential equations of higher order (017101191-Unit-7.2)	---	
	10.2 One dimensional wave equation	Method of separation of variables (017101191-Unit-10.1), Half range fourier series (004-Unit-02)	---	
	10.3 One dimensional heat equation			
	10.4 Laplace equations	---	---	

Proposed Theory + Practical Evaluation Scheme by Academicians
(% Weightage Category Wise and it's Marks Distribution)

L :	3	T:	2	P:	0

Note : In Theory Group, Total 4 Test (T1+T2+T3+T4) will be conducted for each subject.
Each Test will be of 25 Marks.
Each Test Syllabus Weightage: Range should be 20% - 30%

Group (Theory or Practical)	Group (Theory or Practical) Credit	Total Subject Credit	Category	% Weightage	Marks Weightage

Theory	5	5	MCQ	15%	15
Theory			Theory Descriptive	0%	0
Theory			Formulas and Derivation	0%	0
Theory			Numerical	85%	85
Expected Theory %	**100%**		**Calculated Theory %**	**100%**	**100**
Practical	0		Individual Project	0%	0
Practical			Group Project	0%	0
Practical			Internal Practical Evaluation (IPE)	0%	0
Practical			Viva	0%	0
Practical			Seminar	0%	0
Expected Practical %	**0%**		**Calculated Practical %**	**0%**	**0**
Overall %	**100%**			**100%**	**100**

Course Outcome	
	Upon completion of the course students will be able to
1	Apply numerical methods for various mathematical operations and tasks, such as interpolation, integration, the solution of linear equations.
2	Understand and Apply common numerical analysis and how they are used to obtain approximate solutions for Algebraic, Transcendental and Differential equation and solutions of first order ordinary differential equations
3	Evaluate mathematical methods for the solutions of higher order ordinary differential equations and solve some engineering problems related to oscillation resonance, orthogonal trajectories and mechanical vibration.
4	Form and solve first order linear and nonlinear partial differential equations, apply the various methods to solve higher order partial differential equations, modeling and solve some engineering problems related to Heat flows, Wave equation and Laplace equation

Suggested Reference Books	
1	Introduction to Numerical Analysis (2nd Edition), C.E. Froberg, Addison-Wesley,1981
2	Numerical Methods for Engineers, Chapra S.C, Canale, R P, Tata McGraw Hill, 2003
3	Elementary Numerical Analysis-An Algorithmic Approach (3rd Edition), S. D. Conte and Carl de Boor, McGraw-Hill, 1980
4	Advanced Engineering Mathematics, Erwin Kreysig, Wiley Publication.
5	Engineering Mathematics Vol 2, by Baburam, Pearson
6	Elementary Differential Equations (8th Edition), W. E. Boyce and R. DiPrima, John Wiley (2005)

List of Open Source Software/Learning website	
1	https://nptel.ac.in