DEPARTMENT OF MATHEMATICS
FACULTY OF ENGINERING AND TECHNOLOGY
SRM UNIVERSITY

MA0201A- NUMERICAL METHODS (For Bioinformatics)

SEMESTER III **ACADEMIC YEAR: 2013-2014**

LECTURE SCHEME / PLAN

The objective is to equip the students of Engineering and Technology, the knowledge of Mathematics and its applications so as to enable them to apply them for solving real world problems.

The list of instructions (provided below) may be followed by a faculty relating to his/her own schedule includes warm-up period, controlled/free practice, and the respective feedback of the classes who handle. The lesson plan has been formulated based on high quality learning outcomes and the expected outcomes are as follows

Each subject must have a minimum of 56 hours, which in turn, 45 hours for lecture and rest of the hours for tutorials. The faculty has to pay more attention in insisting the students to have : 95 % class attendance.

UNIT I: CURVE FITTING & NUMERICAL SOLUTION OF EQUATIONS			
Lect. No	**Lesson schedule**	**Learning outcomes**	**Cumulative hours**
L 1.1	Warm-up session/Motivation About the previous semester and their performance.	Students will be motivated	1
L1.2	Introduction to curve fitting and its applications/uses and various methods of curve fitting for different types of data. . Curve fitting by the method of least squares. Definition, Fitting a straight line. Problems solving.	Students will get an idea/advantages of curve fitting and problem solving techniques	2
L.1.3	Fitting a parabola, Solving numerical problems.	One applies the knowledge in solving Problems.	3 ,4
L.1.4	To find out the best fit for a given numerical data	A learner will be able to compare straight line and parabola.	5
L.1.5	Calculation of sum of squares of the residuals, Error calculation during the curve fitting Solving numerical problems	Student will understand the concept of fitting a curve more effectively	6
L.1.6	Fitting an exponential curve Fitting a curve of the form $y = ax^b$ .Solving numerical problems	Learner will learn the transforming technique to convert a complicated curve into a simpler curve and solve the problems by afore said techniques	7

L.1.7	Fitting a curve of the form $y = ab^x$ Fitting a curve of the form $y = ae^{bx}$ Solving numerical problems Solving numerical problems	Will get an idea about Fitting of an exponential curve. He will be able to compare different types of curves	8
L.1.8	Introduction : solving linear algebraic and transcendental equations by various methods (Direct /Iterative) Newton Raphson method Solving numerical problems	To be familiarized with the methods , fundamental phenomena	9,10
L.1.9	Solving the system of linear algebraic equations by direct method : Gauss elimination method. Solving numerical problems	Students will get a knowledge of solving the system of equations by one of the easiest technique	11
L.1.10	Finding Inverse of a given matrix by Gauss elimination method. Solving numerical problems	Learner will understand the concept of finding inverse of a given matrix by another simplest way.	12
L.1.11	Solving the system of linear algebraic equations by Iterative methods: i) Gauss Jacobi method. ii) Gauss Seidel method. Solving numerical problems	One applies the knowledge of Solving the system of equations numerically to real world problems	13
CYCLE TEST – I :		**DATE: 29.07.2013**	
UNIT II: FINITE DIFFERENCES & INTERPOLATION			
L.2.1	Introduction to First & Higher order Differences-Forward &backward differences and operators	Learners will understand the basic principles of operators	15
L.2.2	Difference between the operators/relation between the operators, Properties of operators	Knowledge in understanding the differences for future topics	16
L.2.3	Introduction to Interpolation: Newton Gregory Forward & Backward interpolation formulae for equally spaced intervals and its applications , Numerical problems	Recognize and visualize the methods of finding intermediate values of a given function from a given set of tabular values of that function.	17,18,19
L.2.4	Fitting a polynomial to the given data by the above methods and hence finding an intermediate value of the given data. Numerical problems	To learn the idea of finding the actual function of the given data	20
L.2.5	Newton's interpolation formulae-Divided differences-Divided Difference formula for unequal intervals . Numerical problems	One understand the difference between Forward /Backward difference and divided difference	21

L.2.6	Lagrange's Interpolation formula for unequal intervals. Numerical problems	A knowledge of the methods of Newton and Lagrange and understands to find unknown y for a given x	22
L2.7	Finding the actual polynomial of the given numerical data by Lagrange method, Newton's divided difference method Numerical problems	Understands the concept more clearly and gets an idea in applying different types of methods to find an unknown intermediate value	23
L.2.8	Inverse Interpolation: Lagrange's inverse formula. Numerical problems	To relate the Lagrange's and inverse Lagrange's methods and understands to find x for a given y	24
L.2.9	Tutorial	Students able to solve problems themselves	25
CYCLE TEST – II :			**DATE: 26.08.2013**
UNIT III: NUMERICAL DIFFERENTIATION & INTEGRATION			
L.3.1	Introduction : Newton's forward & backward Differences formulae to compute I st & higher order derivatives	Students get an idea of finding derivatives of a given function from a given set of tabular values at the origin, near the origin ,at the end point and near the end point	26, 27,28
L.3.2	Introduction : Numerical Integration-Trapezoidal rule Numerical problems	Learners will understand the concept of numerical integration of a definite integral for a given function from a given set of tabular values .	29
L.3.3	Simpson's one third rule Numerical problems	Able to compare this rule with the previous rule and understands the advantage of Simpson's rule.	30
L.3.4	Simpson's three eighth rule Numerical problems	Gets an idea of this rule for the kind of problems it is applicable	31
L.3.5	Tutorial	Students able to solve problems themselves	32
SURPRISE TEST			
UNIT IV: NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS			
L.4.1	Introduction: solving ordinary differential equations numerically. Solution by Taylor's Method Numerical problems	Provides the deeper understanding of solving ordinary differential equations by different types of methods. Tailor's method provides an idea of solving simple ordinary differential equations easily	33, 34
L.4.2	Euler's method Numerical problems	Understands the flexibility of Euler's method	35
L.4.3	Improved Euler's method Numerical problems	Accuracy is more than the previous methods	36
L.4.4	Modified Euler's method Numerical problems	This provides an idea of the best among the previous three methods	37
L.4.5	Runge-kutta method of fourth	Test and evaluate that this method is	38, 39

	order. Numerical problems	the best of the afore said methods.	
L.4.6	Milne's predictor corrector method . Numerical problems	Predicts the solution of a given problem and confirm it with its corrector value if it deviates applies the corrector again	40, 41
L.4.7	Adam Bash forth predictor corrector method Numerical problems	Understands the advantage of this method with Milne's method .	42
L.4.8	Tutorial	Students able to solve problems themselves	43
UNIT V: NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS			
L.5.1	Classification of p.d.e. of the second order	Able to classify different kinds of partial differential equations of second order	44
L.5.2	Laplace equation & its solution by Liebmann's process . Numerical problems	Comprehensive knowledge of solving Laplace equation By Liebmann's process. Knows about standard five point formula and diagonal five point formula.	45, 46, 47, 48
L.5.3	Solution of Poisson's equations. Numerical problems	One acquires enhanced knowledge of solving Poisson's equation numerically.	49
L.5.4	Solution of parabolic equations :Bender Schmidt method Numerical problems	Acquires the problem-solving skills of one dimensional heat equation numerically by finite difference scheme.	50, 51
L.5.5	Solution of parabolic equations Crank-Nicholson's method Numerical problems	Identifies the problem where this method is applicable in comparison with Bender Schmidt method	52, 53
L.5.6	Solution of hyperbolic equations Numerical problems	One applies the knowledge of solving two dimensional wave equation by finite difference scheme .	54, 55
L.5.7	Tutorial	Students able to solve problems themselves	56
MODEL EXAM		**23.10.2013 (Duration: 3 Hours)**	
LAST WORKING DAY : 1.11.2013			

REFERENCES

- Dr. M. K. Venkataraman, Numerical Methods in science & Engineering, National Publishing Co., 1999.
- S. S. Sastry, Introductory methods of Numerical Analysis, Prentice Hall of India, Pvt.Ltd. New Delhi, 2001.
- E. Balagurusamy, computer oriented statistical & numerical methods-Tata McGraw Hill, New Delhi, 2000.

- M. K. Jain, S. R. K. Iyengar and R. L. Jain, Numerical methods for scientific & Engineering Computation, Wiley Eastern Ltd., 1987.
- M. K. Jain, Numerical solution on Differential equations, Wiley, New York, 1979.
- P.Kandasamy etal. , Numerical methods, S. Chand & Co., New Delhi, 2003.

WEB BASED RESOURCES

http://www.the-science-lab.com/Math/

http://botw.org/top/Science/Math/

http://dir.yahoo.com/Science/Mathematics/

http://www.cms.caltech.edu/

http://www.en.wikipedia.org

Internal marks Total: 50

Internal marks split up: Cycle Test 1: 10 Marks Model Exam: 20 Marks

Cycle Test 2: 10 Marks Surprise Test: 5 marks

Attendance: 5 marks

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