DEPARTMENT OF PHYSICS

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I

Name of the programme and specialization	M.Sc. (Physics)		
Course Title	Numerical and Computational Methods		
Course Code	PH667	No. of Credits	3
Course code of Pre-requisite subject(s)	PH651 & PH652	-	-
Session	July 2019	Section (if applicable)	-
Name of Faculty	Dr. R. Sankaranarayanan	Department	Physics
E-mail	sankar@nitt.edu	Telephone No.	9442627604
Name of Course Coordinator(s) (if applicable)	-		
E-mail	sankar@nitt.edu	Telephone No.	0431-250-3609
Course Type	Core / ~~Elective~~		

SYLLABUS (Approved in BoS)

Roots of Equations
Computer arithmetic – mathematical preliminaries – computation of errors – secant method – Newton-Raphson method – rate of convergence – polynomial equation – complex equation.

Linear Algebra
Gauss-elimination method – pivoting – LU decomposition – inverse and determinant of a matrix – eigenvalue equation – Jacobi method – Power method – singular value decomposition.

Interpolation and Approximation
Lagrange interpolation – Newton's divided difference – finite difference methods – cubic spline – method of least squares: linear and nonlinear – Gram-Schmidt process – Legendre and Chebyshev polynomials.

Differentiation and Integration
Numerical differentiation by interpolation – method of finite differences – integration by trapezoidal rule and Simpson's rule – estimation of errors – composite methods – double integration.

Differential Equations
Initial and boundary value problems – Euler method – Runge-Kutta methods: second and fourth orders – finite difference method – shooting method – solutions of PDEs: elliptic, parabolic and

hyperbolic equations.

Text Books

1. S.S. Sastry, Introductory Methods of Numerical Analysis, Prentice-Hall of India (2005).
2. E. Kreyszig, Advanced Engineering Mathematics, 8th edition, Wiley India (2008).
3. M.K. Jain, S.R.K. Iyengar, R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International (1993).

Reference Books

1. W.H. Press, S.A. Teukolsky, W.T. Vetterling and B.P. Flannery, Numerical Recipes in C: The Art of Scientific Computing, Cambridge University Press (1992).
2. Samuel D. Conte and Carl de Boor, Elementary Numerical Analysis, 3rd edition, Tata McGraw-Hill (2010).

COURSE OBJECTIVES

To introduce various numerical and computational techniques useful to handle complex problems.

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes(PO)
Students will be equipped with necessary numerical and computational techniques to handle various physical problems, where exact solutions are not possible.	

COURSE PLAN – PART II

COURSE OVERVIEW

The course will be useful to solve complex mathematical problems using computers.

COURSE TEACHING AND LEARNING ACTIVITIES

S. No.	Week/Contact Hours	Topic	Mode of Delivery
1.	1 – 3 Weeks	Roots of Equations	Predominantly Chalk and talk. Supplemented with demonstration with Computer software like Mathematica/ MATLAB
2.	4 – 6 Weeks	Linear Algebra	
3.	7 – 9 Weeks	Interpolation and Approximation	
4.	10 – 12 Weeks	Differentiation and Integration	
5.	13 – 15 Weeks	Differential Equation	

COURSE ASSESSMENT METHODS (Shall range from 4 to 6)

S. No.	Mode of Assessment	Week/Date	Duration	% Weightage
1.	I Cycle Test	7th Week	1 Hour	20

2.	I Assignment	8th Week	-	10
3.	II Cycle Test	12th Week	1 Hour	20
4.	II Assignment	13th Week	-	10
CPA	Compensation Assessment	15th Week	1 Hour	Refer Course Policy
4.	Semester Examination	As per Institute Calender	$2\frac{1}{2}$ Hours	40
			Total	100

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

As per the Institute practice

COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, academic honesty and plagiarism etc.)

- Faculty can be contacted through email/phone/in-person for discussion, counseling and mentoring.
- Those who are absent in I or/and II Cycle Test on genuine grounds shall be allowed to appear for compensation assessment with the maximum weightage of 20%.
- At least 75% attendance is mandatory. A maximum of 10% shall be relaxed under ON DUTY. Students with less than 65% of attendance shall be prevented from writing the final assessment (semester examination) and shall be awarded with 'V' grade.
- Relative grades will be awarded based on gap theory.
- Passing minimum is 40 marks.
- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during any assessments will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- Departmental disciplinary committee including course faculty member, PAC chairperson and HoD, as members shall verify the facts of reported malpractice and award punishment if the student is found guilty. A report shall be submitted to the academic office.

ADDITIONAL COURSE INFORMATION

Problems on each topic shall be obtained from the webpage of faculty from time to time. Students are encouraged to have academic interaction on mutual convenience.

FOR APPROVAL

Course Faculty R. Sankaranaray 22/8/19   CC-Chairperson R. Nagalak 26/8/19

HOD 26/8/2019