DEPARTMENT OF MATHEMATICS
NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Name of the programme and specialization	**M.Tech. / Power Systems**		
Course Title	**Advanced Engineering Mathematics**		
Course Code	**MA603**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	**NIL**		
Session	**July 2020**	**Section (if, applicable)**	**-**
Name of Faculty	**Dr. Kamalika Roy**	**Department**	**Mathematics**
Email	**kamalikaroy@nitt.edu**	**Telephone No.**	**9775428757**
Name of Course Coordinator(s) (if, applicable)	**-**		
E-mail	**-**	**Telephone No.**	**-**
Course Type	☑ **Core course** ☐ **Elective course**		

Syllabus (approved in BoS)

Introduction to Linear Programming Techniques - Unconstrained one dimensional optimization techniques - Necessary and sufficient conditions - Unrestricted search methods - Fibonacci and Golden section method.

Unconstrained n dimensional optimization techniques – Descent methods - Steepest descent, conjugate gradient. Constrained optimization Techniques - Necessary and sufficient conditions - Equality and inequality constraints - Kuhn-Tucker conditions - Gradient projection method.

Numerical Solution of Ordinary Differential Equations - Euler's method - Euler's modified method - Taylor's method and Runge-Kutta method for simultaneous equations and 2nd order equations - Multistep methods - Milne's and Adams' methods.

Random variable – Two dimensional random variables – standard probability distributions – Binomial, Poisson and normal distributions - moment generating function.

Sampling distributions - confidence interval estimation of population parameters - testing of hypotheses - Large sample tests for mean and proportion - t-test, F-test and Chi-square test - curve fitting - method of least squares.

ESSENTIAL READINGS : Textbooks, reference books Website addresses, journals, etc

1. Rao,S.S., 'Optimization :Theory and Application', Wiley Eastern Press, 2nd edition 1984.
2. Taha, H.A.,'Operations Research – An Introduction', Prentice Hall of India,2003.
3. Jain, M.K., Iyengar, S.R., and Jain, R.K., 'Numerical Methods for Scientific and Engineering Computation', Wiley Eastern, 1992.
4. Bowker and Liberman, Engineering Statistics, Prentice - Hall, 1972.
5. S. C. Gupta, Fundamentals of Statistics, Himalaya Publishing House, Seventh Revised Edition, 2009.
6. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons, Eleventh Revised Edition, 2014.

COURSE OBJECTIVES

1. To study essential optimization techniques to solve linear programming problems and unconstrained one dimensional optimization problems.
2. To learn Kuhn-Tucker conditions for constrained optimization problems and methods to solve multidimensional optimization problems.
3. To discuss the numerical methods to solve the ordinary differential equations.
4. To introduce random variables and find moment generating function of standard probability distributions.
5. To discuss the concepts of Sampling Distribution and Testing of hypotheses.

Mapping of course outcomes (COs) with programme outcomes (POs)

Course Outcomes	**Aligned Programme Outcomes (PO)**
On completion of this course students will be able to: 1. solve linear programming problems and unconstrained one dimensional optimization problems. 2. Use Kuhn-Tucker conditions to solve constrained optimization problems and apply Steepest Descent and Conjugate methods to solve multidimensional optimization problems. 3. Solve ordinary differential equations numerically using Euler's, Taylor's and Runge-Kutta methods. 4. Find moment generating function of Binomial, Poisson and Normal distributions. 5. Apply t-test, F-test and Chi-square test to analyze population means.	(i) Identify, formulate and analyze engineering problems through technical literature, and (ii) apply knowledge of mathematics to arrive at solutions.

COURSE PLAN – PART II

COURSE OVERVIEW

1. Introduce linear programming problems and unconstrained one dimensional optimization problems and study Fibonacci and Golden section methods to solve the problems.
2. Study Kuhn-Tucker conditions for constrained optimization problems and Steepest Descent and Conjugate methods to solve multidimensional optimization problem.
3. Discuss Euler's, Taylor's and Runge-Kutta numerical methods to solve ordinary differential equations.
4. Explain Random variable and finding moment generating function of Binomial, Poisson and Normal Distributions.
5. Learn statistical methods related to sampling distributions and testing of hypotheses.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1.	1st & 2nd week	Introduction to Linear Programming Techniques - Unconstrained one dimensional optimization techniques - Necessary and sufficient conditions - Unrestricted search methods - Fibonacci and Golden section method.	Online class
2.	3rd, 4th ,5th week	Unconstrained n dimensional optimization techniques – Descent methods - Steepest descent, conjugate gradient. Constrained optimization Techniques - Necessary and sufficient conditions - Equality and inequality constraints - Kuhn-Tucker conditions - Gradient projection method.	Online class
3.	6th Week	**Assessment - 1**	
4.	7th& 8thweek	Numerical Solution of Ordinary Differential Equations - Euler's method - Euler's modified method - Taylor's method and Runge-Kutta method for simultaneous equations and 2nd order equations - Multistep methods - Milne's and Adams' methods.	Online class
5.	9th &10th week	Random variable – Two dimensional random variables – standard probability distributions – Binomial, Poisson and normal distributions - moment generating function.	Online class
6.	11th Week	**Assessment - 2**	

7.	11th & 12th Week	Sampling distributions - confidence interval estimation of population parameters - testing of hypotheses - Large sample tests for mean and proportion - t-test, F-test and Chi-square test - curve fitting - method of least squares.	Online class
8.	After 12th Week	**Assessment – 4** **(**End-Semester Exam)	

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week / Date	Duration	% Weightage
1.	Assessment- 1 (online exam)	6th Week	1.5 hours	25%
2.	Assessment -2 (online exam)	11th Week	1.5 hours	25%
3.	Assessment-3 (Assignments)		Will be announced while distributing the assigments	20%
CPA	Compensation Assessment (online exam)	12th Week	1.5 hours	25%
4.	Final Assessment (Written Exam)	After 12th Week	3 hours	30%

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

1. Feedback from the students during class committee meetings and in the class after the assessments 1 and 2.
2. Online feedback through questionnaire before the final assessment.
3. Student knowledge about the topics covered in this course will be judged through marks obtained in examination.

COURSE POLICY (preferred mode of correspondence with students, compensation assessment policy to be specified)

MODE OF CORRESPONDENCE (email / phone etc)

Students can meet the course faculty for clarifying doubts through E-mail (kamalikaroy@nitt.edu) or mobile (9775428757).

COMPENSATION ASSESSMENT POLICY

a) Students who have missed either Assessment-1 or Assessment-2 can register for Compensation Assessment which shall be conducted soon after the completion of the Assessment-2 and before the final assessment.

b) The Compensation Assessment shall be conducted for 25 marks comprising the syllabus of both Assessment -1 & Assessment - 2.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- **At least 75% attendance in each course is mandatory.**
- **A maximum of 10% shall be allowed under On Duty (OD) category.**
- Students with **less than 65% of attendance** shall be prevented from writing the final assessment and **shall be awarded 'V' grade.**

ACADEMIC DISHONESTY & PLAGIARISM

- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HOD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

FOR APPROVAL

Kamalika Roy

24.9.2020

Course Faculty

Dr. Ankur Singh Rana

CC-Chairperson

HOD