DEPARTMENT OF PRODUCTION ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Course Title	**ADVANCED OPTIMIZATION TECHNIQUES**		
Course Code	**PR 669**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	-	-	-
Session	**January 2018**	**Section (if, applicable)**	-
Name of Faculty	**Dr.K.Panneerselvam**	**Department**	**Production Engineering**
Email	kps@nitt.edu	**Telephone No.**	**04312503515**
Name of Course Coordinator(s) (if, applicable)	-		
E-mail	-	**Telephone No.**	-
Course Type	☐ **Core course**	☑ **Elective course**	

Syllabus (approved in BoS)

PR669 ADVANCED OPTIMIZATION TECHNIQUES

L	T	P	C
3	0	0	3

Introduction-Engineering Applications of Optimization-Statement of an Optimization Problem-Classification of Optimization Problems - Optimization Techniques

Classical Optimization Techniques- Single-Variable Optimization - Multivariable Optimization with No Constraints - Multivariable Optimization with Equality Constraints- Multivariable Optimization with Inequality Constraints- Transportation

Nonlinear Programming I: 1D Minimization Methods - Unimodal Function, Elimination Methods-Unrestricted Search, Exhaustive, Dichotomous Search- Interval Halving Method-Fibonacci Method- Golden Section Method, Interpolation Methods -Quadratic, Cubic Interpolation Method - Direct Root Methods -Newton Method-Quasi-Newton, Secant Method

Nonlinear Programming II: Unconstrained Optimization Techniques -Direct Search Methods - Indirect Search (Descent) Methods, Non-linear Programming III: Constrained Optimization Techniques- Direct Methods-Indirect Methods, Geometric Programming, Dynamic Programming, Integer Programming -Integer Linear Programming - Stochastic Programming.

Modern Methods of Optimization - Genetic Algorithms -Simulated Annealing -Particle Swarm Optimization -Ant Colony Optimization -Optimization of Fuzzy Systems - Neural-Network-Based Optimization, Practical Aspects of Optimization

References

1.Kalyanmoy Deb, "Optimization for Engineering design – algorithms & examples", PHI, New Delhi, 1995.
2.SingiresuS.Rao, "Engineering optimization – Theory and practices", John Wiley and Sons, 1998.
3.Garfinkel, R.S. and Nemhauser, G.L., "Integer programming", John Wiley & Sons, 1972.

https://www.nitt.edu/home/academics/curriculum/M.Tech-PR-IEM-2016.pdf

COURSE OBJECTIVES

1. Study and understand the principles of Traditional optimization techniques and Non Traditional optimization techniques.
2. Apply the concept of Traditional optimization techniques and Non Traditional optimization techniques in practical enginering applications for optimization.

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)
CO1. Describe the Traditional optimization techniques and apply it in engineering field. CO2. Distinguish between the Non Traditional optimization techniques and apply it in engineering field.	

COURSE OUTCOMES	Program Outcomes (PO)												
	1	2	3	4	5	6	7	8	9	10	11		
CO1	√	√	√	√	√	√	√	√	√		√		
CO2	√	√	√	√	√	√	√	√	√		√		

PROGRAMME OUTCOMES (POs)

M.Tech. – Industrial Engineering &Management		
	Attributes	**Programme Outcomes** On successful completion of the programme, the graduates will be able to
1	Scholarship of Knowledge	Acquire in-depth knowledge of industrial engineering with an ability to define, evaluate, analyse and synthesize existing and new knowledge.
2	Critical Thinking	Analyse complex real time industrial engineering problems critically, apply independent judgement for synthesizing information to make intellectual and/or creative advances for conducting research.
3	Problem Solving	Conceptualize and solve industrial engineering problems and evaluate potential solutions after considering economic and eco-friendly factors.
4	Research Skill	Develop scientific/technological knowledge in industrial engineering domain through literature review and design and analysis of experiments.
5	Usage of modern tools	Apply tools for modelling and simulation of complex system, life cycle assessment, ergonomic assessment, supply chain assessment and data analysis.
6	Collaborative and multi-disciplinary work	Perform collaborative-multidisciplinary industrial engineering research, through self-management and teamwork.
7	Project Management and Finance	Apply engineering and management principles to manage real time projects considering economical and financial factors.
8	Communication	Communicate with the engineering community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.
9	Life-long Learning	Recognize the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.
10	Ethical Practices and Social Responsibility	Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.
11	Independent and Reflective Learning	Observe and examine critically the outcomes of one's actions and make corrective measures subsequently, and learn from mistakes without depending on external feedback.

COURSE PLAN – PART II

COURSE OVERVIEW

This course is to teach the principles and application of Traditional optimization techniques and Non Traditional optimization techniques in such a way that the students can understand and use it in practical applications.

This course gives Overall view of introduction-Engineering Applications of Optimization Optimal problem formulation, Single value and multi-variable optimization algorithms. Non-linear programming -One-dimensional minimization, constrained and unconstrained optimization techniques, Integer linear and non-linear programming, Geometric programming. Non-traditional optimization -Genetic algorithms, PSO, Simulated annealing and ACO.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No	Week	Topic	Mode of Delivery
1.	Weeks :1	Introduction to Optimization - Historical Development , Engineering Applications of Optimization , Optimal problem formulation, Statement of an Optimization Problem - Design Vector - Design Constraints Constraint Surface -Objective Function- Objective Function Surfaces	C&T/PPT
2.	Weeks :2	Classification of Optimization Problems, Single-Variable Optimization, Multivariable Optimization with No Constraints	C&T/PPT
3.	Weeks :3	Multivariable Optimization with Equality Constraints , Multivariable Optimization with Inequality Constraints	C&T/PPT
4.	Weeks :4	NON TRADITIONAL ALGORITHM: Genetic Algorithms , Simulated Annealing	C&T/PPT
5.	Weeks :5	**Cycle Test-1**	
6.	Weeks :6	NON TRADITIONAL ALGORITHM: Particle Swarm Optimization, Ant Colony Optimization	C&T/PPT
7.	Weeks :7	ELIMINATION METHODS - Unrestricted Search -Dichotomous Search , Interval , Halving Method , Kuhn-Tucker conditions, Fibonacci Method- Golden Section Method	C&T/PPT
8.	Weeks :8	INTERPOLATION METHODS - Quadratic Interpolation Method , Cubic Interpolation Method , Direct Root Methods - Newton Method , Quasi-Newton Method - Secant Method	C&T/PPT
9.	Weeks :9	**Cycle Test-2**	
10.	Weeks :10	DIRECT SEARCH METHODS - Random Jumping Method - Simplex Method	
11.	Weeks :11	DIRECT METHODS :- Random Search Methods - Rosen's Gradient Projection Method	C&T/PPT
12.	Weeks :12	INDIRECT METHODS :- Transformation Techniques - Basic Approach of the Penalty Function Method	C&T/PPT
13.	Weeks :13	Interior Penalty Function Method - Convex Programming Problem - Exterior Penalty Function Method	C&T/PPT
14.	Weeks :14	Geometric Programming - Geometric Programming with Mixed Inequality Constraints	C&T/PPT
15.	Weeks :15	**Assignment**	
16.	Weeks :16	**Retest**	C&T/PPT
17.	Weeks :17	**End Semester Examinations**	C&T/PPT

C & T : Chalk and Talk PPT : Power Point

COURSE ASSESSMENT METHODS

S.No.	MODE OF ASSESSMENT	WEEK/DATE	DURATION	% WEIGHTAGE
1.	Cycle Test-1		60 Minutes	20
2.	Cycle Test-2		60 Minutes	20
3.	Assignment			10
4.	Retest		60 Minutes	20
5.	End Semester Examinations		180 Minutes	50

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

Mention the ways in which the feedback about the course is assessed and indicate the attainment also:

- Feedback from the students during class committee meetings
- Anonymous feedback through questionnaire (Mid of the semester & End of the semester)

MODE OF CORRESPONDENCE (email/ phone etc.)

1. All the students are advised to check their NITT WEBMAIL regularly. All the correspondence (schedule of classes schedule of assessment course material any other information regarding this course) will be done through their webmail only.
2. Queries (if required) may be emailed to me / contact me during 4.00 pm to 5.00 pm on Monday and Friday with prior intimation for any clarifications.

ATTENDANCE

Attendance will be taken by the course faculty in all the contact hours.

ACADEMIC HONESTY & PLAGIARISM

Copying in any form during assessments is considered as academic dishonesty and will attract suitable penalty.

ADDITIONAL COURSE INFORMATION

The faculty is available for consultation at times as per the intimation given by the faculty.

Queries may also be emailed to the Course Faculty directly at kps@nitt.edu

FOR APPROVAL

Course Faculty	CC Chairperson	HOD
11/1/18		