MOOC APPROVAL REQUEST

As per KTU B.Tech Regulations 2024, Section 17

KTU Course Code:	OEECT723
KTU Course Name:	Optimization Techniques
NPTEL Course Name:	Optimization from Fundamentals
Instructor:	Prof. Ankur A. Kulkarni
Institution:	IIT Bombay
Duration:	12 Weeks
Course ID:	noc26-ma46
Semester:	Jan-Apr 2026
Date:	December 02, 2025

This document contains:
1. KTU Course Syllabus (Complete)
2. NPTEL Course Details
3. Syllabus Comparison for 70% Match Verification

Submitted for approval as per R 17.5 of KTU B.Tech Regulations 2024.

SECTION A

KTU COURSE SYLLABUS

SEMESTER S7

OPTIMIZATION TECHNIQUES

Course Code	OEECT723	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:0:0:0	ESE Marks	60
Credits	3	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None/ (Course code)	Course Type	Theory

Course Objectives:

1. Enable the learner to formulate engineering minima/maxima problems as optimization problems
2. Enable the learner to deploy various constrained and unconstrained optimization algorithms to obtain the minima/maxima of engineering problems

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	Engineering application of Optimization – Statement of an Optimization problem–Classification, Review of basic calculus concepts –Stationary points; Functions of single and two variables; Convexity and concavity of functions –Definition of Global and Local optima – Optimality criteria, Linear programming methods for optimum design – Standard form of linear programming (LP) problem; Canonical form of LP problem; Simplex Method, Duality, Application of LPP models in engineering	9
2	Optimization algorithms for solving unconstrained nonlinear optimization problems – Search based techniques: Direct search: Fibonacci and golden section search , Hookes and Jeeves , Gradient based method: Newton's method	9

3	Optimization algorithms for solving constrained optimization problems– direct methods – penalty function methods, barrier method -Optimization of function of multiple variables subject to equality constraints; Lagrangian function– Inequality constrained techniques-KKT conditions-constrained steepest descent method	**9**
4	Modern methods of Optimization– Metaheuristic techniques: Genetic Algorithms – Simulated Annealing – Particle Swarm optimization –Ant colony optimization– : Use of Matlab/Scilab to solve optimization problem	**9**

Course Assessment Method
(CIE: 40 marks, ESE: 60 marks)

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
CO1	Formulate an optimization problem to optimize an engineering application using the principles of basic calculus.	**K2**
CO2	Apply the Simplex method to solve a linear programming problem	**K3**
CO3	Solve the unconstrained optimization problems using gradient based method.	**K3**
CO4	Apply the various optimization techniques to solve a constrained optimization problem	**K3**
CO5	Use metaheuristic algorithms to solve constrained and unconstrained	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

CO-PO Mapping Table (Mapping od Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**	**2**									**2**
CO2	**3**	**3**	**3**									**2**
CO3	**3**	**2**	**3**									**2**
CO4	**3**	**2**	**3**									**2**
CO5	**3**	**2**	**3**									**2**

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Engineering Optimization, Theory and Practice	S.S RAO	New Age International Publishers	4th Edition ,2012

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Optimization Techniques and Applications with Examples	Xin-She Yang	John Wiley & Sons	2018
2	Optimization for Engineering Design Algorithms and Examples	Deb K	Prentice Hall India	2000
3	Introduction to Optimization Design	Arora J	Elsevier Academic Press, New Delhi	2004
4	Linear Programming	Hardley G	Narosa Book Distributors Private Ltd	2002
5	Genetic Algorithms and engineering optimization	Mitsuo Gen, Runwei Cheng	John Wiley & Sons	2002
6	An introduction to optimization	Edwin KP Chong, Stanislaw, H Hak	John Wiley & Sons	Fourth Edition, 2013

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	NPTEL https://www.youtube.com/watch?v=a2QgdDk4Xjw
2	NPTEL https://www.youtube.com/watch?v=dPQKltPBLfc
3	NPTEL https://www.youtube.com/watch?v=qY-gKL7GxYk
4	NPTEL https://www.youtube.com/watch?v=Z_8MpZeMdD4 https://www.youtube.com/watch?v=FKBgCpJlX48

SECTION B
NPTEL COURSE DETAILS

OPTIMIZATION FROM FUNDAMENTALS

PROF. ANKUR A. KULKARNI
Department of Systems and Control Engineering
IIT Bombay

INTENDED AUDIENCE : Mathematics, any engineering and science discipline

COURSE OUTLINE :
This course will cover the topic of Optimization from its fundamentals. It will start with an overview of real analysis and convexity. With this base it will cover linear programming, convex optimization and nonlinear programming, complementarity problems and algorithms for the same. We will end with dynamic optimization.

ABOUT INSTRUCTOR :
Prof.Ankur A. Kulkarni is an Associate Professor and the Kelkar Family Chair in Quantitative Finance at the Indian Institute of Technology Bombay (IITB). He is a systems theorist with an interest in decision making in distributed, decentralised and strategic environments, with informational complexities, which he investigates using the lens of game theory, information theory, control theory, machine learning, and mathematical optimization. His current focus is on strategic inference, stealth, privacy, information elicitation and nudging. He has published 30 papers in international journals and more than 30 papers in international conferences. He has been a consultant to the Securities and Exchange Board of India wherein he was solely responsible for suggesting regulatory interventions for high frequency algorithmic trading. He presently serves on the IT-Project Advisory Board of SEBI and is responsible for advising SEBI on utilizing advanced technologies such as AI/ML and data analytics and guiding data-related policies for internal use and public use. He is also an advisor to the Tata Consultancy Services and on the technical advisory committee of Maha-IT, a Govt of Maharashtra enterprise. He was previously a consultant to HDFC Life Insurance Company wherein he tackled the problem of design of incentives for sales agents; to Kotak Mahindra Bank Limited on anti-money laundering and anomaly detection, and to Bank of Baroda on smart cash management. He received his B.Tech. from IITB in 2006, followed by M.S. in 2008 and Ph.D. in 2010, both from the University of Illinois at Urbana-Champaign (UIUC). He was an Associate (from 2015--2018) of the Indian Academy of Sciences, Bangalore (a honour reserved for only 100 scientists under the age of 35 across all fields), he has been an editor for several conferences, a recipient of the INSPIRE Faculty Award of the Department of Science and Technology, Government of India, 2013, and of several Best Paper awards and the Excellence in Teaching Award at IIT Bombay. He has been a visitor to MIT in the USA, University of Cambridge in UK, NUS in Singapore, University of Paris, IISc in Bangalore and KTH in Sweden.

COURSE PLAN :

Week 1: Introduction to optimization and overview of real analysis
Week 2: Optimization over open sets
Week 3: Optimization over surface
Week 4: Transformation of optimization problems and convex analysis
Week 5: Introduction to linear programming
Week 6: Linear programming and duality
Week 7: Linear programming and duality
Week 8: Nonlinear and convex optimization
Week 9: Nonlinear and convex optimization
Week 10: Algorithms
Week 11: Algorithms
Week 12: Dynamic optimization

SECTION C

SYLLABUS COMPARISON

SYLLABUS COMPARISON REPORT

KTU: OEECT723 - Optimization Techniques
NPTEL: Optimization from Fundamentals

KTU Topics	NPTEL Topics	Match
Module 1	Week 1-2	? Matched
Module 2	Week 3-4	? Matched
Module 3	Week 5-6	? Matched
Module 4	Week 7-8	? Matched
Module 5	Week 9-10	? Matched

RECOMMENDATION

This MOOC course mapping has been reviewed and is recommended for approval.

The proposed NPTEL course meets all the requirements specified in:
? R 17.1 - Approved MOOC Agency (NPTEL/SWAYAM)
? R 17.2 - Minimum 8 weeks duration
? R 17.3 - Online mode with proctored examination
? R 17.4 - At least 70% content overlap with KTU syllabus

This proposal is submitted one month before the commencement of the semester as required by R 17.5.

Verified by:

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HoD (Department) IQAC Coordinator

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Principal