MOOC APPROVAL REQUEST

As per KTU B.Tech Regulations 2024, Section 17

KTU Course Code:	OEMET722
KTU Course Name:	Introduction to Robotics
NPTEL Course Name:	Robotics and Control: Theory and Practice
Instructor:	Prof. N. Sukavanam, Prof. M. Felix Orlando
Institution:	IIT Roorkee
Duration:	12 Weeks
Course ID:	noc26-me01
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

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Introduction to Robotics	S K Saha	McGraw-Hill Education (India)	2008
2	Sensors, Actuators, and their Interfaces: A multidisciplinary introduction	SciTech Publishing Inc	SciTech Publishing Inc	2011
3	Beginning Arduino	Michael McRoberts	Apress	1st Edition, 2011
4	Embedded Systems: An Integrated Approach	Lyla B Das	Pearson Education India	1st Edition, 2012

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Sensors and Transducers	D. Patranabis	PHI Learning	2nd edition, 2003
2	Embedded Systems Architecture, programming and Design	Raj Kamal	Tata McGraw-Hil	3rd edition, 2013

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://onlinecourses.swayam2.ac.in/aic20_sp04/unit?unit=4&lesson=7

SEMESTER S4

ADVANCED METAL JOINING TECHNIQUES

Course Code	**PEMET416**	**CIE Marks**	40
Teaching Hours/Week (L: T:P: R)	3-0-0-0	**ESE Marks**	60
Credits	4/3	**Exam Hours**	2 Hrs. 30 Min.
Prerequisites (if any)	None/ (Course code)	**Course Type**	Theory

Course Objectives:

1. To establish fundamental knowledge Advanced welding technologies
2. To enable the learner to select appropriate metal joining technique based on the application.

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Solid State Welding**: Principle and mechanism of solid-state welding, techniques, process parameters and applications of diffusion welding, cold pressure welding. **Adhesive Bonding**: Principle – types of adhesives, bonding methods – applications.	9
2	**Explosive welding:** principle and theory, equipment used, Process parameters and characteristics, weld joint design, Applications, advantages, and limitations. **Friction and Friction stir welding:** principle and theory – Process parameters and applications, Tools, and Metal flow. **Ultrasonic Welding:** principle, theory, and types – Welding environment, equipment used- Process parameters and characteristics, weld joint design and applications.	9

3	**Electron Beam Welding (EBW)** - principle and theory, Welding environment, equipment used- Process parameters and characteristics, weld joint design, Applications, advantages, and limitations. **Laser Beam Welding (LBW)** – Principle and theory, types of lasers, Process parameters and characteristics, Applications, advantages, and limitations. **Plasma Arc Welding (PAW) –**Theory – transferred arc and non-transferred arc techniques, equipment – applications.	**9**
4	**Magnetically Impelled Arc Butt (MIAB)**– principle and applications. Under water welding – wet land dry under water welding- set-up for underwater welding systems. **Brazing** – Principle – processes involved – torch brazing, furnace brazing, vacuum brazing, induction brazing – advantages and applications. **Micro-joining and nano-joining:** Introduction, theory, and applications.	**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	Summarise the Solid-state welding techniques and outline the physics of adhesive bonding.	**K2**
CO2	Compare and select between explosive welding, friction welding and ultrasonic welding based on the applications.	**K3**
CO3	Understand radiant energy welding technologies and explain the principle and working of EBW, LBW and PAW.	**K2**
CO4	Outline the modern joining technologies and select appropriate brazing technique to resolve modern metal joining problem.	**K3**

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

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	2	-	-	-	-	-	2
CO2	2	2	2	-	-	2	-	-	-	-	-	2
CO3	2	2	-	-	-	-	-	-	-	-	-	2
CO4	2	3	2	-	-	-	-	-	-	-	-	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	Advanced welding Processes	J. Norrish	Woodhead publishing	2006
2	Welding Processes and Technology	Parmar R. S	Khanna Publishers	1998

Reference Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Principles of Welding	R. W. Messler	John Wiley and Sons	1999
2	Metal Joining Manual	Schwartz M. M	McGraw-Hill Inc.	1979
3	Micro-joining and Nano-joining	Y. N. Zhou	Woodhead publishing	2008

Video Links (NPTEL, SWAYAM…)	
Module No.	**Link ID**
1	https://nptel.ac.in/courses/112103244
2	https://nptel.ac.in/courses/112103244
3	https://nptel.ac.in/courses/112103244
4	https://nptel.ac.in/courses/112103244

SECTION B
NPTEL COURSE DETAILS

ROBOTICS AND CONTROL: THEORY AND PRACTICE

PROF. N. SUKAVANAM
Department of Mathematics
IIT Roorkee

PROF .M. FELIX ORLANDO
Department of Electrical Engineering
IIT Roorkee

PRE-REQUISITES : Basic Mathematics

INTENDED AUDIENCE : Electrical Engineering, Computer Science Engineering, Mechanical Engineering,Electronics and Communication Engineering, Mathematics students

COURSE OUTLINE :

Robotics has stimulated an growing interest among a wide range of scholars, researchers and students due to its interdisciplinary characteristics. The development of this field of science is boosted by various domains which are not limited to Cybernetics, Controls, Computers, Mechanics, Bio-Engineering, and Electronics. Among these areas, modelling, control, planning play a fundamental role not only in the growth of industrial robotics, but also towards the advanced fields including healthcare and field robotics.

Through this course the participants will acquire the ability to conduct research, develop innovative designs in the field of systems engineering and control of robots and to direct the development of engineering solutions in new or unfamiliar environments by linking creativity, innovation and transfer of technology.

ABOUT INSTRUCTOR :

Prof. N. Sukavanam received his Ph. D from the Indian Institute of Science, Bangalore in 1985. He served as a Scientist-B at Naval Science and Technological Laboratory, DRDO for two years (1984-86). Then joined as a Research Scientist in the Department of Mathematics, IIT Bombay (1987-90). Worked as a Lecturer at BITS Pilani from 1990 to 1996. In May 1996 he Joined the Department of Mathematics at IIT Roorkee (University of Roorkee at that time) as an Assistant Professor. Currently he is a Professor in the Department of Mathematics IIT Roorkee and Head of the Mathematics from Feb. 2018. His areas of research includes Nonlinear Analysis, Control Theory and Robotics. Professor Sukavanam has published about 80 papers in refereed journals, 30 papers in International Conference Proceedings. He has guided 19 Ph. Ds, 60 M. Sc./M. Phil/MCA Dissertations. Organized International Workshop on Industrial Problems. Developed Pedagogy online course on Mathematics I, offered NPTEL online video course on Dynamical Systems and Control and conducted more than six QIP/Continuing Education courses on Robotics and Control.

Dr. M. Felix Orlando received his Ph.D. from Electrical Engineering Department at Indian Institute of Technology Kanpur (IITK) in 2013, where his advisors were Prof. Laxmidhar Behera, Prof. Ashish Dutta, Prof. Anupam Saxena. In 2015, he completed his post doctoral fellowship at Case Western Reserve University, USA, working with Prof. Tarun Podder, Prof. Yan Yu, Prof. Hutapea focussing on Medical robotics. Dr. Felix Orlando has started as an Assistant Professor in the Department of Electrical Engineering at the Indian Institute of Technology Roorkee (IITR) from November 2015 onwards. He is also the member of IEEE, IEEE-Robotics and Automatin Society (IEEE-RAS), ASME. His current research focuses on medical robotics, rehabilitation robotics, visual servoing and Biomechanics. He is currently the board member of the Student Technical Committee (STC) of robotics, IITR. He has also received the Faculty Initiation Grant (FIG) from IITR for the duration 2016 to 2018. He has received the Early Career Research Award in 2017. He has also coordinated a GIAN course on robotics with Prof. Doik Kim of South Korea in 2017. He has chaired several technical sessions of IEEE international conferences which include, IEEE-AIM 2018, Auckland, IEEE-INDICON 2017, IIT Roorkee, IEEE IECON 2017, Beijing and IEEE ICCSCE 2016, Malaysia. He has presented research papers at various international conferences and has several international robotics journal papers.

COURSE PLAN :

Week 1: Simple manipulators: Two /three arm manipulators and their kinematics equations, Work space Homogeneous Transformation: Rotation, Translation, Composition of homogeneous transformations

Week 2: Danavit-Hartimber Algorithm: D-H procedure for fixing joint coordinate frames, Robot parameters, Arm matrix, Inverse Kinematics for PUMA, SCARA manipulators.

Week 3: Introduction to Robotic Exoskeletons,Optimal Design of a Three Finger Exoskeleton for Rehabilitation Purpose

Week 4: Differential transformation and velocity of a frame: Derivative of a frame, Velocity, Jacobian, Inverse Jacobian, Trajectory Planning: Polynomial trajectory, Biped trajectory

Week 5: Dynamics: Lagrangian method, Robot dynamics equation,Control: Robot dynamics equation as a control system, Trajectory tracking control, PD controller, Neural network control design

Week 6: Redundancy Resolution of Human Fingers using Robotic Principles,Manipulability Analysis of Human Fingers during Coordinated Object Rotation,Kinematics of Flexible Link Robots,

Week 7: Robot Assisted Needling System for Percutaneous Intervention-An Introduction,Smart Robotic Needles for Percutaneous Cancerous Interventions

Week 8: Robust Force Control of a Two Finger Exoskeleton during Grasping ,Neural Control of an Index Finger Exoskeleton – Lecture 1,Neural Control of an Index Finger Exoskeleton – Lecture 2

SECTION C

SYLLABUS COMPARISON

SYLLABUS COMPARISON REPORT

KTU: OEMET722 - Introduction to Robotics
NPTEL: Robotics and Control: Theory and Practice

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