OPEN ELECTIVE-III **ROBOTICS**											
Code	Category	Periods						Sessional Marks	End Exam Marks	Total Marks	Credits
		L	T	P	E	O	Total				
MEC 411	OE	3	1	0	0	0	48	40	60	100	3

Prerequisite: Engineering Mathematics, Kinematics of Machinery, Dynamics of Machinery, Basic Electrical Engineering, Basic Electronics Engineering

Course Objectives: Expose students to the history, fundamental principles, mechanical manipulators design, artificial intelligence and machine learning concepts applicable to robotics

Course Outcomes: At the end of the course the student will be able to:	
CO-1	Understand the basic concepts associated with the design and Functioning of robot manipulator.
CO-2	Get acquainted with performing trajectory planning, spatial transformations, kinematics and dynamics of the robot
CO-3	Learn about various sensors, feedback systems for robot
CO-4	Understand and Write programme for various applications of a robot
CO-5	Understand the fundamental principles of artificial intelligence and earn machine learning concepts applicable to robotics

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	3		2		2							
CO-2	3	3	3	3	2							
CO-3	3	2	2		2							
CO-4	3	2	2		2							
CO-5	3				2							

Course Outcomes	PSO1	PSO2
CO-1	1	
CO-2	1	
CO-3	1	
CO-4	1	
CO-5	1	

CO- Course Outcome; PO- Program Outcome; PSO-Program Specific Outcome; Level- 1: Low, 2: Medium, 3: High

SYLLABUS

UNIT - I	**Periods: 6L+0T=6**

UNIT TITLE: Introduction to Robotics

Basics of Robot: Need of robot, Laws of robot, History of robotics, Degree of freedom, Anatomy of robot, Classification of robots, robot configurations, End effectors-classification, Design considerations, general considerations for selection of end effectors. Robot drive and actuation systems.

UNIT - II	**Periods: 10L+0T=10**

UNIT TITLE: Robot mechanics and Trajectory Planning

Kinematics: Scaling, Rotation and homogenous transformation matrix, D-H notation for position and orientation. Differential transformation and manipulators, Jacobians–problems

Dynamics: Lagrange –Euler and Newton–Euler formulations and Problems.

Trajectory planning: definitions and planning tasks, terminology, steps in trajectory planning, Joint Space Techniques, Cartesian Space Techniques,

UNIT - III	**Periods: 12L+0T=12**

UNIT TITLE: Robot sensors and Feedback systems

Robot Sensors: Types- analog and digital, sensor examples - Light sensors, Sound Sensor, Temperature Sensor, Proximity Sensor, Distance Sensor, Pressure Sensors, Tilt Sensors, Navigation / Positioning Sensors, Acceleration Sensor, Voltage Sensors, Current Sensors, Humidity Sensors , Gas sensors, Potentiometers, Magnetic Field Sensors.

Feedback systems: Feedback System Block Diagram, open and closed loop feedback systems

UNIT - IV	**Periods: 12L+0T=12**

UNIT TITLE: Robotic Programming languages and Applications

Programming Languages: Introduction, languages and software packages, requirements of a robot programming language.

Applications: Robotics at Agriculture, Automotive, Supply Chain, Healthcare, Warehouses - material Transfer, Material handling, loading and unloading; Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

UNIT - V	**Periods: 5L+0T=5**

UNIT TITLE: Artificial Intelligence for Robotics

Artificial Intelligence: Introduction to Artificial Intelligence, Machine Learning, Deep Learning, Reinforcement Learning, Artificial Neural Networks and Fuzzy logic.

Types of AI – weak AI, strong AI – examples. Role of AI in robots- vision and imaging, grasping and manipulation, machine learning applications, customer service applications, security and surveillance, Retail-shopping and fashion, Exploration, Entertainment.

TEXT BOOKS:

1.	Groover M P ,*Industrial Robotics*, Pearson Edu.
2.	Mittal R K & Nagrath I J , *Robotics and Control*, TMH.
3.	Asada and Slow time, *Robot Analysis and Intelligence*, Wiley Inter-Science.
4.	Francis X. Govers, *Artificial Intelligence for Robotics: Build intelligent robots that perform human tasks using AI techniques*, Pearson Edu.
5.	Peter Norvig & Stuart Russell, *Artificial Intelligence: A Modern Approach*, Third Edition, By Pearson Education India
6.	Kevin Murphy, *Machine Learning: A Probabilistic Perspective*, MIT Press, 201

REFERENCE BOOKS:	
1.	Fu K S, *Robotics*, McGraw Hill.
2.	Robert J. Schilling, *Fundamentals of Robotics Analysis and Control*, PHI Learning,
3.	Rich and Knight, *Artificial Intelligence*, 3rd Edition, Tata McGraw Hill, 2014.
4.	Groover, *Industrial Robotics, Technology, Programming and Applications*, Tata Mc GrawHill, 2008
WEB RESOURCES:	
1.	http://ecoursesonline.iasri.res.in/course/view.php?id=82
2.	https://www.robotplatform.com/knowledge/sensors/types_of_robot_sensors.html
3.	https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_robotics.htm
4.	https://www.iiitdmj.ac.in/ict.iiitdmj.ac.in/summer-courses-2020/R-AI/
5.	https://ocw.snu.ac.kr/sites/default/files/NOTE/Chap12_Robot%20programming%20languages.pdf
6.	https://www.plyrotech.com/blog/artificial-intelligence-machine-learning-and-robotics/#:~:text=Robotic%20Process%20Automation%20is%20an,scale%20Internet%20companies%20are%20built.