CVM UNIVERSITY
Aegis: Charutar Vidya Mandal (Estd.1945)

FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: Bachelor of Technology (Electrical Engineering)

Semester: VI

Course Code: 202090621

Course Title: Robotics for Engineers

Course Group: Open Elective Course-II

Course Objectives: To impart widespread acquaintance of robotic system along with different configurations, their kinematics, interfacing with various sensors, robot vision system and real field applications of them.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
2	0	2	3	50 / 18	50 / 17	25 / 9	25 / 9	150 / 53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Introduction to Robotics:** History, Robot anatomy, classification of robots, Work envelop, Specifications of Robots (accuracy, precision, repeatability, resolution, etc), Applications, Safety Laws, Types of robot programming	04
2	**Robot drive systems, End effectors and Automation:** Types of drives: Hydraulic drives, Pneumatic and Electric drives. DC servo motors, stepper motors and AC servo motors – Salient features and applications. Comparison of all drives End effectors. **Types of grippers – Mechanical Grippers, Magnetic, vacuum, pneumatic and hydraulic gripper, Selection, and design consideration of grippers, Design of Mechanical Grippers.**	06
3	**Robot sensor and Machine vision:** Need for sensors, types of sensors used in robotics, Classification and applications of sensors, Characteristics of sensing devices, selections of sensors, force and tactile sensor, slip sensor, proximity sensors, Robot vision setup (RVS), block diagram, components, working of RVS, Human vision vs. Robot vision, Applications of RVS	05

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4	**Robot Kinematics:** Direct Kinematics, Kinematic Modelling of the Manipulator; Denavit Hartenberg (DH) Representation; Performance Measurement Indices	**07**
5	**Interfacing with Microcontroller:** Introduction to AVR, Sensor (temperature and humidity, PIR, etc) interfacing with controller, Optocoupler interfacing with controller, Actuator (stepper motor, DC motor) interfacing with controller	**06**
6	**Robot Applications:** Industrial, Material Handling, Processing, Assembly: Peg in hole, Compliance, Inspection, Surgical, Space and Military applications; Futuristic robotics., Principles for robot application and application planning.	**02**
	Total	**30**

List of Practicals / Tutorials:

1	Introduction of Robotic system, various configurations and DOF calculations.
2	Basic robot Joints and its simulation using Robo Analyzer Software.
3	Pin, Slider joint using High end CAD software
4	MATLAB for Robotics application
5	Direct kinematics for open/closed loop configurations analytically/simulation/coding.
6	Inverse kinematics for open/closed loop configurations analytically/simulation/coding.
7	Coding/simulation of direct kinematics for open/closed loop configurations along with workspace generation using MATLAB.
8	Formulation of DH parameters of robot configuration and its simulation using Robo Analyzer Software.
9	Introduction to microcontroller hardware
10	Interfacing with Microcontroller

Reference Books:

1	Industrial Robotics, Technology, Programming and Applications, Mikell P Groover, Tata McGraw Hill
2	Introduction to Robotics: Analysis, Control, Applications , Saeed Niku, John Wiley & Sons
3	Robotics and control, R K Mittal, I J Nagrath, Tata McGraw Hill
4	The AVR Microcontroller and Embedded Systems, Using Assembly and C, Muhammad Ali Mazidi, Sarmad Naimi and Sepehr Naimi, Pearson Education
5	A Robot Engineering Textbook , Mohsen Shahinpoor, Harper and Row, Publisher, New York
6	Introduction to robotics, John J Craig, Pearson/Prentice Hall
7	Introduction to Robotics, S K Saha, Tata McGraw Hill

Supplementary learning Material:	
1	NPTEL resources

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz

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- Continuous assessment
- Interactive methods

Internal Evaluation:
The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
20%	**30%**	**25%**	**10%**	**10%**	**5 %**	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	To understand and learn basic terminologies, anatomy and various types of hardware used in Robotic system.	30
CO-2	To understand the use of DH Parameters for forward and Inverse Kinematics.	20
CO-3	To know about the interfacing of hardware devices with controller.	25
CO-4	To understand Real-time applications of robot systems in different fields.	25

Curriculum Revision:	
Version:	2.0
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	--
Next Review on (Month-Year):	June-2025

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