VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
SCHEME OF INSTRUCTION AND EXAMINATION (R-24)
B.E. (ME) Honours Degree Program in Robotics
(2026-2028)

B.E (ME) Honours Degree in Robotics								
S. No.	Name of the Course	Scheme of Instruction			Scheme of Examination			
		Hours per Week			Duration in Hrs	Maximum Marks		Credits
		L	T	P		SEE	CIE	
THEORY CUM PRACTICALS								
V-Semester AY 2026-27								
U24PC560ME	Introduction to Robotics and Automation	3	-	-	3	60	40	3
U24PC570ME	Control Engineering	3	-	-	3	60	40	3
VI-Semester AY 2026-27								
U24PC660ME	Embedded C Programming	3	-	-	3	60	40	3
VII-Semester AY 2027-28								
U24PC760ME	Robotics and Control	3	-	-	3	60	40	3
U24PC770ME	Robotics Lab	-	-	2	3	50	30	1
U24PW729ME	Course Project	-	-	6	3	50	50	3
	TOTAL	**12**	**0**	**8**		**340**	**240**	**16**
	GRAND TOTAL	**20**				**580**		**16**
NPTEL Course (Robotics related): 12 weeks durations (V or VI -Semester)								3
							Total Credits:	**19**

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

INTRODUCTION TO ROBOTICS AND AUTOMATION

SYLLABUS FOR B.E. V-SEMESTER

Instruction : 3 Hrs /week	SEE Marks : 60	Course Code : U24PC560ME
Credits : 3	CIE Marks: : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVE **The objective of the course is to**	**COURSE OUTCOMES** **On completion of the course, students will be able to**
study industrial robot components, configuration, sensors, drives, applications and Understand and assess the principles and technologies of Industry 4.0.	1 explain configuration of industrial robots and summarize various applications. 2 interpret various elements of the industrial robots 3 develop methodology to represent position and orientation of industrial robot links in spatial coordinate system 4 Grasp Industry 4.0 concepts and its impact on modern manufacturing. 5 Understand key technologies driving smart manufacturing.

UNIT-I

ROBOT BASICS

Robot-Basic concepts, Need, Law, History, Anatomy, specifications.

Robot configurations-cartesian, cylindrical, polar, articulated and SCARA. Parallel robots

ROBOT APPLICATIONS

Application in industry – material handling, loading & unloading, processing, welding &painting, assembly and inspection

UNIT-II

ROBOT ELEMENTS

End effectors-Classification, Types of Mechanical actuation, Gripper design, Robot joints

types, Robot drive system types: Electrical, pneumatic and hydraulic. Position and velocity feedback devices

UNIT-III

ROBOT COORDINATE SYSTEMS

Coordinate frames, Rotation matrix, Euler angles, Roll pitch and yaw angle representation, Composite rotations, Homogeneous Transformation matrix.

UNIT- – IV

Introduction to Industry 4.0

Definition and Evolution of Industry 4.0
Introduction to Industry 4.0
Key concepts and principles
Comparison of Industry 4.0 Factory and Today's Factory
Advantages and challenges of transitioning to Industry 4.0
Cyber-Physical Systems and Big Data
Overview of cyber-physical systems (CPS) in Industry 4.0
Real-time monitoring and control of manufacturing processes

UNIT –V

Basic Principles and Technologies of a Smart Factory
Internet of Things (IoT) and Industrial Internet of Things (IIoT)
Integration of IoT devices for data collection and analysis
Enhancing operational efficiency and predictive maintenance
Value Chains in Manufacturing Companies and Customization of Products
Digital Twins and Cloud Computing/Cloud Manufacturing
Benefits and challenges of adopting cloud-based manufacturing solutions
Security Issues within Industry 4.0 Networks

Learning Resources:

1. Mikell P. Groover, Mitchell Weiss, Roger N Nagel and Nicholas G Odrey, "Industrial Robotics Technology, Programming and Applications", Tata Mc Graw-Hill Publishing Company Limited, 2008.
2. Deb.S.R and Sankha Deb, "Robotics Technology and Flexible Automation", Tata Mc Graw Hill Publishing Company Limited, 2010.
3. Klafter R.D, Chmielewski T.A, and Negin. M, "Robotic Engineering: An Integrated Approach", Prentice Hall of India Pvt. Ltd.,1994.
4. K.S. Fu, R.C. Gonzalez and C.S.G. Lee , "Robotics control, sensing, vision and intelligence", Tata Mc Graw-Hill Publishing Company Limited, 2008
5. R.K. Mittal and I. J. Nagrath"Robotics and Control", Tata Mc Graw-Hill Publishing Company Limited,2003.

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	10
3	No. of Quizzes:	0	Max. Marks for each Quiz Test:	--

Duration of Internal Test: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

CONTROL ENGINEERING

SYLLABUS FOR B.E. V-SEMESTER

Instruction : 3 Hrs /week	SEE Marks : 60	Course Code : U24PC570ME
Credits : 3	CIE Marks: : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVE The objective of the course is to	**COURSE OUTCOMES** On completion of the course, students will be able to
describe physical systems through mathematical models and graphical representations and assess their response and stability in frequency and time domains and design suitable control methods through experiential learning.	1. develop Transfer functions for Mechanical systems using mathematical modelling and obtain the equivalent electrical analogous systems. 2 simplify the systems given in pictorial representation and examine the steady state and transient behaviour. 3 estimate the system behaviour using Routh criterion, Root locus and Bode diagrams. 4 analyze the steady state and transient behaviour of various systems using different compensators with Root locus technique . 5 model the system in state space domain and test for controllability and observability.

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	1								2	3	2	1
CO2	3	2									2	3	2	1
CO3	3	2	2								2	3	2	1
CO4	3	2	1								2	3	2	1
CO5	3	2	2								2	3	2	1

UNIT-I

Control Systems Classification: Examples of control systems, Open Loop & Closed Loop Systems. Mathematical models and Transfer functions from governing equations of translator mechanical systems. Force- Voltage and Force-Current analogy.

Hands on Experience:

Experiment on DC Position control system

Experiment on traffic control system

Case Study: AI-Powered Temperature Control in Smart Homes

UNIT-II

Block diagrams, Block diagram reduction. Signal flow graphs, Mason's gain formula. Types of inputs. Time domain specifications of 2nd order systems, Response of 2nd order systems to Step input. Steady state error, Static Error constants.

Hands on Experience:

Experiment to find the time response of second order system

To calculate characteristics of a second order system, such as damping ratio, natural frequency, percent overshoot, settling time, rise time and peak time using mathematical programming

UNIT-III

Routh stability criteria, Root Locus method for negative feedback systems.

Frequency Response, Bode plots. Gain and Phase Margins.

Hands on Experience:

Write a mathematical program to plot the Root locus, Bode diagram of the system

UNIT-IV

Introduction to compensator design (qualitative treatment only): PID, Lead, Lag and Lag–Lead compensators design using Root locus method.

Hands on Experience:

Experiment on temperature control system

Simulate and analyze a transfer function to step input by building a PID Controller using mathematical simulation

UNIT-V

State–space representation of linear control systems. Conversion of Transfer function into State Space, Conversion of State-Space in to Transfer Function, Solution of state equations by Laplace transformation technique. Concept of Controllability and Observability.

Hands on Experience:

To transform a mathematical model of a linear time invariant system from Transfer-function to State-space and State-space to Transfer- function using mathematical programming

Learning Resources:

1. R.C. Dorf, "Modern Control Systems", Addison Wesley, 1989
2. M. Gopal, "Control Systems", Tata McGraw-Hill, 2004.
3. Ogata, K. "Modern Control Engineering", Prentice Hall, 2004
4. Norman S. Nise, "Control Systems Engineering", John Wiley & Sons, Inc., 2001.

5. William J. Palm, III, Modelling, Analysis, and Control of Dynamic Systems, John Wiley & Sons Inc., 2nd Edition, 1999.
6. Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo, Robotics: Modelling, Planning and Control, Springer Science & Business Media, 2008

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	10
3	No. of Quizzes:	0	Max. Marks for each Quiz Test:	--

Duration of Internal Test: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

EMBEDDED C PROGRAMMING

SYLLABUS FOR B.E. VI-SEMESTER

Instruction : 3 Hrs /week	SEE Marks : 60	Course Code : U24PC660ME
Credits : 3	CIE Marks: : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES The objectives of the course is to	COURSE OUTCOMES On completion of the course, students will be able to
1. Describe the developments of embedded C programming 2. Interfacing of various sensors along with displays using Embedded 'C' 3. Develop the various applications using embedded development board	1. Analyze the various functions used in embedded C programming. 2. UnderstandtheevaluationofArduinofamilyandit sdevelopmentboarddetails 3. Interface the sensors and various /o devices to embedded development board 4. Apply the concepts of IoT to embedded development board 5. Demonstrate and design embedded C based applications.

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	1	1	1	-	-	-	-	-	-	-	-	2	2	-
CO2	2	2	2	1	2	-	-	-	-	-	1	-	3	2
CO3	2	2	3	2	2	-	-	-	-	-	-	3	2	2
CO4	2	1	2	2	3	-	-	-	-	-	2	3	2	3
CO5	2	2	3	3	2	-	-	-	-	-	2	3	2	2

UNIT – I

Introduction to Embedded C: Overview, Datatypes: variables and constants, Operators, Control Statements, Arrays and Functions. i/o Functions: Pins Configured as input, Pins Configured as output, pin Mode function, digital Write function, analog Read function, time delay functions. Simple programming in 'C'

UNIT – II

Introduction to Arduino: Origin of Arduino, familiarizing with Arduino family Introduction to Arduino UNO: Pin configuration and architecture, power connections, concept of digital and analog ports, Arduino clones and variants , installation of Arduino IDE, uploading of the program.

UNIT – III

Interfacing with Displays and Sensors: Working with Serial Monitor, Line graph via serial monitor, LED interfacing, 8 bit LCD interfacing to Arduino, Fixed one line static message display, Runningmessagedisplay,.Interfacing-humiditysensor,temperaturesensor, gas detection sensor, PIR Sensor, Ultrasonic Sensor, Flex Sensor

UNIT –IV

Motors Interfacing: L-293D, DC motor, ULN 2003, Stepper Motor, Servo Motor

UNIT – V

Applications / Case Study: Case studies related on agriculture, medical domains using Ardunio, Applications on consumer electronics, automotive and security using Arduino development board.

Learning Resources:

1. Simon Monk, "Programming Arduino: Getting Started with Sketches", McGraw-Hill Education, Second Edition, 2016.
2. Massimo Banzi, "Getting Started with Arduino: The Open Source", Shroff Publishers & Distributors Pvt Ltd, 2014
3. MichaelJ.Pont,"EmbeddedC",2nd Edition,PearsonEducation,2008

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	10
3	No. of Quizzes:	0	Max. Marks for each Quiz Test:	--

Duration of Internal Test: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

ROBOTICS AND CONTROL

SYLLABUS FOR B.E. VII-SEMESTER

Instruction : 3 Hrs /week	SEE Marks : 60	Course Code : U24PC760ME
Credits : 3	CIE Marks: : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVE The objective of the course is to	**COURSE OUTCOMES** On completion of the course, students will be able to
To develop the fundamental knowledge and skills required to analyze, design and control robotic systems	1. Analyze the kinematics of robotic systems and apply them to solve real world problems 2 Apply differential kinematics and statics concepts to design and control robotic systems 3 Analyze the dynamics of serial manipulators using lagrangian and Newton-Euler mechanics 4 Develop motion and force control strategies for robotic systems using feedback control techniques 5 Generate and analyze robot trajectories for various applications

CO-PO and CO-PSO mapping

CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	2	2			2		2	2		2	3	2	1
CO2	2	2	2			2		2	2		2	3	2	1
CO3	3	3	3			3		3	3		2	3	2	1
CO4	3	2	2		3	3	3	2	2	3	3	3	2	1
CO5	2	2	2		2	2	2	2	2	2	2	3	2	1

UNIT-I

Robot Kinematics

Forward Kinematics: Forward/direct kinematic analysis of serial manipulators. Inverse Kinematics: General properties of inverse kinematic solution. Inverse kinematics of serial manipulators.

UNIT-II

Differential Kinematics and Statics

Linear and angular velocity of links, Manipulator Jacobian for serial manipulators, Jacobian Singularities, Static Analysis: Force and moment balance.

UNIT-III

Dynamics of serial manipulators

Lagrangian formulation for equations of motion for RP, RR serial manipulators, Recursive dynamics using Newton-Euler formulation of RP and RR serial manipulator.

UNIT-V

Motion and Force Control:

Decentralized Control: Independent joint control, Decentralized feed forward compensation, computed torque control

Centralized control: PD control with gravity compensation

Force Control: Passive and active compliance impedance control

UNIT-V

Trajectory Generation

Joint-Space Techniques: Cubic Polynomial Trajectories, Linear Segments with Parabolic Blends-without and with via points

Cartesian-Space Techniques: Straight line path, Circular Path, Position Planning, Orientation Planning.

Learning Resources:

1. Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo, "Robotics: Modelling, Planning and Control", Springer Science & Business Media, 2010.
2. M.W. Spong and M.Vidyasagar, "Robot Dynamics and Control", 1st Edition, John Wiley and sons,1990.
3. R.K.Mittal and I.J.Nagrath, "Robotics and Control", Tata McGraw-Hill, 2003.
4. Subir Kumar Saha, "Introduction to Robotics", Tata McGraw-Hill Education, 2014.
5. Howie M. Choset, Seth Hutchinson, Kevin M. Lynch, "Principles of Robot Motion: Theory, Algorithms, and Implementation", MIT Press, 2005.

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	10
3	No. of Quizzes:	0	Max. Marks for each Quiz Test:	--

Duration of Internal Test: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

ROBOTICS LAB

SYLLABUS FOR B.E. VII-SEMESTER

Instruction : 2 Hours /week	SEE Marks : 50	Course Code : U24PC731ME
Credits : 1	CIE Marks: : 30	Duration of SEE : 2 Hours

COURSE OBJECTIVE The objective of the course is to	**COURSE OUTCOMES** On completion of the course, students will be able to
model, analyses different types of industrial robotics using CAD software and 6DOF serial manipulator.	1. Modelling of various industrial robotics using ADAMS software. 2. Designing and controlling of robotic path using various sensors. 3. Analyses of forward and inverse kinematics of industrial manipulator using 6-dof serial manipulator

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	1	3		1	3						2	1	3	2
CO2	1		3	1	3						2	1	3	2
CO3	1	3		1	3						2	1	3	2

List of Experiments:

1. Modelling of 5 DOF anthropomorphic robotic arm in ADAMS.
2. Simulation of 5 DOF anthropomorphic robotic arm in ADAMS.
3. Forward kinematic analysis of 4 DOF SCARA Robot using MATLAB (Simscape Multi-body)
4. Inverse kinematic analysis of 4 DOF SCARA Robot using MATLAB (Simscape Multi-body)
5. Assembling of robot mechanical components mounting of motors, sensors, electronic circuits to the chassis
6. Navigation and obstacle avoidance robot using ultrasonic sensor
7. Navigation and obstacle avoidance robot using computer vision
8. Programming and controlling a line follower robot using IOT
9. Trajectory planning and navigation of an autonomous rover
10. Forward kinematic analysis of 6-DOF serial manipulator

11. Inverse kinematic analysis of 6-DOF serial manipulator
12. Forward kinematic analysis of 6-DOF Parallel manipulator
13. Inverse kinematic analysis of 6-DOF parallel manipulator
14. Assembling of drone using mechanical components mounting of motors, sensors, electronic circuits

The break-up of CIE: Internal Tests + Assignments + Quizzes

No. of Internal Tests:	02	Max. Marks for Internal Test:	12
Marks for day-to-day laboratory class work			18
Duration of Internal Test: 3Hours			

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

COURSE PROJECT

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week)::0:0:6	SEE Marks: 50	Course Code: U24PW729ME
Credits : 3	CIE Marks: 50	Duration of SEE: 3 Hours

COURSE OBJECTIVE *The objective of the course is to*	**COURSE OUTCOMES** *On completion of the course, students will be able to*
Design and develop a prototype related to robotics engineering using relevant tools and techniques, write a report and give a presentation.	1. define and design the robotics problem by literature study. 2. analyze by conducting experiments and obtain relevant data. 3. develop a prototype / working model using the data obtained. 4. To work in teams and adapt for the advanced technological changes 5. make logical conclusions to justify the results.

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3										3	3	3	2
CO2		3	3	2	3						3	3	2	3
CO3					3	3	1	1	3		3	1	2	2
CO4								3	2	3	2	1	2	2
CO5	2	1							3	3	3	1	2	3

The department will appoint a project coordinator who will be in-charge of the following.

- Grouping of students (Maximum of 3 in a group)
- Allotment of project guide
- Project progress monitoring at regular intervals
- Attendance monitoring for those students doing project in Industry.

Project topics may be chosen by the student with advice and approval from the faculty members. Students are to be assessed and evaluated as per the following criteria.

- Problem definition based on literature study.

- Usage of modern tools.
- Analysis of the problem under consideration.
- Fabrication of the model / prototype.
- Results and conclusions.
- Team Work, Report writing & Presentation with ethics
- Project Management

Each student is required to:

1. Submit a one-page synopsis in the beginning of project work for display on the notice board.
2. Give a 20 minutes presentation through LCD power point presentation followed by a 10 minutes discussion.
3. Submit a report on the project work with list of references and slides used.

The project allotment should be completed by the IV week of VII semester so that students get enough time for completion of their project.

All the projects are to be evaluated for progress at least twice in a semester. CIE marks (30 marks) are based on the performance in the two presentations which are awarded by a committee based on project rubrics.

The SEE marks (50 marks) are awarded by an external examiner based on a viva-voce exam.

Norms of final documentation of the project report will be provided by the Department.

No. of Presentations for CIE marks	2	Max. Marks for each CIE presentation:	15
Marks are awarded based on literature study, usage advanced tools, prototype development, presentation and conclusions using rubrics.			
Duration of Presentation: 20 min			