Pimpri Chinchwad Education Trust's

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

SECTOR NO. 26, PRADHIKARAN, NIGDI, PUNE 411044

An Autonomous Institute Approved by AICTE and Affiliated to SPPU, Pune

DEPARTMENT OF MECHANICAL ENGINEERING

Curriculum Structure and Syllabus of

Honor in Mechanical Engineering

Automation and Robotics

(Regulation 2023)

Effective from Academic Year 2025-26

Institute Vision

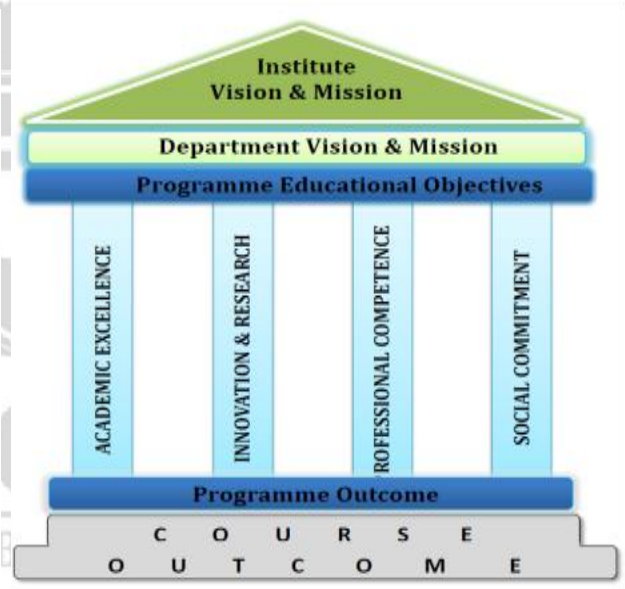
To be one of the top 100 Engineering Institutes of India in coming five years by offering exemplarily Ethical, Sustainable and Value Added Quality Education through a matching ecosystem for building successful careers.

Institute Mission

1. Serving the needs of the society at large through establishment of a state-of-art Engineering Institute.
2. Imparting right Attitude, Skills, Knowledge for self-sustenance through Quality Education.
3. Creating globally competent and Sensible engineers, researchers and entrepreneurs with an ability to think and act independently in demanding situations.

Quality Policy

We at PCCOE are committed to impart Value Added Quality Education to satisfy the applicable requirements, needs and expectations of the Students and Stakeholders. We shall strive for academic excellence, professional competence and social commitment in fine blend with innovation and research. We shall achieve this by establishing and strengthening state-of- the-art Engineering and Management Institute through continual improvement in effective implementation of Quality Management System.



Course Approval Summary

Board of study- Department of Mechanical Engineering

Sr. No.	Course Name	Course Code	Page Number	Signature and stamp of BoS
1	Industrial Automation	BME25HN31	10	
2	Robot Kinematics and Programming	BME26HN32	13	
3	Robot Kinematics and Programming Lab	BME26HN33	15	
4	Control Systems	BME27HN34/ BME28HN34	17	
5	Control Systems Lab	BME27HN35/ BME28HN35	19	
6	Seminar/Mini-Project / MOOC / Industrial Training	BME27HN36/ BME28HN36	21	
7	Integrated Project	BME28HN37/ BME27HN37	24	

Approved by Academic Council:

Chairman, Academic Council
Pimpri Chinchwad College of Engineering

Preface

Looking at Global Scenario to enhance the employability skills and impart deep knowledge in emerging/ multidisciplinary areas, an additional avenue is provided to passionate learners through the Minors and Honors Degree Scheme in academic structure.

For Honors degree program, student has to earn additional 20 credits in emerging area of one's own domain.

Objectives of Honors Degree

- To enable students to pursue allied academic interest in contemporary areas.
- To provide effective yet flexible options for students to achieve basic to intermediate level competence in the contemporary area.
- To enhance the employability skills with different combinations of competencies and flavors.
- To provide an academic mechanism for fulfilling demand of specialized areas from industries for higher order skill jobs.
- To provide a strong foundation to students aiming to pursue research/ higher studies in the Contemporary field of study.

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Credit distribution: semester wise						
1 Lecture hour = 1 Credit 2 Lab Hours = 1 Credit 1 Tutorial Hour = 1 Credit						
Sr. No	**Course Title**	**Credits/Semester**				
		5	**6**	**7**	**8**	**Total**
1.	Industrial Automation	**4**	**0**	**0**	**0**	**4**
2.	Robotics: Kinematics and Programming	**0**	**4**	**0**	**0**	**4**
3.	Robotics: Kinematics and Programming Lab	**0**	**1**	**0**	**0**	**1**
4.	Control System	**0**	**0**	**3**	**0**	**3**
5.	Control System Lab	**0**	**0**	**1**	**0**	**1**
6.	Seminar	**0**	**0**	**2**	**0**	**2**
7.	Integrated Project	**0**	**0**	**0**	**5**	**5**
	Total	**4**	**5**	**6**	**5**	**20**

Curriculum structure

Honor in Mechanical Engineering

Automation and Robotics

Honor- Automation and Robotics

Curriculum Structure

Automation and Robotics Honor in Mechanical Engineering (Academic Regulations 2023)																	
(With effect from Academic Year 2025-26)																	
Course Type	**Course Code**	**Course Name**	**Credit Scheme**				**Teaching Scheme (Hrs./Week)**					**Evaluation Scheme and Marks**					
			L	**P**	**T**	**Total**	**L**	**P**	**T**	**O**	**Total**	**FA**		**SA**	**TW**	**PR**	**OR**	**Total**
												FA1	**FA2**					
PCC	BME25HN31	Industrial Automation	**3**	**-**	**1**	**4**	**3**	**-**	**1**	-	4	20	20	60	-	-	-	100
PCC	BME26HN32	Robot Kinematics and Programming	**3**	**-**	**1**	**4**	**3**	**-**	**1**	-	4	20	20	60	-	-	-	100
PCC	BME26HN33	Robot Kinematics and Programming Lab	**-**	**1**	**-**	**1**	**-**	**2**	**-**	-	2	-	-	-	25	-	25	50
PCC	BME27HN34 /BME28HN34	Control Systems	**3**	**-**	**-**	**3**	**3**	**-**	**-**	-	3	20	20	60	-	-	-	100
PCC	BME27HN35 / BME28HN35	Control Systems Lab	**-**	**1**	**-**	**1**	**-**	**2**	**-**	-	2	-	-	-	25	-	25	50
ELC	BME27HN36 / BME28HN36	Seminar/Mini-Project / MOOC / Industrial Training	**-**	**2**	**-**	**2**	**-**	**4**	**-**	-	4	-	-	-	25	-	25	50
ELC	BME28HN37 / BME27HN37	Integrated Project	**-**	**5**	**-**	**5**	**-**	**10**	**-**	-	10	-	-	-	100	-	50	150
Total			**9**	**9**	**2**	**20**	**9**	**18**	**2**	**-**	**29**	**60**	**60**	**180**	**175**	**-**	**125**	**600**

L-Lecture, **P**-Practical, **T**-Tutorial, O- Other i.e. self-directed learning, (self- study), FA-Formative Assessment,

SA-Summative Assessment, **TW**-Term Work, **OR**-Oral, **PR**-Practical Exam

Course Syllabus

TY. B Tech.

Semester - V

Program:	Honor in Automation and Robotics							Semester: V
Course:	Industrial Automation							Code: BME25HN31
Credit	Teaching Scheme/week				Evaluation Scheme			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
4	3	-	1	-	20	20	60	100

Prior knowledge of Manufacturing practices, Mechatronics

Objectives: Students are expected to study,
1. The need for automation in modern industry
2. Automated Material handling and assembly systems
3. PLC programming techniques and explore the application of AI in industrial automation systems.

Outcomes: The students will be able to,
1. **Comprehend** the fundamental concepts of industrial automation.
2. **Select** the appropriate automated material handling and assembly system.
3. **Use** PLC programming and AI in industrial automation.

Detailed Syllabus

Unit	Description	Duration (Hrs.)
1	**Introduction** Automation in Production Systems, Principles and Strategies of Automation, Basic Elements of an Automated System, Levels of Automation. **Flexible Manufacturing System:** Types, Advantages, Limitations	7
2	**Types of Automation** Transfer Mechanism, Buffer Storage, Control Functions, and Automation for Machining Operations, Design and Fabrication Considerations. Analysis of Automated Flow Lines: General Terminology and Analysis, Analysis of Transfer Lines Without Storage, Partial Automation, Automated Flow Lines with Storage Buffers, Computer Simulation of Automated Flow Lines	8
3	**Automated material handling** Material handling function, Types of Material Handling Equipment. Automated Guided Vehicle Systems. Automated Storage Systems, Automated Storage/Retrieval Systems. Automated flow lines with storage buffers.	7
4	**Automated Assembly** Automated flow lines and transfer mechanisms, Analysis of transfer lines without storage. Types of Automated Assembly Systems, Part Feeding Devices, Multi-station Assembly Machines, Analysis of a Single Station Assembly Machine.	8
5	**Programmable Logic Controller (PLC)** Introduction to PLC, Architecture of PLC; Specifications of PLC; Ladder Logic programming for different types of logic gates; Latching, Timers, Counters; PLC programming; Case studies.	7
6	**AI in Industrial Automation** Introduction to AI and Machine Learning, AI Applications in Industrial Automation, Key AI Technologies and Tools, Challenges and Future Trends	8
	Total	45

Text Books:

1. Groover, M. P., (2016), "Automation, Production Systems, and Computer-integrated Manufacturing," Pearson Education, ISBN: 9789332572492
2. Deb, S. R., Deb, S., (2017), "Robotics Technology and Flexible Automation," McGraw Hill Education, ISBN: 9780070077911

Reference books:

1. Sandler, B. Z., (1999), "Robotics: Designing the Mechanisms for Automated Machinery," Academic Press/Prentice Hall, ISBN: 9780137816002
2. Derby, S. J., (2004), "Design of Automatic Machinery," CRC Press, ISBN: 9780824753696
3. Gupta, A. K., Arora, S. K., Westcott, J. R., (2016), "Industrial Automation and Robotics: An Introduction," Mercury Learning & Information, ISBN: 9781938549304
4. Niku, S. B., (2020), "Introduction to Robotics, Analysis, Control, Applications," Wiley, ISBN: 9781119527626
5. Siegwart, R., Nourbakhsh, I. R., Scaramuzza, D., (2011), "Introduction to Autonomous Mobile Robots," The MIT Press, ISBN: 9780262015356

Course Syllabus

TY. B Tech.

Semester - VI

Program:	Honor in Automation and Robotics						Semester: VI	
Course:	Robot Kinematics and Programming						Code: BME26HN32	
Credit	Teaching Scheme (Hrs./week)				Evaluation Scheme			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
4	3	-	1	-	**20**	**20**	**60**	**100**

Prior Knowledge of: Theory of Machines, Mechatronics, Basics of Electrical and Electronics Engineering is essential

Objectives: Students are expected to study,

1. Classification of robots and homogeneous transformation of matrix
2. Represent the robot in matrix form and perform Direct and Inverse kinematics
3. Velocity, static force and dynamics analysis of the robot
4. Generation of required trajectory
5. Identify required Robot Programming
6. Program the Robot for a given motion

Outcomes: After learning the course, the students should be able to:

Sr. No.	Course Outcome Statement
CO 1	**Classify** robots and **Solve** homogeneous transformations
CO 2	**Analyze** the Forward and Inverse kinematics of a robot.
CO 3	**Analyze** the Velocity, Static force, and Dynamics of a robot.
CO 4	**Generate** a trajectory for a given path.
CO 5	**Describe** various types of programming used in robots.
CO 6	**Write** a programme using VAL.

Detailed Syllabus

Unit	Description	Duration (Hrs.)
1.	**Fundamentals of robotics** Structure of a robot. Classification and applications of robots. Anatomy of robots. Configurations of robots, work envelope, dexterity, and compliance of robots. Description of the frame in the robotic system. Homogeneous transformations and mapping of frames.	7
2.	**Manipulator kinematics** Representation of joints and links using Denavit-Hartenberg parameters. Forward and Inverse kinematics of robots.	8
3.	**Velocity, static force, and Dynamics** Linear and angular velocity of links, velocity propagation, manipulator Jacobians, Manipulability, and Singularity analysis. Static forces in manipulators. Introduction to Dynamics.	7
4.	**Trajectory generation** Considerations in path description, Joint space schemes, and Cartesian space schemes. Geometric problems with paths.	8
5.	**Basics of Robot Programming** Robot task planning, programming methods, programming languages and their requirements, motion interpolation, motion and task-level languages, robot language classifications and structures, and robot safety.	7
6.	**Robot Language: VAL** VAL language commands, motion control, hand control, program control, pick and place application, palletizing application, and welding application.	8
	Total	**45**

Text Books:

1. Craig, J., (2022), "Introduction to Robotics Mechanics and Control" Mechanics and Control, Pearson, ISBN-13: 978-1292164953.
2. Saha, S. K., (2024), "Introduction to Robotics" McGraw-Hill Education, ISBN-13: 978-9355326461.
3. Deb, S. R., Deb, S., (2017), "Robotics Technology and Flexible Automation," McGraw Hill Education, ISBN: 9780070077911

Reference Books:

1. Sandler, B. Z., (1999), "Robotics: Designing the Mechanisms for Automated Machinery," Academic Press/Prentice Hall, ISBN: 9780137816002
2. Tsai, L. W., (1999), "Robot Analysis: The Mechanics of Serial and Parallel Manipulators," Wiley-Interscience, ISBN: 9780471325932
3. Nagarajan, R., (2016), "Introduction to Industrial Robotics," Pearson Education India, ISBN: 9789332544802
4. Gupta, A. K., Arora, S. K., Westcott, J. R., (2016), "Industrial Automation and Robotics: An Introduction," Mercury Learning & Information, ISBN: 9781938549304
5. Niku, S. B., (2020), "Introduction to Robotics, Analysis, Control, Applications," Wiley, ISBN: 9781119527626
6. Mittle, R., Nagrath, I., (2017), "Robotics and Control," McGraw Hill Education, ISBN: 9780070482937

e-Resources:

1. Introduction to robotics, By Prof. Asokan T, Prof. Balaraman Ravindran, Prof. Krishna Vasudevan, IIT Madras https://onlinecourses.nptel.ac.in/noc21_de13/preview
2. Robotics , by Prof. Dilip Kumar Pratihar, IIT Kharagpur. https://onlinecourses.nptel.ac.in/noc21_me76/preview
3. Mechanism and Robot Kinematics, by Anirvan Dasgupra, IIT Kharagpur, https://archive.nptel.ac.in/courses/112/105/112105236/

Program:	Honor in Automation and Robotics					Semester :	VI
Course:	Robot Kinematics and Programming Lab					Code :	BME26HN33
Credit	Teaching Scheme (Hrs./week)				Evaluation Scheme		
	Lecture	Practical	Tutorial	Other	TW	PR	OR	Total
1	-	2	-	-	25	-	25	50

Prior knowledge of: Theory of Machines, Mechatronics, Basics of Electrical and Electronics Engineering is essential

Objectives: Students are expected to study,

1. Transform frames
2. Simulation of various types of Robots
3. Write robot programs

Outcomes: After learning the course, the students should be able to:

Sr. No.	Course Outcome Statement
CO1	**Transform** the robot frames
CO2	**Simulate** the configuration of robots
CO3	**Generate** trajectory for various paths
CO4	**Inscribe and Simulate** the robot program

Detailed Syllabus

Experiment No.	List of Experiments (any six):	Duration (Hrs.)
1	Homogeneous **transformations and mapping** of frames using suitable software	5
2	**Simulation** of Cartesian/ cylindrical/ spherical robot.	5
3	**Simulation** of Articulated/ SCARA robot	5
4	**Virtual modelling** for the kinematics of a robot using suitable software	5
5	**Generate a trajectory** for a path generation task	5
6	**Robot program for** pick and place application	5
7	**Robot program for** palletizing application	5
8	**Robot program for** welding application	5
	Total	30

Text Books:

1. Craig, J., (2022), "Introduction to Robotics Mechanics and Control" Mechanics and Control, Pearson, ISBN-13: 978-1292164953.
2. Saha, S. K., (2024), "Introduction to Robotics" McGraw-Hill Education, ISBN-13: 978-9355326461.
3. Deb, S. R., Deb, S., (2017), "Robotics Technology and Flexible Automation," McGraw Hill Education, ISBN: 9780070077911

Reference Books:

1. Sandler, B. Z., (1999), "Robotics: Designing the Mechanisms for Automated Machinery," Academic Press/Prentice Hall, ISBN: 9780137816002
2. Tsai, L. W., (1999), "Robot Analysis: The Mechanics of Serial and Parallel Manipulators," Wiley-Interscience, ISBN: 9780471325932
3. Nagarajan, R., (2016), "Introduction to Industrial Robotics," Pearson Education India, ISBN: 9789332544802
4. Gupta, A. K., Arora, S. K., Westcott, J. R., (2016), "Industrial Automation and Robotics: An Introduction," Mercury Learning & Information, ISBN: 9781938549304
5. Niku, S. B., (2020), "Introduction to Robotics, Analysis, Control, Applications," Wiley, ISBN: 9781119527626
6. Mittle, R., Nagrath, I., (2017), "Robotics and Control," McGraw Hill Education, ISBN: 9780070482937

Course Syllabus

B Tech

Semester - VII

Program:	Honor in Automation and Robotics					Semester:	VII/ VIII
Course:	Control Systems					Code:	BME27HN34/ BME28HN34

Credit	Teaching Scheme (Hrs./week)				Evaluation Scheme			
	Lecture	Practical	Tutorial	Other	FA		SA	Total
					FA1	FA2		
3	3	-	-	-	20	20	60	100

Prior knowledge of: fundamentals of electrical and electronics, basics of mathematics, mechatronics, basics of simulation and coding using tools like MATLAB is essential.

Course Objectives: Students are expected to study

1. Basics of control systems, mathematical modelling and stability analysis of the control systems.
2. The implementation of various control strategies for the mechanical / electro-mechanical application.
3. Modeling the control systems

Course Outcomes: After learning the course, the students should be able to

Sr. No.	Course outcome Statements
CO1	**Describe** the concept and design principles of control systems.
CO2	**Categorize,** identify, and select an appropriate control system for any application.
CO3	**Perform** system modelling of a control system.
CO4	**Perform** stability analysis of a control system
CO5	**Develop** a controlling strategy for a control system.
CO6	**Model** the control system using state space methods

Detailed Syllabus

Unit	Description	Duration (Hrs.)
1	**Fundamentals of control systems** Definition, classification, Relative merits and demerits of open loop and closed loop control systems, Linear and non-linear systems, Design principles of control systems, System stability, Time and frequency domain analysis of systems.	7
2	**Types of control systems and their applications** Servo systems, Automatic regulating systems, Process control systems, Adaptive control systems, Learning control systems, Discrete control systems, Multivariable control systems.	7
3	**System modelling** Concept of the transfer function, Block diagram reduction, Signal flow graph: Mason's gain formula, Modelling of mechanical systems, Applications.	8
4	**Stability analysis** Concept of stability analysis, Routh-Hurwitz criterion, Bode Plot, Root locus techniques, Nyquist criterion, Applications.	6
5	**PID control action** Introduction, proportional control, integral control, derivative control, combination of control actions and their effect on system performance, Discrete PID Controller, Gain scheduling, Lead compensation, Lag compensation, Lead and Lag compensation, PID tuning, Ziegler-Nichols method , Low pass filter and high pass filter.	8
6	**State space analysis** Concept of state, state variables and state models, state space equations, transfer function from state variable representation, transfer model, State space representation of dynamic systems, state transition matrix, controllability and observability, Kalman Filter	9
	Total	45

Text Books:

1. Mechatronics: Electronics Control Systems in Mechanical and Electrical Engineering, William Bolton, 6th Ed, 2019.
2. Automatic Control Systems, B. C. Kuo, 9th ed. Wiley, 2017

Reference Books:

1. Modern Control Engineering, K. Ogata, 5th ed. Pearson, 2015.
2. Control Systems Engineering, I. J. Nagrath, and M. Gopal, 6th ed. New Age International, 2020.
3. Modern Control Systems, R. C. Dorf and R. H. Bishop, 11th ed. Pearson Education, 2021.
4. Introduction to Mechatronics and Measurement Systems, Alciatore and Histand, 5th Ed, 2019
5. Mechatronics – An Introduction, Bishop, CRC, Taylor & Francis, 2017.
6. Electric Motors and Control Systems, Petruzella, F.D. McGraw Hill, New York, New York (2010). ISBN 978-0-07-352182-4

e-Resources:

1. https://onlinecourses.nptel.ac.in/noc20_ee90/preview
2. https://www.youtube.com/watch?v=PT8D_ITgqzw&list=PL7C8BCEB9D5421BD3
3. https://www.youtube.com/@controlengineering5957

Program:	Honor in Automation and Robotics				Semester:	VII/ VIII		
Course:	Control Systems Laboratory				Code:	BME27HN35/ BME28HN35		
Credit	Teaching Scheme (Hrs./week)				Evaluation Scheme			
	Lecture	Practical	Tutorial	Other	TW	PR	OR	Total
1	-	2	-	-	25	-	25	50

Prior knowledge of: Fundamentals of electromechanical systems, Basics of mathematics, Mechatronics, Basics of simulation and coding using tool like MATLAB is essential.

Objectives:

1. To equip students with the skills to design, model, and analyze control systems using simulation software, enabling them to apply theoretical concepts to practical scenarios.
2. To develop the ability to design and implement controllers for various mechanical systems, fostering a deep understanding of control theory and its applications in real-world engineering problems.

Outcomes: After learning the course, the students should be able to:

Sr. No.	Course outcome Statement
CO1	**Design** and **Analyze** control systems and **demonstrate** proficiency in using simulation software to model various systems.
CO2	**Compare** and **interpret** the performance of different control systems, **identify** the effect on system stability and response characteristics.

Detailed Syllabus (Any 8)

Expt. No.	List of practical:	Duration (Hrs.)
1	Design, Modeling, and analysis of control systems using suitable software.	3
2	Design and analyze PID Controller for DC Motor	3
3	Design of PID controller for any mechanical system using simulation software.	3
4	Stability analysis of linear system using suitable method.	3
5	Design a mathematical model for a Quarter Car system using Simulink.	3
6	To study motion control of conveyor belt using PID controller.	3
7	Construct the root locus plot in Simulink for a transfer function and observe the effect of changing system parameters on the pole locations.	3
8	Create an unstable system in Simulink, apply different control strategies to stabilize it, and analyze the stability of the closed-loop system	3
9	Compare the open-loop and closed-loop responses of a system in Simulink to understand the impact of feedback on system performance	3
10	Modeling and control of a DC Motor: Simulation and PID implementation using Python	3
11	Implementing machine learning algorithms for predictive control.	4
12	Modeling and Simulation of a Mechanical system using Simscape	4
	Total	**30**

Text Books:

1. Kuo, B. C., & Golnaraghi, F. (2018). Automatic Control Systems (10th ed.). Wiley.
2. Chen, C. L., & Kuo, B. C. (2018). Linear Control System Analysis and Design with MATLAB (2nd ed.). Wiley.
3. Dorf, R. C., & Bishop, R. H. (2011). Modern Control Systems (12th ed.). Prentice Hall.
4. Nise, N. S. (2015). Control Systems Engineering (7th ed.). Wiley.
5. Khalil, H. K. (2015). Nonlinear Systems (3rd ed.). Prentice Hall.

Reference Books:

1. Hughes, A., & Drury, B. (2019). Electric Motors and Drives: Fundamentals, Types and Applications. Newnes.
2. Chapman, S. J. (2012). Electric Machinery Fundamentals (5th ed.). McGraw Hill.
3. Ogata, K. (2010). Modern Control Engineering (5th ed.). Prentice Hall.
4. Franklin, G. F., Powell, J. D., & Emami-Naeini, A. (2015). Feedback Control of Dynamic Systems (7th ed.). Pearson.

E-Sources:

1. https://nptel.ac.in/courses/108102113
2. https://onlinecourses.nptel.ac.in/noc25_cs50/preview
3. https://onlinecourses.nptel.ac.in/noc20_ee90/preview
4. https://archive.nptel.ac.in/courses/107/106/107106081/

Program:	Honor in Automation and Robotics						Semester: VII/ VIII	
Course:	Seminar/Mini-Project/MOOC/Industrial Training						Code: BME27HN36/ BME28HN36	
Credit	Teaching Scheme (Hrs./week)				Evaluation Scheme			
	Lecture	Practical	Tutorial	Other	TW	PR	OR	Total
2	-	4	-	-	25	-	25	50

Prior knowledge of: Robot Kinematics, Programming, Control System, Industrial Automation, PLC, Mechatronics, Theory of Mechanisms is essential

Course Objectives:

Students are expected,

1. To identify practical learning skills and concepts and learn to communicate them to society.
2. To encourage the personal growth of students and the development of practical communication skills.

Course Outcomes:

After learning the course, the students should be able to:

1. Get an overview of the current trends in Automation and Robotics, and learn them in more detail.
2. Improve Practice in written and oral presentations.
3. Learn the research methods used in that specific field.

Detailed Guidelines: (30 Hours)

Seminar/Mini-Project/MOOC/Industrial Training is a course requirement where in under the guidance of a faculty member a student is expected to do an in-depth study on the topic relevant to latest trends in the field of concerned Honor selected by him / her and approved by the authority; by doing literature survey, understanding different aspects of the problem and arriving at a status report in that area. While doing Seminar/Mini-Project/MOOC/Industrial Training, the student is expected to learn investigation methodologies, study relevant research papers, correlate work of various authors/researchers critically, study concepts, techniques, prevailing results etc., analyze it and present a seminar report. It is mandatory to give a presentation on Seminar/Mini-Project/MOOC/Industrial Training before a panel constituted for the purpose. The grading will be done on the basis of the depth of the work done, understanding of the problem, report and presentation by the student concerned.

1. Guidelines for the Preparation of Seminar/Mini-Project/MOOC/Industrial Training Report

- Report should have at least 20 and at most 30 pages.
- The entire pages of the report should be in A4 size strictly, with 1" top and bottom margin and 1.25" left and right margin.
- The entire report should be typed in Times New Roman with (12 Pt.)
- The title and main headings of the paragraphs are to be in bold.
- Report may be divided into the number of chapters as required, with chapter number assigned on the top left corner and chapter name immediately below it (with single line spacing) using Times New Roman (16 Pt. Bold).
- Every sub heading should be given decimal of whole number of the heading. (e.g1.1).
- The complete text should be justified in the report (no left or right aligning).
- No short forms are to be used in the report besides the specified areas.
- Numbering of each figure and table should be done according to the chapter number.
- Numbering of each page should be done in the footer section at the bottom right corner.
- Each line should be separated by a line spacing of 1.5, and each paragraph by line spacing of 2.

2. Contents in the Report:

- The Cover
- Cover page. (Same as The Cover)
- Certificate from Department/Industry
- Acknowledgement.
- Abstract.
- Table of content.
- List of figures and tables
- The report.
- References and appendices

3. Guidelines for Presentation:

- The presentation shall be limited to 15 minutes plus 10 minutes questions and answers.

Course Syllabus

B Tech

Semester-VIII

Program:	Honor in Automation and Robotics					Semester:		VIII/VII
Course:	Integrated Project					Code:		BME28HN37/ BME27HN37
Credit	Teaching Scheme/week				Evaluation Scheme			
	Lecture	Practical	Tutorial	Other	TW	PR	OR	Total
5	-	10	-	-	100	-	50	150

Prior knowledge of: Robot Kinematics, Programming, Control Systems, Mechatronics, Theory of Mechanisms

Objectives: Students are expected to study Interdisciplinary implementation of Automation and Robotics

Outcomes:

The students will be able to,

1. Understand, plan and execute a project.
2. Design a real-time application
3. Prepare a technical report based on the project.
4. Deliver technical seminars based on the project work carried out.
5. Understand the publication and copyright process of research

Guidelines: Total: 24 h (contact) + 72 h (non-contact / implementation)

1. A group of 3 to 4 students needs to design and demonstrate the project under the guidance of the allocated guide.
2. Students can choose the project considering their implementation in Major Project.
3. The hardware implementation and or software simulation is compulsory.
4. Project Report should be submitted in compliance with term work associated with the subject.
5. Paper publication associated with the project as research outcome is appreciable.
6. Project work preferably should be completed in the laboratory/ industry.

Detailed Syllabus

Sr. No.	Activity	Duration (Hrs.)
1	Semester VIII (week 1 & 2): Project guide allotment, Finalization of topic and platform, Planning of the work, Literature review, identifying a problem, and formulating the problem for the project	20
2	Semester VII (week 3 & 4): Methodology finalization, finalizing project proposal, Review 1 for finalization of topic and specification.	20
3	Semester VIII (week 5 & 6): Simulation of Ideas on appropriate software tools and finalization of hardware	20
4	Semester VIII (week 7 & 8): Implementation of the project as a prototype. Review 2 to understand the progress of the project	20
5	Semester VIII (week 9 & 10): Project Report writing and publication or copyright planning and execution.	20
6	Semester VIII (week 11 & 12): Demonstration of Project work and Final Review for submission and term work compliances.	20
	Total	120

DEPARTMENT OF MECHANICAL ENGINEERING

VISION

To be the department of sustainable academic excellence, fostering innovation, skill development, and work ethics leading to globally competent mechanical engineers.

जागतिक स्तरावर सक्षम यांत्रिक अभियंत्यांना मार्गदर्शन करणारा नावीन्य, कौशल्य विकास आणि कामाच्या नैतिकतेला चालना देणारा शाश्वत शैक्षणिक उत्कृष्टतेचा विभाग बनणे.

MISSION

1. **Nurture cohesive learning environment and develop matching ecosystem.**

   एकसंध शिक्षण वातावरण जोपासणे आणि जुळणारी परिसंस्था विकसित करणे.

2. **Cultivate excellent work ethics and right attitude among students by imparting essential skills and knowledge.**

   आवश्यक कौशल्ये आणि ज्ञान देऊन विद्यार्थ्यांमध्ये उत्कृष्ट कार्य नैतिकता आणि योग्य दृष्टिकोन विकसित करणे.

3. **Instill a sense of creativity, social responsibility and environmental awareness among students.**

   विद्यार्थ्यांमध्ये सर्जनशीलता, सामाजिक जबाबदारी, आणि पर्यावरण विषयक जागरुकता निर्माण करणे.

DEPARTMENT OF MECHANICAL ENGINEERING

Program Educational Objectives

1. To cultivate knowledge and skills in formulating, analyzing, and solving interdisciplinary engineering problems among the mechanical engineering graduates.
2. To inculcate right attitude and awareness about codes of professional practice, social commitment, and life-long learning among the mechanical engineering graduates.
3. To enhance professional competence for catering to the needs and expectations of society as a profound Mechanical Engineer.

Program Specific Outcomes

1. Conceptualize, design, model, simulate, and analyze mechanical components, systems and processes in complex interdisciplinary applications.
2. Develop sustainable solutions to real-life mechanical engineering problems in products and process industries.
3. To practice professional codes and conducts, safety norms, industrial engineering and management principles while working in the industry or as an entrepreneur.