INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

EMBEDDED SYSTEMS IN ROBOTICS								
II Semester: ES								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
		L	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
BESE16	**Elective**	3	0	0	3	40	60	100
Contact Classes: 45	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 45**		
Prerequisite: Internet of Thins, Embedded Systems.								

I. COURSE OVERVIEW:
Embedded systems are basically an extension of advanced robotic applications, which have had a profound impact on almost all our modern technology such as video cameras, computing machinery, smartphones, digital display systems, and so on. The course will begin with a brief introduction to robotics terminologies, control system, differential motion and path planning, mobile robot design and applications. The whole field of robotics and embedded systems has been predicted to be one of the most in-demand technologies of the decade, with exponential growth and job opportunities.

II. COURSES OBJECTIVES:
The students will try to learn

I. The fundamental knowledge of the robots and their characteristics.
II. Obtain knowledge on fixed base and mobile robots and their working principles
III. Identify the various areas of application for inclusion of the robotic technology.

III. COURSE OUTCOMES:
At the end of the course students should be able to:

CO1 Describe the concept of robots and robotic terminologies for robotic design and its applications.
CO2 Identify the sensors and actuators for the functioning and controlling of robots.
CO3 Analyze the working principle of the serial and parallel chain manipulators and transformation forkinematic analysis of a robot.
CO4 Illustrate the principle and characteristics of mobile robots to simulate and manipulates the robot.
CO5 Select the various robotic technologies to use in the different modern robotic applications.
CO6 Make use of modern robotic systems to design and implement the various applications.

IV. COURSE CONTENT:

MODULE - I: INTRODUCTION TO ROBOTIC TERMINOLOGIES (9)
Introduction, robot definitions by different agencies, history of robotics, laws of robotics, advantages and disadvantages, degrees of freedom, robot joints, robot coordinates, reference frames, characteristics of robots, workspace, applications, other robots and applications, social issues.
Introduction to Robotics: Types and Classification of robots; Science and Technology of Robots

MODULE –II: SENSORS AND ACTUATORS (9)
Introduction, sensor characteristics, sensor utilization, position sensors, velocity sensors, acceleration

sensors, force sensors, miscellaneous sensors. Introduction to actuators, pneumatic, hydraulic and electric actuators, characteristics and control, applications.

MODULE –III: INDUSTRIAL ROBOT MANIPULATORS (9)

Introduction, serial robots and parallel robots, classification of serial chain manipulators.

Position and Orientation: Feature based alignment; Pose estimation; Time varying pose and trajectories, Structure from motion, dense Motion Estimation, Visual Odometry (Semi-direct VO, direct sparse odometry),

Bundle Assignment.

MODULE –IV: MOBILE ROBOTS (9)

Driving Robots, balancing Robots, autonomous Vessels and Underwater Vehicles, robot Manipulators, mobile RobotSimulation.

MODULE –V: MODERN ROBOTIC SYSTEMS AND APPLICATIONS (9)

Introduction, intelligence and autonomy, collaborative robots, humanoid robots, aerial robots, intelligent vehicles, industrial applications, applications of humanoids and other robotic systems, house hold robotic systems.

V. TEXT BOOKS:

1. Thomas Braunl, "Embedded Robotics: Mobile Robot Design and Applications with Embedded Systems", 3rdEdition, Springer-Verlag Berlin Heidelberg, 2008.
2. Saeed B Niku, (2019), introduction to robotics, analysis, control and applications, Wiley Publications.
3. R.K. Mittal and I J Nagrath, "Robotics and Control", Tata McGraw Hill, 1st Edition, 2003.

VI. REFERENCE BOOKS:

1. Anis Koubaa, "Robot Operating System (ROS) The Complete Reference", First Volume, Springer, 2016.
2. K S Fu, Gonzalez, C S Lee, "Robotics: Control, Sensing, Vision and Intelligence ", Mc Graw Hill, int edition, 1987.
3. R.D. Klafter, TA Chmielewski and Michael Negin, "Robotic Engineering- An Integrated approach", prentice Hall of India, 1st Edition, 2003.
4. Steve heath, "Embedded system design", Elsevier, 2nd Edition, 2004.

VII. WEB RESOURCES:

1. http://www.gettextbooks.com/author/ Thomas Braunl
2. http://nptel.ac.in/video.php?subjectId=112101099
3. http://nptel.ac.in/courses/112101099/

VIII. TEXT BOOKS:

1. http://www.springer.com/us/book/9781846286414
2. http://www.robotee.com/index.php/download-free-robotic-e-books/
3. http://www.e-booksdirectory.com/listing.php?category=279
4. http://bookboon.com/en/automation-and-robotics-ebook

IX. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Assignments
4. Model question paper – I
5. Model question paper – II
6. Lecture notes
7. Power point presentations
8. Early Lecture Readiness Videos