ROBOTICS AND CONTROL

I Semester: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BESB08	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

I. COURSE OVERVIEW:

This course is an introduction to the field of robotics. It covers the fundamentals of kinematics, dynamics, trajectory planning, control of robot manipulators, and sensing. The course deals with homogeneous transformations, forward and inverse kinematics of robotic manipulators, differential kinematic equations, the manipulator Jacobian, and force relations. It also presents the fundamental principles on proximity, tactile, and force sensing. Students are expected to have a background in linear algebra, calculus, and basic physics

II. COURSE OBJECTIVES:

The students will try to learn:

I. The robot terminologies and robotics sensors for controls of robotics.
II. Apply different robot control techniques for control of robotics.
III. The robot dynamics to design robotics.

UNIT-I	**INTRODUCTION AND TERMINOLOGIES**	**Classes: 09**

Definition, Classification, History, Robots components, Degrees of freedom, Robot joints, coordinates, Reference frames, workspace; Robot languages, actuators, sensors: Position, velocity and acceleration sensors, torque sensors, tactile and touch sensors, proximity and range sensors, vision system, social issues.

UNIT-II	**KINEMATICS**	**Classes: 09**

Mechanism, matrix representation, homogenous transformation, DH representation, Inverse kinematics, solution and programming, degeneracy and dexterity.

UNIT-III	**DIFFERENTIAL MOTION AND PATH PLANNING**	**Classes: 09**

Jacobian-differential motion of frames, Interpretation.

Calculation of Jacobian, Inverse Jacobian, Robot Path planning.

UNIT-IV	**DYNAMIC MODELLING**	**Classes: 09**

Lagrangian mechanics, two-DOF manipulator, Lagrange-Euler formulation, Newton- Euler formulation, Inverse dynamics.

UNIT-V	**ROBOT CONTROL SYSTEM**	**Classes: 09**

Linear control schemes, joint actuators, decentralized PID control, computed torque control, force control, hybrid position force control, Impedance/ Torque control.

Text Books:

1. R.K. Mittal and I J Nagrath, " Robotics and Control", Tata McGraw Hill, 1st Edition, 2003.
2. Saeed B. Niku ,"Introduction to Robotics ", Pearson Education, 1st Edition, 2002.

Reference Books:

1. K S Fu, Gonzalez, C S Lee, "Robotics: Control, Sensing, Vision and Intelligence ", Mc Graw Hill, international edition, 1987.
2. R.D. Klafter, TA Chmielewski and Michael Negin, "Robotic Engineering- An Integrated approach", Prentice Hall of India, 1st Edition, 2003.
3. Steve heath, "Embedded system design", Elsevier, 2nd Edition, 2004.

Web References:

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

E-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

EMBEDDED PROGRAMMING LABORATORY

I Semester: ES

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
BESB09	Core	-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

I. COURSE OVERVIEW:

This course outlines the design and implementation of embedded systems using suitable hardware and Keil Embedded C software tools.The instruction set, Embedded C programming for I/O and memory interfacing techniques are covered.The hands-on experience acquired by the student's during the course makes them to carry out processor/controller based projects and extend their knowledge on the latest trends and technologies in the field of embedded system.

II. COURSE OBJECTIVES:

The students will try to learn:

I. Use embedded C for reading data from port pins.
II. he interfacing of data I/O devices with microcontroller.
III. The serial communication and port RTOS on microcontroller.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Make use** of emulators and cross-compilers for writing, compiling and running an embedded C language programs on training boards.	Apply
CO 2	**Develop** Embedded C language programs for accomplishing code to reading the data from ports, blinking the LED and interfacing of switch andbuzzer and temperature sensors to the microcontrollers.	Apply
CO 3	**Select** suitable RTOS of microcontroller and write Embedded C language program to run 2 to 3 tasks simultaneously.	Apply
CO 4	**Choose** serial or parallel communication for transmitting the data between microcontroller and peripherals.	Apply
CO 5	**Utilize** the Analog to Digital and Digital to Analog converters with micro- controller for data conversion.	Apply
CO 6	**Build** an interface between micro controller and peripherals to provide solutions to the realworld problems.	Analyze

LIST OF EXPERIMENTS

Week-1	**LED BLINKING**

Program to toggle all the bits of port P1 continuously with 250 ms delay.

Week-2	**INTERFACING OF SWITCH AND BUZZER**