Academic Course Description

BHARATH UNIVERSITY
Faculty of Engineering and Technology
Department of Electrical and Electronics Engineering

BEE009 ROBOTICS AND AUTOMATION
Sixth Semester, (Even Semester)

Course (catalog) description

To provide comprehensive knowledge of robotics in the design, analysis and control point of view.

Compulsory/Elective course: Elective for EEE students

Credit hours : 3 credits & 45Hrs

Course Coordinator : S .P.Vijayaragavan

Instructors **:** S .P.Vijayaragavan

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@ bharathuniv.ac.in	Consultation
S .P.Vijayaragavan	Final year EEE	KS 304		hod.eee@ bharathuniv.ac.in	9.00-9.50 AM

Relationship to other courses:

Pre –requisites **:** (BEE501)- Control System
Assumed knowledge : Develop mathematical models and understand the mathematical relationships between the sensitivity functions and how they govern the fundamentals in control systems. Design and fine tune PID controllers and understand the roles of P, I and D in feedback control; implement PID controllers design pole-assignment controller and the specific design procedures
Following courses : nil

Syllabus Contents

UNIT I BASICCONCEPTS 9

Robotics – basic components – classification - performance characteristics- drives and control systems – electric , hydraulic and pneumatic actuators – control loops using current amplifiers and voltage amplifiers**.**

UNIT II SENSORS AND TRANSDUCERS 9

Sensors and vision systems; Transducers and sensors – tactile sensors –Proximity and range sensors –Acoustics sensors- visition systems – image Processing and analysis –image data reduction – segmentation feature

UNIT III ROBOTIC PROGRAMMING AND GRIPPER 9

End effectors –type –mechanical gripper –vacuum cup- magnetic grippers – robot to end effectors interface –software for industrial robots – positive stop program-Point to point program and continuous path program.

UNIT IV KINEMATICSANDPATHPLANNING 9

Robot motion analysis and control manipulation kinematics – homogeneous Transformation and robot dynamics configuration of a robot controller

UNIT V INDUSTRIALROBOT 9

Industrial robots –Robots for welding ,painting and assembling –remote Controlled robots for nuclear ,thermal and chemical plants –industrial Automation – typical examples of automated industries .

Text book(s) and/or required materials

T1. MikellPGroover, "Industrial robotics : technology, programming, and applications" McGraw Hill New Delhi, 1996.

T2. Ghosh, "Control in Robotics and Automation: Sensor Based Integration", Allied Publishers, Chennai, 1998

Reference Books:

R1. Deb.S.R, "Robotics technology and flexible Automation", John Wiley1992

R2. Asfahl. C.R, "Robots and manufacturing Automation", John Wiley, USA ,1992.

Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	0%
Professional subject	-	0%
Non major elective	-	100%

Broad area : Circuit Theory | Electrical Machines| Electronics | Power System| **Control &Instrumentation**

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	February 2nd week	Session 1 to 14	2 Periods
2	Cycle Test-2	March 2nd week	Session 15 to 28	2 Periods
3	Model Test	April 3rd week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

To provide comprehensive knowledge of robotics in the design, analysis and control point of view.	Correlates to program outcome		
	H	**M**	**L**
1. To study the basic concepts of robotics	b,c,e,g,I,k,l	a,f,h,j	
2. To study about the sensors and transducers involved in robotics.	l	a,b,c	
3. To study about the software and programming for robots	b,g,l	a,c,e,f,h,j	
4. To study about the robot motion analysis and control manipulation kinematics	b,i,k,l	a,c,	
5. To study the remote controlled robots for industrial automation	b,g,j,l	a,c,f,h	

H: high correlation, M: medium correlation, L: low correlation

Draft Lecture Schedule

S.NO	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I	**BASICCONCEPTS**		
1.	Robotics	NO	T1,T2
2.	basic components	NO	
3.	classification	NO	
4.	performance characteristics	NO	
5.	drives and control systems	NO	
6.	Electric, hydraulic and pneumatic actuators	NO	
7.	control loops using current amplifiers	YES	
8.	control loops using voltage amplifiers	YES	
9.	Applications of Components	NO	
UNIT II	**SENSORS AND TRANSDUCERS**		
10.	Sensors and vision systems	NO	T1,T2
11.	Transducers and sensors	NO	
12.	tactile sensors	NO	
13.	Proximity and range sensors	NO	
14.	Acoustics sensors	NO	
15.	visition systems	NO	
16.	image Processing and analysis	NO	
17.	image data reduction	NO	
18.	segmentation feature	NO	
UNIT III	**ROBOTIC PROGRAMMING AND GRIPPER**		
19.	End effectors	NO	T1,T2
20.	type –mechanical gripper	NO	
21.	vacuum cup	NO	
22.	magnetic grippers	NO	
23.	robot to end effectors interface	NO	
24.	software for industrial robots	NO	
25.	positive stop program	NO	
26.	Point to point program	NO	
27.	continuous path program.	NO	
28.	Programming Algorithm	YES	
UNIT IV	**KINEMATICS AND PATH PLANNING**		
29.	Robot motion analysis	YES	

30.	control manipulation kinematics	YES	T1,T2
31.	homogeneous Transformation	YES	
32.	Robot dynamics configuration of robot controller	YES	
33.	matrix transformations	YES	
34.	formulating homogeneous transformation	YES	
35.	matrices and composite transformations	YES	
36.	D-H parameters	YES	
37.	3-D wrist	NO	
38.	kinematics solutions for a robot arm	YES	
UNIT V	**INDUSTRIALROBOT**		
39.	Industrial robots	NO	T1,T2
40.	Robots for welding	NO	
41.	painting and assembling	NO	
42.	remote Controlled robots for nuclear	NO	
43.	remote Controlled robots for thermal and chemical plants	NO	
44.	industrial Automation	NO	
45.	typical examples of automated industries .	NO	

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	10%
Attendance	-	5%
Assignment	-	5%
Final exam	-	70%

Prepared by: **Dated:**
S .P.Vijayaragavan

Addendum

ABET Outcomes expected of graduates of B.Tech / EEE / program by the time that they graduate:

a) An ability to apply knowledge of mathematics, science, and engineering fundamentals.
b) An ability to identify, formulate, and solve engineering problems.
c) An ability to design a system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d) An ability to design and conduct experiments, as well as to analyze and interpret data.
e) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
f) An ability to apply reasoning informed by the knowledge of contemporary issues.
g) An ability to broaden the education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
h) An ability to understand professional and ethical responsibility and apply them in engineering practices.
i) An ability to function on multidisciplinary teams.
j) An ability to communicate effectively with the engineering community and with society at large.
k) An ability in understanding of the engineering and management principles and apply them in project and finance management as a leader and a member in a team.
l) An ability to recognize the need for,and an ability to engage in life-long learning.

Program Educational Objectives

PEO1: PREPARATION

Electrical Engineering Graduates are in position with the knowledge of Basic Sciences in general and Electrical Engineering in particular so as to impart the necessary skill to analyze and synthesize electrical circuits, algorithms and complex apparatus.

PEO2: CORE COMPETENCE

Electrical Engineering Graduates have competence to provide technical knowledge, skill and also to identify, comprehend and solve problems in industry, research and academics related to power, information and electronics hardware.

PEO3: PROFESSIONALISM

Electrical Engineering Graduates are successfully work in various Industrial and Government organizations, both at the National and International level, with professional competence and ethical administrative acumen so as to be able to handle critical situations and meet deadlines.

PEO4: SKILL

Electrical Engineering Graduates have better opportunity to become a future researchers/ scientists with good communication skills so that they may be both good team-members and leaders with innovative ideas for a sustainable development.

PEO5: ETHICS

Electrical Engineering Graduates are framed to improve their technical and intellectual capabilities through life-long learning process with ethical feeling so as to become good teachers, either in a class or to juniors in industry.

Course Teacher	Signature
S .P.Vijayaragavan	

Course Coordinator
(**S .P.Vijayaragavan**)

HOD/EEE
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