

Academic Course Description

BHARATH UNIVERSITY Faculty of Engineering and Technology Department of Electrical and Electronics Engineering BEE703 & ELECTRICAL DRIVES AND CONTROL Seventh semester (Odd Semester)
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Course (catalog) description

To enable the students to gain a fair knowledge on characteristics and applications of electrical drives and how to control the speed of the AC & DC Motors.

Compulsory/Elective course: Compulsory for EEE students

Credit hours & contact hours: 4 & 60 hours

Course Coordinator : Mr.K.Sakthivel

Instructors : Mr.K.Sakthivel

Name of the instructor	Class handling	Office location	Office phone	Email (domain: @bharathuniv.ac.in)	Consultation
Mr.K.Sakthivel	Final year, EEE	KS 304	04422290125	sakthivelk.eee@bharathuniv.ac.in	12.00- 12.50 PM

Relationship to other courses:

Pre –requisites : Electrical Machines – I

Assumed knowledge : The students have the basics of power electronics, AC & DC machines which can be utilized for drives and control.

Syllabus Contents

UNIT I CHARACTERISTICS OF ELECTRICAL DRIVES 12

Speed – torque characteristics of various types of loads and drives motors-joint speed –torque characteristics – selection of power rating for drives motors with regard to thermal over loading and load variation factors – load equalization – starting, breaking and reversing operation.

UNIT II DC DRIVES 12

Speed control of DC motors- Ward Leonard scheme - Closed loop operation - speed regulation and speed loop - current loop , tracing of waveforms , speed reversal , torque reversal , with/ without braking and regeneration.

UNIT III THREE PHASE INDUCTION MOTORS DRIVES 12

Speed control of three phase induction motors- Stator control o stator voltages and frequency control-AC chopper, inverter and cyclo converter fed induction motor drives’ Rotor control- Rotor resistance control and slip power frequency recovery schemes- Static control of rotor resistance using DC chopper- Static Kramer and scherbius drives.

UNIT IV THREE PHASE SYNCHRONOUS MOTOR DRIVES 12

Speed control of the phase synchronous motor- Voltage source and current source inverters fed synchronous motor- Commutator less DC motor- closed loop control of drives motors. .Marginal angle control - torque angle control - power factor control of synchronous motor

UNIT V DIGITAL CONTROL AND DRIVE APPLICATION 12

Digital techniques in speed control-advantages and limitations-Microprocessor based control of drives- selection of drives and control schemes for steel rolling mills,papermills,lifts and cranes.

Text book(s) and/or required materials

- T1. S.K Pillai’A First Course On Electrical Drives’, Wiley eastern Ltd., Bombay 1989.
- T2.Gopal,K.Dubey,’ Power Semiconductor Controlled Drives,’Prentics Hall, Englewood Cliffs, New Jersey 1989.
- T3. N.K.De, P.K.SEN, “Electrical Drives”, PHI, New Delhi.

Reference Books:

- R1.P.C. Sen,’Thyristor DCdrives’, John Whey and Sons, New York, 1981.
- R2.B.K. Bose,’Power electronics and AC drives’, Prentice Hall, Englewood cliffs, New Jersey, 1986.
- R3. Vedhamsubramanyam, Thyristor control of electric drives’,Tata McGraw hill publishing company Ltd. New Delhi, 1991.
- R4. http://www.motioncontrolonline.org/content-detail.cfm/Motion-Control-News/Electric-Drives-Concepts-and-Applications/content_id/1082

Computer usage:

Professional component

General	-	0%
Basic Sciences	-	0%
Engineering sciences & Technical arts	-	0%
Professional subject	-	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	August 1 st week	Session 1 to 24	2 Periods
2	Cycle Test-2	September 2 nd week	Session 25 to 42	2 Periods
3	Model Test	October 2 nd week	Session 1 to 460	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

<p>This course is to develop a strong foundation in analysis and design of digital electronics. This course introduces combinational and sequential circuit design. It also discussed concepts of memory, programmable logic and digital integrated circuits.</p>	Correlates to program outcome		
	H	M	L
1. To learn the General characteristics of different types of electrical AC & DC Motors with respect to the applications.		a,f,g,i	
2.: To understand the operation of different types of DC electrical drives.		a,f,g,i	
3. To understand the operation of Three Phase Induction Motors Drive.		a,f,g,i	
4. To understand the operation of Three Phase Synchronous Motor Drives.		a,f,g,i	
5. To learn the operation of control circuits and applications of Digital Control And Drive Application.	g	a,f,i	

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

Draft Lecture Schedule

S.NO	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I CHARACTERISTICS OF ELECTRICAL DRIVES			
1.	Speed torque characteristics of various types of loads and drives motors	No	[T2]
2.	Joint speed torque characteristics	No	
3.	Selection of power rating for drives motors with regard to thermal over loading	Yes	
4.	Selection of power rating for drives motors with regard to load variation factors	Yes	
5.	Load equalization	Yes	
6.	Starting operation	Yes	
7.	Breaking operation	Yes	
8.	Reversing operation	Yes	
9.	Review of UNIT I	No	
10.	No	No	
UNIT II DC DRIVES			
11.	Review of speed control techniques	Yes	[T2]
12.	Speed control of DC motors	Yes	
13.	Ward Leonard scheme	No	
14.	Closed loop operation	Yes	
15.	speed regulation and speed loop	Yes	
16.	current loop , tracing of waveforms	Yes	
17.	speed reversal with/ without braking and regeneration	Yes	
18.	torque reversal with/ without braking and regeneration	Yes	
19.	Review of UNIT I	No	
20.	No		
UNIT III THREE PHASE INDUCTION MOTORS DRIVES			
21.	Speed control of three phase induction motors	Yes	[T2]
22.	stator voltages and frequency control method	Yes	
23.	AC chopper	Yes	
24.	inverter fed induction motor drives	Yes	
25.	Rotor control	Yes	
26.	cyclo converter fed induction motor drives	Yes	

27.	converter fed induction motor drives	Yes	
28.	Rotor resistance control and slip power frequency recovery schemes	Yes	
29.	Static control of rotor resistance using DC chopper- Static Kramer	Yes	
30.	Static control of rotor resistance using DC chopper- scherbius drives.	Yes	
31.	Problems	Yes	
32.	Review of Unit III	Yes	
33.	No	No	
UNIT IV THREE PHASE SYNCHRONOUS MOTOR DRIVES			
34.	Speed control of three phase synchronous motor	Yes	[T2]
35.	Voltage source inverters fed synchronous motor	Yes	
36.	Current source inverters fed synchronous motor	Yes	
37.	Commutator less DC motor- closed loop control of drives motors	Yes	
38.	.Marginal angle control of synchronous motor	Yes	
39.	torque angle control of synchronous motor	Yes	
40.	power factor control of synchronous motor	Yes	
41.	Problems	Yes	
42.	Problems	Yes	
43.	Problems	Yes	
44.	Surprise Test	Yes	
45.	Review of Unit IV	Yes	
46.	No	No	
UNIT V DIGITAL CONTROL AND DRIVE APPLICATION			
47.	Digital techniques in speed control	No	[T2]
48.	Discussion on advantages and limitations	No	
49.	Microprocessor based control of drives	No	
50.	selection of drives and control schemes for steel rolling mills,paper mills,lifts and cranes.	No	
51.	Extra Problems	Yes	
52.	Extra Problems	Yes	
53.	Extra Problems	Yes	
54.	Extra Problems	Yes	
55.	Extra Problems	Yes	
56.	Surprise Test	Yes	
57.	Review of Unit V	No	
58.	Review of all units	No	
59.	Test	No	
60.	Test	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	-	05%
Cycle Test – II	-	05%
Model Test	-	10%
Attendance	-	05%
SEMINAR&ASSIGNMENT	-	05%
Final exam	-	70%

Prepared by: Mr.K.Sakthivel

Dated :

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
Mr.K.Sakthivel	

Course Coordinator
(Mr.K.Sakthivel)

HOD/EEE
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