Academic Course Description

BHARATH UNIVERSITY

Faculty of Engineering and Technology

Department of Electrical and Electronics Engineering

BEE504 & ELECTRICAL MACHINE DESIGN

Fifth Semester (Odd Semester)

Course (catalog) description:

To provide sound knowledge about constructional details and design of various electrical machines.

Compulsory/Elective course : Compulsory for EEE students

Credit hours &contact hours : 4 & 60 hours

Course Coordinator : Mrs.Anitha Sampathkumar

Instructors : Mrs.Anitha Sampathkumar

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@ bharathuniv.ac.in	Consultation
Mrs.Anitha Sampathkumar	Third year EEE	KS 302	04422290125	Anitha.eee:@ bharathuniv.ac.in	12.30 PM-1.30 PM

Relationship to other courses:

Pre –requisites **:** BEE302 - Electrical Machines – I

Assumed knowledge : Knowledge based on electrical machines

Syllabus Contents:

UNIT I INTRODUCTION 12

Major considerations in Electrical Machine Design - Electrical Engineering Materials – Space factor – Choice of Specific Electrical and Magnetic loadings - Thermal considerations - Heat flow – Temperature rise - Rating of machines – Standard specifications.

UNIT-II DCMACHINES 12

Output Equations – Main Dimensions - Magnetic circuit calculations – Carter's Coefficient - Net length of Iron –Real & Apparent flux densities – Selection of number of poles – Design of Armature – Design of commutator and brushes – performance prediction using design values.

UNIT-III TRANSFORMERS 12

Output Equations – Main Dimensions - KVA output for single and three phase transformers – Window space factor – Overall dimensions – Operating characteristics – Regulation – No load current – Temperature rise in Transformers – Design of Tank - Methods of cooling of Transformers.

UNIT-IV INDUCTIONMOTOR 12

Output equation of Induction motor – Main dimensions – Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings – Design of wound rotor – Magnetic leakage calculations – Leakage reactance of polyphase machines- Magnetizing current - Short circuit current – Circle diagram - Operating characteristics.

UNIT-V SYNCHRONOUS MACHINES 12

Output equations – choice of loadings – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field mmf – Design of field winding – Design of turbo alternators – Rotor design.

Text book(s) and/or required materials:

T1:Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 1984.

T2:Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987

Reference Books:

R1.Shanmugasundaram, G.Gangadharan, R.Palani, 'Electrical Machine Design Data Book', New Age Intenational Pvt. Ltd., Reprint 2007.

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 1st week	Session 1 to 24	2 Periods
2	Cycle Test-2	September 2nd week	Session215 to 48	2 Periods
3	Model Test	October 2nd week	Session 1 to 60	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

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.	Correlates to program outcome		
	H	**M**	**L**
CO1: To study mmf calculation and thermal rating of various types of electrical machines.	A,b,e	F,g	C,d,h,I,j, k,l
CO2: To design armature and field systems for D.C. machines.	A,b	E,f,g	c,d,h,I,j, k,l
CO3: To design core, yoke, windings and cooling systems of transformers.	A,b,e	F,g	c,d,h,I,j, k,l
CO4: To design stator and rotor of induction machines.	A,b,e	F,g	c,d,h,I,j, k,l
CO5: To design stator and rotor of synchronous machines and study their thermal behavior	A,b,e	F,g	c,d,h,I,j, k,l

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

Draft Lecture Schedule			
S.NO	**Topics**	**Problem solving (Yes/No)**	**Text / Chapter**
UNIT I	**INTRODUCTION**		
1.	Major considerations in Electrical Machine Design.	YES	[T1],[R1]
2.	Major considerations in Electrical Machine Design.	YES	
3.	Electrical Engineering Materials.	YES	
4.	Space factor.	YES	
5.	Choice of Specific Electrical and Magnetic loadings.	YES	
6.	Choice of Specific Electrical and Magnetic loadings.	YES	
7.	Thermal considerations.	YES	
8.	Thermal considerations.	YES	
9.	Heat flow.	YES	
10.	Temperature rise.	YES	
11.	Rating of machines.	YES	
12.	Standard specifications.	YES	
UNIT II	**DC MACHINES**		
13.	Output Equations.	YES	

14.	Main Dimensions.	YES	[T1],[T2]
15.	Magnetic circuit calculations.	YES	
16.	Carter's Coefficient.	YES	
17.	Net length of Iron.	YES	
18.	Real & Apparent flux densities.	YES	
19.	Real & Apparent flux densities.	YES	
20.	Selection of number of poles.	YES	
21.	Selection of number of poles.	YES	
22.	Design of Armature.	YES	
23.	Design of commutator and brushes.	YES	
24.	Performance prediction using design values.	YES	
UNIT III	**TRANSFORMERS**		
25.	Output Equations.	YES	[T1],[R1]
26.	Main Dimensions.	YES	
27.	KVA output for single and three phase transformers.	YES	
28.	KVA output for single and three phase transformers.	YES	
29.	Window space factor.	YES	
30.	Overall dimensions.	YES	
31.	Operating characteristics.	YES	
32.	Regulation.	YES	
33.	No load current.	YES	
34.	Temperature rise in Transformers.	YES	
35.	Design of Tank	YES	

36.	Methods of cooling of Transformers.	YES	
UNIT IV	**INDUCTION MOTOR**		
37.	Output equation of Induction motor.	YES	[T1],[T2]
38.	Main dimensions.	YES	
39.	Length of air gap.	YES	
40.	Rules for selecting rotor slots of squirrel cage machines.	YES	
41.	Design of rotor bars & slots.	YES	
42.	Design of end rings.	YES	
43.	Design of wound rotor.	YES	
44.	Magnetic leakage calculations.	YES	
45.	Leakage reactance of polyphase machines.	YES	
46.	Magnetizing current.	YES	
47.	Short circuit current.	YES	
48.	Circle diagram, Operating characteristics.	YES	
UNIT V	**SYNCHRONOUS MACHINES**		
49.	Output equations.	YES	[T1],[R1]
50.	Choice of loadings.	YES	
51.	Design of salient pole machines.	YES	
52.	Short circuit ratio.	YES	
53.	Shape of pole face.	YES	
54.	Armature design ,Armature parameters	YES	
55.	Estimation of air gap length.	YES	
56.	Design of rotor.	YES	

57.	Design of damper winding.	YES	
58.	Determination of full load field mmf.	YES	
59.	Design of field winding.	YES	
60.	Design of turbo alternators,Rotor design.	YES	

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: **Dated :**

Mrs.Anitha Sampathkumar

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
Mrs.Anitha Sampathkumar	

Course Coordinator **HOD/EEE**

(Mrs.Anitha Sampathkumar) ( )