Academic Course Description

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

BEE 302 Electrical Machines 1
Third Semester (Odd Semester)

Course (catalog) description

To give the students a fair knowledge on the working of various DC machines & Transformers

Compulsory/Elective course : Compulsory for EEE students

Credit hours &contact hours : 3 & 45 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	Second year EEE	KS 101	**04422290125**	**Anitha@ bharathuniv.ac.in**	9.00 – 9.50 AM

Relationship to other courses:

Pre –requisites **:** BEE101 - Basic Electrical & Electronics Engg

Assumed knowledge : Knowledge based on electrical machines

Syllabus Contents

UNIT I ELECTRO MAGNETIC INDUCTION & BASIC CONCEPTS IN ROTATING MACHINES 9

Introduction to magnetic circuits – Magnetically induced EMF and force – AC operation of magnetic circuits –. Energy in magnetic systems – Field energy & mechanical force – Single and Multiple excited systems. MMF of distributed windings – Magnetic fields in rotating machines – Generated voltages – Torque.

UNIT II DC GENERATORS 9

Constructional features of DC machine – Principle of operation of DC generator – EMF equation – Types of excitation – No load and load characteristics of DC generators – commutation – armature reaction – Parallel operation of DC generators.

UNIT III DC MOTORS 9

Principle of operation of DC motors-Back EMF – Torque equation –Types of DC motors-Speed – Torque characteristics of DC motors – Starting of DC motors: 2 point starter, 3 point starter, 4 point starter – Speed control: Field control, Armature control, voltage control, Thyristor control – Losses and efficiency – Applications

UNIT IV TRANSFORMERS 9

Principle of operation – Constructional features of single phase and three phase transformers – EMF equation – Transformer on No load and Load –Phasor diagram –equivalent circuit – Regulation – three phase transformer connections- parallel operation of single phase and three phase transformer- Auto transformers

UNIT V TESTING OF DC MACHINES& TRANSFORMERS 9

Losses and efficiency –Condition for maximum efficiency – Testing of DC machines: Brake test, Swinburne's test, Retardation test, Hopkinson's test- Testing of transformer: polarity test, load test, open circuit and short circuit test, Sumpner's test – All day efficiency.

Text book(s) and/or required materials

T1. Kothari.D.P and Nagrath.I.J., "Electrical Machines", Tata McGraw Hill Publishing Co.Ltd, New Delhi, 5th edition 2002.

T2.Bimbhra.P.S, Electrical Machinery, Khanna Publishers, IL Stephen L. Herman "Electrical transformers and rotating machines " Prentice Hall of India. 1st edition 2012.

T3.Theraja B.L. "Electrical Technology: Volume II. S. Chand and Co., New Delhi – 2012.

Reference Books:

R1. Dr. Murugesh Kumar.K. "DC Machines & Transformers", Vikas Publishing House PvtLtd.,2nd edition 2003.

R2. Fitgerald, A.E., Charles Kingsely Jr. Stephen D.Umans, "Electric Machinery" McGraw Hill Books Company, 6 th edition 2002.

R3. Hill Stephen, Chapman.J, "Electric Machinery Fundamentals", McGraw Hill Book Co., New Delhi, 4th edition 2005.

R4. Albert E Clayton and Hancock.N.N, "The performance and design of direct current Machines", Oxford and IBH publishing company Pvt. Ltd., New Delhi 1990.

R5. http://nptel.ac.in/courses/108105017/

Computer usage:

http://nptel.ac.in/courses/108102042/

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 18	2 Periods
2	Cycle Test-2	September 2nd week	Session 19 to 36	2 Periods
3	Model Test	October 2nd week	Session 1 to 45	3 Hrs
4	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

To give the students a fair knowledge on the working of various DC machines & Transformers	Correlates to program outcome		
	H	**M**	**L**
1. To familiarize the constructional details, the principle of operation, prediction of performance, the methods of testing the transformers and three phase transformer connections.	A,b,e	f,g	c,d,h,i,j,k,l
2. To introduce the principles of electromechanical energy conversion in singly and multiply excited systems.	A,b	e,f,g	c,d,h,i,j,k,l
3. To study the working principles of electrical machines using the concepts of electromechanical energy conversion principles and derive expressions for generated voltage and torque developed in all Electrical Machines.	A,b,e	f,g	c,d,h,i,j,k,l
4. To study the working principles of DC machines as Generator and Motor, types, determination of their no-load/load characteristics, starting and methods of speed control of motors.	A,b,e	f,g	c,d,h,i,j,k,l
5. To estimate the various losses taking place in D.C. machines and to study the different testing methods to arrive at their performance.	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	**ELECTRO MAGNETIC INDUCTION & BASIC CONCEPTS IN ROTATING MACHINES**		
1.	Introduction to magnetic circuits	YES	[T1],[T2]
2.	Magnetically induced EMF and force	YES	
3.	AC operation of magnetic circuits	YES	
4.	Energy in magnetic systems	YES	
5.	Field energy & mechanical force	YES	
6.	Single and Multiple excited systems. MMF of distributed windings	YES	
7.	Magnetic fields in rotating machines	YES	
8.	Generated voltages	YES	
9.	Torque.	YES	
UNIT II	**DC GENERATORS**		
10.	Constructional features of DC machine	YES	[T1],[R1],[R4]
11.	Principle of operation of DC generator	YES	
12.	EMF equation	YES	
13.	Types of excitation	YES	
14.	No load and load characteristics of DC generators	YES	
15.	commutation	YES	
16.	armature reaction	YES	
17.	Parallel operation of DC generators.	YES	
18.	Parallel operation of DC generators.	YES	
UNIT III	**DC MOTORS**		
19.	Principle of operation of DC motors-Back EMF	YES	[T1],[T2],[R1]
20.	Torque equation	YES	
21.	Types of DC motors	YES	
22.	Speed – Torque characteristics of DC motors –	YES	
23.	Starting of DC motors: 2 point starter, 3 point starter, 4 point starter	YES	
24.	Speed control: Field control, Armature control,	YES	
25.	voltage control, Thyristor control	YES	
26.	Losses and efficiency	YES	
27.	Applications	YES	
UNIT IV	**TRANSFORMERS**		
28.	Principle of operation	YES	[T1],[R1]
29.	Constructional features of single phase and three phase transformers	YES	
30.	EMF equation	YES	
31.	Transformer on No load and Load	YES	
32.	Phasor diagram	YES	
33.	equivalent circuit	YES	
34.	Regulation - three phase transformer connections	YES	
35.	parallel operation of single phase and three phase transformer	YES	
36.	Auto transformers	YES	
UNIT V	**TESTING OF DC MACHINES& TRANSFORMERS**		
37.	Losses and efficiency	YES	[T1],[R1],[R4]

38.	Condition for maximum efficiency	YES	
39.	Testing of DC machines: Brake test	YES	
40.	Swinburne's test	YES	
41.	Retardation test, Hopkinson's test	YES	
42.	Testing of transformer: polarity test, load test	YES	
43.	open circuit and short circuit test	YES	
44.	Sumpner's test	YES	
45.	All day efficiency.	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: Mrs. Anitha Sampathkumar **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
Mrs. Anitha Sampathkumar	

Course Coordinator
(Mrs. Anitha Sampathkumar)

HOD/EEE
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