Academic Course Description

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

BEE701 &POWER SYSTEM ANALYSIS

Seventh semester (Odd Semester)

Course (catalog) description

To model various power system components and carry out load flow, short circuit and stability studies.

Compulsory/Elective course: Compulsory for EEE students

Credit hours& contact hours : 4& 60 hours

Course Coordinator : Dr.V.Jayalakshmi

Instructors **:** Dr.V.Jayalakshmi

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@ bharathuniv.ac.in	Consultation
Dr.V.Jayalakshmi	Final year EEE	KS 304	04422290125	Jayalakshmi.eee@ bharathuniv.ac.in	12.30 PM-1.30 PM

Relationship to other courses:

Pre –requisites **:**BEE601Transmission And Distribution

Assumed knowledge :Mathematical skills to work with matrix algebra, complex numbers, vectors, first and second order differential equations

Syllabus Contents

UNIT I POWER SYSTEM COMPONENTS 12

Power System Model: Representation-Single Line Diagram-Per unit Quantities-Per unit impedance diagram-Primitive network and its matrices, Network formulation using bus admittance matrix and bus impedance matrix-Symmetrical Components-Sequence impedance and networks.

UNIT II LOAD FLOW STUDIES 12

Primitive network equation-Incidence Bus Matrix. Power flow studies: Formulation of Power flow equations using Y-bus matrix-power flow analysis-Guass-Seidal and Newton Raphson Methods-Handling of Voltage Controlled Buses Off nominal transformer ratios and phase shifting transformer-Fast Decoupled Method.

UNIT III SYMMETRICAL FAULT ANALYSIS 12

Symmetrical Short Circuit Analysis: Types of faults in power systems-Analysis of Symmetrical faults-short circuit capacity-symmetrical fault analysis through Z-bus.

UNIT IV UNSYMMETRICAL FAULT ANALYSIS 12

Unsymmetrical Short Circuit Analysis: Unsymmetrical faults in Power Systems-Analysis of single line to ground, line to line and double line to ground faults power systems using Z-bus.

UNIT V POWER SYSTEM STABILITY 12

Stability Analysis: Steady state and transient Stability limits-Swing equation for single machine infinite bus system-Equal area criterion- Critical clearing angle and time-Solution of swing equation by modified Euler and Runge-kutta methods Stability analysis of multi machine power system. Techniques for stability Improvement

Text book(s) and/or required materials

T1.J.J Nagrath& D.P Kothari, 'Modem Power System Analysis', Tata McGraw Hill, New Delhi, 1989.

T2.John J. Graigner and Stevenson Jr.W.D., 'Power System Analysis'. McGraw Hill International Edition, 199

Reference Books:

R1. Stevenson WD , 'Elements of Power System Analysis', Tata McGraw Hill, 1952.

R2.MA Pai, 'Computer Techniques in Power System Analysis', Tata McGraw Hill. New Delhi, 1979.

Computer usage: MATLAB

Professional component

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

Broad area : 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	Session 25 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

To model various power system components and carry out load flow, short circuit and stability studies.	Correlates to program outcome		
	H	**M**	**L**
1.Create computational models for analysis power systems and able to understand per unit system	a,b,d,	c,e,f,g, h,l	i,j,k
2. Perform load flow computations and analyze the load flow results.	a,b,d,e,f,	c,g,h,j,l	i,k
3. Analyse a power system network under Symmetrical Conditions.	a,b,c,d,e,f ,h	g,j,l	i,k
4. Understand Positive Sequence, Negative & zero sequence system and fault analysis.	a,b,c,d,e, h,	f,g,j,l	i,k
5. Analyze power system operation and stability control.	a,b,d,e,f,	c,g,h,j,l	i,k

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

Draft Lecture Schedule

S.no	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I	**POWER SYSTEM COMPONENTS**		
1.	Power System Model Representation	No	T1,T2
2.	Single Line Diagram	No	
3.	Per unit Quantities	Yes	
4.	Per unit Quantities	Yes	
5.	Per unit Quantities	Yes	
6.	Per unit impedance diagram-Primitive network and its matrices	Yes	
7.	Per unit impedance diagram-Primitive network and its matrices	Yes	
8.	Network formulation using bus admittance matrix and bus impedance matrix-Symmetrical Components	Yes	
9.	Network formulation using bus admittance matrix and bus impedance matrix-Symmetrical Components	Yes	
10.	Symmetrical Components	Yes	
11.	Sequence impedance and networks.	Yes	
12.	Sequence impedance and networks.	Yes	
UNIT II	**LOAD FLOW STUDIES**		
13.	Primitive network equation	Yes	R1,T2
14.	Incidence Bus Matrix	Yes	
15.	Power flow studies	No	
16.	Formulation of Power flow	No	
17.	equations using Y-bus matrix-power flow analysis	Yes	
18.	Guass-Seidal Methods	Yes	
19.	Guass-Seidal Methods	Yes	
20.	G Newton Raphson Methods	Yes	
21.	Newton Raphson Methods	Yes	
22.	Fast Decoupled Method.	Yes	
23.	Fast Decoupled Method.	Yes	
24.	Handling of Voltage Controlled Buses Off nominal transformer ratios and phase shifting transformer	No	
UNIT III	**SYMMETRICAL FAULT ANALYSIS**		
25.	Symmetrical Short Circuit Analysis	No	T2
26.	Types of faults in power systems	No	
27.	Analysis of Symmetrical faults	Yes	
28.	Analysis of Symmetrical faults	Yes	
29.	Analysis of Symmetrical faults	Yes	
30.	Analysis of Symmetrical faults	Yes	

31.	short circuit capacity	Yes	
32.	short circuit capacity	Yes	
33.	short circuit capacity	Yes	
34.	symmetrical fault analysis through Z-bus	Yes	
35.	symmetrical fault analysis through Z-bus.	Yes	
36.	symmetrical fault analysis through Z-bus.	Yes	
UNIT IV	**UNSYMMETRICAL FAULT ANALYSIS**		
37.	Unsymmetrical Short Circuit Analysis	No	T2
38.	Unsymmetrical Short Circuit Analysis	No	
39.	Analysis of single line to ground	Yes	
40.	Analysis of single line to ground	Yes	
41.	Analysis of single line to ground	Yes	
42.	Analysis of single line to line fault	Yes	
43.	Analysis of single line to line fault	Yes	
44.	Analysis of single line to line fault	Yes	
45.	Analysis of single double line to line fault	Yes	
46.	Analysis of single double line to line fault	Yes	
47.	line to line and double line to ground faults power systems using Z-bus.	Yes	
48.	line to line and double line to ground faults power systems using Z-bus.	Yes	
UNIT V	**POWER SYSTEM STABILITY**		
49.	Stability Analysis	No	T2,R1
50.	Steady state and transient Stability limits	No	
51.	Steady state and transient Stability limits	Yes	
52.	Swing equation for single machine infinite bus system	Yes	
53.	Swing equation for single machine infinite bus system	Yes	
54.	Equal area criterion	Yes	
55.	Equal area criterion	Yes	
56.	Critical clearing angle and time	Yes	
57.	Critical clearing angle and time	Yes	
58.	Solution of swing equation by modified Euler and Runge-kutta methods Stability analysis of multi machine power system.	Yes	
59.	Solution of swing equation by modified Euler and Runge-kutta methods Stability analysis of multi machine power system.	Yes	
60.	Techniques for stability Improvement	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:
Dr.V.Jayalakshmi

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.

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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
Dr.V.Jayalakshmi	

Course Coordinator ***HOD/EEE***

(Dr.V.Jayalakshmi) ()