

Academic Course Description

BHARATH UNIVERSITY
 Faculty of Engineering and Technology
 Department of Electrical and Electronics Engineering
BEE053 & POWER SYSTEM PROTECTION AND SWITCHGEAR
Fifth Semester (Odd Semester)

Course (catalog) description

To develop an ability and skill to design the feasible protection systems needed for each main part of a power system in students.

Compulsory/Elective course : Elective for EEE students

Credit & Contact hours : 3 and 45 hours

Course Coordinator : Mr.D. Purushothaman

Instructors : Mr.D. Purushothaman

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@bharathuniv.ac.in)	Consultation
Mr.D. Purushothaman	Third year EEE	KS 302	04422290125	hod.eee@bharathuniv.ac.in	9.00-9.50 AM

Relationship to other courses:

Assumed knowledge :To develop an ability and skill to design the feasible protection systems needed for each main part of a power system in students

Syllabus Contents

UNIT I PROTECTIVE RELAYS

9

Relay construction and characteristics-over current relays - Directional over current relays Directional relays- Differential relays-COMPARATORS-Under frequency and negative sequence relays-Electromagnetic and solid relay comparison.

UNIT II APPARATUS PROTECTION

9

Protection of generator &-transformer protection-Bus zone protection-Feeder protection carrier current scheme for transmission line-Relay co-ordination for a sample system- Substation layout and arrangement of equipment's.

UNIT III THEORY OF ARC QUENCHING

9

Arcing phenomena- Theory and methods of arc quenching- Circuit interruption in AC circuits- Recovery voltage- Restriking voltage- Resistance switching- Current chopping- Capacitive breaking characteristics of fuses and HRC fuses- DC circuit breaking.

UNIT IV CIRCUIT BREAKERS

9

Fault clearing process- Classification of circuit breakers- Construction and operation of circuit breakers- Oil minimum circuit breakers-air blast circuit breaker- Vacuum circuit breaker-SF₆, circuit breaker- Circuit breaker rating- Circuit breaker testing.

UNIT V CIRCUIT BREAKERS

9

Cause for over voltages- Lighting surges insulation failure and arcing grounds- Method of protection- ground wires, Peteron coils, surge absorbers and diverters- location of protective apparatus- Insulation co-ordination- neutral earthing.

Text book(s) and/or required materials

- T1.Sunil S. Rao. 'Switchgear and Protection', Khanna publisher,NewDelshi.1986
- T2 C.L Wadhwa,'Electrical Power System', Witey eastern Ltd, New Delhi 1983.
- T3. Ravindranath& M. Chandar," Protection & switch gear"New Age International

Reference Books:

- R1.S L Uppal. 'ELECTRIAL POWER', Khanna publishers. New Delhi. 1981
- R2. Son Bhatnagar \$ Gupta,' A course in electrical power', Dhanpat Rai & Sons, New Delhi,1976
- R3.B Ravindranath N chander, 'Power system protection and switch gear'. Wiley eastern Ltd, NEW Delhi, 1997
- R4.<http://www.nptel.ac.in/downloads/108101039/>

Computer usage:

Professional component

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

Broad area :Circuit theory| Electrical machines |Electronic | **Power system** | Control & Instrumentation

Test Schedule

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

Mapping of Instructional Objectives with Program Outcome

To develop an ability and skill to design the feasible protection systems needed for each main part of a power system in students	Correlates to program outcome		
	H	M	L
1. Understand the basic concepts of power system protection and relays.	A,c,d,i	B,e,g,j	F,h,k
2. Design the relevant protection systems for the main elements of a power system	A,c,d,i	B,e,g,j	F,h,k
3.Understand the theory of arcing phenomenon.	A,c,d,i	B,e,f,g, j	h,k
4.Analyze the purpose and working principle of different circuit breakers and tests.	A,c,d,i	B,e,f,g, h,j,l	k
5.Understand the overvoltage protection methods.	A,c,d,i	B,e,f,g, h,l	k

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

Draft Lecture Schedule

S.NO	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I PROTECTIVE RELAYS			
1.	Relay construction and characteristics-over current relays	No	[T1]
2.	Directional over current relays Directional relays	No	
3.	Differential relays-COMPARATORS	No	
4.	-COMPARATORS-Under frequency and negative sequence relays-	No	
5.	Electromagnetic	No	
6.	solid relay comparison.	No	
UNIT II APPARATUS PROTECTION			
7.	Protection of generator &-transformer protection	No	[T2]
8.	Bus zone protection	No	
9.	Feeder protection carrier current scheme for transmission line	Yes	
10.	Relay co-ordination for a sample system	No	
11.	Substation layout and arrangement of equipment's.	No	
UNIT III THEORY OF ARC QUENCHING			
12.	Arcing phenomena-	No	[R1]
13.	Theory and methods of arc quenching	No	
14.	Circuit interruption in AC circuits	Yes	
15.	Recovery voltage	No	
16.	Restriking voltage	No	
17.	Resistance switching	No	
18.	Current chopping	No	
19.	Capacitive breaking characteristics of fuses and HRC fuses-	Yes	
20.	DC circuit breaking	No	
21.			
UNIT IV CIRCUIT BREAKERS			
22.	Fault clearing process	No	
23.	Classification of circuit breakers	No	
24.	Construction and operation of circuit breakers	no	

25.	Oil minimum circuit breakers	No	[T2]
26.	air blast circuit breaker	No	
27.	Vacuum circuit breaker	No	
28.	SF ₆	Yes	
29.	circuit breaker	No	
30.	Circuit breaker rating	No	
31.	Circuit breaker testing	No	
UNIT V CIRCUIT BREAKERS			
32.	Cause for over voltages	No	[R2]
33.	Lighting surges insulation failure and arcing grounds	Yes	
34.	Method of protection-	No	
35.	ground wires	Yes	
36.	Peteron coils	nO	
37.	surge absorbers and diverters	No	
45.	location of protective apparatus- Insulation co-ordination- neutral earthing.	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	-	5%
SEMINAR& ASSIGNMENT		05%
Final exam	-	70%

Prepared by: Mr.D. Purushothaman

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.D.Purushothaman	

Course Coordinator
(Mr.D. Purushothaman)

HOD/EEE

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