



DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE PLAN – PART I			
Name of the Programme and Specialization	B.Tech. – Electrical and Electronics Engineering		
Course Title	POWER SYSTEM PROTECTION AND SWITCHGEAR		
Course Code	EEPC24	No. of Credits	04
Course Code of Pre-requisite subject(s)	EEPC18		
Session	JANUARY 2022 (On-line)	Section (if, applicable)	B
Name of Faculty	P. RAJA	Department	EEE
Email	<a href="mailto:protection.pr2022@gmail.com">protection.pr2022@gmail.com</a>	Telephone No.	9942680653
Name of Course Coordinator(s) (if, applicable)	-		
Course Type	<input checked="" type="checkbox"/> Core course	<input type="checkbox"/> Elective course	
<b>Syllabus (approved in BoS)</b>			
<p>Relays – General classification, Principle of operation, types, characteristics, Torque equation, Relaying Schemes, Relay Co-ordination.</p> <p>Apparatus and line protection – Line Protection – Distance, Differential protection and Carrier current protection. Generator protection – protection against abnormal condition, stator and rotor protection Transformer Protection – Incipient fault–Differential protection, Feeder and Bus bar protection.</p> <p>Introduction to substation architecture, automation and protection - Protection against over voltages – Causes of over voltage, Ground wires, Surge absorbers and diverters. Earthing - types. Insulation co-ordination.</p> <p>Theory of arcing and arc quenching circuit breakers-types – rating and comparison, RRRV, Resistor switching and capacitor switching.</p> <p>Introduction to Static relays – Digital relays - Microprocessor based relays – Apparatus and line protection – Basics of Numerical relays.</p>			
<b>COURSE OBJECTIVES</b>			
To give a broad coverage on all types of protective relays, circuit breakers and provide a strong background for working in a practical power system protection.			



<b>COURSE OUTCOMES (CO)</b>	
<b>Course Outcomes</b>	<b>Aligned Programme Outcomes (PO)</b>
Upon completion of the course the students would be able to	
1. Classify and describe the working of various relaying schemes	5, 8, 9, 11
2. Identify and implement an appropriate relaying schemes for different power apparatus	2, 5, 8, 9, 10, 11
3. Illustrate the function of various CBs and related switching issues	5, 8, 9, 11
4. Describe the causes of overvoltage and protection against overvoltage	2, 5, 8, 9, 11

**COURSE PLAN – PART II**

**COURSE OVERVIEW**

Electrical power system operates at various voltage levels from 415 V to 400 kV or even more. Electrical apparatus used may be enclosed (e.g., motors) or placed in open (e.g., transmission lines). All such equipment undergo abnormalities in their life time due to various reasons.

For example, a worn out bearing may cause overloading of a motor. A tree falling or touching an overhead line may cause a fault. A lightning strike (classified as an act of God!) can cause insulation failure. Pollution may result in degradation in performance of insulators which may lead to breakdown. Under frequency or over frequency of a generator may result in mechanical damage to its turbine requiring tripping of an alternator. Even otherwise, low frequency operation will reduce the life of a turbine and hence it should be avoided.

It is necessary to avoid these abnormal operating regions for safety of the equipment. Even more important is safety of the human personnel which may be endangered due to exposure to live parts under fault or abnormal operating conditions. Hence, every electrical equipment has to be monitored to protect it and provide human and apparatus safety under abnormal operating conditions. This job is assigned to electrical protection systems. It encompasses apparatus protection and system protection.

This course is designed such a way that it covers basic relaying schemes and their applications towards the apparatus protection. The other part of the syllabus engages construction and operating principles of various Circuit Breakers (CBs) used. Along with this the switching effects during the operation of CBs and various specifications of CBs also will be dealt. The course covers the causes and effects of over voltage in electric power system and its associated protection schemes. Finally the course introduces various Numerical relaying schemes through schematics.



COURSE TEACHING AND LEARNING ACTIVITIES			
S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	3 <sup>rd</sup> Week of January (19 <sup>th</sup> Jan to 21 <sup>st</sup> Jan) <b>(2 Contact Hours)</b>	Course plan details Discussion on fundamentals of Power System Protection	MS Teams One-note
2	4 <sup>th</sup> Week of January (24 <sup>th</sup> Jan to 28 <sup>th</sup> Jan) <b>(4 Contact Hours)</b>	Current and Potential Transformers Over-current relays	MS Teams One-note
3	5 <sup>th</sup> Week of January & 1 <sup>st</sup> Week of February (31 <sup>st</sup> Jan to 4 <sup>th</sup> Feb) <b>(4 Contact Hours)</b>	Directional over-current relay Problems and relay co-ordination General Torque equation	MS Teams One-note
4	2 <sup>nd</sup> Week of February (7 <sup>th</sup> Feb to 11 <sup>th</sup> Feb) <b>(4 Contact Hours)</b>	Introduction to Impedance relay Distance relays Differential relays	MS Teams One-note
5	3 <sup>rd</sup> Week of February (14 <sup>th</sup> Feb to 18 <sup>th</sup> Feb) <b>(4 Contact Hour)</b>	Numerical Examples <i>Protection of Alternators</i>	MS Teams One-note
6	4 <sup>th</sup> Week of February (21 <sup>st</sup> Feb to 25 <sup>th</sup> Feb) <b>(4 Contact Hour)</b>	Protection of Transformers <i>(Doubt Clearing)</i> <b>QUIZ – I</b>	<i>Flipped Class (Recorded Video Lecture)</i>
7	5 <sup>th</sup> Week of February & 1 <sup>st</sup> Week of March (28 <sup>th</sup> Feb to 4 <sup>th</sup> Mar) <b>(4 Contact Hours)</b>	Protection of Transmission Lines and bus bars	MS Teams One-note
8	2 <sup>nd</sup> Week of March (7 <sup>th</sup> Mar to 11 <sup>th</sup> Mar) <b>(4 Contact Hour)</b>	Introduction to substation architecture, automation and protection - Protection against over voltages	MS Teams One-note
9	3 <sup>rd</sup> Week of March (14 <sup>th</sup> Mar to 18 <sup>th</sup> Mar) <b>(3 Contact Hour)</b>	Causes of over voltage, Ground wires, Surge absorbers and diverters <b>QUIZ - II</b>	MS Teams One-note & PPT
10	4 <sup>th</sup> Week of March (21 <sup>st</sup> Mar to 25 <sup>th</sup> Mar) <b>(2 Contact Hours) (Break)</b>	Earthing - types. Insulation co- ordination. Theory of arcing and arc quenching	<i>Flipped Class (Recorded Video Lecture)</i>
11	5 <sup>th</sup> Week of March & 1 <sup>st</sup> Week of April (28 <sup>th</sup> Mar to 1 <sup>st</sup> Apr) <b>(4 Contact Hours)</b>	Circuit Breakers Introduction – Oil and Air CB, Vacuum and SF <sub>6</sub> CB Problems Associated with CBs	MS Teams One-note & PPT
12	2 <sup>nd</sup> Week of April (4 <sup>th</sup> Apr to 8 <sup>th</sup> Apr) <b>(4 Contact Hours)</b>	Circuit Breakers rating and comparison, RRRV, Resistor switching and capacitor switching.	MS Teams One-note & PPT



13	3 <sup>rd</sup> Week of April (11 <sup>th</sup> Apr to 15 <sup>th</sup> Apr) <b>(2 Contact Hour)</b>	Introduction to Static relays – Digital relays - Microprocessor based relays – Apparatus and line protection.	MS Teams One-note & PPT
14	4 <sup>th</sup> Week of April (18 <sup>th</sup> Apr to 22 <sup>nd</sup> Apr) <b>(4 Contact Hours)</b>	Introduction to Static relays – Digital relays - Microprocessor based relays – Apparatus and line protection contd.... <b>QUIZ - III</b>	MS Teams One-note & PPT
15	5 <sup>th</sup> Week of April (25 <sup>th</sup> Apr to 27 <sup>th</sup> Apr) <b>(2 Contact Hours)</b>	Basics of Numerical relays. <b>COMPENSATION ASSESSMENT (CPA)</b>	MS Teams PPT Descriptive Written Exam
16	1 <sup>st</sup> week to 3 <sup>rd</sup> Week of May (5 <sup>th</sup> May to 18 <sup>th</sup> May)	<b>ASSESSMENT - V</b>	Descriptive Written Exam

**COURSE ASSESSMENT METHODS (shall range from 4 to 6)**

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	QUIZ I (objective type NOT MCQ)	4 <sup>th</sup> Week of February 2022	30 Minutes	<b>20</b>
2	QUIZ II (objective type NOT MCQ)	3 <sup>rd</sup> Week of March 2022	60 Minutes	<b>25</b>
3	Surprise test & Assignment	--	10 Minutes	<b>15</b>
4	QUIZ III (objective type NOT MCQ)	4 <sup>th</sup> Week of April 2022	30 Minutes	<b>10</b>
CPA	Compensation Assessment (Written Test)	5 <sup>th</sup> Week of April 2022	60 Minutes	<b>20</b>
5	Descriptive Type Examination (Final Assessment)	2 <sup>nd</sup> Week of May 2022	120 Minutes	<b>30</b>

**\*mandatory; refer to guidelines on page 4**

**COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)**

- Feedback from the students during class committee meetings
- Anonymous feedback through questionnaire (Mid of the semester & End of the semester) end semester feedback on Course Outcomes

**COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, , academic honesty and plagiarism etc.)**

**MODE OF CORRESPONDENCE (email/ phone etc)**

1. All the students are advised to check their NITT WEBMAIL regularly. All the correspondence (schedule of classes/ schedule of assessment/ course material/ any other information regarding this course) will be done through their webmail only.
2. Queries (if required) to the course teacher shall only be emailed to [protection.pr2022@gmail.com](mailto:protection.pr2022@gmail.com).



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### ATTENDANCE

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

### COMPENSATION ASSESSMENT

1. Attending all the assessments are **MANADATORY** for every student.
2. One Compensation Assessment (CPA) will be conducted for those students who are being physically absent for the assessments 1 and 2.
3. At any case, CPA will not be considered as an improvement test.
4. Relative grading will be adopted for the course.

### ACADEMIC HONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

### ADDITIONAL INFORMATION

The faculty is available for consultation at times as per the intimation given by the faculty.

Queries may also be emailed to the Course Coordinator directly at [protection.pr2022@gmail.com](mailto:protection.pr2022@gmail.com).

### FOR APPROVAL

Course Faculty  CC-Chairperson  HOD Approved By HOD

(Dr. S MAGESHWARI) (Dr. V SANKARANARAYANAN)



**Guidelines**

- a) The number of assessments for any theory course shall range from 4 to 6.
- b) Every theory course shall have a final assessment on the entire syllabus with at least 30% weightage.
- c) One compensation assessment for absentees in assessments (other than final assessment) is mandatory. Only genuine cases of absence shall be considered.
- d) The passing minimum shall be as per the regulations.

B.Tech. Admitted in				P.G.
2018	2017	2016	2015	
35% or (Class average/2) whichever is greater.		(Peak/3) or (Class Average/2) whichever is lower		40%

- e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.
- f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.
- g) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.