



# NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

## DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE PLAN – PART I			
Name of the Programme and Specialization	B.Tech - Electrical 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	Section (if, applicable)	III Year/VI sem - Sec A
Name of Faculty	Dr. S. Kayalvizhi	Department	EEE
Email	<a href="mailto:kayalvizhi@nitt.edu">kayalvizhi@nitt.edu</a>	Telephone No.	9790050752
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><b>Module 1:</b> Relays – General classification, Principle of operation, types, characteristics, Torque equation, Relaying Schemes, Relay Co-ordination.</p> <p><b>Module 2:</b> 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><b>Module 3:</b> 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><b>Module 4:</b> Theory of arcing and arc quenching circuit breakers-types – rating and comparison, RRRV, Resistor switching and capacitor switching.</p> <p><b>Module 5:</b> 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.			



**COURSE OUTCOMES (CO)**

<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.	1,2,3,5,6,8,9,12,13
2. Identify and implement an appropriate relaying scheme for different power apparatus.	1,2,3,5,6,8,9,12,13
3. Illustrate the function of various CBs and related switching issues.	1,2,3,5,6,8,9,12,13
4. Describe the causes of overvoltage and protection against overvoltage	1,2,3,5,6,8,9,12,13

**COURSE PLAN – PART II**

**COURSE OVERVIEW**

The proper operation of a power system requires an efficient, reliable and fastacting protection scheme, which consists of protective relays and switching devices. A protection scheme in a power system is designed to continuously monitor the power system to ensure maximum continuity of electrical supply with minimum damage to human life, equipment, and property. While designing the protective schemes, one has to understand the fault characteristics of the individual power system elements. One should also be knowledgeable about the tripping characteristics of various protective relays.

The job of the protection engineer is to devise such schemes where closest possible match between the fault characteristics and the tripping characteristics is obtained. It becomes mandatory for every power engineer to get familiarized with the basic concepts of power systems protection even before they get placed in field. Hence the course aimed 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.

**COURSE TEACHING AND LEARNING ACTIVITIES**

<b>S.No.</b>	<b>Week/Contact Hours</b>	<b>Topic</b>	<b>Mode of Delivery</b>
1	Week 1 19 <sup>th</sup> - 21 <sup>st</sup> Jan 2022	Introduction to power system and power system protection	PPT/Online lecture mode
2	Week 2 24 <sup>th</sup> - 28 <sup>th</sup> Jan 2022	General Structure of protection system, Relays – General classification, types, characteristics	PPT/Online lecture mode
3	Week 3 31 <sup>st</sup> Jan - 4 <sup>th</sup> Feb 2022	Principle of operation Torque equation, Relaying Schemes, Relay Co-ordination	PPT/Online lecture mode



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4	Week 4 7 <sup>th</sup> - 11 <sup>th</sup> Feb 2022	Line Protection – Distance, Differential protection and Carrier current protection	PPT/Online lecture mode
5	Week 5 14 <sup>th</sup> - 18 <sup>th</sup> Feb 2022	Generator protection – protection against abnormal condition, stator and rotor protection	PPT/Online lecture mode
6	Week 6 21 <sup>st</sup> – 25 <sup>th</sup> Feb 2022	Transformer Protection – Incipient fault–Differential protection	PPT/Online lecture mode
7	Week 7 28 <sup>th</sup> Feb - 4 <sup>th</sup> Mar 2022	Feeder and Bus bar protection	PPT/Online lecture mode
8	Week 8 7 <sup>th</sup> - 11 <sup>th</sup> Mar 2022	Introduction to substation architecture, automation and protection	PPT/Online lecture mode
9	Week 9 14 <sup>th</sup> - 17 <sup>th</sup> Mar 2022	Protection against over voltages – Causes of over voltage, Ground wires, Surge absorbers and diverters	PPT/Online lecture mode
10	Week 10 21 <sup>st</sup> & 22 <sup>nd</sup> Mar 2022	Earthing – types and Insulation co- ordination	PPT/Online lecture mode
11	Week 11 28 <sup>th</sup> Mar - 1 <sup>st</sup> April 2022	Theory of arcing and arc quenching circuit breakers-types.	PPT/Online lecture mode
12	Week 12 4 <sup>th</sup> - 8 <sup>th</sup> April 2022	Rating and comparison, RRRV	PPT/Online lecture mode
13	Week 13 11 <sup>th</sup> - 15 <sup>th</sup> April 2022	Resistor switching and capacitor switching	PPT/Online lecture mode
14	Week 14 18 <sup>th</sup> - 22 <sup>nd</sup> April 2022	Introduction to Static Relays, Digital Relays and Microprocessor based relays	PPT/Online lecture mode
15	Week 15 25 <sup>th</sup> - 29 <sup>th</sup> April 2022	Apparatus and line protection – Basics of Numerical relays	PPT/Online lecture mode

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

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	I <sup>st</sup> Class Test	Week 6 21 <sup>st</sup> – 25 <sup>th</sup> Feb 2022	75 minutes	20
2	II <sup>nd</sup> Class Test	Week 11 21 <sup>st</sup> & 22 <sup>nd</sup> Mar 2022	75 minutes	20
3	Assignments/Surprisetest/ Attendance/projects/seminar	Throughout semester		30
CPA	Compensation Assessment	Week 15 25 <sup>th</sup> - 29 <sup>th</sup> April 2022	75 minutes	20
4	Final Assessment	5 <sup>th</sup> May – 18 <sup>th</sup> May 2022 120 Minutes	120 minutes	30



**Text Books:**

1. Badri Ram and Vishwakarma, D.N., 'Power System Protection and Switchgear', Tata McGraw Hill Publishing Company Ltd., 2nd Edition, 2011.
2. Ravindranath B., and Chander, N., 'Power Systems Protection and Switch Gear', Wiley Eastern Ltd., 1st Edition, 1977.

**Reference Books:**

1. Sunil S. Rao, 'Protective Switch Gear', Khanna Publishers, New Delhi, 13th Edition, 2008.
2. Y. G. Paithangar, 'Fundamentals of Power System Protection', PHI Learning Private Limited, 2nd Edition, 2010.
3. C.L. Wadhwa, 'Electrical Power Systems', Wiley-Blackwell, 6th Edition, 2007.
4. Ramesh Bansal, "Power System Protection in Smart Grid Environment", CRC Press, 1st Edition

**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 (including compensation assessment to be specified)**

1. Attending all the assessments mandatory for every student
2. One compensation assessment will be conducted for those students who are being physically absent for the assessment 1 and/or 2, only for the valid reason.
3. At any case CPA will not be considered as an improvement test.
4. Absolute/Relative grading will be adopted for the course.

**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 [kayalvizhi@nitt.edu](mailto:kayalvizhi@nitt.edu) and contacted at [9790050752](tel:9790050752)

**ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)**

- 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.



**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 [Kayalvizhi@nitt.edu](mailto:Kayalvizhi@nitt.edu)

**FOR APPROVAL**

**Course Faculty**  
**[Dr. S. Kayalvizhi]**

**CC-Chairperson**  
**[Dr. S. Mageshwari]**

Approved By HOD

**HOD / EEE**  
**[Dr. V. SANKARANARAYANAN]**