



DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	B.TECH. and ELECTRICAL AND ELECTRONICS ENGINEERING		
Course Title	EHV AC AND DC TRANSMISSION		
Course Code	EEPE23 / EEHO11	No. of Credits	3
Course Code of Pre-requisite subject(s)	EEPC16		
Session	July 2019	Section (if, applicable)	
Name of Faculty	Mr. KARTHICK KUMAR S A	Department	ELECTRICAL AND ELECTRONICS ENGINEERING
Official Email	karthicksa@nitt.edu	Telephone No.	8124441507
Name of Course Coordinator(s) (if, applicable)			
Official E-mail		Telephone No.	
Course Type (please tick appropriately)	<input type="checkbox"/> Core course	<input checked="" type="checkbox"/> Elective course	
Syllabus (approved in BoS)			
<p>Design aspects of HVAC – conductor, tower, insulator and substation structure design, mechanical design - sag-tension calculations, design of EHVAC lines based on steady state limits and transient over voltages - design of extra HV cables - XLPE cables and gas insulated cables.</p> <p>Real and reactive power flows in HVAC systems – reactive power compensation, FACTS devices in EHV Transmission, short circuit level & real power transfer capacity. Stability- voltage stability and control. Theory of travelling and stationary waves.</p> <p>Introduction to HVDC transmission - Bridge converters – rectifier and inverter operation, equivalent circuit representation, power reversal, desired features of control and actual control characteristics.</p> <p>Basic HVDC controllers, converter faults, commutation failure, bypass action in bridges, protection issues in HVDC - DC reactors, voltage and current oscillations, DC circuit breakers and over voltage protection.</p> <p>Harmonics in HVDC - characteristics and uncharacteristic harmonics, troubles due to harmonics, harmonic filters – active and passive filters. Introduction to Hybrid HVDC and Off-shore wind power evacuation schemes.</p>			



COURSE OBJECTIVES	
<ol style="list-style-type: none"> To understand and analyze the HVAC and HVDC transmission systems. To plan an appropriate transmission system between two destinations based on the load requirement and anticipated technical performance of power transmission 	
MAPPING OF COs with POs	
Course Outcomes	Programme Outcomes (PO) (Enter Numbers only)
1. Distinguish between the usage of EHVAC and HVDC transmission systems.	1, 2, 5, 8, 9, 10,12
2. Judge when and where to use EHAV / HVDC transmission systems in practice.	1, 2, 5, 8, 9, 10,12, 13
3. Design implementation circuitry for various controllers used in HVDC transmission systems.	1, 2, 5, 7, 8, 9, 10,12
4. Plan an appropriate electric power transmission system between two destinations to satisfy the pre-defined load requirement without compromising the technical performance.	1, 2, 5, 8, 9, 10, 12

COURSE PLAN – PART II

COURSE OVERVIEW
<p>The transmission system is an integral part of a power system. Due to the remoteness of generating stations long range power transfer becomes indispensable. Therefore it results in power transmission at Extra High Voltage (EHV) range to reduce power losses. Transmission at High voltages takes two different forms i.e. HVAC and HVDC. Having a good knowledge of these two systems, their features, design aspects, advantages and disadvantages ia an absolute must for any electrical power engineer. The aim of this course is to provide students with an understanding of the features of EHVAC and DC transmission systems and make them able to choose and desing an appropriate transmission system for any power system.</p> <p>In this course, Chapter 1 deals with design aspects of HVAC system, Chapter 2 deals with features of HVAC system and associated FACTS devices; Chapter 3 provides the introductory concepts of HVDC system, Chapter 4 deals with the controllers used in HVDC and its respective protection issues, Chapter 5 deals with harmonics involved in HVDC system and corresponding mitigation techniques and introduction to hybrid HVDC.</p>

COURSE TEACHING AND LEARNING ACTIVITIES			
S.No.	Week/Contact Hours	Topic	Mode of Delivery
1.	Week 1 Two contact hours 22 nd July to 26 th July	Introduction, Design aspects of HVAC – conductor, tower design	Chalk & Talk / PPT
2.	Week 2 Three contact hours 29 th July to 2 nd August	Insulator and substation structure design, Mechanical design	Chalk & Talk / PPT



3.	Week 3 Three contact hours 5 th August to 9 th August	Sag-tension calculation, Design of EHVAC lines based on steady state limits and transient over voltages	Chalk & Talk / PPT
4.	Week 4 Two contact hours 12 th August to 16 th August	Design of extra HV cables - XLPE cables and gas insulated cables.	Chalk & Talk / PPT
5.	Week 5 Three contact hours 19 th August to 23 rd August	Real and reactive power flows in HVAC systems – reactive power compensation, FACTS devices in EHV Transmission	Chalk & Talk / PPT
6.	Week 6 Three contact hours 26 th August to 30 th August	short circuit level & real power transfer capacity. Stability- voltage stability and control.	Chalk & Talk / PPT
7.	Week 7 Two contact hours 2 nd September to 6 th September	Theory of travelling and stationary waves.	Chalk & Talk / PPT
8.	Week 8 Three contact hours 9 th September to 13 th September	Theory of travelling and stationary waves, First Assessment, Introduction to HVDC transmission - Bridge converters	Chalk & Talk / PPT
9.	Week 9 Three contact hours 16 th September to 20 th September	Rectifier and inverter operation, Equivalent circuit representation, power reversal	Chalk & Talk / PPT
10.	Week 10 Three contact hours 23 th September to 27 th September	desired features of control and actual control characteristics, Basic HVDC controllers, converter faults,	Chalk & Talk / PPT
11.	Week 11 Three contact hours 7 th October to 11 th October	commutation failure, bypass action in bridges, Protection issues in HVDC	Chalk & Talk / PPT
12.	Week 12 Three contact hours 14 th October to 18 th October	DC reactors, Voltage and current oscillations, DC circuit breakers and	Chalk & Talk / PPT
13.	Week 13 Three contact hours 21 st October to 25 th October	Over voltage protection, Second Assessment, Harmonics in HVDC - characteristics and uncharacteristic harmonics,	Chalk & Talk / PPT
14.	Week 14 Three contact hours 28 th October to 1 st November	troubles due to harmonics, Harmonic filters – active and passive filters,	Chalk & Talk / PPT



15.	Week 15 Three contact hours 4 th November to 8 th November	Introduction to Hybrid HVDC and Off-shore wind power evacuation schemes.	Chalk & Talk / PPT
16.	Week 16 Three contact hours 11 th November to 15 th November	Revision, Compensation Test	Chalk & Talk / PPT

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	First Assessment – First Class Test	Week 8 9 th September to 13 th September	One Hour 15 Minutes	25
2	Second Assessment – Second Class Test	Week 13 21 st October to 25 th October	One Hour 15 Minutes	25
3	Assignment/ Surprise Test/ Attendance/ Seminar /	Throughout Semester		20
CPA	Compensation Assessment*	Week 16 11 th November to 15 th November	One Hour 15 Minutes	25
4	Final Assessment *	18 th November to 4 th December	One and Half Hour	30

*mandatory; refer to guidelines on page 6

ESSENTIAL READINGS: Textbooks, Reference books, website address, journals,etc

Text Books:

1. S.Rao, 'EHV-AC, HVDC Transmission and Distribution Engineering', Khanna Publishers, 3rd Edition, 2012.
2. Rakosh Das Begamudre, 'Extra High Voltage AC Transmission Engineering', New Age International Publishers, 3rd Edition, 2009.

Reference Books:

1. Padiyar K.R., 'HVDC Transmission Systems', New Age International Publishers, 2nd Revised Edition, 2012.

Useful Web Links:

1. <http://nptel.iitm.ac.in/courses/108104013>

COURSE EXIT SURVEY

1. Feedback from the students during class committee meetings
2. Anonymous feedback through questionnaire (Mid of the semester & End of the semester)
3. End semester feedback on course outcomes

COURSE POLICY

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 to the course teacher shall only be emailed sakarthickkumar@gmail.com

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 DISHONESTY & 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.
- The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION, IF ANY

FOR APPROVAL

Course Faculty S. Sakarthickkumar

CC- Chairperson S. Mageshwarar

HOD S. Indira



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.