Hall Ticket No: | | | | | | | | | | |

Question Paper Code: AEE524

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

MODEL QUESTION PAPER -I

B.Tech VIII Semester End Examinations (Regular), April – 2020

Regulation: IARE–R16

FLEXIBLE ALTERNATING CURRENT TRANSMISSION SYSTEM

(Electrical and Electronics Engineering)

Time: 3 hours **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1	a)	What are FACTS controllers and explain different categories of FACTS controllers?	[7M]
	b)	What is meant by Active and Reactive Compensation? Discuss the effects of various types of Passive Compensation on power transmission capacity with necessary diagrams and expressions?.	[7M]
2	a)	What are the objectives of Line Compensation? Explain the effect of series and shunt compensation on power transmission capacity of a short symmetrical transmission line.	[7M]
	b)	Consider a 735kVsymmetrical loss less transmission line with L=0.932mH/km, C=12.2nF/km and a line length of 900km.Frequency 50Hz. If a midpoint compensator is installed to regulate the midpoint voltage at 1.02puwith a rating of -400MVAR to +400MVAR, calculate the loading limits for which the compensator would regulate the bus voltage at 1.02p.u	[7M]

UNIT – II

3	a)	Explain the design of SVC voltage regulator and discuss the voltage control capability of SVC. What are the advantages of slope in dynamic characteristics of SVC?	[7M]
	b)	Explain the operation of two-machine Power system with an ideal midpoint reactive compensator with an equivalent circuit and necessary phasor diagram.	[7M]
4	a)	Describe the working principle of the two types of Static Var Compensators SVC with neat schematic diagrams.	[7M]
	b)	A 400KV,50 Hz,600 km long symmetrical line is operated at the rated voltage. (i)What is the theoretical maximum power carried by the line? what is the midpoint voltage corresponding to this condition? (ii) A series capacitor is connected at the midpoint of the line to double the power transmitted. What is its reactance? (iii) A shunt capacitor of value 450 ohms is connected at the midpoint of the line. If the midpoint voltage is 0.97, compute the power flow in the line corresponding to this operating point. Data : L=1 mH/Km, C= 11.1 *10-9 F/km	[7M]

UNIT – III

5	a)	What are the different variable impedance type series compensators? Explain any one	[7M]
	b)	Explain the modeling of TCSC and GCSC for load flow studies	[7M]
6	a)	Draw the single line diagrams of TCSC and SSSC with a clear explanation?	[7M]
	b)	Consider the SMIB system in which the synchronous machine is generating 0.9p.u MW and 0.25p.u MVAR. The infinite bus voltage is 1 at angle of 0. The machine transient reactance is 0.65 p.u. calculate the value of net reactance offered by the TCSC, the degree of series compensation and the voltage that has be injected by the TCSC to enhance the power flow to 1.0p.u	[7M]

UNIT – IV

7	a)	Show that with Power-angle curve the STATCOM can enhance the transient stability margin?	[7M]
	b)	What is interline power flow controller? With a schematic diagram, explain its working. Also list its applications?	[7M]
8	a)	Compare the performance between STATCOM and SVC?	[7M]
	b)	Explain the modeling of STATCOM and SSSC for transient stability studies	[7M]

UNIT – V

9	a)	Discuss Linear quadratic regulator based techniques, Global coordination using nonlinear constrained optimization., Control coordination using genetic algorithms in detail	[7M]
	b)	Explain the co-ordinated tuning of FACTS controllers using Genetic Algorithm for damping power system oscillation	[7M]
10	a)	Explain in detail about Electromechnical and Small Signal Oscillations	[7M]
	b)	Explain the co-ordination of multiple controllers using linear control techniques?	[7M]

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

COURSE OBJECTIVES:

The course should enable the students to:

I	Describe the effect of series and shunt compensation using various FACTS controllers
II	Static VAR compensator for voltage regulation and transient stability enhancement of system
III	Analyse voltage source converter based FACTs controllers and their coordination.

COURSE OUTCOMES (COs):

CO 1	Understand the fundamentals of FACTS controllers and their role in improving power system performance.
CO 2	Understand SVC for various functions viz. Transient stability Enhancement, voltage instability prevention and power oscillation damping
CO 3	Analyse the use of control schemes of TCSC, TSSC, GSC in improving the power quality.
CO 4	Analyse the applications of Voltage Source Converter based FACTS Controllers.
CO 5	Explain the FACTS Controllers and their co-ordination.

COURSE LEARNING OUTCOMES (CLOs):

AEE524.01	Discuss about the introduction of FACTS technology in Power Systems and power flow in transmission lines
AEE524.02	Discuss about the Reactive Power Compensation in Transmission line and also the types of Compensation methods
AEE524.03	Explain the need of FACTS and types of FACTS Controllers.
AEE524.04	Discuss about the Static VAR Compensator, its configuration and Voltage Regulation
AEE524.05	Study the modelling of SVC for Stability and for Load flow analysis
AEE524.06	Designing of SVC to regulate transient stability enhancement and power oscillation damping
AEE524.07	Understanding the concepts Controlled Series Capacitors.
AEE524.08	Explain the operation, analysis and gate turn off characteristics of Thyristor Controlled Series Capacitor
AEE524.09	Modeling of TCSC and GCSC for Stability and for Load flow analysis.
AEE524.10	Operation of Static Synchronous Compensator(STATCOM) and Synchronous Series Compensator(SSSC)
AEE524.11	Modeling of Static Synchronous Compensator (STATCOM) and Synchronous Series Compensator (SSSC) Transient Stability and for Power Flow analysis.
AEE524.12	Modeling of UPFC and IPFC for Transient Stability and for Power Flow analysis
AEE524.13	Discuss about FACTS controller interactions
AEE524.14	Explain SVC interaction, co- ordination of multiple controllers using linear control techniques
AEE524.15	Explain the quantitative treatment of control co ordination
AEE524.16	Explore the knowledge and skills of employability to succeed in national and international

MAPPING OF SEMESTER END EXAMINATION - COURSE OUTCOMES

SEE Question No		Course Learning Outcomes		Course Outcomes	Blooms Taxonomy Level
1	a	AEE524.01	Discuss about the introduction of FACTS technology in Power Systems and power flow in transmission lines	CO 1	Understand
	b	AEE524.02	Discuss about the Reactive Power Compensation in Transmission line and also the types of Compensation methods	CO 1	Understand
2	a	AEE524.02	Discuss about the Reactive Power Compensation in Transmission line and also the types of Compensation methods	CO 1	Remember
	b	AEE524.03	Explain the need of FACTS and types of FACTS Controllers.	CO 1	Understand
3	a	AEE524.04	Discuss about the Static VAR Compensator, its configuration and Voltage Regulation	CO 2	Understand
	b	AEE524.05	Study the modelling of SVC for Stability and for Load flow analysis	CO 2	Understand
4	a	AEE524.04	Discuss about the Static VAR Compensator, its configuration and Voltage Regulation	CO 2	Understand
	b	AEE524.06	Designing of SVC to regulate transient stability enhancement and power oscillation damping	CO 2	Understand
5	a	AEE524.07	Understanding the concepts Controlled Series Capacitors	CO 3	Understand
	b	AEE524.09	Modeling of TCSC and GCSC for Stability and for Load flow analysis	CO 3	Understand
6	a	AEE524.09	Modeling of TCSC and GCSC for Stability and for Load flow analysis	CO 3	Understand
	b	AEE524.08	Explain the operation, analysis and gate turn off characteristics of Thyristor Controlled Series Capacitor	CO 3	Understand
7	a	AEE524.10	Operation of Static Synchronous Compensator(STATCOM) and Synchronous Series Compensator(SSSC)	CO 4	Remember
	b	AEE524.12	Modeling of UPFC and IPFC for Transient Stability and for Power Flow analysis	CO 4	Understand
8	a	AEE524.10	Operation of Static Synchronous Compensator(STATCOM) and Synchronous Series Compensator(SSSC)	CO 4	Understand
	b	AEE524.11	Modeling of Static Synchronous Compensator (STATCOM) and Synchronous Series Compensator (SSSC) Transient Stability and for Power Flow analysis.	CO 4	Understand
9	a	AEE524.15	Explain the quantitative treatment of control co ordination	CO 5	Understand

	b	AEE524.14	Explain SVC interaction, co- ordination of multiple controllers using linear control techniques	CO 5	Understand
10	a	AEE524.13	Discuss about FACTS controller interactions	CO 5	Understand
	b	AEE524.15	Explain the quantitative treatment of control co ordination	CO 5	Understand

Signature of Course Coordinator
K.Harshini, Assistant Professor

HOD, EEE