SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Technology

B.Tech. IV Semester VII

Subject Name: Application of Power Electronics in Power System **Subject Code: BTEL14742**

Type of course: **Professional Elective Course**
Prerequisite: Power Electronics, Fundamental knowledge of Power systems
Rationale: The active as well as reactive power management and control is crucial to utilize the existing power transmission network to its maximum operating limit. The subject aims to develop thorough understanding of requirement of power management in power system by employing Power Electronics converters.

Teaching and Examination Scheme:

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	100
3	0	0	3	60	25	15			

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests **CA2:** Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems **TEE:** Term End Examination **TEP:** Term End Practical Exam (Performance and viva on practical skills learned in course) **CA3:** Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1.	**Introduction:** Background, Electrical Transmission Networks, Flow of power in AC system and conventional control mechanisms, Definition of Flexible ac Transmission Systems (FACTS) and brief description, possible benefits from FACTS, Emerging Transmission Networks.	04	**09**
2.	**Reactive-Power Control in Electrical Power Transmission Systems:** Reactive Power, Uncompensated Transmission Lines, Reactive Power Compensation, Dynamic Performance of Transmission Systems, Passive Compensation	07	**15**
3.	**Shunt Compensation:** Objectives of shunt compensation, Synchronous Condensers, The Thyristor- Controlled Reactor (TCR), The Thyristor-Controlled Transformer (TCT), The Fixed Capacitor- Thyristor	13	**29**

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	Controlled Reactor (FC-TCR), The Mechanically Switched Capacitor Thyristor-Controlled Reactor (MSC-TCR), The Thyristor-Switched capacitor and Reactor, The Thyristor-Switched capacitor-Thyristor Controlled Reactor (TSC-TCR), A Comparison of Different SVCs, STATCOM: Principal of operation, VI characteristic, steady state model, harmonic performance, SSR mitigation, transfer function and dynamic performance, transient stability enhancement and power oscillation damping, VAR reverse control, comparison of SVC and STACOM, operation with unbalance AC system, Summary		
4.	**Series Compensation:** Objectives of Series compensation, GCSC, TSSC, The Thyristor Controlled Series Capacitor (TCSC), The TCSC Controller, Operation of the TCSC, The TSSC, Analysis of the TCSC, Capability Characteristics, Harmonic Performance, Losses, Response of the TCSC, Modeling of the TCSC, TCSC Applications: Open-Loop Control, Closed-Loop Control; Mitigation of Sub synchronous Resonance; NGH-SSR Damping Scheme, Static Synchronous Series Compensator (SSSC): principle of operation, transmitted power versus transmission angle characteristics, control range and VA rating, capability to provide real power compensation, immunity to SSR, control scheme for SSSC, summary of series compensators	13	**29**
5.	**Combined compensators:** Introduction, operating principle and control structure of UPFC, IPFC, Generalized and multi functional FACTS controllers	04	**09**
6.	**HVDC Transmission:** Evolution of HVDC Transmission, Comparison of HVAC and HVDC systems, Type of HVDC Transmission systems, Components of HVDC transmission systems.	04	**09**

Suggested Specification table with Marks (Theory/Practical):

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
20	**20**	**20**	**20**	**15**	**05**

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels **(Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

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Reference Text Books:

Sr. No.	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1	Thyristor-based FACTS controllers for Electrical Transmission Systems	R. Mohan Mathur, R K Verma		Wiley IEEE Press	
2	Understanding FACTS	N.G.Hingorani and L.Gyugyi		Standard Publishers, Delhi, 2001	
3	FACTS Controllers in Power Transmission & Distribution	Padiyar K R		New Age International	
4	Reactive Power Control in Electric Systems	T J E Miller		John Willey	
5	HVDC Power Transmission Systems	KR Padiyar		Willey Eastern Limited	Second
6	Power System Stability and Control	Prabha Kundur		Tata McGrawHill,	

Course Outcome:

Sr. No.	CO Statement After learning this subject, students will be able to	Marks % weightage
CO-1	Explain the basic principle of power transmission and reactive power control.	20
CO-2	Analyze shunt compensation and its requirement.	30
CO-3	Evaluate series compensation and its requirement	30
CO-4	Analyze shunt-series compensation and its requirement.	10
CO-5	Describe the basic concepts of HVDC transmission system	10

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Mapping with POs:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO12	PSO 1	PSO 2	PSO 3
CO-1	2	3	3	2		1	1		1		1		3		1
CO-2	2	3	3	2		1	1		1		1		3		1
CO-3	2	3	3	2		1	1		1		1		3		1
CO-4	2	3	3	2		1	1		1		1		3		1
CO-5	2	3	3	2		1	1		1		1		3		1
Rationale*															

Rationale*: Explaining why it is matching this particular program outcome

Major Equipment:

List of Open Source/learning website:

- https://nptel.ac.in

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