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<b>Question Paper Code</b>	<b>14311</b>
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**B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2025**  
 Eighth Semester  
**Electrical and Electronics Engineering**  
**20EEEL801 – FACTS AND CUSTOM POWER DEVICES**  
 Regulations - 2020

Duration: 3 Hours

Max. Marks: 100

**PART - A (MCQ) (10 × 1 = 10 Marks)**

Answer ALL Questions

	<i>Marks</i>	<i>K – Level</i>	<i>CO</i>
1. In a transmission line, the real power flow mainly depends on which of the following parameters? (a) Line resistance (b) Difference in voltage magnitudes at the ends (c) Phase angle difference between sending and receiving end voltages (d) Line capacitance	1	K3	CO1
2. The main objective of series compensation in transmission lines is to: (a) Reduce line reactance and improve power transfer capability (b) Increase system inductance (c) Provide reactive power at load end (d) Maintain constant current	1	K2	CO1
3. Which mode of TCSC operation effectively bypasses the capacitor to create an inductive reactance in the power system? (a) Capacitive mode (b) Inductive mode (c) Bypass mode (Bypass operation) (d) Blocking mode	1	K2	CO2
4. In a Thyristor-Controlled Series Capacitor (TCSC), which component allows for continuous control of the effective series capacitance or inductance? (a) Fixed Capacitor (FC) (b) Thyristor-Controlled Reactor (TCR) (c) Circuit Breaker (d) Fixed Reactor (FR)	1	K2	CO2
5. Which of the following applications is NOT a primary function of a STATCOM? (a) Preventing voltage instability (b) Enhancement of transient stability (c) Controlling the flow of active power on a transmission line (d) Providing fast dynamic voltage support	1	K2	CO3
6. The Interline Power Flow Controller (IPFC) is used to: (a) Control the power flow on a single transmission line. (b) Compensate for the reactive power of a single load centre. (c) Control the power flow of multiple transmission lines originating from a common substation. (d) Improve the transient stability of a generator.	1	K1	CO3
7. Distributed Static Synchronous Compensator (DSTATCOM) (a) A series-connected device. (b) A shunt-connected device. (c) A combined series-shunt device. (d) A passive filter.	1	K2	CO4
8. Interline Unified Power Quality Conditioner (IUPQC) (a) It uses passive components instead of active filters. (b) It is used to compensate for power quality issues on a single transmission line. (c) It is designed to compensate for power quality issues on multiple transmission lines simultaneously. (d) It is only capable of mitigating voltage sags.	1	K3	CO4

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|-----|---|---|----|-----|
| 9.  | The primary purpose of a damping controller in power systems, particularly in the context of the swing mode, is to:   | 1 | K2 | CO5 |
|     | (a) Increase the steady-state error of the system.  |   |    |     |
|     | (b) Enhance system gain and speed up the response without affecting stability.  |   |    |     |
|     | (c) Add a damping torque component to suppress oscillations of the rotor angle following a disturbance.   |   |    |     |
|     | (d) Act as a high-pass filter to block low-frequency signals.   |   |    |     |
| 10. | In the analysis of the swing equation (a second-order differential equation), an under damped system is characterized by a damping ratio ( $\zeta$ ) that is: | 1 | K3 | CO6 |
|     | (a) Equal to 1  |   |    |     |
|     | (b) Greater than 1  |   |    |     |
|     | (c) Less than 1 but greater than 0  |   |    |     |
|     | (d) Equal to 0  |   |    |     |

**PART - B (12 × 2 = 24 Marks)**

Answer ALL Questions

- |     |   |   |    |     |
|-----|---|---|----|-----|
| 11. | Distinguish between load compensation and system compensation.                              | 2 | K2 | CO1 |
| 12. | Write the expression for the real and reactive power flowing through a transmission line.   | 2 | K1 | CO1 |
| 13. | What is the synchronous voltage reversal (SVR) control scheme?                              | 2 | K1 | CO2 |
| 14. | Give the condition for transient free switching for the TSC for different residual voltage. | 2 | K2 | CO2 |
| 15. | Evaluate the functions of STATCOM.  | 2 | K2 | CO3 |
| 16. | Compare over voltage with voltage swell.  | 2 | K2 | CO3 |
| 17. | Draw the basic structure of IPFC.   | 2 | K1 | CO4 |
| 18. | State the basic UPFC power flow control functions.  | 2 | K2 | CO4 |
| 19. | Define Interline Unified Power Quality Conditioner (IUPQC).                                 | 2 | K2 | CO5 |
| 20. | Write short notes on the role of DSTATCOM in reactive power compensation.                   | 2 | K2 | CO5 |
| 21. | List the factors affecting swing mode oscillations.   | 2 | K1 | CO6 |
| 22. | State the main objective of an adaptive controller.   | 2 | K1 | CO6 |

**PART - C (6 × 11 = 66 Marks)**

Answer ALL Questions

- |     |  |    |    |     |
|-----|--|----|----|-----|
| 23. | a) Explain the factors which limit the loading capability of a power system.   | 11 | K2 | CO1 |
|     | <b>OR</b>  |    |    |     |
|     | b) Explain the working and characteristics of Thyristor switched series capacitor with a neat diagram.   | 11 | K2 | CO1 |
| 24. | a) Propose the mathematical modelling of TCSC for power flow analysis.   | 11 | K4 | CO2 |
|     | <b>OR</b>  |    |    |     |
|     | b) Derive the transfer function & explain dynamic performance of static VAR compensator.   | 11 | K4 | CO2 |
| 25. | a) With neat diagram describe the power exchange mechanism of STATCOM.   | 11 | K3 | CO3 |
|     | <b>OR</b>  |    |    |     |
|     | b) Draw and explain the typical control system of SSSC.  | 11 | K3 | CO3 |
| 26. | a) Analyze the operation of a unified power flow controller (UPFC) with the help of its circuit diagram, and examine how its control principles influence the regulation of power flow and voltage in a transmission line. | 11 | K4 | CO4 |

**OR**

b) Compare the control capabilities of UPFC with IPFC. 11    K4    CO4

27. a) Apply the concept of DVR to mitigate voltage sag and swell with relevant waveforms. 11    K3    CO5

**OR**

b) Apply the configuration and control scheme of a UPQC to improve power quality in a distribution system, and illustrate its operation using a neat block diagram. 11    K3    CO5

28. a) Justify the use of adaptive control over fixed-parameter control for varying operating conditions. 11    K5    CO6

**OR**

b) Examine the influence of controller parameters on damping performance. 11    K5    CO6