SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603203

DEPARTMENT OF

ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK

VI SEMESTER

1905605–POWER SYSTEMS STABILITY

Regulation – 2019

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(Even Semester)

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK

SUBJECT : 1905605–POWER SYSTEMS STABILITY

SEM / YEAR : VI/ III

UNIT –I: INTRODUCTION TO STABILITY				
Fundamental concepts - Stability and energy of a system - Power System Stability: Definition, Causes, Nature and Effects of disturbances, Classification of stability, modelling of electrical components - Basic assumptions made in stability studies Modelling of Synchronous machine for stability studies (classical model)- Rotor dynamics and the swing equation.				
PART –A				
Q.No	**Questions**	**BT Level**	**Competence**	**Course Outcome**
1.	Illustrate Swing Equation as two first order differential equation?	**BTL 1**	Remember	CO1
2.	Define Power System Stability.	**BTL 1**	Remember	CO1
3.	Prepare the list of assumptions associated with the mathematical model of a synchronous machine?	**BTL 1**	Remember	CO1
4.	Define rotor angle stability. List out two categories of rotor angle stability.	**BTL 1**	Remember	CO1
5.	What is stability studies in power system?	**BTL 2**	Understand	CO1
6.	Define the basic concept of rotor angle stability	**BTL 4**	Analyze	CO1
7.	Describe the fundamental concept of stability of dynamic	**BTL 3**	Apply	CO1
8.	Illustrate the state space representation?	**BTL 6**	Create	CO1
9.	What are the causes of power system stability?	**BTL 2**	Understand	CO1
10.	Illustrate Swing Equation as two first order differential equation?	**BTL 1**	Remember	CO1
11.	Give the simplified power angle equation of a SMIB system and the expression for maximum power.	**BTL 4**	Analyze	CO1
12.	How does an analytical solution differ from a numerical solution?	**BTL 5**	Evaluate	CO1
13.	Differentiate an EMTP-kind of simulation package from a state-space model-based package	**BTL 2**	Understand	CO1
14.	What decides degrees-of-freedom for a dynamical system?	**BTL 1**	Remember	CO1
15.	List some properties of LTI systems	**BTL 4**	Analyze	CO1
16.	Explain the significance of motoring and generated torque in a synchronous generator.	**BTL 1**	Remember	CO1

17.	Write any three assumptions upon transient stability.	**BTL 2**	Understand	CO1
18.	What are the machine problems seen in the stability study	**BTL 2**	Understand	CO1
19.	Give the expression for swing equation. Explain each term along with their units.	**BTL 3**	Apply	CO1
20.	What are the assumptions made in solving swing equation?	**BTL 2**	Understand	CO1
21.	Define park's transformation	**BTL 6**	Create	CO1
22.	Prepare the list of methods for producing changing flux linkages.	**BTL 3**	Apply	CO1
23.	List the stability of dynamics system	**BTL 5**	Evaluate	CO1
24.	List the Classification of stability	**BTL 4**	Analyze	CO1
	PART B			
1.	Distinguish between transient and steady-state stability and discuss the need for performing stability analyses of power systems.	**BTL 2**	Understand	CO1
2.	A three-phase 300MVA, 20kV, 0.9pf, 50Hz, 2 pole Synchronous generator has the following parameter. $l_{aa} = 4.675 + 0.0534 \cos(2\theta)$ mH $l_{ab} = -2.3375 - 0.0534 \cos(2\theta + (\pi/3))$ mH $l_{ls} = 0.5792$ mH $l_{afd} = 67.2 \cos(\theta)$ mH $l_{fd} = 1084.08$ mH $r_s = 0.0014\ \Omega$ $r_{fd} = 0.0635\ \Omega$ Define the base quantities and express all the generator parameters in per units in dq0 reference frame.	**BTL 4**	Analyze	CO1
3.	Compare the structure of the inductance matrices for non-salient and salient pole synchronous machines and comment on their dependency on the rotor-angle.	**BTL 2**	Understand	CO1
4.	Compose the Power angle equation	**BTL 6**	Create	CO1
5.	Write short notes on "Role of Automatic Voltage Regulator in improving Stability".	**BTL 2**	Understand	CO1
6.	Enumerate different types of standardized synchronous machine models.	**BTL 1**	Remember	CO1
7.	Give important difference between steady state, transient state and dynamic stability	**BTL 6**	Create	CO1
8.	Discuss the power system stability and stability limit.	**BTL 4**	Analyze	CO1
9.	Discuss the following terms: (a) transfer reactance (b) inertia constant.	**BTL 6**	Remember	CO1
10.	Draw and explain power angle curve of a synchronous machine	**BTL 2**	Understand	CO1
11.	Describe the synchronizing power coefficient and explain its significance.	**BTL 3**	Apply	CO1

12.	What is steady state stability? Explain it with respect to power angle curve.	**BTL 6**	Create	CO1
13.	Discuss the methods to improve steady state stability	**BTL 3**	Apply	CO1
14.	Write in detail about Equal Area Criterion for Stability.	**BTL 1**	Remember	CO1
15.	A Synchronous Generator has the following parameters in per units. X_d=1.508, X_q=1.489, X_{md}=1.371 X_{mq}=1.352, X_{is}=0.1366, X_{fd}=1.6 X_{lfd}=0.229, T'_{d0}=8s, X'_q=0.65 T'_{q0}=1.0s, X''_d=0.23, T''_{d0}=0.03s, f_s=50Hz With these parameters defined find the following generator parameters: R_{fd}, R_{1d}, R_{1q}, X'_d, X_{l1q}, X_{1q}, X_{l1d}, X_{1d}	**BTL 3**	Apply	CO1
16.	A 50 Hz, 4 pole turbo generator of rating 20 MVA, 13.2 KV has an inertia constant of 9 kW-sec/KVA. Find the kinetic energy stored in the rotor at synchronous speed. Find the acceleration, if the input less the rotational loss is 26,800 hp and the electric power developed is 16 MW equal at 115 kW.	**BTL 6**	Create	CO1
17.	Mention a type of power system dynamic study in which the generator stator transients are usually neglected. What are the reasons for neglecting the stator transient effects?	**BTL 2**	Understand	CO1
	PART – C			
1.	A two-pole, 50-MVA, 11-kV generator is supplying full load at 0.8 power factor lagging. If the inertia constant of the moving parts of the generator is 6.0 MJ/MVA, calculate the energy stored when the generator is running at the synchronous speed of 3000 rpm. If the net input to the generator is suddenly increased to 62000 metric HP, calculate the acceleration produced.	**BTL 4**	Analyze	CO1

2.	A power station A consists of two synchronous consists of two synchronous generators. The generator-1 has a rating 50 MVA, 50 Hz, 1500 rpm and has an inertia constant of 8MJ/MVA. The generator-2 has a rating of 100 MVA, 50HZ, 3000 rpm and has a inertia constant of 4 MJ/MVA. i. Find the inertia constant for the equivalent generator on a base of 100MVA ii. Another power station B has 4 generators two each of the above type. Find the inertia constant for the equivalent generator on a base of 100MVA. iii. If the two power systems are connected through on inter connector, find the inertia constant for the equivalent generator connected to infinite bus bar.	**BTL 6**	Create	CO1
3.	What is the swing equation? Derive the expression for swing equation?	**BTL 4**	Analyze	CO1
4.	A 60 Hz, 4 pole turbo-generator rated 500 MVA, 22 kV has an inertia constant of 7.5 MJ/MVA. Find (i) the kinetic energy stored in the rotor at synchronous speed (ii) the angular accelerat ion If the electrical power developed is 400 MW when the input less the rotational losses is 740,000 HP. (iii) if the acceleration calculated in part (ii), is constant for a period of 15 cycles, find the change in d in electrical degree in that period and the speed in rpm at the end of 15 cycles. Assume that the generator is synchronized with a large system and has no accelerating torque before the 15 cycle period begins.	**BTL 6**	Create	CO1
5.	Explain Rotor Dynamics and the Swing Equation	**BTL 4**	Analyze	CO1

UNIT –II: SMALL-SIGNAL STABILITY				
Basic concepts and definitions – State space representation, Physical Interpretation of small–signal stability, Eigen properties of the state matrix: Eigen values and eigen vectors,modal matrices, eigen value and stability, mode shape and participation factor. Small–signal stability analysis of a Single-Machine Infinite Bus (SMIB) Configuration with numerical example				
PART – A				
Q.No	**Questions**	**BT Level**	**Competence**	**Course Outcome**
1.	What are the different types of problems to be considered under small-signal stability?	**BTL 1**	Remember	CO2
2.	What is small-signal stability analysis?	**BTL 5**	Evaluate	CO2
3.	What are the methods used to determine the control or small signal oscillation interaction?	**BTL 1**	Remember	CO2
4.	Prepare the Eigen properties of the state matrix	**BTL2**	Understand	CO2
5.	Distinguish between Eigen values and Eigenvectors.	**BTL 4**	Analyze	CO2
6.	Discuss mode shape and participation factor?	**BTL 4**	Analyze	CO2
7.	Show the block diagram of SMIB configuration represented by classical Model.	**BTL 6**	Create	CO2
8.	What is the need for small signal stability analysis in Power system?	**BTL 2**	Understand	CO2
9.	Express the linearized system equations	**BTL 1**	Remember	CO2
10.	Illustrate the block diagram of synchronous machine with k constants	**BTL 5**	Evaluate	CO2
11.	How does the global stability differ from local stability	**BTL 2**	Understand	CO2
12.	Explain the basic function of power system stabilizer?	**BTL 5**	Evaluate	CO2
13.	Differentiate between steady state and transient stability	**BTL 4**	Analyze	CO2
14.	Describe the SMIB configuration	**BTL 1**	Remember	CO2
15.	Give the effect of excitation system.	**BTL 3**	Apply	CO2
16.	Show the block diagram with the excitation system.	**BTL 2**	Understand	CO2
17.	What is Multimachine stability?	**BTL 1**	Remember	CO2
18.	Define system state matrix.	**BTL 6**	Create	CO2
19.	Compose the principle behind the small signal stability improvement.	**BTL 1**	Remember	CO2
20.	Illustrate the principle of PSS application.	**BTL 3**	Apply	CO2
21.	What is State Variable?	**BTL 2**	Understand	CO2
22.	How local modes of oscillations are caused?	**BTL 1**	Remember	CO2
23.	Differentiate between AVR&PSS.	**BTL 1**	Remember	CO2
24.	Infer the Classical machine model stability analysis with numerical Example.	**BTL 2**	Understand	CO2

PART – B				
1.	Describe the fundamental concept of stability for dynamic systems.	**BTL 5**	Evaluate	CO2
2.	The moment of inertia of a 250-MVA generator is 75000 kgm2. If the operating frequency is 50 Hz and the generator has two poles, compute (i) kinetic energy of the rotating parts, (ii) H, and (iii) M.	**BTL 2**	Understand	CO2
3.	A two-pole, three-phase, 50-MVA, 11-kV generator is supplying rated power at 0.8 lagging power factor to an 11 - kV bus. Due to a fault the generator output is reduced to 40%. Compute (i) accelerating power and (ii) acceleration at the time of fault. Assume that the kinetic energy stored in the moving parts of the generator is 175 MJ.	**BTL 2**	Understand	CO2
4.	What is the significance of small-signal stability analysis? How does it differ from transient stability analysis?	**BTL 2**	Understand	CO2
5.	Briefly discuss the tools and techniques used to perform small- and large-signal stability analysis.	**BTL 5**	Evaluate	CO2
6.	Explain, how the inferences made in the rotor-angle stability analysis are used to improve the dynamic performance of power systems	**BTL 3**	Apply	CO2
7.	For an SMIB system with classical model for the generator, derive an expression for swing mode frequency, if mechanical damping D is considered.	**BTL 1**	Remember	CO2
8.	Briefly state the importance of damping and synchronizing torque components with regard to a swing mode. How do you identify their inadequacies in a power system?	**BTL 3**	Apply	CO2
9.	What are the influences of a fast-acting high-gain exciter on the power system stability?	**BTL 5**	Evaluate	CO2
10.	Two generators rated 200 MVA and 150 MVA are having inertia constants5 and 4 MJ/MVA respectively. The two machines are put in parallel and are swinging coherently. Therefore, find the inertia constant of the equivalent machine on a base of 100 MVA, which represents the two machines.	**BTL 1**	Remember	CO2
11.	Explain the eigen properties of the state matrix?	**BTL 4**	Analyze	CO2
12.	Describe the state space representation in detail	**BTL 4**	Analyze	CO2

13.	Briefly explain the single-machine infinite bus (SMIB)configuration.	**BTL 3**	Apply	CO2
14.	Obtain the equation for Eigen properties of the state matrix and its characteristics of Eigen value and stability.	**BTL 5**	Create	CO2
15.	Explain the fundamental concept of stability for dynamic systems.	**BTL 4**	Analyze	CO2
16.	Explain the small-signal stability of a single-machine infinite Bus system?	**BTL 3**	Apply	CO2
17.	What are the effects of synchronous machine field circuit dynamics?	**BTL 2**	Understand	CO2
	PART – C			
1.	A power station A consists of two generators G1 and G2. The equivalent details are G1=60 MVA, 50 Hz, 1500 RPM, H1=7 MJ/MVA G2 =100 MVA, 50 Hz, 3000 RPM, H2 =4 MJ/MVA where H is the inertia constant a) Find the inertia constant of the equivalent generator on a base of 100 MVA. b) Another power station B has 3 generators whose details are G3: 50 MVA, 50 Hz, 1500 RPM, H3=8 MJ/MVA G4 : 25MVA, 50 Hz, 1000 RPM, H4=4 MJ/MVA G5 : 50MVA, 50 Hz, 3000 RPM, H5=8 MJ/MVA Find the inertia constant for the equivalent generator a 100 MVA base. c) If two power stations are connected through an inter-connector to an infinite bus, replace all the generators with one single machine connected to the infinite bus.	**BTL 4**	Analyze	CO2
2.	A synchronous generator having a reactance of 1 p.u is connected to an infinite bus (VL0) through a transmission line. The line reactance is 0.5 p.u. The machine has an inertia constant of 4MW– sec/MVA. Under no load conditions, the generated emf is 1.1 p.u. The system frequency is 50 Hz. Calculate the frequency of natural oscillations, if the generator is loaded to 75% of its maximum power limit.	**BTL 4**	Analyze	CO2

3.	Develop the equation for Eigen properties of the state matrix and its characteristics of Eigen value and stability.	**BTL 4**	Analyze	CO2
4.	Two identical machines feed a common load. The impedance between each machine terminal and the load bus is 0+j0.8p.u. on machine rated MVA. Other relevant data is given below. The terminal voltage of each machine is generators are identical, rating of each=123.5MVA; reactance parameters of each machine on its own rating are X_d=2.225, X_q=2.11, X'_d=0.266, T'_{do}=7.0sec. Total kinetic energy stored at synchronous speed of both machines=379.2MJ; rated frequency =50Hz. Loading Data: Both generators are identically loaded; active power output of each machine=0.5p.u. On total rated MVA; power factor=0.85. choose the base MVA as 247. Also, (i) Derive linearized network equations suitable for small signal stability analysis. (ii) Derive state equations for small signal stability analysis.	**BTL 5**	Evaluate	CO2
5.	Briefly state the importance of damping and synchronizing torque components with regard to a swing mode. How do you identify their inadequacies in a power system?	**BTL 3**	Apply	CO2

UNIT- III: TRANSIENT STABILITY

Review of numerical integration methods: modified Euler and Fourth Order RungeKutta methods, Numerical stability, Interfacing of Synchronous machine (classical machine) model to the transient stability algorithm (TSA) with partitioned – explicit approaches- Application of TSA to SMIB system.

PART – A

Q.No.	Questions	BT Level	Competence	Course Outcome
1.	List the method of improving the transient stability limit of a power system.	**BTL 1**	Remember	CO3
2.	List the advantages of Euler's method of transient stability analysis.	**BTL 4**	Analyze	CO3
3.	Define transient stability for a multi machine system.	**BTL 4**	Analyze	CO3
4.	Differentiate between steady state stability and transient stability.	**BTL 3**	Apply	CO3
5.	Describe transient stability limit.	**BTL 1**	Remember	CO3
6.	Show the expression for maximum power transfer		Apply	CO3
7.	What do you infer from single machine infinite bus system?	**BTL 2**	Understand	CO3
8.	Define dynamic stability of power system.	**BTL 3**	Apply	CO3
9.	Summarize the factors influencing transient stability analysis of single machine infinite bus system.	**BTL 1**	Remember	CO3
10.	What are the types of transient stability algorithms?	**BTL 1**	Remember	CO3
11.	Demonstrate the models used to represent generators and transmission lines in stability analysis?	**BTL 2**	Understand	CO3
12.	Develop the single line diagram for single machine infinite bus?	**BTL 2**	Understand	CO3
13.	Define critical clearing time?	**BTL 3**	Apply	CO3
14.	Explain power or torque angle?	**BTL 1**	Remember	CO3
15.	Illustrate any two expressions made to simplify the transient stability problem?	**BTL 2**	Understand	CO3
16.	On what basis can we conclude that synchronous generator goes out of stability?	**BTL 2**	Understand	CO3
17.	Discuss the methods to improve steady state and transient state stability margins.	**BTL 5**	Evaluate	CO3

18.	Discuss why? the use of automatic enclosing circuit breakers improves system stability.	**BTL 3**	Apply	CO3
19.	How do you calculate transient stability?	**BTL 5**	Evaluate	CO3
20.	What is the value of transient stability limit?	**BTL 4**	Analyze	CO3
21.	Write any three assumptions upon transient stability.	**BTL 1**	Remember	CO3
22.	Why transient stability limit is lower than the steady state stability limit.	**BTL 2**	Understand	CO3
23.	What is Numerical Stability?	**BTL 1**	Remember	CO3
24.	Differentiate: Explicit and Implicit methods of numerical integration.	**BTL 1**	Remember	CO3
PART-B				
1.	Explain the stability analysis by: (i)Runge Kutta method (ii)Implicit integration method.	**BTL 4**	Analyze	CO3
2.	Discuss on (i)Factors influencing transient stability (ii)Algorithm for simulation of SMIB system.	**BTL 5**	Evaluate	CO3
3.	Explain Euler's method with neat flow chart and necessary equation for a multi machine system	**BTL 2**	Understand	CO3
4.	Explain the fourth order Runge Kutta method in the study of power system stability	**BTL 3**	Apply	CO3
5.	Explain the integration method of analyzing transient stability and also explain the factors influencing transient stability.	**BTL 2**	Understand	CO3
6.	Describe the explicit and implicit method of numerical integration with an example of each.	**BTL 3**	Apply	CO3
7.	A generator operating at 50Hz delivers 1 p.u. power to an infinite bus through a transmission circuit in which resistance is neglected. A fault takes place reducing the maximum power transferable to 0.3 p.u., whereas before the fault this power was 2.0. p.u. and after the clearance of the fault it is 1.5. p.u. By the use of equal area criterion determine the critical clearing angle.	**BTL 1**	Remember	CO3
8.	Describe transient stability. Assume a classical generator model and consider the response of the system to a three-phase fault on transmission circuit and explain the transient stability phenomenon with illustrations.	**BTL 3**	Apply	CO3
9.	Summarize the following: (i)Runge Kutta method (ii)Modified Euler Method	**BTL 3**	Apply	CO3

10.	Explain the solution of differential equation in power system analysis using numerical integration by Modified Euler's method.	**BTL 1**	Remember	CO3
11.	List the assumptions made in the transient stability solution techniques.	**BTL 1**	Remember	CO3
12.	Device and explain the concept of equal area criterion for stability analysis of a power system.	**BTL 5**	Remember	CO3
13.	Discuss the possible solutions of the disturbed motion of a Synchronous generator, connected to an infinite bus, when subjected to a small disturbance represented by, assume damping to be proportional to dl/dt.	**BTL 2**	Understand	CO3
14.	Discuss how equal area criterion can be employed for determining the critical clearing angle.	**BTL 5**	Evaluate	CO3
15.	Explain the combined model of SMIB system with PSS.	**BTL 4**	Analyze	CO3
16.	Explain the types of algorithms for Transient Stability Analysis (TSA).	**BTL 3**	Apply	CO3
17.	Explain the model of SMIB system with SVC.	**BTL 4**	Analyze	CO3
PART C				
1.	A synchronous generator is connected to an infinite bus through a lossless double circuit transmission line. The generator is delivering 1.0 per unit power at a load angle of 30° when a sudden fault reduces the peak power that can be transmitted to 0.5 p.u. After clearance of fault, the peak power that can be transmitted becomes 1.5 per unit. Find the critical clearing angle.	BTL 5	Evaluate	CO3
2.	A two-pole, 50-MVA, 11-kV generator is supplying full load at 0.8 power factor lagging. If the inertia constant of the moving parts of the generator is 6.0 MJ/MVA, calculate the energy stored when the generator is running at the synchronous speed of 3000 rpm. If the net input to the generator is suddenly increased to 62000 metric HP, calculate the acceleration produced.	BTL 5	Evaluate	CO3

3.	A 50-Hz synchronous generator is supplying 0.8 pu real power at 0.8 lagging power factor to an infinite bus via a transmission line whose reactance is0.4 pu. If the direct axis transient reactance of the generator is 0.2 pu and the inertia constant H = 10 MJ/MVA, determine (i) the steady-state power limit, (ii) Synchronizing power coefficient, (iii) the frequency of free oscillations, and(iv) the time period of free oscillations. Assume the infinite bus voltage equal to 1.0 VL0	BTL 5	Evaluate	CO3
4.	Draw a diagram to illustrate the application of equal area criterion to study transient stability when there is a sudden increase in the input of generator.	BTL 5	Evaluate	CO3
5.	Explain the model of SMIB system with a TCSC & STATCOM Controllers	BTL 4	Analyze	CO3

UNIT-IV: VOLTAGE STABILITY

Factors affecting voltage stability- Classification of Voltage Stability-Transmission system characteristics- Generator characteristics- Load characteristics- Characteristics of reactive power compensating Devices- Voltage collapse.

PART-A

Q.No	Questions	BT Level	Competence	Course Outcome
1.	Define Voltage Stability.	BTL 1	Remember	CO4
2.	What are the classification of voltage Stability?	BTL 1	Remember	CO4
3.	What are the sources of reactive power? How it is controlled?	BTL 2	Understand	CO4
4.	When is feedback stability compensation used?	BTL 1	Remember	CO4
5.	Give the characteristics of line compensators?	BTL 3	Apply	CO4
6.	What are the factors contributing to volage instability?	BTL 2	Understand	CO4
7.	What is known as bank of capacitors? How it is adjusted?	BTL 1	Remember	CO4
8.	What is the disadvantage of switched capacitors are employed for compensation?	BTL 1	Remember	CO4
9.	What are the effects of capacitor in series compensation circuit?	BTL 2	Understand	CO4
10.	Give two kinds of capacitors used in shunt compensator?	BTL 5	Evaluate	CO4
11.	Define Voltage Security.	BTL 2	Understand	CO4
12.	Explain the effect of series compensation on voltage instability?	BTL 4	Analyze	CO4
13.	Write about Static VAR Compensator (SVC).	BTL 6	Create	CO4
14.	Draw the characteristics of Synchronous motor loads.	BTL 1	Remember	CO4
15.	On what factor voltage stability analysis is done?	BTL 2	Understand	CO4
16.	Give some of the Static compensator’s schemes.	BTL 3	Apply	CO4
17.	What is tap changing transformers?	BTL 1	Remember	CO4
18.	Draw the characteristics of Induction motor loads.	BTL 4	Analyze	CO4
19.	Write the types of tape changing transformers.	BTL 2	Understand	CO4
20.	Draw the characteristics of Converter loads.	BTL 6	Create	CO4
21.	What is Static VAR Switches or Systems?	BTL 1	Remember	CO4
22.	What are the factors affecting voltage collapse and insecurity?	BTL 2	Understand	CO4
23.	What are the System Design Measure to prevent voltage collapse?	BTL 1	Remember	CO4
24.	Define Voltage Collapse.	BTL 2	Understand	CO4

PART-B

1.	Explain the basic concept of voltage stability.	BTL 4	Analyze	CO4

2.	Derive the physical relation indicating dependency of voltage on reactive power flow.	**BTL 3**	Apply	CO4
3.	What are the salient disturbances that cause voltage instability?	**BTL 2**	Understand	CO4
4.	Explain the voltage collapse phenomenon with the help of P-V curves.	**BTL 1**	Remember	CO4
5.	How would you take into account the magnitude of the load voltage as an indicator of stability?	**BTL 3**	Apply	CO4
6.	Explain the analysis of voltage stability of two machine system.	**BTL 6**	Create	CO4
7.	Derive an expression for determinant of Jacobian as proximity indicator in voltage stability indices.	**BTL 4**	Analyze	CO4
8.	Discuss various sources of generation and absorption of reactive power.	**BTL 4**	Analyze	CO4
9.	Explain the role of OLTC transformer on voltage stability	**BTL 6**	Create	CO4
10.	Describe the analytical concept of voltage stability for a single machine connected to infinite bus.	**BTL 1**	Remember	CO4
11.	Explain how the following loads that influences the voltage stability (i) Discharge lights, (ii) Air conditioning and (iii) Electronic power supplies.	**BTL 3**	Apply	CO4
12.	Discuss in brief how the following devices can compensate the reactive power a) Shunt compensation b) Synchronous condenser c) SVC d) Booster transformer.	**BTL 2**	Understand	CO4
13.	Explain the effect of location of series capacitor on voltage stability	**BTL 2**	Understand	CO4
14.	Discuss the relation of voltage stability and rotor angle stability.	**BTL 5**	Evaluate	CO4
15.	Explain the mechanism of voltage collapse in power transmission system.	**BTL 3**	Apply	CO4
16.	Explain the characteristics of reactive compensating devices.	**BTL 4**	Analyze	CO4
17.	How voltage collapse can be prevented?	**BTL 2**	Understand	CO4
PART – C				
1.	Explain how the following loads that influences voltage stability i) Induction motor ii) Heat pumps and iii) OH lines and cables.	**BTL 5**	Evaluate	CO4
2.	Discuss in detail, enhancement of voltage stability with various types of localized reactive power support.	**BTL 5**	Evaluate	CO4
3.	Write short notes on the following a) Practical aspects to improve voltage stability b) Static VAR compensation c) Voltage stability margin.	**BTL 6**	Create	CO4
4.	Write short notes on the following a) Voltage security b) On load tap changing transformer c) Causes of voltage collapse incidences.	**BTL 3**	Apply	CO4
5.	Explain the characteristics of voltage collapse based on real incidents.	**BTL 4**	Analyze	CO4

UNIT-V: ENHANCEMENT OF SMALL-SIGNAL STABILITY AND TRANSIENT STABILITY				
Power System Stabilizer –. Principle behind transient stability enhancement methods: high-speed fault clearing, regulated shunt compensation, dynamic braking, reactor switching, independent pole-operation of circuit-breakers, single-pole switching, fast valving, high-speed excitation systems. Data-omega of p-s stabilizer.				
PART – A				
Q.No	**Questions**	**BT Level**	**Competence**	Course Outcome
1.	Explain power stabilizer	**BTL 3**	Apply	CO5
2.	List the types of stabilizers.	**BTL 1**	Remember	CO5
3.	Explain small signal stability?	**BTL 1**	Remember	CO5
4.	Define exciter gain	**BTL 2**	Understand	CO5
5.	Describe phase lead compensation	**BTL 1**	Remember	CO5
6.	Give the stabilizer limits	**BTL 1**	Remember	CO5
7.	Define frequency-based stabilizers	**BTL 2**	Understand	CO5
8.	What are the different types of Power system stabilizer?	**BTL 3**	Apply	CO5
9.	Discuss enhancement of small signal stability	**BTL 1**	Remember	CO5
10.	Describe shaft speed signal? BTL	**BTL 4**	Analyze	CO5
11.	On what basis the stabilizers are classified?	**BTL 3**	Apply	CO5
12.	Prepare the list of merits & demerits of digital stabilizers	**BTL 5**	Evaluate	CO5
13.	List the applications of frequency-based stabilizers	**BTL 4**	Analyze	CO5
14.	Write the expression for stabilizing signal washout stabilizer gain.	**BTL 1**	Remember	CO5
15.	Explain how to enhance the signal stability.	**BTL 2**	Understand	CO5
16.	Classify the power system stabilizers.	**BTL 6**	Create	CO5
17.	What are the secondary arc suppression methods?	**BTL 2**	Understand	CO5
18.	Compose the need for digital stabilizer.	**BTL 4**	Analyze	CO5
19.	Prepare the list of major disadvantages associated with delta-omega stabilizer?	**BTL 6**	Create	CO5
20.	Explain stabilizer gain.	**BTL 5**	Evaluate	CO5
21.	What are the Methods of Improving Transient Stability?	**BTL 2**	Understand	CO5
22.	What is Fast-Valving?	**BTL 1**	Remember	CO5

23.	Comparison between phase lead &lag compensations.	**BTL 2**	Understand	CO5
24.	Comparison between delta omega & delta p-omega stabilizers	**BTL 1**	Remember	CO5
	PART B			
1.	What is power system stabilizer and why it is used? How can you design a power system stabilizer?	**BTL 5**	Evaluate	CO5
2.	Explain the Special techniques for the analysis of very large systems.	**BTL 2**	Understand	CO5
3.	Explain the following briefly: (a)Digital excitation (b)Design of Phase lead compensation.	**BTL 2**	Understand	CO5
4.	Discuss the role of power system stabilizers for the enhancement of small signal stability	**BTL 4**	Analyze	CO5
5.	Describe briefly the stabilizing signal washout stabilizer gain with some examples	**BTL 1**	Remember	CO5
6.	Describe briefly the stabilizing signal washout stabilizer gain with some examples	**BTL 3**	Apply	CO5
7.	Briefly differentiate between delta omega & delta p-omega stabilizers.	**BTL 3**	Apply	CO5
8.	Explain in detail with necessary equation and block diagram the Supplementary control of synchronous machine excitation using three types of PSS.	**BTL 1**	Remember	CO5
9.	Explain the power system stabilizer.	**BTL 4**	Analyze	CO5
10.	(i)Compare the properties of P-Omega stabilizer and Delta Omega stabilizer. (ii)Explain with a neat function block diagram the excitation control design.	**BTL 2**	Understand	CO5
11.	Draw the schematic diagrams of P omega stabilizer and delta omega stabilizer and compare their properties and operation in detail.	**BTL 6**	Create	CO5
12.	What are the different types of power system stabilizers?	**BTL 2**	Understand	CO5
13.	What are power system stabilizers? Explain the alternative type of PSS	**BTL 1**	Remember	CO5
14.	Explain the operation of stabilizer based on shaft speed signal.	**BTL 1**	Remember	CO5
15.	Explain the methods of improving transient stability.	**BTL 4**	Analyze	CO5
16.	Explain the following: (i) Phase lead compensation (ii) Excitation control design.	**BTL 2**	Understand	CO5
17.	Write short notes on: (i) Digital Stabiliser (ii) Phase lead compensation and (iii) Delta –P-Omega stabilizer	**BTL 1**	Remember	CO5
	PART C			
1.	(i) Explain with a neat schematic diagram the operation of a power system stabilizer. (ii) Explain with a neat diagram the frequency-based stabilizer.	**BTL 4**	Analyze	CO5
2.	Explain the generator tripping and what are the types of control measures for improving system stability.	**BTL 4**	Analyze	CO5

3.	Summarize the role of power system stabilizers for the enhancement of small signal stability.	**BTL 6**	Create	CO5
4.	Design a Power system stabilizer (PSS).	**BTL 6**	Create	CO5
5.	Explain fast valving and high-speed excitation systems.	**BTL 4**	Analyze	CO5

COURSE OUTCOMES:

COs	**COURSE OUTCOMES**
CO1	Learners will attain knowledge about the stability of power system.
CO2	Learners will have knowledge on small-signal stability, transient stability.
CO3	Learners will have knowledge on voltage stability.
CO4	Learners will be able to understand the dynamic behavior of synchronous generator for different disturbances.
CO5	Learners will be able to understand the various methods to enhance the stability of a power system.