2021 SCHEME

Basavarajeswari Group of Institutions

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

USN											Course Code	2	1	E	E	8	1

Eighth Semester B.E. Degree Examinations, April/May 2025

POWER SYSTEM OPERATION AND CONTROL

Duration: 3 hrs **Max. Marks: 100**

Note: ***1. Answer any* FIVE *full questions, choosing* ONE *full question from each module.***
2. Missing data, if any, may be suitably assumed

Q. No		Question	Marks	(RBTL:CO: PI)
		Module-1		
1.	**a.**	Illustrate the key factors considered for reliable operation of power system.	**10**	**(2 :1 : 1.4.1)**
	b.	Define SCADA. Discuss major component of SCADA.	**10**	**(2 :1 : 1.4.1)**
		(OR)		
2.	**a.**	Explain the major components of energy management centre.	**10**	**(2 :1 : 1.4.1)**
	b.	Explain the operating states of power system with neat diagram.	**10**	**(2 :1 : 1.4.1)**
		Module-2		
3.	**a.**	Model the complete ALFC loop with neat block diagram.	**10**	**(3 :2 : 1.4.1)**
	b.	A power system has a total load of 1400 MW at 50 Hz. D=1.2. A load of 50 MW is tripped. Find the steady-state speed(frequency) deviation if (i) There is no speed control. (ii)The system has a spinning reserve of 250 MW with a regulation of 4 % on this capacity. Due to governor dead band only 75 % of the governors respond to the change in load.	**10**	**(3 :2 : 2.1.2)**
		(OR)		
4.	**a.**	Model the generator of ALFC loop.	**10**	**(3 :2 : 1.4.1)**
	b.	A control area has following data: Total generation capacity=2000 MW, Normal load=1500 MW, h=4.8s; d=1.2%; f=50 Hz; R=2.5 Hz/pu MW. (i) Determine the primary ALFC parameters. (ii) For an increase of 0.02pu in the load, find the frequency drop without governor control. (iii) Repeat (ii) with governor control. (iv) Repeat (ii) with governor control but frequency dependence of the loads neglected.	**10**	**(3 :2 : 2.1.2)**
		Module-3		
5.	**a.**	Illustrate the effect of change of load in any one area in two-area tie-line control.	**10**	**(2 :3 : 1.4.1)**
	b.	Two control areas are connected via a tie-line with the following characteristics: Area 1: R1=1%, D1=0.8, base MVA=500 Area 2: R2=1%, D1=1.0, base MVA=500 A load increase of 100 MW occurs in Area 1. What is the new steady state frequency and the change in tie-line flow if the nominal frequency is 50 Hz?	**10**	**(3 :3: 2.1.2)**

Note: (RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI– Performance Indicator)

(OR)

6. **a.** Elaborate the frequency bias tie-line control with neat block diagram. **10** **(2 :3 : 1.4.1)**

b. A two-area system by a tie-line has the following parameters, on a base of 1000 MVA. **10** **(3 :3: 2.1.2)**

The units are operating at a nominal frequency of 50 Hz, when there is a

Area	1	2
Speed regulation	**R_1=0.05**	**R_2=0.0625**
Frequency-sensitive load coefficient	**D_1=0.6**	**D_2=0.9**
Inertia constant	**H_1=5.5**	**H_2=5**
Governor time constant	**T_{G1}=0.25 s**	**T_{G2}=0.3 s**
Turbine time constant	**T_{TR1}=0.5 s**	**T_{TR2}=0.5 s**

sudden change in load of area 1 by 150 MW. The synchronising power coefficient T=2pu. Obtain the time-domain response of $\Delta\omega_1$, $\Delta\omega_2$, ΔP_{m1}, ΔP_{m2} and ΔP_{12}. Repeat for a step change of 150 MW in Area 2. If the value of R1 is reduced to 0.01 what is the effect?

Module-4

7. **a.** Discuss in detail the voltage control by using series reactive power injection. **10** **(2 :4 : 1.4.1)**

b. Three generating stations are connected to a common bus bar X, as shown in Figure. Q 7(b), for a particular system load, the line voltage at bus bar falls by 2 kV. Calculate the reactive power injection required to bring back the voltage to the original value. All per unit values are on a 500 MVA base. Justify the answer. **10** **(3 :4: 2.1.2)**

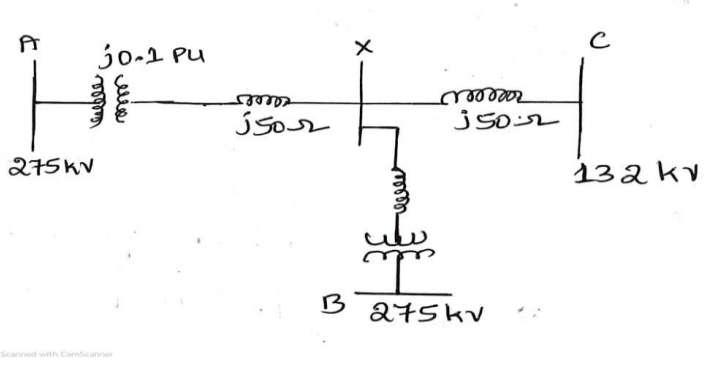

Fig. Q 7(b)

(OR)

8. **a.** List out the different methods of voltage control. Discuss in detail the voltage control by using transformers. **10** **(2 :4: 1.4.1)**

b. Consider a single phase 220 kV line of length 200 KM. The resistance per KM=0.031Ω and the reactance per KM = 0.32 Ω. Compute the following sending end voltage with accurate and approximate formulae, if the load is 500 MW at a power factor of 0.85? Justify the answer. **10** **(3 :4: 2.1.2)**

Module-5

9. **a.** Explain the generation shift sensitivity factors with neat flow chart. **10** **(2 :5: 1.4.1)**

b. Write a short note on contingency selection and ranking. **10** **(2 :5: 1.4.1)**

(OR)

10. **a.** Explain the line outage distribution factors with neat flow chart. **10** **(2 :5: 1.4.1)**

b. What are the state variables and measurements involved in state estimator? Explain in brief state estimation problem formulation. **10** **(2 :5: 1.4.1)**

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