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UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, April 2018

Program:	**B.Tech. PSE**	**Semester –**	**VIII**
Course Name:	**Load Dispatch and Electricity Regulation**	**Max. Marks**	**: 100**
Course Code:	**PSEG-462**	**Duration**	**: 3 Hr**
No. of page/s: 6			

Section A [20= 5x4]

All questions are compulsory

1. **Write short notes on :** **[2+2]**
   i) Availability Based Tariff
   ii) Generator load model.

2. **Explain the effect of speed governor dead band on automatic generation control (AGC).**

3. **Elucidate the four sources of risk in the electricity market.**

4. **A load of 30 MW, 45 MVAr is connected to a line where (**$\frac{X}{R}=5$¿ **and the short circuit capacity of the load bus is 250 MVA. The supply voltage is 11 kV and the load is star connected. Determine the load bus voltage.**

5. **An industrial load has motors which are shunt compensated. Assume that the real part of the load is insensitive to voltage variation; determine the voltage sensitivity at nominal voltage of the net reactive load assuming 75% shunt compensation. The uncompensated voltage sensitivity (**$\Delta Q/\Delta V$**) is unity. Also, discuss the effect of tap changing.**

Section B [10x4]

All questions are compulsory

6. **Define unit commitment and explain following concepts with reference to Unit Commitment.**
   i. **Minimum up time**
   ii. **Minimum down time**
   iii. **Fuel constraint**
   iv. **Must run**
   v. **Hydro-constraint**

7. **Central Electricity Regulatory Commission (CERC) has released Model Guidelines for Accreditation of a Renewable Energy Based project or Distribution Licensee, as the case**

may be under REC mechanism. These regulations shall be applicable to all renewable energy based projects of generating companies which are grid connected. All sources recognized and approved by the Ministry of New and Renewable Energy shall come under these regulations.

Discuss the major changes proposed in the procedures.

8.

a) **What do you mean by "BAD Data" in power system ? How does it creep in while obtaining a good state estimator? Explain clearly how it is taken care of by using theory of probability. [5]**

b) **The term power line carrier is used to represent the entire process of communication which uses high voltage overhead power lines as means of transmission. Considering the aforementioned statement, understate the five advantages that power lines offer: [5]**

9. a) **Banking of power means exchange of electricity for electricity (instead of money). Illustrate the afore-said statement with the suitable examples pertaining to the power system scenario. [6]**

(b) State True / False: [4]

(i) One of the main functions of CERC is to regulate inter-State sale of power.

(ii) SERC aims at improving the financial health of the State Electricity Boards (SEBS)

(iii) Shunt Compensation in an EHV is restored to improve the voltage profile

(iv)Load frequency control is non-interactive for small changes in input parameters.

Section C [20x2]

Attempt any one question out of Q. 11 and Q.12.

Q.10 is compulsory.

10.

Shown below is the case study for the black-out occurred in Switzerland and Italy. Carefully go through the paragraph detailing the key findings of the blackout by the concerned body (of authority) and find out the primary causes of the same:

The UCTE (Union for the Co-ordination of Transmission of Electricity) Investigating Committee Final Report notes that the integrated system was operating in an N-1 secure state, consistent with UCTE operating procedures, prior to the failure of the Mettlen-Lavorgo line. The inability of the system operator to reclose this line after its initial failure due to the phase angle exceeding stability limits was a direct and decisive underlying cause of the event. 10 minutes were lost in unsuccessful attempts to reclose the line, time which proved crucial given that the resulting overload on the Sils-Soazza line could only be sustained for around 15 minutes.

Subsequent responses by system operators in Switzerland and Italy were considered slow, given the nature of the emergency, and the measures adopted were insufficient to return the system to an N-1 secure state within the 15 minute margin to reduce the overload on the Sils-Soazza line. The UCTE Investigation Committee Final Report also noted the differing accounts of a conversation between the Italian and Swiss system operators, and suggested that ineffective communication and information exchange contributed to an ineffective response. Therefore, although the countermeasures were available to return the system to a secure state, operational, technical and organizational factors prevented a timely and appropriate response.

Primary Causes of the Swiss-Italian Blackout

Primary Cause	Impact on Event	Origin of Primary Cause	Action
Unsuccessful re-closing of the Lukmanier line because the phase angle difference was too high	Decisive	Large phase angle due to power flows and network topology	Study settings of concerned protection devices. Reassess possible consequences for net transfer capacity to Italy. Coordination of emergency procedures.
Lacking a sense of urgency regarding the San Bernardino line overload and call for inadequate countermeasures in Italy	Decisive	Human factor	Operator training for emergency procedures. Reassess acceptable overload margins. Study real-time monitoring of transmission line capacities
Angle instability and voltage collapse in Italy	Not an underlying cause of the events but was the reason that island operation of Italy after its disconnection failed.	General tendency towards grid use close to its limits	Further studies necessary on how to integrate stability issues in UCTE security & reliability policy.
Right-of-way maintenance practices	Possible	Operational practices	Perform technical audit if necessary, improve tree cutting practices

Source: UCTE (2004a).

What recommendations can be provided after analyzing the data (given) in relation to the interface with regulatory arrangements, principally regarding factors affecting system adequacy, especially investments in the transmission system, and the need to strengthen the powers and independence of TSOs (transmission system operators) to ensure system security?

One can recommend the requisite w.r.t: **[2x10]**

a) **Operational Procedures**
b) **Day- Ahead Congestion forecast (DACF)**
c) **Real-time data exchange**
d) **Technical Specifications for Generating Equipment**
e) **Emergency Control and Co-ordination of Load Frequency Control**
f) **Improving Wide Area Measurement System (WAMS) Management**
g) **Enforcement of Technical Specifications for Generating Equipment**
h) **Defense and Restoration Plans**
i) **Vegetation Management**
j) **Distribution Level Measures**

11. Two generating units have the following expression for incremental cost: **[20]**

$\Lambda_1 = 0.08P_1+8$

$\Lambda_2= 0.0096P_2+6.4$; where P_1 and P_2 are in MW;

Calculate the economic loading of each unit to meet a total customer load of 500 MW. What is the system Λ and transmission loss of the system?

Determine the penalty factor for each unit and IFC (Incremental fuel Cost) for each generating bus.

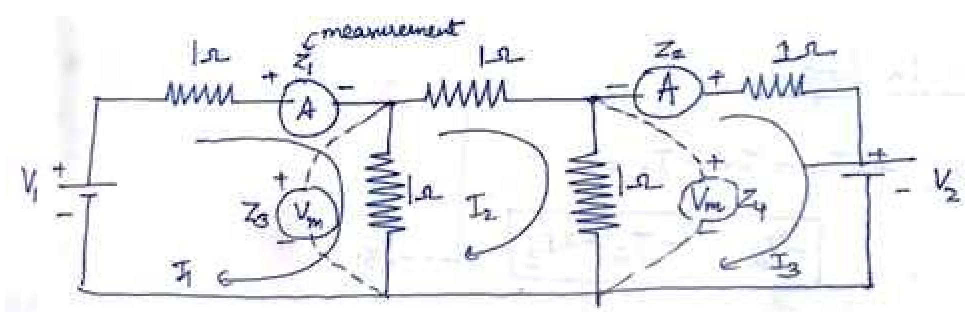
At specified load level of 500 MW, the loss coefficients in p.u. on a 100 MVA base are given as:

$$\begin{matrix} B11 & B12 & \frac{B10}{2} \\ B21 & B22 & \frac{B20}{2} \\ \frac{B10}{2} & \frac{B20}{2} & B00 \end{matrix} \quad =$$

8.33	-0.049	0.370
-0.049	5.96	0.195
0.37	0.195	0.09

Multiply the order of magnitudes of the loss coefficients by 10^{-3}.

12. **[20]**



In the dc circuit, the meter readings are:

$Z_1 = 9.01$ A

$Z_2= 3.02$ A

Z_3= 6.98 V
Z_4= 5.01 V
Assuming that the ammeters are more accurate than that of voltmeters; the measurements weights are assigned as:
W_1 = 100
W_2= 100
W_3= 50
W_4=50
Determine the weightage least square estimates of the voltage sources [V_1 & V_2].