



RM-7767

B. E. - IV (Sem. VIII) (Electrical) Examination
May / June - 2010
Power System Operation & Control

Time : 3 Hours]

[Total Marks : 100

Instructions :

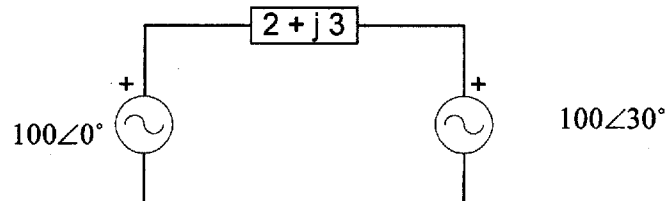
(1)

नीचे दृष्टावेक निशानीवाणी विगतो उत्तरवडी पर अवश्य लपवी. Fillup strictly the details of signs on your answer book.	Seat No. :
Name of the Examination :	<input type="text"/>
B. E. - 4 (Sem. 8) (Electrical)	<input type="text"/>
Name of the Subject :	<input type="text"/>
Power System Operation & Control	<input type="text"/>
Subject Code No. : <input type="text"/> 7 <input type="text"/> 7 <input type="text"/> 6 <input type="text"/> 7	Section No. (1, 2,.....): <input type="text"/> 1&2
Student's Signature	

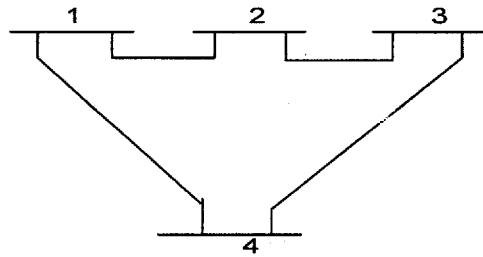
- (2) Attempt all questions.
- (3) Figures to the right indicate full marks.
- (4) Assume necessary data wherever required.
- (5) Scientific calculator up to Casio-100D, 100MS or equivalent is permitted.

SECTION - I

- 1 (a) (i) What is decoupled load flow method? **6**
(ii) At PQ bus we assume _____ and _____.
(iii) How is sparsity useful in load flow analysis?
- (b) Calculate the active and reactive power exchange **4**
between two machines.



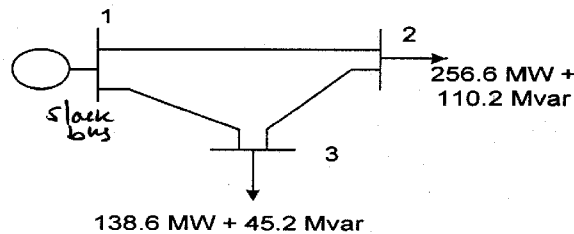
- (c) For given 4-bus system the line impedances and shunt admittances are as under. Draw its equivalent network and Formulate Y_{bus} . 8



Bus to Bus	1-2	2-3	3-4	2-4	1-3
R (pu)	0.2	0.3	0.25	0.2	0.1
X (pu)	0.8	0.9	0.12	0.8	0.7
$Y_{pq}/2$	$j0.02$	$j0.03$	$j0.04$	$j0.02$	$j0.01$

- 2 (a) For a 3-bus power system with generation at bus no 1. Magnitude of which is adjusted is 1.05 pu. Using Gauss-Seidal method, determine the phasor values of the voltage at the load buses 2 and 3 accurate to four decimal places. Also find slack bus real and reactive power. Use 100 MVA base. 16

Bus to Bus	1-2	2-3	1-3
R (pu)	0.02	0.0125	0.01
X (pu)	0.04	0.025	0.03

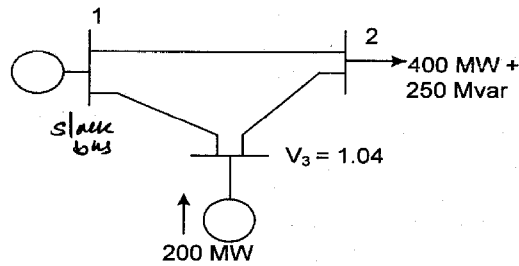


OR

- 2 (a) For a 3-bus power system with generation at buses no 1. Magnitude of bus no 1 is adjusted is 1.05 pu and bus no 3 is fixed at 1.04 pu with a real power generation of 200 MW. Using Gauss-Seidal method, determine the phasor values of the voltage at the load buses 2 and 3 accurate to four decimal places. Also find slack bus real and reactive power. 16

Use 100 MVA base

Bus to Bus	1-2	2-3	1-3
R (pu)	0.02	0.0125	0.01
X (pu)	0.04	0.025	0.03



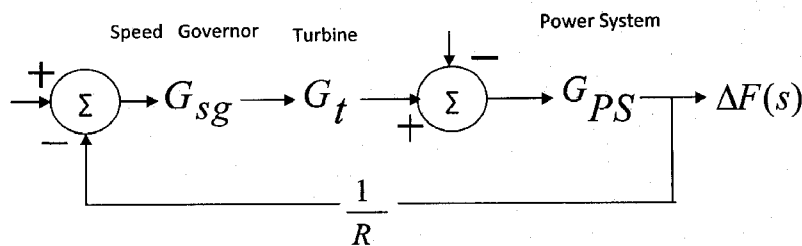
- 3 Attempt any two : 16
- (i) Derive Generalized power flow equations.
 - (ii) Write an algorithm for the Newton-Raphson Method for Load flow study
 - (iii) Draw the flow chart for the FDLF Method/algorithm
 - (iv) State all assumptions made for approximate load flow solution. Explain individually how these assumptions make load flow solution easy.
- 4 (a) With a neat schematic diagram, explain load frequency control loop and voltage control loop of a generator connected in an isolated power system? Explain why these loops are analyzed independently. 8
- (b) Two generators rated 200 MW and 400 MW are operating in parallel. The drop characteristics of their governors are 4% and 5% respectively from no load to full load. The speed changers are so set that the generators operate at 50 Hz sharing the load of 400 MW in the ratio of their ratings. If the load increases to 600 MW, how will it be shared among the generators and what will the system frequency be? Assume free governor operation. 8
- The speed changers of the governors are reset so that the load of 600 MW is shared among the generators at 50 Hz in the ratio of their ratings. What are the no load frequencies of the generators?
- OR**
- 4 (a) Draw schematic diagram of turbine speed governing system. Explain various components of the system. 6
- (b) Assume that in an isolated power system all generators operating at their rated power generation limit. Also assume that all loads are frequency dependent loads. Explain qualitatively the effect of increase in load on frequency under steady state with suitable expression. Neglect effect of load variation due to change in voltage. 4
- (c) Write short note on Automatic Voltage Control for a single area system. 6
- 5 (a) With a neat schematic diagram, explain load frequency control loop and voltage control loop of a generator connected in an isolated power system? Explain why these loops are analyzed independently. 8
- (b) Derive co-ordination equation for k generators committed at a given station. Write an algorithm for computer solution. 8

- 5 (a) The complete block diagram representation of frequency control of an isolated power system is shown in the figure. The ΔP_C is change in speed changer setting and ΔP_D is change in load demand. 6

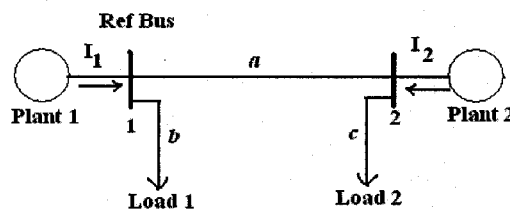
It is given that $G_{sg} = \frac{K_{sg}}{1+sT_{sg}}$ $G_t = \frac{K_t}{1+sT_t}$ $G_{PS} = \frac{K_{PS}}{1+sT_{PS}}$

Assume that $K_{sg}K_t = 1$ and $K_{PS} = 1/B$, where $B = \frac{\partial P_D}{\partial f} / P_r$ and P_r is rated power of the generator.

Obtain the expression of Δf in terms of ΔP_C and ΔP_D under steady state.



- (b) Derive transmission loss formula (β -coefficients). 10
State the assumptions to be made.
- 6 (a) The given figure shows a system having two plants 1 and 2 connected to buses 1 and 2, respectively. There are two loads and the branches a, b and c. The bus 1 is the reference bus with voltage of $1.0 \angle 0^\circ$ pu. The branch currents and impedances are: $I_a = 2 - j0.5$ pu, $I_b = 1.6 - j0.4$ pu, $I_c = 1.8 - j0.45$ pu, $Z_a = 0.06 + j0.24$ pu, $Z_b = 0.03 - j0.12$ pu and $Z_c = 0.03 - j0.12$ pu. Calculate the loss formula coefficients of the system in per unit and in reciprocal megawatts, if the base is 100 MVA.



- (b) A plant has two generators supplying the plant bus and neither is to operate below 100 MW or above 625 MW. Incremental costs with P_1 and P_2 in megawatts are $dF_1/dP_1 = 0.012P_1 + 8.0$ \$/MWh and $dF_2/dP_2 = 0.018P_2 + 7.0$ \$/Mwh. For economic dispatch find the plant λ when $P_1 + P_2$ equals (a) 200 MW, and (b) 1150 MW. 8
- (c) Explain physical significance of λ . Take usual notations for various related variables. Assume that at a given station k generators are committed. 2