BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: BE **SEMESTER : VII**
BRANCH: EEE **SESSION : MO/19**

SUBJECT: EE7211 COMPUTER AIDED POWER SYSTEM ANALYSIS

TIME: 3:00 HOURS **FULL MARKS: 60**

INSTRUCTIONS:
1. The question paper contains 7 questions each of 12 marks and total 84 marks.
2. Candidates may attempt any 5 questions maximum of 60 marks.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

Q.1(a) How the Y_{bus} matrix gets modified if there is off – nominal tap ratio present between any two buses? Mathematical explanation is required only. [2]

Q.1(b) With necessary connection diagram and phasor diagram, prove that a transformer can be used as regulating transformer for voltage phase control. [4]

Q.1(c) A 50 MVA, 30kV, three – phase, 60 Hz synchronous generator has synchronous reactance of 9Ω per phase and a negligible resistance. The generator is delivering rated power at a 0.8 p.f. lagging at the rated terminal voltage to an infinite bus. Determine the excitation voltage per phase *E* and the power angle δ. [6]

Q.2(a) The bus admittance matrix of a three-bus three-line system is: [2]

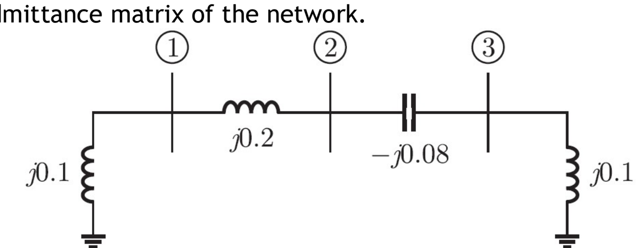
$$Y = j\begin{bmatrix} -13 & 10 & 5 \\ 10 & -18 & 10 \\ 5 & 10 & -13 \end{bmatrix}$$

Each of the transmission line between the two buses is represented by an equivalent π-network. Determine the magnitude of the shunt susceptance of the line connecting bus 1 and 2.

Q.2(b) Compare Gauss Seidel technique and Newton Raphson method for solving power flow problem. [4]

Q.2(c) Write down the algorithm for solving load flow problem using Netwon Raphson method, use all related mathematical expressions. [6]

Q.3(a) A three – bus network is shown in the figure below indicating the p.u. impedance of each element. Determine the bus admittance matrix of the network. [2]



Q.3(b) Define sparsity. What are the methods used for modification of Y_{bus} matrix in order to minimize the computational effort and computer storage. [4]

Q.3(c) Write the algorithm and draw the flow chart for decoupled power flow method. [6]

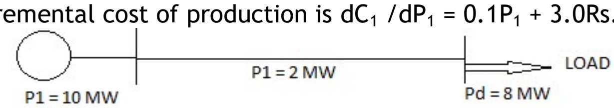
Q.4(a) The incremental costs (in Rupees/MWh) of operating two generating units are functions of their respective powers P1 and P2 in MW, and are given by [2]

$dC_1/dP_1 = 0.2P_1 + 50$; $dC_2/dP_2 = 0.24P_2 + 40$

Where, $20MW \le P_1 \le 150$ MW; $20MW \le P_2 \le 150MW$.

For a certain load demand, P_1 and P_2 have been chosen such that $dC_1/dP_1 = 76$ Rs/MWh and $dC_2/dP_2 = 68.8$ Rs/MWh. If the generations are rescheduled to minimize the total cost, then calculate new value of P_2.

Q.4(b) Determine the incremental cost of received power and the penalty factor of the plant shown in figure below if the incremental cost of production is $dC_1/dP_1 = 0.1P_1 + 3.0$Rs./MWhr [4]



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Q.4(c)	What do you mean by incremental cost and incremental loss in context of economic dispatch of real power? Derive the condition for economic dispatch including the losses and no generator limits.	[6]
Q.5(a)	What do you mean by committing and de-committing of generating units? Define the term unit commitment?	[2]
Q.5(b)	Enumerate different constraints considered in unit commitment problem. What are the assumptions made for solving unit commitment problem using dynamic programming?	[4]
Q.5(c)	Draw the flowchart for dynamic programming method of solving unit commitment problem.	[6]
Q.6(a)	Why Z_{BUS} is used instead of Y_{BUS} in short circuit analysis?	[2]
Q.6(b)	Derive the equation for fault current for single line– to– ground fault at any bus *k*.	[4]
Q.6(c)	Prove that the principle diagonal elements of Z_{BUS} represents Thevenin's impedance Z_{th}.	[6]
Q.7(a)	What is swing curve and what is its use?	[2]
Q.7(b)	A synchronous generator having H = 8MJ/MVA is connected to an infinite bus and supplying power of 1.0 p.u. with initial power angle as 25^0. Assume a 3-phase fault occurring at t = 0 and cleared at t = 2.0 sec. The power equations expressed in p.u. are as under: Power transfer in pre-fault condition = 2.5sin(δ) Power transfer during fault condition = 0.6 sin(δ) Power transfer in post-fault condition = 1.5 sin(δ) System frequency is 50 Hz, use step-by-step method to solve the swing equation with step size 0.05 till the fault is cleared.	[10]

::::::29/11/2019::::::E