



- Instructions –
- All questions are compulsory.
 - Figures to the right indicate full marks.
 - Assume suitable data wherever necessary.
 - Use separate answer book for each section.
 - Use of non-programmable calculator, Steam Table, IS Code are allowed.

Section I

Q1 Solve any *two* of the following

a The "Element- Node Incidence Matrix" is given below. Draw its oriented graph. 8

Element 'e' ↓ Node 'n' →	0	1	2	3
1	1	-1	0	0
2	1	0	-1	0
3	1	0	0	-1
4	0	1	-1	0
5	0	0	-1	1
6	0	1	0	-1

b 8

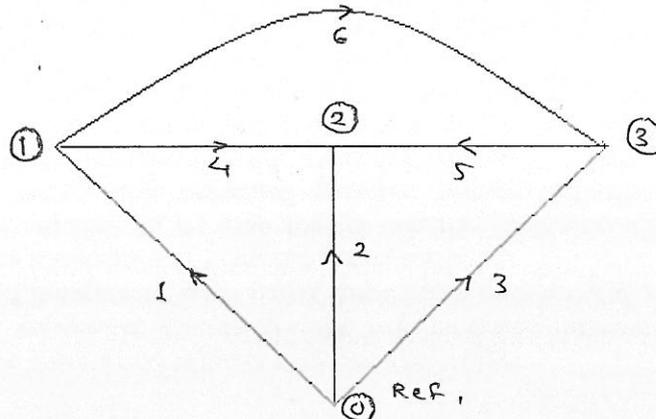


Fig.Q.1(b)

Figure Q.1(b) represents an oriented graph of a power system network. The element numbers are marked in the figure. The reactances in per unit are given below,

Element No.	1	2	3	4	5	6
Reactance p.u.	0.1	0.2	0.15	0.25	0.15	0.12

Formulate Y_{BUS} by direct inspection method.

c Discuss the "Primitive network and its significance". Explain the steps in constructing 'Primitive admittance matrix', when the impedances of elements are given. 8

- Q2 Solve any *two* of the following
- a Explain "Load Flow Studies" and their objectives in Power System Analysis. Discuss how the buses of the power system network are classified in such studies as per the quantities specified and unknown. 8
- b Describe Gauss-Seidel method using Y_{BUS} for the computation of the voltages at the load buses in load flow analysis. 8
- c Use the Newton-Raphson method to solve, 8
- $$f(x_1, x_2) = x_1^2 - x_2^2 - 4$$
- $$g(x_1, x_2) = x_1^2 + x_2^2 - 1$$
- Assume $x_1^{(0)} = 2$ and $x_2^{(0)} = -1$.
Update the values of x_1 and x_2 . Perform only two iterations.

- Q3 Solve any *two* of the following
- a Derive and explain the concept of "Equal Area Criteria" for transient state stability analysis of a power system. 9
- b Explain "Power-Angle Curve" of a synchronous generator connected to infinite bus. Derive the Power-angle equation. Define 'Transfer reactance'. 9
- c Explain point-by-point method for solving the Swing equation. 9

Section II

- Q4 Solve any *two* of the following
- a Explain the method of unbalanced fault analysis using zero-, positive- and negative- sequence bus impedance matrices (Z_{BUS}) for double-line fault. 8
- b The per unit positive- sequence impedance matrix for the power system is given by, 8

$$Z_{1,BUS} = j \begin{bmatrix} 0.0450 & 0.0075 & 0.0300 \\ 0.0075 & 0.0637 & 0.0300 \\ 0.0300 & 0.0300 & 0.2100 \end{bmatrix}$$

- A three-phase fault occurs at Bus-3 through a fault impedance $Z_f = j 0.19$ per unit using the bus impedance matrix. Calculate the fault current at Bus 3.
- c Discuss the phase shift occurring between positive-sequence and negative-sequence line voltages on h.v side and the corresponding line voltage on the low voltage side in star-delta and delta-star transformers. 8
- Draw the configuration of some major three-phase two-winding transformers and explain their equivalent circuits for the zero-sequence impedance and flow of zero-sequence currents on primary and secondary side.

- Q5 Solve any *two* of the following
- a Starting from Z Bus for a partial network, describe step by step, how you will obtain Z_{BUS} for the modified network, when a new element (LINK) is to be added (i) between an existing bus and the reference bus, and (ii) between two buses of an existing bus 8
- b Discuss the necessity of system security function such as "System monitoring" and "Contingency Analysis". 8

Q5c

8

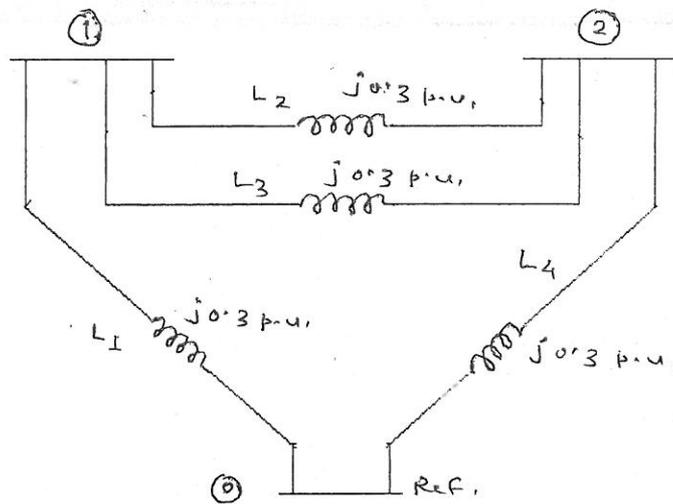


Fig.Q5(c)

Obtain bus-impedance matrix of the power system network shown in figure Q5(c).

Q6 Solve any *two* of the following

- a Discuss in brief Direct and Indirect methods for contingency selection. 9
- b Explain: "Network (Linear) sensitivity factors", 9
Define the following sensitivity factors,
(i) Generation shift factors,
(ii) Line voltage distribution factors
- c Explain "State estimation in power system" and its role in monitoring and control of power system. 9



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Enrol. No	
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First Year M.Tech.Electrical (SEMESTER - I) Examination, Dec.2011.

EM-016

Advanced Power System Protection (EE-503)

Day and Date: Tuesday, 20/12/2011

Time: 10.00am to 01.00pm

Max Marks- 100

- Instructions –
- All questions are compulsory.
 - Figures to the right indicate full marks.
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 - Use separate answer book for each section.
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SECTION – I

- Answer any **THREE**. (6 x 3 = 18)
 - Explain principle of digital relaying systems and block diagram of digital relays.
 - Explain Carrier Intercropping and Carrier Acceleration
 - Explain Coordination of over current relays in an interconnected system
 - Explain advantages and applications of digital relays
- Attempt any **TWO** (3 x 2 = 16)
 - Explain different reclosing system considerations
 - Discuss reclosing precautions and reclosing system considerations
 - Explain in detailed transients due to capacitive switching
- Attempt any **TWO** (8 x 2 = 16)
 - Explain reclosing relays and their operation
 - Explain carrier current protection and phase comparison carrier
 - Give details about what factors consider for applications of instantaneous reclosing

SECTION – II

4. Attempt any **TWO** **(8 x 2 = 16)**
- a. Explain Coupling Capacitor Voltage Transformer (CCVT) Switching.
 - b. Explain carrier current protection and phase comparison carrier
 - c. Explain instantaneous trip lock-out and inhibit control for reclosing relay
5. Attempt any **THREE** **(6 x 3 = 18)**
- a. Explain rate of frequency decline with suitable diagram
 - b. Write a short note on location of frequency relay.
 - c. Write a short note on load shedding steps
 - d. Explain frequency setting in an interconnected system.
 - e. Explain special consideration for industrial systems.
6. Attempt any **TWO** **(8 x 2 = 16)**
- a. Explain different types of frequency relays
 - b. Explain shunt reactor turn to turn protection scheme.
 - c. Explain capacitor bank configuration



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First Year M.Tech. Electrical (SEMESTER – I) Examination, Dec.2011.

EM-026

Power System Deregulation (EE-505)

Day and Date: Wednesday, 21/12/2011

Time: 10.00am to 01.00pm

Max Marks- 100

Instructions –

- i) All questions are compulsory.
- ii) Figures to the right indicate full marks.
- iii) Assume suitable data wherever necessary.
- iv) Use separate answer book for each section.
- v) Use of non-programmable calculator, Steam Table, IS Code are allowed.

SECTION – I

Q.No.1 Answer any **Two**

(8 x 2 = 16)

- a) Explain the power sector scenario in the Indian context
- b) Make relevant comments on growth profile of Indian power sector and discuss issue of power shortage with respect to gap between supply and demand.
- c) What is national electricity policy? Who prepares it? Highlight on the objectives and thrust areas of the same.

Q. No 2) Answer any **Two**

(9 x 2 = 18)

- a) Briefly describe the following concepts in the unbundled structure of power system.
 - i. Independent System operator (ISO)
 - ii. Power exchange (PX) and scheduling coordination (Scs)
- b) Explain clearly the functions and responsibilities of Px and ISO's
- c) What is trading arrangement? Discuss the alternative categories of conceptualized models in new trading structure.

Q.No.3) Answer any **Two**

(8 x 2 = 16)

- a) Discuss the motivation behind restructuring hence high light on the components of restructuring system.
- b) Explain the pool model and contractual model as applied to congestion management in normal operation of transmission system
- c) Explain three main pricing paradigms used for transmission pricing methods in UK

SECTION – II

1. Attempt any **TWO** (8 x 2 = 16)
 - a. Explain Ancillary Services.
 - b. Discuss Ancillary services management in Australia.
 - c. Explain reactive power management in some deregulated electricity markets

2. Attempt any **THREE** (6 x 3 = 18)
 - a. Explain Reliability analysis.
 - b. Explain interruption criterion for reliability analysis
 - c. Write a short note on stochastic components in reliability analysis
 - d. Write a short note on Calculation methods in reliability analysis
 - e. Explain stochastic network models in reliability analysis.

3. Attempt any **TWO** (8 x 2 = 16)
 - a. Explain various effects on actual reliability in reliability analysis.
 - b. Discuss reliability for generation, transmission and distribution
 - c. Explain reliability and deregulation on various aspects.



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First Year M.Tech. Electrical (SEMESTER - I) Examination, Dec.2011.

EM-045

Grid Integration of Renewable Energy (EE-509)

Day and Date: Friday, 23/12/2011

Time: 10.00am to 01.00pm

Max Marks- 100

- Instructions –
- All questions are compulsory.
 - Figures to the right indicate full marks.
 - Assume suitable data wherever necessary.
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 - Use of non-programmable calculator, Steam Table, IS Code are allowed.
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SECTION - I

- Attempt any **TWO** 16
 - Briefly explain various different types of dispersed generation technologies.
 - Explain the impact of wind farm integration on voltage variation of grid
 - Discuss on various factors influencing the wind energy economics.
- Attempt any **THREE** 18
 - With the help of blade elementary theory, derive an expression for power produced by blade.
 - Wind at one standard atmospheric pressure and 15° C has a speed of 10 m/s. A 10-m diameter wind turbine is operating at 5 rpm with maximum efficiency of 40%. Calculate (i) power output of the turbine (ii) axial thrust on turbine structure.
 - Explain pitch control, active stall control and passive stall control of wind turbine system.
 - Show that the efficiency of power conversion for wind turbine operating on thrust principle is $\frac{8}{27}$
- Attempt any **TWO** 16
 - Draw equivalent circuit of induction generator and explain principle of power generation
 - Explain advantages of variable speed wind energy conversion system over fixed speed system.
 - Explain the operation of direct-connect synchronous generator for wind power application.

4. Attempt any **TWO**

- a. Explain the term capacity factor in wind power studies and hence explain the procedure to select suitable wind turbine for give site.
- b. Explain weibull pdf and hence explain the variation of distribution function with different value scale factor and shape factor.
- c. The Weibull parameters for certain site are, scale factor, $c = 7$ m/s and shape factor, $k = 2$. Determine number of hours per month that the wind speed will be between 6 and 8 m/s. Also, estimate the number of hours per year that the wind speed is greater than or equal to 16 m/s.

5. Attempt any **THREE**

- a. Explain the concept of LVRT capability of wind turbine system. Explain LVRT code of Ireland.
- b. State the grid codes of different countries for reactive power control and voltage regulation
- c. Explain cost model for economic power dispatch used in wind integrated power system.
- d. Derive an expression for weibull pdf of power output of wind turbine for all ranges of wind speeds.

6. Attempt any **TWO**

- a. Explain inertial control method for primary frequency regulation of grid
- b. Explain power reserve control method for primary frequency regulation of grid
- c. Explain different methods of market clearing price in electricity market containing large penetration of wind power.