Code No: R05220203 **Set No. 1**

II B.Tech II Semester Regular Examinations, Apr/May 2008
POWER SYSTEMS-I
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Draw the complete schematic diagram of a coal fired thermal power plant. Label each component. Discuss briefly the function of each component. [16]

2. (a) What are the functions of moderator and control rods in a nuclear power plants.
   (b) Distinguish between thermal and fast reactors. Classify each according to moderator, coolant and fuel utilized. [8+8]

3. (a) Distinguish between primary and secondary distribution systems with suitable examples.
   (b) A 2-wire DC distributor AB, 600m long as loaded as under:

Distance from A (mts) :	150	300	350	450
Loads (Amps) :	100	200	250	300

   The feeding point A is maintained at 440V and that of B at 430V. If each conductor has a resistance of 0.01Ω per 100m, calculate
      i. the currents supplied from A to B
      ii. the power dispatched in the distributor. [8+8]

4. A three-phase distribution system power is supplied at 11 kV (line voltage) and balanced load of 50 A/phase at 0.8 lagging p.f and 70 A at 0.9 lagging p.f are taken at Q and R respectively. The impedance of the feeders are PQ = (5+j9)Ω, QR = (6+j10) Ω and RP = (4+j8)Ω. Calculate the voltage at Q and R and the current in each branch. Power factors are assumed with respect to voltage at P. [16]

5. Briefly discuss the classification of substations. [16]

6. (a) Why Voltage control and p.f. correction are necessary in power systems? What are the disadvantages of low voltage and low p.f. of the system
   (b) A 400V, 50 cycles, three phase line delivers 207 kW at 0.8 p.f.(lag). It is desired to bring the line p.f. to unity by installing shunt capacitors. Calculate the capacitance if they are
      i. star connected
      ii. delta connected. [8+8]

7. (a) Define the following:
      i. Connected load
      ii. maximum demand

iii. demand factor.

(b) A power supply is having the following loads.

Type of load	Max.demand(KW)	Diversity of group	Demand factor
Domestic	15,000	1.25	0.7
Commercial	25,000	1.2	0.9
Industrial	50,000	1.3	0.98

If the overall system diversity factor is 1.5, determine

i. the maximum demand

ii. connected load of each type. [8+8]

8. (a) Discuss the flat rate and block rate tariffs.

(b) A power station has an installed capacity of 20,000KW. The cost of the station is Rs. 1,200/kW. The fixed costs are 13% of the cost of investment on full load at 100% load factor, the variable costs of the station per year is 1.5 times the fixed costs. Assume that there is no reserve capacity of the plant and that are variable costs and proportional to energy production. Find the cost of generation per KWh at load factor of 100% and 20%. Comment on the results. [8+8]

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Code No: R05220203 **Set No. 2**

II B.Tech II Semester Regular Examinations, Apr/May 2008
POWER SYSTEMS-I
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is meant by fire tube boilers and what are the types as well as demerits of fire tube boilers?
   (b) Explain the super heater in thermal plants. [8+8]

2. (a) Discuss briefly the ratio-active pollution of environment by nuclear power plant.
   (b) Describe the different types of fuels used in a nuclear power plant and discuss the problems of nuclear waste disposal. [6+10]

3. (a) Discuss the classification of distribution systems.
   (b) A 300m ring distributor has loads as shown in figure 3b, where distances are in meters. The resistance of each conductor is 0.2Ω per Km and the loads are tapped off at points B, C and D as shown. If the distributor is fed at A at 240V, find voltages at B, C and D. [8+8]

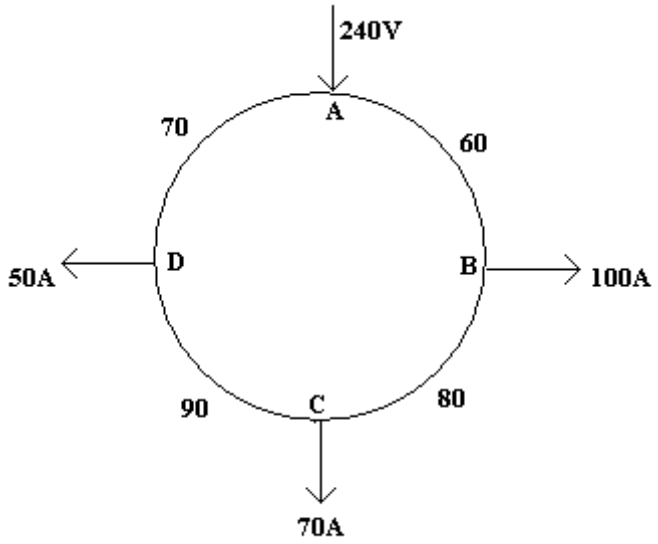

Figure 3b

4. A single phase line (ABC) of length 2 Km having resistance and reactance (go and return) as 0.06 and 0.1 ohms / Km. A is the feeding point, B is the mid point of the line taking a load of 100A at 0.9 p.f. leads and C is the far end taking a load of 120 A at UPF. The voltage at the 'C' is 230V. Find the voltage at the sending end and the phase angle difference between the voltages of two ends. If
   (a) power factors of the loads are with reference to far end voltage

(b) Power factors of the loads are with reference to the voltages at the load points. [8+8]

5. (a) Explain the main and transfer bus bar system with circuit diagram.

   (b) What is the difference between single bus bar with and without sectionalization arrangement? [8+8]

6. (a) What are the different methods used for voltage control of a power system?

   (b) A 12KV, 500KVA load is supplied at a p.f. of 0.8 lagging by a 3-phase transmission line whose voltage is to be maintained at 33 KV at both ends. Determine the capacity of the synchronous condenser to be installed for voltage regulation. Given that the line resistance and reactance per phase are 4Ω and 12Ω respectively. [8+8]

7. (a) Define the terms : plant capacity factor and plant use factor and explain their importance in an electric supply system.

   (b) A generating station has the following daily load cycle

Time(hrs) :	0-6	6-10	10-12	12-16	16-20	20-24
Load (MW) :	40	50	60	50	70	40

   Draw the load curve and find

   i. maximum demand

   ii. units generated per day

   iii. average load and load factor. [8+8]

8. (a) Describe the desirable characteristics of a tariff.

   (b) A steam station with an installed capacity of 120 MW has the following data:
   Maximum demand = 100 MW; Average Load factor = 0.75
   Capital cost = Rs. 800/ kW installed
   Interest and depreciation = 12%
   Operational cost = Rs. 1×10^6 per annum.
   Maintenance cost $\left(\frac{2}{5}\text{fixed}, \frac{3}{5}\text{variable}\right)$ = Rs. 6.5×10^5 p.a.
   Cost of fuel = Rs. 35 per metric ton
   Calorific value of fuel = 6,500 K. cal / kg
   Generator efficiency = 96% Thermal efficiency of turbine = 28% Boiler efficiency = 75% Overall thermal efficiency = 20%
   Determine the total fixed costs, total variable costs and the cost / kW generated. [8+8]

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Code No: R05220203 **Set No. 3**

II B.Tech II Semester Regular Examinations, Apr/May 2008
POWER SYSTEMS-I
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Draw a typical layout of a thermal power plant and describe the function of the following components.
   (a) Coal and ash handling
   (b) steam generating plant
   (c) steam turbines
   (d) feed water circuit
   (e) Cooling tower circuit. [3+3+4+3+3]
2. (a) What is the need of nuclear power generation?
   (b) What are the merits and demerits of nuclear power plant? [6+10]
3. (a) What is meant by radial and loop systems of distribution.
   (b) On what factors does the primary distribution voltage depend.
   (c) A two wire distributors are fed at F_1 and F_2 at 230 V and 220 V respectively. Loads of 150 A and 100 A are taken at points P and Q. Resistance of both the conductors between F_1P is 0.03Ω, between PQ is 0.05Ω and between QF_2 is 0.02Ω. Determine the current in each section of the distributor and voltage at each load point. [4+6+6]
4. A single phase line (ABC) of length 2 Km having resistance and reactance (go and return) as 0.06 and 0.1 ohms / Km. A is the feeding point, B is the mid point of the line taking a load of 100A at 0.9 p.f. leads and C is the far end taking a load of 120 A at UPF. The voltage at the 'C' is 230V. Find the voltage at the sending end and the phase angle difference between the voltages of two ends. If
   (a) power factors of the loads are with reference to far end voltage
   (b) Power factors of the loads are with reference to the voltages at the load points. [8+8]
5. (a) What are the factors to be considered for selecting location of substations?
   (b) What are the merits and demerits of indoor substations over outdoor substations? [8+8]
6. (a) What factors determine the economical limit of p.f. correction? Show that the economical limit to which the p.f. of a lagging p.f. load can be raised is independent of the original value of the p.f. if the tariff consists of a fixed charge per KVA of maximum demand plus a flat rate per KWh.

(b) Calculate the value of the new p.f. when the tariff is Rs. 1,350 per KVA of maximum demand plus a flat rate paise 80 per kWh. Assume additional cost of condensers etc. at Rs. 1,050 per KVA of such plant. Rate of interest and depreciation together is taken as 10%. [8+8]

7. (a) Explain clearly how a good load factor and a good diversity factor help to keep overall cost of generation low.

(b) The peak load on a 50MW power station is 39 MW. It supplies power through for transformers whose connected loads are 17, 12, 9 and 10 MW. The maximum demands on these transformers are 15, 10 8 and 9 MW respectively. If the annual load factor is 50% and the plant is operating for 65% of the period in the year, find out

i. average load on the station
ii. energy supplied per year
iii. demand factor
iv. diversity factor and
v. use factor for the power station. [8+8]

8. (a) Describe the desirable characteristics of a tariff.

(b) A steam station with an installed capacity of 120 MW has the following data:
Maximum demand = 100 MW; Average Load factor = 0.75
Capital cost = Rs. 800/ kW installed
Interest and depreciation = 12%
Operational cost = Rs. 1×10^6 per annum.
Maintenance cost $\left(\frac{2}{5}\text{fixed}, \frac{3}{5}\text{variable}\right)$ = Rs. 6.5×10^5 p.a.
Cost of fuel = Rs. 35 per metric ton
Calorific value of fuel = 6,500 K. cal / kg
Generator efficiency = 96% Thermal efficiency of turbine = 28% Boiler efficiency = 75% Overall thermal efficiency = 20%
Determine the total fixed costs, total variable costs and the cost / kW generated. [8+8]

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Code No: R05220203 **Set No. 4**

II B.Tech II Semester Regular Examinations, Apr/May 2008
POWER SYSTEMS-I
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Draw a general layout of a modern thermal power plant and explain the working of different circuits. [16]

2. (a) Explain the function of moderator. How is a moderator selected? Why does a breeder reactor require no moderator?
   (b) Discuss the boiling water reactor, mentioning its merits and demerits. [10+6]

3. (a) Discuss briefly the requirements of a distribution system
   (b) A 2-wire DC ring distributor is 300m long and is fed at 240V at point A. At point B, 150m from A, a load of 120A is taken and at C, 100m in the opposite direction, a load of 80a is taken if the resistance per 100m of single conductor is 0.03Ω, find
      i. current in each section of distributor
      ii. voltage at points B and C. [8+8]

4. A 3-phase distribution system is shown in figure 4 Power is supplied at A at line voltage of 6.6 kV and balanced loads of 25A per phase at 0.8 lagging p.f and 35A per phase at 0.9 lagging p.f are taken at B and C respectively. The impedances of the feeders are AB = (5 + j9) Ω, BC = (6 + j10)Ω and CA = (4 + j8) Ω. Calculate the voltage at B and C and the current in each branch p.f.'s are assumed w.r. to voltage at A. [16]

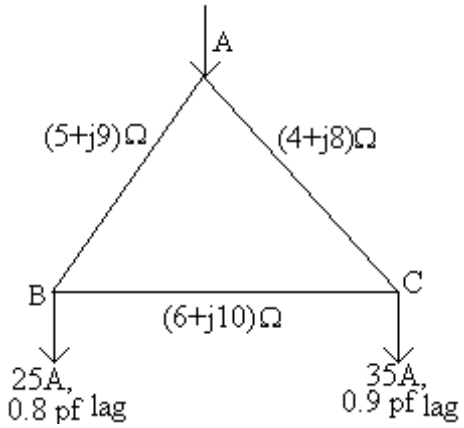

Figure 4

5. (a) What are the different types of bus bar arrangements?
   (b) Explain the single bus bar system with sectionalization and what its merits are as well as demerits. [6+10]

6. (a) Why the improvement of power factor is very important for both consumers and generating stations? List the various causes of low power factor and explain.

   (b) A single-phase motor takes a current of 10 amps at a p.f. of 0.707 lagging from a 230 V, 50 Hz supply. What value must a shunting capacitor have to raise the p.f. to unity. [8+8]

7. (a) Discuss the role of load factor on the cost of electrical energy.

   (b) From a load duration curve, the following data are available: the maximum demand on the system is 25 MW. The load supplied by two units is 15 MW and 12.5 MW. Unit no.1 acts as a base load unit and No.2 as a peak load unit. The base load unit works for 100% of the time and peak load unit for only 40% of time the energy generated by unit No.1 is 1×10^8 units and that by No.2 is 1×10^7 units. Determine the load factor, plant capacity factor and plant use factor of each unit and load factor of the total plant. [6+10]

8. What are the factors influencing tariff design and explain the various types of tariffs in detail. [16]

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