Code No: T0221 **R07** SET - 1

II B. Tech II Semester Supplementary Examinations Dec – 2012
POWER SYSTEMS - I
(Electrical and Electronics Engineering)

Time: 3 hours Max. Marks: 80

Answer any **FIVE** Questions
All Questions carry **Equal** Marks
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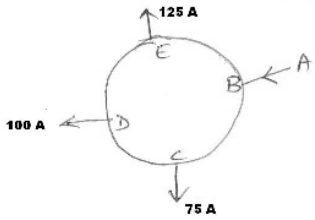
1. a) Draw a neat schematic diagram of feed water/steam flow circuit of a modern large thermal power plant. Explain the working.
   b) Explain with the help of neat diagrams the working of cooling towers in a steam power plant.

2. a) Draw a neat line diagram of a nuclear power plant showing basic components. Discuss the merits of nuclear power plant compare to thermal power plants.
   b) Explain with a neat diagram various parts of a nuclear reactor, mentioning clearly the function of each part.

3. A 2-wire, DC ring main, having the loading at points C, D, and E is fed at points B from feeder AB as shown in below figure. If the cross section area of the feeder is 'a' cm^2 and that of the distributor is 'b' cm^2, find the values of 'a' and 'b' for minimum volume of copper of the system. Given that the maximum drop from 'A' does not to exceed 10V. The length of the feeder AB is 500m and the length of distributor BC, CD, DE and EB are 200, 150, 120 and 70m respectively. Take resistivity of copper = 1.7 μΩ-cm.



4. A 1-phase distributor has a total resistance of 0.5Ω and a reactance of 0.4Ω. At the mid point 'A', a current of 110A at 0.85 p.f lag and at the far end 'B', a current of 120A at 0.9 p.f lead is tapped. If the voltage at the midpoint is 230V, find the voltage at the supply end and also its phase angle with respect to voltage at the far end when
   a) The power factors are with reference to respective voltages at the load point.
   b) The power factors are with respect to voltages at the mid point

5. a) What is substation? Classify the substation according to the service and constructional features.
   b) Explain the installation and maintenance of gas insulated substations.
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6. a) What are the various methods of voltage control? Explain the booster transformer for voltage control.
   b) A single-phase motor connected to a 230 V, 50 Hz supply takes 25 A at a p.f of 0.8 lag. A capacitor is shunted across the motor terminals to improve the p.f to 0.95 lag. Determine the capacitance of the capacitor to be shunted across the motor terminals.

7. a) Define and explain the significance of the following terms with illustrations.
   i) Demand factor, ii) Load factor, iii) Diversity factor and iv) Plant factor
   b) The load on a power plant on a typical day is as under

Time	12-5AM	5-9 AM	9-6 PM	6-10 PM	10-12MidNight
Load(MW)	20	40	80	100	20

   Plot the chronological load curve and load duration curve. Find the load factor of the plant and energy supplied by the plant in 24 hours.

8. a) Explain the desirable characteristics of tariff method.
   b) An industrial load requiring 500 kW at 0.8 power factor can be supplied on the following tariff rates. i) HT supply at Rs 1500 per kVA per annum + 60 paise per unit
   ii) LT supply at Rs 150 per kVA per annum + 75 paise per unit Transformer and switchgear for HT supply costs Rs 1125 per kVA, the full load losses being 2.5%. The fixed charges are 25% per annum of the capital cost of HT plant. If the installation works on full load, find the number of working hours per week above which HT supply is cheaper. There are 48 weeks in a year.

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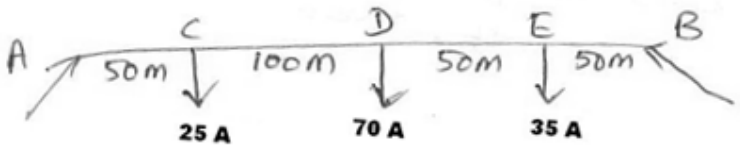
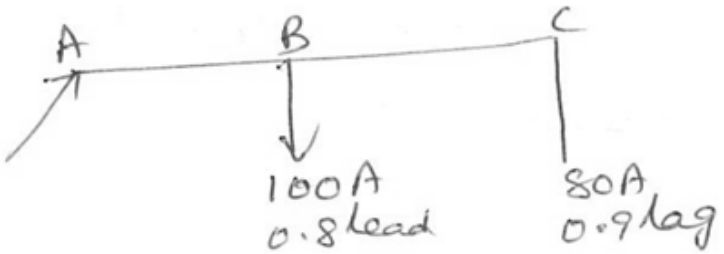
1. a) What is the function of a condenser in a steam power plant? Describe with a neat sketch any one type of condenser commonly used in power plants.
   b) Discuss the necessity of super heated steam, pulverized coal and preheated air in thermal power plant.

2. a) With the help of a schematic diagram, explain the working of a gas turbine plant. What are its merits and demerits compared to steam power plant?
   b) Explain the function of moderator. How is a moderator selected? Why a feeder reactor does require no moderators?

3. a) Compare the DC distribution and AC distribution systems
   b) A distributor AB is fed from both ends, as shown in below figure. The loop resistance of the distributor is 0.5 ohm/km. Calculate the minimum voltage and its location and also currents in various sections if
   i) Voltage at 'A' and 'B' are equal to 230V
   ii) Voltage at point 'A' is 230V and at 'B' is 234V.



4. The below figure shows a 1-phase line having resistance and reactance (ground and return) as 0.06 and 0.1 ohm/km. The length of section AB and BC are 1.0 km each. The voltage at the far end 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 farther end voltage
   b) Power factors of the loads are with reference to the voltages at the load points.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5. a) Give layout of outdoor substation and describe briefly the function of each component used.
   b) What are the various types of Gas insulated substations? Explain.

6. a) What are the sources for generation and absorption of reactive power in a given power system
   b) A synchronous motor having a power consumption of 40kW is connected in parallel with a load of 250 kW having a lagging p.f. of 0.85. If the combined load has a p.f of 0.95, what is the value of leading reactive kVA supplied by the motor and at what p.f is it working.

7. a) Define the following
   i) Load factor, ii) Utilization factor, iii) Capacity factor and iv) Diversity factor
   b) A consumer has the following connected loads, 10 lamps of 60W each and two heaters of 1000W each. His maximum demand is 1500W. On an average he uses 8 lamps for 5 hours a day and each heater for 3 hours a day. Find his average load monthly energy consumption and load factor.

8. a) What is meant by tariff? Explain some commonly used tariffs.
   b) The maximum demand of a consumer is 1MW and the units consumed per annum are 5,00,000 kWh. Calculate the reduction in cost if the power factor is raised from 0.5 to 0.8. The tariff is Rs 900 per annum per kW demand plus Rs 1.5 per kWh plus Rs 0.3 per KVAh reactive. Calculate the flat rate tariff for a unity power factor load.

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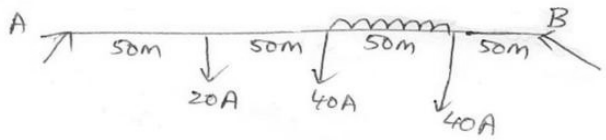
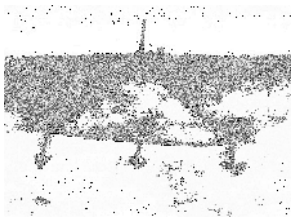
1. a) Draw a typical layout of a thermal power plant and describe the function of a coal and ash handling plant.
   b) Explain the function of super heater and economizer in modern thermal power plant with suitable diagrams.
2. a) What is meant by nuclear fission and chain reactions?
   b) Explain the following terms with reference to a nuclear plant.
   i) Moderator ii) Coolant and iii) Control Rods
3. a) Compare under ground and over head distribution systems.
   b) If the resistance of a distributor (both return and ground) is 0.05 ohm/m and the distributed load in section 'DE' is 1 A/m, find the current distribution and minimum voltage in the distributor as shown in below figure, when
   i) Both the ends are at same potential and
   ii) Potential difference between the ends 'A' and 'B' is 4 Volts.



4. A 3-phase distribution system is shown in below figure. Power is supplied at 'A' at a line voltage of 11kV and balance loads of 25A per phase at 0.8 p.f lag and 35A per phase at 0.9 p.f lag are taken at B and C. The impedance of the feeders are $Z_{AB} = (5+j9)\Omega$, $Z_{BC} = (6+j10)\Omega$ and $Z_{CA} = (4+j8)\Omega$. Calculate the voltages at B, C and D and the current in each branch. Load at mid point D of section BC is 10A at upf. Power factors are assumed with respect to voltage at 'A'.



5. a) Make a list of the main equipment in a substation. Draw layout of a typical substation.
   b) Explain the constructional aspects of gas insulated substations.
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6. a) Derive the expression for most economical power factor for constant kVA load .
   b) A 3 phases, 750 H.P, 50 Hz, 11 kV star connected induction motor has a full load efficiency of 90% at lagging p.f. of 0.8 and is connected to a feeder. If it is desired to correct the p.f of load to 0.95 lagging. Determine the size of the capacitor back in kVAr and the capacitance of each unit if the capacitors are connected in delta as well as in star.

7. a) Explain the following with suitable characteristics
   i) Chronological load curve and ii) Load duration curve
   b) Maximum demand of a generating station is 100MW, a load factor is 65%, the plant capacity factor and plant usage factor are 50% and 80% respectively. Determine
   i) The daily energy produced
   ii) Installed capacity of plant
   iii) Reserve capacity of plant
   iv) Utilization factor

8. a) Differentiate between fixed and operating costs of power plant. List the item which contributes to the fixed and the operating costs.
   b) An industrial consumer having a maximum demand of 100kW, maintains a load factor of 60%. The tariff rates are Rs. 900 per kVA of maximum demand per annum plus Rs. 1.8 per kWh of energy consumed. If the average power factor is 0.8 lag, calculate the total energy consumed per annum and the annual electricity bill. Also workout the overall cost per kWh consumed.

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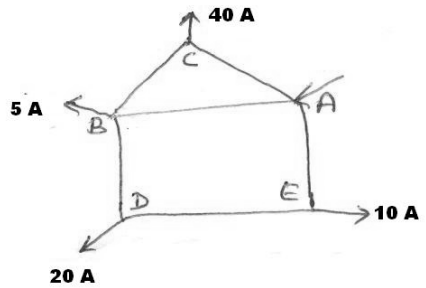
1. What are the main flow circuits in modern thermal power plant? Explain with suitable diagram for each flow circuit.

2. a) What are the merits and demerits of nuclear power plant as compared to other conventional power plants?
   b) Explain what is chain reaction in connection with a nuclear power plant.

3. Find the percentage change in the volume of copper required with and without interconnector AB for the same voltage drop between points A and B of the distributor as shown in figure. Assume, all the conductors have the same cross sectional area and same resistivity. The length of sections AC, CB, BD, DE, EA and AB are 100, 150, 100, 200, 50 and 200m respectively.



4. A 1-phase distributor has a total resistance of 0.2Ω and a reactance of 0.3Ω. At the mid point 'A', a current of 100A at 0.8 p.f lag and at the far end 'B', a current of 110A at 0.85 p.f lead is tapped. If the voltage at the midpoint is 200V, find the voltage at the supply end and also its phase angle with respect to voltage at the far end when
   a) The power factors are with reference to respective voltages at the load point.
   b) The power factors are with respect to voltages at the mid point

5. a) Draw the schematic diagram of main and transfer bus arrangement? Explain.
   b) What are the different types of gas insulated substations? Explain any one type.

6. a) Explain the working of on-load tap changing transformer for voltage control
   b) A consumer is charged at the rate of Rs.100 per annum per kVA of maximum demand plus a flat rate per kWh. The phase advancing plant can be purchased at a rate of Rs.75 per kVA. The rate of interest and depreciation on the capital is 10%. Find the most economical p.f to which it can be improved.
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7. a) Explain load duration curve and information one can get from this curve.
   b) A generating station has a maximum demand 100MW, load factor 65%, plant capacity factor 50% and plant use factor 75%. Find out the following
   i) Daily energy produced
   ii) Reserve capacity of the plant
   iii)The maximum energy that can be produced if the plants are running all the times and
   iv)The maximum energy that can be produced daily if the plant (according to operation schedule) is fully loaded.

8. a) What is the special feature of two part tariff? For which category of consumers is it used? Discuss the importance of encouraging customers to use electricity during off-peak hours.
   b) A consumer takes a steady load of 250kW at a power factor of 0.8 lag for 10 hours per day and 300 days per annum. Estimate the annual payment under each of the following tariffs
   i) Rs 1.2 per kWh + Rs 1200 per kVA per annum
   ii) Rs 1.2 per kWh + Rs 1200 per kW per annum + 25 paise per kVArh