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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination – May, 2018

Program/course: M.Tech / Energy System **Semester – II**
Subject: Power System **Max. Marks : 100**
Code : MNEG 767 **Duration : 3 Hrs** **No. of page/s: 03**

Note: All questions are compulsory

Section A
(Each question carries 5 marks)

Q.1 With neat diagram, explain the working of Diesel Based Power Plant (CO1)

Q.2 Explain the need and importance of Reactive Power Management (CO3)

Q.3 Explain the PLF and PCF and their importance on cost of generation. (CO1)

Q.4 Explain the procedure to lay the UG cables. (CO4)

Section B
(Each question carries 10 marks)

Q.5 A transformer is supplying power to 4 motors as per following duty cycle, (CO2)

Motor No.	P (kW)	Q (kVAr)	Duty cycle/ day
1	120	70	18 Hours
2	80	55	20 hours
3	250	130	6 hours
4	450	270	4 hours

Draw the Load curve (3 Marks) and propose the minimum size of transformer with justification (7 Marks) to meet the load.

Q.6 A3-phase, 415 V, 200 kW Compressor induction motor is drawing 150 kW at a 0.85 PF lagg Calculate the kVA rating of an over excited synchronous motor (drawing 40 kW) which is connected in parallel with induction motor terminals for improving PF to 0.95 lagg (6 Marks). Also calculate the change in current drawn and kVA, from the source (4 Marks). Assume, prior to PF improvement SM is working at UPF and active power drawn by SM is unchanged. (CO3)

Q.7 The average annual Energy cost of 200 MW Steam Power Plant is Rs. 2.68 per unit, if the load factor is 45%. Estimate the cost per unit generated, if the load factor is increased to 67%. Consider a flat rate change of 3% in every load changes of 10%. (CO2)

OR

Q.7 Compare the annual cost of Power Supply to a factory having a MD of 500 kW and a load factor of 40% by having the supply from: (CO2)

1) Factory's own Diesel Power Plant
2) A Public Supply

With regards to (1) the capital cost of factory's own generating plant is Rs. 25 Lakhs, cost of fuel oil is Rs. 28000/- per tonne. Fuel consumption 0.60 kg/kWh. Capital charges, cost of repairs and maintenance, interest and depreciation 15% of total capital cost. Salaries and wages of the operating staff are Rs. 1.5 Lakhs per year. With regards to (2) the MD charges are Rs. 200 per kW/month and Rs. 4.5 per unit. Which of these two alternatives is favorite for the operation of the factory.

Q.8 For the same amount of power transfer, if a 3.3 kV supply line is converted into 11 kV supply system, estimate the revised change in line losses, if the length of line & cross section of conductor remains same. (CO4)

Part – III

(Each question carries 20 Marks)

Q.9 Four residential apartment buildings are supplied with 230 V, Single phase AC supply. The combined maximum demand by all buildings is 150 kVA and load factor is 50%. The individual maximum demand of the buildings are 45 kVA, 50 kVA, 30 kVA & 60 kVA. The buildings are physically located at distances of 180 m, 300 m, 210 m & 500 m from the transformer supplying power. The electricity board proposes to revise the distribution voltage from 230 V to 10 kV (HVDS System) by installing one transformer at terrace of each building. (CO5)

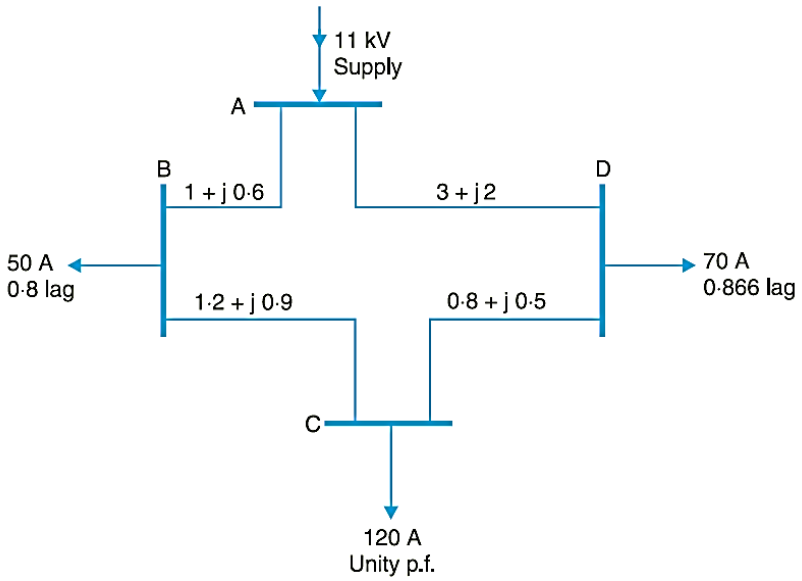
Solve:

1) Explain the old and new system with neat diagram? (3 mark)
2) Find the Diversity factor and average load for the old system? (3Marks)
3) Find the ratings of transformers for the new system? (3 marks)
4) Find the 'nett' savings in losses due to HVDS system. For the purpose of calculation of losses, consider transformer efficiency as 99%. (For all transformers for any load)

OR

Q.No.10 For the following distribution system calculate the approximate voltage at each load terminal

(At terminal A: 5 Marks, At Terminal D: 5 Marks, at Terminal C: 10 Marks) (CO5)



Q.No.10 A fertilizer industry is connected with following loads: (CO3)

Sr. No.	Load	Rating	Working Hours
1	Distillation Column	100 kW @ 0.93 lag	18
2	Dryer	50 kW @ 0.866 lag	7
3	Grinder	350 kW @ 0.92 lag	10
4	Evaporator	150 kW @ UPF	12…Simultaneous Process
5	Preceptor Chiller	75 kW @ 0.89 lag	12…Simultaneous Process
6	Compressor	200 kW @ 0.9 lag	16
7	Mixers	225 kW @ 0.91 lag	14
8	Avg. Lighting & Utility load	125 kw @ 0.95 lag	24 Hrs

The recorded industrial maximum demand is 1100 kVA and corresponding PF is 0.83 lag. The tariff charges are Rs. 250/kVA for MD & Rs. 5.5 per unit (kVAh)

The company has consulted an Energy auditor to work on the possibility of 'Energy Bill reduction'. The management of industry has also mentioned that, there is one more vacuum pump is to be added over and above existing load. The required rating of Vacuum pump is 100 kW which will operate for 24 hours of a day. As an energy auditor you are required to.

1) Add the desired vacuum pump driven by over excited Synchronous motor, so that the overall maximum demand should not exceed 1100 kVA. Calculate the kVAr that need to supplied by SM driving vacuum pump. (5 Marks)
2) After adding Vacuum pump, rearrange all load's operating hours so as to reduce MD below 1100 kVA (3 Marks) and calculate revised monthly energy bill (2 Marks)
3) Propose to install capacitor bank so as to reduce energy bill. The cost of capacitor is Rs. 900/- per kVAr and APFC panel costs Rs. 2 Lakhs/500 kVAr. Calculate simple Payback period due to energy saving (Capacitor Bank Size: 3 Marks, Energy Bill: 5 Marks, Payback period:2 Marks).

All the Best