UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2017

Program: M.Tech. – Energy System **Semester – III**

Subject (Course): Performance Analysis of Electrical Equipment **Max. Marks : 100**
Course Code : MNEG 811 **Duration : 3 Hrs**
No. of page/s: 2

Section A [4 marks x 5 = 20]

Q.1) (CO3) Explain, why is it beneficial to operate induction motors in star mode operating at loads below 50 % of rated capacity.

Q.2) (CO4) Estimate the percentage voltage unbalance if the measured voltages are as follows:
Y_{RY} = 425, V_{YB} = 418, V_{BR} = 423

Q.3) (CO5) Briefly explain the functions of electronic ballast.

Q.4) (CO5) Briefly describe advantages of installing microprocessor based controllers for lighting circuit.

Q.5) (CO4) Give 5-typical instruments that has to be deployed and its purpose for carrying out an energy audit of a DG set.

Section B [10 marks x 4 = 40]

Q.6) (CO1) Compute AT & C (Aggregate Technical and Commercial) losses for the following data:

S. No.	Description	Annual Data
1	Input Energy = (Import – Export), MU	10
2a	Energy Billed (Metered), MU	7
2b	Energy Billed (Un-Metered), MU	1
2c	Total energy Billed (E1 + E2)	8
3	Amount Billed (Rs. Lakhs)	450
4a	Gross Amount Collected (Rs. Lakhs)	460
4b	Arrears Collected (Rs. Lakhs)	40

Q.7) (CO1) Explain methodology of any two DSM (demand Side Management) practices.

Q.8) (CO2) Derive equation to calculate Total Harmonics Distortion and explain its effects on electrical system.

Q.9) (CO4) A small-scale industry has a constant load of 380 kVA. It has installed two transformers of 500 kVA each. The no load loss and full load copper loss of each 500 kVA transformer is 750 W and 5410 W respectively. From the energy efficiency point of view the small scale industry management wants to take a decision on whether to operate a single transformer or two transformers equally sharing the load. Give recommendation based on your calculations.

Section C [20 marks x 2 = 40]

Q.10) (CO5) A layout dimension of an office building was 9 m length by 6 m width. The height of the lamp fixed above the desk plan area is 3 m. The total circuit watt for the entire lighting is 1200 W. The measured lux level at the existing condition was 600 lux using lux meter. The lux level was improved to 800 lux by modification of layout fittings. The target lux of this office is 40 lux/watt/m^2.

Find out energy saving potential if office is working 10 hours a day for 300 working days using ILER method.

Q.11) (CO1,CO3) A 3 phase, 415 V, 75 kW induction motor is drawing 40 kW at a 0.7 PF. Calculate the capacitor rating requirements at motor terminals for improving PF to 0.95. Also, calculate the reduction in current drawn and kVA reduction, from the point of installation back to the generating side due to the improved PF.

OR

Q.11) (CO3) (i) Explain slip power recovery system as a speed control mechanism of motors.
(ii) Discuss in detail different factors for successful implementation of Variable speed drives.

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Section A [4 marks x 5 = 20]

Q.1) (CO3) A no load test conducted on a three phase delta connected induction motor gave the following values:

No load power	= 890 W
Stator resistance per phase at 30°C	= 0.233 Ohms
No load current	= 14.5 A

Calculate the fixed losses for the motor.

Q.2) (CO4) Discuss likely effect of unbalanced loads on DG set operation.

Q.3) (CO5) Briefly explain meaning of daylight linked controls.

Q.4) (CO5) Briefly describe advantages of installing a 'servo stabilizer' for lighting circuits.

Q.5) (CO4) Explain steps one need to consider while selecting DG set with nonlinear loads.

Section B [10 marks x 4 = 40]

Q.6) (CO1) Explain in detail the direct and indirect methods of estimation of technical losses in distribution system.

Q.7) (CO1) Discuss for Demand Side Management

(i) Key objectives
(ii) Type of measures
(iii) Customer, societal and Utility benefits

Q.8) (CO2) (i) Explain the meaning of 'total harmonic distortion or THD'.
(ii) Discuss any five problems that can arise due to harmonics in a system.

(iii) List down any three common type of devices, which cause harmonics in the system.

Q.9) (CO4) A Genset is operating at 700 kW loading with 450^{O}C exhaust gas temperature: The DG set generates 8 kg gas/ kWh generated, and specific heat of gas at 0.25 kCal/ kg ^{O}C. A heat recovery boiler is installed after which the exhaust temperature drops by 260°C. How much steam will be generated at 3 kg/ cm^2 with enthalpy of 650.57 kCal/ kg. Assume boiler feed water temperature as 60°C.

Section C [20 marks x 2 = 40]

Q.10) (CO5) An Engineering industry has lighting load of 40 kVA. The incoming supply voltage is 415 V during daytime and 440 V during nighttime.

Lighting load during day time = 20 kVA
Lighting load during night time = 40 kVA
Power factor of lighting feeder = 0.7
Energy cost = Rs. 5/kWh
Energy manager has installed a 50 kVA lighting transformer. The lighting voltage is set to 200 V always.

i) Find out the payback period if investment for transformer is Rs. 2,50,000 and lighting load is 10 hours daily throughout the year
ii) What is % Energy saving?

Q.11) (CO1) An energy audit of electricity bills of a process plant was conducted. The plant has a contract demand of 3000 kVA with the power supply company. The average maximum demand of the plant is 2300 kVA/month at a power factor of 0.95. The maximum demand is billed at the rate of Rs.500/kVA/month. The minimum billable maximum demand is 75 % of the contract demand. An incentive of 0.5 % reduction in energy charges component of electricity bill are provided for every 0.01 increase in power factor over and above 0.95. The average energy charge component of the electricity bill per month for the company is Rs.11 lakhs.
The plant decides to improve the power factor to unity. Determine the power factor capacitor kVAr required, annual reduction in maximum demand charges and energy charge component. What will be the simple payback period if the cost of power factor capacitors is Rs.800/kVAr.

OR

Q.11) (CO3) Explain the function of Soft Starters in case of Induction Motor. Also explain its starting current and stress profile during starting with the help of diagrams.