UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2018

Course: Performance Analysis of Electrical Equipment (ETEG 322) **Semester: VI**
Program: Int. B. Tech.
Time: 03 hrs. **Max. Marks: 100**

SECTION A

S. No.		Marks	CO
Q 1	Discuss in brief "Estimation of technical losses in distribution system".	**4**	**CO1**
Q 2	Briefly explain the impact of power supply quality on the operating performance of induction motors.	**4**	**CO2**
Q 3	Explain the parameters need to be analyzed to assess the DG set performance.	**4**	**CO3**
Q 4	Explain the function of ballast in case of fluorescent lamps.	**4**	**CO5**
Q 5	Describe Room Index and minimum number of measurement points.	**4**	**CO5**
	SECTION B		
Q 6	A 15 kW, 415 V, 26 A, 4 pole, 50 Hz, 3 phase rated squirrel cage induction motor has a full load efficiency and power factor of 90% and 0.89 respectively. An energy auditor measures the following operating data of the motor (a) Supply voltage = 408 V (b) Current drawn = 15 A (c) PF = 0.81 (d) Supply frequency = 49.9 Hz (e) RPM = 1488 Find out the following at the motor operating conditions: 1. Power input in kW 2. % motor loading 3. % slip	**10**	**CO2**
Q 7	Draw and explain a centrifugal pump system curve with representation of static and friction head.	**10**	**CO4**
Q 8	Calculate the free air delivery (FAD) of a compressor for the following observed data: Receiver capacity: 0.25 m3 Initial pressure: 1 kg/cm2 (g) Final pressure: 13 kg/cm2 (g) Initial temperature: 22 oC Final temperature: 42 oC Additional holdup volume: 0.05 m3 Compressor pump up time: 3.9 minutes	**10**	**CO4**
Q 9	Briefly describe the principle of variable speed drive. Discuss advantages of VSD application in case of pumps	**10**	**CO4, CO6**

SECTION-C			
Q 10	The contracted demand approved by a utility is 5500 kVA and tariff provides for minimum billing demand of 80% of approved. Review of past 12 months records of bills reveals that the monthly maximum demand recorded is around 4200 kVA. Will there be any benefits in surrendering part of contract demand? If so what is the kVA that you recommend for surrendering? Calculate the costs savings by surrendering demand, if unit rate for kVA demand is Rs 200.	**20**	**CO1**
Q 11	An Engineering industry has lighting load of 40 kVA. The incoming supply voltage is 415 Volt during daytime and 433 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? **OR** 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.	**20**	**CO5, CO3** **CO5**

Name: Enrolment No:	UPES

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SECTION A

S. No.		Marks	CO
Q 1	Discuss the merits of VSD application in case of pumps.	4	CO4, CO6
Q 2	Describe positive features on 'construction aspects' how an "energy efficient motor" is different from a "standard motor".	4	CO2
Q 3	Discuss likely effect of unbalanced loads on DG set operation.	4	CO3
Q 4	Explain the lighting performance assessment from Installed Load Efficacy Ratio (ILER).	4	CO5
Q 5	The ILER of a room is 0.7. If the lighting load is 990 W, estimate the annual energy wastage. Assume the room is ON for 8hours/day for 300 days.	4	CO5

SECTION B

Q 6	Discuss different methods of capacity control in centrifugal air compressors.	10	CO4
Q 7	A pump is delivering 48 m^3/hr of water with a discharge pressure of 37m. The water is drawn from a well where water level is 4m below the pump centreline. The power drawn by the motor is 9.3 kW . If the efficiency of the pump is 65% calculate the motor efficiency.	10	CO4
Q 8	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. What is your recommendation ?	10	CO3
Q 9	Describe various methods of calculating motor loading.	10	CO2

SECTION-C

<table>
<tr><td>Q 10</td><td>During April-2013, the plant has recorded a maximum demand of 600 kVA and average PF is observed to be 0.82 lag, The minimum average PF to be maintained is 0.92 lag as per the independent utility supplier and every one % dip in PF attracts a penalty of Rs 10,000/in each month.
a) Calculate the improvement in PF for May-2013 by installing 100kVAr capacitors.
Calculate penalty to be paid if any during May-2013.</td><td>20</td><td>CO1</td></tr>
<tr><td>Q 11</td><td>a) The exterior areas of a Compressor House are illuminated by twenty wall-mounted 1000W Tungsten Halogen, single lamp, luminaires. The lamps burn 12 hours a day, throughout the year.
The energy and cost savings that could be realized by changing to a more efficient light source were investigated. With reference to data given below suggest the suitable retrofit for annual energy saving and the simple pay back period.
<table><tr><th>Luminaire</th><th>Lumens</th><th>Efficacy</th><th>Cost /lamp</th></tr><tr><td>1000 W Halogen lamp</td><td>22,700</td><td>22.70</td><td>Rs. 5000</td></tr><tr><td>250 W HPSV lamp</td><td>24,600</td><td>98.40</td><td>Rs. 5500</td></tr><tr><td>400 W Metal halide lamp</td><td>27,000</td><td>67.50</td><td>Rs. 6500</td></tr></table>Plant Operating Hours: 12 hours per day, 365 days per year, Electricity Costs: Rs 3.00/kWh
<u>OR</u>
Two main areas of an industrial plant have the following lighting systems:
Area A: 50 x 400W High Pressure Sodium (HPSV) single lamp luminaires.
Area B: 35 x 400W Mercury Vapour (HPMV) single lamp luminaires.
In Area A and Area B, the measured illuminance during daylight hours (12 hours) without artificial light was found to be adequate.
In Area B it was noted that 8 of the MV fixtures are redundant.
Plant Operating Hours: 24 hours per day, 365 days per year,
Electricity Energy costs: Rs 3.00/kWh
Estimate the annual potential energy cost savings from switching off unnecessary lights and from disconnecting redundant luminaires?
Note: Ignore the ballast energy consumption.</td><td>20</td><td>CO5</td></tr>
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