Name: Enrolment No:	UPES

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

Programme Name: M Tech Energy Systems **Semester : I**
Course Name : Electrical Utilities **Time : 03 hrs**
Course Code : EPEC-7015 **Max. Marks: 100**
Instructions : Internal choice is given in Q9 and Q11

SECTION A

S. No.		Marks	CO
Q1	Explain how Diversity Factor, Load Factor and Maximum Demand plays crucial role in Electrical Distribution System.	4	CO1
Q2	A supply is offered on the basis of fixed charges of Rs. 30 per annum plus 3 paise per unit or alternatively at the rate of 6 paise per unit for the first 400 units per annum and 5 paise per annum for all additional units. Find the number of units taken per annum for which the cost under the two tariffs become the same.	4	CO2
Q3	A utility is having monthly average energy bill of Rs. 10,00,000 and having the average maximum demand of 1000 KVA at 0.7 power factor. Suggest some measures to reduce the electricity bills.	4	CO2
Q4	Explain the power flow diagram of Induction Motor.	4	CO3
Q5	Explain psychometrics chart, and list the main components of refrigeration system.	4	CO4
	SECTION B		
Q6	Explain in detail with respect to the cooling towers, wet bulb temperature, range and capacity. Discuss the methodology used to conduct energy audit of cooling towers.	10	CO4
Q7	Explain various energy saving opportunities available in induction motors and explain the star operation of induction motor.	10	CO5
Q8	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 PF in the lighting feeder = 0.7 Energy cost = Rs.5 / kw Energy Manager has installed a 50 KVA lighting transformer. The lighting voltage is set to 200 V always. **i)** Calculate payback period if investment for transformer is Rs.25,000. **ii)**Determine percentage energy savings.	10	CO2
Q9	**(a)** 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. **(b)** Comment on 'construction aspects' how an "energy efficient motor" is different from a "standard motor". **OR** **(b)** Discuss in detail how ice banks systems are utilized in order to reduce the maximum demand from the system.	**5** **5** **5**	**CO1** **CO3** **CO3**
	SECTION-C		
Q10	A multi-storied shopping mall has installed 5 x 110 TR reciprocating compressors of which four compressors are in use and fully loaded for 14 hours per day. The specific power consumption of reciprocating compressor is 0.8 kW/TR. Due to higher energy cost the shopping mall chief engineer has decided to replace reciprocating compressors with screw compressors having specific power consumption of 0.65 kW/TR. The chief engineer needs following input from energy consultant: **(i)** Comparison of power and electricity consumption of both reciprocating and screw compressors. **(ii)** Annual energy bill savings (for 320 days operation). Present unit cost is Rs 6.00 per kWh **(iii)** What should be the size of cooling tower required for proposed screw compressors.	**20**	**CO5**
Q11	**(a)** 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. **(b)** A process plant consumes of 150000 kWh per month at 0.9 Power Factor (PF). What is the percentage reduction in distribution losses per month if PF is improved up to 0.96 at load end? **(c)** Write short notes on the following • Energy Efficient lighting controls • Rewinding of induction motor • Types of compressor for refrigeration system. **OR** **(c)** Write short notes on the following • Heat Pumps • Ice bank	**5** **5** **10** **10**	**CO3** **CO2** **CO5, CO3, CO4** **CO5 CO3, CO4**

	• Types of refrigeration system		

Name:

Enrolment No:

UPES

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

Programme Name: M Tech Energy Systems — **Semester : I**
Course Name : Electrical Utilities — **Time : 03 hrs**
Course Code : EPEC-7015 — **Max. Marks: 100**
Instructions : Internal choice is given in Q9 and Q11

SECTION A

S. No.		Marks	CO
Q1	In a Refrigeration system, the evaporator and condenser temperature are -10°C and 32°C. Chilled water is at 5°C produced from 30°C. Ambient water. For a refrigerator load 15 TR, What is the ideal power consumption in compressors.	**4**	**CO4**
Q2	List any four DSM programs that were executed in India with their benefits.	**4**	**CO1**
Q3	List down the consequences in the industrial power system due to large harmonics.	**4**	**CO2**
Q4	List down the advantages of using energy efficient motors from utility and consumer point of view.	**4**	**CO3**
Q5	List any four energy conservation measures available in street lighting system.	**4**	**CO5**

SECTION B

Q6	A 5 kVA, 2300/230V, 50Hz transformer was tested for the iron losses with normal excitation and Copper losses at full load and these were found to be 40W and 112W respectively. Calculate the efficiencies of the transformer at 0.8 power factor of the following KVA outputs. **Sr. No** | **1** | **2** | **3** | **4** | **5** | **6** **KVA** | 1.25 | 2.5 | 3.75 | 5.00 | 6.25 | 7.50 Plot efficiency verses kVA output curve.	**10**	**CO2**
Q7	Explain the methodology of conducting energy audit of Electrical Distribution System and list five energy conservation measures available in Electrical Distribution System.	**10**	**CO1, CO2**
Q8	A load on an installation is 800kW, 0.8 lagging power factor, which works for 3000 hours per annum. The tariff is Rs. 100 per kVA plus 20 paise per kWh. If the power factor is improved to 0.9 lagging by means of loss free capacitors costing Rs. 60 per kVAr, calculate the annual savings effected. Allow 10% per annum for interest and depreciation on capacitors.	**10**	**CO1**
Q9	**(a)** The cooling water flow in a cooling tower is 150 m3/hr. The inlet and outlet temperature of CW 38°C and 33°C. The ambient air temperature are 35 °C and 27 °C. Find out the effectiveness of cooling tower and heat duty .What is the effectiveness if water flow is reduced by 50% **OR**	**10**	**CO3**

	(b) A 4-pole 415 V 3-phase, 50 Hz induction motor runs at 1440 RPM at .88 pf lagging and delivers 10.817 kW. The stator loss is 1060 W, and friction & windage losses are 375 W. Calculate A. Slip B. Rotor Copper loss C. Line current D. Efficiency	**10**	**CO3**
	SECTION-C		
Q10	A Cooling Tower cools 1565 m3/hr of water from 44º C to 37.6º C at 29.3º C wet bulb temperature. The cooling tower fan flow air rate is 989544 m3/hr (air density =1.08 kg/m3) and operates at 2.7 cycles of concentration. Find a) Range, b) Approach, c) % CT Effectiveness d) L/G Ratio in kg/kg e) Cooling Duty Handled in TR f) Evaporation Losses in m3/hr g) Blow down requirement in m3/hr h) Make up water requirement/cell in m3/hr	**20**	**CO4**
Q11	**(a)** A single-phase distributor one kilometer long has resistance and reactance per conductor is 0.1Ω and 0.15 Ω resp. At the far end, the voltage V_B=200V and the current is 100A at a power factor of 0.8 lagging. At the mid-point M of the distributor. A current of 100A is tapped at 0.6 power lagging with reference to the voltage V_M at the mid-point. Calculate (i) Voltage at mid-point (ii) Sending end voltage V_A (iii) Phase angle between V_A and V_B **(b)** Explain the methodology to conduct lighting audit. **OR** **(b)** Explain the working of following (i) Occupancy Sensors (ii) CFL (iii) LED	**15** **5** **5**	**CO2** **CO5** **CO5**