UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2019

Course: Energy Efficient Buildings   **Semester: V**
Program: B Tech-ASE/GIE/GSE/ADE/Civil/EL/FSE/E&CE/CHE/MECHATRONICS
Course Code: EPEC3203   **Time 03 hrs.**
Instructions: **Max. Marks: 100**
Section A: Attempt all questions
Section B: Attempt all questions and Attempt any one from question Q9(a) or Q9(b).
Section C: Attempt all questions and Attempt any one from question Q11(a) or Q11(b).

SECTION A

S. No.		Marks	CO
Q 1	List the difference between the Residential and Commercial Buildings and highlight the energy use of each type of buildings.	4	CO1
Q2	Define Energy Efficient buildings and list any 4 building materials which can impact the environment.	4	CO2
Q3	Discuss any four energy conservation options available in Building Lighting System.	4	CO3
Q4	Explain the concept of Net Zero Energy Buildings.	4	CO4
Q5	List any four energy conservation options available in buildings envelope.	4	CO3

SECTION B

Q 6	The measured values of a water cooled 20 TR package air conditioning plant are given below: **Average air velocity across suction side filter**: 2.5 m/s **Cross Sectional area of suction**: 2.4 m^2 **Inlet air:** Dry Bulb:20 deg. C, Wet Bulb: 14 deg. C; Enthalpy: 9.37 k Cal per kg **Outlet air:** Dry Bulb: 12.7 deg. C, Wet Bulb: 11.3 deg. C; Enthalpy: 7.45 k Cal per kg **Specific volume of Air**: 0.85 m^3/kg Power drawn:by Compressor:18.42 kW; by Pump:2.1 kW by Evaporator Fan:1.25 kW Calculate the following: i. Air Flow rate ii. Cooling effect delivered iii. Compressor kW/TR	10	CO1

	iv. Overall kW/TR v. Overall Energy Efficiency ratio in W/W		
Q7	"Green Buildings should use less embodied energy materials" Justify the statement by giving suitable examples. Discuss any three green materials used in green buildings emphasizing on the impact of using each material on environment	**10**	**CO2**
Q8	An exterior wall of a house may be approximated by a 0.1 m layer of common brick (k = 0.7 W/m°C) followed by a 0.04 m layer of gypsum plaster (k = 0.48 W/m°C). What thickness of loosely packed rock wool insulation (k = 0.065 W/m°C) should be added to reduce the heat loss or (gain) through the wall by 80 per cent.	**10**	**CO3**
Q9(a)	Discuss the methodology used for Lighting Audit in a building. Also explain with the help of one example the mandatory clause related to Lighting in ECBC.	**10**	**CO4**
OR			
Q9 (b)	Discuss in detail how ECBC code for Building Envelope can improve the building performance.	**10**	**CO4**
SECTION-C			
Q 10	(a) Explain in detail how the usage of skylights, windows and HVAC impact the indoor environment in Buildings. (b) Explain in detail how GRIHA criterions help in reducing the impact of buildings on environment. List down the difference in GRIHA and LEED criterions of building rating system in Indian context.	**20**	**CO2, CO4**
Q11 (a)	In UPES following information was obtained after the lighting audit It is proposed to reduce the energy consumption of University by taking suitable measures in lighting system. Identify various energy conservation measures in lighting system along with the cost benefit analysis. Make suitable assumptions if any. Identify the best option for UPES based on the information provided by two vendors by stating the benefits for selecting the identified Vendor.	**20**	**CO1, CO3**

Sr. No	Lighting Fixture	Wattage (W)	Number	Status
1	CFL	36	2000	Working
2	Florescent Tube	40	1500	50 Not working
3	LED	28	40	10 Not working

Details of new retrofits provided by two vendors

Sr. No	Details of the Product	Vendor A	Vendor B
1	LED wattage	9Watts	9Watts
2	LED Cost (per unit)	120 Rs	130Rs
3	LED Maintenance Cost	100 Rs	60 Rs
4	LED Life	2800hrs	2300 hrs
5	LED Tubelight	28Watts	28Watts
7	LED tubelight Cost (per unit)	200 Rs	220 Rs
8	LED tubelight Maintenance Cost	120 Rs	70 Rs
9	LED tubelight Life	2000Hrs	25000 Hrs

OR			

Q11 (b)	In a building there are total 80 rooms of size 20*20*13 ft. Building have the following load which operates for 6200 hours in a year,		

In a building there are total 80 rooms of size 20*20*13 ft. Building have the following load which operates for 6200 hours in a year,

Sr. No	Load	Wattage (Watts)	Number
1	CFL Bulb	36	1000
2	CFL Tube light	40	2000

After the energy audit, it was found that each room has extra luminaire that can removed so that the average lux level in the room can be maintained.

There were 100 CFL bulbs and 50 CFL tube light that were extra total in number. It was also proposed to make the following replacement

Sr. No	Load	New Replacement	Wattage of New Replacement (W)	Cost per unit (Rs)
1	CFL Bulbs	LED Bulb	9	130
2	CFL Tube light	LED Tube light	28	170

Calculate the payback time of the energy conservation measure recommended by you. Assume energy charges Rs 4/kWh

20 **CO1, CO3**