Name: **Enrolment No:**	UPES

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

Course: Energy Conservation and Audit (PSEG-441) **Semester: VIII**
Program: B Tech Power System Engineering
Time: 03 hrs. **Max. Marks: 100**

Instructions: In Question number 9 of Section B has internal choice attempt any one question
In Question number 11 of Section C has internal choice attempt any one question

SECTION A **(5*4)**

Q1	Differentiate between primary and secondary sources of energy.	**4**	**CO1**
Q2	Define Energy Policy with reference to the industries and discuss its advantages.	**4**	**CO2**
Q3	List down any four energy conservation options available in boilers.	**4**	**CO3**
Q4	Explain the methodology for the performance analysis of three-phase induction motor.	**4**	**CO4**
Q5	Explain the concept of fuel substitution by giving one example.	**4**	**CO3**

SECTION B **(4*10)**

Q6	A 4-pole 415 V 3-phase, 50 Hz induction motor runs at 1440 RPM at 0.88 pf lagging and delivers 10.817 kW. The stator loss is 1060 W, and friction & windage losses are 375 Watts. Calculate (A) Slip (B) Rotor Copper loss (C) Line current (D) Efficiency	**10**	**CO3**
Q7	A generating station has the following data: Installed capacity = 300MW Capacity Factor = 50% Annual Load Factor = 60% Annual Cost of fuel = Rs $9*10^7$ Capital Cost = Rs 10^9 Annual Interest and Depreciation = 10% Calculate (i) The minimum reserve capacity of the station (ii) The cost per kWh generated	**10**	**CO1**
Q8	List down five important points of energy audit report format and explain the methodology for performance analysis of heat exchangers.	**10**	**CO5, CO6**
Q9	**A)** In a process plant a coal-fired boiler of 78% efficiency is propose to replace with paddy husk fired boiler of 68% efficiency. Calculate the cost savings for changing over to paddy husk. **Calorific value of coal = 4800 kcalAl / kg** **Cost of coal = Rs. 2500 / MT** **GCV of paddy husk (Kcal/kg) = 3568** **Cost of Paddy Husk = Rs. 1100 / MT** **Quantity of steam requirement = 15 TPH** **Enthalpy of steam = 770 kCal / kg** **Enthalpy of feed water = 120 kCal / kg** Annual operating hours of boiler = 8000 hrs	**10**	**CO5**

<table>
<tr><td></td><td colspan="3">OR</td><td></td><td></td></tr>
<tr><td>Q9</td><td colspan="3">B) In a building there are total 80 rooms of size 20*20 ft. Building has the following load which operates for 6200 hours in a year,
<table>
<tr><th>Sr. No</th><th>Load</th><th>Wattage (Watts)</th><th>Number</th></tr>
<tr><td>1</td><td>CFL Bulb</td><td>36</td><td>1000</td></tr>
<tr><td>2</td><td>CFL Tubelight</td><td>40</td><td>2000</td></tr>
</table>
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 tubelight that were extra total in number. It was also proposed to make the following replacement
<table>
<tr><th>Sr. No</th><th>Load</th><th>New Replacement</th><th>Wattage of New Replacement (W)</th><th>Cost per unit (Rs)</th></tr>
<tr><td>1</td><td>CFL Bulbs</td><td>LED Bulb</td><td>9</td><td>130</td></tr>
<tr><td>2</td><td>CFL Tubelight</td><td>LED Tubelight</td><td>28</td><td>170</td></tr>
</table>
Calculate the payback time of the energy conservation measure recommended by an energy auditor. Assume energy charges Rs 4/kWh</td><td>10</td><td>CO4</td></tr>
<tr><td colspan="4">SECTION-C</td><td></td><td>(2*20)</td></tr>
<tr><td>Q10</td><td colspan="3">a) Explain in detail the role of BEE (Bureau of Energy Efficiency) and explain two energy conservation projects implemented by BEE in India
b) Discuss in detail how energy management system can implemented in UPES by giving suitable example.</td><td>10
10</td><td>CO1
CO2</td></tr>
<tr><td>Q11 (i)</td><td colspan="3">a) Explain in detail preliminary and detail Energy Audit, list down various outputs obtained while conducting walk through and detail energy audits.
b) Discuss in detail about flash steam recovery from steam condensate and list down the formats required to gather the data for evaluating the performance of flash steam recovery system.</td><td>10
10</td><td>CO6
CO5</td></tr>
<tr><td colspan="4">OR</td><td></td><td></td></tr>
<tr><td>Q11 (ii)</td><td colspan="3">Discuss in detail the following:
a) Various methods for motor loading assessment.
b) Five options for electricity distribution loss optimization
c) Method of capacity assessment of air compressors.
d) ISO-50001 PDCA cycle.</td><td>20</td><td>CO3
CO4
CO5
CO2</td></tr>
</table>

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In Question number 11 of Section C has internal choice attempt any one question

SECTION A

(5*4)

Q1	Differentiate between Renewable and Non-Renewable sources of energy by giving examples.	**4**	**CO1**
Q2	Discuss with appropriate examples the concept of energy management in line with ISO.	**4**	**CO2**
Q3	Discuss industrial electricity tariff structure, also list benefits of present tariff structure.	**4**	**CO3**
Q4	Explain the methodology for performance analysis of compressor.	**4**	**CO4**
Q5	"Energy conservation can be done by increasing the system efficiency" justify the statement by giving one example.	**4**	**CO6**

SECTION B

(4*10)

Q6 A particular area can supplied either by hydro station or by steam station. The following data is available

	Hydro	**Steam**
Capital Cost/kW	Rs. 2100	Rs. 1200
Running Cost/kWh	3.2 paise	5 paise
Interest and Depreciation	7.5%	9%
Reserve Capacity	33%	25%

(i) At what load factor would the overall cost be the same in both cases.

(ii) What would be the cost of generating $40*10^6$ units at this load factor.

10 **CO1**

Q7 Explain the function and powers assigned to BEE (Bureau of Energy Efficiency) and State Designated Agency under Energy Conservation Act 2001.

10 **CO2**

<table>
<tr><td>Q8</td><td>In a large paper plant, the following are the designed and measured parameters for a clear water pump.
<table><tr><td>Particulars</td><td>Design</td><td>Operating</td></tr><tr><td>Flow m3/hr</td><td>800</td><td>576</td></tr><tr><td>Head m of WC</td><td>55</td><td>24</td></tr><tr><td>Power (kW)</td><td>160</td><td>124</td></tr><tr><td>Speed RPM</td><td>1485</td><td>1485</td></tr></table>The pump delivery has throttled to about 30% (closed) manually to get the required flow rate. Normal required water flow rate is 500 m³/h to 700 m³/h. Calculate the present operating efficiency and in your opinion what should be the optimum solution to get the required flow rate variation. And what would be the savings if the pump is delivering the flow rate of 550 m³/h.(Consider efficiency of motor as 93%).</td><td>10</td><td>CO3</td></tr>
<tr><td>Q9
(A)</td><td>Estimate the boiler efficiency by indirect method for the following data.
Type of fuel fired = Paddy husk
<u>Paddy Husk composition:</u>
Moisture = 10.79% Mineral Matter = 16.73% Carbon = 33.95%
Hydrogen = 5.01% Nitrogen = 0.91% Sulphur = 0.09%
Oxygen = 32.52% GCV(Kcal/kg) = 3568
Cost of Paddy Husk = Rs. 1100 / MT AmbientDBT = 32^{o}C
Boiler parameters on Paddy Husk Flue gas temperature = 190 ^{o}C
CO_2influegas = 12%
The losses other than exhaust loss = 28%</td><td>10</td><td>CO5</td></tr>
<tr><td colspan="4">OR</td></tr>
<tr><td>Q9
(B)</td><td>An after cooler of shell and tube type with single pass is used for cooling compressed air from 85 ^{o}C to 35 ^{o}C. The compressed air generated is 1350 m^{3}/h at mean air temperature. Calculate:
1) The amount of cooling water to be circulated at a temperature of 30 ^{o}C. Assume the cooling water outlet temperature as 35 ^{o}C.
2) The LMTD and no of tubes if the dia of the tube is 25.4 mm and 2500 mm length. Assume overall heat transfer coefficient for air to water is 150 W/m^{2}.K.
3) The hp of the pump required if the pressure required is 3.5 kg/cm^{2}.g.
Indicate all assumptions clearly.</td><td>10</td><td>CO4</td></tr>
</table>

SECTION-C

(2*20)

<table>
<tr><td>Q10</td><td>(a) Discuss in detail a typical energy audit report format.
(b) Discuss in detail various energy conservation options available in lighting system and electrical induction motors.</td><td>10
10</td><td>CO5
CO3</td></tr>
<tr><td>Q11
(i)</td><td>(a) List the measuring instruments used in conducting energy audit of industries and explain the working and application of any two instruments.
(b) 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>1000W Halogen Lamp</td><td>22700</td><td>22.7</td><td>5000</td></tr>
<tr><td>250 W HPSV Lamp</td><td>24600</td><td>98.4</td><td>5500</td></tr>
<tr><td>400W Metal Halide Lamp</td><td>27000</td><td>67.5</td><td>6500</td></tr>
</table></td><td>10

10</td><td>CO6

CO4</td></tr>
<tr><td colspan="4">OR</td></tr>
<tr><td>Q11
(ii)</td><td>Explain in detail the following:
(a) Long term strategies for improving energy security of India
(b) Energy Pricing
(c) Energy Conservation in Pumps
(d) Boilers Performance Analysis
(e) Types of Energy Audits</td><td>20</td><td>CO1
CO2
CO3
CO4
CO6</td></tr>
</table>