SRM VALLIAMMAI ENGINEERING COLLEGE

(An Autonomous Institution)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF

ELECTRICAL AND ELECTRONICS ENGINEERING

QUESTION BANK

M.E (Power Systems Engineering)

III SEMESTER

1916302- ENERGY MANAGEMENT AND AUDITING

Regulation – 2019

Academic Year 2022–23 (ODD)

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SUBJECT: 1916302-ENERGY MANAGEMENT AND AUDITING

SEM / YEAR: III /II

UNIT I - ENERGY CONSERVATION CONCEPTS					
	Energy – classification – scenario – energy pricing – energy and environment – energy conservation and its importance – energy strategy for the future – energy conservation act and its features				
PART – A					
Q.No	**Questions**		**BT Level**	**Competence**	**Course Outcome**
1.	List out various types of energy available		**BTL 1**	**Remember**	**CO1**
2.	Discuss the energy accounting		**BTL 6**	**Create**	**CO1**
3.	Define primary energy and list out its types.		**BTL 1**	**Remember**	**CO1**
4.	Describe Final energy consumption.		**BTL 1**	**Remember**	**CO1**
5.	Name the five states in India, where coal production is concentrated.		**BTL 1**	**Remember**	**CO1**
6.	State about energy conservation and energy efficiency.		**BTL 1**	**Remember**	**CO1**
7.	List out the schemes of BEE under energy conservation act		**BTL 1**	**Remember**	**CO1**
8.	Explain the major sources of pollutants in Air.		**BTL 4**	**Analyze**	**CO1**
9.	Describe the greenhouse gas effect.		**BTL 3**	**Apply**	**CO1**
10.	How Bureau of Energy Efficiency (BEE) facilitates energy efficiency programs in India?		**BTL 1**	**Remember**	**CO1**
11.	How a nation benefits from Energy Efficiency programs?		**BTL 2**	**Understand**	**CO1**
12.	Discuss the basis aim of Energy Security for any country.		**BTL 1**	**Remember**	**CO1**
13.	Discuss the energy policy.		**BTL 1**	**Remember**	**CO1**
14.	What is meant by necessary load		**BTL 6**	**Create**	**CO1**
15.	Propose the objectives of the energy management program		**BTL 4**	**Analyze**	**CO1**
16.	What is ABT		**BTL 1**	**Remember**	**CO1**
17.	Explain the need of energy management.		**BTL 2**	**Understand**	**CO1**

18.	Estimate at least three effects of acid rain?		**BTL 5**	**Evaluate**	**CO1**
19.	Justify the components of the energy management program to ensure the success.		**BTL 2**	**Understand**	**CO1**
20.	Discuss the basis aim of Energy Security for any country.		**BTL 5**	**Evaluate**	**CO1**
21.	Define the following i) Specific heat ii) Power factor iii) Electrical Energy		**BTL 2**	**Understand**	**CO1**
22.	Discuss present energy scenario of our country		**BTL 4**	**Analyze**	**CO1**
23.	Illustrate various energy conservation acts		**BTL 3**	**Apply**	**CO1**
24.	Discuss about importance of energy conservation		**BTL 4**	**Analyze**	**CO1**
	PART – B				
1.	Briefly discuss about various types of energy available	(13)	**BTL1**	**Remember**	**CO1**
2.	How does Electricity pricing is carried out in India	(13)	**BTL5**	**Evaluate**	**CO1**
3.	Explain some of the strategies to meet future energy requirements	(13)	**BTL4**	**Analyze**	**CO1**
4.	Discuss about long term energy scenario for India	(13)	**BTL4**	**Analyze**	**CO1**
5.	Classify the various steps in designing an energy management program.	(13)	**BTL1**	**Remember**	**CO1**
6.	Write short notes on the following, 1) Energy balance 2) Energy conservation opportunities.	(13)	**BTL2**	**Understand**	**CO1**
7.	Compile energy management and forecasting methodology	(13)	**BTL1**	**Remember**	**CO1**
8.	Briefly discuss about the necessity of energy conservation	(13)	**BTL5**	**Evaluate**	**CO1**
9.	Explain the Indian scenario for renewable energy source.	(13)	**BTL6**	**Create**	**CO1**
10.	Write the short notes on Energy conservation Act, 2003.	(13)	**BTL3**	**Apply**	**CO1**
11.	Examine the energy security and energy policy.	(13)	**BTL4**	**Analyze**	**CO1**
12.	Explain what is meant by Renewable Purchase Obligation (RPO)	(13)	**BTL3**	**Apply**	**CO1**

13.	Tabulate the difference between the renewable and non-renewable energy source.	(13)	**BTL2**	**Understand**	**CO1**
14.	Elaborately discuss about energy conservation act and its features	(13)	**BTL1**	**Remember**	**CO1**
15.	Explain the difference between energy conservation and energy efficiency with suitable example.	(13)	**BTL4**	**Analyze**	**CO1**
16.	List five strategic measures of meeting energy security of a country	(13)	**BTL4**	**Analyze**	**CO1**
17.	Elaborately discuss about commercial and non-commercial energy in India.	(13)	**BTL1**	**Remember**	**CO1**
	PART – C				
1.	Evaluate the energy conservation and its importance.	(15)	**BTL 5**	**Evaluate**	**CO1**
2..	Evaluate the five strategic measures for meeting energy security of a country.	(15)	**BTL5**	**Evaluate**	**CO1**
3.	Explain the difference between energy conservation and energy efficiency with a suitable example.	(15)	**BTL 5**	**Evaluate**	**CO1**
4.	Propose the Energy monitoring and forecasting methodologies.	(15)	**BTL6**	**Create**	**C01**
5.	Explain the 'Bachat Lamb Yojana' scheme.	(15)	**BTL5**	**Evaluate**	**CO1**
	UNIT II - ENERGY AUDITING AND ECONOMICS				
	Scope of energy audit-– principles – energy audit strategy - types – detailed energy audit steps. Role of energy managers in industries; Energy performance - bench marking – fuel substitutions – energy audit instruments – material and energy balance – energy conversion – energy index – cost index – financial management – financing options				
	PART – A				
Q. No	**Questions**		**BT Level**	**Competence**	**Course Outcomes**
1.	Examine the need for energy auditing.		**BTL1**	**Remember**	**CO2**
2.	Define Energy management.		**BTL1**	**Remember**	**CO2**
3.	Explain the types of energy audits.		**BTL6**	**Create**	**CO2**
4.	Give the objectives of energy management		**BTL4**	**Analyze**	**CO2**
5.	What do you understand from Energy- Benchmarking		**BTL3**	**Apply**	**CO2**
6.	List out some of the instruments and metering used in Energy Auditing		**BTL5**	**Evaluate**	**CO2**
7.	What is the use of Lux meter		**BTL2**	**Understand**	**CO2**
8.	Evaluate the role of energy manager		**BTL1**	**Remember**	**CO2**
9.	Describe the energy economics		**BTL1**	**Remember**	**CO2**

10.	Explain the difference between preliminary energy audit and detailed audit		**BTL5**	**Evaluate**	**CO2**
11.	What are the areas that need to be focused during pre-audit phase		**BTL6**	**Create**	**CO2**
12.	What do you understand by matching energy use to requirements		**BTL4**	**Analyze**	**CO2**
13.	Illustrate the baseline data should be collected for a detailed energy audit.		**BTL1**	**Remember**	**CO2**
14.	Discuss the functions of energy auditor.		**BTL1**	**Remember**	**CO2**
15.	What are the limitations of ROI method		**BTL4**	**Analyze**	**CO2**
16.	Draw the components of material and energy balance of a process or unit operation		**BTL1**	**Remember**	**CO2**
17.	Give the basic principle of material and energy balance		**BTL2**	**Understand**	**CO2**
18.	Define production factor.		**BTL1**	**Remember**	**CO2**
19.	What is the use of Sankey diagram		**BTL3**	**Apply**	**CO2**
20.	Draw a diagram explaining about Plant energy systems, usages, wastages etc		**BTL2**	**Understand**	**CO2**
21.	List out the financial analysis techniques.		**BTL1**	**Remember**	**CO2**
22.	Explain the Financing options for energy		**BTL2**	**Understand**	**CO2**
23.	What do you understand from Payback period, NPV		**BTL3**	**Apply**	**CO2**
24.	Define Plant Energy performance		**BTL1**	**Remember**	**CO2**
	PART – B				
1.	Discuss the manners and intervals of time for conduct of energy audit as per Bureau of Energy Efficiency (BEE) regulations	(13)	**BTL5**	**Evaluate**	**CO2**
2.	Summarize the role of energy manager under energy conservation Act.	(13)	**BTL3**	**Apply**	**CO2**
3.	Explain the following i) Production factor ii) Reference year Equivalent iii) Plant energy Performance	(13)	**BTL4**	**Analyze**	**CO2**
4.	Write short notes on i) Psychrometer ii) Infrared Thermometer iii) Stroboscope iv) Pitot tube	(13)	**BTL2**	**Understand**	**CO2**
5.	Justify the Methodology for detailed energy audit process	(13)	**BTL2**	**Understand**	**CO2**
6	Elaborately explain about various instruments and monitoring systems used for auditing	(13)	**BTL2**	**Understand**	**CO2**

7	Discuss about energy analysis and Sankey diagram	(13)	**BTL4**	**Analyze**	**CO2**
8	Discuss about the energy balance of a system	(13)	**BTL6**	**Create**	**CO2**
9	Discuss at least 5 duties and 3 responsibilities of an energy manager	(13)	**BTL2**	**Understand**	**CO2**
10.	Elaborately discuss about PPV, ROI and IRR with some examples	(13)	**BTL4**	**Analyze**	**CO2**
11.	Briefly explain cash flow/cash flow diagram for an investment in energy sector	(13)	**BTL1**	**Remember**	**CO2**
12.	Briefly explain about operation of an ESCO	(13)	**BTL5**	**Evaluate**	**CO2**
13.	i)An outlay of Rs 100,000 for equipment is expected to provide an after-tax cash flow of Rs 25,000 over a period of 6 years, without significant annual fluctuations. What is the return on investment (ROI)? ii)A cogeneration system installation is expected to reduce a company's annual energy bill by Rs 23 lakhs. If the capital cost of the new cogeneration installation is Rs 90 Lakhs, and the annual maintenance and operating costs are Rs 5 Lakhs, what will be the expected payback period for the project	(13)	**BTL2**	**Understand**	**CO2**
14.	Discuss about sensitivity & risk analysis in a project	(13)	**BTL5**	**Evaluate**	**CO2**
15.	Briefly explain about benchmarking	(13)	**BTL1**	**Remember**	**CO2**
16.	Discuss about financial analysis techniques.	(13)	**BTL5**	**Evaluate**	**CO2**
17.	Briefly explain about material balance procedure.	(13)	**BTL2**	**Understand**	**CO2**
	PART – C				
1.	Briefly explain about various financing options to start a project	(15)	**BTL5**	**Evaluate**	**CO2**
2.	Compose a case study of energy audit for any suitable industries	(15)	**BTL5**	**Evaluate**	**CO2**
3.	Summarize the role of energy manager and explain the instruments for energy auditing	(15)	**BTL6**	**Create**	**CO2**
4.	Justify the Methodology for detailed energy audit process	(15)	**BTL5**	**Evaluate**	**CO2**
5.	Briefly explain about fuel substitutions in energy management.	(15)	**BTL5**	**Evaluate**	**CO2**

UNIT III - THERMAL ENERGY AUDIT

Energy efficiency in thermal utilities – methodology – stoichiometric analysis of combustion in a boiler – performance evaluation – boiler losses - analysis – feed water treatment – energy conservation opportunities in boilers and steam system – furnaces – insulation and refractories – cogeneration – principles of operation - waste heat recovery systems – case study – analysis.

PART – A

Q.No	Questions		BT	Competence	Course Outcomes
1.	Give the formula for stoichiometric air fuel ratio		BTL2	Understand	CO3
2.	What are the types of boilers?		BTL1	Remember	CO3
3.	Evaluate the boiler efficiency.		BTL5	Evaluate	CO3
4.	Identify the techniques of improving boiler availability		BTL1	Remember	CO3
5.	Generalize the fuel economy measures in furnaces		BTL2	Understand	CO3
6.	Examine the factors that shall indicate if a boiler is being run to maximize its efficiency		BTL6	Create	CO3
7.	Explain the steam distribution		BTL3	Apply	CO3
8.	Identify the duty of steam traps.		BTL1	Remember	CO3
9.	Give the advantages of condensate recovery		BTL4	Analyze	CO3
10.	Explain the flash steam utilization		BTL1	Remember	CO3
11.	Describe the condensate recovery.		BTL4	Analyze	CO3
12.	Quote the energy efficiency measures in boilers.		BTL2	Understand	CO3
13.	Draw the schematic diagram of steam distribution.		BTL4	Analyze	CO3
14.	Examine the purpose of insulation.		BTL2	Understand	CO3
15.	Generalize the properties of refractory.		BTL1	Remember	CO3
16.	Illustrate the features of cold insulation.		BTL1	Remember	CO3
17.	Evaluate the different types of refractory.		BTL3	Apply	CO3
18.	What do you understand from cogeneration		BTL6	Create	CO3
19.	How to determine the feasibility of co-generation.		BTL3	Apply	CO3
20.	Examine the forms of the cogeneration		BTL5	Evaluate	CO3
21.	State about evaporation ratio.		BTL1	Remember	CO3
22.	Analyse and list out the advantages and disadvantages of direct method of testing.		BTL4	Analyze	CO3
23.	Give the losses are applicable to liquid, gas and solid fired boiler		BTL2	Understand	CO3

24.	Define pump Capacity		**BTL1**	**Remember**	**CO3**

PART – B					
1.	Briefly explain the energy conservation opportunities for boilers	(13)	**BTL4**	**Analyze**	**CO3**
2.	Explain the boiler types and classifications	(13)	**BTL5**	**Evaluate**	**CO3**
3.	Evaluate the boiler system and draw the schematic diagram of boiler system	(13)	**BTL1**	**Remember**	**CO3**
4.	Examine the performance evaluation of boilers.	(13)	**BTL3**	**Apply**	**CO3**
5.	Analysis the Thermic Fluid Heaters	(13)	**BTL4**	**Analyze**	**CO3**
6.	Define furnace. Explain the types and classifications of different furnaces.	(13)	**BTL2**	**Understand**	**CO3**
7.	Discuss the energy efficiency measures in boilers	(13)	**BTL2**	**Understand**	**CO3**
8.	Briefly explain about stoichiometric analysis of combustion in a boiler	(13)	**BTL5**	**Evaluate**	**CO3**
9.	Explain the steam distribution systems and draw its schematic diagram	(13)	**BTL6**	**Create**	**CO3**
10.	Briefly discuss about Cogeneration system design	(13)	**BTL1**	**Remember**	**CO3**
11.	Describe the condensate recovery and also quote the advantages.	(13)	**BTL1**	**Remember**	**CO3**
12.	Demonstrate the flash steam utilization.	(13)	**BTL3**	**Apply**	**CO3**
13.	Explain the procedure for calculating economic thickness of Insulation.	(13)	**BTL4**	**Analyze**	**CO3**
14.	Integrate the properties of Refractories.	(13)	**BTL6**	**Create**	**CO3**
15.	Briefly explain the feed water treatment	(13)	**BTL4**	**Analyze**	**CO3**
16.	Discuss the waste heat recovery systems.	(13)	**BTL2**	**Understand**	**CO3**
17.	Explain about waste heat sources and grades	(13)	**BTL1**	**Remember**	**CO3**
PART – C					

1.	An oil-fired boiler is generating 30 T/hr steam and operates for 8000 hrs/ year. The TDS in boiler feed water was reduced from 500 ppm to 200 ppm. The maximum permissible limit of TDS in the boiler is 3000 ppm and make up water is 10%. Temperature of the blow down water is 170 C and boiler feed water temperature is 40 C .GCV of fuel is 10000 kcal/kg and efficiency of the boiler is 80%. Calculate the saving in fuel oil per annum due to	(15)	**BTL5**	**Evaluate**	**CO3**
2.	Explain any five properties of ceramic fibre from the point of view of their uses in furnace	(15)	**BTL5**	**Evaluate**	**CO3**
3.	Explain the process of condensate recovery and flash steam utilization	(15)	**BTL5**	**Evaluate**	**CO3**
4.	Integrate the working of a steam trap and its performance assessment methods.	(15)	**BTL6**	**Create**	**CO3**
5.	Discuss about the application considerations with biomass FBC Boilers.	(15)	**BTL5**	**Evaluate**	**CO3**

UNIT-4 ELECTRICAL ENERGY AUDIT – I

Electrical systems – introduction – electricity billing – load management – power factor – improvements and benefits – transformers – distribution losses – analysis –energy audit in electrical utilities methodology – energy conservation opportunities in motors – efficiency – energy efficient motors – motor losses – analysis – energy efficiency in compressed air system

PART – A

Q.No	Questions		BT	Competence	Course Outcomes
1.	Integrate the components of EB billing.		**BTL 3**	**Apply**	**CO4**
2.	Describe the 'Reactive power' and 'Active power'		**BTL 2**	**Understand**	**CO4**
3.	Analyse the HT and LT supply system.		**BTL 3**	**Apply**	**CO4**
4.	A mercury vapour lamp of 400 W is switched on for 12 hours per day. The details of this single phase power supply is 230V,2 amp, p.f = 0.8.Calculate the units of electricity consumption.		**BTL 1**	**Remember**	**CO4**
5.	Evaluate the transformer loss.		**BTL 2**	**Understand**	**CO4**
6.	What is meant by deferrable load?		**BTL 4**	**Analyze**	**CO4**
7.	Define Harmonics.		**BTL 4**	**Analyze**	**CO4**
8.	Describe the power factor and how it is evaluated in the electrical system		**BTL 2**	**Understand**	**CO4**

9.	A three-phase induction 75 kW motor operates at 55 kW. The measured voltage is 415 V, current is 80 amps. Calculate the power factor of the motor?		**BTL 3**	**Apply**	**CO4**
10.	Differentiate between 'contract demand' and 'maximum demand'		**BTL 1**	**Remember**	**CO4**
11.	Define the term 'Load Factor' with an example.		**BTL 2**	**Understand**	**CO4**
12.	Describe the motor efficiency.		**BTL 1**	**Remember**	**CO4**
13.	Analyse the methods of motor efficiency testing.		**BTL 5**	**Evaluate**	**CO4**
14.	Examine the energy efficient motors.		**BTL 6**	**Create**	**CO4**
15.	Express the comparison of different compressors		**BTL 1**	**Remember**	**CO4**
16.	Classify the Compressor types.		**BTL 4**	**Analyze**	**CO4**
17.	Demonstrate the reciprocating compressors.		**BTL 5**	**Evaluate**	**CO4**
18.	Draw the schematic diagram of a basic vapour compression refrigeration system.		**BTL 1**	**Remember**	**CO4**
19.	Quote the types of transformer and also explain ways to reduce losses in conductors.		**BTL 6**	**Create**	**CO4**
20.	Give the methods to improve power factor		**BTL 1**	**Remember**	**CO4**
21.	List out the losses in distribution systems		**BTL 1**	**Remember**	**CO4**
22.	Give the technical aspects in energy efficient motors.		**BTL 1**	**Remember**	**CO4**
23.	Classify the speed control systems in motors		**BTL 4**	**Analyze**	**CO4**
24.	Give the efficiency comparison of various air compressors		**BTL 5**	**Evaluate**	**CO4**
	PART – B				
1.	Summarize the voltage levels in a power system	(13)	**BTL 1**	**Remember**	**CO4**
2.	Illustrate the components of Electricity Billing.	(13)	**BTL 1**	**Remember**	**CO4**
3.	Explain the power factor improvement and benefits.	(13)	**BTL 2**	**Understand**	**CO4**
4.	Briefly explain about load management	(13)	**BTL 1**	**Remember**	**CO4**
5.	Give short notes on (i) Types of Transformers (ii) Transformers Losses iii) Methods for energy audit and conservation in transformer	(13)	**BTL 3**	**Apply**	**CO4**

6.	The contract demand of plant is 1000 kVA. The minimum billing demand is 75% of the contract demand. The basic tariff structure is as follows: Demand charges : Rs. 180 per kVA / month Unit charges : Rs. 3.75 for the first one lakh units / month Rs. 3.50 above one lakh units / month Fuel surcharge : Rs. 0.20 per unit / month Service Tax : Rs. 0.25 per unit / month Meter rent : Rs 500 / month The energy consumption is 3,15,000 units and the maximum demand recorded is 600 kVA. Calculate the cost of monthly electricity consumption?	(13)	**BTL 3**	**Apply**	**CO4**
7.	Describe the selection and location of capacitors	(13)	**BTL 4**	**Analyze**	**CO4**
8.	Explain the Harmonic mitigation techniques used in Industry	(13)	**BTL 1**	**Remember**	**CO4**
9.	Explain the checklist for energy efficiency in compressed air system.	(13)	**BTL 6**	**Create**	**CO4**
10.	Examine the power loss for motors and improvement of motor efficiency.	(13)	**BTL 2**	**Understand**	**CO4**
11.	A10 kW motor has full load efficiency of 85 %. Input at part loading is 415 V and 10 A. The power factor is 0.68. Find the motor loading in percentage.	(13)	**BTL 2**	**Understand**	**CO4**
12.	Illustrate the Energy Efficient Motors and also mention the drawbacks of Energy Efficient Motors.	(13)	**BTL 3**	**Apply**	**CO4**
13.	Describe the compressed air system components	(13)	**BTL 4**	**Analyze**	**CO4**
14.	Explain the efficient operation of compressed air system.	(13)	**BTL 5**	**Create**	**CO4**
15.	Describe rewinding effects in energy efficiency in motors.	(13)	**BTL 4**	**Analyze**	**CO4**
16.	Explain the speed control systems in motors	(13)	**BTL 6**	**Create**	**CO4**
17.	Explain the factors affecting the efficiency of motor in operation.	(13)	**BTL 5**	**Create**	**CO4**
PART – C					
1.	Explain the electrical load management and maximum demand control	(15)	**BTL 5**	**Evaluate**	**CO4**

2.	Evaluate the motor efficiency and explain motor efficiency testing	(15)	**BTL 5**	**Evaluate**	**CO4**
3.	Explain the checklist for energy efficiency in compressed air system.	(15)	**BTL 6**	**Create**	**CO4**
4.	Explain the best location for capacitors banks for power factor improvement from energy conservation point of view? Why? Give detail	(15)	**BTL 6**	**Create**	**CO4**
5.	Explain the losses occur in rewound motor and analyse the checking of efficacy of rewound motor?	(15)	**BTL 5**	**Evaluate**	**CO4**

UNIT-5 ELECTRICAL ENERGY AUDIT – II

HVAC and refrigeration system – fans and blowers – fan performance – pumps - lighting system - energy auditing and reporting in industries – replacement of renewable energy technology option – case study in agro-industries

PART-A

Q.No	Questions		BT	Competence	Course Outcomes
1.	Write notes on HVAC and energy management		**BTL 1**	**Remember**	**CO5**
2.	Estimate the head -flow curve of pumping system		**BTL 1**	**Remember**	**CO5**
3.	Illustrate the types of pumps		**BTL 3**	**Apply**	**CO5**
4.	Examine the factors affecting pump performance		**BTL 3**	**Apply**	**CO5**
5.	What are the major types of centrifugal fan?		**BTL 2**	**Understand**	**CO5**
6.	Differences between Fans, Blower and Compressor		**BTL 3**	**Apply**	**CO5**
7.	Estimate the Lux and Lumens.		**BTL 2**	**Understand**	**CO5**
8.	Illustrate the luminous efficacy and lamp circuit efficacy.		**BTL 2**	**Understand**	**CO5**
9.	Discuss the guidelines for energy efficiency in lighting.		**BTL 1**	**Remember**	**CO5**
10.	Discuss the types of lighting.		**BTL 4**	**Analyze**	**CO5**
11.	A 250 W sodium vapour lamp is installed on a street. The supply voltage for a street light is 230 V and it operates for around 12 hours in a day. Considering the current of 2 amps and power factor 0.85 calculate the energy consumption per day.		**BTL 2**	**Understand**	**CO5**
12.	Analyse the characteristics of modern fluorescent lamps.		**BTL 1**	**Remember**	**CO5**
13.	Classify the disadvantages of high-pressure sodium lamps.		**BTL 5**	**Evaluate**	**CO5**
14.	Draw the schematic diagram of a basic vapour compression refrigeration system		**BTL 6**	**Create**	**CO5**
15.	What are the factors affecting performance of refrigeration plants?		**BTL 4**	**Analyze**	**CO5**
16.	Generalize the air conditioning systems and types of refrigeration systems.		**BTL 1**	**Remember**	**CO5**

17.	Discuss the selection of a suitable Refrigeration system.		**BTL 1**	**Remember**	**CO5**
18.	What is the necessity for Renewable energy		**BTL 4**	**Analyze**	**CO5**
19.	Suggests some of latest Renewable energy methodologies to replace conventional system in Home and industries		**BTL 6**	**Create**	**CO5**
20.	Give some outline to conduct energy audit in		**BTL 1**	**Remember**	**CO5**
21.	Give the heat transfer loops in refrigeration system.		**BTL 5**	**Evaluate**	**CO5**
22.	Discuss about psychrometrics		**BTL 1**	**Remember**	**CO5**
23.	Analyze about the efficiency of fan.		**BTL 4**	**Analyze**	**CO5**
24.	Discuss the options available for replacement of				**CO5**
PART – B					
1.	Discuss about energy saving concepts in HVAC and	(13)	**BTL 2**	**Understand**	**CO5**
2.	Examine the factors affecting pump performance	(13)	**BTL 1**	**Remember**	**CO5**
3.	Describe the efficient pumping system operation	(13)	**BTL 2**	**Understand**	**CO5**
4.	Examine the energy conservation opportunities in pumping systems.	(13)	**BTL 2**	**Understand**	**CO5**
5.	Illustrate the fan design and selection criteria.	(13)	**BTL 1**	**Remember**	**CO5**
6.	Examine the types of fans. Explain the characteristics		**BTL 4**	**Analyze**	**CO5**
7.	Evaluate the basics parameters and terms in lighting system.	(13)	**BTL 3**	**Apply**	**CO5**
8.	Discuss the terms of Lux, Lumens and Explain the types of lighting.	(13)	**BTL 4**	**Analyze**	**CO5**
9.	Summarize the Light Emitting Diode (LED) lamp.	(13)	**BTL 3**	**Apply**	**CO5**
10.	Explain the important considerations in the lighting design process.	(13)	**BTL 6**	**Create**	**CO5**
11.	Classify the various lightning design calculation	(13)	**BTL 1**	**Remember**	**CO5**
12.	Briefly discuss about various methodologies to conduct energy audit in Industries with some examples	(13)	**BTL 4**	**Analyze**	**CO5**

13.	Discuss about various renewable energy options available to replace existing conventional sources	(13)	**BTL 1**	**Remember**	**CO5**
14.	Briefly discuss about energy auditing possibilities	(13)	**BTL 5**		**CO5**
15.	Discuss about various types of refrigeration systems.	(13)	**BTL 1**	**Remember**	**CO5**
16.	Describe the types of pumping systems.	(13)	**BTL 2**	**Understand**	**CO5**
17.	Discuss about the energy auditing report in paper industry	(13)	**BTL 5**	**Evaluate**	**CO5**
	PART-C				
1.	Evaluate the energy conservation opportunities in a fan and pumping systems.	(15)	**BTL 5**	**Evaluate**	**CO5**
2.	Integrate the recommended illuminance levels for various locations and various tasks.	(15)	**BTL 5**	**Evaluate**	**CO5**
3.	Discuss the way for energy auditing and conservations in Renewable energy technology adopted with any two examples	(15)	**BTL 6**	**Create**	**CO5**
4.	Discuss with a case for energy auditing and saving in agro industries	(15)	**BTL 6**	**Create**	**CO5**
5.	Discuss about the energy conservation options available for lighting system in any industry	(15)	**BTL 6**	**Create**	**CO5**

COURSE OUTCOMES (CO)

1. Acquire the knowledge on fundamentals of economic operation of an electrical system and understand the basic principles of energy auditing, types and objectives
2. Develop procedures for conducting energy audit in different utilities in accordance with national and international energy regulations and understand the instruments used.
3. Evaluate the performance of thermal utilities like furnace, boilers and steam distribution systems to improve efficiency
4. Carryout performance assessment and suggest methods to improve the overall efficiency for different energy intensive industries.
5. Evaluate the performance of an electrical utilities like pumps, fans blowers to improve efficiency.