Subject: - Energy Conservation &Audit (22525)

SYLLABUS

Chapter No.	Name of chapter	Marks With Option
1	Energy Conservation & Basics	10
2	Energy conservation In Electrical Machines	20
3	Energy conservation in electrical installation systems	26
4	Energy conservation by Cogeneration and Tariff	28
5	Energy audit of electrical System	18
6	Energy Conservation & Basics	10
	Total Marks: -	**102**

BOARD THEORY PAPER PATTERN FOR ECA (22525)

Q.1		**Attempt any FIVE** **5*2=10**
	a)	Energy Conservation & Basics
	b)	Energy conservation In Electrical Machines
	c)	Energy conservation in electrical installation systems
	d)	Energy conservation by Cogeneration and Tariff
	e)	Energy conservation by Cogeneration and Tariff
	f)	Energy audit of electrical System
	g)	Energy audit of electrical System
Q.2		**Attempt any THREE** **3*4=12**
	a)	Energy Conservation & Basics
	b)	Energy conservation In Electrical Machines
	c)	Energy conservation in electrical installation systems
	d)	Energy conservation by Cogeneration and Tariff

Q.3		**Attempt any THREE** **3*4=12**
	a)	Energy conservation In Electrical Machines
	b)	Energy conservation in electrical installation systems
	c)	Energy conservation by Cogeneration and Tariff
	d)	Energy audit of electrical System
Q.4		**Attempt any FOUR** **3*4=12**
	a)	Energy Conservation & Basics
	b)	Energy conservation In Electrical Machines
	c)	Energy conservation in electrical installation systems
	d)	Energy conservation by Cogeneration and Tariff
	e)	Energy audit of electrical System
Q.5		**Attempt any TWO** **2*6=12**
	a)	Energy conservation In Electrical Machines
	b)	Energy conservation by Cogeneration and Tariff
	c)	Energy conservation by Cogeneration and Tariff
Q.6		**Attempt any TWO** **2*6=12**
	a)	Energy conservation in electrical installation systems
	b)	Energy conservation in electrical installation systems
	c)	Energy audit of electrical System

CLASS TEST - I

PAPER PATTERN

COURSE: - Energy Conservation & Audits (22525)

PROGRAMME: - Electrical Engineering

Syllabus: -

Unit No.	Name of the Unit	Course Outcome (CO)
1	**Energy Conservation & Basics**	**CO.525.1**
2	**Energy conservation In Electrical Machines**	**CO.525.2**
3	**Energy conservation in electrical installation systems**	**CO.525.3**

Q.1	**Attempt any FOUR** **4*2=8Marks**	Course Outcome (CO)
a)	Energy Conservation & Basics	CO.525.1
b)	Energy conservation In Electrical Machines	CO.525.2
c)	Energy conservation In Electrical Machines	CO.525.2
d)	Energy conservation in electrical installation systems	CO.525.3
e)	Energy conservation in electrical installation systems	CO.525.3
f)	Energy conservation in electrical installation systems	CO.525.3
Q.2	**Attempt any THREE** **3*4=12 Marks**	
a)	Energy Conservation & Basics	CO.525.1
b)	Energy conservation In Electrical Machines	CO.525.2
c)	Energy conservation In Electrical Machines	CO.525.2
d)	Energy conservation in electrical installation systems	CO.525.3
e)	Energy conservation in electrical installation systems	CO.525.3

CLASS TEST - II

PAPER PATTERN

COURSE: - Energy Conservation & Audits (22525)

PROGRAMME: - Electrical Engineering

Syllabus: -

Unit No.	Name of the Unit	Course Outcome (CO)
4	**Energy conservation by Cogeneration and Tariff**	**CO.525.4**
5	**Energy audit of electrical System**	**CO.525.5**

Q.1	Attempt any FOUR 4*2=8Marks	Course Outcome (CO)
a)	Energy conservation by Cogeneration and Tariff	CO.525.4
b)	Energy conservation by Cogeneration and Tariff	CO.525.4
c)	Energy conservation by Cogeneration and Tariff	CO.525.4
d)	Energy audit of electrical System	CO.525.5
e)	Energy conservation by Cogeneration and Tariff	CO.525.4
f)	Energy audit of electrical System	CO.525.5
Q.2	Attempt any THREE 3*4=12 Marks	
a)	Energy audit of electrical System	CO.525.5
b)	Energy conservation by Cogeneration and Tariff	CO.525.4
c)	Energy audit of electrical System	CO.525.5
d)	Energy audit of electrical System	CO.525.5

COURSE OUTCOME (CO)

COURSE: - Energy Conservation & Audits (22525)

PROGRAMME: - Electrical Engineering

CO. NO.	Course Outcome
CO.525.1	Interpret energy conservation policies in India
CO.525.2	Implement Energy conservation techniques in electrical Machines
CO.525.3	Apply Energy conservation techniques in electrical installation
CO.525.4	Use of Co-generation & relevant tariff structure for reducing losses in facilities
CO.525.5	Carry out energy audit for electrical system
CO.525.1	Interpret energy conservation policies in India

1. Energy Conservation

Position in Question Paper **Total Marks-10**

Q.1. a) 2-Marks.

Q.2.a) 4-Marks.

Q.3.d) 4-Marks.

Descriptive Question

1. State the importance and need of energy conservation in present scenario
2. List out any six significant features of Indian Electricity Act, 2003.
3. Write about the functions and working of following
4. NPC b) IREDA c) BEE d) MEDA
5. Draw the flowchart of energy audit
6. What is star labelling? State its need
7. List out any six significant features of Indian Electricity Act, 2001
8. State the need of energy conservation
9. State the role of MEDA
10. State the role of BEE 10.State the role of IREDA

MCQ Question

(Total number of Question=Marks*3=10*3=30)

Note: Correct answer is marked with **bold.**

1. The energy sources, that are either found or stored in nature are
   a) Secondary Energy Sources
   b) **Primary Energy Sources**
   c) both (a) and (b)
   d) none of the above
2. Which of the following is commercial energy source?
   a) **Electricity**
   b) Coal

c) Oil
d) All the above

3. Inexhaustible energy sources are known as
   a) commercial Energy
   b) **renewable Energy**
   c) primary energy
   d) secondary energy
4. Which country has the largest share of the global coal reserves?
   a) Russia
   b) China
   c) **USA**
   d) India
5. The % of gas reserves for Russian Federation, when compared to world reserve is considered at
   a) 10 % of World reserve
   b) 20 % of World reserve
   c) **30 % of World reserve**
   d) 40 % of World reserve
6. World oil reserves are estimated to last over
   a) **45 years**
   b) 60 years
   c) 200 years
   d) 75 years
7. World gas reserves are estimated to last over
   a) 45 years
   b) **65 years**
   c) 200 years
   d) 75 years
8. The global primary energy consumption (2002) was equivalent to
   a) 21,842 Mtoe
   b) 15,360 Mtoe
   c) **9405 Mtoe**
   d) 12,396 Mtoe
9. The primary energy consumption of India is
   a) **1/29 of the world**
   b) 1/16 of the world
   c) 1/7 of the world
   d) 1/20 of the world
10. The world average per person energy consumption is equivalent to _____tonnes of coal
   a) 3
   b) **2.2**
   c) 4.5
   d) 1.0
11. Which fuel dominates the energy mix in Indian energy scenario?–
   a) Oil
   b) Natural gas
   c) **Coal**
   d) Nuclear
12. The fourth largest producer of coal and lignite in the world is _____ (EM/EA)
   a) USA
   b) Russia
   c) **India**
   d) China

13. Indian per capita energy consumption is ____ of the world average.

a) 4%
b) **20%**
c) 1%
d) 10%

14. Energy consumption per unit of GDP is called as:
a) Energy Ratio
b) **Energy intensity**
c) Per capita consumption
d) None

15. India's energy intensity is ___ times of world average.
a) **1.5**
b) 3.6
c) 2.5
d) 10

16. India's current percentage peak demand shortage for electricity is: (EM/EA)
a) 1%
b) 3%
c) 10%
d) 40%

18. Name the Act, which is proposed to bring the qualitative transformation of the electricity sector:
a) Regulatory Commission Act 1998
b) Indian Electricity Act 1910
c) Supply Act 1948
d) Electricity Act 2003

19. One unit of electricity is equivalent to kcal heat units.
a) **800**
b) 400
c) 860
d) 680

20. An energy policy does not include
a) Target energy consumption reduction
b) Time period for reduction
c) Declaration of top management commitment
d) Future production projection

21. The energy sources that are either found or stored in nature are
a) Secondary Energy Sources
b) Primary Energy Sources
c) both (a) and (b)
d) none of the above

22. Which of the following is commercial energy source?
a) Electricity
b) Coal
c) Oil
d) **All the above**

23. Energy consumption per unit of GDP is called as:
a) Energy Ratio
b) **Energy intensity**
c) Per capita consumption
d) None

24. Natural Gas contains ?
a) **95-99% methane**
b) 95-99% Ethane
c) 95-99% methane & ethane mix

d) None

25.Energy is released from fossil fuels when they are_____

a) Pumped
c) **Burned**
b) Cooled
d) Pressurized

26. How many forms of fossil fuels are there

a) One
c) Three
b) Two
d) Four

27.SI unit of energy is

a) Watt
c) **Joule**
b) Newton
d) Kilogram

28. Which of the following is highest contributor to the air pollution

a) **Carbon Monoxide**
c) Hydro Carbons
b) Sulphur Oxides
d) Particulates

29. Projected temperature increase in degree centigrade 2100 due to climate change is:

a) 2
c) 6
b) 4
d) 8

30. Which of following is non commertial energy sourse

a) Coal
c) Oil
b) Electricity
d) **None of these**

2. Energy Conservation in Electrical Machine

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Position in Question Paper **Total Marks-20**

Q.1. b) 2-Marks.
Q.2. b) 4-Marks.
Q.3. a) 4-Marks.
Q.4. b) 4-Marks
Q.5. a) 6-Marks

-

Descriptive Question

1. Explain energy conservation method in lighting system by using installation of separate transformer servo stabilizer.
2. Explain the following energy conservation methods of electrical motor.
3. Matching motor rating with required load.
4. Rewinding of motors.
5. Write opportunities for energy conservation in transformer.
6. State the working and applications of following energy conservation equipments. i) soft starter ii) power factor controller.
7. Explain energy conservation technique in induction motor by minimizing the idle and redundant running of motor.
8. Write comparison between energy efficient motor and conventional induction Motor
9. State four benefits of Variable Frequency Drives
10. Explain the importance of amorphous core transformers from the energy conservation point of view.
11. State need of energy conservation in electrical motors..
12. Explain why frequent rewinding of induction motors reduces its efficiency
13. Explain when induction motors are run in star connection under 30% load condition, how energy is conserved.

14. List out the factors to be considered to select electrical drives for an application.
15. Epoxy resin transformers are more suitable in hazardous areas. Give reason.
16. State and explain various factors governing the selection of 3-phase induction motor
17. State how 'parallel operation of transformers' helps in energy conservation
18. State the comparison between soft starter and conventional DOL starter.
19. State the need of energy conservation in electrical motor.
20. State the need of energy conservation in transformer.
21. Compare conventional induction motor with energy efficient motor on the basis of following points
22. Explain energy conservation technique in induction motor by improving mechanical power and transmission efficiency.
23. Draw and explain power flow diagram of induction motor

MCQ Question

(Total number of Question=Marks*3=14*3=42)

Note: Correct answer is marked with **bold**

1. Both the pump and motor are inside water in case of
   a) Turbine pump
   b) Centrifugal pump
   c) **Submersible pump**
   d) Jet pump
2. Maximum demand controller is used to _____.
   a) switch off essential loads in a logical sequence
   b) exceed the demand of the plant
   c) **switch off non-essential loads in a logical sequence**
   d) controls the power factor of the plant
3. Capacitors with automatic power factor controller when installed in a plant:
   a) reduces active power drawn from grid
   b) **reduces the reactive power drawn from grid**
   c) reduces the voltage of the plant
   d) increases the load current of the plant
4. _____ controls the power factor of the installation by giving signals to switch on or off power factor correction capacitors.
   a) KILOVAR
   b) **Automatic power factor control rela**y

c) Intelligent power factor controller
d) Maximum demand controller

5. _____ determines the rating of capacitance connected in each step during the first hour of its operation and stores them in memory.
   a) Maximum demand controller
   b) Intelligent power factor controller
   c) Automatic power factor controller
   d) KILOVAR
6. The following function can not be achieved with automatic power factor controllers.
   a) Voltage control
   b) KILOVAR control
   c) **kW control**
   d) PF control
7. The following features apply to energy efficient motors by design: a) Energy efficient motors last longer b) Starting torque for efficient motors may be lower than for standard motors State whether the two statements are
   a) **True**
   b) False
8. Eddy current drive can be a retrofit for _____.
   a) constant speed system requirement
   b) **variable speed system requirement**
   c) dual speed system requirement only
   d) none of the above
9. Electronic variable frequency drive (VFD) connected to motors:
   a) **provide variable speed with high efficiency**
   b) induces eddy-current in the secondary member of the clutch mechanism
   c) is not suitable for variable torque load
   d) does not provide variable speed and has low-efficiency
10. Variable speed can not be obtained with ____.
    a) DC motors controller
    b) AC motor controller
    c) **soft starter controller**
    d) AC & DC controllers
11. Energy savings potential of variable torque applications compared to constant torque application is:
    a) **higher**
    b) lower
    c) equal
    d) none of the above
12. As an energy efficient application, slip power recovery system fits well for ____.
    a) Squirrel cage and slip ring motors
    b) DC motor

c) **Slip ring motors only**
d) None of the above

13.Energy efficient transformer core is made up of _____.
a) silicon alloyed iron (grain oriented)
b) copper
c) **amorphous core - metallic glass allo**y
d) none of the above

14.The basic functions of electronic ballast excludes one of the following:
a) to ignite the lamp
b) to stabilize the gas discharge
c) **to reduce lumen output of the lamp**
d) to supply power to the lamp

15. To reduce Electrical energy bill, power factor should be kept
a) power factor does not affect energy bill
b) as high as possible
c) **as close to unity as possible**
d) as less as possible

16.Select the application of fluid coupling fitting from the following:
a) acts as a voltage limiter
b) enables no-load start-up of prime-mover
c) works on the principle of eddy current
d) none of the above

17.The characteristic of conventional ballast in lighting application is one among the following:
a) They have low operational losses than electronic ballasts.
b) They have tuned circuit to deliver power at 25 Hz
c) They do not require a mechanical switch (starter)
d) They have high operational losses and high temperature rise

18.Application of occupancy sensors is well suited for ___.
a) day light based controllers
b) night based controllers
c) motor controllers
d) movement or noise detector in room space

19.Find the odd retrofit group from the following:
a) Occupancy sensors
b) timer based control

c) photo sensors
d) capacitor based control

20.Application of timers as a retrofit will assist in saving energy in areas of ____.
a) **Lighting & motors**
b) Transformers
c) HV- Feeder Panels
d) All the above

21.Electronic soft starters are used for motors to:
a) achieve variable speed
b) provide smooth start and stop
c) improve the loading
d) none of the above

22.Energy efficient lighting can be planned by using the following retrofits. – photo-sensor , timer , occupancy sensor ,localized switching
a) **True**
b) False

23.Power transformers are designed to have maximum efficiency at
a) **Full load**
b) 50% load
c) 80% load
d) No load

24.Non-contact speed measurements can be carried out by
a) **Tachometer**
b) Stroboscope
c) Oscilloscope
d) Speedomete

25.The _____ are the general principles of energy conservation planning in industries.
a) Maximum energy efficiency
b) Maximum cost effectiveness
c) **Both A and B**
d) Only A or B

26.In energy conversion_____ of input energy is converted into out or useful work.
a) **Only a part**
b) All
c) 50%
d) depends on type of energy

27.When _____is done for a given amount of input energy to the equipment / process is known as to have maximum efficiency**.**
a) Minimum work
b) maximum work
c) 75% work
d) Any of the above

28.There is _____ in conversion of energy from one form to another form.
a) Ano energy loss
b) most of part of energy is loss
c) **energy loss**
d) all of the above

29.In energy conversion the energy losses may be in the form of _____
a) electrical energy
b) chemical energy
c) heat energy
d) **any of the above**

30.What is the aim of all energy conservation techniques in Electrical machine?
a) to increase energy losses
b) **to reduce energy losses**
c) to use new system by replacing old one

d) none of the above

31.How we can improves system efficiency?

a) if energy losses are maximum
c) replacing old equipment
b) **if energy losses are minimized**
d) using higher rating system

32.The energy losses or discharge in energy conversion is depends on___.

a) temperature of discharge
c) quantity of energy losses
b) discharge rate
d) **Both A and B**

33.Maximum cost effectiveness in energy conservation is achieved when____

a) total cost is maximum
b) **total cost is the least**
c) total cost is equal to installation cost
d) total cost is more than installation cost

34. In energy conservation schemes it requires___

a) **Additional investment**
c) it requires replacement of old one
b) No additional investment
d) Any of the above

35.Energy conservation schemes may be classified on the basis of___.

a) system efficiency
c) **an economic**
b) type of system like old or new
d) cost of investment

36.Efficiency of the any system or equipment is given by

a) output / input
c) output/ output+ losses
b) input – losses/ input
d) **all of the above**

37.In ____ energy conservation scheme, it involves change in operating practices.

a) long term scheme
c) medium term scheme
b) short term scheme
d) all of the above

38.Which of the following is/are an examples of short term scheme of energy conservation?

a) repairs of system or leakages
b) improves housekeeping
c) minimization of excess combustion air in furnaces
d) **all of the above**

39. In Energy conservation, reduction in energy consumption ____the quality and quantity of output.

a) without affecting
c) may be affect
b) with affecting
d) Any of the above

40.The all day efficiency of a transformer is also known as

a) load efficiency.
c) current efficiency.
b) power efficiency.
d) **energy Efficiency**

41. Power transformers are generally designed to have maximum efficiency at

a) no load.
b) half load.
c) **near full load**
d) any load

42.Select the application of fluid coupling fitting from the following:

a) acts as a voltage limiter
b) enables no-load start-up of prime-mover
c) works on the principle of eddy current
d) none of the above

3. Energy Conservation in Electrical Installation System

Position in Question Paper **Total Marks-26**

Q.1. c) 2-Marks.
Q.2. c) 4-Marks.
Q.3. b) 4-Marks.
Q.4. c) 4-Marks
Q.6. a) 6-Marks
Q.6. b) 6-Marks

Descriptive Question

1. Describe how by replacing existing lamp sources with energy efficient lamp sources will improve efficiency
2. State proper maintenance program for energy conservation in lighting system.
3. Classify commercial losses in Transmission & Distribution system.
4. How power factor and load factor contributes technical losses in T & D system
5. Describe methods of reducing technical losses in transmission & distribution system.
6. Describe the methods of reducing commercial losses in distribution system.
7. Discuss how optimization of system voltage and balancing of phase current results into conservation of energy in transmission and distribution system
8. State commercial losses in transmission and distribution system. Also state the remedies for same.
9. Explain reactive power compensation in Transmission and Distribution system.
10. Explain reactive power compensation in Transmission and Distribution system.
11. State and explain any four commercial losses in transmission and distribution system.
12. With neat diagram, explain use of "reactive power controller" to reduce technical losses in transmission and distribution system.
13. With reference to Trans and Distr. system explain why reactive power

Should be compensated for conserving electric energy.

14. Explain how technical losses can be reduced by use of energy efficient transformer in Transmission and Distribution system.
15. State the working principle and operation of Automatic power factor controller
16. Used in Transmission and Distribution system.
17. State and explain various reasons of technical losses in transmission and distribution system.
18. Explain following techniques related to energy, conservation in transmission and distribution system.

MCQ Question

(Total number of Question=Marks*3=16*3=48)

1. Cloud base energy management system provides the ability to
   a) Remotely control HVAC
   b) Collect real time data
   c) Generate intelligent, specific and real time guidance
   d) Only b and c
   e) **All of these**
2. The monitor and control of energy management system is done by using
   a) MATLAB
   b) **SCADA**
   c) AUTO – CAED
   d) All of these
3. The energy strategies of companies have the principle of
   a) restoring and preserving the environment
   b) reducing wastes and pollutants
   c) educating the people about energy conservation
   d) all of these
   e) **none of these**
4. In Germany, the maximum energy consumption of a low energy house is
   a) 50 kWh / m^2a
   b) 60 kWh / m^2a
   c) **70 kWh / m^2a**
   d) 80 kWh / m^2a
5. IFMA stands for
   a) **International Facility Management Association**
   b) Indian Facility Management Association
   c) International Facility Management Academy

d) Indian Facility Management Academy

6. Maximum demand charges are given in
   a) kWh
   b) **kVA**
   c) All of these
   d) None of these

7. Which among the following fuel is not available for thermal energy supply?
   a) LSHS
   b) LDO
   c) All of these
   d) **None of these**

8. Energy management is a key component of
   a) Environmental management
   b) **Carbon management**
   c) Nitrogen management
   d) Water management

9. The main objective of energy management is to
   a) Minimize energy cost
   b) Minimum environmental effects
   c) Maintain optimum energy procurement and utilization
   d) **All of these**

10. For voltage boosting in distribution networks the capacitors used is
   a) Series capacitors
   b) Shunt capacitors
   c) Both (a) and (b)
   d) None of these

11. To reduce the power consumption, the capacitors should be located
   a) As close as possible to the load
   b) As far as possible to the load
   c) Not too close not too far from the load
   d) All of these

12. A synchronous motor takes the leading current when it is
   a) Overexcited
   b) Under excited
   c) Not excited
   d) Either (a) or (b)

13. In order to improve the power factor of equipment operating at lagging power factor, a capacitor is connected
   a) In series with the equipment
   b) **In parallel with the equipment**
   c) In series-parallel with the equipment
   d) Either (a) or (b)

14. To save energy, Washington DC, has developed an investment analysis software package, ENVEST. This program can be run on an
   a) IBM PC
   b) PCXT
   c) PCAT
   d) All of these

15. A tax credit substantially

a) Increases the investment merit of the investment
b) Decreases the investment merit of the investment
c) Does not cause any effect on the investment merit of the investment
d) None of these

16.The ratio of average load over a designated period to the peak load demand occurring in that period is known as
a) power factor
b) ratchet rate
c) load factor
d) production factor

17. The reactive power component kVAR is equal to the
a) kVA sinØ
b) kW tanØ
c) kW cosØ
d)Both (a) and (b)

18. The efficiency of variable speed drives generally
a) **Decreases with speed**
b) Increases with speed
c) Remains constant with change in speed
d) None of these

19.The basic function of electronic ballast is
a) To ignite the lamp
b) To stabilize the gas discharge
c) To supply the power to the lamp
d) All of these

20. A conventional incandescent lamp has a luminous efficiency of
a) 10 lumens / watt
b) 12 lumens / watt
c) 14 lumens / watt
d) 14.6 lumens / watt

21. In valley filling, the incremental costs during peak hours are
a) Less than the average costs of electricity
b) More than the average costs of electricity
c) Equal to the average cost of electricity
d) None of these

22.The Indian electricity rules of 1956 cover
a) Inspections of electric installations
b) Licensing
c) General safety precautions
d) **All of these**

24. Energy conservation act was formed in the year
a) 1998
b) 1999

c) 2000
d) **2001**

25. The rules of a particular electricity supply system provision for metering, earthing and for other installation matters are in accordance with the electricity supply act of
a) 1947
b) **1948**
c) 1956
d) 1958

26. Which among the following is not the pronged approach to energy management?
a) Capacity utilization
b) Fine turning of equipment
c) Technology up gradation
d) **None of these**

27. Phase advancers are used to improve the power factor of
a) Induction motors
b) Induction generators
c) Synchronous motors
d) Synchronous generators

28. If power factor is less than unity then it will result in
a) Large kVA rating of equipment
b) Greater conductor size
c) Large copper losses
d) **All of these**

29. If the load current decreases then the power factor
a) Will also decrease
b) **Will increase**
c) Will remains unchanged
d) None of these

30. The wattles component is
a) I
b) I cosØ
c) **I sinØ**
d) None of these

31. The capital cost of generating equipment, transmission system and distribution system comes under
a) Fixed capital
b) Running capital
c) Both fixed and running capital
d) None of these

32. Power factor is the ratio of
a) Active power to the reactive power
b) **Active power to the apparent power**
c) Apparent power to the active power
d) Reactive power to the apparent power

33. For a typical AC power supply, the secondary transmission carries the voltage of
a) 11kV
b) 33 kV
c) 66 kV
d) 132 kV

34. The reduction of utility load primarily during peak demand is known as
a) Peak clipping
b) Load shifting
c) Valley filling
d) MTP analysis

35. The demand side management can be achieved by the technique of

a) Time of day pricing and metering
b) Multi - utility power exchange model
c) Load management
d) **All of these**

36. EPRI stands for
a) European power research institute
b) Electrical power Russian institute
c) Electrical power research institute
d) **Electrical power research industries**

37. Demand Side Management is required to
a) Reduce overall cost of installed capacity
b) Reduce needs for peaking stations
c) Ensure quality and equity of supply
d) **All of these**

38. Maximum demand charges are given in
a) kWh
b) **kVA**
c) kVAr
d) All of these

39. Which among the following fuel is not available for thermal energy supply?
a) LSHS
b) LDO
c) All of these
d) **None of these**

40. Energy management is a key component of
a) Environmental management
b) **Carbon management**
c) Nitrogen management
d) Water management

41. Which is the major energy source to meet the Indian energy demand?
a) Coal
b) Oil
c) Natural gas
d) Lignite

42. Maximum demand controller is used to _____.
a) switch off essential loads in a logical sequence
b) exceed the demand of the plant
c) **switch off non-essential loads in a logical sequence**
d) controls the power factor of the plant

43. Capacitors with automatic power factor controller when installed in a plant:

a) reduces active power drawn from grid
b) **reduces the reactive power drawn from grid**
c) reduces the voltage of the plant
d) increases the load current of the plant

44.__ controls the power factor of the installation by giving signals to switch on or off power factor correction capacitors.
a) KILOVAR
b) Automatic power factor control relay
c) Intelligent power factor controller
d) Maximum demand controll

45.How is the voltage and frequency controlled in automatic generation control?
a) By By controlling the excitation
b) controlling the turbine action
c) **Turbine speed control for voltage and excitation control for frequency**
d) Excitation control for voltage and turbine speed control for voltage.

46.What is the unit of transmission loss coefficient?
a) MW
b) **$(MW)^{-1}$**
c) Unit less
d) $(MW)^2$

47.What will be the penalty factor for a unit, if the generating station is located very close to load centre?
a) Zero
b) **Almost equal to unity**
c) The penalty factor is negative
d) The value is very high

48.Why are the series capacitors used?
a) Improve the voltage
b) Reduce the fault level
c) **Compensate for line inductive reactance and improve the stability of power system.**
d) Improves the power factor

4. Energy Conservation by Cogeneration and Tariff

Position in Question Paper **Total Marks-28**

Q.1. d) 2-Marks.
Q.1. e) 4-Marks.
Q.2. d) 4-Marks.
Q.3. c) 4-Marks
Q.4. d) 4-Marks
Q.5. b) 6-Marks
Q.5. c) 6-Marks

Descriptive Question

1. What is co-generation ? Explain any five factors governing the selection of co-generation system
2. Define the terms : electricity duty, connected load, electricity tax,tariff structure
3. With the help of neat labelled diagram explain working of Gas-turbine co-generation system.
4. State the incentives and penalty related with p.f. tariff.
5. What are the different types of tariffs
6. Give classification of cogeneration system on the basis of the sequence of energy generation.
7. Draw layout of steam turbine cogeneration system and label it.
8. Write four objectives of tariff system.
9. State any four advantages of co – generation system.
10. Explain how TOD and peak-off tariff can helps for energy conservation.
11. With the help of conceptual diagram explain what is cogeneration.
12. Classify cogeneration system based on sequence of energy generation.
13. State any four factors on which cogeneration system is selected
14. Define theTime-off-day tariff. &Peak-off-day tariff..
15. State and explain “power factor tariff

16.How the application of tariff system helps to reduce energy bill
17.State the need of cogeneration in present scenario
18.State the classification of cogeneration system based on sequence of energy use.
19.State and explain the desirable characteristics of a Tariff
20..Explain bottoming cycle type of co-generation.
21.Draw and label steam turbine cogeneration system.
22.State the advantages of adoption of cogeneration system in an industry.
23.Explain the factors that governs the selection of cogeneration system for an industry

MCQ Question

(Total number of Question=Marks*3=16*3=48)

1.Which of the following is not a benefit of cogeneration
a) Increased efficiency of energy conversion and use
b) Reduced power factor
c) Reduced greenhouse gas emissions
d) Reduced transmission losses

2.Cogeneration is the simultaneous generation of
a) Heat and power
b) Steam and condensate
c) Mechanical energy and power
d) All of the above

3.The Ranking Cycle is related to
a) Boiler
b) Condenser
c) Steam turbine
d) All of the above

4.What is an important advantage of closed-cycle gas turbine cogeneration systems? ®
a) Working fluid remains clean and it does not cause corrosion or erosion
b) High pressure of produced steam
c) Low capital costs
d) High temperature of produced steam

5. The cogeneration system which has a high overall efficiency is the
a) Gas turbine Reciprocating engine
b) Back pressure steam turbine
c) Combined cycle
d) All of these

6.Which of the following statements is not correct

a) A topping cycle plant generates electricity or mechanical power first
b) A bottoming cycle plant generates electricity or mechanical power first
c) **A bottoming cycle plant generates heat first**
d) Both a and b

7.How is the efficiency of cogeneration measured?

a) Electrical conversion
b) Both a and b
c) Thermal recovery
d) None of the above

8.The cogeneration is not applicable to which type of industry?

a) Sugar
b) Refinery
c) Paper and pulp
d) Refractory / brick-making

9. What is a typical efficiency of a cogeneration system?

a) 58%
b) 85%
c) 68%
d) 95%

10. Which fuel type can be used in a gas turbine?

a) Light fuel oil
b) Diesel
c) Natural gas
d) All of the above

11.Having two separate units for process heat and power is?

a) Auseful
b) Useless
c) pollution reducing
d) none of the mentioned

12. A plant producing both, electrical power & process heat simultaneously is?

a) Cogenital plant
b) Cogenerial plant
c) Cogeneration plant
d) Conglomerate plant

13. In a back pressure turbine _____

a) pressure at the exhaust from the turbine is the saturation pressure corresponding to the temperature desired in the process
b) pressure at the entrance of the turbine is the saturation pressure corresponding to the temperature desired in the process
c) pressure at the exhaust from the turbine is the saturation pressure corresponding to the pressure desired in the process
d) none of the mentioned

14. In a by-product power cycle?

a) the power is produced initially
b) power production is in the middle stages of the cycle

c) power production is after the cycle has ended
d) none of the mentioned

16. Back pressure turbines are usually _____ with respect to their power output.
a) large
b) small
c) very large
d) very small

17. In terms of cost per MW compared to condensing sets of the same power, the back pressure turbines are?
a) more expensive
b) cheaper
c) costly
d) none of the mentioned

17. Which of these is not an application of back pressure turbine?
a) desalination of sea water
b) filtration of water
c) process industries
d) petrochemical installations

18. Back pressure turbine is placed between _____
a) Turbine & Pump
b) Boiler & Pump
c) Turbine & Heat Exchanger
d) Boiler & Turbine

19. Which of the following is a good medium for constant temperature heating?
a) Water
b) Steam
c) Coolant
d) Diesel

20. The cogeneration plant efficiency nCO if WT, Qi, QH represents turbine work, heat input, heat output respectively is given by?
a) nCO = (WT + Qi) / QH
b) nCO = (WT – Qi) / QH
c) nCO = (WT + QH) / Qi
d) nCO = (WT + QH) / Qi

21. The electricity fraction of total energy output if W1 and Q1 represents the turbine work and heat output is given by?
a) W1 / (W1 + Q1)
b) W1 / (W1 – Q1)
c) W1 / (W1Q1)
d) W1 / Q1

22. If e is the electricity fraction of the total energy output, m is the electric plant efficiency and n is the steam generator efficiency; the heat added per unit total energy output is given by?
a) (1 / m) + ((1 – e) / n)
b) (1 / n) + ((1 – e) / m)
c) (1 / m) + ((1 + e) / n)
d) (1 / n) + ((1 – e) / m)

23. Pass-out turbines are used in which of these cases?
a) relatively high back pressure
b) small heating requirement

c) only relatively low back pressure

d) both relatively high back pressure and small heating requirement

24. Which of these is not considered economical for cogeneration?

a) a high fraction of electric to total energy

b) a low fraction of electric to total energy

c) a low fraction of total energy to electric energy

d) none of the mentioned

25. Compounding of steam turbine is done for

a) reducing the work done

b) increasing the rotor speed

c) reducing the rotor speed

d) balancing the turbine

26. In India largest thermal power station is located at

a) Kota

b) Sarni

c) Chandrapur

d) Neyveli

27.The proper indication of incomplete combustion is

a) high CO content in flue gases at exit

b) high CO2 content in flue gases at exit

c) high temperature of flue gases

d) the smoking exhaust from chimney

28.Rankine cycle efficiency of a good steam power plant may be in the range of

a) 15 to 20 percent

b) 35 to 45 percents

c) 70 to 80 percent

d) 90 to 95 percent

29.Carnot cycle comprises of

a) two isentropic processes and two constant volume processes

b) two isentropic processes and two constant pressure processes

c) two isothermal processes and three constant pressure processes

d) none of the above

30. In Rankine cycle the work output from the turbine is given by

a) change of internal energy between inlet and outlet

b) change of enthaply between inlet and outlet

c) change of entropy between inlet and outlet

d) change of temperature between inlet and outlet

31.Regenerative cycle thermal efficiency

a) is always greater than simple Rankine thermal efficiency

b) is greater than simple Rankine cycle thermal efficiency only when steam is bled at particular pressure

c) is same as simple Rankine cycle thermal efficiency

d) is always less than simple Rankine cycle thermal efficiency

32. Regenerative cycle thermal efficiency

a) is always greater than simple Rankine thermal efficiency

b) is greater than simple Rankine cycle thermal efficiency only when steam is bled at particular pressure

c) is same as simple Rankine cycle thermal efficiency

d) is always less than simple Rankine cycle thermal efficiency

33. In a regenerative feed heating cycle, the optimum value of the fraction of steam extracted for feed heating

a) decreases with increase in Rankine cycle efficiency

b) increases with increase in Rankine cycle efficiency

c) is u naffected by increase in Rankine cycle efficiency

d) none of the above

34. Having two separate units for process heat and power is?

a) useful

b) **useles**s

c) pollution reducing

d) none of the mentioned

35 .Back pressure turbine is placed between _____

a) Turbine & Pump

b) Boiler & Pump

c) Turbine & Heat Exchanger

d) Boiler & Turbine

36. In cogeneration, the system efficiencies can go up to ------

a) 70%

b) 80%

c) 90%

d) 60%

37.Find the thermodynamic cycle not related to cogeneration.

a) Brayton cycle

b) Rankine cycle

c) Otto cycle

d) Bell-Coleman cycle

38.Tariff is best defined as:

a) The duty imposed on exporting electrical equipment

b) The rate at which electricity is supplied to the consumer

c) A set of rules explaining the pros and cons of using a specific rating of alternators

d) None of these

39.Which one of the following is an objective of tariff:

a) Recovery of cost on production of power

b) Recovery of capital investment

c) Profit gain

d) All of these

40.Which of following is correct statement about Simple tariff:

a) Has no discrimination of consumers
b) Charges more to commercial users
c) Enoourages use of electricity
d) Is most commonly used tariff method

41.The tariff in which power factor is taken as reference:

a) Sliding scale tariff
b) kVA maximum demand tariff
c) kW and kVAR tariff
d) All of these

42.A specific tariff is

a) **Any tax on a particular imported good (as opposed to one on all imports**).
b) An import tax that must be paid in kind (giving the government the good itself).
c) A requirement to pay the government a specified fraction of the monetary valueof an imported good.
d) A tax on imports defined as an amount of currency per unit of the good

43.A tariff on imports benefits domestic producers of the imported good because

a) **They get the tariff revenue**.
b) It raises the price for which they can sell their product on the domestic market.
c) It prevents imports from rising above a specified quantity.
d) It reduces their producer surplus, making them more efficient

44.When a large country levies a tariff on imports

a) The world price falls.
b) Demanders of the good on the domestic market are hurt
c) Foreigners are hurt.
d) The domestic price rises by less than the tariff.
e) All of the above.

45.Which of the following refers to the fact that a large country can benefit by levying a tariff?

a) The "optimal tariff"
b) The "terms of trade effect of a tariff"
c) The "monopoly effect of a tariff"
d) All of the above

46.This tariff is applied for which kind of consumers?

a) **Big consumers**.
b) Small consumers.
c) Residential consumers.
d) All of these.

47.Why is this tariff not applicable to domestic consumers?

a) Low maximum demand.
c) Lower energy consumption.
b) **Low load factor**.
d) Low power factor

48.Why is a big consumer charged at a lower rate than the small consumer?

a) Their maximum demand is small.
c) Both (a) and (b).
b) It improves the load factor.
d) None of these

5. Energy Audits of Electrical System

Position in Question Paper **Total Marks-10**

Q.1. f) 2-Marks.
Q.1. g) 2-Marks.
Q.3. d) 4-Marks.
Q.4. e) 4-Marks
Q.6. c) 6-Marks

Descriptive Question

1. State various instruments used in energy audit procedure with functions
2. What is ABC analysis ? State its three advantages referred to energy audit projects.
3. Draw block diagram of microprocessor based centralised control equipment of energy conservation and explain it.
4. State any four advantages of energy audit.
5. Explain how motion detectors can be used for energy conservation
6. Explain any four advantages of centralized control equipment for conserving energy.
7. Write different steps of energy audit of an industry.
8. Prepare any eight questions related to energy audit of a shopping mall.
9. Explain use of ABC analysis in energy audit project
10. State the stepwise procedure to assess the performance of existing lighting
11. system in a facility
12. List out the energy conservation equipments related to
13. Name the energy audit instruments used
14. Define :Energy Audit,Simple payback periodReturn on Investment,,Energy Audit Instruments
15. State the difference between “Walk Through Audit” & “Detailed Audit”.
16. Enlist any four energy audit instruments and also give their functions.
17. Explain stepwise the “Detailed energy audit” procedure.
18. Define & explain the procedure to calculate the payback period. Also state its significance

1."The judicious and effective use of energy to maximise profits and enhance competitivepositions". This can be the definition of:

a) Energy conservation
c) Energy policy
b) Energy Saving
d) Energy Audit

2.The objective of energy management includes

a) Minimising energy costs
b) minimising waste
c) Minimising environmental degradation
d) all the above

3.The ratio of current year's production to the reference year's production is called as.(EA/EM)

a) demand factor
c) utilisation factor
b) production factor
d) load factor

4.Replacement of steam based hot water generation by solar system is an example of

a) matching energy usage to the requirement
b) maximising system efficiency
c) Energy substitution
a) Performance improvement

5.One unit of electricity is equivalent to ___ kcal heat units.

a) 800
c) 400
b) 860
d) 680

6.The benchmarking parameter for air conditioning equipment is

a) kW/Ton of Refrigeration
b) kW/ kg of refrigerant handled
c) kcal/m3 of chilled water
d) Differential temperature across chiller

7.The percentage of energy saved at the current rate of use, compared to the reference year rate of use, is called

a) Energy Utilization
c) Energy Efficiency
b) Energy Performance
d) None

8.Which instrument is used to monitor O2, CO in flue gas?

a) Combustion analyzer
c) Pyrometer
b) Power analyzer
d) Fyrite

9.Lux meter is used to measure……

a) Illumination level
b) Sound intensity and illumination level

c) Harmonics
d) Speed

10.For a cement plant the parameter, "kWh/MT of clinker "indicates
a) Energy Index parameter
b) Utility factor
c) Production factor
d) load factor

11.Energy manger should be well versed with
a) Manufacturing and processing skills
b) Managerial and technical skills
c) Technical and marketing skills
d) Managerial and commercial skills

12.An energy policy does not include
a) Target energy consumption reduction
b) Time period for reduction
c) Declaration of top management commitment
d) Future production projection

13.CO2 measurement of Fyrite kit is based on (EA)
a) Weight basis (dry)
b) Volume basis (dry)
c) Weight basis (wet)
d) Volume basis (wet)

14.Non contact speed measurements can be carried out by
a) Tachometer
b) Stroboscope
c) Oscilloscope
d) Speedometer

15.The tool used for performance assessment and logical evaluation of avenues for improvement in Energy management and audit is
a) Fuel substitution
b) Monitoring and verification
c) Energy pricing
d) Bench marking

16.Infrared thermometer is used to measure
a) Surface temperature
b) Flame temperature
c) Flue gas temperature
d) Hot water temperature

17.Find out the 'odd' among the following choices for fuel substitution for industrial sector of India.
a) LDO with LSHS
b) coal with rice husk
c) natural gas for fertilizer plant
d) LPG for soft coke

18.The various types of the instruments, which requires during audit need to be
a) easy to carry
b) easy to operate
c) inexpensive
d) all the above

19.Air velocity in ducts can be measured by using ___ and manometer
a) Orifice meter
b) Borden gauge
c) Pitot tube
d) Anemometer

20.The commercial production of energy by nuclear fusion is not yet possible mainly due to difficulties with
a) obtaining plentiful supplies of a suitable fuel.
b) reaching the high temperatures required.
c) confining the hot plasma.
d) **disposing of the radioactive waste products**.

21.Heat engines
a) produce more work output than energy input
b) take in thermal energy at a low temperature and exhaust it t high temperature
c) convert heat into mechanical energy
d) can be close to 100% efficient

22.The fuel below with the highest energy density value is:
a) coal
b) crude oil
c) ethanol
d) compressed natural gas

23.The efficiency of a modern natural gas power station is approximately
a) 10 %.
b) **50 %**.
c) 75 %.
d) 90 %.

24.The energy source that currently provides the greatest proportion of the world's total energy demand is
a) coal.
b) oil.
c) natural gas.
d) uranium

26.The rate of global warming might be reduced by
a) replacing the use of coal and oil with natural gas.
b) a reduction in the Earth's albedo.
c) **a reduction in carbon fixation**.
d) an increase in deforestation.

27.An energy audit team is formed during
a) post audit phase
b) audit phase
c) pre-audit phase
d) the time of study

28.Which of the following is not part of energy monitoring
a) data recording
b) data analysis
c) data reporting
d) energy efficiency equipment financing

29.The energy sources that are either found or stored in nature are
a) Secondary Energy Sources
b) Primary Energy Sources

c) both (a) and (b)
d) none of the above

30. Energy consumption per unit of GDP is called as:
a) Energy Ratio
b) Energy intensity
c) Per capita consumption
d) None

31.Stochiometric air required for combustion of Bagasse is about
a) 13.7
b) 3.2
c) 6
d) 18

32.Which fuel releases the most energy per kg on complete combustion
a) Carbon
b) Sulphur
c) Nitrogen
d) Hydrogen

33.How many kg of CO2 are produced in complete combustion of 16 kg of Methane?
a) 42
b) 44
c) 16
d) none of the above

34.In flue gas the theoretical CO2 is 15.5% and measured CO2 is 11% by volume. The percentage of excess air will be
a) 40.9%
b) 38.7 %
c) 240.9 %
d) 140.9 %

35.The lowest excess air is required in a
a) coal burner
b) low pressure oil burner
c) high pressure gas burner
d) high pressure oil burner

36.Which of the following is not measured in ultimate analysis?
a) carbon
b) sulphur
c) hydrogen
d) ash

37.With increase in the percentage of excess air for combustion of coal, percentage ofCO2 in flue gas.
a) Increases
b) decreases
c) remains same
d) none of the above

38.Good opportunity for energy savings from continuous blow down of boiler is by
a) recovery of flash steam for use in deaerator
b) using the blow down steam to run steam turbine
c) reusing the hot water so formed as make-up water
d) none of the above

39.Which of the following benefits is not achieved by maximizing condensate recovery?
a) minimization of boiler exit flue gas temperature
b) maximization of boiler output
c) reduction in water treatment costs
d) reduction in energy input costs

40.Which of the following is most suitable for high temperature waste heat recovery ?

a) heat whee
c) heat pipe
b) heat pump
d) recuperator

41. Thermocouples are often chosen because of:

a) High accuracy
b) Ability to measure high temperatures
c) Economy
d) Ability to measure an extremely narrow span of temperature

42. A temperature range between 300 °F and 310 F° or 149°C to 154°C must be measured with the greatest possible accuracy. The best choice of the system would be:

a) A copper RTD
b) A copper-constant at thermocouple
c) A nickel RTD
d) A Class lA filled thermal system

43.A hygrometer is

a) Convenient for measuring specific gravity
b) An instrument that measures gas weight
c) Any instrument that measures moisture content
d) Another name for psychrometer

44.Anemometer was invented by

a) Sir Tom Kurtz
c) Sir Leon Battista Alberti
b) Sir Richard Morris Hunt
d) Sir Louis Braille

45. The radiant efficiency of the luminous source depends on

a) The shape of the source
c) The wavelength of the light rays
b) The temperature of the source
d) All of the above

46.The unit of luminous flux is

a) Steradian
c) Lumen
b) Candela
d) Lux

47.The illumination is directly proportional to the cosine of the angle made by the normal to the illuminated surface with the direction of the incident flux. Above statement is associated with

a) Planck's law
c) Bunsen's law of illumination
b) Macbeth's law of illumination
d) Lambert's cosine law

48.Which of the following can be used for measuring temperature?

a) Metallic diaphragm
b)Fluid expansion system
c)Capsule
d)Bourdon tube