Subject: - Basic Mechanical Engineering (22656)

SYLLABUS

Chapter No.	Name of chapter	Marks With Option
1	Steam Boiler and Steam Turbine	12
2	IC engine and Gas Turbine	14
3	Fluid Machinery	16
4	Air Compressor	14
5	Refrigeration and Air Conditioning	14
	Total Marks: -	**70**

BOARD THEORY PAPER PATTERN FOR BME (22214)

Q.1		**Attempt any FIVE** **5*2=10**
	a)	Define dryness fraction and degree of superheat.
	b)	What is compounding of steam turbines?
	c)	Enlist four important components of I.C. engines.
	d)	Define Mach number.
	e)	Write two effect of knocking in engine.
	f)	Define ton of refrigeration.
Q.2		**Attempt any THREE** **4*3=12**
	a)	Explain second law of thermodynamics and give 1 example of each statement.
	b)	Write the function of superheated and fusible plug in boilers.
	c).	Draw layout of steam power plant and name the components.
	d)	Explain construction and working of impulse turbine with simple sketch.
Q.3		**Attempt any THREE** **4*3=12**

	a)	Suggest with justification the remedies in the following situations : i) Engine does not start. ii) Smokey exhaust of diesel engine.
	b)	Differentiate between open and closed cycle gas turbines.
	c)	Suggest various measures to control the pollution due to petrol engine and diesel engines.
	d)	A dam having 50 m head of water. i) Suggest with justification the turbine to be used. ii) Sketch the turbine you suggest.
Q.4		**Attempt any THREE** **4*3=12**
	a)	Explain the working of two stage reciprocating air compressor with PV diagram.
	b)	Suggest the type of air compressor for the following applications : i) Refrigerator (domestic) ii) Central air conditioner iii) Air filling station iv) Domestic air cooler.
	c)	Explain two methods to reduce power consumption of air compressor.
	d)	In a diesel engine, heat is supplied at the rate of 16.8 kW engine produces power at the rate of 4.2 kW. Estimate the brake thermal efficiency.
	e)	A turbine is operating on 120 m of water head. The discharge of water is 3.5 m3/s. Find the power developed by the turbine, neglecting the losses. Take density of water 9.81 kN/m3.
Q.5		**Attempt any TWO** **6*2=12**
	a)	Explain with neat sketch the vapour compression system used in domestic refrigerator.
	b)	Suggest the remedial action to be taken over following faults occurred in window air conditioner. i) Desired cooling effect is not getting. ii) Air conditioner making more noise. iii) Unit is not running. iv) Throw of conditioned air in room is with bad odour and dust.
	c)	Suggest with justification the type of air conditioning system for i) Computer lab of 60 computers

		ii) Auditorium iii) ATM.
Q.6		**Attempt any TWO** **6*2=12**
	a)	Explain the function of following : i) Defrost heaters ii) Thermostat iii) HP/LP cutouts.
	b)	Classify various types of nozzles and give their applications.
	c)	Write with justification the situations when you will select the following pumps for particular applications. i) Centrifugal pump ii) Jet pump iii) Submersible pump.

CLASS TEST - I

PAPER PATTERN

COURSE: - Basic Mechanical Engineering (22214)

PROGRAMME: - Electrical Engineering

Syllabus: -

Unit No.	Name of the Unit	Course Outcome (CO)
1	**Check the board based working of various type of boilers and steam turbine**	**CO-214.01**
2	**Check the board based working of various type of diesel engine and gas turbine**	**CO-214.02**
3	**Check the board based working of various type of Pelton and Francis Turbine**	**CO-214.03**

Q.1	**Attempt any FOUR** **4*2=8Marks**	Course Outcome (CO)
a)	Define dryness fraction and degree of superheat.	CO-214.01
b)	What is compounding of steam turbines?	CO-214.01
c)	Enlist four important components of I.C. engines.	CO-214.02
d)	Define Mach number.	CO-214.03
e)	Write two effect of knocking in engine.	CO-214.02
Q.2	**Attempt any THREE** **3*4=12 Marks**	
a)	Differentiate between open and closed cycle gas turbines.	CO-214.03
b)	Write the function of superheated and fusible plug in boilers.	CO-214.01
c).	Draw layout of steam power plant and name the components.	CO-214.01
d)	Differentiate between open and closed cycle gas turbines.	CO-214.02

CLASS TEST - II

PAPER PATTERN

COURSE: - Basic Mechanical Engineering (22214)

PROGRAMME: - Electrical Engineering

Syllabus: -

Unit No.	Name of the Unit	Course Outcome (CO)
4	Check the board based working of various type of Air Compressor	CO-214.04
5	Check the board based working of various type of Refrigeration and Air Conditioning System	CO-214.05

Q.1	Attempt any FOUR 4*2=8Marks	Course Outcome (CO)
a)	State the meaning of HVAC.	CO-214.05
b)	State the application of Nozzle.	CO-214.03
c)	Define pressure and state its SI units.	CO-214.04
d)	State the unit of Brake Power and define Brake Thermal Efficiency.	CO-214.04
e)	Define Ton of Refrigeration.	CO-214.05
Q.2	**Attempt any THREE 3*4=12 Marks**	
a)	Explain the working of two stage reciprocating air compressor with PV diagram.	CO-214.04
b)	Suggest the type of air compressor for the following applications i) Refrigerator (domestic) ii) Central air conditioner	CO-214.05
c)	Explain two methods to reduce power consumption of air compressor.	CO-214.04
d)	In a diesel engine, heat is supplied at the rate of 16.8 kW engine produces power at the rate of 4.2 kW. Estimate the brake thermal efficiency.	CO-214.03

COURSE OUTCOME (CO)

COURSE: - Basic Mechanical Engineering (22214)

PROGRAMME: - Electrical Engineering

CO. NO.	Course Outcome
CO-214.01	Check the board based working of various type of boilers and steam turbine
CO-214.02	Check the board based working of various type of diesel engine and gas turbine
CO-214.03	Check the board based working of various type of Pelton and Francis Turbine
CO-214.04	Check the board based working of various type of boilers and steam turbine
CO-214.05	Check the board based working of various type of Refrigeration and Air Conditioning System

1. Steam Boiler and Steam Turbine (Total Marks = 12)

Position in Question Paper **Total Marks-12**

Q.1. a) 2-Marks.
Q.2. a) 4-Marks.
Q.4. a) 6-Marks.

Descriptive Question.

1. Define Dryness fraction, Wet steam
2. Define Enthalpy, Degree of superheat and state their SI units.
3. Describe the functions of three parts Cochran boiler using a sketch.
4. Sketch the layout of a steam power plant and do the following
   i. Label the components.
   ii. Describe the function of any two major components.
5. List the three methods of compounding steam turbines with a sketch of any one.
6. Define enthalpy and state its SI unit.
7. Define thermodynamic work, give its unit.
8. Give various statements for 'first law of thermodynamics'.
9. What are the limitations of first law of thermodynamics
10. State Kelvin-Plank and clausius statement of second law of thermodynamics
11. State the two statements of second law of thermodynamics.
12. Define wet steam, and superheated steam.
13. Define degree of superheat.
14. Define 'Dryness fraction' of steam.
15. Draw labeled sketch of Babcock and Wilcox boiler.
16. Describe the working of Babcock and Wilcox boiler
17. State the applications of Babcock and Wilcox boiler.

MCQ Question

(Total number of Question= Marks*3=12*3=36)

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

1. Mechanical equivalent of heat for 1 kcal or Joule's equivalent is equal to
   a) 421 kg.m
   b) 421 kg.m
   c) 539 kg.m
   d) 102 kg.m
2. The effect of super-saturation is that the
   a) Mass of the steam discharged increase
   b) Entropy and specific volume of the steam increases
   c) Exit velocity of steam reduces
   d) All of these
3. The diameter of superheated tubes in a locomotive boiler is
   a) 130 mm
   b) 13 mm
   c) 31 mm
   d) 230 mm
4. The change in internal energy in steam engines equals to
   a) Work done during the Rankine cycle
   b) Work done during compression
   c) Work done during adiabatic expansion
   d) Change in enthalpy
5. The pressure velocity compounded impulse turbine allows a bigger pressure drop and hence _____ numbers of stages are required.
   a) More
   b) Less
   c) Equal
   d) None of these
6. In fire tube boilers
   a) Water passes through the tubes which are surrounded by flames and hot gases
   b) **The flames and hot gases pass through the tubes which are surrounded by water**
   c) Forced circulation takes place
   d) None of these
7. The shell diameter and length of locomotive boiler are
   a) 1.5 m, 4 m
   b) 1.5 m, 6 m
   c) 1 m, 4 m
   d) 2 m, 4 m
8. The ratio of the workdone on the blades to the energy supplied to the blades, is called
   a) Blading efficiency
   b) Nozzle efficiency
   c) Gross or stage efficiency
   d) Mechanical efficiency

9. The numbers of fire tubes in a Cochran boiler are
a) 75 b) 115
c) 165 d) 225

10. In forced circulation type boiler
a) Heating takes place at bottom and the water supplied at bottom gets converted into the mixture of steam bubbles and hot water which rise to drum
b) Water is supplied in drum and through down comers located in atmospheric condition it passes to the water wall and rises to drum in the form of mixture of water and steam
c) Feed pump is employed to supplement natural circulation in water wall type furnace
d) Water is converted into steam in one pass without any recirculation

11. The critical pressure ratio for initially dry saturated steam is
a) 0.546 **b) 0.577**
c) 0.582 d) 0.601

12. In cross compounding, the cylinders are arranged
a) Side by side and each cylinder has common piston, connecting rod and crank
b) Side by side and each cylinder has separate piston, connecting rod and crank
c) At 90° and each cylinder has common piston, connecting rod and crank
d) At 90° and each cylinder has separate piston, connecting rod and crank

13. Vacuum for reciprocating steam engines compared to steam turbines is
a) More **b)** Equal
c) Less d) None of these

14. In a nozzle, the effect of super-saturation is to
a) Decrease dryness fraction of steam
b) Decrease specific volume of steam
c) **Increase the entropy**
d) Increase the heat drop

15. The cylindrical shell of a Lancashire boiler has diameter from
a) 1 to 2 m b) 1.25 to 2.25 m
c) 1.5 to 2.5 m d) **1.75 to 2.75 m**

16. How can we classify steam generators on the basis of application?
a) utility steam generators b) industrial steam generator
c) marine steam generator d) **all of the mentioned**

17. What is the critical pressure of steam?
a) **221.2 bar** b) 220 bar
c) 120 bar d) 300 bar

18. An air preheater is installed _____
a) **between the economiser and chimney**
b) before the superheater
c) before the economiser
d) none of the mentioned

19. What is the length of shell of a Locomotive boiler?
a) 5m
b) **4m**
c) 3m
d) 2m

20. Which of the following statement is correct?
a) **A simple vertical boiler has one fire tube**
b) A fire tube boiler occupies less space than a water tube boiler, for a given power
c) Steam at a high pressure and in large quantities can be produced with a simple vertical boiler
d) all of the mentioned

21. The object of producing draught in a boiler is _____
a) to discharge the gases of combustion to the atmosphere through the chimney
b) to exhaust the gases of combustion from the combustion chamber
c) to provide an adequate supply of air for the fuel combustion
d) all of the mentioned

22. The natural draught is produced by _____
a) team jet
b) **chimney**
c) centrifugal fan
d) none of the mentioned

23. Which of the following statement is wrong?
a) Water tube boilers are internally fired
b) Locomotive boiler is a water tube boiler
c) La-mont boiler is a low pressure water tube boiler
d) All of the mentioned

24. Which of the following boiler is best suited to meet the fluctuating demand of steam?
a) **Locomotive boiler**
b) Lancashire boiler
c) Babcock and Wilcox boiler
d) Cornish boiler

25. Which of the following auxiliaries are not used in steam Generators?
a) **economiser**
b) burner
c) fan
d) stoker

26. The formation of scale boiler leads to _____
a) **decrease in efficiency of boiler**
b) increase in efficiency of boiler
c) increase in heat transfer
d) decrease in maintenance of boiler

27. What is the pH value of water permissible for boiler?
a) 0
b) 7
c) **slightly less than 7**
d) slightly more than 7

28. Which device used to separate condensate from the steam without letting steam escape?
a) condenser
b) steam valve
c) **steam trap**
d) none of the mentioned

29. What is the disadvantage of natural draught?
a) it has less life
b) it has more maintenance cost of cleaning and more capital cost to build the chimney
c) **the available draught decreases with increasing outside air temperature**
d) all of the mentioned

30. The natural draught in the steam generator depends upon _____
a) the air condition outside the chimney
b) the temperature of exhaust gases
c) **the air condition outside the chimney & the temperature of exhaust gases**
d) none of the mentioned

31. What is the purpose of super heater in a boiler?
a) to increase the temperature of saturated steam with increase in its pressure
b) **to increase the temperature of saturated steam without increase in its pressure**
c) to increase the temperature of feedwater for better efficiency
d) none of the mentioned

32. How is the natural draught produced for exhaust gases?
a) by using fan
b) **by using chimney**
c) by using gravity
d) none of the mentioned

33. What is the purpose of using economizer in the boiler?
a) **to heat feed water by utilizing heat from exhaust gases**
b) to heat feed water by utilizing some heat from superheated steam
c) to superheat steam
d) none of the mentioned

34. Comparing fire tube and water tube boilers, which boiler can produce comparatively higher pressure steam than another for the same capacity?
a) fire tube boiler
b) **water tube boiler**
c) both can produce steam at same pressure for the same capacity
d) none of the mentioned

35. The boiler in which the tubes are surrounded by hot gases is called _____

a) fire tube boiler
b) **water tube boiler**
c) both fire and water tube boiler
d) none of the mentioned

36. Which of these is not a type of steam generator depending upon the kind of applications?

a) utility steam generators
b) marine steam generators
c) **agricultural steam generators**
d) industrial steam generators

2. IC engine and Gas Turbine (Total Marks = 14)

Position in Question Paper **Total Marks-14**

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

Descriptive Question

1. Enlist four important components of I.C. engines.
2. Sketch and explain chassis layout of front engine rear wheel drive.
3. (Draw layout of steam power plant and name the components.
4. Enlist the Common fault in IC engine
5. State the type of gas turbine on following basis.(i) Working cycle (iii) Cycle of operation (ii) Application (iv) Fuels
6. State any four application of gas turbine.
7. Describe the working of closed cycle gas turbine. Q.5 Draw a labelled sketch of closed cycle gas turbine.
8. Draw the labelled sketch closed cycle gas turbine
9. State the function of heat exchanger
10. Compare closed cycle and open cycle gas turbine.
11. Enlist the factors for control of pollution due to gas turbine and diesel engine.

MCQ Question

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

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

1. The working cycle in case of four stroke engine is completed in following number of revolutions of crankshaft

   a) 1/2 b) 1
   c) **2** d) 4

2. In a diesel engine, the fuel is ignited by
   a) spark
   b) injected fuel
   c) heat resulting from compressing air that is supplied for combustion
   d) ignition

3. Scavenging air in diesel engine means
   a) air used for combustion sent under pres-sure
   b) burnt air containing products of combustion
   c) air used for forcing burnt gases out of engine's cylinder during the exhaust period
   d) air fuel mixture.

4. Supercharging is the process of
   a) supplying the intake of an engine with air at a density greater than the density of the surrounding atmosphere
   b) providing forced cooling air
   c) injecting excess fuel for raising more load
   d) supplying compressed air to remove combustion products fully

5. The ratio of indicated thermal efficiency to the corresponding air standard cycle efficiency is called
   a) net efficiency b) efficiency ratio
   c) relative efficiency d) overall efficiency

6. Compression ratio of LC. engines is
   a) the ratio of volumes of air in cylinder before compression stroke and after compression stroke
   b) volume displaced by piston per stroke and clearance volume in cylinder
   c) ratio of pressure after compression and before compression
   d) swept volume/cylinder volume

7. The air standard efficiency of an Otto cycle compared to diesel cycle for the given compression ratio is
a) same b) less
c) more d) unpredictable

8. The calorific value of gaseous fuels is expressed in terms of
a) kcal b) kcal/kg
c) kcal/m2 d) **kcal/n?**

9. If the intake air temperature of I.C. engine increases, its efficiency will
a) increase b) **decrease**
c) remain same d) depend on other factors

10. All heat engines utilize
a) low heat value of oil b) high heat value of oil
c) net claorific value of oil d) calorific value of fuel

11. An engine indicator is used to determine the following
a) speed b) temperature
c) volume of cylinder d) **m.e.p. and I.H.P.**

12. Fuel oil consumption guarantees for I .C. engine are usually based on
a) low heat value of oil b) **high heat value of oil**
c) net calorific value of oil d) calorific value of fuel

13. If the compression ratio of an engine working on Otto cycle is increased from 5 to 7, the %age increase in efficiency will be
a) 2% b) 4%
c) 8% d) **14%**

14. In case of gas turbines, the gaseous fuel consumption guarantees are based on
a) high heat value b) **low heat value**
c) net calorific value d) calorific value

15. In a typical medium speed 4-stroke cycle diesel engine the inlet valve
a) opens at 20° before top dead center and closes at 35° after the bottom dead center
b) opens at top dead center and closes at bottom dead center
c) opens at 10° after top dead center and closes 20° before the bottom dead center
d) remains open for 200°.

16. The pressure and temperature at the end of compression stroke in a petrol engine are of the order of
a) 4 – 6 kg/cm2 and 200 – 250°C
b) **6 – 12 kg/cm2 and 250 – 350°C**
c) 12 – 20 kg/cm2 and 350 – 450°C
d) 20 – 30 kg/cm2 and 450 – 500°C

17. The pressure at the end of compression in the case of diesel engine is of the order of
a) 6 kg/cm b) 12kg/cmz
c) 20 kg/cmz d) **35 kg/cm**

18. The maximum temperature in the I.C. engine cylinder is of the order of
a) **2000-2500°C** b) 500- 1000°C
c) 1000- 1500°C d) 1500-2000°C

19. The thermal efficiecny of a diesel cycle having fixed compression ratio, with increase in cut-off ratio will
a) increase b) **decrease**
c) be independent d) none of the above

20. Pick up the wrong statement
a) 2-stroke engine can run in any direction
b) In 4-stroke engine, a power stroke is obtained in 4-strokes
c) thermal efficiency of 4-stroke engine is more due to positive scavenging
d) **petrol engines occupy more space than diesel engines for same power output**

21. Combustion in compression ignition engines is
a) homogeneous b) **heterogeneous**
c) both (a) and (b) d) laminar

22. The fuel in diesel engine is normally injected at pressure of
a) 5-10 kg/cm2 b) 20-25 kg/cm2
c) 60-80 kg/cm2 d) **90-130 kg/cm2**

23. The specific fuel consumption per BHP hour for diesel engine is approximately
a) 0.15 kg b) **0.2 kg**
c) 0.25 kg d) 0.3 kg

24. The temperature of interior surface of cylinder wall in normal operation is not allowed to exceed
a) **180°C** b) 80°C
c) 120°C d) 240°C

25. Crankcase explosion in I.C. engines usual occurs as
a) **first a mild explosion followed by a bi explosion**
b) first a big explosion followed by a mil explosion
c) both mild and big explosions occi simultaneously
d) never occurs

26. Compression loss in I.C engines occurs due to
a) leaking piston rings b) use of thick head gasket
c) clogged air-inlet slots d) **all of the above**

27. The specific fuel consumption per BH hour for a petrol engine is approximately
a) 0.15 kg b) 0.2 kg
c) 0.25 kg d) 0.3kg

28. The air requirement of a petrol engine during starting compared to theoretical air required for complete combustion is
a) more b) **loss**
c) same d) depending on engine capacity

29. The inlet value of a four stroke cycle I.C engine remains open for nearly
a) **235°** b) 180°
c) 125° d) 200°

30. Which of the following is not an interns combustion engine
a) 2-stroke petrol engine b) 4-stroke petrol engine
c) diesel engine d) **steam turbine**

31. Pick up the false statement
a) Thermal efficiency of diesel engine i about 34%
b) Theoretically correct mixture of air am petrol is approximately 15 : 1
c) High speed compression engines operate on dual combustion cycle
d) **S.I. engines are quality-governed engines**

32. If one cylinder of a diesel engine receives more fuel than the others, then for that cylinder the
a) exhaust will be smoky
b) piston rings would stick into piston grooves
c) **scavenging occurs**
d) exhaust temperature will be high

33. The output of a diesel engine can be increased without increasing the engine revolution or size in following way
a) feeding more fuel b) **supercharging**
c) increasing flywheel size d) heating incoming air

34. It the temperature of intake air in IC engines is lowered, then its efficiency
a) **increase** b) decrease
c) remain same d) None of these

35. In a typical medium speed 4-stroke cycle diesel engine
a) **compression starts at 35° after bottom dead center and ends at top dead center**
b) compression starts at bottom dead center and ends at top dead center
c) compression starts at 10° before bottom dead center and, ends just before top dead center
d) may start and end anywhere

36. For the same compression ratio
a) Diesel cycle is more efficient'than Otto
b) **Otto cycle is more efficient than the Diesel**
c) both Otto and Diesel cycles are, equally efficient
d) compression ratio has nothing to do with efficiency

37. The precess of breaking up or a lipuid into fine droplets by spraying is called
a) vaporisation b) carburetion
c) atomisation d) ionisation

38. Which is main component in gas turbine plant ?

a) Boiler
b) **Compressor**
c) Condenser
d) Nozzle

39. Gas Turbine works on which cycle .....

a) Otto cycle
b) Rankine cycle
c) Joule cycle
d) Diesel cycle

40. Which fuel mainly used in gas turbine power plant.

a) Gas oil
b) Coal and peat
c) Reheating
d) Kerosene oil

41. Efficiency of gas turbine is increased by using.....

a) Inter cooling
b) **Adding a generator**
c) Reheating
d) All of above

42. Gas turbine is a ..... types of combustion chamber.

a) **Internal**
b) Open
c) External
d) None of these

3. Fluid Machinery (Total Marks = 16)

Position in Question Paper **Total Marks-14**

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

Descriptive Question

1. Enlist the type of hydraulic turbines.
2. Draw neat sketch of reciprocating pump.
3. Describe working of reciprocating pump
4. State the purpose of air vessel in reciprocating pump.
5. Draw a labeled sketch of casing centrifugal Pump.
6. Write the function of impeller in a centrifugal pump.
7. List the different types of impellers of centrifugal pump.
8. Explain working of centrifugal pump with neat sketch. State the different types of Impellers with their applications.
9. State different types of casings used in centrifugal pump.
10. Draw different types of casings used in centrifugal pump.
11. Define suction head and delivery head of centrifugal pump.
12. Explain the working of centrifugal pump with neat sketch.
13. Explain the priming of centrifugal pump.
14. Compare centrifugal and reciprocating pump.
15. Describe the working of submersible pump.
16. State the application of submersible pump.
17. Describe the working of jet pump.
18. 19 State the application of jet pump

MCQ Question

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

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

1. Bernoulli's equation cannot be applied when the flow is
a) rotational
b) turbulent
c) unsteady
d) **all of the above**

2. Streamline and equipotential lines in a flow field
a) are parallel to each other
b) are identical to each other
c) **are perpendicular to each other**
d) intersect at acute angles

3. Relative density of mercury is
a) 1
b) 9.8
c) 13.6
d) 1000

4. A Newtonian fluid is defined as the fluid which
a) Is compressible
b) **Obeys Newton's law of viscosity**
c) Obeys Hook's law
d) None of these

5. If the Reynolds number is less than 2000, the flow in a pipe is
a) Turbulent
b) **Laminar**
c) Transition
d) None of the above

6. A flow is called super-sonic if the
a) Velocity of flow is very high
b) Discharge is difficult to measure
c) Mach number is between 1 and 5
d) Mach number is less than 1

7. The unit of pressure one bar is
a) 1 Pascal
b) 1 kilo Pascal
c) 100 kPascal
d) 1000 kPascal

8. The dynamic viscosity of a liquid is 1.2×10^{-4} Ns/m^2, whereas, the density is 600 kg/m^3. The kinematic viscosity in m^2/s is
a) 72×10^{-3}
b) **20×10^{-8}**
c) 7.2×10^{3}
d) 70×10^{6}

9. The location of the centre of pressure over a surface immersed in a liquid is
a) always above the centroid
b) will be at the centroid

c) **will be below the centroid**
d) for higher densities it will be above the centroid and for lower densities it will be below the centroid

10. The continuity equation is the result of application of the following law to the flow field
a) First law of thermodynamics
b) Conservation of energy
c) Newtons second law of motion
d) **Conservation of mass**

11. Reynolds number signifies the ratio of
a) **inertial forces to viscous forces**
b) gravity forces top viscous forces
c) inertia forces to gravity forces
d) buoyant forces to inertia forces

12. In pipe flow the critical Reynolds number is about
a) 640
b) 5×10^5
c) 2000
d) 64000

13. Anemometer is used to measure
a) **Velocity**
b) Pressure
c) Viscosity
d) Density

14. Property of fluid that describes its internal resistance is known as:
a) Friction
b) Resistance
c) Viscosity
d) Internal energy

15. Which fluid does not experience shearing stress during flow?
a) Pseudoplastic
b) Dilatant
c) Newtonian
d) **Inviscid**

16. Stress strain relationship for Newtonian fluid is
a) Parabolic
b) Hyperbolic
c) Linear
d) Inverse type

17. According to Archimede's principle, if a body is immersed partially or fully in a fluid then the buoyancy force is _____ the weight of fluid displaced by the body
a) **equal to**
b) less than
c) more than
d) unpredictable

18. If a cylindrical wooden pole, 20 cm in diameter, and 1 m in height is placed in a pool of water in a vertical position (the gravity of wood is 0.6), then it will
a) Float in stable equilibrium
b) **Float in unstable equilibrium**
c) Float in neutral equilibrium
d) Start moving horizontally

19. An open tank contains water to depth of 2m and oil over it to a depth of 1m. If the specific gravity of oil is 0.8, then the pressure intensity at the interface of the two fluid layers will be
a) **7848 N/m^2**
b) 8720 N/m^2
c) 9747 N/m^2
d) 9750 N/m^2

20. Consider the following statements

For a body totally immersed in a fluid
I-The weight acts through the centre of gravity of the body
II-The up thrust acts through the centroid of the body
Of these statements

a) **Both I and II are true**
b) I is true but II is false
c) I is false but II is true
d) Neither I nor II is true

21. A simple Pitot tube can be used to measure which of the following quantities?
I-Static head
II-Datum head
III-Dynamic head
IV-Friction head
V-Total head
Select the correct answer using the codes given below

a) I, II and IV
b) **I, III and V**
c) II, III and IV
d) II, III and V

22. The shear stress in turbulent flow is

a) **Linearly proportional to the velocity gradient**
b) Proportional to the velocity gradient
c) Dependent on the mean velocity of flow
d) Due to the exchange of energy between the molecules

23. Consider the following statements regarding a plane area submerged in a liquid:
I-The total force is the product of specific weight of the liquid, the area and the depth of its centroid
II-The total force is the product of the area and the pressure at its centroid
Of these statements

a) I alone is correct
b) II alone is correct
c) Both I and II are false
d) **Both I and II are correct**

24. The buoyant force acting on a floating body passes through the

a) Metacentre of the body
b) **Centre of gravity of the body**
c) Centroid of volume of the body
d) Centroid of the displaced volume

25. Which one of the following sets of conditions clearly apply to an ideal fluid?

a) Viscous and compressible
b) **Non viscous and incompressible**
c) Non viscous and compressible
d) Viscous and incompressible

26. For flow through a horizontal pipe, the pressure gradient dp/dx in the flow direction is

a) +ve
b) 1
c) zero
d) **-ve**

27. In a pipe flow, the heat lost due to friction is 6 m. If the power transmitted through the pipe has to be maximum then the total head at the inlet of the pipe will have to be maintained at

a) 36 m
b) 30 m
c) 24 m
d) **18 m**

28. The loss of head in a pipe of certain length carrying a rate of flow of 'Q' is found to be 'H'. If a pipe of twice the diameter but of the same length is to carry a flow rate of 2Q, then the head loss will be

a) H
b) H/2
c) H/4
d) **H/8**

29. For a stream function to exist, which of the following conditions should hold?

I-The flow should always be irrotational
II-Equation of continuity should be satisfied
III-The fluid should be incompressible
IV-Equation of continuity and momentum should be satisfied

Select the correct answer using the codes given below

a) I, II, III and IV
b) I, III and IV
c) II and III
d) **II alone**

30. The vertical component of the hydrostatic force on a submerged curved surface is the

a) Mass of liquid vertically above it
b) **Weight of the liquid vertically above**
c) Force on a vertical projection of the surface
d) Product of pressure at the centroid and the surface area

31. If a hydraulic press has a ram of 12.5 cm diameter and plunger of 1.25 cm diameter, what force would be required on the plunger to raise a mass of 1 tonne on the ram?

a) 981 N
b) **98.1 N**
c) 9.81 N
d) 0.98 N

32. The continuity equation $(\partial u/\partial x) + (\partial v/\partial y) + (\partial w/\partial z) = 0$

a) Ideal fluid flow
b) **Incompressible fluid whether the flow is steady or not**
c) Steady flow, whether it is compressible or nor
d) Steady flow and compressible fluids

33. Flow separation is likely to take place when the pressure gradient in the direction of flow is

a) Zero
b) Slightly favourable
c) Adverse
d) Strongly favourable

34. The thickness of laminar boundary layer at a distance 'X' from the leading edge over a flat varies as

a) X
b) $\mathbf{X^{1/2}}$
c) $X^{1/5}$
d) $X^{4/5}$

35. If the diameter of a capillary tube is doubled, the capillary rise will become

a) $\sqrt{2}$ times less
b) Double
c) Half
d) $\sqrt{2}$ times more

36. Velocity defect in boundary layer theory is defined as

a) The error in the measurement of velocity at any point in the boundary layer

b) **The difference between the velocity at a point within the boundary layer and the free stream velocity**
c) The difference between the velocity at any point within the boundary layer and the velocity near the boundary
d) The ratio between the velocity at a point in the boundary layer and the free stream velocity

37. Match list I (Device) with list II (Use) and select the correct answer using the codes given below the lists:

List I (Device)	**List II (Use)**
a. Pitot tube	1. Boundary shear stress
b. Preston tube	2. Turbulent velocity fluctuations
c. Flow Nozzle	3. The total head
d. Hot wire anemometer	4. Flow rate

Codes:

a) a-4, b-2, c-3, d-1
b) **a-3, b-1, c-4, d-2**
c) a-4, b-1, c-3, d-2
d) a-3, b-2, c-4, d-1

38. What is the correct formula for absolute pressure?
a) $P_{abs} = P_{atm} - P_{gauge}$
b) $P_{abs} = P_{vacuum} - P_{atm}$
c) $P_{abs} = P_{vacuum} + P_{atm}$
d) $\mathbf{P_{abs} = P_{atm} + P_{gauge}}$

39. When is a liquid said to be not in a boiling or vaporized state?
a) If the pressure on liquid is equal to its vapour pressure
b) If the pressure on liquid is less than its vapour pressure
c) **If the pressure on liquid is more than its vapour pressure**
d) Unpredictable

40. One litre of a certain fluid weighs 8N. What is its specific volume?
a) 2.03×10^{-3} m^3/kg
b) 20.3×10^{-3} m^3/kg
c) 12.3×10^{-3} m^3/kg
d) $\mathbf{1.23 \times 10^{-3}\ m^3/kg}$

41. Bulk modulus is the ratio of
a) shear stress to volumetric strain
b) volumetric strain to shear stress
c) **compressive stress to volumetric strain**
d) volumetric strain to compressive stress

42. Which type of body is an airfoil?
a) **streamline body**
b) wave body
c) bluff body
d) induced body

43. The body whose surface does not coincide with the streamline when places in a flow is called as
a) streamline body
b) wave body
c) bluff body
d) induced body

44. The sum of components of shear forces in the direction of flow of fluid is called as
a) shear drag
b) friction drag
c) skin drag
d) **all of the above**

45. The component of the total force exerted by fluid on a body in the direction parallel to the direction of motion is called as
a) lift
b) **drag**
c) both a. and b.
d) none of the above

46. Boundary layer thickness is the distance from the boundary to the point where velocity of the fluid is
a) equal to 10% of free stream velocity
b) equal to 50% of free stream velocity
c) equal to 90% of free stream velocity
d) **equal to 99% of free stream velocity**

47. Square root of the ratio of inertia force to elastic force is called as
a) Mach's Number
b) Cauchy's Number
c) Both a. and b.
d) None of the above

48. Which of the following number is applicable in open hydraulic structure such as spillways, where gravitational force is predominant?
a) Reynold's Number
b) Euler's Number
c) Weber's Number
d) **Froude's Number**

4. Air Compressor (Total Marks = 14)

Position in Question Paper **Total Marks-14**

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

Descriptive Question

1. State the different uses of compressed Air.
2. Define free air delivered.
3. Describe the working of single stage reciprocating compressor. Q.4 Explain working of two stage reciprocating compressor.
4. Compare single stage and multistage compressor on Intercooler and power required to drive.
5. Describe working of centrifugal compressor.
6. Draw a sketch of centrifugal compressor.
7. Enlist the part of centrifugal compressor.
8. State two applications of rotary compressor.
9. Compare reciprocating and centrifugal compressor.
10. State any four methods to reduce power consumption in air compressor with justification

MCQ Question

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

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

1. What is the function of the air compressor?
a) Decreases the pressure of air
b) **Increases the pressure of air**
c) Removes dust particles
d) Adds lubricating oil

2. Which among the following are the applications of air compressors?
a) **Supercharging of IC engines**
b) Agriculture
c) Railways
d) Aerospace

3. Which among the following are not the accurate selection criteria for air compressors?
a) Free air delivery
b) Air receiver capacity
c) Power supply
d) **Speed**

4. What is the normal pressure at which the compressed air is stored?
a) 30 bar
b) 40 bar
c) 10 bar
d) 100 bar

5. Which among the following leads to conserving of energy?
a) **Conserving compressed air**
b) Wasting the compressed air
c) Using compressed air for Cleaning and Washing
d) Allowing leakages of compressed air

6. What is the use of Intake air filters?
a) To reduce the temperature of the air
b) To reduce the temperature of the air
c) **To prevent dust from entering the compressor**
d) To remove the traces of moisture

7. What is the function of Interstage coolers?
a) **To reduce the temperature of the air**
b) Used as storage and smoothened
c) To prevent dust from entering the compressor
d) To remove the traces of moisture

8. The removal of moisture from the compressed air is done using ____
a) receivers
b) **moisture drain traps**
c) air dryers
d) interstage coolers

9. A compressor increases the ___ of a gas by ___ its ___ .

a) **pressure, reducing, volume** b) pressure, increasing, volume
c) pressure, reducing, temperature d) pressure, increasing, temperature

10. Compressors are similar to

a) gears b) flywheel
c) pumps d) turbines

11. Following type is a positive displacement compressor

a) Screw b) Diaphragm
c) Centrifugal d) All of the above

12. Reciprocating compressors use ___ driven by a ___ .

a) belt, pulley b) chain, sprocket
c) pistons, crankshaft d) any of the above

13. Commonly used compressors in automotive applications

a) **5 to 30 HP** b) 50 to 100 HP
c) 500 to 1000 HP d) more than 1000 HP

14. Reciprocating compressors suffer higher losses due to

a) clearance volumes
b) resistance due to discharge and suction valves
c) more weight
d) **all of the above**

15. Rotary screw compressor use __ helical screw(s) to force the gas into smaller space.

a) one b) **two**
c) three d) four

16. Screw compressors

a) have less moving components
b) less vibration and surging
c) can operate at variable speeds
d) **all of the above**

17. Rotary vane compressors can be

a) either stationary or portable
b) single or multi-staged
c) driven be electric motors or internal combustion engines
d) **all of the above**

18. Rotary vane compressors can have mechanical efficiency of about

a) 70% b) 80%
c) 90% d) 100%

19. A diffuser section in Centrifugal compressor coverts velocity energy to

a) mechanical energy b) heat energy
c) pressure energy d) potential energy

20. With multiple staging, a centrifugal compressor can achieve higher output pressure greater than
a) 1.5 MPa
b) 3.0 MPa
c) 5.1 MPa
d) **6.9 MPa**

21. Compressors are used in automobiles as
a) superchargers
b) turbochargers
c) both (A) and (B)
d) pumps

22. Axial compressors use ___ to progressively compress a fluid.
a) pistons
b) **airfoils**
c) lobes
d) none of the above

23. Following compressor(s) is (are) used in Aeroplane engine.
a) Axial compressor
b) Centrifugal compressor
c) Mixed flow compressor
d) **All of the above**

24. Rotary compressors are used where ____ quantities of gas are needed at relatively ____ pressure.
a) large, high
b) **large, low**
c) small, high
d) small, low

25. Rotary compressor can be classified as
a) displacement compressor
b) steady-flow compressor
c) both of the mentioned
d) none of the mentioned

26. In steady-flow compressor, compression occurs by
a) **transfer of kinetic energy**
b) transfer of potential energy
c) trapping air
d) all of the mentioned

27. In displacement compressor, compression occurs by
a) transfer of kinetic energy
b) transfer of potential energy
c) trapping air
d) all of the mentioned

28. The rotary positive displacement machines are ____ and compression is ____
a) cooled, isothermal
b) uncooled, isothermal
c) cooled, adiabatic
d) **uncooled, adiabatic**

29. The Roots blower and vane-type compressor are the types of
a) **displacement compressor**
b) steady-flow compressor
c) both of the mentioned
d) none of the mentioned

30. For a Root blower, as pressure ratio increases, efficiency ____
a) increases
b) **decreases**
c) remains constant
d) none of the mentioned

31. The vane type compressor requires ____ the Roots blower.
a) equal work input
b) more work input
c) less work input
d) none of the mentioned

32. The centrifugal and axial flow compressor are the types of
a) displacement compressor
b) **steady-flow compressor**
c) both of the mentioned
d) none of the mentioned

33. Which of the following is true for a centrifugal compressor?
a) rotation of impeller compresses the air
b) diffuser converts part of KE into internal energy
c) typical pressure ratio is around 1.4 to 1
d) **all of the above**

34. Which of the following is true for an axial-flow compressor?
a) blades are arranged in same manner as in reaction turbine
b) flow of air is along the axis of compressor
c) velocity of air changes when it passes through the blades
d) **all of the mentioned**

35. For uncooled rotary compressor, compression process is ____ while ideal process is ____
a) isothermal, adiabatic
b) isentropic, adiabatic
c) adiabatic, isentropic
d) adiabatic, isothermal

36. Reciprocating compressor is best suited for a....
a) Low flow rate and low pressure
b) **Low flow rate and high pressure**
c) High flow rate and low pressure
d) Low flow rate and high pressure.

37. If large clearance volume in reciprocating compressor, result in.....
a) Increased volume flow rate
b) Lower delivery pressure
c) Lower suction pressure
d) **Reduce volume flow rate**

38. In reciprocating compressor one should aim at compressing the air.....
a) Poly topically
b) **Isothermal**
c) Isobaric
d) Adiabatic

39. Reciprocating compressor are provided with.....
a) Proppet valve
b) Solenoid valve
c) Simple disc / plate valve
d) Spring loaded disc valve

40. In two stage reciprocating air compressor with suction pressure is 2.5 bar and delivery 10 bar then ideal intercooler pressure will be.....
a) 3 bar
b) 4 bar
c) 5 bar
d) 6 bar

41. In two stage reciprocating air compressor with suction pressure is 4 bar and delivery 10 bar then ideal intercooler pressure will be.....

a) 6 bar
b) 6.5 bar
c) 6.3 bar
d) 7 bar

42. The degree of reaction is usually kept _____ for all types of axial flow compressors.

a) 0.2
b) 0.3
c) 0.4
d) **0.5**

5. Refrigeration and Air Conditioning (Total Marks = 14)

Position in Question Paper **Total Marks-14**

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

Descriptive Question

1. State the requirement of HVAC and Air conditioning.
2. Define Refrigeration
3. Define One ton of refrigeration.
4. Identify the component in vapour compression cycle.
5. Draw Block diagram of simple vapour compression cycle.
6. Enlist the Components of Vapour Compression Refrigeration Cycle and their functions.
7. Identify the component of domestic refrigerator.
8. Describe the working of domestic refrigerator.
9. Draw the neat sketch of Window Air Conditioner.
10. State the function of each component in Window Air Conditioner.
11. Describe the working of Overload Protector.
12. Describe the working of Thermostat Control.
13. Explain working of Starting relay.
14. State the function of Defrost Heater.
15. Explain H.P/LP cut out.
16. State the types of Air conditioning systems.
17. Describe the working of window Air conditioning.
18. Describe the Package air conditioning systems.
19. Draw the layout of centralised air conditioning system. Name the various component used in central air-conditioning system,
20. State the possible cause and remedies.
21. 22 Enlist the method energy saving in refrigeration and air conditioning.

MCQ Question

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

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

1. Which of the following refrigerant has lowest freezing temperature?
   a) Carbon dioxide
   b) Ammonia
   c) Freon-12
   d) **Freon-22**
2. The working fluid in Bell Coleman cycle is
   a) Carbon dioxide
   b) Ammonia
   c) Freon-12
   d) **Air**

3. In a vapour compression system, the compression of refrigerant follows the law
   a) PVr = C
   b) PV = C
   c) PVn = C
   d) None of the above

4. The dry bulb temperature lines of psychometric chart are
   a) **Vertical**
   b) Horizontal
   c) Inclined
   d) Curved
5. When the lower temperature is fixed, COP of a refrigerating machine can be improved by
   a) operating the machine at higher speeds
   b) operating the machine at lower speeds
   c) raising the higher temperature
   d) lowering the higher temperature
6. Evaporative air-cooler is used effectively when
   a) dry bulb temperature is very close to the wet bulb temperature
   b) dry bulb temperature is high and relative humidity is high
   c) dry bulb temperature is low and relative humidity is high
   d) dry bulb temperature is high and the relative humidity is low
7. Refrigerant Freon 12 belongs to
   a) **methane family**
   b) ethane family
   c) ketone family
   d) aldehyde family
8. Sometimes refrigerant plants use cooling towers. The water cooled in these towers is used
   a) for defrosting evaporator coils
   b) to cool compressor cylinder only
   c) to cool the evaporator coils
   d) to cool refrigerant in condenser

9. The statements concern Psychometric chart.
I-Constant relative humidity lines are uphill straight lines to the right
II-Constant wet bulb temperature lines are downhill straight lines to the right
III-Constant specific volume lines are downhill straight lines to the right
IV-Constant enthalpy lines are coincident with constant wet bulb temperature lines
Which of the statements are correct?
a) II
b) I and II
c) I and III
d) **II and IV**

10. In S.I. unit, one tonne of refrigeration is equal to
a) 110 kJ/min
b) 210 kJ/min
c) 50 kJ/min
d) none of the above

11. Subcooling occurs when the vapour
a) has high latent heat
b) removes sensible heat from refrigerant
c) has low latent heat
d) has high thermal conductivity

12. The refrigerant used in vapour absorption refrigerator is
a) Freon-12
b) Ammonia
c) CO_2
d) Aqua-ammonia

13. In a window air conditioner, the expansion device used is
a) Capillary tube
b) Thermostatic expansion valve
c) Automatic expansion valve
d) Float valve

14. Formula for R134a refrigerant is
a) CH Cl F_2
b) C_2 Cl_3 F_3
c) C_2 Cl_2 F_4
d) **C_2 H_2 F_4**

15. One ton of refrigeration is equal to
a) 21 KJ/min
b) 105 KJ/min
c) 210 KJ/min
d) 420 KJ/min

16. A low side float valve maintains the level of refrigerant in
a) Flooded evaporator
b) Evaporator
c) Condenser
d) Compressor

17. When wet bulb and dry bulb temperature are equal the humidity is
a) 60%
b) 80%
c) 90%
d) 100%

18. The refrigerant used in water cooler is
a) R21
b) R22
c) R134a
d) R717

19. The thermostat used for the window type air conditioner is set at:
a) 65°F
b) 75°F
c) 80°F
d) 85°F

20. Name the temperature at which moisture condenses on a surface:
a) Relative humidity b) Grains of moisture
c) Dew point temperature d) Humidity

21. A compressor externally coupled to a motor is called
a) Open type compressor b) Semi-sealed compressor
c) Hermitically sealed compressor d) None of the above

22. Brine solution density is checked by
a) Tachometer b) Anemometer
c) Barometer **d) Hydrometer**

23. Compressor used in Window Air Conditioner is
a) **Rotary compressor** b) Reciprocating compressor
c) Sealed compressor d) Open type compressor

24. Following is the heart of refrigeration system
a) Condenser b) Evaporator
c) Compressor d) None of the above

25. An ideal refrigerants is one whose boiling point is
a) Very high b) High
c) Medium **d) Low**

26. Boiling point of R-600a is
a) -15.8°C b) -14.8°C
c) -11.8°C d) -10.8°C

27. Colour code for ammonia refrigerant cylinder is
a) Light blue **b) Silver**
c) Orange d) Light green

28. The condenser in indirect system, condenses
a) Oil b) Refrigerant
c) Brine **d) Water**

29. The cooling capacity of 1.0 TR is:
a) 6000 BTU/Hr **b) 12000 BTU/Hr**
c) 18000 BTU/Hr d) 24000 BTU/Hr

30. Following is the type of zeotropic refrigerant
a) R-40 b) R-21
c) R-407C d) R-12

31. High side float valve is fitted on the condensing unit just after the
a) Receiver b) Compressor
c) Condenser d) Evaporator

32. When air is heated relative humidity
a) Decreases b) Increases
c) Very high d) None of the above

33. The Coefficient of Performance (COP) for an air refrigeration system is
a) Very high b) Moderate

c) High d) **Low**

34. Relay is protection device is used in

a) Evaporator **b) Compressor**

c) Condenser d) Thermostat

35. A domestic refrigerator, set at 2°C, handles on an average a thermal load of 8000 kJ per day. The ambient temperature is 30°C and the COP of the refrigerator is 0.15 times that of a Carnot refrigerator. The daily electricity consumption in kWh is approximately

a) 1.47 **b) 1.51**

c) 3.28 d) 2.86

36. COP of a reversed Carnot cycle refrigerator working between higher temperature T_2 and lower temperature T_1

a) will increase with increase in T1 keeping T2 fixed

b) will decrease with increase in T_1 keeping T_2 fixed

c) will first increase with increase in T_1 and then decrease with increase in T_1 keeping T_2 fixed

d) none of the above

37. A refrigerating machine working on reversed carnot cycle takes out 2kW of heat from the cold body while working between the temperature limits of 300K and 200K. The COP and power consumed by the cycle will be respectively.

a) 1 and 1kW b) 1 and 2kW

c) 2 and 1kW d) 2 and 2kW

38. A 1 ton capacity water cooler cools water steadily from 35°C to 20°C. The specific heat of water is 4.18 kj/kg-K. The water flow rate will be nearly.

a) 13.33 liter/hr b) 33.3 liter/hr

c) 200 liter/hr d) 250 liter/hr

39. Consider the following statements:

1. Prevents valve damage

2. enables use of thermostatic expansion valve

3. Minimizes irreversibility in the compressor

4. Prevents washing out of the lubricating oil from cylinder walls

Which of these statements is correct?

a) 1 and 2 b) 2 and 3

c) 1 and 4 d) 3 and 4

40. Sub-cooling heat exchanger is used in a refrigeration cycle. The enthalpies at condenser outlet and evaporator outlet are 78kJ/kg and 182 kJ/kg respectively. The enthalpy at outlet of isentropic compressor is 230kJ/kg and enthalpy of sub cooled liquid is 68kJ/kg. The COP of the cycle is

a) 3.25 b) 2.16

c) 3.0 d) 3.5

41. Waste heat can be effectively used in which one of the following refrigeration systems?

a) vapour compression refrigeration cycle
b) air refrigeration cycle
c) vapour absorption refrigeration cycle
d) vortex refrigeration cycle

42. In vapour absorption refrigeration system, heat is rejected in

a) condenser only
b) generator only
c) absorber only
d) condenser and absorber