V.S.B ENGINEERING COLLEGE, KARUR

DEPARTMENT OF MECHANICAL ENGINEERING

Two Mark Questions with answers

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ME6404 THERMAL ENGINEERING

UNIT I - GAS POWER CYCLES

1. What is an air- standard cycle? Why such cycles are conceives?

(May 2011, May 2012, May 2014)

Cycle is defined as the series of operations or processes performs on a system so that the system attains its original state. The thermodynamic cycles which use air as the working fluids are known as air- standard cycle.

2. What are the assumptions made for air standard cycle analysis?

(May 2011, May 2013, May 2015, May 2016)

(i)The working medium is a perfect gas through i.e., It follows the law $pv = mRT$

(ii)The working medium does not undergo any chemical change throughout The Cycle.

(iii)The compression and expansion processes are reversible adiabatic i.e., There is no loss or gain of entropy.

(iv)The operation of the engine is frictionless.

3. Mention the various processes of dual cycle. (May 2012, May2016)

(i) Isentropic compression.   (ii) Constant pressure heat supplied.

(iii) Isentropic expansion, and   (iv) Constant pressure heat rejection.

4. Define air standard cycle efficiency.

Air standard efficiency is defined as the ratio of work done by the cycle to heat supplied to the cycle.

5. Define mean effective pressure as applied to gas power cycles.

(May 2011, Dec 2013, May 2016)

Mean effective pressure is defined as the constant pressure acting on the piston during the working stroking. It is also defined as the ratio of work done to the stroke volume or piston displacement volume.

6. Define the following terms (i) Compression ratio (ii) Cut off ratio and (iii) Expansion ratio? (May 2014)

(i) Compression ratio is defined as the ratio between total cylinder volumes to clearance

volume.

(ii) Cut off ratio is defined as the ratio of volume after the heat addition to volume before the heat addition.

(iii) Expansion ratio is the ratio of volume after the expansion to the volume before expansion.

7. Which cycle is more efficient with respect to the same compression ratio?

For the same compression ratio, Otto cycle is more efficient than diesel cycle.

8. For the same compression ratio and heat supplied, state the order of decreasing air standard efficiency of Otto, diesel and dual cycle.

$$\text{Otto} > \text{Dual} > \text{Diesel}$$

9. Name the factors that affect air standard efficiency of Diesel cycle.

Compression ratio and cut-off ratio.

10. What is the effect cut-off ratio on the efficiency of diesel cycle when the compression ratio is kept constant? (Nov 2015)

When cut-off ratio of diesel cycle increases, the efficiency of cycle is decreased when compression ratio is kept constant and vice versa.

11. Write any four major differences between Otto and diesel cycle. (Nov 2015)

Sl. No.	Otto cycle	Diesel cycle
1	It consists of two Isentropic and two constant volume processes.	It consists of two isentropic, one constant volume and one constant pressure processes.
2	Heat addition takes place of constant volume.	Heat addition takes place of constant pressure.
3	Compression ratio is equal to expansion ratio.	Compression ratio is greater than expansion ratio.
4	Efficiency is more than diesel cycle for the same compression ratio and heat input.	Efficiency is less.

12. What is a thermodynamic cycle?

Thermodynamic cycle is defined as the series of processes performed on the system so that the system attains its original state.

13. Why is Carnot cycle not used in real applications?

In a Carnot cycle all four processes are reversible but in actual practice there is no

processes reversible.

14. Name the various gas power cycles.

- Carnot Cycle
- Otto Cycle
- Diesel Cycle
- Brayton Cycle
- Duel combustion cycle
- Atkinson Cycle

15. Define air standard efficiency of diesel cycle. (Nov 2013)

Air standard efficiency is defined as the ratio of work done by the cycle to the heat supplied to the cycle.

16. What is the range of compression ratio for Otto and Diesel cycle?

For Otto cycle 7to10 and Diesel cycle 12 to 23.

17. What are all modification carried out in brayton cycle? Why?

In Brayton cycles, the following devices can be incorporates to increase its thermal efficiency such as (i) Regenerator (ii) Reheated and (iii) Intercooler.

18. Is it always useful to have a regenerator in a gas turbine power cycle? Why?

It is not always useful to have a regenerator in a gas turbine cycle. The regenerator causes a pressure drop of 0.035 to 0.2bar in compressed air an about 0.035 bar in exhaust gases. These pressure drops affect the gain in efficiency due to regeneration.

19. What are the effects of providing the intercooler in the gas turbine cycle?

When the pressure ratio is very high, then the intercooler is provided between compressors.

20. What are the effects of reheat cycle?

(i) Thermal efficiency is less since the heat supplied is more.

(ii) Turbine output is increased for the same expansion ratio.

UNIT II – INTERNAL COMBUSTION ENGINES

1. List the various components of engine.

(i)Cylinder block (ii)Cylinder head (iii)Crankcase (iv) Cylinder liners (v) Piston& piston rings

2. Name the basic thermodynamic cycles of the two types of internal combustion reciprocating engines.

Otto cycle in S.I engines and diesel cycle in C.I engines.

3. Define compression ratio of an IC engine?

It is the ratio of volume when the piston is at BDC to the volume when the piston is at TDC.

4. What do you mean by short circuiting in two – stroke engine? (Dec 2013)

The amount of mixture that escape out the open port is known as short circuiting.

5. What is meant by highest useful compression ratio?

The compression ratio which gives maximum efficiency is known as highest useful compression ratio.

6. Why compression ratio of petrol engines is low while diesel engines have high compression ratio?

Since fire point of petrol is less as compared to diesel, petrol engine has low compression ratio.

7. Compare the thermal efficiency of petrol engines with diesel engines. Give reasons.

Thermal efficiency of diesel engine is greater than petrol engine this is due to high compression ratio.

8. What do you mean by scavenging in I.C. Engines?

The process of removing the burnt gases from the combustion chamber of engine cylinder by using fresh air fuel mixture is known as Scavenging.

9. Define Cetane number? (April 2014)

The property that quantities the ignition delay is called as Cetane number.

10. Which is better efficient two stroke or four stroke engines?

Two-stroke engine give always lesser efficiency than four-stroke engine due to incomplete combustion and poor scavenging.

11. Why a choke is used in carburetor and what is meant by automatic chocking?

Initially, more fuel is required to reduce high starting torque which is done by using supply unit will be cut off by a choke called automatic choking.

12. What are the important requirements of fuel injection system? (Nov 2015)

* The beginning as well as end of injection should take place sharply

* Inject the fuel at correct time in the cycle throughout the speed range of the engine.

* The injection of fuel should occur at the correct rate and in correct quantity as required by the varying engine load.

* Atomize the fuel to the required degree.

* Distribute the fuel throughout the combustion chamber for better mixing.

13. Mention different types of fuel injection systems in C. I engines.

a) Air injection system

b) Airless or Solid injection

(i)   Common rail system

(ii)   Individual pump system.

14. Define delay period with respect to a CI engine.

The physical delay period is the time between the beginning of injection and the attainment of chemical reaction reaction conditions. During this period fuel is atomized, mixed with air and raised to its self-ignition temperature. During the chemical delay reactions start slowly ad then accelerate until ignition takes place.

15. What is the purpose of providing spark plug in SI engine?

The function of a spark plug is to produce an electric spark for the ignition of compressed air-fuel mixture inside the engine cylinder.

16. What is the purpose of a thermostat in an engine cooling system? (Nov 2015)

A Thermostat valve is used in the water-cooling system to regulate the circulation of water in system to maintain the normal working temperature of the engine parts during the different operating conditions.

17. State any three functions of lubrication?

a) It reduces friction between moving parts.

b) It reduces wear and tear of the moving parts.   c)   It minimizes power boss due to friction.

18. Define the term brake power. (May 2014)

        Brake power is the useful power available at the crankshaft. It is always lesser than the indicated power. The brake power of an IC engine is usually measured by means of brake mechanism.

19. What is meant by detonation or knocking in SI engine? (May 2016)

        This phenomenon of combustion causing heavy pressure rise during uncontrolled combustion is known as knock.

20. What do you mean by scavenging in IC Engine? (Nov 2010, May 2013)

        The process of removing the burnt gases from the combustion chamber of engine cylinder is known as scavenging.

UNIT III -STEAM NOZZLES AND TURBINES

1. What are the various types of nozzles and their functions?

Nozzle is a duct of varying cross-sectional area in which the velocity increases with the corresponding drop in pressure.

2. What are the effects of friction on the flow through a steam nozzle? (May 2011, May 2014)

1. The final fraction of the steam is increased as the part of the kinetic energy gets converted into heat due to friction and absorbed by steam with n increase in enthalpy.

2. The expansion is no more isentropic and enthalpy drop is reduced thereby resulting in lower exit velocity.

3. The specific volume of steam is increased as the steam becomes drier

due to this frictional reheating.

3. Define nozzle efficiency and critical pressure ratio. (Dec 2011, Dec 2013, Nov 2010)

Nozzle efficiency: It is defined as the ratio of actual enthalpy drop to the isentropic enthalpy drop

Nozzle efficiency = Actual enthalpy drop / Isentropic enthalpy drop

Critical pressure ratio: There is only one value of the ratio (P2/P1)

which produces maximum discharge from the nozzle. The ratio is called critical pressure ratio.

Critical pressure ratio $P_2/P_1 = (2/n+1)^{n/n+1}$

Where,

P_1= Initial pressure, P_2= Throat pressure.

4. Explain the phenomenon of super saturated expansion in steam nozzle. (Or) What is Meta stable flow? (Nov 2010, May 2013, May 2015)

When the supersaturated steam is expanded in the nozzle, the condensation should occur in the nozzle. Since the steam has a great velocity, the condensation does not take place at the expected rate. So the equilibrium between the liquid and vapour phase is delayed and the steam continues to expand in a dry state.

The steam in such set of condition is said to be supersaturated or meta stable flow.

5. What are the conditions that produce super saturation of steam in nozzles?

When the superheated steam expands in the nozzle, the condensation

will occur in the nozzle. Since, the steam has more velocity, the condensation will not take place at the expected rate. So, the equilibrium between the liquid and vapour phase is delayed and the steam continues to expand in a dry state.

The steam in such set of condition is said to be supersaturated or meta stable flow.

6. What are the effects of super saturation in a steam nozzle? (Dec 2012, Nov 2015)

The following effects in a nozzle on steam, in which super saturation occurs, may be

summarized as follows.

1. The dryness fraction of the steam is increased.

2. Entropy and specific volume of the steam are increased.

3. Exit velocity of the steam is reduced.

4. Mass of stream discharged is increased.

7. What are the differences between supersaturated flow and isentropic flow through steam nozzles?

Supersaturated flow	Isentropic flow
1. Entropy is not constant	Entropy is constant
2. Reduce in enthalpy drop	No reduce in enthalpy drop
3. We cannot use mollier diagram to solve problems	We can use mollier diagram tosolve problems.

8. The critical pressure ratio initially dry saturated steam is.

$$P_2 / P_1 = 0.577$$

9. The critical pressure ratio for initially super heated steam is _____ as compared to initially dry saturated steam. **Less.**

10. When the backpressure of a nozzle is below the designed value of pressure at exit of nozzle, the nozzle is said to be _____ **Under damping.**

11. What is a steam turbine?

Steam turbine is a device which is used to convert kinetic energy of steam into mechanical energy.

12. What is the fundamental difference between the operation of impulse and reaction steam turbines? (May 2011, May 2016)

Impulse Turbine	Reaction turbine
1. It consists of nozzles and moving blades.	It consists of fixed blades and moving blades.
2. Pressure drop occurs only in nozzles not in moving blades.	Pressure drop occurs in fixed as well as moving blades.
3. Steam strikes the blades with kinetic energy.	Steam passes over the moving blades with pressure and kinetic energy.
4. It has constant blade channels area.	It has varying blade channels area.

13. Explain the need of compounding in steam turbines. (Or) Explain the purpose of compounding in steam turbines. (Nov 2015)

In simple impulse turbine, the expansion of steam from the boiler pressure to condenser pressure takes place in a single stage turbine. The velocity of steam at the exit of turbine is very high. Hence, there is a considerable loss of kinetic energy (i.e. about 10to 12%). Also the speed of the rotor is very high (i.e. up to 30000rpm). There are several methods of reducing this speed to lower value. Compounding is a method of absorbing the jet velocity in stages when the steam flows over moving blades.

14. What are the different methods of compounding?

1. Velocity compounding

2. Pressure compounding

3. Pressure-velocity compounding

15. What is meant by carry over loss?

The velocity of steam at exit is sufficiently high thereby resulting in a kinetic energy loss called "Carry over loss" or "Leading velocity loss".

16. What is pressure compounding? (May 2015)

The pressure is reduced in each stage of nozzle rings and hence, it is called pressure compounding.

17. What are the different methods of governing steam turbines? (May 2013)

- Throttle Governing

- Nozzle Control Governing

- By- Pass Governing

- Combination of Throttle and Nozzle governing or Throttle and by-pass governing.

18. Define degree of reaction. (May 2014)

It is defined as the ratio of isentropic heat drop in moving blades to isentropic heat drop in the entire stage of the reaction turbine.

19. Enumerate the energy losses in steam turbines. (May 2011, May 2012)

- Losses in regulating valves

- Losses due to steam friction

- Losses due to mechanical friction

- Losses due to leakage

20. What are the effects of super saturation in a steam nozzle? (Dec 2012, Nov 2015)

(i) The dryness fraction of the steam is increases

(ii) Entropy and specific volume of the steam are increased

(iii) Exit velocity of the steam is reduced.

(iv) Mass of steam discharged is increased.

UNIT IV - AIR COMPRESSOR

(1) Classify the various types of air compressors. (Nov 2010)

1. According to the and principle of operation

       a)Reciprocating compressors   b) Rotary compressors.

2) According to the action

       a) Single acting compressors   b) Double acting compressors

3) According to the number of stages

       a) Single stage compressors   b) Multistage compressors

4) According to the pressure limit

a) Low pressure compressors b) Medium pressure compressors c) High pressure compressors

5) According to the capacity

 a)Low capacity compressors b) Medium capacity compressors c) High capacity compressors

(2) What is meant by single acting compressors?

In single acting reciprocating compressor, the suction, compression and delivery of air takes place on both sides of the piston

(3)What is meant by single stage compressor?

In single stage compressor, the compression of air from the initial pressure to the final .pressure is carried out in one cylinder only.

(4)What is meant by double acting compressor?

In double acting reciprocating compressor, the suction, compression and delivery of air takes place on both sides of the piston.

(5) Indicate the application of reciprocating compressors in industry? (May 2011, May 2012)

The applications of compressed air as follows:

1) Pneumatic brakes 2) Pneumatic jakes. 3) Pneumatic drills. 4) Pneumatic lifts. 5) Spray painting. 6) Shop cleaning. 7) Injecting fuel in diesel engines. 8) Supercharging internal combustion engines. 9) Refrigeration, and air conditioning systems.

(6) What are the advantages of multi stage compression with internal cooling over single stage compression for the same pressure ratio?

1. It improves the volumetric efficiency for the given pressure ratio.

2It reduces the leakage loss considerably.

3. It gives more uniform torque and hence a smaller size flywheel is required.

4. It reduces the cost of the compressor.

(7) Define the terms as applied to air compressors: Volumetric efficiency and isothermal compression efficiency.(or) Define the mechanical efficiency and isothermal efficiency of a reciprocating air compressor and Volumetric efficiency:

Volumetric efficiency is defined as the ratio of volume of free air sucked into the compressor per cycle to the stroke volume of the cylinder.

Isothermal efficiency is defined as the ratio between isothermal work to the actual work of the compressor.

$$\text{Isothermal efficiency} = \frac{\text{brake power}}{\text{Indicated power}}$$

(8) Define clearance ratio?

Clearance ratio is defined as the ratio of clearance volume to swept volume

(or) stroke volume.

$$C = \frac{Vc}{Vs}$$

Vc=Clearance volume, Vs=Swept volume

(9) Discuss the effect of clearance upon the performance of an air compressor.

The volumetric efficiency of air compressor increases with decrease in clearance of the compressor.

(10) Give two merits of rotary compressor over reciprocating compressor.

1. Rotary compressor gives uniform delivery of air where compared to reciprocating compressor.

2. Rotary compressors are small in size for the same discharge as compared with reciprocating compressors.

3. Lubricating system is more complicated in reciprocating compressor

where as it is very simple in rotary compressor.

(11) Name the methods adopted for increasing isothermal efficiency of reciprocating air compressor.

Isothermal efficiency is increased by perfect inter cooling.

(12) Why clearance is necessary and what is its effect on the performance of reciprocating compressor?

When the piston reaches top dead center in the cylinder, there is a dead

space between piston top and cylinder head. This space is known as clearance space and

the volume occupied by this space is known as clearance volume.

(13) What is meant by inter cooler?

An inter cooler is a simple heat exchanger. It exchanges the heat of compressed air from the low-pressure compressor to the circulating.

(14) What are the factors that affect the volumetric efficiency of a reciprocating compressor?

1. Clearance volume.

2. Compression ratio.

(15) What is compression ratio?

Compression ratio is defined as the ratio between total volume and clearance volume.

Compression ratio =   Total volume.

Clearance volume.

16. Give the classification of compressor based on the movement of piston. (Dec 2013)

* Single acting compressor

* Double acting compressor

17. Define FAD or Free air delivered. (May 2011, Dec 2012, May 2015)

The free air delivered id the actual volume delivered at the stated pressure with reduced intake pressure and temperature and expressed in m^3/min.

18. What factors limited the delivery pressure in a reciprocating compressor? (Nov 2015)

* Size of the cylinder

* Stroke length

* Pressure and Temperature of intake air

19. What do you mean by perfect intercooling? (Dec 2012, Nov 2015)

When the temperature of air leaving the intercooler is equal to the original atmospheric air temperature then intercooling is known as perfect intercooling.

20. What are the advantages or effects of multi stage compression with intercooling over single stage compression for the same pressure ration? (Dec 2013, May 2015)

* The work done per kg of air is reduced in multistage compression with intercooler as compared with single stage compression for the same delivery pressure.

* It improve the volumetric efficiency for the given ratio.

* It reduces the leakage loss considerably.

* It reduces the cost of the compressor.

UNIT V- REFRIGERATION AND AIR–CONDITIONING

1. Define tonne of refrigeration. (May 2015)

A tonne of refrigeration is defined as the quantity of heat required to be removed from one tonne of water (1000kg) at 0 C to convert that into ice at 0 C in 24 hours. In actual practice, 1 tonne of refrigeration= 210kJ/min=3.5kW

2. Define tonne of refrigeration. Heat is removed from a space at a rate of 42,000kJ/h. Express this heat removal rate in tons.

A tonne of refrigeration is defined as the quantity of heat required to be removed from one tonne of water (1000kg) to convert that into ice at 0° C 24 hours.

3. The vapour compression refrigerator employs the ---- cycle.

Reversed Carnot.

4. The door of a running refrigerator inside a room was left open. What will happen?

The room will be gradually warmed up.

5. In a vapor compression refrigeration system, where the lowest temperature will occur?

At inlet of evaporator

6. How does the actual vapour compression cycle differ from that of the ideal cycle?

1. In actual cycles, pressure losses occur in both condenser and evaporator.

2. Friction losses occur in compressor.

7. Name four important properties of a good refrigerant.

1. Low boiling point.

2. High critical temperature and pressure.

3. Low specific heat of liquid.

8. What is the difference between air conditioning and refrigeration?

Refrigeration is the process of providing and maintaining the temperature in space below atmospheric temperature.

Air conditioning is the process of supplying sufficient volume of clean air containing a specific amount of water vapour and maintaining the predetermined atmospheric condition with in a selected enclosure.

9. What is the function of the throttling valve in vapor compression refrigeration system?

The function of throttling valve is to allow the liquid refrigerant under

high pressure and temperature to pass to controlled rate after reducing its pressure and temperature.

10. In a vapour compression refrigeration system, where the highest temperature will occur?

After compression.

11. The vapour absorption system can use low-grade heat energy in the generator. Is true or false?   **True.**

12. Name any four commonly used refrigerants.

1. Ammonia (NH3) 2. Carbon dioxide (CO2).

13. Explain unit of Refrigeration. (Nov 2010, May 2014)

Unit of refrigeration is expressed in terms of tonne of refrigeration.

A tonne of refrigeration is defined as the quantity of heat required to be removed from one tonne of water (1000kg) to convert that into ice at $0°$ C in 24 hours.

14. Why throttle valve is used in place of expansion cylinder for vapour compression refrigerant machine.

In throttling process, enthalpy remains constant and pressure is reduced so throttle valve is used.

15. What are the effect of superheat and sub cooling on the vapour compression cycle? (May 2012)

Superheating increases the refrigeration effect and COP may be increased or decreased. But sub cooling always increase the COP of the refrigeration and also decrease the mass flow rate of refrigerant.

16. What are the properties of good refrigerant? (Dec 2013, May 2012)

An ideal refrigerant should possess the following desirable properties.

1. The refrigerant should have low freezing point.

2. It must have high critical pressure and temperature to avoid large power requirements.

3. It should have low-specific volume to reduce the size of the compressor.

4. It should be nonflammable, non-explosive, non-toxic and non- corrosive.

17. What is net refrigerating effect of the refrigerant?

Refrigerating effect is the total heat removed from the refrigerant in the evaporator.

COP= Refrigeration effect

        Work done

Refrigeration effect= COP * Work done.

18. Name the various components used in simple vapour absorption system. (Dec 2013)

1. Absorber 2. Pump 3. Generator 4. Condenser. 5. Throttle valve. 6. Evaporator.

19. Define refrigerant.

Any substance capable of absorbing heat from another required substance can be used as refrigerant.

20. How does humidity affect human comfort?

If the humidity is above a certain level, water vapour from human body moisture cannot be absorbed by the atmospheric air. It results in discomfort because of sweating.

21. What is the difference between wet compression and dry compression? (May 2011, May 2012)

In wet compression, the compression starts between saturated liquid and saturated vapour region. The vapour enters the compressor at wet vapour conditions. In dry compression, the compression starts with saturated vapour. The vapour enters the compressor at dry vapour conditions.

ME6402 - MANUFACTURING TECHNOLOGY-II
UNIT – I

1. Explain the cutting shaping process?

The required shape of metal is obtained by removing the unwanted material from the work piece in the form of chips is called cutting shaping. Example: Turning, Drilling, Milling, Boring etc.

2. Classify the relative motion between work piece and cutting tool.

Rotation of work against the tool. Example: Turning,

Rotation of tool against work piece. Example: Drilling, Milling,

Linear movement of the work piece against the tool. Example: Planer,

Linear movement of the tool against the work. Example: Shaper.

3. Classify the various angles in cutting tool?

1) Back rake angle 2) Side rake angle 3) End relief angle 4) Side relief angle 5) Side cutting angle 6) End cutting angle.

4. What is tool signature?

The various angles of tools are mentioned in a numerical number in particular order. That order is known as tool signature.

5. What is effect of back rake angle and mention the types?

Back rake angle of tool is increases the strength of cutting tool and cutting action.

It can be classified into two types. 1. Positive rake angle. 2. Negative rake angle.

6. What is side rake angle and Mention its effects?

The angle between the tool face and the line parallel to the base of the tool. It is used to control chip flow.

7. What is clearance angle and mention the types?

These are the slopes ground downwards from the cutting edges. The clearance angle can be classified into two types. i Side relief angle. Ii. End relief angle. .

8. Explain the nose radius?

Joining of side and end cutting edges by means of small radius in order to increase the tool life and better surface finish on the work piece.

9. What are all conditions for using positive rake angle?

- To machine the work hardened materials.

- To machine low strength ferrous and non-ferrous metals.

- To turn the long shaft of small diameters.

- To machine the metal below recommended cutting speeds.

10.   When will the negative rake angles be used?

a. To machine high strength alloys. b. The machine tools are more rigid. c. The feed rates are high. d. To give heavy and interrupted cuts.

11.   Classify the types of metal cutting process?

The metal cutting processes are mainly classified into two types.

1.Orthogonal cutting process (two dimensional cutting),

2.Oblique cutting process (Three dimensional cutting).

12.   Define orthogonal and oblique cutting?

Orthogonal cutting: - The cutting edge of tool is perpendicular to the work piece axis.

Oblique cutting: - The cutting edge is inclined at an acute angle with normal to the cutting velocity vector is called oblique cutting process.

13. What is shear plane?

The material of work piece is stressed beyond its yield point under the compressive force. This causes the material to deform plastically and shear off. The plastic flow takes place in a localized region is called shear plane.

14.   What is cutting force?

The sheared material begins to flow along the cutting tool face in the form of small pieces. The compressive force applied to form the chip is called cutting force.

15.   What is chip and mention its different types?

The sheared material begins to flow along the cutting tool face in the form of small pieces is called chip. The chips are mainly classified into two types.

a. Continuous chip. b. Discontinuous chip. c. Continuous chip with built up edge.

18. When will the continuous chip deformed?

The following factor favors the formation of continuous c h i p .

(i)Ductile material (ii) Smaller depth of cut (iii) High cutting speed   (iv) Large rake angle

(v) Sharp cutting edge. (vi) Proper cutting fluid (vii) Low friction between tool face and chips.

19. What are the favorable factors for discontinuous chip formation?

a. Machining of brittle material, b. Small rake angle, c. Higher depth of cut, d. Low cutting speeds e. Excess cutting fluid. f. Cutting ductile material with low speed and small rake angle of the tool.

20. What are the favorable factors for continuous chip with built up edge?

1. Low cutting speed. 2. Small rake angle. 3. Coarse feed. 4..Strong adhesion between chip and tool face. 5. Insufficient cutting fluid.

UNIT – II

1. What are the various operations can be performed on a lathe?

1)Turning 2) Facing. 3) Forming. 4) Knurling 5) Chamfering 6) Thread cutting. 7) Drilling 8) Boring 9) Recessing 10) Tapping 11) Grooving etc.

2. What are the principle parts of a lathe?

l)Red 2) Headstock 3) Tailstock 4) Carriage 5) Cross-slide 6) Tool post

3. What is the main requites of a lathe bed?

The lathe bed should be very strong to withstand: cutting forces and vibrations during machining.

4. What are the uses of headstock?

1 Headstock carries a hollow spindle with nose to hold the work piece. 2.To mount the driving and speed changing mechanisms.

5. What is the main difference between live center and dead center?

Live center drives and rotates along with the work pieces.

Dead center is driven by headstock and it just supports support the other end of the work.

6. State the various parts mounted on the carriage.

a. Saddle, b. Compound rest, c.Cross slide, d. Tool post.

7. What is a compound rest?

A member or part, which is mounted on the top of the cross slide having a base graduated in degrees.

8. List any four types of lathes?

- Engine lathe.
- Bench lathe.
- Tool room lathe
- Semi-automatic lathe.
- Automatic lathe.

9. What is a semi-automatic lathe?

A lathe in which all the machining operations are performed automatically and loading and unloading of work piece, coolant on or off is performed manually.

10. What are the two types of semiautomatic lathe?

Capstan lathe

Turret lathe

11. What are the advantages semi-automatic lathes?

- Production time is minimized.
- Accuracy will be high.
- Production rate is increased.

12. What is an automatic lathe?

In addition to automatic machining operations loading and unloading are also performed automatically.

13. Define feed.

Feed is defined as the movement of the tool relative to the work piece by form tool.

14. State the various feed mechanisms used for obtaining automatic feed.

- Tumbler gear mechanism
- Quick change gearbox.
- Tumbler gear-Quick change gearbox.
- Apron mechanism.

15. List any four work holding devices.

- Chucks,
- Centers,
- Face plate,
- Angle plate.

16. Mention the use of chucks.

Chucks are used to hold the work piece of small length and large diameter.

17. What are the various types of chucks?

- Three jaw chuck (or) Self centering chuck.
- Four jaw chuck or Independent chuck.   ..
- Magnetic chuck

18. What is the use of Mandrels?

Mandrels are used for holding hollow work pieces.

19. Define steady and follower rest.

Steady rest:- It is fixed on bed ways of the lathe by .clamping the bolts.

Follower rest: - The saddle is mounted on the saddle and moves together with the tool.

20. What are the different operations performed on a lathe?

- Centering

- Rough turning

- Shoulder turning

- Chamfering Straight turning

- Finish turning

- Facing

- Knurling etc.

UNIT III

1. What is shaper?

The shaper is a reciprocating type of machine tool intended to produce flat surface. These surfaces may be horizontal, vertical or inclined.

2. Classify the shaper according to the reciprocating of ram.

i.Crank type, ii. Hydraulic type, iii. Geared type.

3. Classify the shaper according to the travel and position of the ram

a. Horizontal type, b. Vertical type, c. Traveling head type.

4. Classify the shaper according to the design of table

a. Standard type, b. Universal type.

5. Classify the shaper according to the type of cutting stroke

a. Push type, b. Draw type

6. List the different types of parts involved in the shaper

a. Base, b. Column, c. Cross rail, d. Saddle, e. Table, f. Ram, h. Tool head.

7. List the parts in tool head.

a. Swivel base, b. Vertical slide , c. Apron, d. Tool post

8. List the parts in apron.

a. Clapper box, b. Clapper block, c. Tool post

9. What are the different types of mechanism used in shaper?

- Crank and slotted Mechanism

- Whit worth mechanism

- Hydraulic shaper mechanism

10. List the two block used in the Crank and slotted Mechanism.

a. Bull gear sliding block, b. Rocker arm sliding block.

11. What is Crank and slotted Mechanism?

The rotary motion of the bull gear is transmitted in to reciprocating motion of the ram through the rocker arm.

12. What are the different types of adjustment made in the Crank and slotted Mechanism?

- Adjusting the length of stroke.
- Adjusting the position of the stroke.

13. What is the use of shaper dog in hydraulic shaper mechanism?

It is used to change the position of the flow to facilitate the reciprocating motion.

14. What are the advantages of hydraulic shaper mechanism?

- The cutting and return speed are partially constant through out the stroke.
- Infinite number of cutting may be obtained from zero to maximum value and control easier.

15. What are the work holding devices used in shaper.

- Clamping the vise
- Clamping on the table
- Clamped to the angular plate.

16. What are the devices used to hold the work in to the table?

- T bolt and clamps
- Stop pins
- Strip and stop pins

17. What are the different operations performed by using shaper?

1. Horizontal surface ,   2. Vertical surface

3. Angular surface ,   4. Cutting slot and key ways

5. Irregular surface

18. What is planer?

The planer like a shaper is a machine tool primarily intended to produce plane and flat surfaces by a single point cutting tools. it is used to machining a large work piece which cannot accommodate by shaper table.

19. What is the difference between shaper and planer?

The fundamental difference between shaper and planer is that in a planer the work which is supported on the table reciprocate and the cross wise and perpendicular movement of the tool but shaper the tool reciprocate cross wise and vertical movement of the table.

20. What are the types of planer?

1. Double housing planer 2. Open side planer 3. Pit planer Edge or plate planer

4. Divided table planer

KINEMATICS OF MACHINERY
TWO MARKS QUESTIONS & ANSWERS
UNIT 1 - BASICS OF MECHANISMS

1.   What is Kinematics?

Kinematics is the study of motion (position, velocity, acceleration). A major goal of

Understanding kinematics is to develop the ability to design a system that will satisfy

Specified motion requirements. This will be the emphasis of this class.

2.   What is Kinetics?

Kinetics is the study of effect of forces on moving bodies. Good kinematic design should

produce good kinetics.

3.   Define Link.

A link is defined as a member or a combination of members of a mechanism connecting other members and having relative motion between them. The link may consist of one or more resistant bodies. A link may be called as kinematic link or element. Eg: Reciprocating steam engine.

4. Define Kinematic Pair.

Kinematic pair is a joint of two links having relative motion between them. The types of kinematic pair are classified according to Nature of contact (lower pair, higher pair), Nature of mechanical contact (Closed pair, unclosed pair), Nature of relative motion (Sliding pair, turning pair, rolling pair, screw pair, spherical pair)

5. Define Kinematic Chain

When the kinematic pairs are coupled in such a way that the last link is joined to the first link to transmit definite motion it is called a kinematic chain.

Eg: The crank shaft of an engine forms a kinematic pair with the bearings which are fixed in a pair, the connecting rod with the crank forms a second kinematic pair, the piston with the connecting rod forms a third pair and the piston with the cylinder forms the fourth pair. The total combination of these links is a kinematic chain. Eg: Lawn mower.

6.   Define Degrees of Freedom.

It is defined as the number of input parameters which must be independently controlled in order to bring the mechanism in to useful engineering purposes.

It is also defined as the number of independent relative motions, both translational and

rotational, a pair can have.

7.   Define Pantograph.

Pantograph is used to copy the curves in reduced or enlarged scales. Hence this mechanism finds its use in copying devices such as engraving or profiling machines.

8.   What is meant by spatial mechanism?

Spatial mechanism have a geometric characteristics in that all revolute axes are parallel and perpendicular to the plane of motion and all prism lie in the plane of motion.

9.   Classify the Constrained motion?

Constrained motions are classified into three types

1. Completely constrained motion.

2. Incompletely constrained motion.

3. Successfully constrained motion.

10.   What is Toggle position?

It is the position of a mechanism at which the mechanical advantage is infinite and the sine of angle between the coupler and driving link is zero.

11.   What are the important applications of a single slider crank mechanism?

1.   Rotary or Gnome engine.

2.   Crank and slotted lever mechanism.

3.   Oscillating cylinder engine.

4.   Bull engine and

5.   Hand pump.

12.   Give some examples for kinematic pairs.

1. Crank and connecting rod,

2. Connecting rod and piston rod, and

3. Piston and engine cylinder.

13.   What is meant by transmission angle?

In a four bar chain mechanism, the angle between the coupler and the follower (driven) link is called as the transmission angle.

14.   What are the applications of inversion of double slider crank chain mechanism?

It consists of two sliding pairs and two turning pairs. There are three important inversions of double slider crank chain. 1) Elliptical trammel. 2) Scotch yoke mechanism. 3) Oldham's coupling. Give some examples for kinematic pairs.

15.   Write down the Grashof's law for a four bar mechanism?

Grashof's law states that the sum of the shortest and longest links cannot be greater than the sum of the remaining two links lengths, if there is to be continuous relative motion between two members.

16.   Define sliding pair.

When the two elements of the pair have only sliding motion between them, then the pair is said to be sliding pair. Example: Piston and cylinder of slider crank mechanism.

17.   Define turning pair.

When one link of a pair only rotates or turns with respect to axis of another link, then the pair is said to be turning pair. Example: Cycle wheel turning over its axle.

18.   What is Inversion of mechanism?

The method of obtaining different mechanism by fixing different links in a kinematic chain is known as inversion of mechanism.

19.   Define rolling pair.

When one link of a pair rolls over another link, then the pair is called as rolling pair. Example: Belt and pulley arrangement.

20.   Define screw pair.

When one link of a pair turns or rotates dependently with respect to an axis of the other link by screw thread, then the pair is called as screw pair.

21.   Define cylindrical pair.

When one link of a pair rotates and slides independently with respect to an axis about other link, then the pair is called as cylindrical pair. Example: Shaft in a circular hole.

22.   What is constrained kinematic chain?

When the relative motion of a chain is definite, then the chain is called as constrained kinematic chain.

23.   Define single slider crank chain mechanism.

A single slider crank chain is a modification of the basic four bar chain. It consists of one sliding pair and three turning pair.

24.   Define double slider crank chain mechanism.

A kinematic chain which consists of two turning pair and two sliding pair is known as double slider crank mechanism.

25.   What is locked chain?

When there is no relative motion between the links of a chain, then the chain is called as locked chain.

26.   What is unconstrained kinematic chain?

When the relative motion of a chain is not definite, then the chain is called as unconstrained kinematic chain.

27.   Define lower pair.

When the elements of pair have surface contact, then the pair is called as lower pair. The sliding turning pair, screw pair and spherical pair are lower pairs.

28.   Define higher pair.

When the elements of pair have point or line contact, then the pair is called as lower pair. The rolling pair is the higher pair.

UNIT 2 -KINEMATICS OF LINKAGE MECHANISMS

1.   What are the important concepts in velocity analysis?

*   The absolute velocity of any point on a mechanism is the velocity of that point with reference to ground.
*   Relative velocity describes how one point on a mechanism moves relative to another point on the mechanism.

2.   Define Instantaneous centre.

Instantaneous centre of a moving body may be defined as that centre which goes on changing from one instant to another.

3.   Define Instantaneous centre

Instantaneous axis is a line drawn through an instantaneous centre and perpendicular to the plane of motion.

4.   How to represent the direction of linear velocity of any point on a link with respect to another point on the same link?

The direction of linear velocity of any point on a link with respect to another point on the same link is perpendicular to the line joining the points.

5.   Define Kennedy's theorem.

The Kennedy's theorem states that if three bodies move relatively to each other, they have three instantaneous centers and lie on a straight line.

6.   Define displacement.

It may be defined as the distance moved by a body with respect to a fixed certain fixed point.

When there is no displacement in a body it is said to be at rest and when it is being displaced, it is said to be in motion.

7. **What are the types of motions?**
   - Rectilinear motion.
   - Curvilinear motion.
   - Circular motion.

8. **What are the methods for determining the velocity of a body?** Important methods for determining the velocity of a body are:
   - Graphical method
   - Relative velocity method
   - Instantaneous centre method
   - Analytical method.

9. **Define velocity.**

Velocity may be defined as the rate of change of displacement of a body with respect to the time. Since the velocity has both magnitude and direction, therefore it is a vector quantity.

10. **Define speed.**

Speed may be defined as the rate of change of linear displacement of a body with respect to the time. Since the speed is irrespective of its direction, therefore it is a scalar quantity.

11. **What is deceleration?**

The negative acceleration is also known as deceleration or retardation.

12. **Define Acceleration.**

The rate of change of velocity with respect to time is known as acceleration.

13. **Define coincident points.**

When a point on one link is sliding along another rotating link, then the point is known as coincident point.

14. **Define centrode.**

The locus of all instantaneous centre's (i.e., I_1, I_2,…) is known as centrode.

15. **Define Axode.**

The locus of all instantaneous axis is known as axode.

16. **Define Body centrode.**

The locus of all instantaneous centres relative to the body itself is called the body centrode.

UNIT 3 - KINEMATICS OF CAM MECHANISMS

1. **What is cam?**

A cam is a rotating machine element which gives reciprocating (or) oscillating motion to another element known as follower

2. Define tangent cam?

When the flanks of the cam are straight and tangential to the base circle and nose circle, the cam is known as tangent cam.

3. Distinguish radial and cylindrical cams.

Radial cam	Cylindrical cam
In this cam, the follower reciprocates (or) oscillates in a direction perpendicular to the axis.	In this the follower reciprocates (or) oscillates in a direction parallel to the cam axis.

4. What are the different motions of the follower?

a) Uniform motion,

b) Simple harmonic motion,

c) Uniform acceleration and retardation, and

d) Cycloidal motion.

5. Compare Roller and mushroom follower of a cam.

S.No	Roller Follower	Mushroom Follower
1.	Roller followers are extensively used where more space is available.	The mushroom followers are generally used where space is limited.
2.	It is used in stationary gas engines, oil engines and aircraft valves in engines.	It is used in cams which operate the valves in automobile engines.

6. Explain offset follower.

When the motion of the follower is along an axis away from the axis of the cam centre, it is called offset follower.

7. Define trace point in the study of cams.

It is a reference point on the follower and is used to generate the pitch curve. In case of knife edge follower the knife edge represents the trace point and the pitch curve corresponds to the cam profile. In a roller follower the centre of the roller represents the trace point.

8. Define pressure angle with respect to cams.

It is the angle between the direction of the follower motion and a normal to the pitch curve. This angle is very important in designing a cam profile. If the pressure angle is too large, a reciprocating follower will jam in its bearings.

9. Define Lift (or) Stroke in cam.

It is the maximum travel of the follower from its lowest position to the topmost position.

10. Define undercutting in cam. How is occurs?

The cam profile must be continuous curve without any loop. If the curvature of the pitch curve is too sharp, then the part of the cam shape would be lost and thereafter the intended cam motion would not be achieved. Such a cam is said to be undercut. Undercutting occurs in the cam because of attempting to achieve too great a follower lift with very small cam rotation with a smaller cam.

8. What do you know about Nomogram?

In Nomogram, by knowing the values of total lift of the follower (L) and the cam rotation angle ( ) for each segment of the displacement diagram, we can read directly the maximum pressure angle occurring n the segment for a particular choice of prime circle radius (R_0).

9. What are the classifications of cam based on the follower movement?

1) Rise-Return-Rise (R-R-R) cams,

2) Dwell-Rise-Return-Dwell (D-R-R-D) cams,

3) Dwell-Rise-Dwell-Return-Dwell (D-R-D-R-D) cams,

4) Dwell-Rise-Dwell (D-R-D) cams.

13. What are the different types of cams?

1. Wedge (or) flat cams

2. Radial (or) Disc cams

3. Spiral cams

4. Cylindrical (or) Barrel (or) Drum Cams

5. Conjugate cams

6. Globoidal cams

7. Spherical cams

14. What do you know about gravity cam?

In this type, the rise of the cam is achieved by the rising surface of the cam and the return by the force of gravity of die to the weight of the cam.

15. Define Trace point.

It is a reference point on the follower to trace the cam profile. In case of a knife edge follower, the knife edge itself is a tracing point and in roller follower, the centre of the roller is the tracing point.

16. Define pressure angle.

It is the angle between the direction of the follower motion and a normal to the pitch curve.

This is very important in cam design as it represents steepness of the cam profile. If the pressure angle is too large, a reciprocating follower will jam in its bearings.

17.   Define Prime circle.

The smallest circle drawn tangent to the pitch curve is known as the prime circle.

18.   Define Angle of Ascent.

The angle of rotation of cam from the position when the follower begins to rise till it reaches its highest position is known as angle of ascent. It is also known as out stroke and is denoted by $_0$.

19.   What is meant by Simple Hormonic Motion?

When a body rotates on a circular path with uniform angular velocity, its projection on the diameter will have simple harmonic motion. The velocity of the projection will be maximum at the centre of and zero at the ends of the diameter. In case of acceleration and retardation, the values will be zero at the centre and maximum at the ends of diameter.

20.   What are the different shapes of high speed cams?

1.   Circular Arc cam with flat faced follower

2.   Tangent cam with reciprocating roller follower

21.   Define cam angle.

It is the angle of rotation of the cam for a definite displacement of the follower.

22.   What are the classifications of follower based on the follower movement?

- Reciprocating (or) translating follower.
- Oscillating (or) rotating follower.

23.   Define Pitch curve.

The locus of the tracing point is known as the pitch curve. For the purpose of laying out the cam profiles, it is assumed that the cam is fixed and the follower rotates around it.

24.   What are the classifications of the follower based on the path of motion of the follower?

a)   Radial follower.

b)   Offset follower.

25.   What are the classifications of cam base on the constraint of the follower?

a)   Pre-loaded spring cams.

b)   Positive drive cams. c) Gravity cams.

UNIT 4 – GEARS AND GEAR TRAINS

1.   State law of Gearing.

The law of gearing states that for obtaining a constant velocity ratio, at any instant of teeth the common normal at each point of contact should always pass through a pitch point, situated on the line joining the centre of rotation of the pair of mating gears.

2.   Define normal and axial pitch in helical gears.

Normal pitch is the distance between similar face of adjacent teeth, along a helix on the pitch cylinder normal to the teeth.

Axial pitch is the distance measured parallel to the axis between similar faces of a adjacent teeth.

3.   What is the maximum efficiency in worm and worm gear?

$\max = 1\text{-sin} \ /1\text{+sin}$

4.   What are the advantages and limitations of gear drive? Write any two.

Advantages:

1.   Since there is no slip, so exact velocity ratio is obtained.

2.   It is more efficient and effective means of power transmission.

Limitations:

1.   Manufacture of gear is complicated.

2.   The error in cutting teeth may cause vibration and noise during operation.

5.   Define interference.

The phenomenon when the tip of tooth undercuts the roots on its mating gear is known as interference.

6.   Define cycloidal tooth profile and involute tooth profile.

A cycloid is the curve traced by a point on the circumference of a circle which rolls without slipping on a fixed straight line.

Involute profile is defined as the locus of a point on a straight line which rolls without slipping on the circumference of a circle.

7.   Define circular pitch and diametral pitch in spur gears.

Circular pitch (p_c) : It is the distance measured along the circumference of the pitch circle from a point on one teeth to the corresponding point on the adjacent tooth.

$$p_c = D/T$$

Diametral pitch (p_D) : It is the ratio of number of teeth to the pitch circle diameter.

$P_D = T/D = /p_c$

8. Define Backslash.

It is the difference between the tooth space and the tooth thickness along the pitch circle.

Backslash = Tooth space – Tooth thickness

9. What is gear train of train of wheels?

Two or more gears re made to mesh with each other to transmit power from one shaft to another. Such a combination is called a gear train or train of wheels.

10. Write velocity ratio in compound train of wheels? Speed of last follower - Product of teeth on drivers

Speed of first driver – Product of teeth on followers.

11. Define simple gear train.

When there is only one gear on each shaft, it is known as simple gear train.

12. What is reverted gear train?

When the axes of the first and last wheels are co-axial, the train is known as reverted gear train.

13. Where the epicyclic gear trains are used?

The epicyclic gear trains are used in the back gear of lathe, differential gears of the automobiles, pulley blocks, wrist watches, etc.

14. Write down the difference between involute and cycloidal tooth profile.

S.No	Involute Tooth Profile	Cycloidal Tooth Profile
1.	Variation in centre distance does not affect the velocity ratio.	The centre distance should not vary.
2.	Pressure angle remains constant Throughout the teeth.	Pressure angle varies. It is zero at the pitch point and maximum at the start and end of engagement.
3.	Interference occurs.	No interference occurs.
4.	Weaker teeth.	Stronger teeth.

15. Define Contact Ratio.

It is the ratio of the length of arc contact to the circular pitch is known as contact ratio. The value gives the number of pairs of teeth in contact.

16. What is an angle of obliquity in gears?

It is the angle between the common normal to two gear teeth at the point of contact and the common tangent at the pitch point. It is called as pressure angle.

17. What is bevel gearing? Mention its types.

When the non-parallel (or) intersecting but coplanar shafts connected by gears, they are called bevel gears and the arrangement is bevel gearing. It is of two types namely skew bevel

gearing and spiral gearing.

18.   What are the methods to avoid interference?

1.   The height of the teeth may be reduced.

2.   The pressure angle may be increased.

3.   The radial flank of the pinion may be cut back (undercutting).

19.   What is the advantage when arc of recess is equal to arc of approach in meshing gears?

When arc of recess equal to arc of approach, the work wasted by friction is minimum and efficiency of drive is maximum.

20.   What do you know about tumbler gear?

Tumbler gears are those which are used in lathes for reversing the direction of rotation of driven gears.

21.   What you meant by non-standard gear teeth?

The gear tooth obtained by modifying the standard proportions of gear teeth parameters is known as non- standard gear teeth.

22.   What is meant by compound gear train?

When there are more than one gear on shaft, it is called a compound gear train.

23.   What is the advantage of a compound gear train over a simple gear train?

The advantage of a compound gear train over a simple gear train is that a much larger speed reduction from the first shaft to the last shaft can be obtained with small gears.

24.   State the methods to find the velocity ratio of epicyclic gear train. Two methods are:

1)   Tabulation method.

2)   Algebraic method.

25.   What is the externally applied torques used to keep the gear train in equilibrium?

1)   Impart torque on the driving member.

2)   Resisting or holding torque on the driven member.

3)   Holding or braking torque on the fixed member.

UNIT 5 – FRICTION IN MACHINE ELEMENTS

1 .What is meant by slope of a thread?

It is the inclination of the thread with horizontal.

Slope of thread = $\tan^{-1}$ [Lead screw/Circumference of screw]

2. What are the effects of limiting angle of friction?

1.   If limiting angle of friction ( ) is equal to $\tan^{-1} \mu$, then the body will move over the plane irrespective of the magnitude of the force (F) (Limiting force of friction).

2.   If $<^{\tan-1}$ µ, then no motion of body on plane is possible irrespective of how large the magnitude of F may be.

3. Define co-efficient of friction (µ).

It is defined as the ratio of the limiting friction (F) to the normal reaction (R_N) between the two bodies.

µ   = Limiting force of friction/Normal reaction = F/R_N

4. Differentiate coefficient of friction in square thread and V-thread.

(a)   In square thread, $µ = F/R_N$

(b)   In V thread, $µ_1 = µ/\cos$

Where F = Limiting force of friction,

R_N = Normal reaction, and 2 = Angle of 'V' in a 'V' thread.

5. What is the efficiency of inclined plane?

The efficiency of an inclined plane is defined as the ratio between effort without friction (P_0) and the effort with friction (P).

6.   Why self- locking screws have lesser efficiency?

Self locking needs some friction on the thread surface of the screw and nut hence it needs higher effort to lift a body and hence automatically the efficiency decreases.

7.   What are the functions of clutches?

1.   It supplies power to the transmission system.

2.   It stops the vehicle by disconnecting the engine from transmission system.

3.   It is used to change the gear and idling the engine.

4.   It gives gradual increment of speed to the wheels.

8.   What is the difference between cone clutch and centrifugal clutch?

Cone clutch works on the principle of friction alone. But centrifugal clutch uses principle of centrifugal force in addition with it.

9.   Why friction is called as 'necessary evil'?

Friction is the important factor in engineering and physical applications such as belt and ropes, jibs, clutches and brakes, nut and bolts, so it is the necessary one. If the friction exceeds certain value it will cause heat, damage and wear when applied. So it is called 'necessary evil'.

10. What are the belt materials?

1.   Leather,

2.   Cotton or fabric,

3.   Rubber,

4. Balata, and

5. Nylon.

11. State the law of belting?

Law of belting states that the centre line of the belt as it approaches the pulley must lie in a plane perpendicular to the axis of the pulley or must lie in the plane of the pulley, otherwise the belt will runoff the pulley.

12. What you meant by 'Crowing in pulley"?

The process of increasing the frictional resistance on the pulley surface is known as crowning. It is done in order to avoid slipping of the belt.

13. What is meant by initial tension in belts?

In order to increase the frictional grip between the belt and pulleys, the belts is tightened

up. Due to this the belt gets subjected to some tension even when the pulleys are stationary. This tension in the belts is called initial tension (T_0).

14. List out the commonly used breaks.

1. Hydraulic brakes: e.g., Pumps or hydrodynamic brake and fluid agitator.

2. Electric brakes: e.g., Eddy current brakes.

3. Mechanical brakes: e.g., Radial brakes and axial brakes

15. What do you mean by a brake?

Brake is a device by means of which motion of a body is retarded for slowing down (or) to bring it to rest which works on the principle of frictional force, it acts against the driving force.

16. Explain velocity ratio.

It is defined as the ratio between velocity of the driver and the follower (or) driven.

17. State the law of belting?

Law of belting states that the centre line of the belt as it approaches the pulley must lie in a plane perpendicular to the axis of the pulley or must lie in the plane of the pulley, otherwise the belt will runoff the pulley.

18. What is the centrifugal effect on belts?

During operation, as the belt passes over a pulley the centrifugal effect due to its weight tends to lift the belt from the pulley surface. This reduces the normal reaction and hence the frictional resistance. The centrifugal force produces additional tension in the belt.

19. Write down the disadvantage of V-belt drive over flat belt?

1. V belt cannot be used in large distance.

2.   It is not as durable as flat belt.

3.   Since the V belt subjected to certain amount of creep therefore it is not suitable for constant speed applications such as synchronous machines, and timing devices.

4.   It is a costlier system.

20.   When is the cross belt used instead of open belt?

1.   Cross belt is used where the direction of rotation of driven pulley is opposite to driving pulley.

2.   Where we need more power transmission there we can use cross belt drive.

21.   Why lubrication reduces friction?

In practical all the manting surfaces are having roughness with it. It causes friction. If the surfaces are smooth then friction is very less. Lubrication smoothens the manting surface by introducing oil film between it. The fluids are having high smoothness then solids and thus lubrication reduces friction.

22.   What you meant by 'crowning in pulley'?

The process of increasing the frictional resistance on the pulley surface is known as crowning. It is done in order to avoid slipping of the belt.

23.   What is meant by initial tension in belts?

In order to increase the frictional grip between the belt and pulleys, the belt is tightened up. Due to this belt gets subjected to some tension even when the pulleys are stationary. This tension in the belt is called initial tension (T_0).

24.   Where does the P.I.V. drive system used?

P.I.V. (Positive Infinitely variable) drive is used in an infinitely varying speed system.

25.   When the intensity of pressure acting brake shoe is is assumed to uniform?

The intensity of pressure is assumed to be constant when the break shoe has small angle of contact. For large angle of contact, it is assumed that the rate of wear of the shoe remains constant.

ENGINEERING MATERIALS AND METROLOGY
TWO MARK QUESTIONS AND ANSWERS
UNIT I- CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS

1. What is an alloy?

A metal alloy, or simply an alloy, is a mixture of two or more metals or a metal and a nonmetal.

2. What is meant by Base Metal?

In an alloy, the element which is present in the largest proportion is called the base metal.

3. What are alloying elements?

In an alloy, all elements other than the base metal are called the alloying elements

4. Differentiate between substitutional and interstitial solid solutions

*In a substitutional solid solution, the solute atoms substitute for parent solvent atoms in a crystal lattice.

*In interstitial solid solution, the solute atoms fit into the space between the solvent or parent atoms.

5. What are intermetallic compounds?

The compound formed by two or more metals in apparently stoichiometric proportion is called intermetallic compounds.

6. What are the effects of crystal structure and atomic radii on formation of solid
solution between two metallic elements? (MAY/JUNE 2006)

Hume Rothery's Rules

1. Crystal structure: The two metallic elements that form solid solution must have the same crystal structure. Otherwise, there is some point at which a transition occurs from one phase to a second phase with a different structure.

2. Atomic radii: The solute and solvent elements atoms must be of similar size, with less than a 15% difference in atomic radius.

7. Define Peritectic and Eutectoid reactions. (MAY/JUNE 2006)

In Peritectic reaction, upon cooling a solid and a liquid phase transformation isothermally and reversibly to a solid phase having a different composition.

Liquid + Solid 1 cooling Solid 2 Heating

8. State the conditions under which two metallic will exhibit unlimited solid solubility. (NOV/DEC 2006)

To exhibit unlimited solid solubility, the solute and solvent elements should obey the following general rules of Hume Rothery

1. Size factor: The atoms must be of similar size, with less than the 15% difference in atomic radius.

2. Crystal structure: The materials must have the same crystal structure.

3. Valance: The atoms must have the same valence.

4. Electronegativity: The atoms must have the approximately the same electronegativity.

9. Define the term "ferrite" and "austenite" in iron – carbon alloy system. (NOV/DEC2006)

Ferrite is primary solid solution based on iron having BCC structure. Austenite is a primary solid solution based on iron having FCC structure. Both are interstitial solid solutions of carbon in iron.

10. What do you understand by "allotropy of iron?"

Allotropy refers to the possibility of existence of two or more different crystal structure for a substance depending upon temperature.

11. Why carbon solubility is more in an austenite?

Austenite is a primary solid solution based on iron having FCC structure. Carbon solubility is more in austenite is an interstitial solid structure of carbon in iron.

12. What is steel?

The ferrous alloy having the carbon composition ranging from 0.008 to 2 % is known as steel.

13. Distinguish between hypoeutectic and hypereutectic cast irons.

Cast irons that contain less than 4.3 % carbon are termed as hypoeutectic whereas cast iron that contains more than 4.3 % carbon is termed as hypereutectic cast irons.

14. What are cooling curves?

Cooling curves are obtained by plotting the measured temperatures at equal intervals during the cooling period of a melt to a solid.

15. State Gibb's phase rule.

Gibb's phase rule is given by

$F = C - P + 2$

Where,

F – Degrees of freedom of system or the no. of variables that may be changed independently without altering the equilibrium.

C – No. of components forming the system

P – Number of phases present in the system

16. What are intermediate phases?

If an alloying element is added in excess of the limit of solid solubility, a second phase appears along with the primary solution. If the second phase is differs in both crystal structure and properties from primary solid solution, than it is known as an intermediate phases.

17. What is an equilibrium phase diagram?

A phase diagram can be defined as a plot of the composition of phases as a function of temperature in any alloy system under equilibrium conditions.

18. Define phase.

A phase is defined as any physically distinct, homogeneous, and mechanically separable portions of a substance. Three different kinds of phases are solid, liquid and vapour.

19. How do cast irons differ from steels in terms of carbon content?

Composition from 0.008 to 2% carbon represent steel and those above 2% carbon represent cast iron.

20. What do you mean by invariant reaction?

The eutectic reaction is also called an invariant reaction since it occurs under equilibrium conditions at a specific temperature and alloy composition that cannot be varied.

UNIT II- HEAT TREATMENT

1. Define the term heat treatment.

Heat treatment may be defined as an operation or combination of operations involving heating and cooling of a metal in solid state to obtain desirable properties.

2. What are the purposes of the processing heat treatments?

- To relieve internal stresses
- To improve machinability
- To refine grain size.
- To soften the metal.

3. List some of the important heat treatment operations widely used.

Annealing, Normalizing, Hardening, Tempering and Austempering, Martempering and Case Hardening.

4. What is meant by annealing?

Annealing is defined as a softening process consisting of heating he steel to a temperature at or a near the critical point, holding there for a proper time and then allowing it to cool slowly in the furnace itself.

5. What are the purposes of annealing?

- To remove stresses
- To induce softness
- To refine grain structure
- To remove gases

6. List the different types annealing.

- Full annealing
- Process annealing
- Stress relieve annealing
- Recrystallization annealing
- Spheroidise annealing.

7. What is meant by Normalizing?

Normalizing means similar to full annealing, but cooling is established in still air rather than in the furnace.

8. What is quenching stages for quenching?

- Quenching refers accelerated cooling
- Vapour –jacket stage
- Vapour-transport cooling stage
- Liquid cooling stage

9. What is TTT diagram?

The TTT diagram is a plot of temperature versus the logarithm of time for a steel alloy of definite composition. It is a tool used by heat treaters to predict quenching reactions in steels.

10. What is a CCT diagram?

The CCT diagram is a plot of temperature versus the logarithm of time for steel alloy of definite composition. It is used to indicate when transformations occur as the initially material is continuously cooled at a specified rate. In addition, it is also used to predict the final microstructure and mechanical characteristics.

11. What is significance of the critical cooling rate?

The critical cooling rate is most important in hardening. In order to obtain a 100% martensitic structure on hardening, the cooling must be much higher than the critical cooling rate.

12. List some of the surface hardening techniques employed for altering surface chemistry.

Diffusion methods:

(a)Carburizing (b) Nitriding (c) Cyaniding (d) Carbonitriding

Thermal methods:

(a)Flame hardening (b) Induction hardening

13. In what ways flame hardening differs from induction hardening?

The mechanism and purpose of induction hardening are the same as for flame hardening. The main difference is that induction hardening the source of heat input is an induced electric current instead of using flame.

14. In what ways cyaniding differs from carburizing

The salt both compositions for cyaniding give a case high in nitrogen, whereas carburizing gives a case rich in carbon

15. Case carburizing heat treatment is not generally carried out for medium carbon steels. Why (MAY/JUNE 2006)

The carburizing process is a diffusion treatment process. For diffusion take place the host metal must have a low concentration of the diffusing species and there must be a significant concentration of the diffusing species at the surface in the host metal. Since the medium carbon steels lack the above said criteria, they are not generally carburized

16. What is the critical cooling rate in hardening of steels? (NOV/DEC 2006)

The slowest rate of cooling of austenite that will result in 100% martensite transformation is known as the critical cooling rate

17. Name and explain any one subcritical case hardening treatment. (MAY/JUNE 2009)

Nitriding is a subcritical case hardening treatment.Nitriding is a process of introducing nitrogen atoms, to obtain hard surface of steel components

18. Mention few applications of induction hardening. (April/May 2008)

The induction hardening is employed for hardening he surfaces of gears, tools, wrist pins, crank shaft bearings, machine tool ways and pump shafts

19. Write some advantages of Austempering.

Improved ductility.Increased impact strength and toughness Decreased distortion of the quenched metal less danger of quenching cracks.

20. Write some uses of Surface hardening.

Automobiles, aircrafts, furnace, machines Etc

UNIT III- FERROUS AND NON FERROUS METALS

1. What are metals? Classify engineering materials

Metals are elemental substances. Metals are composed of elements which readily give up electrons to provide a metallic bond and electrical conductivity.

Types of metals: 1.Ferrous metals.2.Non-Ferrous meals

2. State three reasons why ferrous alloys are used extensively

Iron based components are relatively abundant and are widely distributed throughout the world.

Ferrous materials can be produced very economically.

Ferrous materials are versatile. Therefore wide range of mechanical and physical properties of ferrous materials can be achieved.

3. State three characteristics of ferrous alloys that limit their utilization

Heavy in weight, lower electrical and thermal conductivity, lower resistance to corrosion.

4. Why is alloying done?

- To increase strength
- To improve hardness
- To improve toughness
- To improve machinability.

5. What are alloy steels? How are alloy steels classified?

Alloy steels mean may steels other than steels Alloy steels can be divided into two main groups

1. Low alloy steels: These contain upto 3 to 4% of alloying elements

2. High alloy steels: These contain more than 5% of alloying elements

6. List four important alloying elements added in alloy steels

The most commonly used alloying elements are chromium, nickel, molybdenum, vanadium, tungsten, cobalt, boron, copper and others

7. What are the required properties of a tool steel?

Good toughness, Good wear resistance and very good machinability Resistance to softening on heating.

8. What is meant by 18-4-1 high speed steel?

Widely used high speed tool steel is 18-4-1 high speed steel. This steel contains 18% tungsten, 4% chromium and 1% vanadium. It is considered to be one of the best of all purpose tool steels

9. What are HSLA steels?

HSLA steels are nothing but high strength low alloy steels. HSLA steels also known as micro alloyed steels, are low carbon steels containing small amounts of alloying elements.

10. What are maraging steels?

Maraging steels are low carbon, highly alloyed steels. These are very high strength materials that can be hardened o obtain tensile strengths of upto 1900Mpa.

11. What are the effects of carbon on the properties of cast iron?

If a cast iron contains more of the brittle cementite, then its mechanical properties will be poor.

12. What is the chemical composition of grey cast iron?

Carbon-2.5 to 4% Silicon-1 to 3% Manganese – 0.4 to 1% Phosphorus-0.15 to 1% Sulphur - 0.02 to 0.15% Remaining is iron

13. List some bronze alloys.

Bell bronze, phosphor bronze, aluminum bronze, silicon bronze, coinage bronze and leaded bronze

14. What are cupronickels? What is the use of Monel metal?

Cupronickels are alloys of copper and nickel

Uses of Monel metal: For making propellers, pump fittings, condenser tubes, steam turbine blades, sea water exposed parts, tanks, and chemical and food handling plants.

15. What is meant by precipitation hardening?

Precipitation hardening, also known as age hardening, is the most important method of improving the physical properties of some of the non-ferrous alloys by solid state reaction.

16. What is the main strengthening mechanism in high strength aluminum alloys? (MAY/JUNE 2006)

Precipitation strengthening treatment, also known as age hardening is the main strengthening mechanism in high strength aluminum alloys.

17. What are the effect of chromium and molybdenum in low alloy steels? (NOV/DEC 2006)

The effect of chromium in low alloy steels are to: Increase corrosion and oxidation resistance Increase hardenability.

Increase high temperature strength

Resist abrasion and wear.

The effect of molybdenum in low alloy steels are to: Improve high temperature creep resistance Increase hardenability.

Stabilize carbides.

18. Mention any two aluminium base alloys and their applications (NOV/DEC 2007)

1. Duralumin: Used for aircraft and automobile industries

For making electric cables, in surgical and orthopedic implements etc.

2. Y-alloy: Used for making pistons of engines, cylinder heads, gear boxes, propeller blades.

19. What is Carbonitriding? (April / May 2008)

Carbonitriding is a surface hardening process that involves the diffusion of both nitrogen and carbon into the steel surface.

20. What are super alloys?

A super alloy is a general term used to describe the nickel base and cobalt base alloys which have been developed for use at elevated temperatures.

UNIT IV- NON METALLIC MATERIALS

1. What are polymers?

Polymers are composed of a large number of repeating units of small molecules called monomers.

2. List any four attractive characteristics of polymers.

Low density

Good thermal and electrical insulation properties

High resistance to chemical attack

Ease of fabrication

Relatively low cost

3. What is mean by isomerism?

Isomerism is a phenomenon wherein different atomic configurations are possible for the same configuration

4. Why are additives added to polymers .

Filler materials Flame retardants Colorants, Reinforcements Plasticizers, Stabilizers and Lubricants.

5. Differentiate commodity plastics with engineering plastics.

The plastics which are not generally used for engineering applications are known as commodity plastics. The plastics which are used in engineering applications are known as engineering plastics.

6. Classify polymers.

1. Plastics 2.Elastomers 3.Adhesives 4.Coatings 5.Fibers.

7. Name any four commodity plastics and engineering plastics.

Commodity plastics: Polyethylene, Polypropylene, Polystyrene, Polyvinyl chloride

Engineering plastics: Ethenic, Polyamides, Cellulosics, Acetals

8. What are the sources of raw materials for plastics? Animal and vegetable by products.

Coal by products

Petroleum by products

9. Write short notes on nylons.

Polyamides also known as nylons are the product of condensation reaction between an amine and an organic acid

10. What are engineering ceramics?

Engineering ceramics are also known as technical/industrial ceramics, are those ceramics that are specially used for engineering applications or in industries

11. Name any four engineering ceramics.

Alumina Silicon carbide Silicon nitride Sialons

12. What are composites?

Composites are produced when two are more materials are joined to give a combination of properties that cannot be attained in the original materials.

13. What is the role of matrix material in a composite?

The matrix usually provides the major control over electrical properties, the chemical behavior, and elevated temperature use of the composite.

14. Write the general mechanical properties of ceramics? (May / June 2009) Ceramics are strong, hard and brittle.

They are good thermal and electrical insulators.

They have high compressive strength but are weak in tension.

15. What do you meant by copolymers? (Apr. / May 2008)

Copolymers are polymers which are obtained by adding different types of monomers

16. How are refractories classified? (Apr. / May 2008)

Fire clay refractories, Silica refractories, Basic refractories, and Special refractories.

17. Give two examples of particulate reinforced metal matrix composites. (May / June 2007)

Sintered Aluminium Powder (Al/Al2O3) Cermet.

18. What are Cermets and applications?

Ceramic metal composite containing between 80 and 90% of ceramics are known as Cermets.

Cutting tools, Slip gauge, wire drawing dies, rocket motor and jet engine parts.

19. What are the constituents of composites?

Composites are composed of two phases.

Matrix phase, Dispersed phase

20. Name any four engineering polymers.

Ethenic, Polyamids, Silicones, Polyamides.

UNIT-V MECHANICAL PROPERTIES AND TESTING

1. What is meant by mechanical properties of materials?

Mechanical properties are whose characteristics of material that describe its behavior under the action of external forces.

2. Distinguish between elasticity and plasticity.

Elasticity is the property of the material by virtue of which it is able to retain its original shape and size after the removal of load.

Plasticity is the property of the material by virtue of which a permanent deformation takes place whenever it is subjected to the action of external forces.

3. What are the factors affecting mechanical properties?

Grain size,

Heat treatment, Atmospheric exposure, Low and high temperature.

4. Define the terms Slip and Twinning.

Slip may be defined as the sliding of blocks of the crystal over one another along definite crystallographic planes called Slip planes.

Twinning is the process in which the atoms in a part of a crystal subjected to

Stress; rearrange themselves, so that one part of the crystal becomes a mirror image of the other part.

5. Differentiate between ductility and malleability.

Ductility is the property of the material by virtue of which it can be drawn into wires before rupture takes place.

Malleability is the property of the material by virtue of which it can withstand deformation under compression without rupture.

6. Define the terms brittleness and hardness.

Brittleness is the property of the material by virtue of which it can withstand deformation under compression without rupture.

Hardness is the property of the material by virtue of which it is able to resist abrasive indentation, machining, scratching.

7. What do you mean by toughness and stiffness?

Toughness is the property of the material by virtue of which it can absorb maximum energy before fracture takes place.

Stiffness is the property of the material by virtue of which it resists deformation.

8. List any four technological properties of metals.

Machinability, Castability, Weldability, Formability or Workability.

9. What is meant by fracture?

Fracture is the mechanical failure of the material which will produce the separation or fragmentation of a solid into two or more parts under the action of stresses.

10. List the different types of fracture in a material.

Brittle Fracture, Ductile Fracture, Fatigue Fracture, Creep Fracture.

11. What are the factors affecting the creep?

Grain, Thermal stability of the micro structure, Chemical reactions and Prior strain.

12. List some important destructive tests carried out on a material.

Tensile test, Impact test, Fatigue test, Bend test, Torsion test, Creep test.

13. Define the term notch sensitivity.

The notch sensitivity refers to the tendency of some normal ductile material to behave like brittle material in the presence of notches.

14. Define endurance limit in fatigue test. (May / June 2006)

Endurance limit is defined as the value of stress below which the material will not fail even when it is loaded for infinite no. of cycles.

15. What are the properties are determined from tension testing of metallic products? (May / June 2006)

Limit of proportionality, Yield strength, and Maximum tensile strength breaking strength Percentage elongation Modulus of elasticity

16. How will you express the deformation characteristics of a material through tension test? (May / June 2007)

The deformation characteristics of a material through tension test expressed as the stress-strain curve. With the help of stress strain curve, the various tensile properties such as elastic stress, strain yield strength, young's modulus, etc are calculated.

17. Why are the impacts specimens notched? (NOV/DEC 2007)

The impact specimens are notched because the impact test also indicates the notch sensitivity of a material.

The notch sensitivity refers to the tendency of some normal ductile materials to behave the like a brittle material in the presence of notches.

18. What are slip bands? (April/May 2008)

Slip bands are made up of several slip planes. They indicate that the atomic planes within the crystal have sheared with respect to each other.

19. What is creep? (May/June 2009)

The creep is defined as the property of material by virtue of which it deforms continuously under a steady load.

20. What are the different types of loadings available for fatigue testing? (April/May 2008)

- Shock or impact load
- Static load
- Random load
- Repeated or reversed load.