

**V.S.B ENGINEERING COLLEGE, KARUR**  
**DEPARTMENT OF MECHANICAL ENGINEERING**

**Two Mark Questions with answers**

**Academic Year : 2017-2018 (Even Semesters)**

**Year of Study : III Year**

**ME6601-DESIGN OF TRANSMISSION SYSTEMS**

**UNIT-I**

**DESIGN OF FLEXIBLE ELEMENTS**

1. What is a power drive? Mention their types.

The power drive is a set of machine members employed to transmit power or energy produced in one machine to another machine. Their main types (1) Mechanical, (2) Hydraulic, (3) Pneumatic and (4) Electrical drives.

2. What is meant by mechanical drives? Classify them.

The drives which transmit power by means of contact forces are called as mechanical drives. They can be classified based on

(a) Way of power transmission.

(i) Friction drives [E.g. Belt drives, Rope drives]

(ii) Toothed drives [Eg.. Gear drives, Chain drives]

(b) Centre distance between power shafts

(i) Long distance drives (Eg. Belt drives, chain drives, rope drives)

(ii) Short distance drives (Eg. Gear drives)

(c) Intermediate link between driving and driven members.

(i) No intermediate link (Eg. Gear drives)

(ii) With intermediate link (Eg. Belt, rope drives, chain drives)

3. State the 'Law of Belting'

The law of belting states that the centerline of the belt when it approaches the pulley must lie in the mid plane of that pulley which should be perpendicular to the axis of the pulley. Otherwise the belt will run off the pulley.

4. Explain the term crowning of pulleys.

Pulleys are provided with a slight conical shape (or) convex shapes in their rim's surface in order to prevent the belt from running off the pulley due to centrifugal force. This is known as crowning of pulley. Usually the crowning height  $t$  may be  $1/96$  of pulley face width.

5. Briefly explain about friction and its applications

Friction is said to be a resisting force that is developed between two relatively moving surfaces. For some machines, this frictional force may be an unwanted force and hence it is to be reduced to the maximum level. For some other machines, bearings, brakes, clutches are the good examples.

6. What are the types of belts?

(a) Flat Belts (b) V Belts.

(c) Toothed or Timing Belts (d) Round Belts.

7. State the materials for belts.

Leather, cotton fabrics, rubber, animal's hair, silk, rayon, woolen etc

8. Indicate some merits and demerits of belt-drive;

Merits

1. Belt drives are used for long distance power transmission.
2. Their operations are smooth and flexible.
3. Simple in design and their manufacturing cost is lower.

Demerits,.

1. They need large space.
2. Loss of power due to friction is more.

9. By what materials, belt-pulleys are made?

Belt-pulleys are made of cast-iron or steel

10. What is meant by the ply of belt?

Flat belts are made of thin strips and laminated one over the other in order to get thick belt. These thin strips or sheets are called as plies of belt. Usually flat belts are made of 11 ply, 4 ply, 5 ply, 6 ply and 8 ply belt etc And 4 ply belt is thicker than 3 ply belt and so-on.

11. Mention the different types of joints employed for joining flat-belts.

(i) Cemented joints (ii) Laced joints (iii) Crest joints. (iv) Hinged joints.

12. What conditions should be followed when flat belt drive is installed?

1. The axes of power transmitting shafts should be parallel.
2. It should have, optimum center distance between the shafts'.
3. The tight-side of the drive should be at the bottom side of the pulley.

13. What is belt rating?

Flat-belts are made of different sizes such as 3 ply, 4 ply and V - belts are made of different grades such as A, B, C, D and E grade belts. Belt rating is defined as the power transmitting capacity of unit size flat belt or a particular grade single V belt.

14. Specify the application of round belt.

Round-belt is applied, in sewing. Machine.

15. Specify the purpose of crowning of belts.

To prevent slipping from pulley due to centrifugal force.

16. What factors should be considered during the selection of a belt drive?

a) Amount of power to be transmitted., b) Peripheral and angular speeds. c) Speed ratio. d) Efficiency. e) Centre distance between shafts f) Space available. g) Working environment.

17. Explain creep in belts.

Since the tensions produced by the belt on the two sides of the pulley are not equal, the belt moves with a very negligible velocity, due to the difference of two tensions. This

slow movement of the belt over the pulley is known as creep of belt and it is generally neglected."

18. How is a V-belt designated?

V-belt is designated by a grade letter followed by its inside length in code number, year of coding. For example, D 3048: IS 2494: 1964. M belts are designated by the grade letter and inside length *only such* D - 3048. Sometimes, the inside length may be denoted in inches as D –

19. In what ways, timing belts are superior to ordinary V-belts?

Since the timing belts possess toothed shape in their -inner side, engagement with toothed pulley will provide positive drive without, belt-slip where as in the case of ordinary V-belts, chances of slip are and hence positive drive is not possible at all times. Hence toothed belts (I timing belts) are superior to ordinary V-belts.

20. What purpose does the housing of gear-box serve?

Gear-box -housing or casing is used as container inside which, the gears, shafts, bearings and other components are "mounted." Also it prevents the entry of dust inside the housing and reduces noise of operation. That is, the housing Safe-guard the inner components.

## **UNIT-II** **SPUR GEARS AND PARALLEL AXIS HELICAL GEARS**

21. What is the function of spacers in a gear-box?(6r) What are spacers as applied to a gear-box?

Spacers are sleeve like components, which are mounted, in shafts in-between gears and bearings or one gear and another gear in order to maintain the distance between them so as to avoid interruption between them.

22. Fill in the blanks of the following.

(a) The number of gears employed in a gear-box is kept to the minimum by arranging the. Speed of the spindle is ..... series.

(b) In a gear- box, -for a set of gears, if the centre distance and module are same, then the sum of teeth of engaging pair will be.....

a) Geometric series.

b) Equal.

23. What is a speed diagram? (or) What is the structural diagram-of -&.gear-box

Speed diagram or structural diagram is the graphical representation different speeds of output shaft, motor shaft and intermediate shafts.

24. For what purpose we are using gear-box?

Since the gear-box is provided with number of gears of different size arranged in different forms, we can get number of output speeds by operated motor at single speed.

25. Name the types of speed reducers.

a) Single reduction speed reducers.

b) Multi reduction speed reducers.

26. What does the ray-diagram of gear-box indicate?

The ray-diagram or kinematic arrangement of a gear box indicates arrangement of various gears in various shafts of the gear box in order to obtain the different output speeds from the single speed of the motor.

27. What is step ratio?,

Step ratio is the ratio of one speed of the shaft to its previous lower speed. Since the spindle speeds are arranged in geometric progression, the ratios adjacent speeds (i.e., step ratios) are constant. If  $N_r$  is the maximum speed and  $N$ , is the minimum speed.

28. What are the types of ropes?

They are two types namely

- a) Fiber ropes
- b) Wire ropes.

29. In what ways wire ropes are superior to fibre ropes?

- a) Wire ropes are stronger, more durable than fibre ropes.
- b) Wire ropes can withstand 'shock loads'.
- c) Their 'efficiency' is high.
- d) They can be operated for Very long centre distance even upto 1000 m. Hence wire-ropes are superior in most of occasions.

30. How are wire-ropes classified?

- (a) Based on number of strands and wires..
  - i) 6x7 ii) 6 x 19 iii) 6 x 37 iv) 8 x 19 ropes.
- (b) Based on the direction of wire with respect to strands in twisting.
  - i) Cross lay ropes.
  - ii) Parallel-lay ropes.
  - iii) Compound lay ropes.

31. How is wire-ropes designated?

A wire-rope is designated by the number of strands and the number of wires in each strand. For example, a wire rope having six strands, and each strand containing nineteen wires can be denoted as 6 x 19 rope.

32. What are the various stresses induced in wire ropes?

- 1) Direct tensile load due to load and self-weight of the rope.
- 2) Bending stress when the rope winds round the drum.
- 3) Stresses due to changes in starting and stopping etc.

33. Fill in the blanks of the following

- a) The material used for making core of wire-rope is.....
- b) The factor of safety for wire-rope operation ranging from .....

Answers

- a) Asbestos or soft steel. b) 6 to 8.

34. What is a clutch and where it is used?

Clutch is machine, component used as temporary coupling: and is used mainly in automobiles for engaging and disengaging the driving shaft where periodical engagement is required.

35. What is meant by positive clutch?

Which transmits power from driving shaft to the driven shaft by jaws or teeth is called positive clutch. No slipping is there.

36. By what means, power is transmitted by clutches?

In clutches, power transmission is achieved through

- (a) Interlocking (b) Friction (c) Wedging

37. Why are cone clutches better than disc clutches?

Since the cone discs are having large frictional areas and they can transmit a larger torque than disc clutches with, the same oil diameter and actuating force and hence cone clutches are preferred over disk clutches. But usually cone clutches are mainly used in low peripheral applications.

38. What factors should be considered when designing friction clutches?

(a) The friction materials for the clutch should have high coefficient of friction and they should not be affected by moisture and oil.

(b) May be light in weight.

(c) The design is in such a way that the engagement should be made without shock and fast disengagement without drag.

39. Why should the generated heat be dissipated in clutch operation?

In order to save the friction plates and materials from melting by the heat produced during operation, the generated heat should be dissipated.

40. Name the two theories applied for the design of friction clutches.

1. Uniform Pressure theory
2. Uniform wear theory

### UNIT III **BEVEL, WORM AND CROSS HELICAL GEARS**

41. In what ways, the clutches are different from brakes?-

The clutch used to engage the driving and driven members and keep them moving (i.e., rotating) together, whereas brakes are employed to stop a moving member or reduce its speed.

42. Write the features of a chain drive.

A chain drive is a flexible mechanical drive which may be considered to be intermediate between belt drive and gear drive in that it has features common to both. Chains are suitable for long as well as short center distance drives and give a more compact drive than is possible with belts. Chain drives are similar to belt drives in which the chains, are operated between toothed wheels called as sprockets.

43. Mention the applications of chain drives.

Chain drives are employed in transportation machineries like motor-cycle, bi-cycles, automobiles and technological machineries, like agricultural machines, crushers etc.

44. What are the advantages of chain drives?

Chain drives

1. Are having more power transmitting capacity.
2. Have higher efficiency and compact size.
- 3- Exert less load on shafts since no initial tension is applied on the sprocket shafts.

4. Require easy maintenance
45. Specify some drawbacks of chain drives.
1. The design of chain drive is more complicated.
  2. The operation is noisy and production cost is high.
  3. They require more accurate assembly by shafts than for belts.
46. Indicate the types of chains.
- a) Driving chains b) Hauling chains c) Loading chains.
47. In what way silent chain is better than ordinary driving chain?
- A silent chain consists of a series of toothed plates pinned to & across the width of the chain. Even though the structure is more complicated, its engagement with sprocket is very smooth get soundless operation. That is why, silent chain is preferred possible.
48. What are the main components of a chain drive?
- A chain drive has four components such as (1) chains, (2) sprockets,(3) housing and (4) slack adjusters.
49. Fill in the blanks of the following.
- a) The main types of chains used to transmit-power are .....
  - b) The linear distance between the centers of consecutive roller is called As
- a) Bush, roller and silent chains.
  - b) Pitch of chain.
50. What are the possible ways by which a chain drive may fail?
- The chain drive may fail, due to the following causes.
- a) Wear in the joints which leads to the elongation' of chain resulting improper, engagement with the sprockets.
  - b) Wear of, the sprocket teeth.
  - c) Fatigue failure of the plates at the eyes.
  - d) Poor lubrication and improper maintenance.
51. Distinguish between bush chain and roller chain
- Even though the bush and roller chains seem to be similar, roller chains are provided with cylindrical plates over the chains, pins which, are not available in bush chains, Hence wear due to engagement will be reduced much in roller chains. Also roller chains are heavier than bush chains.
52. By what materials, chain components are made of?
- Chain plates are made of medium carbon or alloy steels. Chain pins, bushing and rollers are made of carburizing steels and are hardened to 50-65 RC. Chain sprockets are made of cast-iron or hardened steels.
53. Find the difference between chain-sprocket and gear.
- Usually the gear-width is, comparatively more with respect to its diameter where as sprockets are made of thin plates in order to enable the chain to engage with sprockets.
54. How is a driving chain designated?
- According to Indian Standard, roller chains are designated by their roller diameter and number of standards. For example. 10.0S18 2403 - 1964 stands for single strand (simplex)

chain of 10.16 mm roller diameter. According to International -Standard Organization, chains are specified by their roller diameter followed by the type of chain and the number According to Roller chain manufacturers, chains, are- designated by of strands followed by the chain numbers.

55. What is a gear drive?

A gear drive is a mechanical drive-which transmits power from: another through toothed wheels called as gears.

56. Mention some applications of gear drives.

Gear drives are employed in many fields such as from smaller instruments to the heaviest and most powerful machismos, crushers etc. Some of the common applications of gears are in hoisting machineries, rolling mill, machine tools such as lat machines, etc.

57. Why are gear drives superior to belt drives or chain drives? the advantages of gear drives?

1. The gear drives possess high load carrying capacity, high compact layout.
2. They can transmit power from very small values to several kilowatts.

58. How are gears classified?

Gears are classified based on

(a) Axes of gear shafts as

- i) Parallel - Eg. spur, helical, herring-bone gears. ii) Intersecting - Eg. Bevel gears. iii) Non-parallel and non-intersecting - Eg.- worm, gears, Skew gears.

(b) Profile of gear tooth

- i) Involute gears. ii) Cycloidal gears.

(c) Position of teeth on wheel rim.

(d) Pressure angle

- i) Gears with 20° pressure angle. ii) Gears with 14 1/2° pressure angle.

59. Illustrate the materials for making gears'.

1. Ferrous metals such as carbon steels, alloy steels of nickel, chromium and vanadium.

2. Cast-iron of different grades.

3. Non-ferrous metals such as brass, bronze, etc.

4. Non-metals like phenolic resins nylon, bakelite etc.

Among them steel with proper heat treatment is extensively, employed in many of 'the engineering applications.

60. Specify the types of gears-failures.

a) Tooth breakage. b) Pitting of tooth surface. c) Abrasive- wears. d) Seizing of teeth etc.

## UNIT IV **DESIGN OF GEAR BOXES**

61. At what occasions non-metallic gears are employed.

Non-metallic gears are employed 'where we require silent operation and low power transmission. For example, in instruments like pressure gauge and so on.

62. Fill in the blanks of the following

- a) In a gear pair, the smaller gear is, called as ..... and the bigger is called as

Answers

- a) Pinion, wheel or gear.

63. What is meant by spur-gear?

Spur-gear is the gear in which teeth are cut at the circumference of a slab called as gear-blank such that the teeth are parallel to gear-axis.

64. Define the following terms.

a) Tip circle. b), Root circle. c) Pitch circle

a) **Tip circle** or addendum circle is the circle which coincides crests or tops of all teeth.

b) **Root circle** or addendum circle is the circle which coincides with. roots or bottoms of all teeth.

c) **Pitch circle** is the imaginary circle in which the pair of gears rolls one over the other. This circle can be visible when the pair of gears fastly rotating. This will lie between tip circle and root circle.'

65. How are the following terms defined?

a) Pressure angle. b) Module.

a) **Pressure angle** (a) is the angle making by the line of action common- tangent to the pitch circles of mating pars.

b) **Module m** is the ratio of pitch circle diameter to the number d of gear teeth, and is usually represented in millimeters.

66. Define the following terms.

a) Back lash b) Gear ratio

a) Back lash is the difference between tooth thickness and the space into 'which it meshes, measured along the pitch circle. If we assume the tooth thickness as t, and space width as t<sub>2</sub> then backlash = t<sub>2</sub> - t<sub>1</sub>

b) Gear ratio (i) is the ratio of number of teeth of larger gear to that of smaller gear. At is also defined as the ratio of high speed to the low speed in a gear drive. Usually, the gear ratio should always be greater than one.

67. Fill in the blanks of the following.

a) The difference between tip circle radius and pitch circle -radius is .....

b) The difference between pitch circle radius and root circle radius is .....

### Answers

a) Addendum, b) dedendum.

68. What factors influence backlash?

The factors like errors in tooth thickness, pitch, tooth spacing, mounting misalignment, etc influence the backlash.

69. What preliminary design considerations should be, adopted, When selecting gear drive?

All kinds of gears can not be useful for all kinds of work. Hence following factors should be considered for selecting a specific type of gear drive.

i) The amount of power to be transmitted.

ii) Space availability.

iii) Amount of gear ratio for single step.

iv) Causes for gear failures and their preventing methods.

v) Proper material

vi) Life of gears required, usually 10,000 hours.

70. What is interference in gears? How can you overcome it?

Gear profile usually starts, from base circle and ends with tip teeth are made in such a way that their contact is along the pro the top surface of teeth is made, flat, the tip of the teeth of one gear dig I into the bottom flank of mating gear. This action is called interference.

71. On what basis gear cutters are selected?

Gear cutters are selected based on the following conditions.

1) Properties of materials for work piece and tools.

2) Cost of production.



- 3) Structure of gears such as spur gear, helical gears and so on.  
 4) Module of the gear.
72. How do gears fail?  
 Gears may fail due to tooth breakage by overload and misalignment of shafts. b) Corrosion of teeth by improper lubricants. c) Tooth wear because of insufficient lubrication. d) Interference because of no under-cut.

73. Fill in the blanks of the following.

- a) The size of gears is usually specified by their ..... b) the commonly used gear tooth-profile is.....

**Answers**

- a) Outer diameter, module, number-of-teeth. b) Involute profile.

74. What is working depth of a gear-tooth?

Working depth of gear is the radial distance between addendum circle and clearance circle. It is equal to two times, the addendum value.

75. What stresses are induced in gear tooth?

1. Surface compressive stress.
2. Bending stress.

76. What is meant by a corrected gear?

In normal gear, there may be an undercut between base circle and root circle which weakens the teeth. This undercutting can be avoided by making some modifications on the gear profile. This modification is addendum modification or profile correction or profile shift. The gear, which has this correction, is called as corrected gear.

77. Write short notes on backlash of gears.

Backlash can be defined as the play between a mating pair of gear assembled condition.

78. What are the effects of little backlash and excessive backlash on gears

Too little backlash may lead to over loading, overheating and ultimately seizure resulting eventual failure of the system. On the excessive backlash may cause, non uniform - transmission of *motion*. Backlash may also cause noise and impact loads.

79. Define form factor?

Form factor is a constant, employed in the design of *gear* which, design the shape and the number of teeth.

80. Why dedendum Value is more than addendum value?

In order to get clearance between the teeth of one gear and bottom surface of mating gear so as to avoid interference, dedendum is having more value than addendum.

81. Specify the machine tools used for producing spur gears.

Answers Milling machine and hobbing machine.

## UNIT V

### **DESIGN OF CAM CLUTCHES AND BRAKES**

82. What is a helical gear?

A helical gear is a cylindrical gear similar to spur-gear except that the teeth are cut at an angle, known as helix angle 'to the axis of the gear shaft, whereas in spur-gear, teeth are cut parallel to the axis.

83. In what ways helical gears are differed from spur gears-  
 Spur gears Helical gears

1. Teeth are cut parallel to the axis. Teeth are cut inclined to the axis.

- 2. Entire width of tooth is Gradual engagement is obtained simultaneously engaged with full since their teeth are inclined to width of mating gear. axis.
- 3. Rough and noisy operation Smooth and silent operation.
- 4. Less power is transmitted. More power can be. transmitted.

84. What are the advantages of helical gears?

Helical gears i) transmit more power. ii) provide smooth and soundless operation. iii) used for high speed and high velocity ratio processes.

85. What is helix angle? How this angle differentiate helical gear from

Helix angle -is the angle between the axis of the gear and the through tooth face. For helical gear, teeth are cut at an inclined axis, specified as ' helix angle and its value ranges from 80to25' the case of spur gear, tooth-are cut parallel to the axis, the spur gear is zero.

86. Fill in the blanks of the following:

- a) Double helical gears are otherwise called as .....
- b) Crossed helical gears are known as .....

**Answers**

- a) Herring bone gears. b) Skew gears.

87. What is a herringbone gears?

A herring bone gear is made of two single helical gears attached other hence called as double helical gear in which the teeth of be set in the opposite direction to the teeth of another gear arrangement the axial thrust produced in one gear will be null', thrust produced in another gear, and the resultant thrust is improves the life of the gear. Sometimes, a single cylindrical block is *ova-ployod* for making,,herring bone,,gear.

88. Write any two applications of a skew gear-drive. (or) Where do we, use skew gears?

The skew gears or crossed helical gears are employed in instruments, distributor drive of automobile engine etc, where small loads are applied.

89 Differentiate axial pitch and normal pitch of the helical gear.

Axial pitch is the distance, parallel to the axis, between similar faces of adjacent teeth. It is also defined as the circular pitch in the plane of rotation and is denoted as p, Normal pitch is the distance between similar faces of adjacent teeth along a helix on the pitch cylinders normal to the teeth, and is denoted as Pn-

90. What is a bevel gear?

Bevel gear is the type of gear for Which the teeth are cut on conical surface in contrast with spur and helical gears for which the teeth are cut on cylindrical surfaces. The structure of bevel gear is similar to and uniformly truncated frustum of a cone.

91. When do we use bevel gears?

When the power is to be transmitted in an angular, direction, i.e., between the shafts whose axes intersecting at an angle, bevel gears are employed.

92. How are bevel gears classified?

Bevel gears are classified in two ways

- 1. Based on the shape of teeth.
  - a) Straight bevel gears.
  - b) Spiral bevel gears

2. Based on the included angle between the shaft axes, called as shaft angle
- External gears  $< 90^\circ$ )
  - Internal gears  $> 90^\circ$ \*)
  - Crown gears  $90^\circ$

93. What is a crown gear?

A crown gear is a type of bevel gear whose shaft angle is  $90^\circ$  and angle of pinion is not equal to the pitch angle of gear. Let Shaft angle.

94. What is the specific feature of mitre gear?

Mitre gear is the special type of crown gear in which the **shaft**,  $90^\circ$  and the pitch angles of pinion and gear are equal and each angle to  $45^\circ$ .

95. Fill in the blanks of the following

- Bevel gears having shaft angle,  $90^\circ$  are known as .....
- When the spiral angle of a bevel gear is zero, it is called as ...

**Answers**

- Crown gears.
- Zero bevel gear.

96. Define the following terms

- Cone distance or pitch cone radius.
- Face angle.

a) Cone distance or pitch cone radius is the slant length of pitch cone, i.e., distance between the apex and the extreme point of tooth of bevel gear.

b) Face angle is the angle subtended by the face of the teeth at the cone centre. It is equal to the pitch angle plus addendum angle. It is also called as tip angle.

97. In which gear-drive, self-locking is available?

Self locking is available in worm-gear drive.

98. When do we use worm-gears?

When we require transmitting power between nonparallel and non-intersecting shafts and very high velocity ratio, of about 100, worm gears, can be employed. Also worm-gears provide self-locking facility.

99. Write some applications of worm gear drive.

Worm gear drive find wide applications like milling machine indexing head, table fan, steering rod of automobile and so on.

100. What are the merits of worm gear drive?

Merits

- Used for very high velocity ratio of about 100
- Smooth and noiseless operation.
- Self-locking facility is available.

# ME6604-GAS DYNAMICS AND JET PROPULSION

## UNIT I

### BASIC CONCEPTS AND ISENTROPIC FLOWS

1. Write the steady flow energy equation for an adiabatic flow of air.  
In an adiabatic flow  $q = 0$ . Therefore energy equation becomes,  
 $h_1 + c_1^2/2 + gZ_1 = h_2 + c_2^2/2 + gZ_2 + W_1$   
Adiabatic energy equation is  $h_0 = h + 1/2c_2^2$
2. Explain the meaning of stagnation state with example.  
The state of fluid attained by isentropically decelerating it to zero velocity at zero elevation is referred as stagnation state.  
E.g. Fluid in a reservoir or in a settling chamber
3. Distinguish between static and stagnation pressures.  
In stagnation pressure state the velocity of the flowing fluid is zero whereas in the static pressure, the fluid velocity is not equal to zero
4. Differentiate between the static and stagnation temperatures.  
The actual temperature of the fluid in a particular state is known as static temperature whereas the temperature of the fluid when the fluid velocity is zero at zero elevation known as stagnation temperature  
 $T_0 = T + c^2/2C_p$
5. What is the use of Mach number?  
Mach number is defined as the ratio between the local fluid velocity to the velocity of sound. Mach number  $M = c/a$ . It is used for the analysis of compressible fluid flow problems. Critical mach number is a dimensionless number at which fluid velocity is equal to its sound velocity.  $M_{critical} = (c/a) = 1$
6. What is Crocco number?  
It is a non-dimensional fluid velocity which is defined as the ratio of fluid velocity to its maximum fluid velocity,  $C_r = c/c_{max}$
7. Write down the relationship between stagnation and static temperature in terms of the flow, mach number for the case of isentropic flow.  
 $T_0/T = [1 + (\gamma - 1)/2] M^2$
8. Give expression of  $P/P_0$  for an isentropic flow through a duct.  
The expression is  $P/P_0 = 1/[1 + (\gamma - 1)/2] M^2]^{\gamma - 1}$
9. Name the velocities that are used in expressing the fluid velocities in non-dimensional form.  
Local velocity of sound, stagnation velocity of sound, Maximum velocity of sound, critical velocity of sound
10. What are the different regions of compressible flow?  
Incompressible region  
1. Subsonic region    2. Supersonic region  
3. Hypersonic region    4. Transonic region

11. Define  $M^*$  and give the relation between  $M$  and  $M^*$   
 It is a non-dimensional mach number and is defined by the ratio between the local fluid velocity to its critical velocity of sound,  $M^* = c/a^*$
12. A plane travels at a speed of 2400Km/hr in an atmosphere of 5 degree, find the Mach angle?  
 $C=2400/3.6 = 666.67$   
 $T=278K$   
 $M=c/\sqrt{\gamma RT}=1.9947$   
 $\alpha=\sin^{-1}(1/M) = 30.0876^\circ$
13. Define Mach angle and Mach wedge.  
 Mach angle is formed when an object is moving with supersonic speed. The wave propagation and changes are smooth. When an object is moving with hypersonic speed the changes are abrupt is shown in figure. Hence for a supersonic flow over two-dimensional object "mach wedge" is used instead of "mach cone".
14. What is meant by isentropic flow with variable area?  
 A steady one dimensional isentropic flow in a variable area passages is called "variable area flow". The heat transfer is negligible and there are no other irreversibilities due to fluid friction.
15. Define Mach cone.  
 Tangents drawn from the source point on the spheres define a conical surface referred to as Mach cone.
16. What is characteristic Mach number?  
 $M^* = [M^2(\gamma-1)/2 + M^2(\gamma-1)]^{1/2}$
17. If an aeroplane goes to higher altitudes maintaining the same speed what will happen to the Mach number?  
 At higher altitude the sound velocity 'a' will decrease and hence M will increase. Therefore, M is not a constant.
18. Define open and closed system.  
 In open system both mass and energy transfer takes place. But in closed system mass transfer does not occur; only energy transfer takes place.
19. What is the difference between intensive and extensive properties?  
 Intensive properties: These are independent on the mass of the system. Ex: Pressure and Temperature  
 Extensive properties: These are dependent on the mass of the system.  
 Ex: Total volume, Total energy
20. Distinguish between Mach wave and normal shock?  
 Mach wave: The lines at which the pressure difference is concentrated and which generate cone are called mach lines or mach waves  
 Normal shock: A shock wave is nothing but a steep finite pressure wave. When the shock wave is right angle to the flow, it is called normal shock

## UNIT-II FLOW THROUGH DUCTS

1. Differentiate Adiabatic and Isentropic process.  
Adiabatic process:  
In a process there is no heat transfer from the fluid to surroundings or from the surroundings to the fluid.  
Isentropic process:  
In a isentropic entropy remains constant and it is reversible. During this process there is no heat transfer from the fluid to surroundings or from the surroundings to the fluid. Therefore an isentropic process can be stated as reversible adiabatic process.  
 $S = \text{constant}, Q = 0$
2. Differentiate nozzle and diffuser ?  
Nozzle: It is a device which is used to increase the velocity and decrease the pressure of fluids.  
Diffuser: It is a device which is used to increase the pressure and decrease the velocity of fluids.
3. What is Impulse function ?  
The sum of pressure force (  $pA$  ) and impulse force (  $\rho Ac^2$  ) gives Impulse function (  $F$  )  
 $F = pA + \rho ac^2$
4. Differentiate between adiabatic flow and diabatic flow ?  
Diabatic flow : Flow in a constant area duct with heat transfer and without friction is known as diabatic flow (Rayleigh flow)  
Adiabatic flow: Flow in a constant area duct with friction and without heat transfer is known as adiabatic flow (Fanno flow).
5. State the expression for  $dA/A$  as a function of Mach number ?  
 $dA/A = dp/\rho c^2 [ 1 - M^2 ]$
6. Give the expression for  $T/T_0$  and  $T/T^*$  for isentropic flow through variable area in terms of Mach number ?  
 $T_0/T = 1 + \frac{\gamma - 1}{2} M^2$   
 $T_0/T = 1$
7. Draw the variation of Mach number along the length of a convergent divergent duct when it acts as a (a) Nozzle (b) Diffuser (c) Venturi
8. What is choked flow through a nozzle?  
The mass flow rate of nozzle is increased by decreasing the back pressure. The maximum mass flow conditions are reached when the throat pressure ratio achieves critical value. After that there is no further increase in mass flow with decrease in back pressure. This condition is called choking. At choking condition  $M=1$ .
9. What type of nozzle used for sonic flow and supersonic flow?  
Constant area duct nozzle is used for sonic flow and divergent nozzle is used for supersonic flow.
10. When does the maximum mass flow occur for an isentropic flow with variable area?  
Mass flow rate will be maximum at throat section where the Mach number is one.
11. Give the expression for  $T_0/T$  and  $T/T^*$  for isentropic flow through variable area in terms of Mach number  
 $T/T_0 = 1 / [ (1 + (\gamma - 1)/2) M^2 ]$   
 $T/T^* = (\gamma - 1) / [ (1 + (\gamma - 1)/2) M^2 ]$

- 12 What will happen if the air flowing through a nozzle is heated?  
When the flowing air is heated in a nozzle, the following changes like increase in air velocity, increase in temperature and enthalpy, increase in pressure and increase in entropy will occur.
- 13 Write the Fliegner's formula.  
 $M_{\max}/A^* \times \sqrt{T_0/P_0} = 0.0404$
- 14 Write the equation for efficiency of the diffuser.  
Diffuser efficiency = static pressure rise in actual process/ static pressure rise in ideal process  
 $P_2 - P_1 / P_2' - P_1$
- 15 What is impulse function and give its uses?  
Impulse function is defined as the sum of pressure force and inertia force. Impulse function  $F = \text{Pressure force } pA + \text{inertia force } pAc^2$ . Since the unit of both the quantities is same as unit of force, it is very convenient for solving jet propulsion problems. The thrust exerted by the flowing fluid between two sections can be obtained by using change in impulse function.
- 16 What is choked flow?  
When the back pressure is reduced in a nozzle, the mass flow rate will increase. The maximum mass flow conditions are reached when the back pressure is equal to the critical pressure. When the back pressure is reduced further, the mass flow rate will not change and is constant. The condition of flow is called 'choked flow'.
- 17 State the necessary conditions for choked flow to occur in a nozzle.  
The necessary conditions for this flow to occur in a nozzle is the nozzle exit pressure ratio must be equal to the critical pressure ratio where the mach number  $M=1$ .
- 18 Give the difference between nozzle and venturi.

Nozzle	Venturi
The flow is accelerated continuously.(mach number and velocity increases continuously)	The flow is accelerated upto $M=1$ and then mach number is decreased
Used to increase velocity and mach number	Used for flow measurement (discharges)
Generally convergent portion is short	Convergent and divergent portions are equal

- 19 What is normal shock?  
When the shock waves are right angles to the direction of flow and the rise in pressure is abrupt are called normal shock waves.
- 20 What is meant by normal shock as applied to compressible flow?  
Compression wave front being normal to the direction of compressible fluid flow. It occurs when the flow is decelerating from supersonic flow. The fluid properties jump across the normal shock.
- 21 Shock waves cannot develop in subsonic flow? State the reason.  
Shocks are introduced to increase the pressure and hence it is a deceleration process. Shocks are possible only when the fluid velocity is maximum.

22

Define strength of a shock wave.

Strength of a shock wave is defined as the ratio of increase in static pressure across the shock to the inlet static pressure.

Strength of shock =  $(P_y - P_x)/P_x$

### UNIT-III

#### NORMAL AND OBLIQUE SHOCKS

1. What is mean by shock wave ?  
A shock wave nothing but a steep finite pressure wave. The shock wave may be described as a compression wave front in a subsonic flow field across which there is abrupt change in flow properties.
2. What is mean by Normal shock?  
When the shock wave at right angle to the flow it is called normal shock.
3. What is oblique shock?  
When the shock wave is inclined at an angle to the flow it is called oblique shock.
4. What are applications of moving shock wave ?  
It is used in Jet engines, Shock tubes, Supersonic wind tunnel and Practical admission turbines
5. Shock waves cannot develop in subsonic flow? Why?  
In subsonic flow the velocity of fluid is less than the velocity of sound .Due to this reason, deceleration is not possible in subsonic flow so shock waves cannot develop in subsonic flow.
6. Define compression and rarefaction shock?  
A shock wave which is at a higher pressure than the fluid into which it is moving is called a compression wave.  
The shock wave which is at a lower pressure than the fluid into which it is moving is called a expansion shock wave or rarefaction shock wave.
7. State the necessary conditions for a normal shock to occur in compressible flow?
  1. The compression wave is to be at right angle to the compression flow
  2. Flow should be supersonic
8. Give the difference between normal and oblique shock?  
In Normal Shock, the wave is right angle to the Flow and its is a one dimensional flow  
In oblique shock, Shock wave is inclined at an angle to the flow and it is a two dimensional flow.
9. What are the properties change across a normal shock ?



1. Stagnation pressure decreases
  2. Stagnation temperature remains const
  3. Static pressure and temperature increase
10. What is Prandtl – Meyer relation?  
It is the basis of other equation for shock waves. It gives the relationship between the gas velocities before and after the normal shock and the critical velocity of sound.
11. Define strength of shock wave.  
It is defined as the ratio of difference in downstream and upstream shock pressures to upstream shock pressure. It is denoted by  $\xi$   
 $(P_y - P_x)/P_x$
12. Is the flow through a normal shock an equilibrium one.  
No. Since the fluid properties like pressure, temperature and density are changed during normal shock.
13. Calculate the strength of the shock waves when normal shock appears at  $M=2$ .  
Strength of shock =  $(P_y - P_x)/P_x$   
For, Normal shocks table for  $M_x=2$  and  $\gamma=1.4$ ,  $P_y/P_x = 4.5$   
Therefore, strength =  $4.5 - 1 = 3.5$
14. Show the normal shock in h-s diagram with the help of Rayleigh line and Fanno line.
15. Write down the static pressure ratio expression for a normal shock.  
 $P_y/P_x = (2\gamma/\gamma+1) \times M_x^2 - [(\gamma-1)/\gamma+1]$
16. What are expansion wave?  
A wave which is at a lower pressure than the fluid in to which it is moving is called an expansion wave or refraction wave.
17. What are compression wave?  
A wave which is at a higher pressure than the fluid in to which it is moving is called compression wave.
18. Define oblique shock. Also mention where it occurs.  
The shock wave which is inclined at an angle to the two dimensional flow direction is called as oblique shock. When the flow is supersonic, the oblique shock occurs at the corner due to the turning of supersonic flow.
19. What are the types of shock wave?  
1. Normal shock wave      2. Oblique shock wave      3. Curved shock wave  
4. Stationary shock wave      5. Moving shock wave      6. Weak Wave
20. What is oblique shock?  
When the shock wave is inclined at an angle to the flow. This type of flow is called as oblique shock. It is a two dimensional flow.

**UNIT-IV**  
**JET PROPULSION**

1. Differentiate jet propulsion and rocket propulsion (or) differentiate between air breathing and rocket propulsion?

**Jet propulsion**

Oxygen required for combustion purpose is taken from the atmosphere  
Altitude limitation  
Flight speed always less than jet velocity.  
Reasonable efficiency  
Trust decreases with altitude

**Rocket propulsion**

Oxygen is filled in a tank in the rocket engine itself and used for combustion purpose  
No altitude limitation  
Flight speed can be greater than jet velocity  
Low efficiency expect at extremely high flight speed  
Trust improves slightly with altitude

2. What is monopropellant? Give one example for that?

The liquid propellant both the fuel and oxidizer in a single chemical is known as a Mono propellant. It is stable at normal ambient conditions and liberates thermal chemical energy on heating.

Example: Nitroglycerine and Nitro methane

3. What is bipropellant?

If the fuel and oxidizer are different from each other in its chemical nature, the propellant is called the bipropellant.

Example: Liquid oxygen –gasoline and Hydrogen peroxide – hydrazine

4. Classify the rocket engines based on sources of energy employed?

On the basis of source of energy employed rocket engine is classified as:

Chemical rocket engines  
Solar rocket engines  
Nuclear rocket engines  
Electrical rocket engines

5. What is specifying impulse of rocket?

The thrust developed by unit weight flow rate of the propellant is known as specific impulse.  $I_{sp} = F/W_p$

6. Define specific consumption?

The propellant consumption rate per unit thrust is known as specific propellant consumption.  $SPC = W_p/F$

7. What is weight flow co-efficient?

It is the ratio of propellant flow rate to the throat force.  $C_w = W_p/p_0A^*$

8. What is IWR?

IWR (impulse to weight ratio) is the ratio of total impulse of the rocket to the total weight of the rocket.  $IWR = I_{total}/W_{total}$

9. What is thrust co-efficient?  
It is the ratio of the thrust to the thrust force.  $C_f = F/p_o A^*$
10. Define propulsive efficiency?  
It is ratio of the propulsive power to the power output of the engine  
 $\eta_p = \text{propulsive power} / \text{power output of the engine.}$
11. What is thrust or drag?  
The force which propels the aircraft towards at an given speed is called as thrust or propulsive force. This thrust mainly depends on the velocity of gases at the exit of the nozzle.
12. Define Effective Speed ratio.  
The ratio of flight speed to jet velocity is known as effective speed ratio.  $\Sigma = u/c_j$
13. Define specific thrust.  
The thrust developed per unit mass flow rate is known as specific thrust ( $F_{sp}$ )  
 $(F_{sp}) = F/\dot{m}$
14. What is thrust specific fuel consumption(TSFC)?  
It is defined as the ratio of fuel consumption rate per unit thrust.
15. Define specific impulse.  
The thrust developed per unit weight flow rate is known as specific impulse.  
 $I^{sp} = F/W$
16. What are the main parts of Ramjet engine?  
The main parts of Ramjet engine are,  
Supersonic diffuser, subsonic diffuser, combustion chamber and discharge nozzle.
17. Give the expression for the thrust developed b a turbojet engine.  
Thrust  $F = \dot{m} c_j - \dot{m}_a u$
18. Define overall efficiency.  
It is the ratio of propulsive power to the power input to the engine.  
 $\eta_o = \text{Propulsive power} / \text{power input to the engine.}$
19. What is the type of compressor used in turbo jet? Why?  
Rotary compressor is used in turbojet engine due to its high thrust and high efficiency.
20. What is turboprop unit?  
Turboprop engine is very similar to turbojet engine. In this type, a turbine which is used to drive the compressor and propeller.

21. **What is thrust augmentation?**  
To achieve better take-off performance, additional fuel is burnt in the tail pipe between the turbine exhaust section and entrance section of the exhaust nozzle. This is called as thrust augmentation
22. **Why ramjet engine does not require a compressor and a turbine?**  
In ramjet engine due to supersonic and subsonic diffuser, the static pressure of air is increased to ignition pressure. So there is no need of compressor and turbine.
23. **What is scram jet?**  
A supersonic combustion ramjet engine is known as scramjet.

## UNIT-V

### SPACE PROPULSION

1. What are the types of rocket engines?  
Chemical rockets, 2. Solar rockets, 3.Space rockets, 4. Booster rockets.
2. What are the different types of propellants used in space propulsion?  
Solid propellants, Liquid propellants, Hybrid propellants
3. What is meant by hybrid propellant rocket?  
Hybrid rocket engines employ a combination of liquid and solid propellants; in a large number of experiments and comparatively fewer actual flights of hybrid rockets the fuel is solid and a liquid.
4. What are the different propellant feed systems employed in space propulsion?  
a) Gas pressure feed system b) The pump feed system
5. What are the types of solid propellants used?  
Heterogeneous or composite propellants.  
Homogeneous mixtures or organic substances.
6. State any two properties of solid propellants.  
The propellant grain must have high strength. Physical and chemical properties should not change considerably during processing
7. Define thrust coefficient.  
This is the ratio of the thrust and the force.
8. Define thrust.  
The force which propels the aircrafts forward at a give speed is called thrust or propulsive force. This is developing by the jet at the exit of the propelling nozzle in the turbo jet and turbo fan engines.
9. Define space craft.  
A vehicle or craft that goes into space or to the heavenly bodies is called as space craft it also referred to as spaceship.
10. What is meant by propulsive efficiency?  
The ratio of propulsive power or thrust power to power output of the engine is called as propulsive efficiency.

11. What do you understand about TSFC?

TSFC is nothing but thrust specific fuel consumption which is defined as the ratio of fuel consumption rate per unit thrust.

12. What are the main components of ramjet engine?

Nozzle, Combustion chamber, Fuel injector, Diffuser.

13. What are the advantages of ramjet engine?

- High temperature can be employed
- In the absence of rotating machinery its construction is very simple and cheap.
- It can operate efficiently at high supersonic mach numbers.
- It is not very sensitive to the quality of fuel.
- It has low thermal efficiency and high TFSC.

14. What are the liquid propellants used in rockets?

Liquid hydrogen, UDMH, Hydrazine, Alcohol.

15. Which oxidizers are using in liquid propellants?

Liquid oxygen, red fuming, nitric acid (RFNA), liquid fluorine, WFMA

16. What are the hybrid propellants?

Beryllium hydride ( $\text{Be-H}_2$ ) lithium hydride, Hydrocarbon

17. Which oxidizers are using in hybrid propellants?

Fluorine, ( $\text{F}_2$ ), chlorine trifluoride ( $\text{ClF}_3$ ), Nitrogen tetroxide ( $\text{N}_2\text{O}_4$ )

18. Define thermal Efficiency.

It is defined as the ratio of the power output to the power input to the engine.

19. Define the terms: (i) UDMH; (ii) RFNA; (iii) JATO; (iv) RATO

UDMH- Unsymmetrical dimethyl hydrazine; RFNA- Red fuming Nitric Acid; JATO- Jet Assisted takes off; RATO- Rocket assisted take off.

20. Define Overall Efficiency.

It is defined as the ratio of the propulsive power to the power input to the engine.

## ME 6603 –FINITE ELEMENT ANALYSIS

### UNIT 1

1. What is meant by finite element?

A small units having definite shape of geometry and nodes is called finite element.

2. What is meant by node or joint?

Each kind of finite element has a specific structural shape and is inter- connected with the adjacent element by nodal point or nodes. At the nodes, degrees of freedom are located. The forces will act only at nodes at any others place in the element.

3. What is the basic of finite element method?

Discretization is the basis of finite element method. The art of subdividing a structure in to convenient number of smaller components is known as discretization.

4. What are the types of boundary conditions?

Primary boundary conditions

Secondary boundary conditions

5. State the methods of engineering analysis?

Experimental methods ,

Analytical methods

Numerical methods or approximate methods

6. What are the types of element?

- 1D element
- 2D element
- 3D element

7. State the three phases of finite element method.

- Preprocessing
- Analysis
- Post Processing

8. What is structural problem?

Displacement at each nodal point is obtained. By these displacements solution stress and strain in each element can be calculated.

9. What is non structural problem?

Temperature or fluid pressure at each nodal point is obtained. By using these values properties such as heat flow fluid flow for each element can be calculated.

10. What are the methods are generally associated with the finite element analysis?

Force method

Displacement or stiffness method

11. State stiffness method.

Displacement or stiffness method, displacement of the nodes is considered as the unknown of the problem. Among them two approaches, displacement method is desirable.

12. What is meant by post processing?

Analysis and evaluation of the solution result is referred to as post processing. Postprocessor computer program help the user to interpret the result by displaying them in graphical form.

13. Name the variation methods.

Ray-Leigh Ritz method.

14. What is meant by degrees of freedom?

When the force or reaction act at nodal point node is subjected to deformation. The deformation includes displacement rotation, and or strains. These are collectively known as degrees of freedom

15. What is meant by discretization and assemblage?

The art of subdividing a structure in to convenient number of smaller components is known as discretization. These smaller components are then put together. The process of uniting the various elements together is called assemblage.

16. What is Rayleigh-Ritz method?

It is integral approach method which is useful for solving complex structural problem, encountered in finite element analysis. This method is possible only if a suitable function is available.

17. What is Aspect ratio?

It is defined as the ratio of the largest dimension of the element to the smallest dimension. In many cases, as the aspect ratio increases the in accuracy of the solution increases. The conclusion of many researches is that the aspect ratio should be close to unity as possible.

18. What is truss element?

The truss elements are the part of a truss structure linked together by point joint which transmits only axial force to the element.

19. What are the h and p versions of finite element method?

It is used to improve the accuracy of the finite element method. In h version, the order of polynomial approximation for all elements is kept constant and the numbers of elements are increased. In p version, the numbers of elements are maintained constant and the order of polynomial approximation of element is increased.

20. Name the weighted residual method.

- Point collocation method.
- Sub domain collocation method
- Least squares method
- Galerkins method.

## UNIT 2-ONE-DIMENSIONAL PROBLEMS

1. List the two advantages of post processing.

Required result can be obtained in graphical form. Contour diagrams can be used to understand the solution easily and quickly.

2. During discretization, mention the places where it is necessary to place a node?

Concentrated load acting point Cross-section changing point Different material interjections Sudden change in point load

3. What is the difference between static and dynamic analysis?

Static analysis: The solution of the problem does not vary with time is known as static analysis Example: stress analysis on a beam

Dynamic analysis: The solution of the problem varies with time is known as dynamic analysis Example: vibration analysis problem.

4. Name any four FEA softwares.

ANSYS , NASTRAN, COSMOS, NISA

5. Differentiate between global and local axes.

Local axes are established in an element. Since it is in the element level, they change with the change in orientation of the element. The direction differs from element to element.

Global axes are defined for the entire system. They are same in direction for all the elements even though the elements are differently oriented.

6. Distinguish between potential energy function and potential energy functional.

If a system has finite number of degree of freedom ( $q_1, q_2, \text{ and } q_3$ ), then the potential energy expressed as,

$$= f(q_1, q_2 \text{ and } q_3)$$

It is known as function. If a system has infinite degrees of freedom then the potential energy expressed as

$$\int \left( x, y, \frac{dy}{dx}, \frac{d^2y}{dx^2}, \dots \right) dx$$

7. What are the types of loading acting on the structure?

- Body force (f)
- Traction force (T)
- Point load (P)
- Define the body force.

A body force is distributed force acting on every elemental volume of the body Unit: Force per unit volume.

Example: Self weight due to gravity

8. Define traction force.



Traction force is defined as distributed force acting on the surface of the body. Unit: Force per unit area.

Example: Frictional resistance, viscous drag, surface shear

9. What is point load?

Point load is force acting at a particular point which causes displacement.

10. What are the basic steps involved in the finite element modeling?

Discretization of structure.

Numbering of nodes.

Write down the general finite element equation.

$$\{F\} = [K] \{u\}$$

11. What is discretization?

The art of subdividing a structure into a convenient number of smaller components is known as discretization.

12. What are the classifications of coordinates?

Global coordinates

Local coordinates

Natural coordinates

13. What is Global coordinates?

The points in the entire structure are defined using coordinates system is known as global coordinate system.

14. What is natural coordinates?

A natural coordinate system is used to define any point inside the element by a set of dimensionless number whose magnitude never exceeds unity. This system is very useful in assembling of stiffness matrices.

15. Define shape function.

Approximate relation

$$\phi(x,y) = N_1(x,y) \phi_1 + N_2(x,y) \phi_2 + N_3(x,y) \phi_3$$

Where  $\phi_1$ ,  $\phi_2$ , and  $\phi_3$  are the values of the field variable at the nodes N1, N2, and N3 are the interpolation functions.

N1, N2, and N3 are also called shape functions because they are used to express the geometry or shape of the element.

15. What are the characteristic of shape function?

It has unit value at one nodal point and zero value at other nodal points. The sum of shape function is equal to one.

16. Why polynomials are generally used as shape function?

Differentiation and integration of polynomial are quite easy.

The accuracy of the result can be improved by increasing the order of the polynomial. It is easy to formulate and computerize the finite element equations.

17. How do you calculate the size of the global stiffness matrix?

Global stiffness matrix size = Number of nodes X Degrees of freedom per node

### UNIT 3-TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS

1. Write down the expression of stiffness matrix for one dimensional bar element.

$$[K] = \frac{AE}{l} \begin{pmatrix} 1 & -1 \\ -1 & 1 \end{pmatrix}$$

2. State the properties of stiffness matrix.

It is a symmetric matrix

The sum of elements in any column must be equal to zero

It is an unstable element. So the determinant is equal to zero.

3. Write down the expression of stiffness matrix for a truss element.

$$\begin{Bmatrix} u_1 \\ u_2 \end{Bmatrix} = \begin{bmatrix} l & m & 0 & 0 \\ 0 & 0 & l & m \end{bmatrix} \frac{1}{m} \begin{Bmatrix} u_1 \\ u_2 \\ u_3 \\ u_4 \end{Bmatrix}$$

4. Write down the expression of shape function N and displacement u for one dimensional bar element.

$$U = N_1 u_1 + N_2 u_2$$

$$N_1 = 1 - X/l$$

$$N_2 = X/l$$

5. Define total potential energy.

Total potential energy, = Strain energy (U) + potential energy of external forces (W)

6. State the principle of minimum potential energy.

Among all the displacement equations that satisfied internal compatibility and the boundary condition those that also satisfy the equation of equilibrium make the potential energy a minimum is a stable system.

7. Write down the finite element equation for one dimensional two noded bar element.

$$[K] = \frac{AE}{l} \begin{pmatrix} 1 & -1 \\ -1 & 1 \end{pmatrix}$$

8. What is truss?

- A truss is defined as a structure made up of several bars, riveted or welded together.
- States the assumption are made while finding the forces in a truss.
- All the members are pin jointed.
- The truss is loaded only at the joint

- The self weight of the members is neglected unless stated.

9. State the principles of virtual energy?

A body is in equilibrium if the internal virtual work equals the external virtual work for the every kinematically admissible displacement field

10. What is essential boundary condition?

Primary boundary condition or EBC Boundary condition which in terms of field variable is known as Primary boundary condition.

11. Natural boundary conditions?

Secondary boundary natural boundary conditions which are in the differential form of field variable is known as secondary boundary condition

12. How do you define two dimensional elements?

Two dimensional elements are define by three or more nodes in a two dimensional plane. The basic element useful for two dimensional analysis is the triangular element.

13. What is CST element?

Three noded triangular elements are known as CST. It has six unknown displacement degrees of freedom ( $u_1, v_1, u_2, v_2, u_3, v_3$ ). The element is called CST because it has a constant strain throughout it.

14. What is LST element?

Six noded triangular elements are known as LST. It has twelve unknown displacement degrees of freedom. The displacement function for the elements are quadratic instead of linear as in the CST.

15. What is QST element?

Ten noded triangular elements are known as Quadratic strain triangle. It is also called as cubic displacement triangle.

16. What meant by plane stress analysis?

Plane stress is defined to be a state of stress in which the normal stress and shear stress directed perpendicular to the plane are assumed to be zero.

17. Define plane strain analysis.

Plane strain is defined to be state of strain normal to the xy plane and the shear strains are assumed to be zero.

18. Is beam element isoparametric element?

Beam element is not an isoparametric element. Since the geometry and displacements are defined by different order interpolation functions.

19. Define superparametric element.

If the number of nodes used for defining the geometry is more than number of nodes used for defining the displacements, then it is known as superparametric element.

## UNIT 4- TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS

1. Write down the stiffness matrix equation for two dimensional CST elements.

$$\text{Stiffness matrix } [K] = [B]^T [D] [B] A t$$

$[B]^T$  - Strain displacement  $[D]$  - Stress strain matrix  $[B]$  - Strain displacement matrix

2. Write down the stress strain relationship matrix for plane stress conditions.

$$\frac{E}{1+\nu} \begin{pmatrix} 1-\nu & \nu & 0 \\ 0 & 1-\nu & 0 \\ 0 & 0 & \frac{1-2\nu}{2} \end{pmatrix}$$

3. What is axisymmetric element?

Many three dimensional problem in engineering exhibit symmetry about an axis of rotation such type of problem are solved by special two dimensional element called the axisymmetric element

4. What are the conditions for a problem to be axisymmetric?

The problem domain must be symmetric about the axis of revolution

All boundary condition must be symmetric about the axis of revolution

All loading condition must be symmetric about the axis of revolution

Give the stiffness matrix equation for an axisymmetric triangular element.

Stiffness matrix

$$[K] = [B]^T [D] [B] 2\pi r A$$

5. What is the purpose of Isoparametric element?

It is difficult to represent the curved boundaries by straight edges finite elements. A large number of finite elements may be used to obtain reasonable resemblance between original body and the assemblage.

Write down the shape functions for 4 noded rectangular elements using natural coordinate system.

$$N_1 = \frac{1}{4}(1-\xi)(1-\eta) \quad N_2 = \frac{1}{4}(1+\xi)(1-\eta)$$

$$N_3 = \frac{1}{4}(1+\xi)(1+\eta) \quad N_4 = \frac{1}{4}(1-\xi)(1+\eta)$$

6. Write down Jacobian matrix for 4 noded quadrilateral elements.

$$[J] = \begin{pmatrix} J_{11} & J_{12} \\ J_{21} & J_{22} \end{pmatrix}$$

7. Write down stiffness matrix equation for 4 noded isoparametric quadrilateral elements.

$$\text{Stiffness matrix } [K] = t \int_{-1}^1 \int_{-1}^1 [B]^T [D] [B] |J| d\xi d\eta$$

8. Define super parametric element.

If the number of nodes used for defining the geometry is more than of nodes used for defining the displacement is known as super parametric element

9. Define sub parametric element.

If the number of nodes used for defining the geometry is less than number of nodes used for defining the displacement is known as sub parametric element.

10. What is meant by Isoparametric element?

If the number of nodes used for defining the geometry is same as number of nodes used for defining the displacement is known as Isoparametric element.

11. Is beam element an Isoparametric element?

Beam element is not an Isoparametric element since the geometry and displacement are defined by different order interpretation functions.

12. What is the difference between natural coordinate and simple natural coordinate?

$$L1 = 1-x/l$$

$$L2 = x/l$$

13. What is Area coordinates?

$$L1 = A1/A \quad L2 = A2/A \quad L3 = A3/A$$

14. What is simple natural coordinate?

A simple natural coordinate is one whose value between -1 and 1.

15. Give example for essential boundary conditions.

The geometry boundary condition are displacement, slope.

16. Give example for non essential boundary conditions.

The natural boundary conditions are bending moment, shear force

17. What is meant by degrees of freedom?

When the force or reaction act at nodal point node is subjected to deformation. The deformation includes displacement rotation, and or strains. These are collectively known as degrees of freedom.

18. What is QST element?

Ten noded triangular elements are known as Quadratic strain triangle. It is also called as cubic displacement triangle.

## UNIT 5 - ISOPARAMETRIC FORMULATION

1. What meant by plane stress analysis?

Plane stress is defined to be a state of stress in which the normal stress and shear stress directed perpendicular to the plane are assumed to be zero.

2. Define plane strain analysis.

Plane strain is defined to be state of strain normal to the x,y plane and the shear strains are assumed to be zero.

3. What is truss element?

The truss elements are the part of a truss structure linked together by point joint which transmits only axial force to the element.

4. List the two advantages of post processing.

Required result can be obtained in graphical form.

Contour diagrams can be used to understand the solution easily and quickly.

5. What are the h and p versions of finite element method?

It is used to improve the accuracy of the finite element method. In h version, the order of polynomial approximation for all elements is kept constant and the numbers of elements are increased. In p version, the numbers of elements are maintained constant and the order of polynomial approximation of element is increased.

6. During discretization, mention the places where it is necessary to place a node?

Concentrated load acting point

Cross-section changing point

Different material inter junction point

Sudden change in point load

7. What is the difference between static and dynamic analysis?

Static analysis: The solution of the problem does not vary with time is known as static analysis

Example: stress analysis on a beam

Dynamic analysis: The solution of the problem varies with time is known as dynamic analysis

Example: vibration analysis problem.

8. What is meant by discretization and assemblage?

The art of subdividing a structure in to convenient number of smaller components is known as discretization. These smaller components are then put together. The process of uniting the various elements together is called assemblage.

9. What is Rayleigh-Ritz method?

It is integral approach method which is useful for solving complex structural problem, encountered in finite element analysis. This method is possible only if a suitable function is available.

10. What is Aspect ratio?

It is defined as the ratio of the largest dimension of the element to the smallest dimension. In many cases, as the aspect ratio increases the in accuracy of the solution increases. The conclusion of many researches is that the aspect ratio should be close to unity as possible.

11. What is essential boundary condition?

Primary boundary condition or EBC, Boundary condition which in terms of field variable is known as Primary boundary condition

Natural boundary conditions.

Secondary boundary natural boundary conditions which are in the differential form of field variable is known as secondary boundary condition.

12. How do you define two dimensional elements?

Two dimensional elements are define by three or more nodes in a two dimensional plane. The basic element useful for two dimensional analysis is the triangular element.

13. State the principles of virtual energy?

A body is in equilibrium if the internal virtual work equals the external virtual work for the every kinematically admissible displacement field.

14. Define Resonance.

When the frequency of external force is equal to the natural frequency of a vibrating body, the amplitude of vibration becomes excessively large. This phenomenon is known as Resonance

15. What is non-homogeneous form?

When the specified values of dependent variables are non-zero, the boundary conditi said to be non-homogeneous.

16. What is homogeneous form?

When the specified values of dependent variables is zero, the boundary condition are said to be homogeneous.

17. Define initial value problem.

An initial value problem is one in which the dependent variable and possibly is derivatives are specified initially.

18. Define boundary value problem.

A differential equation is said to describe a boundary value problem if the dependent variable and its derivatives are required to take specified values on the boundary.

19. What are the types of Eigen value problems?

- Determinational based methods
- Transformation based methods
- Vector iteration methods

**AUTOMOBILE ENGINEERING**  
**UNIT-1 VEHICLE STRUCTURE AND ENGINES**

**1) What are the components of an automobile?**

The main units are

- a) The Basic structure
- b) The power plant
- c) The transmission system
- d) The auxiliaries
- e) The controls
- f) The super structure

**2) What are the advantages of frameless construction over the conventional framed construction?**

- a) Reduced weight and consequent saving in fuel consumption.
- b) Lower manufacturing cost
- c) During collision the body crumbles, thereby absorbing the shock due to impact and thus providing safety to the passengers.
- d) Compared to framed construction lower body position may be obtained, thus
- e) Resulting in increased stability of the automobile.

**3) Classify the automobiles based on use.**

- a) Auto cycles
- b) Motor cycles
- c) Cars, jeep
- d) Buses and trucks

**4) Classify the automobiles based on capacity.**

1. Heavy transport vehicles Examples trucks and buses
2. Light transport vehicles like cars, jeeps etc.

**5) Write the firing order of 4cylinder and 6cylinder I C engines.**

1. 4 Cylinder Engine  
1-3-4-2 or 1-4-3-2
2. 6 Cylinder Engine  
1-5-3-6-2-4

**6) What is the difference between dry liners and wet liners?**

**Dry liners**

1. Cooling water is not in contact with the dry liner.
2. This type of liner is machined very accurately and pressed into the cylinder block.

**Wet Liners**

1. Cooling water is in contact with the wet liner.
2. The liner is machined only on the inside and outside surface.

**7) What is the function of piston rings?**

1. Prevention of leakage of gas into the crank case.
2. Prevention of lubricating oil film.
3. Prevention of lubricant entry into the combustion chamber above the piston.
4. Balancing of side thrust of the piston.

**8) Name any two materials used for connecting rods.**

1. Forged steel
2. Graphite cast iron

**9) Define indicated power and brake power.**

**1. Indicated Power**



It is the power developed in the cylinder measured by a form of pressure indicator connected to the cylinder head.

## **2. Brake power**

It is the useful power available at the crank shaft of the engine for doing external work.

### **10) What is the function of gasket in an engine?**

Gasket is used for providing a tight fitting joint between two surfaces.

### **11) What are the two types of balancing of IC engines?**

- i. Power Balance
- ii. Mechanical Balance

### **12) What are the types of mufflers?**

- a. Baffle type
- b. Wave cancellation Type
- c. Resonance Type
- d. Absorber type
- e. Combined resonance and absorber type.

### **13) What is meant by over hauling of engines?**

This is a general process consisting of cleaning, inspection, diagnosis, readjustment, minor replacement, and turning up of engines.

### **14) What are the disadvantages of gas turbines?**

- a. There is no engine braking and acceleration.
- b. Since the speed varies from 25,000 to 50,000 rpm braking is not effective.
- c. Difficult to obtain an effective transmission speed on road.
- d. A high speed self starter with a large battery is required.

### **15) What are the main sources of automobile pollutants?**

- a) Fuel tank – Gasoline vapour
- b) Carburettor- Gasoline vapour
- c) Crankcase-Unburnt air fuel mixture blown through the piston rings.
- d) Tail pipe- Unburnt Gasoline, Hydrocarbon, Carbon monoxide, etc.

### **16) What is a particulate matter?**

Particulate matter is a pollutant of respirable size emitted from vehicular traffic exhaust and it produces respiratory distress and cancer.

### **17) What is the function of timing gear?**

The timing gears are responsible for transmission between the crank shaft and the cam shaft.

### **18) What are the types of valve operating mechanism?**

There are two types of valve operating mechanism, they are

- a. Side valve mechanism
- b. Over Head mechanism

### **19) Mention some of the purpose of I.C. engines.**

Purpose of testing an I.C. engines are

1. To determine the information, which cannot be obtained by calculations.
2. To confirm the validity of data used in design.
3. To prepare heat balance sheet.

**20) What are the steps adopted in overhaul of propeller shaft?**

- a) Removal of the shaft.
- b) Dismantling.
- c) Inspection and service.
- d) Reassembling
- e) Refitting.

**21. What are the functions of a frame?**

- To support the chassis components and the body.
- To withstand static and dynamic loads without undue deflection or distortion.
- To carry the load of the passengers or goods carried in the body.

**22. List out the various materials used in the construction of chassis frames.**

- Low Carbon Steel - 0.18 or 0.20 % carbon content
- High Carbon Steel - 0.25 % carbon content
- Alloy Steel – With alloying elements like Ni & Cr

**23. Write down any two main sections of vehicle construction.**

1. Chassis construction
2. Body construction

**24. What are two types of vehicle suspensions?**

1. Rigid axle suspension
2. Independent suspension

**25. What loads are coming to axle?**

1. Vertical bending load due to vehicle weight
2. Driving torque
3. Braking torque
4. Side thrust

**26. What are the functions of a gear box?**

1. It has to provide torque multiplication
2. It has to provide neutral position
3. It has to provide the means to reverse a vehicle

**27. Why you need a gear box?**

When a vehicle is moving on a road, it has to encounter different resistances depending upon the road surface, vehicle speed and road gradient. Hence, wheel torque required at road wheels is different for different operating conditions. To satisfy this requirement, a gearbox is necessary in a vehicle.

**28. Name the different kind of resistances to vehicle motion.**

1. Air resistance
2. Rolling resistance
3. Gradient resistance

**29. Why is the frame narrow at front?**

The frame is narrowed at the front to provide a better steering lock. This also permits smaller turning circle radius.

**30. List out the various materials used in the construction of vehicle body**

1. Wood

2. Metals
3. Plastics
4. Mixed construction of all these materials

**31. Why are the side members of the frame upswept at two places?**

The frame is upswept at the rear and front to accommodate the movement of the axles due to springing. It also keeps the chassis height low.

**32. What is the function of a bumper?**

A bumper is the front-most or rear-most part, which is designed to allow the vehicle to sustain an impact without damage to the vehicle's safety systems.

**33. What are the stresses to which the frame members are subjected to?**

- a) Frame longitudinal members – bending stress
- b) Frame side members – twisting stress

**34. Name few components of engine.**

1. Cylinder block
2. Cylinder head
3. Crankcase
4. Cylinder
5. Piston
6. Connecting rod
7. Crankshaft
8. Camshaft
9. Valves
10. Spark plug (in the case of petrol engine)
11. Fuel injector (in the case of diesel engine)

**35. What are the types of frames?**

1. Ladder type frame
2. Perimeter type frame
3. X type frame
4. Backbone type frame

**36. What is meant by self-propelled vehicle?**

A self propelled vehicle is known as an “Automobile”

**37. List the various manufacturers of automobile products in India.**

1. Maruti, Hyundai, Nissan, Ford – Passenger Vehicles
2. Tata, Ashok Leyland – Heavy Commercial Vehicles
3. Bajaj, Hero Honda, TVS Suzuki – Two Wheelers
4. Bajaj, Mahindra – Three Wheelers

**38. State the major types of automobiles according to the fuel used.**

1. Petrol Engines (SI engines)
2. Diesel Engines (CI engines)
3. Gas Engines (either SI or CI mode)

**39. Classify automobiles with respect to the drive of the vehicle.**

- a) Front wheel drive

- b) Rear wheel drive
- c) All four wheel drive
- d) Left hand drive
- e) Right hand drive

**40. What is meant by the term Chassis?**

A complete vehicle without a body structure is known as Chassis. It comprises of basic structure, power unit, transmission system, controls and auxiliaries.

**41. How automobiles are classified into different types?**

- a) Based on Make & Model
- b) Based on Fuel
- c) Based on Body Style
- d) Based on No. of Wheels
- e) Based on Drive
- f) Based on Transmission

**42. What are the two types of cylinder liners?**

1. Dry liners
2. Wet liners

**43. What are the functions of piston rings?**

To provide a gas tight seal between the piston and cylinder liner to prevent the escape of gases from top side of the piston to the underside.

**44. What are the two types of piston rings?**

1. Compression rings
2. Oil rings

**45. What are the different methods of engine cooling?**

- a) Air cooling
- b) Oil (or) Water cooling

**46. What are the advantages of air-cooled engines?**

- a) Less weight-power ratio
- b) Does not require radiator and water pump
- c) No antifreeze agents required
- d) No salt and mud deposits in the system
- e) Air cooled engines are cheaper

**47. What are the components of water cooling method?**

Water pump, radiator tube, upper tank, lower tank, thermostat valve etc.

**48. State the difference between S.I and C.I engine.**

Parameter	SI Engine	CI Engine
Type of fuel	Petrol	Diesel
Compression Ratio	Low ( 6 to 10)	High (12 to 24)

Operating cycle	Otto cycle	Diesel or Dual cycle
Thermal efficiency	Low	High

**49. What is clearance volume? And what are its effects?**

The volume above the piston, when it reaches TDC is known as clearance volume. The clearance volume is inversely proportional to the compression ratio.

**50. What is the function of piston, connecting rod, crank shaft and cylinder head?**

- a) Piston – The piston assembly transfers the force from the power stroke to the crankshaft
- b) Connecting rod – converts reciprocating motion of piston into rotary motion of crankshaft
- c) Cylinder head – it acts as a top cover to the cylinder block. The valves are placed in the cylinder head in an overhead valve engine.

**51. What is the purpose of cooling system?**

The purpose of cooling system is to cool the engine components in order to keep their temperature below certain limit and thereby avoiding excessive thermal stress in those components.

**52. State the merits and demerits of air and water cooling system.**

**Air Cooling**

**Merits**

- 1. Less weight-power ratio
- 2. Does not require radiator and water pump
- 3. No antifreeze agents required
- 4. No salt and mud deposits in the system
- 5. Air cooled engines are cheaper

**Demerits**

- 1. Cooling efficiency is lower
- 2. Non uniform cooling
- 3. Engines are noisier.
- 4. It needs impellor or blower to blow air over the fins

**Water Cooling**

**Merits**

- 1. Cooling efficiency is better
- 2. More uniform cooling
- 3. Engine operation is silent in nature
- 4. It does not need an impeller or blower

**Demerits**

- 1. More number of components like radiator, water pump
- 2. Antifreeze agents needed (Ethylene Glycol, Methanol)
- 3. More salt and mud deposition in the system
- 4. Engines are costlier

**53. What is the purpose of lubricating system? State its types.**

The purpose of lubrication system is to supply the lubricating oil between the moving parts of the engine in order to

1. Reduce the friction
2. Provide the cooling effect
3. Carry away the deposits formed due to wear and tear

**Types: -**

- a) Mist lubrication
- b) Splash lubrication
- c) Pressure feed lubrication
- d) Combined splash & pressure feed lubrication

**54. What is meant by turbo charging?**

Increasing the density of inducted charge/air by using a compressor which gets its power from exhaust driven turbine is known as Turbo charging.

**55. What are the various pollutants in I.C engine?**

HC, CO, NO<sub>x</sub> Particulates, SO<sub>2</sub>, CO<sub>2</sub>

**56. What is meant by P.C.V? And what are its effects?**

PCV – Positive Crankcase Ventilation. It is used to reduce the blow-by and thereby unburned hydrocarbon emissions

**57. What is a Catalyst?**

Catalyst is a chemical substance which increases the rate of chemical reaction. Examples are Platinum, Palladium and Rhodium.

**58. Write down the firing order a 4 cylinder and 6 cylinder engine**

4 cylinder engine firing order: 1-4-3-2

6 cylinder engine firing order: 1-5-3-6-2-4

## **UNIT-2 ENGINE AUXILIARY SYSTEMS**

**1) What are the functions of carburetor?**

1. To keep a small reserve of fuel at a constant head.
2. To vaporize the fuel to prepare a homogenous air fuel mixture.
3. To supply correct amount of air fuel mixture at the correct strength under all conditions of load and speed of the engine.

**2) What are the types of carburetor?**

1. Carter carburetor
2. Zenith carburetor
3. S U carburetor
4. Solex carburetor

**3) Name the various circuits in Carter carburetor**

1. Float circuit
2. Idle and low speed circuit
3. Full throttle
4. Part throttle circuit

5. Acceleration pump circuit
6. Starting circuit

**4) How is the injector opened in an electronic injection system?**

The Injectors are held closed by means of spring and are opened by means of solenoids energized by the control signal from the electronic control unit (ECU).

**5) List out type of sensor used in electronic injection system.**

1. Manifold absolute pressure (MAP) sensor.
2. Barometric pressure (BARO) sensor.
3. Throttle position sensor (TPS).
4. Coolant temperature sensor (CTS).

**6) Define single point injection system.**

It consists of a single injector for the entire engine mounted above the throttle butterfly valves, feeding the engine in a manner similar to a conventional carburetor system.

**7) What are the types of battery?**

1. Alkaline Battery
2. Zinc-air Battery

**8) What are the major components in battery system?**

1. Container.
2. Plates
3. Separators
4. Cell covers
5. Electrolyte.

**9) What is the material used for battery containers?**

1. Polypropylene
2. Bituminous materials

**10) What is the function of generator in automobiles?**

A generator in an automobile supplies the electrical energy for charging the battery in the vehicle. The generator is driven from the engine by means of a belt.

**11) What is the function of multipoint injection system?**

In multi point injection system a separate injector for each cylinder is mounted in the inlet manifold. The fuel is injected into each intake port on the manifold side of the inlet valve, so that the mixture preparation and distribution is high. By using throttle body and butterfly valve at the intake system, the air flow is metered and controlled.

**12) What is the purpose of cut-out relay?**

Cut-out relay is a circuit breaker or an automatic switch which opens and closes between the generator and the battery. Some means are prevent the battery from discharging through generator.

**13) What are the main types of starting devices in automobile?**

- A) Bendix drive
  - 1) Standard Bendix drive
  - 2)'Folo-thru' Bendix drive
    - i) Compression spring type Bendix drive

- ii) Rubber spring type Bendix drive
- B) Overrunning clutch drive
- C) Dyer drive.

**14) Name various types of starting motor switches**

1. Manual switch
2. Solenoid switch
3. Solenoid switch-cum-shift.
4. Solenoid shift with relay.

**15) What is the advantage of a solenoid switch compared to the manual type?**

The advantage of solenoid switch compared to the manual is that the heavy current wiring length is reduced and the driver has to operate only a push button or key switch which carries a nominal amount of current only.

**16) Name different lights used on an automobile.**

The automobile lighting systems consists of head lamps, side, tail, stop and reverse lamps. Apart from these there are instrument panel lights, direction indicator flash lights and the lights inside the body to light up passenger compartment.

**17) Write the requirements of an automobile ignition system.**

1. Spark at the plug electrodes must be regular and synchronously timed with respect to the cylinder-piston position at all speeds and loads on the engine.
2. The spark should be sufficiently strong so as to start ignition of the charge.
3. It should be light and compact.
4. The system must be easy to maintain.
5. It should be adaptable to mass production.
6. It must not cause radio interference.

**18) What is the function of contact breaker?**

The function of a contact breaker is to make and break the primary ignition system. This is probably the weakest member of an ignition system.

**19) What is the function of a spark plug?**

The function of a spark plug is to contact a high potential from the ignition circuit to the combustion chamber and to allow its discharge across an air gap in the spark plug. This initiates the ignition of the compressed air fuel mixture.

**20) What is the type of magneto ignition system?**

- i. Rotating armature type
- ii. Rotating magnet type

**21. What is Gasoline Direct Injection?**

The gasoline (petrol) is directly into the cylinder at the end of compression stroke as such in diesel engines. This is called Gasoline Direct Injection (GDI).

**22. What is conventional ignition system?**

The conventional ignition system gets its electrical voltage either from battery or dynamo, which will be boosted to a very high voltage due to which spark is produced in the cylinder to combust the mixture.



**23. Define common rail injection system.**

A common rail which is maintaining high fuel pressure is connected to individual fuel injectors of a multi cylinder engine.

**24. What is unit injection system?**

It is an integrated direct fuel injection system for diesel engines, combining the injector nozzle and the injection pump in a single component

**25. What is a rotary distributor?**

The rotary distributor has a rotating element, which releases a high intensity spark to the individual spark plugs according to the engine firing order.

**26. What is the function of a spark plug?**

The spark plug is a device to produce electric spark to ignite the compressed air-fuel mixture inside the cylinder.

**27. What is an Electronic ignition system?**

The ignition system, in which the mechanical contact points are replaced by electronic triggering and switching devices, is known as electronic ignition system.

**28. What are the functions of Turbo chargers?**

- To produce more power from the same size engine
- To provide the altitude compensation
- To improve more complete combustion & hence less emissions

**29. Why the engine emissions to be controlled?**

Some of the engine emissions are carcinogenic. Moreover, the engine emissions led to green house effect. For these reasons, the engine emissions need to be controlled.

**30. What are the advantages of petrol injection?**

1. High power can be developed
2. It has quick starting characteristics
3. It has lowest specific fuel consumption
4. Less engine emissions than carbureted engines

**31. What is super charging?**

The process of increasing the density of inducted charge/ air is known as supercharging. It is performed for the following reasons.

- To produce more power from the same size engine
- To provide the altitude compensation
- To improve more complete combustion & hence less emissions

**32. What is meant by carburetion in I.C engine?**

The method of preparing the air-fuel mixture in an IC engine is known as carburetion. The device used for this purpose is known as carburetor.

**33. What are the advantages of electronic fuel injection system over conventional injection?**

- |                            |  |
|----------------------------|--|
| a) Cold starting is easier | c) Less engine emissions                                 |
| b) High fuel economy       | d) Quick response to varying engine operating conditions |

**34. What are the functions of generator and starting motor?**

The function of the generator is to produce electricity to charge the battery. The starting motor is used to crank the engine during the starting condition.

**35. What is the function of an ignition system in I.C engine?**

The function of an ignition system is to ignite the air-fuel mixture at the end of the compression stroke.

**36. State the requirements of ignition system? And state its types**

- a) It should consume minimum of power and produce high intensity spark across spark plug electrodes
- b) It should have sufficient spark duration which is sufficient to establish burning of air-fuel
- c) mixture under all operating conditions
- d) It should provide sufficient ignition energy over the entire speed range of the engine
- e) Good performance at high speed
- f) Longer life of contact breaker points and spark plug
- g) Adjustment of spark advance with speed and load

**Types:**

- 1. Battery ignition
- 2. Magneto ignition
- 3. Electronic ignition

**37. What is the ignition advance?**

When the speed of the engine increases, the ignition timing also needs to be advanced for proper combustion. This process is known as ignition advance.

**38. What are the difference between battery coil ignition and magneto ignition system?**

Sl.No	Battery Ignition	Magneto Ignition
1	Battery is needed	No battery needed
2	Battery supplies current in primary circuit	Magneto produces the required current for primary circuit
3	A good spark is available at low speed also	During starting the quality of spark is poor due to slow speed
4	Occupies more space	Very much compact
5	Recharging is a must in case battery gets Discharged	No such arrangement required
6	Mostly employed in car and bus for which it is required to crank the engine	Used on motorcycles, scooters, etc
7	Battery maintenance is required	No battery maintenance problems

**39. What is the sealed head lamp system?**

A sealed headlamp system is a type of unitized lamp with a parabolic reflector, one or more filaments and a glass or polycarbonate lens all permanently attached together and sealed.

**40. What is the function of carburetor?**

The function of a carburetor is to prepare the air-fuel mixture according to the engine operating conditions.

**41. What are the merits and demerits of mono point and multi point fuel injection system?**

Sl.No	Mono Point Injection	Multi Point Injection
1	Single injector is sufficient	Separate fuel injector for individual cylinders
2	Low cost	High cost
3	Low injection pressure	Comparatively higher injection pressure
4	Slightly higher SFC and emissions than MPFI	Low SFC and engine emissions

**42. List the different methods of battery charging.**

- a) Constant current charging
- b) Constant voltage charging
- c) High rate charging
- d) Slow rate charging

**43. State the principle of working of an A.C. Generator.**

The basic principle of ac generator is electromagnetic induction when a coil of a conductor moves in a magnetic field the electrons in it starts moving because of attraction and repulsion of magnetic field. Thus, an emf is induced in it.

**44. In what respect does a Dynamo differ from an Alternator?**

i). Dynamo produces Direct Current (DC), while Alternator produced Alternating Current (AC)

which can be converted to DC using rectifiers.

ii). Alternator is lighter in construction than dynamo for the same output

**45. What is the purpose of Stator in the Torque Converter?**

The stator resides in the center of the torque converter. Its job is to redirect the fluid returning from the turbine before it hits the pump again. This dramatically increases the efficiency of the torque converter.

**46. What are the components of lead acid battery?**

- a) Lead terminals
- b) Electrolyte
- c) Internal plates (positive and negative plates)
- d) Resilient Plastic container

**47. What are the different types of starter motor drives?**

- a) Bendix drive
- b) Overrunning drive
- c) Outboard drive

**48. What are the chemicals used in battery?**

PbO<sub>2</sub> – Positive plate

Pb – Negative plate

Electrolyte – Diluted Sulphuric acid

**49. What is a dry charged battery?**

The battery is built, charged, washed and dried, sealed, and shipped without electrolyte. It can be stored for up to 18 months. When put into use, electrolyte and charging are required.

**50. What is the purpose of the grid?**

The more "plates" in the grid, the more surface area exposed to the electrolyte, hence the more power produced.

**51. How will you distinguish a positive plate from a negative plate in a lead acid battery?**

The positive plates are coated with PbO<sub>2</sub> and chocolate brown in color  
The negative plates are coated with spongy lead and grey in color.

**52. What is the function a cut out in a charging system?**

The cut out permits the current flow from dynamo/alternator to battery for charging while it does not permit the reverse flow of current.

**53. What is the function of regulators in a charging system?**

Current regulator – regulates the alternator/dynamo current for charging the battery (constant current charging mode)

Voltage regulator – regulates the alternator/dynamo voltage for charging the battery (constant voltage charging mode)

### UNIT-3 TRANSMISSION SYSTEMS

**1. What is the necessity of transmission system in automobile?**

- a) Variation of resistance to the vehicle motion at various speeds.
- b) Variation of tractive effort of the vehicle motion at various speeds.

**2. What is the function of a clutch?**

A mechanism which enables the rotary motion of one shaft to be transmitted, when desired, to a second shaft, the axis of which is coincident with that of the first.

**3. What is “clutch free pedal play”?**

When the clutch pedal is pressed, the thrust bearing is not pressed immediately. Rather a part of the pedal movement is purposely kept idle. This is done to avoid a rapid wear of the thrust bearing and the clutch plates and is called clutch free pedal play.

**4. Why are cone clutches better than disc clutches?**

Since the cone discs are having large frictional areas and wedging action, they can transmit a larger torque than disc clutches with the same outside diameter and actuating force and hence cone clutches are preferred to disc clutches. But usually cone clutches are mainly used in low peripheral speed applications.

**5. Define slip in the clutch. Write down the causes for it.**

A large amount of heat is generated due to which clutch facings wear out rapidly and even burn out. This is called as slip in the clutch. This may be caused by the following reasons.

- a) Incorrect linkage adjustment
- b) Weak or broken clutch springs.
- c) Worn out facings

**6. What are the main components in friction clutch?**

- a) Clutch plate
- b) Clutch facing
- c) Pressure plate
- d) Springs
- e) Bearing

**7. What do you mean by fluid flywheel?**

It is an alternative to clutch, uses fluid for transmitting the torque. It is also called hydraulic coupling.

**8. What is the function of a synchronizer in a gearbox?**

It is used for avoids the double declutching. It fitted only on the high gears and on the low and reverse gears ordinary dog clutches are only provided. This is done to reduce the cost.

**9. List out some automatic transmission device.**

- a) Epicyclic gear box
- b) Multiplate clutches
- c) Torque convertor

**10. Difference between torque convertor and fluid flywheel**

**Fluid Flywheel**

- a) The fluid flywheel transmits the same torque given to it by the engine shaft.
- b) Stator is not there.
- c) Efficiency is low.

**Torque Convertor**

- a) The torque convertor increases the torque in a ratio of about 2:1 to 3:1.
- b) Stator is there.
- c) Efficiency is high.

**11. What is the function of stator in a torque convertor?**

Stator is used for avoid the dragging action on the impeller.

**12. Define over drives. what are its advantages?**

Overdrive is a device to step up the gear ratio in the car. It is fitted in between transmission and the propeller shaft.

**13. Define propeller shaft and list out various parts of propeller shaft**

This is the shaft which transmits the drive from the transmission to the bevel pinion or worm of final drive in front engine rear drive vehicles. It is also called as drive shaft. It consists mainly of three parts

- a) Shaft
- b) One or Two universal joints
- c) Slip joint

**14. What is the function of universal joint?**

It is a special type of joint between two shafts whose axes are inclined to each other. Most common example is the Hook's joint.

**15. List out various steps involved in the overhaul of propeller shaft**

- a) Removal of the shaft from the chassis
- b) Dismantling
- c) Inspection and service
- d) Reassembling
- e) Refitting

**16. List out three types of final drives**

- a) Straight bevel gears
- b) Spiral bevel gears
- c) Hypoid gears

**17. What is the need for a differential mechanism in an automobile?**

When the vehicle is taking a turn, the outer wheels will have to travel greater distance as compared to the inner wheels in the same time. If therefore, the vehicle has a solid rear axle only and no other device; there will be tendency for the wheels to skid. Hence the wheel skidding is to be avoided, some mechanism must be incorporated in the rear axle, which should reduce the speed of the inner wheels and increase the speed of the outer wheels when taking turn ;it should at the same time keep the speeds of all the wheels same when going straight ahead.

**18. List out various forces acting on rear axle.**

- a) Weight of the body
- b) Driving thrust
- c) Torque reaction
- d) Side thrust

**19. List out two type of rear axle drive.**

- a) Hotchkiss drive
- b) Torque tube drive

**20. List out rear axle casting**

- a) Split type
- b) Banjo or separate carrier type
- c) Salisbury or integral carrier type.

**21. What is the function of clutch?**

The function of the clutch is to connect and disconnect the engine with road wheels. The clutch has to be disengaged during gear shifting, idling etc.

**22. What are the types of clutch?**

**Friction clutches**

- a) Single plate clutch
- b) Multi plate clutch
- c) Cone clutch
- d) Semi centrifugal clutch
- e) Centrifugal clutch

**Fluid clutches**

- a) Fluid flywheel

**23. State the requirements of an automotive clutch**

1. Torque transmission should be maximum
2. Gradual engagement of clutch plates
3. Heat dissipation should be more
4. Dynamic balancing of clutch components
5. Vibration damping
6. Size should be small

7. Inertia should be low
8. Clutch free pedal play should be sufficient
9. Ease of operation
- 10.

**24. What is the function of gear box? State its types.**

The functions of the gearbox are

- i). To provide the leverage ratio
- ii). To provide the neutral position
- iii). To provide a means to reverse the vehicle.

**Types**

1. Sliding mesh gearbox
2. Constant mesh gearbox
3. Synchromesh gearbox
4. Automatic gearbox – Torque converter

**25. Why is gear box necessary in automobile?**

- a) The variation of resistance to vehicle motion at different speeds
- b) The variation of tractive effort of the vehicle required at various speeds

For above said reasons, a gearbox is necessary in an automobile

**26. What is tractive effort?**

It is the force available at the road wheels for propelling the vehicle.

$$T = \mu W$$

Where, T = Tractive effort

$\mu$  – Coefficient of friction between tyre and road surface

W – Load of the vehicle

**27. Why is sliding mesh gear box not preferred?**

- a) More noise
- b) More wear and tear on the gears
- c) For smooth, quiet and quick change of gears, the driver requires great skill

For the above-said drawbacks, the sliding mesh gearbox is generally not preferred.

**28. What is automatic transmission?**

In the automatic transmission, for changing the gear ratios, manual effort is not at all needed.

The change of gear is performed automatically according to the vehicle speed.

**29. What is an over drive?**

When the speed of the output shaft is greater than the speed of the input shaft, then the drive is known as overdrive. Example: 0.8:1 or 0.9: 1

**30. What is a universal joint? What are its types?**

Universal joint is a type of flexible joint between two shafts whose axes intersect and may assume different inclinations at different times. It is used to transmit power even at inclined angles of the shaft.

**Types**

- a) Yoke joint
- b) Single cardan joint
- c) Double cardan joint
- d) Rag joint
- e) Canfield joint

**31. State the functions of a slip joint.**

The function of a slip joint is to accommodate the propeller shaft length variations, when a vehicle is moving over a bump or bit.

**32. What is the necessity of a propeller shaft?**

The propeller shaft is used to transmit the power from the gearbox to the final drive. It is also used to cover the span between these two components.

**33. What is Hotchkiss drive and Torque Tube drive?**

In Hotchkiss drive, the loads such as vehicle weight, driving torque, braking torque and side thrust all are taken by leaf springs. Two universal joints and one slip joint are must needed.

In Torque tube drive, the driving torque and braking torque are taken by torque tube while the vehicle weight and side thrust are taken care of by leaf springs. One universal joint is just sufficient.

**34. What is the function of differential unit?**

The function of a differential unit is to permit the vehicle turns without wheel skidding. It permits higher speed for outer wheels and reduced speed for inner wheels during turning.

**35. What is the function of pressure plate in a clutch?**

The function of a pressure plate is to hold the friction (clutch) plate tightly against the engine flywheel.

**36. What is meant by differential lock?**

A Differential lock will transmit the same amount of power to both wheels on the axle - which is very useful in 4WD applications where a truck might be stuck and have problems getting out of deep mud or snow.

**37. What is a fluid coupling?**

Fluid coupling is device which transmits torque due to the kinetic energy of the moving fluid. In a fluid coupling, two members namely impeller and turbine are present.

**38. What is the use of torque convertor?**

The torque converter is device which provides a varying torque ratio using fluid energy. In a torque converter, three members namely impeller, turbine and stator are present.

**39. State the forces act on the rear axle**

1. Shear force due to vehicle weight
2. Bending moment due to vehicle weight
3. Driving torque
4. Shear force due to side thrust
5. Bending moment due to side thrust

**40. What are the different types of rear axles?**

- a) Semi floating rear axle
- b) Full floating rear axle
- c) Three quarter floating rear axle

**41. What is the purpose of Stator in the Torque Converter?**

The stator changes fluid flow between the turbine and pump and thus permits the torque multiplication. Without a stator, a torque converter will simply act as a fluid coupling.

**42. Why Synchronizer is required in the automotive transmission system?**

Synchronizer is used to equalize the speed of two mating surfaces, before the contact is established. By doing so, wear & tear and noise can be avoided.

**43. What is transfer box? Where it is used?**

The transfer box is used to convert 2 wheel drives into 4 wheel drive. This is mainly used in hilly regions.



## UNIT- 4 STEERING, BRAKES AND SUSPENSION SYSTEMS

### 1. What is a divided wheel and reversible wheel?

#### Reversible Wheel

A wheel whose disc can be mounted on either face to provide inset or outset, thus decreasing or increasing the wheel track is called reversible wheel.

#### Divided Wheel

A wheel constructed in two parts, which when securely fastened together combine to form a rim having two fixed flanges is called a divided wheel.

### 2. Write the function of tyres

- a. To support the vehicle load.
- b. To provide cushion against shocks.
- c. To transmit driving and braking forces to the road.
- d. To provide cornering power for smooth steering

### 3. What is the advantage of tubeless tyre?

- a. Lesser unstrung weight
- b. Better cooling
- c. Slower leakage of air
- d. Simpler assembly
- e. Improved safety

### 4. What is the factor affecting tyre life?

- a. Inflation
- b. Vehicle maintenance
- c. Manner of driving
- d. Miscellaneous factors

### 5. List out type of stub axles.

- a. Elliot type
- b. Reversed Elliot type
- c. Lamoine type
- d. Reversed Lamoine type

### 6. Define camber, castor and toe in.

#### Camber

Camber is the tilt of the car wheels from the vertical. Camber is positive if the tilt is outward at the top. Camber is also called wheel rake.

#### Castor

The angle between the king pin centre line and the vertical in the plane of the wheel is called the caster angle.

#### Toe In

Toe in is the amount by which the front wheels are set closer together at the front than at the rear when the vehicle is stationary, i.e.  $\text{toe in} = B - A$ .

### 7. What is the different type of steering gears?

- a. Worm and wheel steering gear
- b. Cam and double roller steering gear
- c. Worm and nut steering gear
- d. Recirculating ball type steering gear
- e. Rack and pinion steering gear

**8. Define steering ratio.**

It is the ratio of the angle turned by the steering wheel to the corresponding turning angles of the stub axle. The steering ratio generally used with the present day steering gears vary from about 12:1 for cars to about 35:1 for heavy vehicles.

**9. What is power steering?**

Large amount of torque is required to be applied by the driver for steering medium and heavy vehicles. The power steering system provides automatic hydraulic assistance to the turning effort applied to the manual steering system.

**10. What is the advantage of electronic power steering over hydraulic power steering?**

- a. No problem of leakage of fluid.
- b. Energy being consumed only while steering.
- c. Steering assistance available even when the engine is not running.
- d. While steering manually lesser force is required compared to a hydraulic system since there is no fluid to be forced through valves.

**11. What is objective of vehicle suspension?**

- a. To prevent the road shocks from being transmitted to the vehicle components.
- b. To safeguard the occupants from road shocks.
- c. To preserve the stability of the vehicle in pitching or rolling, while in motion.

**12. What is the type of suspension spring?**

- a) A) Steel Spring
  - a) Leaf spring b) Tapered leaf spring c) Coil spring d) Torsion spring
- b) B) Rubber Spring
  - a) Compression spring b) Compression- shear spring c) Steel-reinforced spring
- c) d) Progressive shear spring e) Face shear spring f) Torsional shear spring
- d) Plastic spring
- e) Air spring
- f) Hydraulic spring

**13. What is material used for leaf springs?**

- a. Chrome- Vanadium steel
- b. Silico Manganese steel
- c. Carbon steel

**14. What is the advantage of rubber spring?**

- a. It can store greater energy per unit weight than the steel.
- b. The rubber has excellent vibration damping properties.
- c. The absence of squeaking which is always present in steel springs.
- d. The number of bearings is reduced considerably for the rubber suspension system.
- e. Rubber is more reliable. A rubber suspension cannot suddenly fail like the metal springs.

**15. Write different type of front wheel independent suspension.**

- a. Wishbone type or parallel link type
- b. Macpherson strut type
- c. Vertical guide type
- d. Trailing link type
- e. Swinging half-axle type

**16. What is the function of a brake?**

Break is a mechanical device by means of which motion of a body is retarded for slowing down or to bring it to rest, by applying artificial frictional resistance.

**17. Write down any two advantages of hydraulic brake over mechanical break system.**

- a. The fluid exerts equal pressure everywhere in its circuit. For this reason equal breaking effort is obtained at all the four wheels.
- b. The system is simple in construction.
- c. Due to absence of joints compared to mechanical brakes, rate of wear is also less.
- d. The system is mostly self-lubricating.

**18. What are the characteristics of brake fluid?**

- a. Boiling point
- b. Viscosity
- c. Lubrication properties
- d. Effect on rubber
- e. Corrosive action
- f. Storage stability

**19. Define air brakes**

In air brake, the compressed air is used to apply brakes instead of hydraulic pressure. Air brake is commonly used on heavy vehicle, like trucks, buses etc.

**20. Define wheel track and wheel base.**

The distance between the tyre centers, mounted on the same axle is known as wheel track. The wheelbase is the distance between the centers of the front and rear wheels.

**21. Give a brief note on damper.**

It is used to dampen the vibrations of the suspension springs. It is mostly used in independent suspension.

**22. Distinguish between disc brake with drum brake.**

Sl.No	Drum Brakes	Disc Brakes
1	Relatively cheaper	Costlier
2	More weight	Lighter than drum brakes
3	Easily subjected to brake fading	Offer resistance to brake fading
4	Non uniform pressure distribution	Uniform pressure distribution

**23. What is meant by bleeding of brakes?**

The process of removing air from the hydraulic brakes is known as bleeding of brakes.

**24. Define steering gear.**

The steering gear is used to convert the rotational movement of the steering wheel into linear movement of the steering linkage. Moreover it provides mechanical advantage.

**25. What are the different types of wheels?**

- a. Pressed steel disc wheels
- b. Wire spoke wheels
- c. Light alloy casted wheels.

**26. What is the purpose of Toe-in and Toe-out?**

The purpose of providing a toe in and toe out is straight line stability of the vehicle, after negotiating a turn.

**27. What are the different types of tyres used in automobile?**

- a. Cross ply tyres
- b. Radial ply tyres
- c) Belted bias tyres

**28. What are the different types of springs used in suspension system?**

- a. Leaf springs (Rigid axle suspension)
- b. Coil springs (Independent suspension)
- c. Torsion bar (Independent suspension)

**29. Define king pin inclination.**

The tilt of the king pin from the vertical reference line is known as King Pin Inclination (KPI). It is also called as Steering Axis Inclination (SAI).

**30. Give the function of tyre?**

1. Supporting Vehicle Weight
2. Transferring Traction & Braking forces to the Road Surface
3. Changing & Maintenance Direction of Travel
4. Absorbing Road shocks

**31. Define castor and camber.**

Castor: The tilt of the king pin from the vertical reference line when viewed from side is known as castor.

Camber: The camber angle is the inward or outward tilt of the wheel relative to the vertical reference.

**32. What are the benefits of anti-lock brake system?**

1. Preventing the wheel from locking at the time of braking
2. Keeping the wheel rotating
3. Due to rotating wheel, it helps you to steer away the vehicle from the object, while applying brakes at the same time.
4. It is even more effective in sand, snow, water, and mud where loss of traction is even higher, with normal braking system; it is even easier to lock wheels and lose traction but ABS works excellent in these conditions also and stops the vehicle in a much shorter distance.

**33. What is steering ratio?**

The steering ratio is defined as the ratio of angle turned on the steering wheel to the angle turned by the stub axle.  $\text{Steering ratio} = \frac{\text{Angle turned on steering wheel}}{\text{Angle turned by the stub axle}}$

**34. What is toe in and toe out?**

The distance between the front ends of wheels is less than the rear end, the condition is said to be toe-in. The distance between the front ends of wheels is more than the rear end, the condition is said to be toe out.

**35. What are the types of steering gear box?**

- a) Worm & Worm wheel steering gear
- b) Worm and Nut steering gear
- c) Worm and Roller steering gear
- d) Recirculating Ball steering gear
- e) Rack and Pinion steering gear

**36. What are main advantages of power steering?**

1. The manual effort required to turn the vehicle is getting reduced.
2. This layout also gives road feel to the driver.

**37. What is function of suspension system in automobile?**

The function of the suspension system is to isolate the vehicle and its occupants from road shocks and vibrations generated by the road surface, while maintaining steering control and stability at all times.

**38. What is the function of brake? State its type.**

The function of brake is to stop the vehicle within a short distance.

**Types:**

1. Mechanical brakes
  - a. Drum brakes
  - b. Disc brakes
2. Power brakes
  - c. Air brakes
  - d. Air-hydraulic brakes
  - e. Vacuum brakes
  - f. Electric brakes
3. Hydraulic brakes

**39. What are the functions of front axles?**

- It carries the weight of the front of the vehicle.
- It carries the horizontal and vertical loads on bumpy roads.
- It works as a cushion through its spring for a comfortable ride.
- In a four wheel drive, it also transmits power to the road wheels.
- When brakes are provided at the front wheels, it withstands bending stresses and torsional stresses.

**40. What I section at middle and oval section at end is preferred for front axle?**

'I' section is suitable for bending loads and 'circular' or 'oval' section is suitable for torsional loads. Hence I section at middle and circular or oval section at ends is provided in the front axle.

**41. What are the different types of stub axles? Which is the most preferred one?**

1. Elliot
2. Reversed Elliot
3. Lamoine
4. Reversed Lamoine. Out of these four types, Reversed Elliot is the most preferred.

**42. What is meant by the term "tread"?**

The tread of a tire refers to the patterns on its rubber circumference that makes contact with the road.

**43. What are differences between cross ply, radial ply and bias belted ply tyres?**

<b>Cross Ply</b>	<b>Bias Belted Ply</b>	<b>Radial Ply</b>
Two or more layers running across perpendicular to tyre rotation	In addition to body plies, additional plies or breaker chords	Plies running from bead to bead across the crown at right angles to rotation
Comfortable ride	Don't flex as like cross ply, reduced comfort	Additional breaker chord angle varies from 18° to 22°
Poor steering control	Steering control improved	Reduced the tyre wear, increases overall life and harder drive at low speed.

**44. What is a self energizing brake?**

A brake is called self-energizing if it uses the rotational force of the wheel to help stop the automobile.

**45. What is disc brake?**

These brakes are different from drum brakes in that the drum is replaced by a circular plate and the brake shoes are replaced by a caliper which supports a pair of friction pads, one on each side of the disc. These pads are forced inward by the operating force and so retard the disc.

**46. What is meant by electric brake?**

In an electric brake, the current from the battery is utilized to energize an electromagnet within the brake drum. This actuates a cam to expand the brake shoes. When the current is not supplied, the cam and brake shoes are returned to the release position by retractor springs.

**47. What is regenerative braking?**

A regenerative brake is an energy recovery mechanism, which slows a vehicle by converting its kinetic energy into another form, which can be either used immediately or stored until needed. This contrasts with conventional braking systems, where the excess kinetic energy is converted to heat by friction in the brake linings and therefore wasted.

**UNIT- 5 ALTERNATIVE ENERGY SOURCES****1) What are the general compositions for natural gas?**

1. Methane : 85-90%
2. Ethane : 5-7%
3. Propane : 2 %
4. Carbon dioxide: 3-5%
5. Others : 1%

**2) What are the physical properties of natural gas?**

Colorless, odorless, non-toxic, lighter than air.

**3) What is the need for CNG?**

- 1) Rising urban pollution.
- 2) Rising global concern for environment.
- 3) Rising vehicle pollution.

**4) What are the constraints in natural gas?**

1. Gas availability.
2. Availability of CNG equipment.
3. Pipeline network infrastructure.
4. Competition from other fuels.

**5) What are the different concepts used in the description of CNG system?**

1. Mother-Daughter concept.
2. On-line station concept.

**6) What are the advantages of using compressed natural gas over diesel?**

- I. Natural gas provides clean burning characteristics.
- II. Natural gas does not saturate flammable materials.
- III. The explosive limit of natural gas mixture is higher than air-diesel mixture.

**7) What are the components of LPG pipeline?**

1. Vaporizer
2. Regulator
3. Safety valve
4. Mixer
5. Fuel line

**8) What are the methods for using hydrogen into the cylinder?**

1. By manifold connection.
2. By direct injection of hydrogen.
3. By supplementation to gasoline.

**9) What are components of an electric vehicle?**

1. Motor.
2. Power pack.
3. Onboard charger.
4. Motor controller.
5. Energy management.
6. Regenerative braking.

**10) What are the advantages of electric car?**

1. Maintenance cost is low.
2. Vibration free operation
3. Lighter in weight.

**11) Mention the classification of Hybrid vehicles?**

- a) Series Hybrid.
- b) Parallel Hybrid.

**12) What are the components of Hybrid cars?**

- a) Electric motor.
- b) Generator.
- c) Direct injection gasoline.

**14) What is meant by a fuel cell?**

A fuel cell is a device that harnesses the energy produced during the electro chemical reaction between hydrogen and oxygen. The products are water and electricity.

**15) What is the need of fuel cell?**

- a. Depletion of conventional types of fuels leading to energy crisis.
- b. Low emission required to make a car economic friendly.
- c. To attain certain standards of emission control.

**16) List out fuel cell gases**

- a. Oxygen
- b. Hydrogen

**17) What are the advantages of fuel cell?**

- a. The fuel cell has low emission of pollutants.
- b. The oxygen air bags are varying useful for the passenger.
- c. The fuel cell prevents the depletion of the fossil fuels.
- d. The CO<sub>2</sub> exhaled by the passenger is also removed.
- e. More efficient than IC engine.

**18) What are the requirements of hybrid vehicle?**

- a. Increased fuel efficiency
- b. Reduced emissions
- c. Increased acceleration capacity
- d. Reduced noise emission

**19) Write short notes on series hybrid vehicles**

The engine runs a motor directly and also charges a battery. Thus the motor thus drives the vehicle always. The motor can also be used for regenerating braking.

**20) What are components of hybrid cars?**

- a. An electric motor
- b. A generator
- c. Direct injection gasoline engine.

**21. List the advantages of hydrogen fuel used in automobiles.**

1. It can be manufactured from water through electrolysis process
2. It does not contain carbon. Hence, CO and unburned HC emissions are not present
3. The flame speed is highest. Hence it results in high thermal efficiency
4. It has wide ignition limits.

**22. What is a hybrid vehicle?**

A hybrid vehicle is a vehicle that uses two or more distinct power sources to move the vehicle. The term most commonly refers to hybrid electric vehicles (HEVs), which combine an internal combustion engine and one or more electric motors.

**23. What is a fuel cell?**

A fuel cell is an electrochemical device that converts a source fuel into an electrical current and water. It generates electricity inside a cell through reactions between a fuel and an oxidant, triggered in the presence of an electrolyte.

**24. Write the composition of LPG and CNG.**

Composition of CNG

CH<sub>4</sub> = 70.9%, C<sub>2</sub>H<sub>6</sub> = 5.10%, H<sub>2</sub> = 3%, CO + CO<sub>2</sub> = 22%

Composition of LPG:

Propane = 30 % and Butane = 70 %

**25. Define detonation and pre-ignition.**

The abnormal combustion occurring in IC engines is called as detonation. This results in sudden rate of pressure rise, abnormal heat release, heavy vibrations of the engine and loud noise operation. The ignition of the air-fuel mixture before the introduction of the spark in the combustion chamber is called as pre-ignition.

**26. What are the advantages of an electric car?**

1. No emissions from an electric car
2. It does not depend upon the availability fossil fuels.

**27. State the advantages of fuel cell.**

1. Higher efficiency than diesel or gas engines.
2. Quiet operation.
3. Fuel cells can eliminate pollution problems
4. Don't need conventional fuels such as oil or gas and can therefore reduce economic dependence
5. The maintenance of fuel cells is simple since there are few moving parts in the system.

**28. What are the types of fuel cell?**

- a. Proton exchange membrane fuel cell
- b. Alkaline fuel cell
- c. Phosphoric acid fuel cell
- d. Direct methanol fuel cell
- e. Solid oxide fuel cell
- f. Molten carbonate fuel cell

**29. What are the alternative fuels?**

Alcohols, Hydrogen, Natural Gas, CNG, LNG, LPG, Bio Gas, Producer Gas, Coke oven Gas, Water Gas, Gasohol, Biodiesel.

**30. What are the various properties of gaseous fuel?**

**Advantages**

Gaseous fuels due to ease and flexibility of their applications possess the following advantages over solid or liquid fuels:

(a) They can be conveyed easily through pipelines to the actual place of need, thereby eliminating manual labour in transportation.



- (b) They can be lighted at ease.
- (c) They have high heat contents and hence help us in having higher temperatures.
- (d) They can be pre-heated by the heat of hot waste gases, thereby affecting economy in heat.
- (e) Their combustion can readily be controlled for change in demand like oxidizing or reducing atmosphere, length flame, temperature, etc.
- (f) They are clean in use.
- (g) They do not require any special burner.
- (h) They burn without any shoot, or smoke and ashes.
- (i) They are free from impurities found in solid and liquid fuels.

**Disadvantages**

- (a) Very large storage tanks are needed.
- (b) They are highly inflammable, so chances of fire hazards in their use is high.

**31. What is CNG?**

Compressed Natural Gas. It is typically stored in a tank at a pressure of 3,000 to 3,600 pounds per square inch.

**32. What is bio- diesel? State its advantages.**

Biodiesel is a non-petroleum based diesel fuel which consists of the mono alkyl esters of long chain fatty acids derived from vegetable oil and animal fats.

**Advantages**

- a. Domestically produced from non-petroleum, renewable resources
- b. Can be used in most diesel engines, especially newer ones
- c. Less air pollutants (other than nitrogen oxides)
- d. Less greenhouse gas emissions (e.g., B20 reduces CO<sub>2</sub> by 15%)
- e. Biodegradable
- f. Non-toxic
- g. Safer to handle

**33. What are advantages of LPG over conventional fuels?**

- a. LPG contains less carbon than petrol
- b. LPG mixes with air at all temperatures
- c. In multi cylinder engines, a uniform mixture can be supplied to all cylinders
- d. Since the vapor in the form of vapor, no crankcase dilution
- e. Automobile engines can use propane if they use high compression ratio.
- f. LPG has better antiknock characteristics
- g. Running on LPG produces fuel saving cost of about 50%
- h. The engine will have 50% longer life.

**34. What are the disadvantages of using alcohol as an alternative fuel?**

- a) A larger quantity of fuel is required to produce a specified power output. For example, in an automobile, more fuel is required for each mile driven.
- b) Low boiling points and high vapor pressures of methyl and ethyl alcohol indicate that vapor lock could be a serious problem, particularly at high altitudes on warm summer.
- c) The relatively high latent heats of methyl and ethyl alcohol cause problems in mixing these alcohols with air and transporting them through the intake manifold of the engine. Heating the intake manifold may be necessary in cold weather or before the engine reaches operating temperatures.
- d) Without external heat to more completely vaporize the fuel, the engine may be difficult to start and sluggish for a considerable time after starting.

- e) All of the alcohols are soluble in water, but butyl alcohol is relatively insoluble compared to methyl and ethyl alcohol. Less engine power is produced as the water content of an alcohol increases. Further, vapor lock, fuel mixing and starting problems increases with water.

**35. Define flame speed.**

The speed at which flame travels inside the combustion chamber is called as flame speed. The unit is m/s.

**36. List out the various forms of natural gas.**

1. Natural Gas (NG)
2. Compressed Natural Gas (CNG)
3. Liquefied Natural Gas (LNG)

**37. Write down the components of LPG equipment.**

1. Converter
2. Mixer
3. Gas Injector

**38. Write down the parts of a fuel cell.**

1. Anode
2. Cathode
3. Electrolyte
4. Fuel

**39. What are the properties of CNG?**

1. Colorless
2. Odorless
3. Lighter than air
4. Non – toxic

**40. What are the two types of LPG used for automotive-engine fuel?**

1. Propane based LPG
2. Butane based LPG

**41. What are the main components of electric and hybrid vehicles?**

1. Gasoline engine
2. Fuel tank
3. Generator
4. Electric motor
5. Battery
6. Transmission elements

**42. What are the advantages of fuel cell?**

1. The only by product from the fuel cell is either water or CO<sub>2</sub>, which can be safely disposed.
2. It is compact in size
3. As long as there is a supply of fuel, there will be generation of electricity.

**43. What are the advantages of Gasohol?**

Gasohol – It is the mixture of 10 % Ethanol + 90 % unleaded gasoline

1. 10 % fuel savings in terms of consumption of petrol
2. Less emissions than conventional petrol fuelled vehicles

# PRINCIPLES OF MANAGEMENT

## TWO MARKS QUESTION AND ANSWERS

### UNIT – I

1) Define any 1 definition of Management.

Management is the process of working with and through others to achieve organizational objectives in a changing environment. Management utilizes the limited resources effectively and efficiently.

2) What is Efficiency and Effectiveness?

Efficiency is a measure of how well the resources are used to achieve a goal.

Effectiveness is a measure of the appropriateness of the goals chosen and the degree to which they are achieved.

3) Define Administration

Administration is defined as

- Formulation of corporate policy
- Coordination of finance, Production and distribution
- Settlement of the compass of an organization
- The Ultimate control of exercise

4) Name the 3 factors that the organization compass depends on.

- Degree of centralization / decentralization of authority
- Level of Specialization
- Division of Work

5) Who is referred as the father of scientific management? What are the principles of scientific Management?

Frederick W. Taylor is referred as “The Father of Scientific management”.

The principles of Scientific Management are follows:

- A scientific method should be developed for each operation to replace the rules-of-thumb
- Scientific distribution of work and responsibility between workers and managers
- Workers should be scientifically selected with right attitudes for the job and ability and then properly trained to perform the job.
- Heartily cooperate with the men as to ensure that all of the work being done in accordance with the principles of science which have been developed.

6) What do you understand by Management science theory?

Management science uses various quantitative techniques to maximize resources.

- Quantitative management
- Operations Management
- Total Quality Management
- Management Information System

7) List out the managerial roles described by Henry Mintzberg.

Mintzberg identified 10 roles and those are as follows,

- Interpersonal Role
  - Figurehead Role
  - Leader role
  - Liaison Role

- Informational Role
  - Monitor role
  - Disseminator role
  - Spokesperson Role
- Decision Role
  - Entrepreneur Role
  - Disturbance handler Role
  - Resource Allocator Role
  - Negotiator Role

8) Define Gang Plank

Gang Plank is the link between two people at the same level working in different departments instead of communicating from top to bottom.

9) What are the Key functions of management?

- Planning
- Organizing
- Staffing
- Directing
- Controlling

10) What are the Levels of management?

There are three levels of management.

- Top level management
- Middle level management
- First line Management or low level Management

11) How many types of Business organizations are there and list them out.

There are 3 common types of Business organizations are as follows,

- Private Sector Organization
  - Sole Proprietorship or Individual Ownership
  - Partnership Organization
  - Joint stock companies
  - Cooperative Societies
- Public Sector Organization
  - Departmental Organizations
  - Public corporations
  - Government companies
- Joint Sector Organization

12) Name the types of Partners.

- General partners
- Active Partners
- Sleeping and Silent Partners
- Nominal Partners
- Secret Partners
- Minor Partners

13) Define Liquidation and Amalgamation

Liquidation is defined as the state of the company if the liability becomes much more than the assets when the creditors press for payments of loan. At this stage the company has to dissolved or wind up.

Amalgamation is defined as the joining together of two businesses in order to increase the efficiency of the operation because of large economies of scale.

- 14) What are the two important trading certification that a public limited company has to obtain from the registrar if companies?
- Memorandum of Association
  - Articles of Association
- 15) How does a Joint Stock company raise its finance for their business?
- Issue of shares
  - Issue of debentures
  - Issue of Preferential Shares
  - Loan from Banks
  - State loans from Industrial corporations.
- 16) Name the types of co-operative societies.
- Producer' co-operative society
  - Consumer's co-operative society
  - Housing co-operative society
  - Farming co-operative society
  - Credit co-operative society
- 17) What are the problems in the Government Company?
- Excessive Centralization
  - Price Policy
- 18) What do you mean by Joint Sector Company?  
Joint Sector means Participation by the government and the private industry in sharing the capital and general management of the firm to be set up.
- 19) What are the 5M's of organizational resources?
- Men
  - Machine
  - material
  - Money
  - method
- 20) Name the three essential skills according to Katz that the managers need to perform the duties.
- Technical Skills
  - Human Skills
  - Conceptual Skills

## UNIT – II

### 1. Define Planning.

Planning is a process by which a manager looks into the future. Planning is the most basic of all managerial functions.

Planning is the process used by managers to identify and select goals and courses of action of the organization.

### 2. What are the elements that an organization's mission statement consists of?

- Defining the organization's purpose
- Creating a vision of the organization
- Outlining how the vision will be accomplished
- Stating a common goal.

### 3. Give two examples of Policy.

- An university may have the policy that it will give admission to P.G. Program only for students those who have secured more than 55% marks in their U.G degree
- A Software company may have the policy that will not recruit candidates having break-up in their studies.

4. What are the two different approaches for setting Objectives?  
One is top-down approach, in which top management determines objectives for subordinates.
- Another approach is bottom-up approach, in which subordinates help managers in setting objectives.
5. What is MBO?  
Management by Objectives is jointly set by superiors and Subordinates. MBO is the approach which uses objectives as a focal point to improve managerial performance and managerial effectiveness, both at the individual and at the organizational level.
6. Mention any 2 Benefits of MBO.  
a) MBO increases the productivity of employees  
b) MBO helps managers to exercise better control over their employees
7. Define Strategy.  
Strategy is defined as the determination of long-term objectives of an organization, making the best choices for the future and allocating the resources necessary to accomplish the Objectives.
8. What are the different types of Strategy?  
a) Grand Strategy – Stability Strategy, Growth Strategy, Retrenchment Strategy  
b) Global Strategy – Globalization Strategy, Multidomestic Strategy, Transnational Strategy.
9. What is Retrenchment Strategy?  
Retrenchment means reduction in products, services and personnel. This strategy is many times useful in face of tough competition, scarcity of resources and reorganization of the enterprise to reduce waste.
10. What are the levels of Strategy?  
There are three levels of strategy. They are,  
a) Corporate level Strategy    b) Business Level Strategy  
b) Functional Level Strategy
11. What are the 3 major variables that the BCG Matrix based on?  
a) a firm's relative market share    b) the growth rate of its market  
c) Cash flows generated by the activities of the organization.
12. What are the five competitive forces in the company environment according to Porter?  
a) Threat of new entrants  
b) Threat of substitute products  
c) Bargaining power of buyers  
d) Bargaining power of suppliers  
e) Rivalry among current competitors
13. What are the different types of Organizational policies?  
a) Sales Policy                      b) Production Policy    c) Personnel Policy  
d) Accounting Policy etc.,
14. Mention the different categories of Policy?  
a) On the basis of levels                      b) On the basis of Functions  
e) On the basis of Sources
15. Mention any two distinction between policies and Objectives

POLICIES	OBJECTIVES
1. Policies are the guidelines that provide direction for decision making.	1. Objectives are aims or goals. They are the ends
2. Policies are formulated by top and	2. Objectives are set by only top

middle management.	management
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**16. Define Inflation, Recession.**

Inflation is defined as, the situation of rising prices. Recession or stagflation is defined as, the rise in price due to fall in demand

**17. Mention any 4 factors involved in demand forecasting.**

- a) Long-term or short term forecasting
- b) General or specific forecasting
- c) Nature of competition in the market
- d) Forecasting for new products or existing products

**18. What is Quantitative forecasting Technique?**

Quantitative Techniques uses past Quantitative data to forecast future and past data is extrapolated into future.

Forecasting for new products can be made only by qualitative methods because of no past data is available.

**19. What are five techniques of trend projection based on time series data?**

- a) Fitting trend line by observation
- b) Least squares method
- c) Simple moving average method
- d) Weighted moving average method
- e) Exponential Smoothing Method.

**20. What are the types of Economic Indicators?**

- a) Leading Indicators
- b) Coincidental Indicators
- b) Lagging Indicators.

### UNIT – III

**1. What is meant by organization?**

The term organization implies a formalized intentional structure of roles or position. William Scott defines organization as follows:

Organizations are collectivities of people that have been established for the pursuit of relatively specific objectives on a continuous basis.

**2. What do you understand by effective organizing?**

Effective organizing focuses on finding mistakes in present organizing And avoiding such mistakes by proper planning. Effective organizing avoids organizational inflexibility and makes the staff work effectively by avoiding conflicts by clarification.

**3. What is organization structure**

Organization structure deals with the pattern of relationships among various components, activities, positions and people in the organization.

**4. Explain the Formal organization.**

Formal organization is designed to achieve some particular objectives. It has the structure of well defined jobs with defined authority and responsibility. According to Classical theorists, the formal organization is built on four pillars. They are Division of labor, Scalar and Functional processes, Structure and span of Control.

**5. Explain the Informal organization.**

Informal organization refers to the natural grouping of people in the work situation. In other words the informal organization refers to the people in group associations at work, but these associations are not specified in the blue print of the formal organization.

**6. What do you know by organization chart?**

An organization chart is a diagrammatic representation of organization structure. The contents in the organization chart are

- Authority and Responsibility of various position
- Rank, names and the line of command
- Relationship between different authorities

**7. Explain about the types of organization charts.**

There are three types of organization charts. They are

1. Top to Down or Vertical organization chart
2. Left to Right or Horizontal organization chart
3. Circular organization chart
- 4.

**8. Who is called as Intrapreneur and Entrepreneur?**

An intrapreneur is a person who focuses on innovation and creativity and who transforms a dream or an idea into a profitable venture by operating within the organizational environment.

Entrepreneur is a person who does similar things, but outside the organizational environment. He is a person who undertakes new business operations, bears high risks and capital arrangements.

**9. What is departmentation?**

The word departmentation designates a distinct area, division or branch of an organization over which a manager has authority for the performance of specified activities. Departments may vary in different organizations accordingly to the size and nature of the firm.

**10. What are the types of Departmentation?**

1. Departmentation by Function
2. Departmentation by Territory or Geography
3. Customer Departmentation
4. Departmentation by Product
5. Matrix Departmentation

**11. What is a matrix organization?**

Matrix organization is any organization that employs a multiple command system that includes not only the multiple command structure, but also related support mechanism and an associated organizational culture and behavior pattern.

**12. Define a committee organization**

Committee means a group of persons formed for a stated purpose. It may be a standing committee, or convened for a special purpose. Committees are a valuable, though often maligned, form of organizational structure. For example the Board of directors is a committee form of organization, and there may also be others such as executive committee, finance committee, planning committee and so on.

**13. What is Strategic Business Unit (SBU)?**

Strategic Business Unit is a distinct little business setup as unit in a larger company to ensure that a certain product line is promoted and handled like an independent business. Companies have



been using an organizational device generally refers to SBU. One of the earlier users of this organizational device is the General Motors.

**14. Discuss the principles of Span of Management.**

Span of Management is also called as Span of control. The principles of Span of Management states that there is a limit to the number of subordinates a manager can effectively supervise, but the exact number will depend on the impact of underlying factors. Span of Management is of two types. They are:

1. Narrow Span of Management
2. Wide Span of Management

**15. Discuss the term Reengineering.**

Michael Hammers defines reengineering as “the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical contemporary measurement of performance such as cost, quality, service and speed.

**16. What is Power and Authority?**

Power is a broader concept than authority. Power is the ability to influence the flows of resources towards certain goals as opposed to other goals.

Authority may be defined as the power to make decisions which guide the actions of another. It is the legitimate right to give orders by the superior and those orders to be obeyed by the subordinates.

**17. What is Empowerment?**

Empowerment means that the employees, managers or teams at all levels in the organization have the power to make decision without asking their superior for permission. The notion underlying empowerment is that those closest to the task are best able to make the decision, provided that they have required competencies.

**18. Explain Decentralization and Recentralization.**

Decentralization is the tendency to disperse decision making authority in an organized structure. It is the fundamental aspect of delegation.

Recentralization means centralization of authority over a certain type of activity or function wherever in the organization it may be found.

**19. Define Staffing.**

Staffing is defined as filling the position of each person in the organization. It deals with selecting and placing the right person in the right job. Staffing includes several sub-functions like recruitment, selection, placing, transfers and promotion, training, career planning, compensation etc.,

**20. Define Recruitment.**

Recruitment is the process of searching for prospective employees and stimulates them to apply for jobs in the organization. It may be described as an activity that aims to bring the jobseeker (applicant) and the job giver (employer) in contact with one another.

**21. Define Selection.**

Selection is a deliberate effort of the organization to select a fixed number of personnel from a large number of applicants. It involves a careful screening and testing of candidates who have put in their applications for any job in the enterprise.

**22. What is called as interview?**

Interview is a selection technique that enables the interviewer to view the total individuals and to appraise them. It consists of interaction between interviewer and the applicant and the purpose of interaction is to evaluate the experience, physical strength aptitude and training of the prospective employees.

**23. What is called as Orientation?**

Orientation involves the introduction of new employee to the enterprise, its function, tasks and people. Large firms usually have formal orientation program which explain the features of the company: history, product and services, general policies and practices, safety and other regulations.

**24. What are the methods for on the job training?**

- Job rotation
- Apprenticeship and coaching
- Committee assignments
- Experience
- Temporary promotions

**25. What are the methods for off the job training?**

- Lecture
- Seminars
- Case studies
- Business games
- In basket method
- Sensitivity training

**26. Define the term Job Analysis.**

Job Analysis is the process of studying and collecting information relating to the operations and responsibilities of a specific job. The immediate products of this analysis are job description and job specification.

**27. Define the terms Job Description and Job Specification.**

Job description is an organized factual statement of duties and responsibilities of a specific job. In brief it should tell what is to be done and how it is to be done.

Job specification or Employee specification is a statement of the minimum acceptable human qualities to perform a job properly.

**28. What is performance appraisal?**

Performance appraisal is the process of evaluating the performance of employee in his job conditions. The objectives of performance appraisal are:

- To find out individual potential identification
- To improve the management development
- To improve the employee performance

**29. What is called as Virtual organization?**

Virtual organization is a temporary network of independent companies suppliers, customers linked by information technology to share skills, costs and across to one another's markets. It has neither central office nor organization chart. Thus it is a temporary alliance between two or more organizations that band together to undertake a specific venture.

**30. Define Line and Staff Authority.**

Line Authority is the relationship in which superior exercises direct supervision over their subordinates.

Staff Authority is advisory. The function of the people in a pure staff capacity is to investigate research and give advice to line managers.

**31. List out the benefits of Line and Staff Authority.**

1. Specialization
2. Flexibility
3. Expert advice
4. Sound decisions
5. Relief to line executives
6. Opportunities for advancement

**32. Trace the reasons for conflict between Line & Staff executives.**

The conflict between line and staff may be attributed to: a) personal backgrounds of the line and staff personnel, resulting in different attributes to the organizational activities: and tendency on the part of both line and staff to play disruptive political games because of consciousness as regards differences in their authority positions.

**33. What are the disadvantages of Line and Staff Authority?**

1. Confusion
2. Advice ignored
3. Expensive
4. Conflicts between Line and Staff
5. Lack of responsibility of specialist

**34. Explain the Functional Authority.**

Functional Authority is the right that is delegated at an individual of a department to control specified processes, practice, policies or other matters relating to activities undertaken by persons in other departments. If the unity of command is followed without expectations, authority over these activities would be expressed only by their line superiors.

**35. What is the concept of Delegation of Authority?**

Authority is delegated when a superior directs subordinates to make decision. Authority must be delegated to subordinates who will make decision with in the area of their assigned duties. Superiors cannot delegate authority if they are board members, presidents and vice presidents.

**36. Explain the delegation process.**

The process of delegation involves:

- Determining the results expected from a position
- Assigning tasks to the position
- Delegating authority for accomplishing these tasks
- Holding a person in that position responsible for the accomplishment of these tasks

## UNIT – IV

1. State the Maslow's hierarchy of needs?

Maslow viewed human needs in the form of hierarchy. The hierarchy of needs are  
Physiological needs

- Safety needs
- Social needs
- Esteem needs
- Self actualization needs

2. Define motivation?

Motivation is the process of inspiring and actuating the workers to accomplish the objectives of an organization. Managers are responsible for inducing the workers to do work towards an objectives

3. Define leadership?

Leadership is the process where a person exerts influence over other and inspires, motivates and directs their activities to achieve goals. Leadership is the dynamic process whereby one individual in a group is not only responsible for the group's result but actively seeks the collaboration and commitment of all the group members in achieving group goals.

4. What is "noise" in a communication system?

Any thing which affects the communication process is known as noise  
Communication is hindered by noise.

5. Define communication?

Communication is the process of transmitting ideas, facts, opinion and feelings to others. Communication is a mutual interchange process that occurs between two or more persons.

6. Define effective communication?

The communication after removing the barriers in communication process and channels is known as effective communication.

7. What are the types of communication?

Downward, Upward, horizontal, diagonal, Formal, Informal.

8. List the 3 types of basic motivating needs proposed by McClelland.

Need for Power, Need for Affiliation, Need for Achievement.

9. List out the important electronic media which is useful for communication.

Telecommunication, Tele-conferencing, E-mail, Internet.

10. What is innovation?

The effort of an individual or an organization to develop new products or services is known as innovation. It is the process of creating and implementing a new idea.

11. Write about the different noise barriers you know?

Poor timing, Inappropriate channel, physical distraction and improper information, information overload.

12. Define principle of clarity?

The communication should be clear and easily understandable by the receiver of communication.

13. What are the three elements of Vroom's Expectancy model?

Expectancy, Instrumentality and valence.

14. Define Instrumentality?

This factor relates to a person's belief and expectation that his performance will lead to a particular desired reward.

15. Define Expectancy?

This is a person's perception of the likelihood that a particular outcome will result from a particular behaviour or action.

16. Write about Porter and Lawler model?

Porter and Lawler suggests that the amount of energy a person believes is required and the portability of receiving the reward.

17. What are the most prominent needs according to McClelland?

-Needs for Achievement -Needs for Affiliation -Needs for power.

18. How can you make job enrichment effective?

Organization need a better understanding of what people want and if productivity increases are the main goal of enrichment the program must show how workers will benefit.

19. What is the purpose of communication?

-To develop plans for their achievement. -To organize human and other resources in the most effective and efficient way -To control performance.

20. Define Noise?

Noise is what that hinders the communication process and it may hinder the development of a clear thought.

## UNIT – V

1. What is controlling?

Controlling is the measurement and correction of performance in order to make sure that enterprise objectives and the plan devised are being accomplished. Planning identifies the activities and controlling regulates the activities. Success or failure of planning depends on the results of success or failure of controlling. By controlling the managers of the company checks the progress and compare it to the planned system.

2. What are the importances of controlling?

1. Policy verification
2. Adjustments in operation

3. Psychological pressure
4. Co-ordination
5. Employee morale

3. What are the steps involved in the process of control?

The steps involved in the controlling process is

- Establishing standards
- Measuring performance
- Compare the measured performance against standards:
- Evaluate the performance and take action:

4. State the requirements of effective control.

1. Suitability
2. Flexibility
3. Economical
4. Simple
5. Motivation
6. Forward looking
7. Objective
8. Control should reflect the organization structure & needs
9. Control should lead to corrective action
10. Less time.

5. What is a standard?

A standard is the target against which the performance or the operations can be compared to. Eg: Standard time to complete the job.

6. What are the types of critical point standards?

- a) Physical standards
- b) Cost standards
- c) Capital standards
- d) Revenue standards
- e) Program standards
- f) Intangible standards
- g) Goals as standards

7. What is budgetary control?

Budgetary control is a tool used by the management to obtain the objectives expressed as in the form of budget. The actual results compared with the budgeted figures. If there is any deviation, they can be remedied by either adjusting or correcting the cause of difference. Budget is concerned with policy making whereas budgetary control results from the implementation of such a policy.

8. How budget can be used as a controlling technique?

Budgeting is defined as the process of expressing a set of planned activities for a future time period in numeric terms. Budgets are designed to serve the following requirements:

- Guiding the management in the areas of their organizational resources.
- Helps to coordinate the projects and resources.
- Helps to define the control system standards.

9. What are the types of budgets?

a. Variable budgets Budget that vary according to the organization level of output are called variable or flexible budgets.

b. Program budgets Program budgets are budgets in which the agency identifies goal, develops detailed programs to meet the goal, and estimates the cost of each program.

c. Zero – Base budget Zero – base budget is to calculate costs afresh for each budget period, thus avoiding the common tendency in budgeting of looking only at changes from a previous period.

d. Sales Budget

e. Production budget

f. Purchase budget

g. Capital budget

10. What are zero based budgets?

Zero based budget looks at all activities and priorities for the present year. The budgeting system is started from the scratch. Instead of adding to previous budget, the management creates the budgets by examining the objectives for the present year and justifies the expenditure for each. The zero budgeting system is established by following three steps:

- i. All the information about the activity is taken and put into one module.
- ii. Modules are ranked according to their benefit to the organization.
- iii. Allocation of resources depending on the final ranking of modules.

11. Define MIS.

The Management Information System is defined as a formal system of gathering, integrating, comparing, analyzing and dispersing information internal and external to the enterprise in a timely, effective and efficient manner.

12. List the applications of computers in management.

1. Budget preparation
2. Stimulating models
3. Graphic presentation
4. Forecasting
5. Maintaining database

13. Explain the use of computer in handling the information.

The computer can store, retrieve and process information. The mainframe is a full scale computer that is capable of handling huge amounts of data. Some of these super computers are used for the engineering, simulation, and the large manipulation of large databases. The minicomputer has less memory and is smaller than the mainframe. This kind of computer is often- connected with the peripheral equipment.

The microcomputer is even smaller and may be desk computer, home computer, personal computer, portable computer, or small computer for business system. Increasingly, minicomputers are used by larger organizations either as a stand alone computer or as parts of network.

14. How Information Technology used in controlling?

The management information system has to be tailored to specific needs and may include *routine* information, such as monthly reports; information that points out *exceptions*, especially at critical points: and information necessary to *predict* the future.

15. What do you mean by telecommuting?

The wide spread use of computers and the easy linking of them through telephone lines to a companies mainframe have led to growth of new concept called telecommuting. It means that a person can work at computer terminal at home instead of commuting to work.

The advantages of this system include greater flexibility in scheduling work, the avoidance of traffic congestion, and a reduced need for office space. With the increasing traffic congestion, especially in metropolitan cities, the telecommuting is found to be much useful. But the office work cannot be replaced by the telecommuting.

16 Define Productivity.

Productivity can be defined as “the output-input ratio within a time period with due consideration for quality. It can be expressed as follows.

$$\text{Productivity} = \frac{\text{Outputs}}{\text{Inputs}}$$

Here inputs are Labour, Material, and Capital.

17. List out the tools and techniques for improving the productivity.

- Inventory planning and control
- Just I time inventory systems
- Outsourcing
- Operations research
- Value engineering
- Work simplification
- Quality circles
- Total quality management
- Computer aided design
- The manufacturing automation protocol

18. Explain the economic order quantity (EOQ).

The main objective of inventory management is to balance the ordering costs and the carrying costs. The total cost of the inventory is found to be lowest when the ordering cost and the carrying cost are equal. Economic ordering quantity is the size of the order which minimizes the total annual of carrying the inventory and cost of ordering.

19. What is Quality circle?

Quality circle is a way of capturing the creative and innovative power that lies within the workforce. Quality circle is a small group of people doing similar work who together with their supervisor agree for an hour every week and solve work related problems. The objectives of quality circle are to

- Improving the quality and productivity
- Identifying and solving the work related problems
- Tapping the creative intelligence of working employees
- Increasing employee loyalty and commitment



20. What do you mean by outsourcing?

Outsourcing is the recent trend in business. It means that products and operations are contracted to outside vendors that have expertise in particular area. The aim may be to reduce costs by saving on personnel benefits, reduces personnel, or to be able to reassign employees to other tasks that are more important. It enables the firm to focus on its core competencies and let outside companies do what these firms can do best.

21. What is value engineering?

A product can be improved and its cost lowered through the value engineering, which consists of analyzing the operation of the product or services, estimating the value of each operation, and attempting to improve that operation by trying to keep costs low at each step or part. The following specific steps suggested are:

1. Divide the product into parts and operations
2. Identify the cost for each part and operation
3. Identify the contribution of each part to the final unit or product
4. Find a new approach for items which appear to be high cost and low value.

22. What is Total Quality Management (TQM)?

TQM involves the organization long term commitment to the continuous improvement of quality throughout the organization and with the active participation of all members at all levels. It usually requires a careful analysis of the customer needs, an assessment of the degree to which these needs are currently met and a plan to fill the gap between the current and the desired situation.

23. What do you know by direct control?

The normal procedure is to trace the cause of an unsatisfactory result back to the persons responsible for it and get them to correct their practices. This is called as direct control.

**ME 6004-UNCONVENTIONAL MACHINING PROCESS**  
**2 MARKS QUESTIONS & ANSWER**

**UNIT I INTRODUCTION**

**1. Define AJM?**

It is the material removal process where the material is removed or machined by the impact erosion of the high velocity stream of air or gas and abrasive mixture, which is focused on to the work piece.

**2. How does AJM differ from conventional sand blasting process?**

AJM differ from the conventional sand blasting process in the way that the abrasive is much finer and effective control over the process parameters and cutting. Used mainly to cut hard and brittle materials, which are thin and sensitive to heat.

**3. What are the advantages of AJM process?**

1. Low capital cost
2. Less vibration.
3. Good for difficult to reach area.
4. No heat is generated in work piece.
5. Ability to cut intricate holes of any hardness and brittleness in the material.
6. Ability to cut fragile, brittle hard and heat sensitive material without damage

**4. What are the applications of AJM?**

1. For abrading and frosting glass, it is more economical than acid etching and grinding.
2. For doing hard suffuses, safe removal of smears and ceramics oxides on metals.
3. Resistive coating etc from ports to delicate to withstand normal scrapping
4. Delicate cleaning such as removal of smudges from antique documents.
5. Machining semiconductors such as germanium etc.

**5. Write the Disadvantages of AJM process?**

1. Low metal removal rate.
2. Due to stay cutting accuracy is affected.
3. Parivles is imbedding in work piece.
4. Abrasive powder cannot be reused.

**6. Give the formula for find the material remove rate for brittle metal?**

$$MRR = 1.04 ( MV^{3/2} / 1/4H^{3/4} )$$

**7. Give a summary of the abrasive of their application for different operation?**

- (1) Aluminum Cleaning, Cutting and Debar
- (2) Silicon Carbide. Faster cleaning, Cutting.
- (3) Glass Heads Matt polishing, cleaning
- (4) Crushed glass Peening and cleaning.

**8. Write the formula for find the MRR for ductile materials?**

$$MRR = 0.5 ( MV^2 / H )$$

**9. What are the Process parameters affecting the MRR in AJM?**

1. Gas Pressure.
2. Velocity of Particles.

3. Abrasive **mass** flow rate.
4. Mixing ratio.
5. Nozzle Tip Distance.

**10. What are the disadvantages of using abrasives again and again?**

1. Cutting ability of the abrasives decreases after the large
2. Contamination of wears materials clogging the nozzle and the cutting unit orifices.

**11. What are the different types of nozzles heads used in AJM?**

1. Right angle head.
2. Straight head.

**12. Why oxygen should not be used in AJM?**

Oxygen should not be used because of fire hazard problem.

**13. What are the different types abrasives used in AJM?**

Aluminum oxides, silicon carbides, Crushed glass, Sodium bicarbonate, Dolomite.

**14. Reuse of abrasives is not recommended in AJM. Why?**

Reuse of abrasives is not recommended since the cutting ability of abrasive decrease after the usage and also the contamination of wear materials clogging the nozzle and the cutting unit orifice.

**15. What are the emission lines?**

The atoms when they are bringing down goes to the excited state by stimulated emission and emit photons within 10 nano secs. They have the same wavelength as the excited photons.

**16. What is the Maser principle?**

The energy density of laser with  $100,000\text{Kw/cm}^2$ . The atoms at this state will impinge with electrons waves having resonate frequency. This is known as maser.

**17. What is population inversion?**

If the atoms in the excited state are greater than that of the ground state then it is known as population inversion.

**21. What are the different types of concentrators?**

1. Conical Type
2. Exponential type
3. Stepped type.

**22. What are the characteristics of carrier fluid?**

1. Good wetting characteristic
2. High thermal conductivity
3. Non-toxic and non-corrosive.
4. Should have low viscosity.

**23. What are the elements of Carrier Fluid?**

1. Act as a coolant.
2. Act as an acoustic bond between the work piece and the tool.
3. Helps efficient **transfer** of energy.
4. Act as medium to carry the abrasive machined materials and worm abrasives

## UNIT II (MECHANICAL ENERGY BASED PROCESSES)

### 1. What are the properties of water jet machining about effect cutting action?

High pressure, high velocity jet of water.

### 2. What are the types of units and its purpose used in water jet cutting system?

- a. Pump -- to generate high pressure
- b. Machining unit-- to actually cut the material with the jet nozzle.
- c. Filtration unit -- to clear the water after use.

### 3. Why we are using the diamond nozzle?

- a. High hardness metal
- b. Working life is more compared to other jewel nozzle such as ruby or sapphire.

### 4. Why do you select proper cutting fluid in WJM?

Cutting fluids mainly depends on the operation requirement, quality of finish, cutting speed and overall cost

### 5. Does there is any environmental effects while using the water jet machining?

There is no environmental pollution such as dust suspended in the air because the water jet drains any dust simultaneously when cutting.

### 6. What are the advantages of WJC over conventional cutting methods?

- a. Because of point cutting WJC is able to cut materials almost any pattern.
- b. Material loss due to machining is minimum.
- c. WJC will not burn surfaces or produces a **heat** an affected zone.
- d. No environmental pollution.

### 7. What are the applications of WJM?

- 1 Aero space
- 2 Automobile
- 3 Paper pulp industries

### 8. What are the commonly used additives in WJM?

1. Crly cerine
2. Polyethylene oxide
3. Long chain polymers

### 9. What is optical tracing system?

It employs an optical scanner that traces a line drawing and produces electronic signals that control the X-rays.

### 10. What is ultrasonic machining?

USM is a mechanical material removal process in which the material is removed by repetitive impact of abrasive particles carried in liquid medium on to the work surface, by a shaped tool, vibrating at ultrasonic frequency.

### 11. What are the advantages of USM?

1. High accuracy and good surface finish
2. No **heat** generation during machining

3. Capability of drilling circular and non-circular holes in very hard materials.
4. No thermal effects on mechanical work piece.
5. Non-conductive materials can be machined.

**12. What are the Disadvantages of USM?**

1. Tool wear
2. Frequent turning is required
3. Low material removal rate.
4. Not economical for soft materials.
5. Not suitable for heavy stock removal.

**13. What are the applications of USM?**

1. Almost all the material can be machined except some soft materials.
2. Diamond, Tungsten, Tungsten carbide, and synthetic ruby can be successfully machined.
3. USM can be used for drilling, grinding, profiling, coining, threading and even for welding.
4. For preparing wire drawing dies and tool room items.
5. Used in jewellery for shaping jewels
6. Drilling of screw threads and curved holes in brittle materials.

**14. What are the components of USM?**

1. Ultrasonic transducer
2. Concentrator
3. Tool
4. Abrasive slurry
5. Abrasive feed mechanism
6. Tool feed mechanism

**15. What is ultrasonic transducer?**

The device used for converting any type of energy into ultrasonic waves or vibration is called ultrasonic transducer.

**16. Write short notes on piezoelectric crystals?**

Piezoelectric crystals are used for inducing ultrasonic vibrations since they possess the capability of changing their dimensions to the given electrical energy or in other sense they have the capability of converting electrical energy into mechanical vibrations.

**17. What is magnetostrictive effect?**

It is the one in which the material changes its dimension in response to a magnetic field.

**18. What are the magnetostrictive materials employed in USM?**

Nickel, Iron – cobalt called as permendium, iron – aluminum called as alfer.

**19. What is the purpose of concentrator used in USM?**

The main purpose of the concentrator is to increase the amplitude of the vibration obtained from the transducer.

**20. What is abrasive Slurry?**

The abrasive slurry is nothing but a mixture of abrasive grains and the carrier fluid, generally water.

**21. What are the types of feed mechanisms used in USM?**

1. Spring type
2. Counter – weight type
3. Motor type
4. Pneumatic and hydraulic type

## UNIT-III (ELECTRICAL ENERGY BASED PROCESSES)

### 1. Define electrical discharge machining?

EDM is the controlled erosion of electrically conductive materials by the initiation of rapid and repetitive spark discharge between the electrode tool to the cathode and work to anode separated by a small gap kept in the path of dielectric medium. This process also called spark erosion.

### 2. What are functions of dielectric fluid used in EDM?

- 1.It acts as an insulating medium
- 2.It cools the spark region and helps in keeping the tool and work piece cool.
- 3.It maintains a constant resistance across the gap.
- 4.It carries away the eroded metal particles.

### 3. Basic requirement of dielectric fluid used in EDM?

- 1.Stable Dielectric strength.
- 2.It should have optimum viscosity.
- 3.It should have high flash point.
- 4.It should be chemically stable at high temperature and neutral.
- 5.It should not emit toxic vapors.

### 4. What the dielectric fluids commonly used in EDM?

1. Petroleum based hydrocarbon fluids.
2. Parafin, white sprite, transformer oil.
3. Kerosine, mineral oil.
4. Ethylene glycol and water miscible compounds.

### 5. What are the prime requirements of tool material in EDM?

- 1.It should be electrically conductive.
- 2.It should have good mach inability.
3. It should have low erosion rate.
4. It should have low electrical resistance.

### 6. What is the effect of capacitance in EDM?

Increasing the capacitance causes the discharge to increase and increase both the peak current and discharge time.

### 7. Name some of the tool material used in EDM?

- |   |                                  |
|---|----------------------------------|
| 1. Copper, brass, alloys of Zinc & tin.       | 2. Hardened plain carbon steel   |
| 3. Copper tungsten, silver tungsten, tungsten | 4. Copper graphite and graphite. |

### 8. What is the process parameter efficiency the MRR?

- |                        |                    |
|------------------------|--------------------|
| 1. Energy discharge    | 2. Capacitance.    |
| 3. Size of work piece. | 4. M/c tool design |

### 9. Write the formula for finding the energy discharge in EDM?

$$W=(1/2) \times EIT$$

W-discharge energy

I-Current, T-time , E-voltage

**10. How do you increase the inductance of the circuit?**

A piece of iron or steel be allowed to lodge between the leads it would increase the inductance of the circuit and reduce the M/C rate.

**11. Define W/T ratio?**

It is the ratio of volume of work removed to the volume of tool removed.

**12. What is cycle time?**

It is the sum of discharge time and waiting time.

**13. Define over cut?**

It is the discharge by which the machined hole in the work piece exceeds the electrode size and is determined by both the initiating voltage and the discharge energy.

**14. Define Rehardening?**

While metal heated to a temperature above the critical and then rapidly cooled by the flowing dielectric fluid the metal is rehardened.

**15. What is recast metal?**

Metal heated to a temperature above the melting point and which is not displaced by the action of the spark discharge, resolidifies as recast metal.

**16. Explain electrode wear?**

A crater is produced in the electrode, which is likewise dependent on the electrode material and the energy of the discharge.

**17. What are types of power supply circuits used in EDM?**

1. R-C circuit.
2. Rotary impulse generator.
3. Controlled pulse (vacuum tube).
4. Oscillator controlled pulse.
5. Transister pulsed circuit.

**18. What are the design factors to be considered while selecting the machine tool?**

1. Number of parts to be produced.
2. Accuracy.
3. Size of work piece.
4. Size of electrode
5. Depth of cavity.

**19. Why the servo controlled system is needed in EDM?**

EDM requires that a constant arc gap be maintained between the electrode and the work piece to obtain maximum machining efficiency. Therefore EDM tool incorporate some form of servo control.

**20. Define wear ratio?**

Wear ratio=Work piece material removed/Loss of electrode material

**UNIT-IV**

**(CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES)**

**1) Define ECM?**

It is the controlled removal of metals by the anodic dissolution in an electrolytic medium, where the work piece (anode) and the tool (cathode) are connected to the electrolytic circuit, which is kept, immersed in the electrolytic medium.

**2) Write the Faraday's first law of electrolysis?**

The amount of any material dissolved or deposited is proportional to the quantity of electrolyte passed.

**3) Write the Faraday's second law of electrolysis?**

The amount of different substances dissolved or deposited by the same quantity of electricity are proportional to their chemical equivalent weight.

**4) Write Ohm's law?**

Current,  $I = V/R$

$V =$  Voltage (volt),  $R =$  resistance (ohm)

**5) What are the factors that influence oxidation in ECM?**

(i) Nature of work piece.

(ii) Type of electrolyte.

(iii) Current density.

(iv) Temperature of the electrolyte.

**6) What are the materials used to make the tool electrode?**

Copper and copper alloys, titanium, aluminum, brass, bronze, carbon, Monel and reinforced plastic.

**7) What are the main functions of electrolysis in the ECM?**

i) For completing the electric circuit between the tool and the work piece and to allow the reaction to proceed efficiently.

ii) To remove the products of machining from the cutting region.

iii) To carry away the **heat** generated during the chemical reaction.

iv) To avoid ion concentration at the work piece- tool gap.

**8) What are the properties are expected from the electrolysis used in the ECM?**

i) High thermal conductivity.

ii) Low viscosity and high specific **heat**.

iii) Should be chemically stable even at high temperature.

iv) Should be non-toxic and non-corrosive.

**9) What are the electrolysis commonly used in ECM?**

15 -20 % NaCl in water, sodium nitrate, potassium nitrate, sodium sulphate, sodium chromate and potassium chloride.

**10) What are the results which is in improper selection of electrolyte in ECM?**

(i) Low machining rate.

(ii) Over cut and stray cutting.

**11) What are the methods generally used to filter the electrolyte?**

(i) Running the system until it is contaminated completely and replace it.

(ii) Centrifugal separation.

(iii) Sedimentation.

(iv) Use of clarifiers.

**12) What are the characteristics of a good ECM tool?**

(i) It should be a good conductor of electricity and **heat**.

(ii) Easily machinable.

(iii) Resistant to chemical reaction.

(iv) It offers resistance to the high electrolyte pressure.

**13) What are the parameters that affect the MRR?**

(i) Feed rate.

(ii) Voltage.

(iii) Concentration of the electrolyte.

(iv) Temperature of the

electrolyte.

(v) Current density.

(vi) Velocity of the electrolyte.

**14) How the current density affect the MRR?**

Current density is controlled not only by the amount of current but also by the size of the gap between the tool and the work piece. A small gap results in high current density, which in turn produce more material removal.



**15) What are the advantages of ECM?**

- i. ECM is simple, fast and versatile method.
- ii. Surface finish can be extremely good.
- iii. Fairly good tolerance can be obtained.

**16) What are the limitations of ECM?**

- i. Large power consumption and the related problems.
- ii. Sharp internal corners cannot be answered.
- iii. Maintenances of higher tolerances require complicated contours.

**17) What are the applications of ECM?**

ECM is used for sinking, profiling and contouring, multi hole drilling, trepanning, broaching, honing, steel mill applications, surfacing, sawing, contour machining of hand to hand machine materials.

**18) Write the disadvantages of EBM?**

- (i) High cost of equipment.
- (ii) Skilled operator is required for operation.
- (iii) Limited to 10mm material thickness.

**19) Write any four application of EBM?**

- (i) Micro machining application on materials.
- (ii) Drilling of apertures for electron microscope.
- (iii) Drilling of holes in ruby and diamond crystal.

**20) Write the Richardson-Dushman Equation.**

$$J = A T^2 e^{-\frac{W}{KT}}$$

J = Current Density

A = constant (120 Amphere/cm<sup>2</sup>deg<sup>2</sup>)

K = Boltzman Constant (1.3x10<sup>-23</sup> J/K)

T = Absolute temperature (Kelvin)

W = work function (Volts)

**UNIT-V (THERMAL ENERGY BASED PROCESSES)**

**1. Define ECG.**

ECG is the material removal process in which the material is removed by the combination of Electro- Chemical decomposition as in ECM process and abrasive due to grinding.

**2. Which material is used to make the grinding wheel?**

Metal bonded diamond (or) Aluminum oxide.

**3. What are the important functions of abrasive particles used in ECG?**

It acts as insulator to maintain a small gap between the wheel and work piece. They are electrolysis products from the working area. To cut chips if the wheel should contact the work piece particularly in the event of power failure.

**4. What are the advantages of ECG?**

- i) No thermal damage to work piece.
- ii) Wheel wear is negligible.
- iii) No distortion of the work piece.

**5. What are the disadvantages of ECG?**

High capital costs, because of the special wheel tool. Power consumption is quite high. Electrolyte is corrosive.

**6. What are the limitations of ECG?**

1. The work material must be conductive.
2. Not suitable for machining soft material.
3. Require dressing tools for preparing the wheels.

**7. What is the application of ECG?**

1. Precision grinding of hard metals economically.
2. Grinding Carbide cutting tools inserts.
3. To grind end mill cutters more precisely.

**8. What is Laser?**

It is acronym of light amplification by stimulated emission of radiation.

**9. What is Maser**

Laser can be melt diamond when focused by lens system. The energy density being of two order 100,000 KW/cm<sup>2</sup>. This energy is due to atoms that have light energy level. When such an atom impinge with electromagnetic waves having resonant frequency.

**10. What are the characteristics of Laser beam?**

1. Material removal
2. Material shaping
3. Welding
4. Thermo kinetic change.

**11. What are the gases commonly used in LASER?**

The gases commonly used are He, Ne, Argon, Co<sub>2</sub> etc.

**12. What are the advantages of Laser drilling?**

No physical contact between work tool pair hence there is no possibility of breakage or wear of tool. Precision location is ensured by focusing of the beam. Large aspect ratio can be achieved.

**13. What are the characteristics of Laser used in Laser machining?**

1. Can be focused to maximum intensity or to lower intensity as needed.
2. Can be moved rapidly on the work.
3. Remote cutting over long standoff distances.

**14. What are the fundamentals of photons used in Laser?**

In the Laser the photons are in ground state at 0°C they are brought to the excited state by means of absorption of energy by temperature change, collision etc.

**15. How does Laser melting works?**

It melts and vaporizes the unwanted material by means of narrow pulsed laser operating at 2 to 100 pulses/sec. Because of this high accuracy is not possible to micro sized holes.

**16. What is solid state Laser?**

Solid state Laser is the Lasers, which consist of a host material, which may be crystalline solid/ glass, doped with an active material whose atoms provide the lasing action.

**17. Define plasma.**

Plasma is defined as the gas, which has been heated to a sufficiently high temperature to become ionized.

**18. What are the advantages of plasma arc welding?**

- a. Exothermic oxidation takes place.
- b. DC power supply

**19. What are the metals that can't be machined by plasma arc machining?**

- a. Stainless steel
- b. Monel
- c. Super alloys

**20. What is the basic heating phenomenon that takes place in plasma arc welding?**

The basic heating phenomenon that takes place at the work piece is a combination of anode heating due to direct electron bombardment recombination of molecules on the work piece.

**21. How does the basic plasma is generated?**

The basic plasma is generated by subjecting a stream of gas to the electron bombardment of the electric arc.

**22. How the initial ionization is accomplished in plasma arc machining?**

A high voltage arc established between electrode and nozzle accomplishes initial ionization.

**23. Why does gas formed in plasma do in P.A.M?**

This gas stabilizes the arc and prevents it from diverging.

**24. How another source of heating achieved in P.A.M?**

It is desirable to achieve a third source of heating by injecting oxygen into work area to take advantage of exothermic oxidation.

**25. Write the principle of P.A.M**

Once the material has been raised to molten point the high velocity gas stream blows the material away.

**26. Write the circuitry details in PAM.**

+ ve terminal connected to work piece and -- ve terminal connected to electrode.

**27. Which type of power supply is used in P.A.M?**

DC power supply is used.

**28. Which part is constricted by plasma?**

Nozzle duct is constricted by plasma.

**29. Define EBM?**

It is the thermo-electrical material removal process on which the material is removed by the high velocity electron beam emitted from the tungsten filament made to impinge on the work surface, where kinetic energy of the beam is transferred to the work piece material, producing intense heat, which makes the material to melt or vaporize it locally.

**30. What is the characteristic of the electron beam?**

- i. High concentrated energy.
- ii. Deep penetration into the metals.
- iii. Low distortion.
- iv. Any material either conductive or non-conductive can be processed.

**31. Why vacuum is needed in EBM?**

- 1) To reduce corrosion
- 2) To get correct focusing

**32. Write the application of electron beam?**

- |                                    |                         |
|------------------------------------|-------------------------|
| - Thin film machining.             | - Surface treatment.    |
| - Engraving metals and non-metals. | - Cutting of materials. |

**33. What are the main elements of the EBM equipment?**

- |                  |  |
|------------------|--|
| 1. Electron Gun. | 2. Beam focusing and deflecting units. |
| 3. Work Table.   | 4. Vacuum chamber                      |

**34. What is the function of magnetic lens used in EBM?**

It converges the beam into a narrow spot into the work piece.

**35. What are the two types of EBM?**

- (i) Thermal type. (ii) Non-thermal Type.

**36. Explain the thermal type EBM?**

In this type the electron beam is used to **heat** the material up to the point where it is selectively vaporized.