



Subject Code :17614

Model Answer

SUMMER – 15 EXAMINATION

Important Instructions to examiners:

- 1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
- 2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
- 3) The language errors such as grammatical, spelling errors should not be given more Importance (Not applicable for subject English and Communication Skills).
- 4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
- 5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
- 6) In case of some questions credit may be given by judgement on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

1	A	Attempt Any Three:
1	a)	Enlist the main requirements of clutch.
		Requirements of Clutch: [1] It should be able to transmit maximum torque under all working conditions. [2] It should engage gradually to avoid sudden jerks & vibration. [3] It should be able to dissipate large amount of heat which is generates during the clutch operation due to friction. [4] It should be dynamically balanced . [5] It should have suitable mechanism to damp vibration and to eliminate noise produced during power transmission. [6] It should be small as possible in size so that it will occupy minimum space. [7] It should have minimum inertia which will be help to reduce the overall weight of engine [8] It should have free pedal play in order to reduce effective clamping load on carbon thrust bearing. [9] It should be easy to operate requiring as the extension as possible on the part of the driver.

Subject Code :17614

Model Answer

[10] It should be **light as possible** so that it will be continue to rotate after disengagement of clutch.

(Enlist any Eight points from the above mentioned, ½ Marks for each)

1 b) **Define Castor and Camber with neat sketch.**

Definition of Castor:

Castor is the angle between king pin centre line and the vertical, in plane of wheel. If king pin center line meets the ground at a point in front of wheel centre line it is called **Positive Castor**. If it is behind the wheel centre line, it is called **Negative Castor**.

Definition of Camber:

Camber is the tilt of car wheels from the vertical. Camber is **positive**, if the tilt is outward at the top. Camber is **negative**, if the tilt is inward at the top.

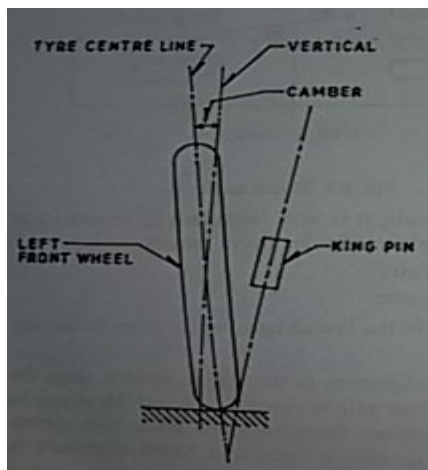


Figure: Camber

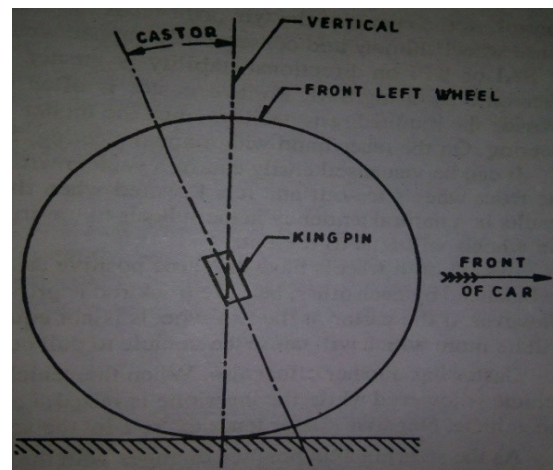


Figure: Castor

(1 Mark for each Definition, 1 Mark for each sketch)

1 c) **Differentiate between Framed and Frameless Vehicles.**

S. No.	Framed Vehicles	Frameless Vehicles
1	There are two heavy side members	In this, heavy cross and side members are eliminated. Thick



Subject Code :17614

Model Answer

			and cross members welded, bolted or riveted to the superstructure.	sheet is directly welded to the floor pan of vehicle.	
		2	Heavier in construction	Light in weight	
		3	Ground clearance is more	Ground clearance is less	
		4	Higher centre of gravity	Lower centre of gravity	
		5	Due to use of nut & bolts, it's having noisy operation.	There are no bolts or nuts to loosen	
		6	Maintenance is easier	In case of accident, difficult to maintain	
		7	Less wear and corrosion	More wear and corrosion	
		8	Production cost is more	Production cost is less, if manufacturing in mass quantity	
		9	Used in heavy vehicles like trucks & buses	Used in light vehicles like passenger cars	
		(Enlist any 8 Points from the above mentioned, ½ Marks for each)			
1	d)	Enlist various types of vehicle layouts.			
		<p>Types of Vehicle Layouts:</p> <p>According to Engine Location:</p> <p>[1] Two Wheel Drive Vehicle:</p> <p>1.1.1 Front Engine Front Wheel Drive (FFWD)</p> <p>1.1.2 Front Engine Rear Wheel Drive (FRWD)</p> <p>1.1.3 Rear Engine Rear Wheel Drive (RRWD)</p> <p>[2] Four Wheel Drive Vehicle:</p> <p>2.1.1 Manual Operated Four Wheel Drive</p> <p>2.1.2 Electronic Operated Four Wheel Drive</p> <p>According to Engine Mounting:</p> <p>1. Full Forward Chassis</p>			



Subject Code :17614

Model Answer

		2. Semi Forward Chassis 3. Bus Chassis (Enlist any four from the above mentioned, 1 mark for each)
1	B	Attempt Any One:
	a)	Define Aerodynamics? Why Aerodynamic aspects are considered while designing the body of Vehicle?
		<p>Definition of Aerodynamics:</p> <p>The Aerodynamics (streamlining) is the process of shaping of the body to reduce the air resistance at the forward motion. In the case of racing cars, where speed is of most importance, Aerodynamics (streamlining) has great influence in car bodies.</p> <p>Importance of Aerodynamics while designing the body of vehicle:</p> <p>Due to the increasing demand of efficient and comfortable cars, Automobile Aerodynamics is an important element in improving the overall performance of Vehicle. Air resistance opposes the forward motion of the car. It influences fuel consumption and attainable maximum speed of vehicle. Hence it is the design engineer's task to make the drag coefficient of vehicle as small as possible by shaping the body aerodynamically. Following are the important aspects of aerodynamic vehicles;</p> <p>[1] Reduce Air resistance or air drag. [2] Reduce driver effort to drive vehicle. [3] Improve speed of vehicle. [4] Provide better fuel economy through reducing fuel consumption. [5] Provide attractive shapes and better aesthetic appearance to the vehicle. [6] Reduce noise pollution. [7] Reduce running cost of vehicle.</p> <p>(2 Marks for Definition, 4 Marks for Importance of Aerodynamics)</p>
	b)	With neat sketch explain working of Overdrive and its advantages.
		<p>Working of Overdrive:[1] When the sun gear is located with the casing, i.e. it becomes stationary, the speed of the output shaft is increased i.e. overdrive is engaged.</p>

Subject Code :17614

Model Answer

[2] When however the sun gear is locked to the carrier or to the ring gear, solid drive through the gear train is obtained.

[3] Thus depending upon the locking of the sun gear with casing or with carrier the overdrive or the normal direct drive is obtained.

[4] There is another possible control of the mechanism, i.e. when the sun wheel is kept free to rotate on the input shaft. In this case, there is direct drive through the freewheel clutch when the engine develops power.

[5] However, when the accelerator pedal is brought to zero position and the engine is simply idling, the output shaft will tends to overdrive the input shaft.

Advantages of Overdrive:

[1] It provides higher top gear ratio.

[2] It provides greater fuel economy.

[3] It reduces the engine wear & tears and fuel consumption.

[4] It provides smoother & quieter running.

[5] It has partially easy engagement and disengagement.

[6] It provides an additional choice of speed ratios.

[7] It prolonged the engine life.

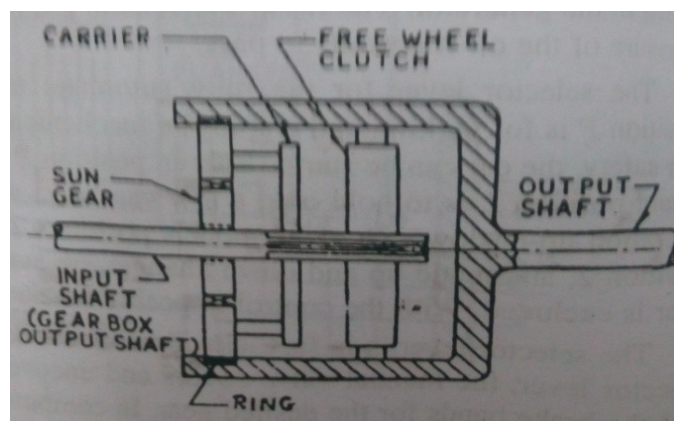
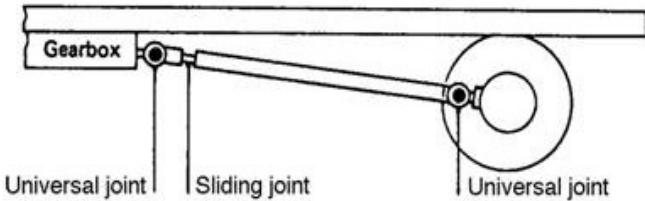


Figure: Constructional features of Overdrive

(2 Marks for Working, Any four Advantages of the above mentioned, ½ Marks for each, 2 Marks for Diagram)

2		Attempt Any Four:
2	a)	Explain the purpose of universal joints and sliding joints in propeller shaft.
		<p>Purpose of Universal Joints:</p> <p>A universal joint is a particular type of connection between two shafts, whose axes are inclined to each other. A universal joint is used where two shafts are connected at an angle to transmit the torque. The purpose of the universal joint is to absorb the angular changes brought about changes in relative positions of the differential in relation to the transmission and in this way to smoothly transmit power from the transmission to the differential.</p> <p>Purposed of Sliding (Slip) Joints:</p> <p>The propeller shaft is connected between the transmission main shaft and the differential pinion shaft. The differential with rear axle housing and wheel moves up and down. This not only changes the angle of drive but also changes the length of the propeller shaft. The U joint permits the variation in the angle of drive. The slip joint permits the effective length of the propeller shaft to change. If there is no slip joint the propeller shaft would buckle or break.</p>  <p style="text-align: center;">Figure: Necessity of U Joint & Slip Joint</p> <p>(2 Marks for Each)</p>
2	b)	Define the term “Power Brakes”. Enlist types of power brakes and their salient features.
		<p>Definition of Power Brakes:</p> <p>These are the brakes wherein the power of the engine and/or the battery power are used to enhance the braking effort.</p> <p>When practically none of the braking effort is applied by the driver, the brakes are termed Power Brakes.</p>



Subject Code :17614

Model Answer

Types of Power Brakes: There are basically four types of the Power Brakes;

- [1] Vacuum Brakes
- [2] Air Brakes
- [3] Brakes with Hydraulic Booster
- [4] Brakes with Electro Hydraulic Booster

Salient Features of Power Brakes:

- [1] In Vacuum brakes, the vacuum from the inlet manifold is utilized, due to which the vacuum power brakes would not function if the engine is not working.
- [2] In Air brakes, compressed air is used to apply brakes instead of hydraulic pressure.
- [3] Hydraulic Booster systems usually employ pressure from the power steering system to increase pressure on the master cylinder.
- [4] Electro Hydraulic booster systems use an electric motor to pressure the hydraulic system beyond the brake pedal.

(1 Mark for Definition, 1 Mark for Types, 2 Mark for Salient Features)

2

c)

What is the necessity of suspension system in Automobile?

Necessity of Suspension System in Automobile:

- [1] To prevent the road shocks from being transmitted to the vehicle frame.
- [2] To preserve the stability of the vehicle in pitching, rolling while in motion.
- [3] To safeguard the occupants from road shocks.
- [4] To maintain proper steering geometry.
- [5] To support the load of vehicle.
- [6] To provide cornering power for smooth riding.
- [7] To provide driving and braking forces to the road.
- [8] To produce minimum noise while the wheel is turning on the road.

(Enlist any four of the above mentioned, 1 mark for each)



Subject Code :17614

Model Answer

2	d)	Explain Forming and Welding processes in car body manufacturing.
		<p>Forming Processes in Car Body Manufacturing:</p> <p>Large group of manufacturing processes in which plastic deformation is used to change the shape of metal work generally referred as forming process. The tool, usually called a die, applies stresses that exceed yield strength of metal. The metal takes a shape determined by the geometry of the die. The basic processes used under forming in car body manufacturing are;</p> <p>[1] High Energy Rate Forming:</p> <ul style="list-style-type: none">1.1.1 Electromagnetic Forming1.1.2 Hydraulic Forming1.1.3 Explosive Forming- (Free & Die Forming) <p>[2] High Velocity Forming:</p> <ul style="list-style-type: none">2.1.1 Petro forge Forming2.1.2 Pneumatic Forming <p>Welding Processes in Car Body Manufacturing:</p> <p>Welding is one of the most important procedures for Automobile Manufacturing. It is a process of joining similar metals by application of heat with or without application of pressure and addition of filler material.</p> <p>There are different types of welding techniques used in car body manufacturing;</p> <p>[1] Plastic (Pressure) Welding:</p> <ul style="list-style-type: none">1.1.1 Gas Welding<ul style="list-style-type: none">1. Oxy Acetylene Welding2. Air Acetylene Welding3. Oxyhydrogen Welding1.1.2 Arc Welding1.1.3 Resistance Welding



Subject Code :17614

Model Answer

		<p>1. Butt Welding</p> <p>2. Spot Welding</p> <p>3. Seam Welding</p> <p>4. Projection Welding</p> <p>5. Percussion Welding</p> <p>[2] Fusion (Non Pressure) Welding:</p> <p>2.1.1 Electron Beam Welding</p> <p>2.1.2 Laser Beam Welding</p> <p>(2 Marks for Forming, 2 Marks for Welding Processes)</p>
2	e)	<p>State general principles of Jig and Fixture design.</p>
		<p>General Principles of Jig and Fixture Design:</p> <p>[1] Location Principle: Location and guiding must be related to the dimensional requirements of work piece.</p> <p>[2] Clamping and guiding Principle: The work piece should be prevented from moving along X, Y, Z axes.</p> <p>[3] Loading and unloading Principle: Location system in jigs and fixtures should facilitates easy and quick loading and unloading of work piece or tool.</p> <p>[4] Motion Economy: It should aim at motion economy to increase the productivity.</p> <p>[5] Fool proofing: It should give fool proofing arrangements such as error free design leads to zero rejection.</p> <p>(1 Mark each for any 4 correct principle- Statement only)</p>
2	f)	<p>Write down design procedure for simple fixture used in milling.</p>
		<p>Design Procedure for Simple Fixture used in Milling:</p> <p>[1] Analysis of part:-</p> <p>While designing the fixtures the part must be analyzed for which it is to be design.</p>

[2] Design basic fixture :-

After analyzing the part the basic fixture must be design. The basic fixture is rough designing for the requirement

[3] Conformance checking:-

Check for the conformance with the basic design of the fixture. If it confirms the requirement then the basic design is

approved for testing and if does not conform then redesigning is need to be done.

[4] Manufacturing:-

After conformance with the basic designing and work piece requirement of the fixture it is manufactured.

(1 Mark for each step)

3

Attempt Any Four:

3

a)

Explain types of stub axle with neat sketch.

Types of Stub Axle:

Stub axle is pivoted at the ends of main axle beam. There are different methods to do it. The purpose is to provide proper movements to the wheels while turning and to keep the vehicle stable.

[1] In **Elliot stub axle**, there is a swivel pin fixed in forging of the stub axle. The ends of the swivel pin can turn in the forked end provided at the end of main axle beam.

[2] In **Reverse Elliot stub axle** the swivel pin is fixed in the main axle beam.

[3] In **Lamoine type the stub axle** is connected to the main axle beam from below it.

[4] Whereas in **Inverted Lamoine type stub axle** is connected to the main beam axle it's the upper side.

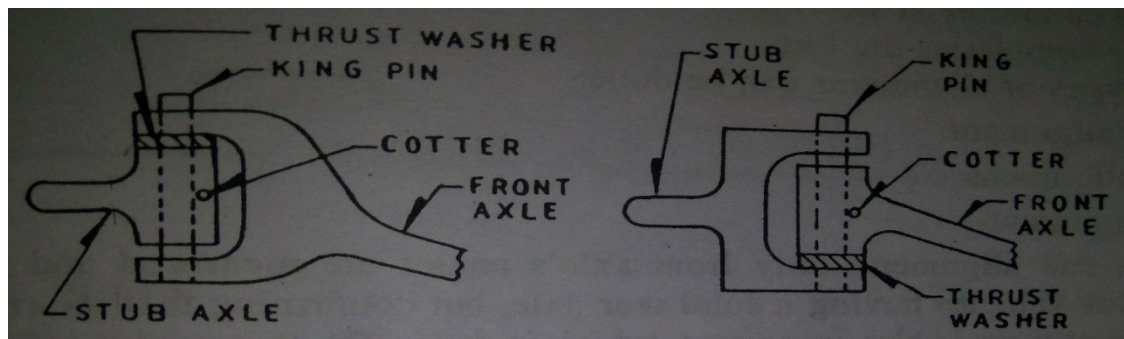


Figure: Elliot

Figure: Reversed Elliot

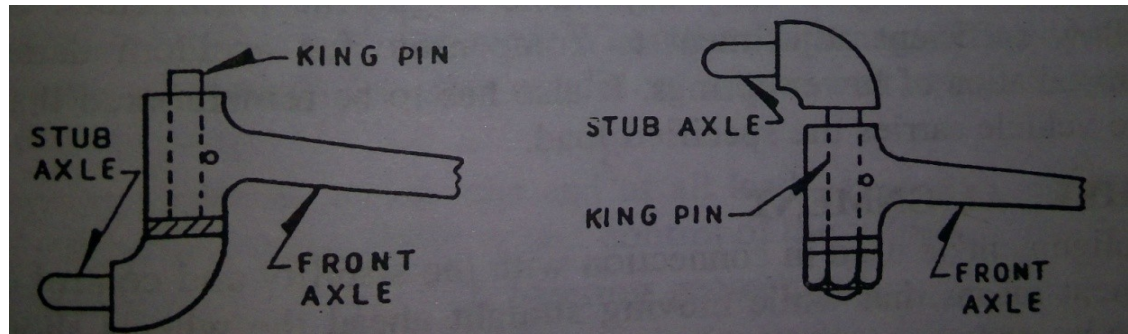


Figure: Lamoine

Figure: Reversed Lamoine

(2 Marks for any 2 Types, 2 Marks for any 2 Sketches of the above)

3

b)

Explain the neat sketch of rack and pinion type steering gear box used in automobile.

Rack & Pinion Type Steering Gear Box:

It is simple, light and responsive. It occupies very small space and uses lesser number of linkage components compared to the worm and wheel type of gear.

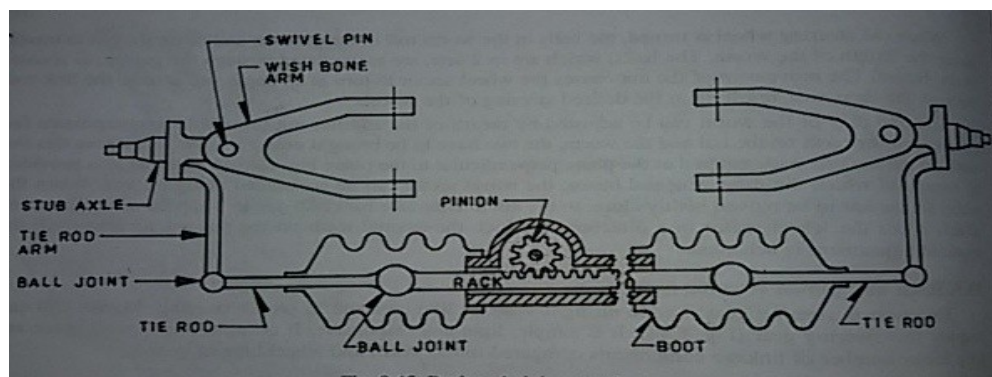


Figure : Rack & Pinion Type Steering Gear Box

Figure shows the rack and pinion type of steering gear along with its linkages. The rotary motion of the steering wheel is transmitted to the pinion of the steering gear through universal joints. The pinion is mesh with a rack. The circular motion of the pinion is transferred into the linear rack movement, which further relayed through the ball joints and the rods to the stub axles for the wheels to be steered.

Applications: This type of steering gear is used on light vehicles like cars and in power steering. Maruti

Subject Code :17614

Model Answer

800 employs this steering gear.

(2 Marks for labeled diagram, 1& ½ Marks for Explanation, 1/2 Marks for Application)

3

c)

With neat sketch explain the working of telescopic shock absorber.

Working of Telescopic Shock Absorber:

Below figure shows a simple Telescopic Shock absorber. There is a fluid in space above valve assembly (A), below (A) & also in annular space between cylinder (C) & tube (D), which is connected to the space below valve assembly (B). (H) is gland in head (J) & any fluid scrapped off by rod (G) is brought down into annular space through inclined passage shown in head. Eye (E) is connected to axle, while eye (F) is attached to chassis frame. Fluid generally used in shock absorbers is a mixture of 60 per cent Transformer oil & 40 per cent Turbine oil.

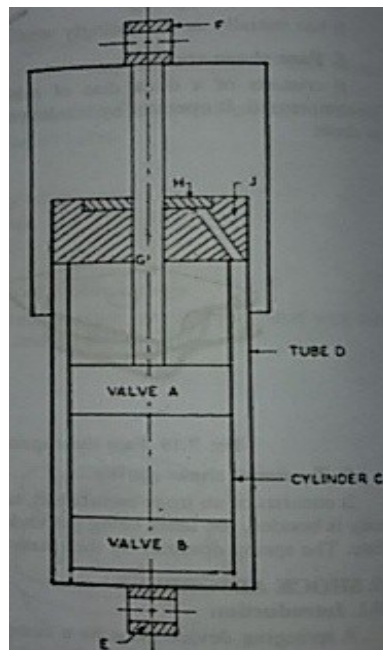


Figure: Telescopic Shock Absorber

When car has come across a bump,

[1] Eye (E) would move up & thereby the fluid will pass from lower side of valve assembly (A) to its upper side.

[2] Due to pressure of fluid through rod (G) fluid will be go to underside of valve (B).

[3] This passing of fluid through valve openings provides damping.

[4] Similarly for downward motion of eye (E), fluid will pass upper side of valve assembly (A) to lower



Subject Code :17614

Model Answer

side & also from lower side of valve assembly (B) to its upper side.

(2 Marks for Working, 2 Marks for Labeled Sketch)

3

d)

Explain any two manufacturing processes used for production of crank shaft.

Manufacturing Processes used for Production of Crank Shaft:

The crankshafts are made by Drop Forging or Casting process, whereas the surface of the crankpin is hardened by case carburizing, nitriding or induction hardening.

[1] Casting Process:

It is one of the most important manufacturing processes. The casting is obtained by remelting of ingots in a cupola or some other foundry furnace and then pouring this molten metal into metal or sand moulds. There are different types of casting processes like; Sand Mould Casting, Permanent Mould Casting, Slush Casting and Die Casting. Out of these, Die casting is used for manufacturing crank shaft and crank cases.

[2] Forging Process:

It is the process of heating a metal to a desired temperature in order to acquire sufficient plasticity, followed by operations like hammering, bending and pressing etc. to give it a desired shape. There are various forging process like; Smith (Hand) Forging, Power Forging, Machine (Upset) Forging and Drop (Stamping) Forging. Out of these, Drop forging is used for manufacturing crank shafts.

Forging Process for production of crank shaft:-

[1] Stock is redistributed and size is increased at certain places and reduced at others by roll forging.



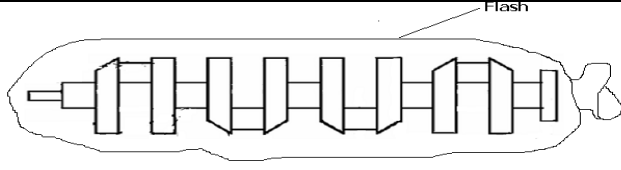
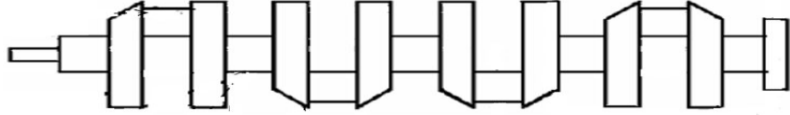
[2] After preliminary roll forging, the stock is again roll forged.



[3] This stock is then forged in first impression or blocking die.

Subject Code :17614

Model Answer

		 <p>[4] The final shape is given to the forging in next blocking die. Then the finished part is trimmed in blanking die to remove excess metal or flash.</p>  <p>(2 Marks for each explanation with simple illustrations)</p>
3	e)	State the application of different types of drilling jigs.
		<p>Application of Different types of Drill Jigs:</p> <p>[1] Template jigs carry correct locations of holes to be made in the work piece.</p> <p>[2] To avoid marking operation completely template jigs are used</p> <p>[3] For accurately drilling holes the plate type jigs are used which hold and locate work and directly drilled through the bushes in correct position</p> <p>[4] Open type jigs are used to drill the holes on work piece which is placed on the base of jig</p> <p>[5] Swing leaf type jig in which plate is capable of swinging about a fulcrum helps to drill holes in the work piece accurately</p> <p>[6] Jigs holds the work piece securely</p> <p>[7] It locates the tool accurately</p> <p>[8] Pot type jigs are used to drill hole in hollow cylindrical components</p> <p>[9] Box type jigs can be used to hole in components of irregular shape</p> <p>[10] Solid type jigs can be used for drilling holes in simple shape and relatively small sizes</p> <p>(1 Mark each for any 4 correct point)</p>
4	A	Attempt Any Three:
4	a)	Explain with neat sketch working of Constant Mesh Gear box.

Subject Code :17614

Model Answer

Working of Constant Mesh Gear Box:

1. When the left dog clutch is slide to the left by using selector mechanism, its teeth are engaged with clutch gear and we get direct gear.
2. When the same dog clutch is slid to the right, it comes in contact with the second gear and second gear is obtained.
3. Similarly the movement of right dog clutch to the left results in first gear and movement of same to the left results in reverse gear.

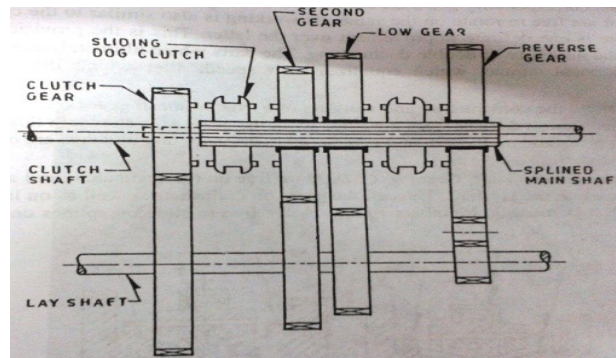


Figure: Constant Mesh Gear Box

(2 Marks for Working, 2 Marks for labeled diagram)

4 b) **Compare between disc brake and drum brake (any four points).**

Difference between Drum and Disc Brake:

S. No.	Drum Brake	Disc Brake
1	Friction occurs on the internal surfaces so it not exposed to the cooling air directly.	Friction surface is directly exposed to the cooling air
2	Friction linings are curved.	Friction pads are flat
3	Loss of efficiency due to expansion	No loss of efficiency due to expansion
4	More weight.	Less weight
5	More Pedal load required to apply brake	Less Pedal load required to apply brake
6	More coefficient of friction.	Less Coefficient of friction.

Subject Code :17614

Model Answer

7	Complicated in design.	Simple in design
8	Replacement of brake lining is difficult as it requires riveting or fixed with adhesives	Replacement of friction pad is easy.

(Enlist any 4 Points from the above mentioned, 1 mark for each)

4 c) **With neat sketch explain the working Mc-Pherson type suspension system.**

Working of Mc-Pherson type Suspension System:

The Mc-Pherson suspension system is most widely used layout for Front wheel drive vehicle.

1. In this type of suspension only lower wishbone is used.
2. A strut containing shock absorber and the spring carries also the stub axle on which the wheel is mounted.
3. The wishbone is hinged with cross member and positions the wheel.
4. With this type of suspension camber also does not change when the wheel moves up and down.

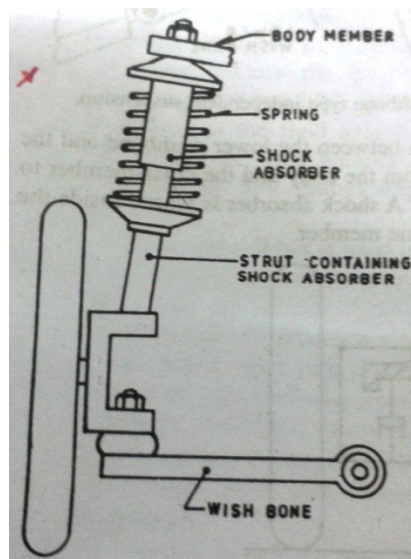
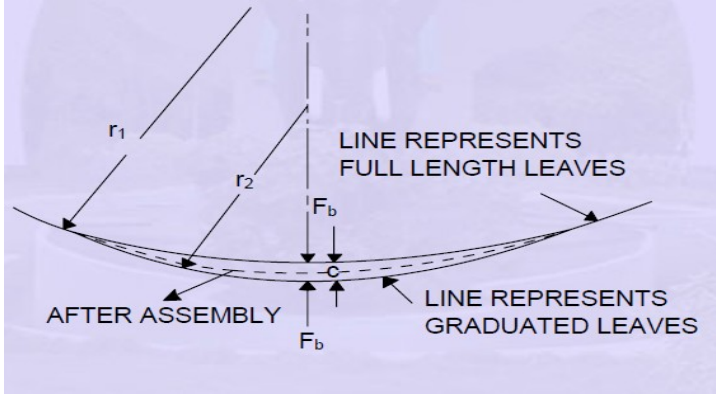


Figure: Mc-Pherson Type Suspension System

(2 Marks for Working, 2 Marks for labeled diagram)

4	d)	<p>Explain the bending and pre-stressing processes in manufacturing of leaf spring.</p> <p>Bending & Pre Stressing in Manufacturing of Leaf Spring:</p> <p>Equalizing the stresses in different leaves is referred as the pre-stressing of the leaf spring. The pre-stressing is achieved by bending the leaves to different radii of curvature, before they are assembled with the centre clip. As shown in Figure the full-length leaf is given a greater radius of curvature than the adjacent leaf.</p>  <p>Figure: Concept of Pre stressing and Bending</p> <p>(2 Marks for Concept, 2 Marks for Sketch)</p>
4	B	<p>Attempt Any One:</p>
4	a)	<p>What are the various types of locators? Explain any two types with neat sketch.</p> <p>Types of Locators:-</p> <ul style="list-style-type: none"> [1] Adjustable locators (Flat locators) [2] Cylindrical locators [3] Fixed V Locators [4] Conical locators [5] Jack pin locator [6] V locator <p>1) Flat Locator:- These are employed for locating flat machined faces of the component. The Jig body may incorporate under cut at the bottom for swarf clearance.</p>

2) Cylindrical locators: - Cylindrical locators are very useful when finely finished holes are available for the positioning of components.

3) Conical locators: - A conical locator is used for locating work piece with drilled holes.

4) Jack pin locator: - These locators are used for supporting rough work pieces from the bottom. The height of pin can be adjusted to accommodate variation in the surface texture of the component.

5) V locator: - It is used for locating components having circular profile.

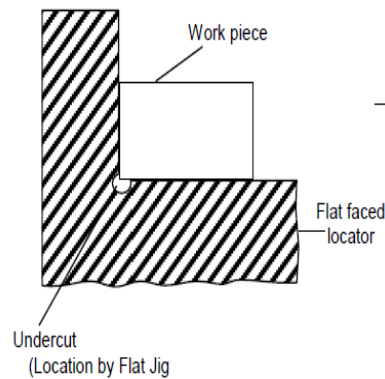


Figure: Flat Locator

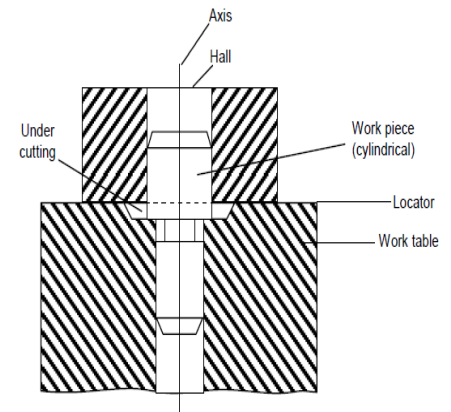


Figure: Cylindrical Locator

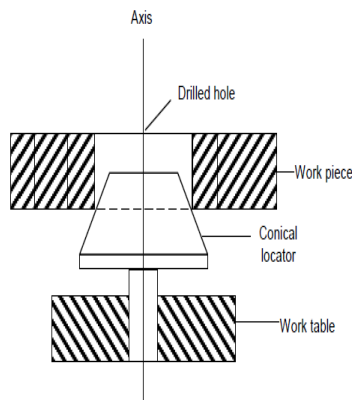


Figure: Conical Locator

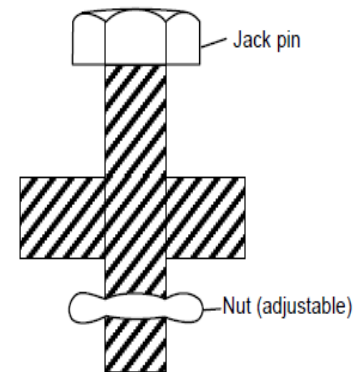

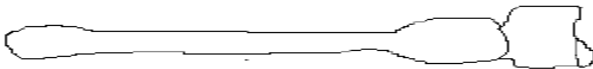


Figure: Jack Pin Locator

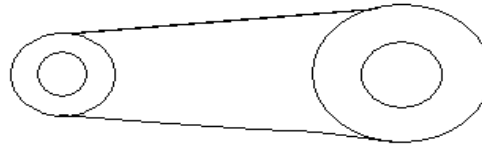
(1/2 mark each for any 4 correct point, 1 Mark each for explanation and neat diagram for any 2 correct point)

4	b)	Explain forging and heat treatment processes in manufacturing of connecting rod.
		<p>Forging Process in Manufacturing of Connecting Rod:</p> <p>The connecting rods are usually manufactured by drop forging process and it should have adequate strength, stiffness and minimum weight. The Drop forging is carried out with the help of Drop hammers and is particularly suitable for mass production of identical parts.</p> <p>Following are the Salient features of Forging Processes:</p> <ul style="list-style-type: none"> [1] It refines the structure of the metal. [2] It renders the metal stronger by setting the direction of grains. [3] It effects considerable saving in time, labor and material. [4] The reasonable degree of accuracy may be obtained by forging. [5] The forgings may be welded. [6] The forging method produces lighter weight but more expensive connecting rods. <p>Forging Process used for Manufacturing Connecting Rod:</p> <ul style="list-style-type: none"> [1] The heated stock is elongated by reducing its cross section in first die. The operation is known as “Fullering” <div style="text-align: center;">  </div> <ul style="list-style-type: none"> [2] The metal is redistributed, increasing the cross section at certain places and reducing at others as required filling the cavities of the die. The operation is known as “Edging”. <div style="text-align: center;">  </div> <ul style="list-style-type: none"> [3] General shape is given in first blocking die and Finished shape is given to forging in final impression die. After that flash is remove.



Subject Code :17614

Model Answer



Heat Treatment Processes involved in Connecting Rod Manufacturing:

[1] Heat treatment is the process which includes heating and cooling of any material to modify their properties or internal structure.

[2] With heat treatment process to the connecting rod the hardness and wear resistance of it increases substantially. [3] Heat treatment is given to reduce the internal stresses.

[4] **Hardening** is generally carried out on connecting rod to increase its hardness immediately followed by **Tempering** process to reduce or eliminate internal stresses.

(2 Marks for Brief Description of Forging Process, 2 Marks for simple sketches, 2 Marks for Heat Treatment)

5

Attempt Any Four:

5

a)

Explain construction and working of Diaphragm Spring type clutch.

Construction of Diaphragm Spring Type Clutch:

The Diaphragm spring type clutch is a modified version of Conventional coil spring type clutch used in modern passenger cars.

1. In this clutch diaphragm spring is used instead of the ordinary coil spring.
2. The diaphragm spring is supported by fulcrum retaining ring which act as lever.
3. The pressure plate is movable axially and fixed radially with respect to cover.
4. This movement of pressure plate is obtained by equally spaced lugs provided on pressure plate.

Working of Diaphragm Spring Type Clutch:

1. The drive from the engine flywheel is transmitted through the cover, pressure plate and the friction plate to the gear box input shaft.
2. The clutch is disengaged by pressing the clutch pedal which actuates the release fingers by means of a release ring. This pivots the spring about its fulcrum, relieving the spring load on the outside diameter, thereby disconnecting the drive. **(2 Marks for Construction, 2 Marks for Working)**



Subject Code :17614

Model Answer

5	b)	State advantages of Hydraulic brakes and pneumatic brakes.
		Advantages of Hydraulic brakes: [1] Simple in Construction. [2] Equal braking efforts obtained at all four wheels. [3] Increased Braking effort. [4] Self Compensation system. [5] Rate of wear is less [6] Flexibility in Braking Lines. [7] High mechanical advantage. [8] The system is self lubricating. Advantages of Pneumatic brakes: [1] It is more powerful than ordinary mechanical and hydraulic brakes. [2] Exclusively used in heavy brakes due to its accuracy and efficiency. [3] Air brake simplifies the chassis design. [4] Apart from braking, air from reservoir can be used for other applications also. (Enlist any four advantages for Hydraulic & Pneumatic, 2 Marks for Hydraulic & 2 Marks for Pneumatic)
5	c)	Explain construction and working of Torsion Bar suspension.
		Construction of Torsion Bar: 1. Torsion bar is simply a rod, made up of heat treated alloy spring steel. 2. The bar is fixed at one end to the frame and other end is fixed to the end of the wheel arm and supported in the bearing. 3. The other end of the wheel arm is connected to the wheel hub. Working of Torsion Bar: When the wheel strikes a bump, it starts vibrating up and down, thus exerting a torque on the torsion bar which acts as a spring.

Subject Code :17614

Model Answer

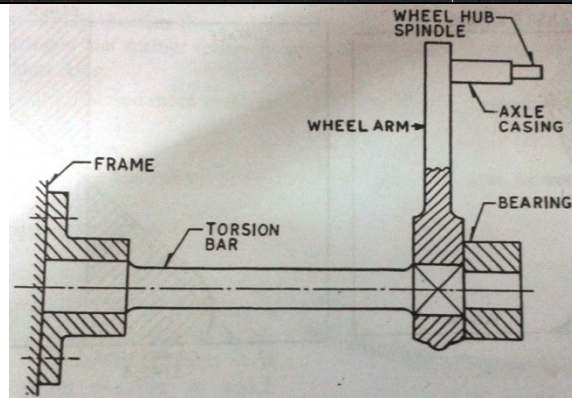


Figure: Torsion Bar

(2 Marks for Construction, 1 Mark for Working, 1 Mark for simple sketch)

5 d) **What is dynamic balancing for crank shaft? State its applications.**

Concept of Dynamic Balancing of Crank Shaft:

Dynamic Balancing is an ability to maintain equilibrium while in motion or to move the body or parts of the body from one point to another and maintain equilibrium.

In case of engine crankshaft,

[1] When the engine is running, the centrifugal forces acting at each crank pin due to the rotation of both the crank shaft as well as the big end of the crank rod which tends to bend and distort the crank shaft.

[2] To counter this tendency, counter weights are either formed as integral part of the crank web or attached separately, on the sides opposite to the crank pin.

[3] As the separate weights can be made to overlap the crank webs, more mass can be concentrated at a smaller radius, thus preventing the inertia from being excessive.

[4] The counter weights should be accurately attached to avoid the **unbalanced** crankshaft.

This is known as dynamic balancing of crank shaft.

Subject Code :17614

Model Answer

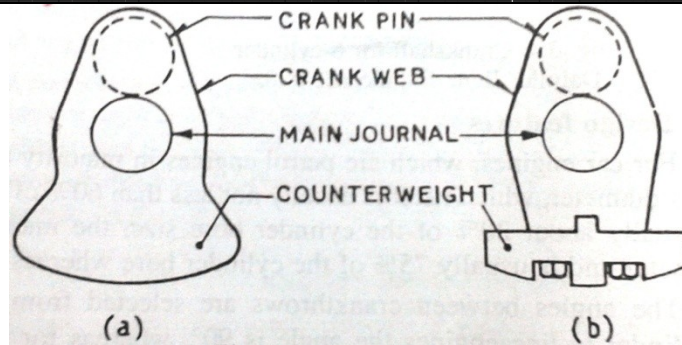


Figure: Counter weight used in Crank shaft for Dynamic Balancing

Application:

To minimize the vibration and noise and maintain the equilibrium condition of shaft while running.

(2 Marks for Concept, 1 Mark for Simple sketch, 1 Mark for application)

5

e)

Write down special clamping devices used in design of milling fixture.

Clamping devices:-

- 1) Screw clamps
- 2) Plate clamps
- 3) Pivoted clamps
- 4) Latch clamps
- 5) Equalizing clamps
- 6) Bridge Clamp
- 7) Heel Clamp

1) **Screw clamp**: - It is particularly useful when a component is to be gripped on its edges. This arrangement insures easy machining of top surface of work piece.

2) **Pivoted clamp**: - It consists of strap and screw. It eliminates used of spanner for clamping the work piece.

3) **Equalizing clamp**: - It is used for exerting equal pressure on two spots of the face of the work piece. It consists of clamp, legs and screws.

4) **Latch clamp**: - This is special type of clamp which provide a means of entry for loading and unloading of work piece. For this strap or latch can be swung out or in.

5) **Bridge clamp**:- It applies more clamping pressure as compared to heel clamp. The clamping pressure experienced by the work piece depends on the distances „x” and „y” marked in the Figure 4.10. To release the work piece the nut named as clamping nut is unscrewed. The spring lifts the lever to release the work

piece.

6) Heel clamp:- Rotation of the clamp in clockwise direction is prevented and it is allowed in anticlockwise direction. For releasing the work piece the clamping nut is unscrewed. The free movement in anticlockwise direction takes place before un-securing the nut to release the work piece

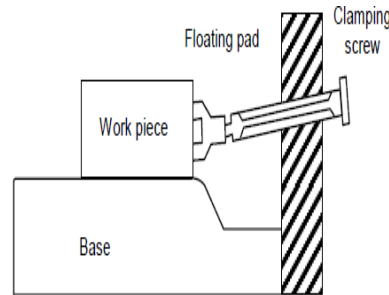


Figure 4.12 : Screw Clamp

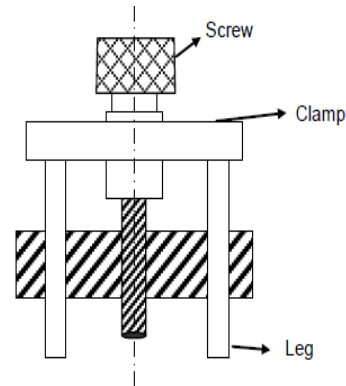


Figure: Equalizing Clamp

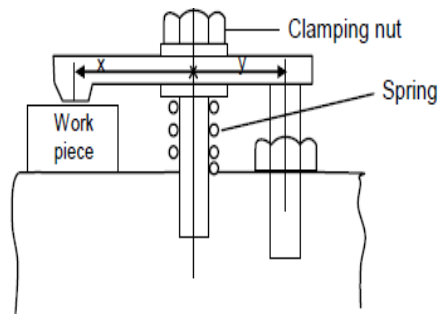


Figure: Bridge Clamp

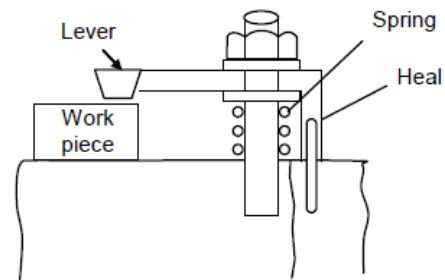


Figure: Heel Clamp

(Enlist and explain any two with simple sketches, each of 2 Marks)

5

f)

Explain process of painting and finishing in car body manufacturing.

Painting in Car Body Manufacturing:

Cars need a surface coating to prevent them from rusting excessively. Currently, this surface coating is electro coat paint, i.e. a paint that is applied using an electrochemical reaction, rather than simply by dipping the car body into a vat of paint. The detail painting and finishing process consists below stages;

[1] Precleaning:

The car body is assembled from imported metal panels and cleaned with kerosene to remove dirt and grease.



Subject Code :17614

Model Answer

[2] Priming:

The Primer is applied to the metal to achieve maximum adherence. Primers are a fairly thin material and this allows them to flow in to grooves, cut into the metal by the grinding disc or sand paper. Zinc chromate is used specially on new construction. Another primer is a vinyl wash primer, which is applied to base substrate portion and primer sealer or primer surface.

[3] Sealing:

The purpose of sealers is to provide adhesion between the new coat of paint and the old painted surface and to act like a barrier, to prevent the solvent from penetrating through the old finish.

[4] Electro Coating:

A mixture of resin and binder and a paste containing the pigments are fed into a tank. The vehicle is then lowered into the tank from an overhead conveyor and an electric current applied. This car body becomes the cathode and the tank the anode in an electro coating reaction that results in a resin polymer being very tightly and evenly bound to the metal surface of the car body.

[5] Rinsing:

The vehicle is rinsed several times, both with water and with a weak paint solution, to remove a thin coat of paint that clings to the surface but hasn't bonded to the metal. If this wasn't removed then the car would have an uneven, messy coat of paint.

[6] Baking:

The car body is then baked to 170 - 180°C in an oven. This causes the different polymer chains to crosslink (i.e. bind to each other in many places) forming a very strong, flexible, interconnected network of polymer over the whole surface of the car.

Finishing in Car Body Manufacturing:

Motor vehicle finishing is a multi-step process subdivided into three categories:

[1] Anti-corrosion operations: It consisting of cleaning applications, a phosphate bath, and a chromic acid bath;

[2] Priming operations: It consisting of an electro deposition primer bath, an anti-chip application, primer-surfacer application and joint sealant application;

[3] Finishing operations: It consisting of a color coat application, a clear coat application, and any painting necessary for two-tone color or touch-up applications



Subject Code :17614

Model Answer

		(2 Marks for Paining & 2 Marks for Finishing Process)
6		Attempt Any Four:
6	a)	Write down design process for a simple fixture.
		<p>Design Process for Simple Fixture:</p> <p>[1] Analysis of part:-</p> <p>While designing the fixtures the part must be analyzed for which it is to be design.</p> <p>[2] Design basic fixture :-</p> <p>After analyzing the part the basic fixture must be design. The basic fixture is rough designing for the requirement</p> <p>[3] Conformance checking:-</p> <p>Check for the conformance with the basic design of the fixture. If it confirms the requirement then the basic design is approved for testing and if does not conform then redesigning is need to be done.</p> <p>[4] Manufacturing:-</p> <p>After conformance with the basic designing and work piece requirement of the fixture it is manufactured.</p> <p>(1 Mark for each step)</p>
6	b)	Describe construction and working of rigid axle.
		<p>Construction of Rigid Axle:</p> <ol style="list-style-type: none">1. Conventionally the front axle is a rigid axle. It is made up by drop forging operation.2. Rigid axle is made up of I- section in the central portion (at B-B), while the ends are of elliptical or circular cross-section (at A-A) as shown in figure.3. The main axle beam is connected to the stub axles by means of kingpins. The front road wheels are mounted on these stub axles.5. The central portion is swept downward to keep the chassis height low.6. Material used for front axle is steel having composition = 0.4% C or 1.3 % Nickel.

Subject Code :17614

Model Answer

Working of Rigid Axle:

1. The rigid axle takes bending loads caused by weight of vehicle.
2. It also takes torque loads due to braking of the wheels.

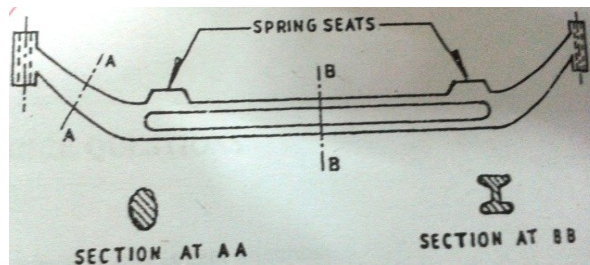


Figure: Construction of Rigid Axle

(2 Marks for construction, 2 Marks for working)

6 c) **Explain with neat sketch pneumatic/air braking system.**

Pneumatic (Air) Braking System:

Air Brakes are applied by the pressure of compressed air. Air pressure applies force on brakes shoes through suitable linkages to operate brakes. It is mostly used in heavy vehicles like trucks and buses.

It consists of following major components;

1. Compressor
2. Un-loader valve
3. Air filter
4. Reservoir
5. Brake valve
6. Brake chamber.

The compressor takes the air from atmosphere through the filter and the compressed air is then sent to reservoir through the un-loader valve where air pressure is lifted to the required value. From reservoir, air goes to the brake chambers through the brake valve. When the brake is applied air pressure in the reservoir decreases. When the pressure drops approx. 700kPa, the governor cuts in the compressor to raise the

Subject Code :17614

Model Answer

system pressure. (2 Marks for Description, 2 Marks for neat labeled sketch)

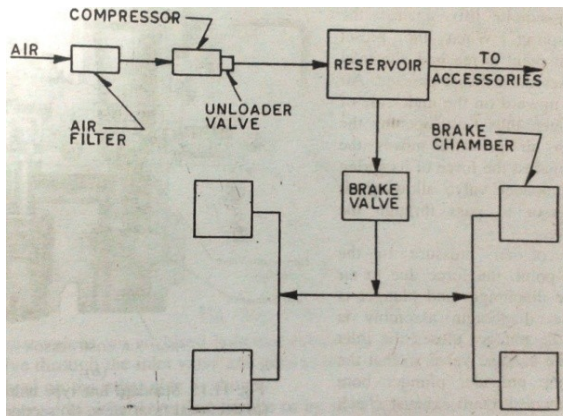


Figure: Pneumatic Brake

6 d) **Explain construction and working of propeller shaft.**

Construction of Propeller Shaft :

It consist of 3 main parts

- 1. Shaft:** It is made up of steel tube having tubular cross section. It withstands mainly the torsional loads.
- 2. Universal joint:** One or two joints depending upon the type of rear axle drive are used. It accounts for up and down movements of the rear axles, when the vehicle is running.
- 3. Slip Joint:** It adjust the length of the propeller shaft according to movements of rear axles.

Working of Propeller Shaft:

It is next to the gear box in transmission system. It is connected between the gear box and the differential with universal joint at each end. The torque is transmitted from the gear box to the differential through the propeller shaft and universal joints. The differential then transmits the torque to the rear axle to which the rear wheels are connected. The rotary motion of transmission main shaft is carried out through the propeller shaft to the differential causing the rear wheels to rotate.

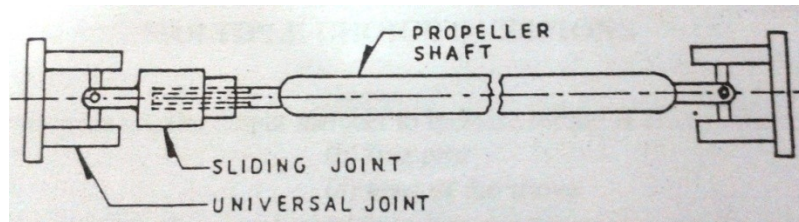


Figure: Construction of Propeller Shaft



Subject Code :17614

Model Answer

		(2 Marks for Construction, 1 Mark for working, 1 Mark for simple sketch)
6	e)	Write down the design procedure for a simple fixture.
		<p>Design Procedure for Simple Fixture used in Milling:</p> <p>[1] Analysis of part:-</p> <p>While designing the fixtures the part must be analyzed for which it is to be design.</p> <p>[2] Design basic fixture :-</p> <p>After analyzing the part the basic fixture must be design. The basic fixture is rough designing for the requirement</p> <p>[3] Conformance checking:-</p> <p>Check for the conformance with the basic design of the fixture. If it confirms the requirement then the basic design is approved for testing and if does not conform then redesigning is need to be done.</p> <p>[4] Manufacturing:-</p> <p>After conformance with the basic designing and work piece requirement of the fixture it is manufactured.</p> <p>(1 Mark for each step)</p>