MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION
(Autonomous)

(ISO/IEC - 27001 - 2005 Certified)

MODEL ANSWER

Summer – 17 EXAMINATION

Subject Title: Automobile Engineering and Manufacturing Subject Code: 17614

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 schem

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 judgment 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.

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Q. No	Sub Q.N.	Answers	Marks
1	A)	**Attempt any THREE**	12
	a)	**Enlist the main requirement of Gear box.**	04
		Answer: Automobile Gear box should fulfil following requirements: 1) Provide varied leverage between the engine and drive wheels. 2) Provide means to transfer power in opposite direction. 3) Enable speed reduction between engine and drive wheels in the ration of 5:1 . 4) Enable to provide varied torque as per requirement. 5) Enable to select different gears smoothly. 6) The gear selector lever shall be placed near to driver.	04

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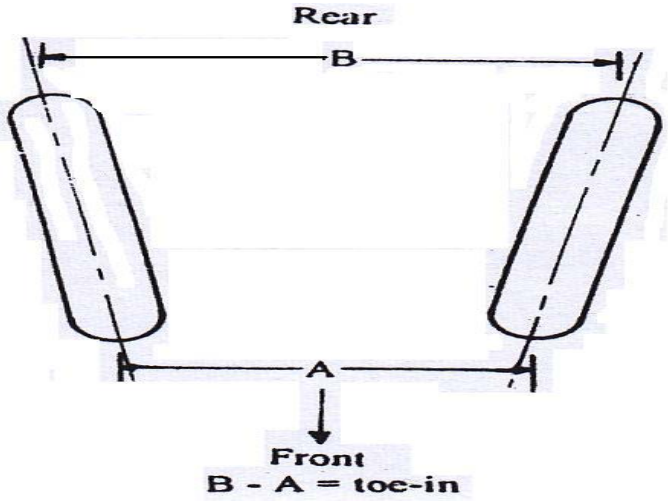
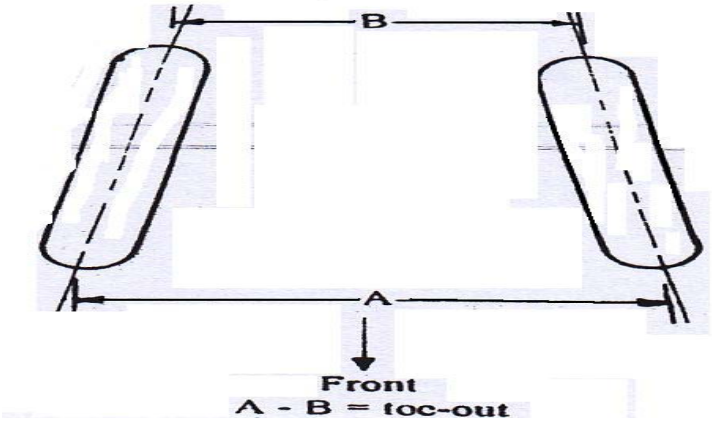
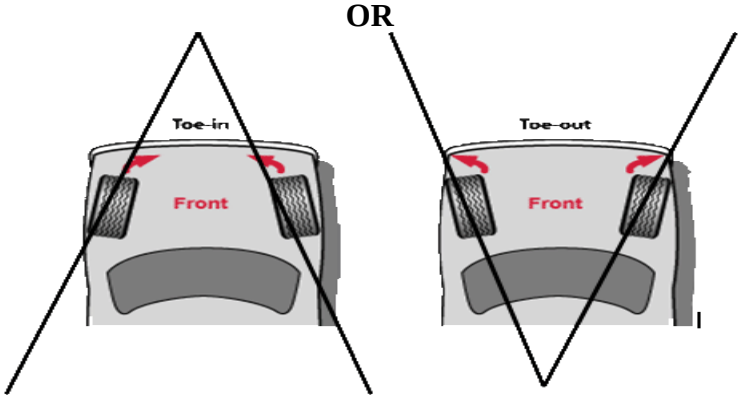
	b)	**Define Toe-in and Toe-out with neat sketch.**	**04**
		Answer: (Definition 1 marks each, sketch 1 mark each)	
		Toe-in: It is the amount by which the front wheels are set closer together at the front than at the rear when the vehicle is stationary. The amount of toe-in is usually 3 to 5mm.	**01**
			**01**
		Toe-out: The front wheels may be set closer at the rear than at the front in which case the difference of the distances between the front wheels at the front and at the rear is called as toe-out.	**01**
			**01**
		Figure: Toe-out when viewed from the top.	
		OR	
			

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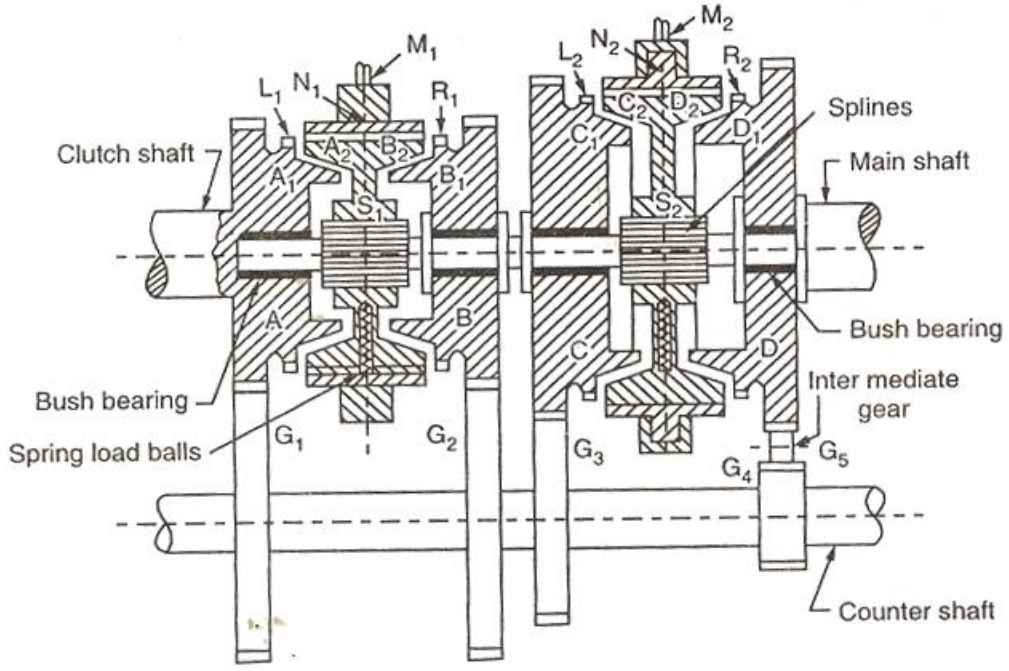
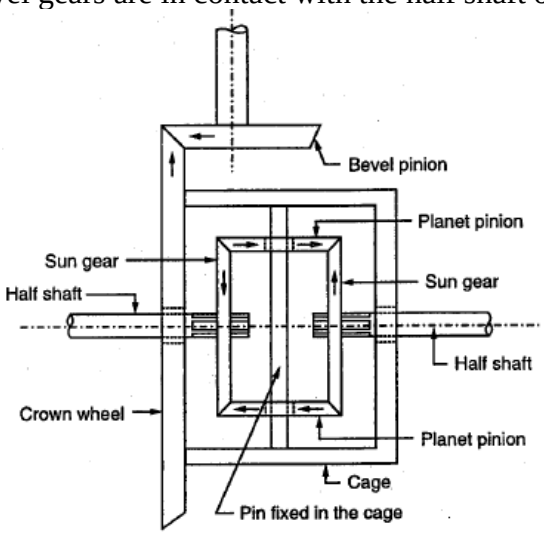
	c)	**Classify automobile vehicles on the basis of use, capacity, wheels, drive.**	**04**
		Answer: (1 marks for each basis) **1. According to Use:** a) Passenger Cars b) Goods Carriage c) Special Purpose d) Earth Moving e) Motor Cycle (Bikes) f) Mopeds 2. **According to Capacity:** a) Heavy Motor Vehicle b) Medium Motor Vehicle c) Light Motor Vehicle **3. According to Wheels:** a) Two and Three Wheeler b) Four Wheeler and Six Wheeler **4. According to Drive:** a) Left and Right Hand Drive b) Two Wheel and Four Wheel Drive .	**1 marks for each basis**
	d)	**Enlist various types of vehicle layouts.**	**04**
		Answer: (1 mark for each type, any four) **Types of Vehicle Layouts:** **According to Engine Location:** **[1] Two Wheel Drive Vehicle:** 1.1.1 Front Engine Front Wheel Drive (FFWD) 1.1.2 Front Engine Rear Wheel Drive (FRWD) 1.1.3 Rear Engine Rear Wheel Drive (RRWD) **[2] Four (All) Wheel Drive Vehicle:** 2.1.1 Manual Operated Four Wheel Drive 2.1.2 Electronic Operated Four Wheel Drive **According to Engine Mounting:** 1. Full Forward Chassis 2. Semi Forward Chassis 3. Bus Chassis	**1 mark for each type, any four**
	B)	**Attempt any ONE**	**06**
	a)	**Define aerodynamics? Why aerodynamic aspects are considered while designing the body of a vehicle.**	
		Answer: (defination: 2 marks, importance- 4 marks) **Definition of Aerodynamics:** 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. **Importance of Aerodynamics while designing the body of vehicle:** 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; [1] Reduce Air resistance or air drag.	**02** **04**

		[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.	
	b)	**With neat sketch explain working of synchromesh gear box and it's advantage.**	
		Answer: (Explanation- 2marks, Sketch- 2marks, Advantage- 2 marks) **Working of synchromesh gear box.** In fig. the gear A is fixed with clutch shaft, Gear A, B, C, and D are free to rotate on the main shaft. Member S_1& S_2 (hub) are free to slide on splines on the main shaft. Ring shaped members N_1 & N_2 having internal teeth can fit on the external teeth of sliding members S_1 & S_2 respectively. L_1 & L_2, and R_1 & R_2 are dog teeth on gear A, B, C, D. M_1 & M_2 are the forks and T_1 & T_2 are the balls supported by springs. A_1, A_2, B_1, B_2, C_1, C_2 and D_1, D_2 are the frictional surfaces. **Working:** For obtaining second gear, slide (move) the member S_1 to the right till conesB_1 and B_2 rub and the friction makes their speed equal. Now push the member N_1 to the right, by overcoming the force of the spring loaded balls and be engaged with teeth R_1. In this way the drive to the main shaft is transmitted from A to G_1 and G_2 to B and then B_2 to the main shaft through member S_1. Similarly for obtaining direct (top) gear, slide (move) the member S_1 to the left till cones A_1 and A_2 come in contact and the friction makes their speed equal. Now push the member N_1 to the left and get engaged with teeth L_1. In this way the drive to main shaft will be direct from A through member S_1. For obtaining first gear, move N_2 and S_2 to the left. Then the drive will be from A to G_1 and G_3 to C and then C_2 to the main shaft through member S_2.For obtaining reverse gear, slide N_2 and S_2 to the right. In this way the drive will be from A to G_1 and G_4 to G_5 and G5 to D and then D_2 to the main shaft through member S_2.  **Figure: Synchromesh Gear Box** **Advantages:** 1) No need of double declutching as in case of constant mesh gearbox. 2) Smooth engagement of higher gears due to synchromesh device.	**02** **03** **01**

		3) Less noisy as helical gears are used. 4) Less vibration.	
2		**Attempt any FOUR**	**06**
	a)	**Explain construction and working of differential and it's advantage**	**06**
		Answer: Figure 2, Construction and working 3 , advantages- 1 marks **Construction :** The fig shows various parts of differential unit. The bevel gear is fixed to propeller shaft which rotates the crown wheel. The crown wheel has another unit called differential unit. it consists of two bevel gears(sun gears) and two bevel pinions(planet pinions) the bevel gears are in contact with the half shaft of the rear axle.	**02**
		 **Figure: Working of differential**	
		Working of differential with neat sketch: 1. **When Running Straight:** When vehicle moves in a straight line, the power comes from propeller shaft to the bevel pinion which drives the crown wheel. Then it is carried to the differential cage in which a set of planet pinions and sun gears are located. From the sun gear it is transmitted to the road wheels through axle half shafts. In this case, the crown wheel, differential cage, planet pinions and sun gears all turn as a single unit and there is no any relative motion between the sun gear and planet pinion. The planet pinions do not rotate about their own axis. The road wheels, half shafts and sun wheels offer the same resistance to being turned and the differential gearing does not therefore operate. Both the road wheels turn at the same speed. 2. **When taking a turn:** When vehicle takes a turn, the inner wheel experiences a resistance and tends to rotate in opposite direction. Due to this the planet pinions starts rotating about their own axis and around the sun gear and transmit more rotary motion to the outer side sun gear. So that outer sun gear rotates faster than the inner sun gear. Therefore the outer road wheel runs faster than the inner road wheel and covers a more distance.	**03**
		Advantages: (Suitable advantages should get full marks) 1) Both driving wheels can rotate in same direction at same speed. 2) Both driving wheels can rotate in same direction at different speed. 3) Both driving wheels can rotate in opposite direction at same speed. 4) Both driving wheels can rotate in opposite direction at different speed	**01**

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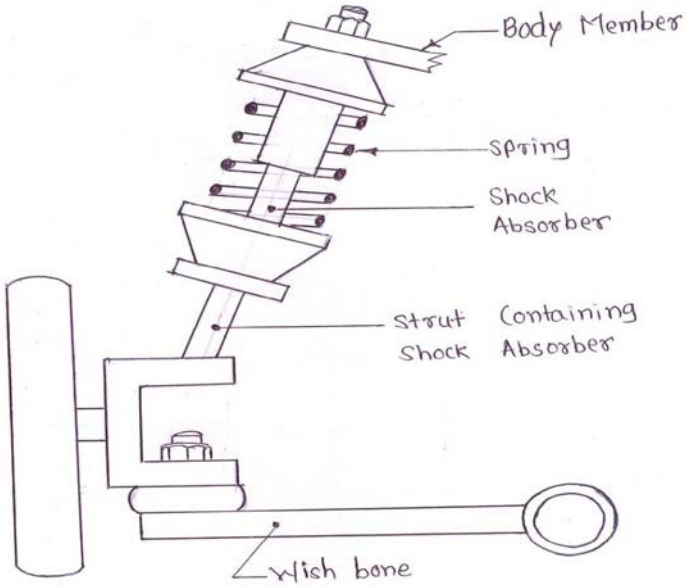
	b)	**Define the term power steering. Enlist the types of steering gear box and it's advantages.**	
		Answer: (definition- 02 mark, types – 01marks, advantages- 01 marks) **Definition of power Steering:** In automobile, the power steering is the system used to assist the driver and reduce his manual efforts to steer the vehicle using external power (like hydraulic power). **Types of steering Gear:** 1) Worm and worm wheel steering gears 2) Worm and nut steering gear 3) Worm and roller steering gear 4) Recirculating ball type steering gear 5) Rack and pinion steering gear. **Advantages :** 1. Power steering reduces the effort needed to turn the steering wheel 2. Higher degree of steering response is achieved 3. Hydraulic system also absorbs road shocks, thereby archiving comfort driving. 4. It reduces driver's fatigue. 5. Higher control over the vehicle is possible which leads to greater safety of vehicle.	**02** **01** **01**
	c)	**Explain construction and working of Mc person strut assembly.**	
		Answer: (Construction & working- 3marks, sketch- 1marks) **Construction and working of Mc-pherson strut type independent suspension:** In this type, only lower wishbones are used as shown in fig. A strut containing shock absorber and the spring carries also the stub axle on which the wheel is mounted. The wishbone is hinged to the cross member and positions the wheel as well as resists accelerating, braking and side forces. This system is simple, lighter and keeping the unsprung weight lower. Further the camber also does not change when the wheels move up and down. This type of suspension provides the maximum area in the engine compartment and is, therefore, commonly used on front wheel drive cars.  	**03** **01**

Figure: Mc-pherson strut type independent suspension.

d) Differentiate between welding and joining processes in car body manufacturing.

Answer: (1 marks for each , four points) — **any Four, 1 mark for each**

Sr. No	Welding	Joining process	
		Soldering/ brazing	Riveting/ Screwed joint
1	Welding joints are comparatively strongest joints used to bear the load.	Soldering and Brazing joints are weaker than welding joints.	Joint strength depends upon the material of rivet or screw.
2	Temperature required is 3800°C in welding joints & To join work pieces need to be heated till their melting point	Temperature requirement is up to 450°C in soldering joints. Temperature may go to 600°C in brazing joints.	Temperature is atmospheric.
3	Mechanical properties of base metal may change at the joint due to heating and cooling.	No change or negligible change in mechanical properties after joining.	No change in mechanical properties after joining.
4	Heat treatment is generally required to eliminate undesirable effects of welding.	No heat treatment is required.	No heat treatment is required

e) State the design considerations for jig and fixture.

Answer: (any Four, 1 mark for each). — **any Four, 1 mark for each**

Important considerations while designing jigs and fixtures:-

Designing of jigs and fixtures depends upon so many factors. These factors are analysed to get design inputs for jigs and fixtures. The list of such factors is mentioned below :

(a) Study of work piece and finished component size and geometry
(b) Type and capacity of the machine, its extent of automation.
(c) Provision of locating devices in the machine.
(d) Available clamping arrangements in the machine.
(e) Available indexing devices, their accuracy.

f) Write down design procedure for simple fixtures used in milling.

Answer: — **04**

Design Procedure for Simple Fixture used in Milling:

[1] Analysis of part:-

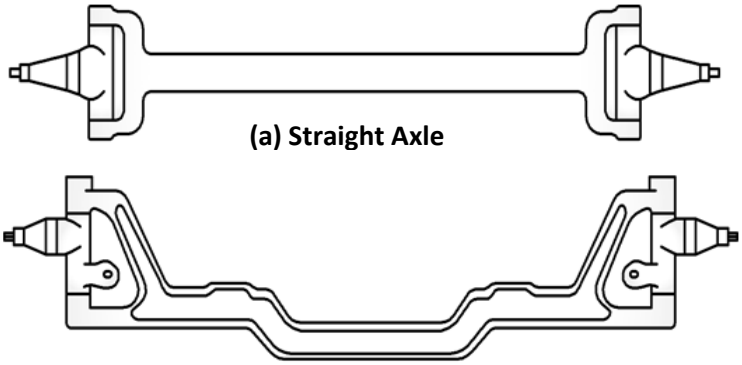
While designing the fixtures the part must be analyzed for which it is to be design.

[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.	
3		**Attempt ANY FOUR of the following**	**16**
	a	**Explain types of front axle used in vehicle.**	**04**
	Ans	**(Sketch = 02 Marks + Description =02)**  (a) Straight Axle (b) Double Drop Axle (c) Full Drop Axle The front dead axles called as rigid axles are straight axle, double drop axle and fully drop axle type. These are made by drop forging from steel having 0.4% carbon or 1.3% nickel steel. The front axle is made of I section at the centre portion. While the ends are made either circular or elliptical. The 'I' section construction takes bending loads due to the load of the vehicle and also the torque due to braking of the wheels. To keep the chassis height low, the centre portion of the front axle is given a downward sweep. It reduces the swing or sway of the vehicle while cornering and give greater stability as well as safety at high speed. The centre of gravity of the road vehicle was lowered by dropping the entire center portion. The dead front axle transmits the weight of front part of the vehicle to the road surface through the front wheels. It also carries the steering mechanism and absorbs shock due to road variation. The rigid type front axle was used in connection with leaf springs. The two longitudinal leaf springs fixed to the two spring seat on the axle beam.	**Sketch = 02** **+** **Description = 02**
	b	**Explain with neat sketch of rack and pinion gear box used in automobile.**	**04**
	Ans	**(Sketch = 02 Marks + Description =02)**	**02 + 02**

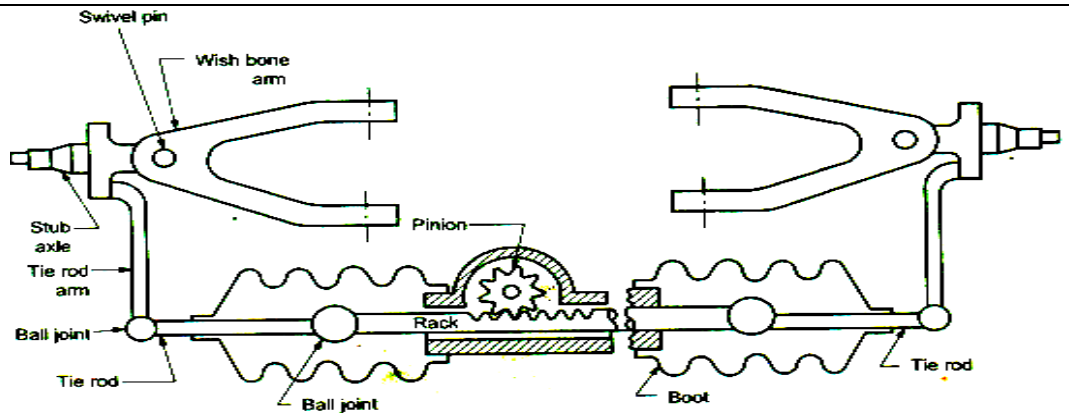
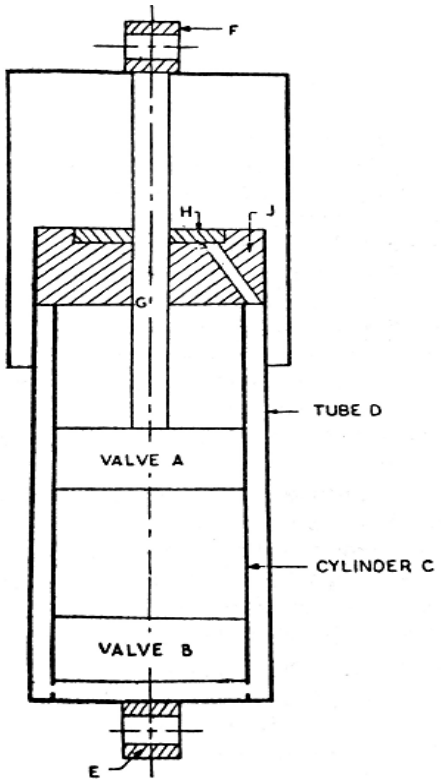


Figure: Rack and Pinion type of steering gear box.

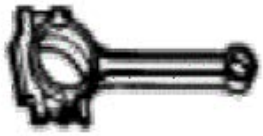
Rack and Pinion type of steering gear box: The rotary motion of the steering wheel is transmitted to the pinion of the steering gear through the universal joints. The pinion is in mesh with rack. The circular motion of the pinion is transferred to the rack and rack moves linearly and this linear movement of rack is transmitted to the stub axle and wheel gets steered. The rack has ball joints at each end to allow for rise and fall of the wheels.

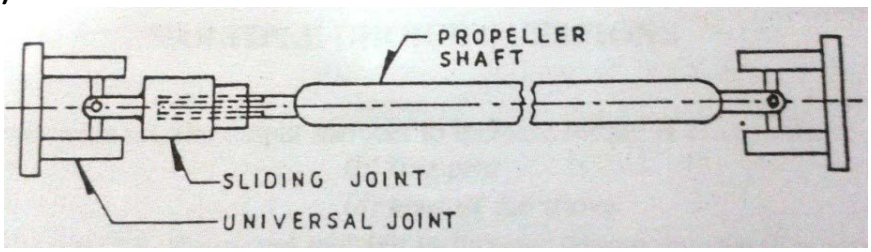
	c	**With neat sketch explain the working of telescopic shock absorber.**	**04**
	Ans	**(Sketch = 02 Marks + Description =02)**	***02 + 02***



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

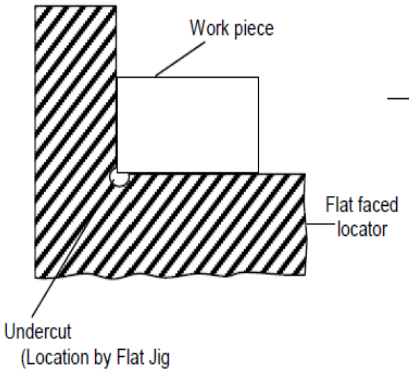
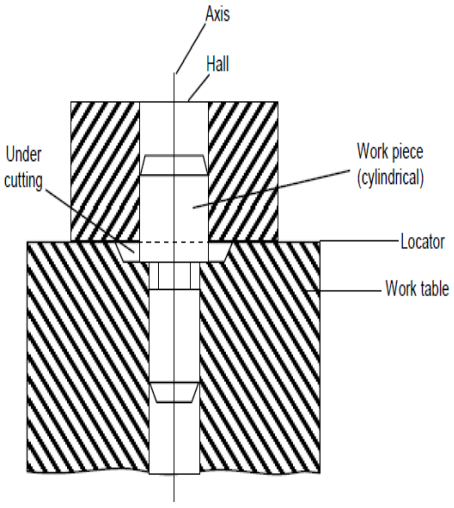
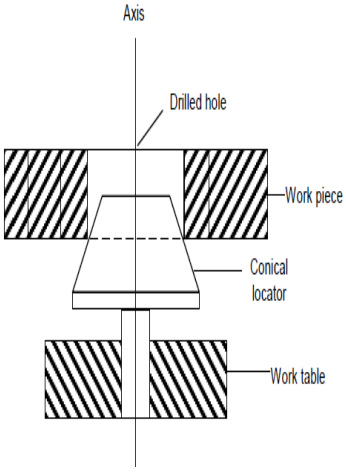
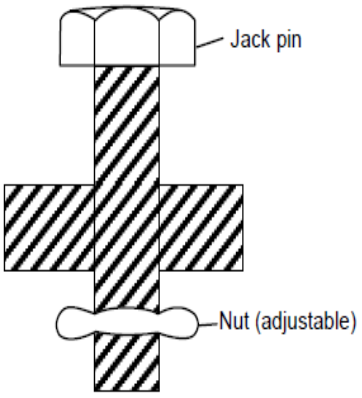
		passage shown in head. Eye (E) is connected to axle, while eye (F) is attached to chassis frame. Fluid generally used in shock absorbers is a mixture of 60 percent Transformer oil & 40 per cent Turbine oil. When car has come across a bump, Eye (E) would move up & thereby the fluid will pass from lower side of valve assembly (A) to its upper side. Due to pressure of fluid through rod (G) fluid will be go to underside of valve (B). This passing of fluid through valve openings provides damping. Similarly for downward motion of eye (E), fluid will pass upper side of valve assembly (A) to lower side & also from lower side of valve assembly (B) to its upper side.	
	d	**Explain any two manufacturing process used for production of connecting rod.**	**04**
	Ans	**(Description on any two process =02 Mark each)** **Manufacturing processes used for production of connecting rod:** 1. Forging process. 2. Casting process. 3. Powder Forging Process **1. Forging Process:** In forging process the round bar of desired dimensions has been taken and is heated in oven up to red hot. Then it is kept on the anvil and hammered to the desired shape. The desired shape is given by means of fullering or upset forging. The heated stock is elongated by reducing its cross section in first die. The operation is known as "Fullering". 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". General shape is given in first blocking die. Finished shape is given to forging in final impression die. Flash is removed by trimming.  1 BLANK  2 EDGING  4 FINISHING  3 BLOCKING  5 TRIMMING **2. Casting Process:** In casting process the molten metal is directly poured into the mould of desired dimensions and cooled to solidify and taken out of mould box. Then it is cleaned by sand blasting and machining is done if required. **3. Powder Forging Process**	**02** **+** **02**

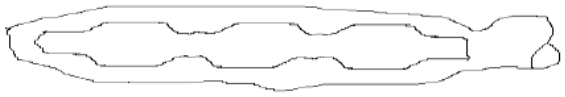
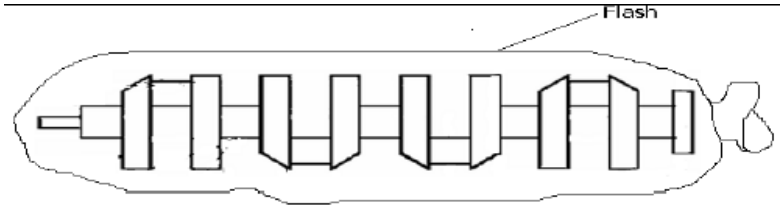
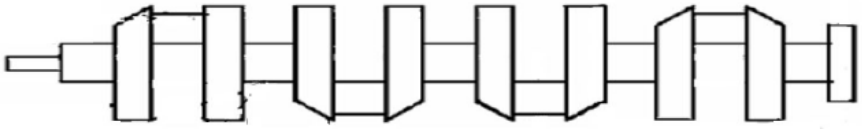
		Powder forging consists of the rapid densification of a heated powder-based preform using a single forging strike. The result is a fully dense net- or near-net shape part suitable for high performance applications where high durability and strength are a requirement. Tight control of the powder perform mass allows the use of a trap die and eliminates any material waste such as the "flash" usually associated with the conventional forging process. Energy savings is another advantage of the process when the forging step directly follows the sintering step, eliminating re-heating. Powder forging is done at a lower forging temperature than conventional forging.	
	e	**State the application of different types of drilling jig.**	**04**
	Ans	**(Any 4 applications = 01 mark each)** **Application of Different types of Drill Jigs:** [1] Template jigs carry correct locations of holes to be made in the work piece. [2] To avoid marking operation completely template jigs are used [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 [4] Open type jigs are used to drill the holes on work piece which is placed on the base of jig [5] Swing leaf type jig in which plate is capable of swinging about a fulcrum helps to drill holes in the work piece accurately [6] Jigs holds the work piece securely [7] It locates the tool accurately [8] Pot type jigs are used to drill hole in hollow cylindrical components [9] Box type jigs can be used to hole in components of irregular shape [10] Solid type jigs can be used for drilling holes in simple shape and relatively small sizes	**01 each**
4	**A**	Attempt **ANY THREE** of the following	**12**
	a	**Explain with neat sketch working of propeller shaft with its universal joint and sliding joints.**	**04**
	Ans	**(Sketch = 01 Mark + Working = 01 Mark + Function of universal joint and slip joint = 01 mark each.)**  **Figure: 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:**	**01 + 01 + 01 + 01**

		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.	
	b	**Compare between hydraulic brake and pneumatic brake.**	**04**
	Ans	(**Any 4 points = 01 Mark each**)	***01 Each***

Hydraulic Brake System	Pneumatic Brake System
1. It is used in light vehicles like car, jeep etc	Used in heavy vehicles like trucks, bus etc
2.Brake works on liquid fluid i.e. brake oil	This works on compressed air
3. These brake stop working as engine stops.	Depends upon reservoir pressure.
4.Less reliable	More reliable
5.Leakages may collapse system	System sustain for a period
6.Required drive pump	Required compressor

	c	**What is necessity of suspension system in the automobile?**	**04**
	Ans	1. It should provide comfort. 2. It should provide safeguard to the occupants. 3. It should have high strain energy per unit weight. 4. It should be of minimum weight. 5. It should have low maintenance and low operating cost. 6. It should have minimum tyre wear. 7. To prevent the road shocks from being transmitted to the vehicle frame. 8. To preserve the stability of the vehicle in pitching, rolling while in motion. 9. To maintain proper steering geometry	***01 each***
	d	**Explain hardening and pre-stressing processes in the manufacturing of leaf spring.**	**04**
	Ans	(**Hardening = 02 Marks + Pre Stressing = 02 Marks**) **i) Hardening:** In this the leaf or blade is heated to a temperature above critical point and held at that temperature for a definite period of time and then quenched in water or oil or molten salt bath. In this the leaf spring is harden to 20 to 30^0C above upper critical temperature for hypo-eutectoid steel and 20 to 30^0C above lower critical temperature for hypereutectoid steel**.** The processed spring leaves are heated to a temperature of 825°cto 875°C (upper critical temperature) in a conveyorised or walking beam furnace for about 30 to 35 minutes depending on the cross section and chemical analysis of the leaf. When it is discharged from the furnace, the leaves are cambered to a desired bend in a cambering machine and immediately dropped into a quenching tank filled with quench oil. The leaves travel though the quenching medium for around 15 minutes. ii) **Pre Stressing**: Pre-stressing is a process used by the spring industries that have significant benefits to spring performance. This process improves the available elastic deflection of the	**02** **+**

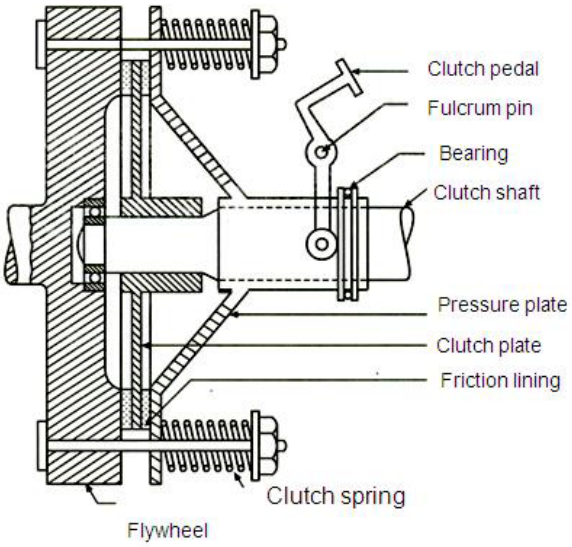
		springs. The stress in the full length leaves are 50 % greater that the stresses in graduated length leaf. One of the methods of equalizing the stress in leaf spring is to pre- stress the spring. The pre stressing is achieved by bending the leaves to different radii of curvature before they are assembled to centre. The full length leaves is given a greater radius of curvature than a graduated leaf. The initial gap C between the full length and graduated length leaf before the assembling is called nip. Such pre stressing achieved by a difference in radii of curvature is known as nipping.	**02**
	B	Attempt **ANY ONE** of the following	**06**
	a	**What are the various types of locators? Explain any two with neat sketch.**	**06**
	Ans	**(Types = 02 Marks + Explanation = 01 Mark each, Sketch = 01 mark each)** **Types Of Locators** 1) Adjustable locators (Flat locators) 2) Cylindrical locators 3) Conical locators 4) Jack pin Locator 5) Fixed V Locators  **Flat Locator**  **Cylindrical Locator**  **Conical Locator**  **Jack Pin Locator**	**02 + 01 each + Sketch 01 Each**

		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. **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.	
	b	**Explain forging and heat treatment processes in the manufacturing of crank shaft.**	**06**
	Ans	**(Stepwise Explanation of Each Forging Process with related sketch = 01 Mark per step + Heat treatment process = 02 Marks)** **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.  [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.  **Heat treatment:** In heat treatment process the crankshaft is heated in the furnace to suitable temperature. After heating it is soaked at that temperature for some time for uniform heating and cooled to room temperature in the furnace. Thus stresses and indentations are removed for increasing the life of the component. The upper portions of connecting rods are only in operation and hence require high hardness and hence those portions are only hardened by means of hardening or induction hardening.	**01 / step + H .T. = 02**

MODEL ANSWER
Summer – 17 EXAMINATION

Subject Title: Automobile Engineering and Manufacturing Subject Code: 17614

5		**Attempt any four of the following.**	
	a)	**Explain construction and working of coil spring clutch.**	
		Answer:	



01

Figure: Coil Spring Clutch

Two basic types of clutch are the coil-spring clutch and the diaphragm-spring clutch. The difference between them is in the type of spring used. The coil spring clutch shown in figure which uses coil springs as pressure springs (only two pressure springs are shown in figure).

Construction of clutch:

A single disc or plate clutch as shown in figure, consist of a clutch plate whose both sides are faced with the friction material (usually ferrodo). It is mounted on the hub which is free to move axially along the splines of the driven shaft. The pressure plate is mounted inside the clutch body which is bolted to the flywheel. Both the pressure plate and the flywheel rotate with the engine crankshaft or the driving shaft. The pressure plate pushes the clutch plate towards the flywheel by a set of strong spring which are arranged radially inside the body. The three levers (also known as release levers or fingers) are carried on the pivots suspended from the case of the body. These are arranged in such a manner so that the pressure plate moves away from flywheel by the inward movement of a thrust bearing. The bearing is mounted upon the forked shaft and moves forward when the clutch pedal is pressed.

03

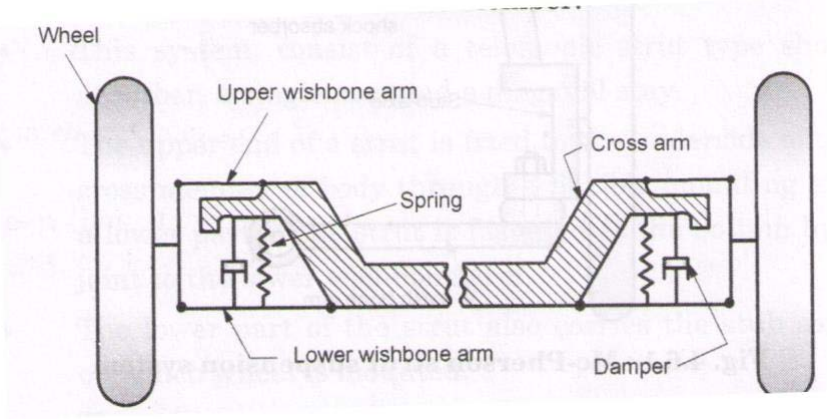
Working : The figure shows single plate clutch.

Disengaging the clutch:

When clutch pedal is pressed down, its linkage forces the thrust bearing to move towards the flywheels and pressing the pressure plate away from the flywheel thereby the compression springs (coil springs) are compressed. This action removes the pressure from the clutch plate and the driving shaft comes to stationary position.

Engaging the clutch:

On the other hand when the foot is taken off from the clutch pedal, the thrust bearing moves back by levers this action allows the coil springs to extend and thus the

		pressure plate pushes the clutch plate back towards the flywheel. The cluch is engaged and power is transmitted from engine to gear box.	
	b)	**State the advantages of disc brakes used in automobile.**	
		Answer: ((Any four -04 marks) **1**. Friction surface directly exposed to the cooling air for better heat dissipation. 2. Uniform wear of friction pad. 3. Design of disc brakes such that there is no loss of efficiency due to expansion. 4. Disc brakes weigh less than conventional brakes. 5. Better anti fade characteristics. 6. Simple in design. 7. Small number of parts. 8. Easy to replace. 9. Total fraction area is less.	**04**
	c)	**Explain construction and working of wishbone suspension system.**	
		Answer:  **Figure: Wishbone suspension system** Wishbone type suspension system: It consists of two wishbone arm pivoted to the frame. The upper arm wishbone arm is shorter in length than lower arm. The weight of the vehicle is transmitted from the body and the cross member to the coil spring through which it goes to the lower wishbone member. A shock absorber is placed inside the coil spring and is attached to the cross member and lower wishbone member.	**02** **02**
	d)	**Explain piston die-casting manufacturing process for cylinder block.**	
		Answer: The casting process used for manufacturing cylinder block is die casting. The molten material is poured in die or mould having pattern of cylinder block. The molten metal solidifies and solid cylinder block is taken out and cleaned. The cylinder block is machined to remove the flash. The mating parts of the block are also machined on milling or boring machines. The bores are machined on boring machine with high accuracy and good surface finish is achieved by honing process.	**04**
	e)	**Write down special clamping device used in design in milling fixture.**	
		Answer: Clamping devices:- 1) Screw clamps	**02**

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. **02**
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 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.
OR

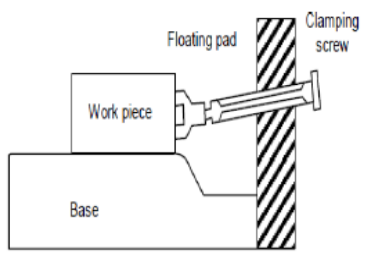


Figure 4.12 : Screw Clamp

Figure: Screw Clamp

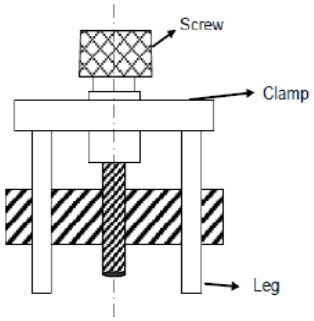


Figure: Equalizing Clamp

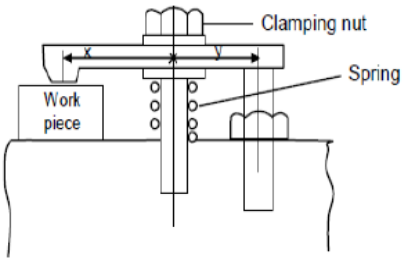


Figure: Bridge Clamp

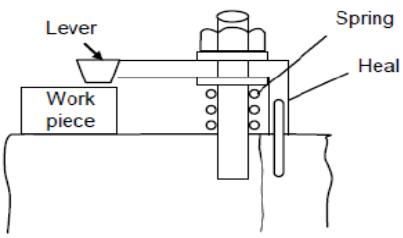
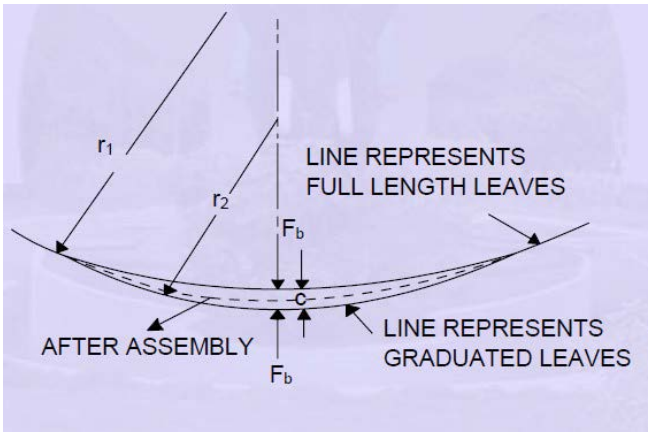
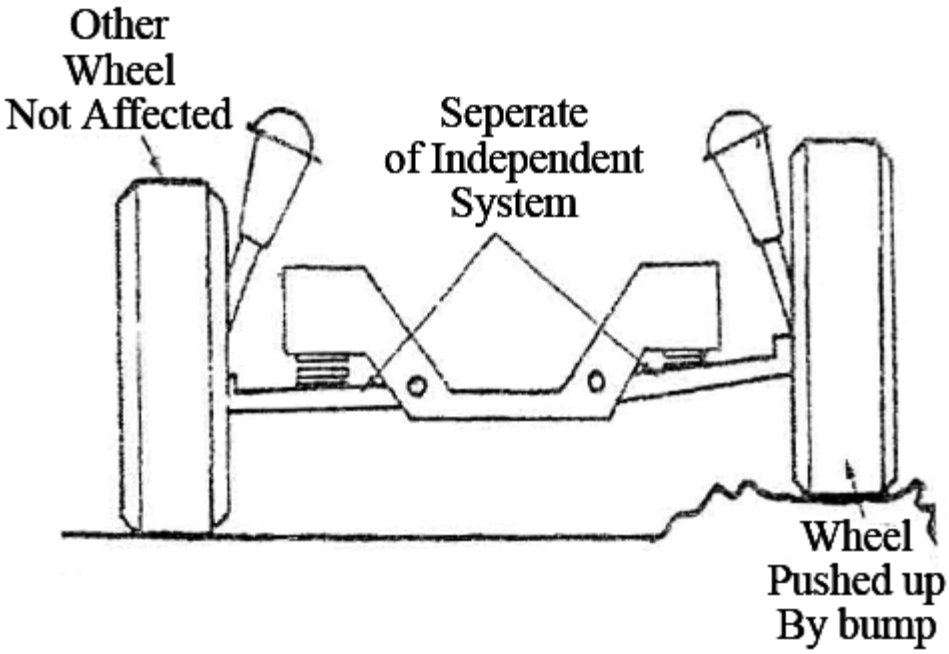


Figure: Heel Clamp

	f)	**Explain manufacturing process for leaf spring final assembly and painting.**	
		Answer:  Figure: Concept of Pre stressing and Bending **final assembly and painting.** The manufacturing of Leaf spring involves following processes sequentially: 1) Shearing + Drilling 2) Eye Formation for Top Springs 3) Heating the Spring leaves 4) Camber formation + Hardening 5) Hardness Testing 6) Tempering 7) Hardness Testing 8) Shot Blasting 9) Spring final Assembly 10) Testing & Inspection 11) Painting & Dispatch Spring final assembly and painting: The required leaves are collected after shot peening. The camber of these leaves are modified in a screw press for specific assembly camber. Clip leaves of the assembly are fitted clips and assembled along with the other leaves in a hydraulic assembly table. These assemblies are subjected to scragging in a scragging machine where it is deflected thrice in succession. This is to make the assembled leaves to set perfectly without any gap between them. These assemblies are painted before dispatch.	**02** **02**
6		**Attempt any FOUR of the following**	
	a)	**Write down the principle of fixture and jig design.**	
		Answer: (Any eight, half mark for each) 1) Reduce Idle time 2) Minimize cheap accumulation	**Any eight, half**

		3) Fool proofing 4) Clearance 5) Rigidity 6) Trunnions 7) Burr groves 8) Easy removal of part 9) Inserts 10) Design for safety 11) Sighting surfaces 12) Simplicity in design 13) Economical	**mark for each**
	b)	**Describe construction and working of independent suspension system.**	
		Independent suspension system: 02 mark for each sketch and explanation  **Figure: Independent suspension system** "Independent" refers to the motion or path of movement of the wheels or suspension. It is common for the left and right sides of the suspension to be connected with anti-roll bars or other such mechanisms. The anti-roll bar ties the left and right suspension spring rates together but does not tie their motion together. The independent suspension allows the two wheels to move up and down independently of one another. The wheels can move up and down and yet not lift the frame. Independent suspension is a broad term for any automobile suspension system that allows each wheel on the same axle to move vertically (i.e. reacting to a bump in the	**02** **02**

road) independently of the others. This is contrasted with a beam axle system in which the wheels are linked – movement on one side affects the wheel on the other side.

c) Differentiate between drum brake and disc brake used in automobile.(Any Four) **04**

Answer:

Sr. No.	Disc brake	Drum brake
1	Friction surface directly exposed to the cooling air.	Friction occurs on the internal surface.
2	Frication pad are flat.	Friction lining are curved.
3	Efficiency is high.	Efficiency is low.
4	Weigh less.	Weigh is more.
5	Better anti-fade characteristics.	Less anti-fade characteristics.
6	Simple in design.	Complicated in design.
7	Easy to replace.	Complicated to replace.

d) Explain construction and working of epicyclic gear box used in automobile.

Answer:

Epicyclic gear box - 02 mark for each sketch and explanation. **02**

An epicyclic gear box consists of two, three or even four planetary gear sets. A simple gear set hasa sun gear, about which planets turn round. These planet gears are carried by carrier and a shaft and also in mesh internally with a ring gear, which is also called annulus or internal gear. **02**

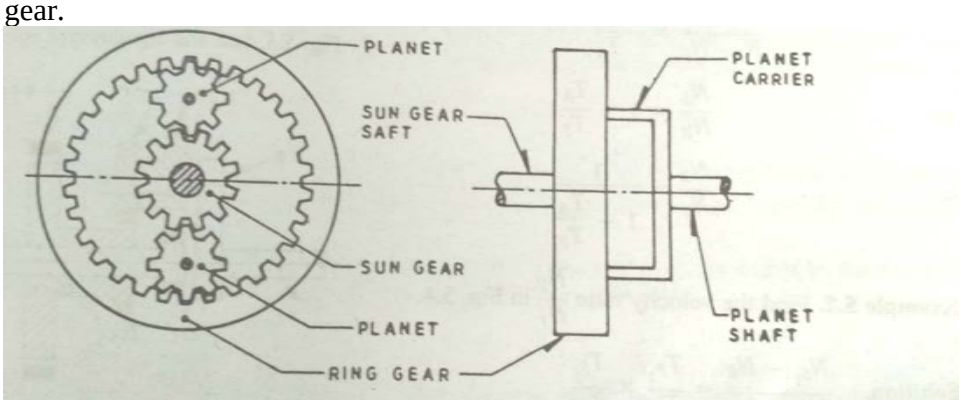


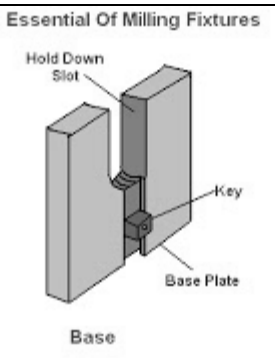
Figure: epicyclic gear box

e) What are essential components of milling fixture? Explain any two with neat sketch.

Essentials of Milling Fixtures: **02**

1: Base:

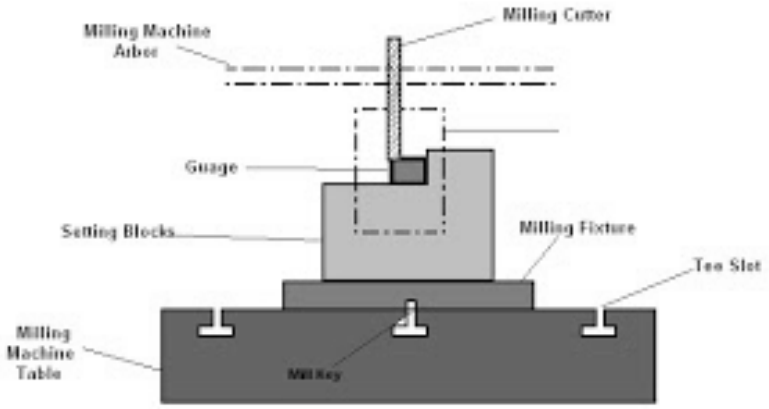
A heavy base is the most important element of a milling fixture. It is a plate with a flat and smooth under face. The complete fixture is built up from this plate. Keys are provided on the under face of the plate which are used for easy and accurate aligning of the fixture on the milling machine table. By inserting them into one the T slot in the table. These keys are usually set in keyways on the under face of the plate and are held in place by a socket head cap screw for end key. The fixture is fastened to the machine table with the help of two T bolts engaging in T slots of the work table.



01

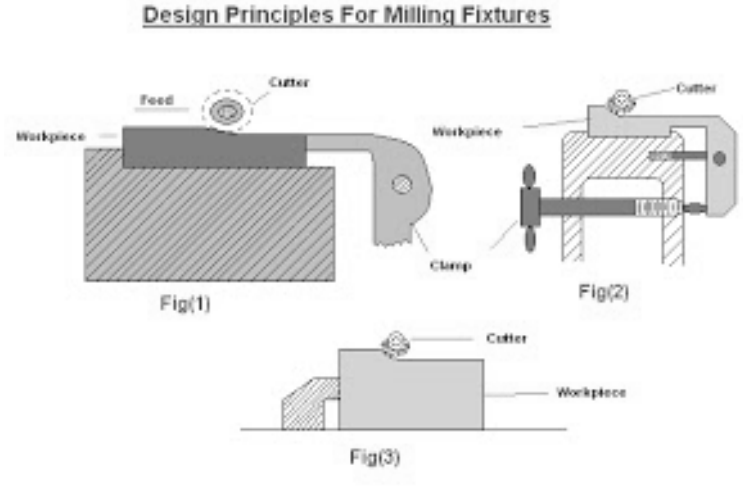
01

2: Setting Blocks:
After the fixture has been securely clamped to the machine table , the work piece which is correctly located in the fixture , has to be set in correct relationship to the cutters. This is achieved by the use of setting blocks and feeler gauges. The setting blocks is fixed to the fixture. Feeler gauges are placed between the cutter and refrence planes on the setting block so that the correct depth of the cut and correct lateral setting is obtained. The block is made of hardened steel and with the refrence planes(feeler surfaces) grooved. In it correct setting , the cutter should clear the feeler surfaces by at least 0.08cm to avoid any damage to the block when the machine table is moved back to unload the fixture. The thickness of the feeler gauge to be used should be stamped on the fixture base near the setting block.



Setting Blocks

3: Locating and Clamping Elements:
The same design principles of location and clamping apply for milling fixtures have been discussed above.
Some Design Principles for Milling Fixtures:
1: Pressure of cut should always be against the solid part of the fixture
2: Clamps should always operates from the front of the fixture
3: The work piece should be supported as near the tool thrust as possible


Design Principles For Milling Fixtures
Cutter
Feed
Workpiece
Clamp
Fig(1)
Cutter
Workpiece
Fig(2)
Cutter
Workpiece
Fig(3)