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.

Q1 a) Classify chassis & explain any one of them.	04
Classification of chassis:- a) With respect to control chassis is classified as- 1) Conventional or forward Control Chassis 2) Semi-forward control Chassis 3) Full-forward control Chassis b) According to fitting of an engine 1. Engine at front- 2. Engine at front but crosswise- 3. Engine at rear 4. Engine at centre 5. Bus Chassis c) According to number of wheels fitted and number of driving wheels - **1.** 4×2 Chassis **2.** 4×4 Chassis **3.** 6×2 Chassis 4. 6×4 Chassis	02
Explain any one of the following- **1. Conventional or forward control chassis:--** In this type of chassis, engine is mounted in front outside the driver's cabin or driver seat. Full utilization of the space is not possible in this type of arrangement. The driver seat is quite far off from the front axle so that driver cannot see the road just in front of the front tyres. Because of this reason, the slope is given to bonnet and mud guard of this vehicle so that the driver can see close to the wheels as far as possible. e.g. Car Chassis. **2. Semi-forward control chassis:--** In this type of chassis, engine is mounted in such a way that the half portion of it is in the	02

driver's cabin and remaining half outside the driver's cabin. In this, part of chassis can be utilized to carry extra passengers or luggage. e.g. Tata SE Truck.

3. Full forward control chassis:--

In this type of chassis, the engine is mounted completely inside the driver's cabin. Hence, maximum utilization of the space is achieved because of increased floor area to carry more luggage or passengers in this type of arrangement. Also, the driving becomes easier especially in dense traffic because the driver can see the road just in front of the front tyres. e.g. Bus and Truck chassis.

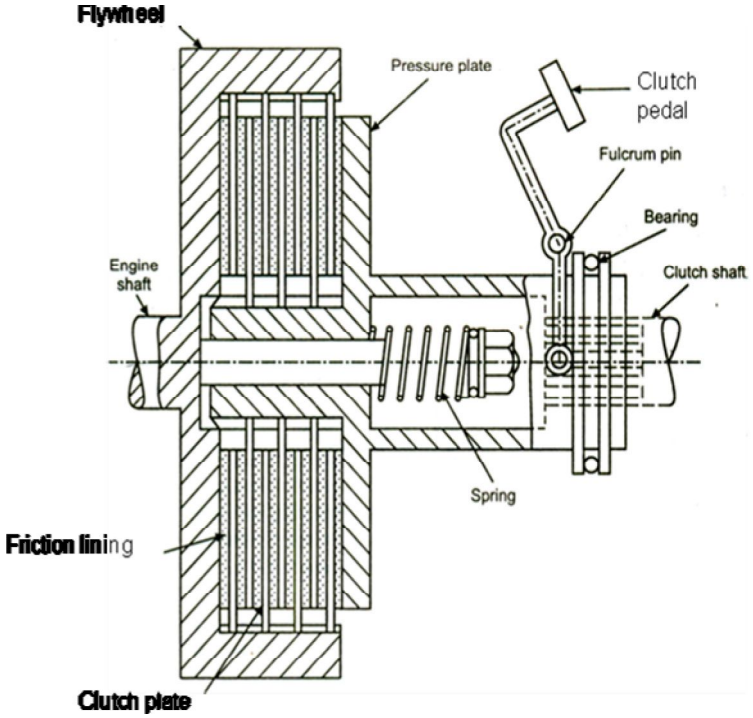
Q1b) Describe multiplate clutch with neat labelled sketch. — 04

Construction-

The figure shows engaged position of multiplate clutch. It is an extension of single plate clutch. In this, the number of frictional and the metal plate is increased i.e. the numbers of clutch plates are used to transmit torque. As the number of frictional surfaces increases, the capacity of torque transmission also increases. It consists of flywheel, number of clutch plates in two sets i.e. one having external splines sliding in slots of flywheel and other having internal teeth sliding on the pressure plate hub. These plates are arranged alternately. On both sides of clutch plate, friction material is attached. The axial force exerted by the spring engages the clutch. — 01

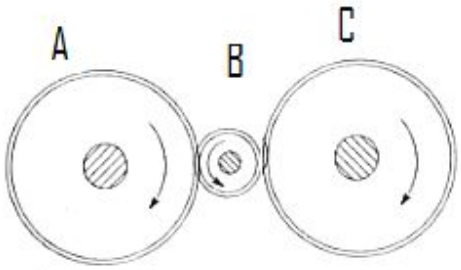
Working-

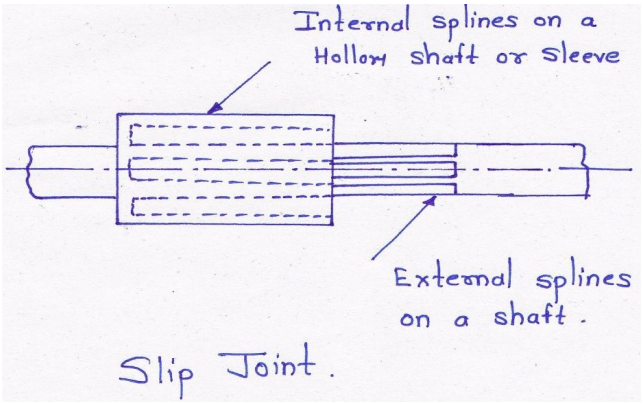
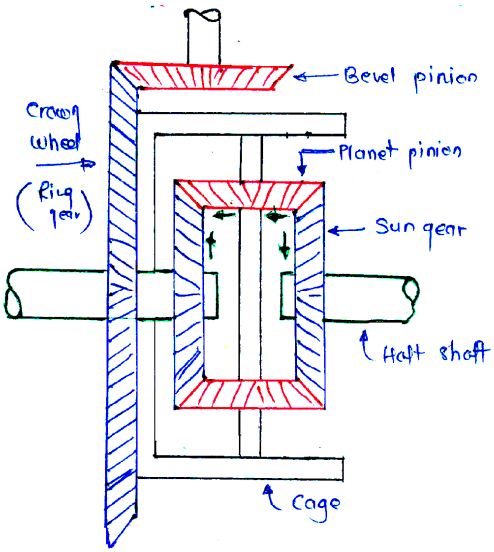
To disengage the clutch, pressure will be applied on the clutch pedal; due to this the pressure plate moves to right and against the spring force. The movement of the pressure plate to the right makes the clutch plate free which means that torque will not be transmitted from the engine shaft to the transmission. When the clutch pedal is released, because of spring force the pressure plate moves forward and keeps the pressure on the clutch plates holding them against the flywheel. Now the torque is transmitted to the transmission. — 01



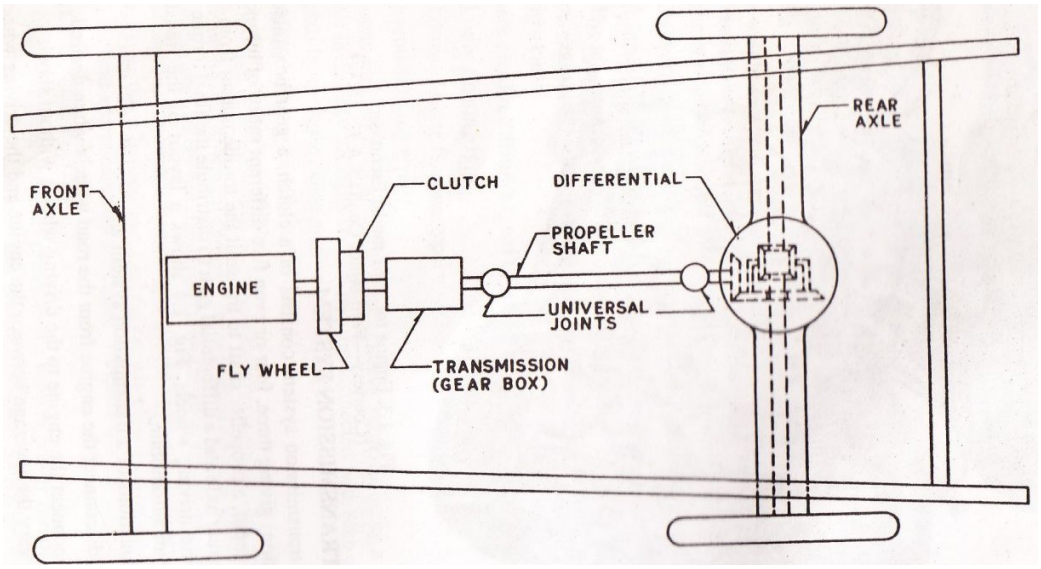
— 02

Multiplate Clutch

Q1c) State the principle & necessity of gear box.	04
Principle of gear box:- Fig. shows the small gear B has 20 teeth whereas big gears A & C have 60 teeth. For every three rotations of small gear, the big gear rotates only once & vice versa .If gear A rotates clockwise, then gear B rotates anti-clockwise & hence gear C rotates in clockwise.  **Figure: Principle of gearing.** **Necessity of gear box:** The engine gives its full horse power at fairly high speed and it is not reversible in direction of rotation. The tractive force required at road wheels to propel the car varies according to the conditions of use. It means- a) On a flat road moderate torque is required at road wheels but at high wheel speed. b) When car starts from rest high torque is required at a low wheel speed. c) When climbing a steep hill a high torque is required. From these facts it will be seen that it is necessary to be able to vary the speed of rotation of the road wheels while keeping the engine revolutions constant. This is the main purpose of gearbox to provide speed variations in road wheels by keeping engine speed constant.	02 02
Q1d) With neat sketch explain slip joint.	04
The slip joint is used to adjust the length of the propeller shaft when demanded by the rear axle. If there is no slip joint, the propeller shaft would buckle or break. It is provided at the gearbox end as is shown in the fig. This joint allows variation in length of the propeller shaft. It consists of a sleeve having internal splines attached to the end of front universal joint. This sleeve meshes with the external splines of the shaft, which allows sliding motion between them. When the rear wheel comes across a bump, the spring compresses or expands as the differential with the rear axle housing and the wheel moves up and down. This not only changes the angle but also varies the length of propeller shaft. So the slip joint permits the effective length of propeller shaft depending upon the road conditions.	02

	Correct Labeled Sketch 02
Q1e) Explain the working of differential with neat labeled sketch.	04
Working of differential :- 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. Both the road wheels turn at the same speed. 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 other 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.	02
 **Figure : Differential**	Correct Labeled Sketch 02

Q1 f) State the necessity & functions of propeller shaft.	04
Necessity of propeller shaft: Propeller shaft is a driving member, which transmits torque/drive from the gearbox to the differential unit. This shaft is also called as the carbon shaft or the driving shaft. The output shaft from the gearbox and pinion shaft extending from differential unit are connected to propeller shaft by using a universal joint. **Functions of propeller shaft:** 1. It transmits rotary motion and power to the differential 2. It transmits power at varied angle. 3. It absorbs the shocks coming on the transmission system when the vehicle starts from rest. 4. It accommodates change in length when the rear axle moves up and down.	01 03
Q1 g) What are the various loads acting on chassis frame? Elaborate briefly.	04
Various loads acting on the frame are given below- **a) Static loads**: The loads due to the chassis parts like engine, transmission, steering system, body, fuel tank etc. and passengers are acting on the frame which causes vertical bending of side members. **b) Inertia loads**: Inertia loads of short duration are acting on the vehicle while application of braking torque and engine torque. This results into bending of side members in the vertical plane**.** **c) Impact loads**: When a vehicle or wheel collides with any other object on the road or road obstacle, it is subjected to externally applied impact load. Impact load may distort the frame to parallelogram shape. **d) Short Duration load**: While crossing a broken patch of a road, a vehicle is acted upon by heavy and suddenly applied loads of short duration. **e) Momentary duration (combined) loads:** While negotiating curves, applying brakes and striking a pot hole, a vehicle is acted upon by combined loads of momentary duration. **f) Overloads**: Overloading a vehicle beyond its designed capacity.	Any four (4)
Q2 a) Classify vehicle layout & explain front engine rear wheel drive with neat sketch.	08
Classification of vehicle layout:- 1) Front engine front wheel drive 2) Front engine rear wheel drive 3) Front engine all wheel drive 4) Rear engine rear wheel drive 5) Central engine all wheel drive	02
Front engine rear wheel drive:- As shown in figure, in this type of layout the engine is fitted or mounted in the front of vehicle and the drive is given to the rear axle through transmission system. In this case, front axle is dead axle and rear axle is drive or live axle because power is only given to the rear axle.	01
Advantages: a) Weight distribution between front and rear axle is reasonably balanced. b) Because of only engine is in the front, it occupies less space and has easy front wheel steering movement. c) Increased load carrying capacity is provided since the large luggage space is available behind the rear seats. d) Since the engine is at front, it gives better cooling effect. Full benefit of natural air stream created by vehicles movement is taken by the forward facing radiator. e) It gives better access to various components like engine, gear box and rear axle etc. as compare to other layouts. f) The control linkages- accelerator, choke, clutch, gear box are short and simple.	01 (Any two)



Front engine rear wheel drive

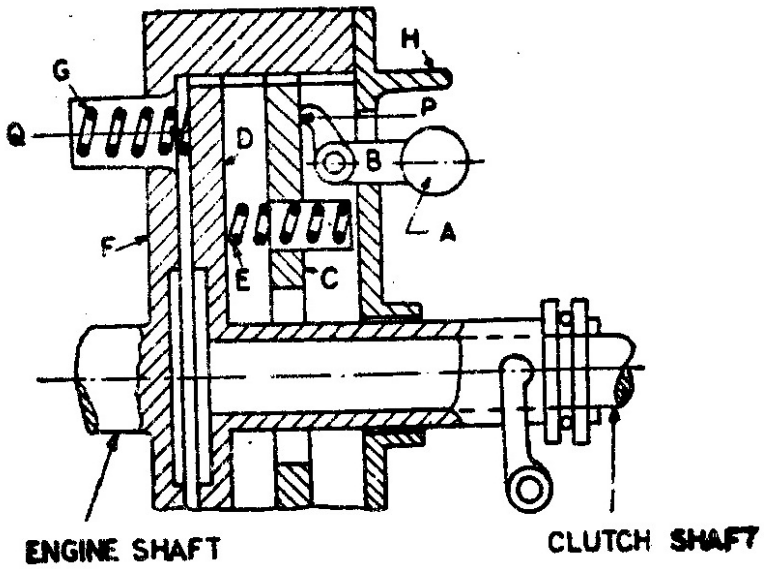
04

Q2 b) Explain working of centrifugal clutch with neat sketch & also state its applications. 08

Working of centrifugal clutch:- 03

Fig. Shows schematic arrangement of centrifugal clutch. As the speed increases the weight A flies, therefore operating the bell crank lever B which presses the plate C. This force is transmitted to the plate D by means of springs E. The plate D containing friction lining is thus pressed against the flywheel F therefore engaging the clutch.

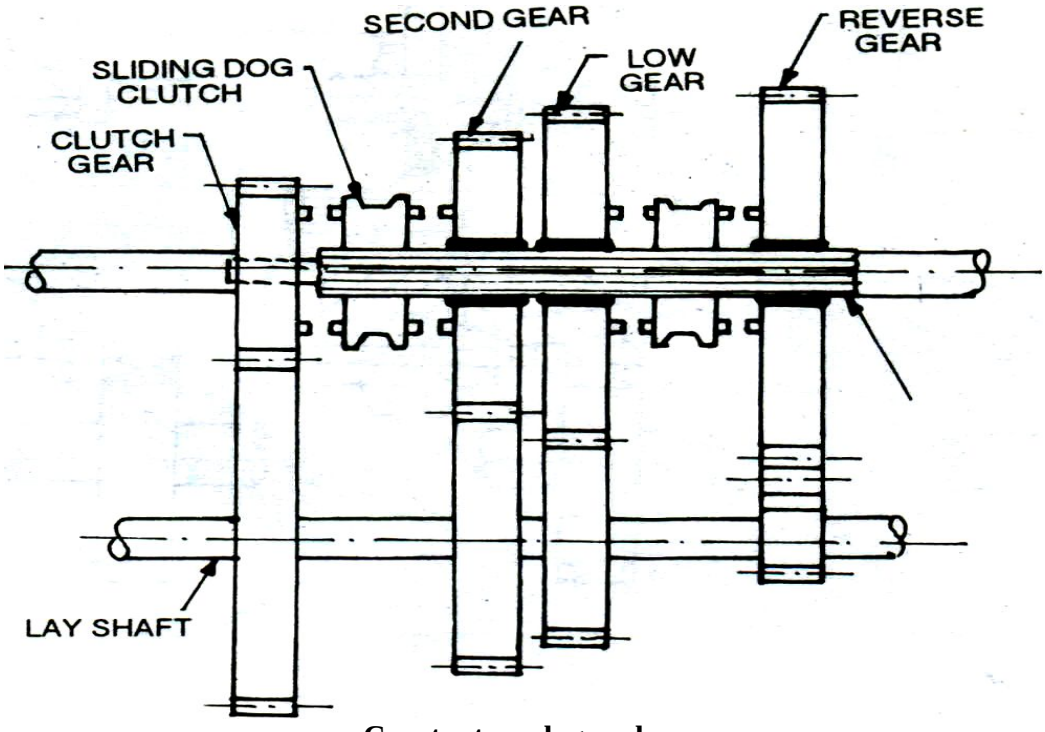
Spring G serves to keep the clutch disengaged at low speed. The stop H limits the amount of centrifugal force.

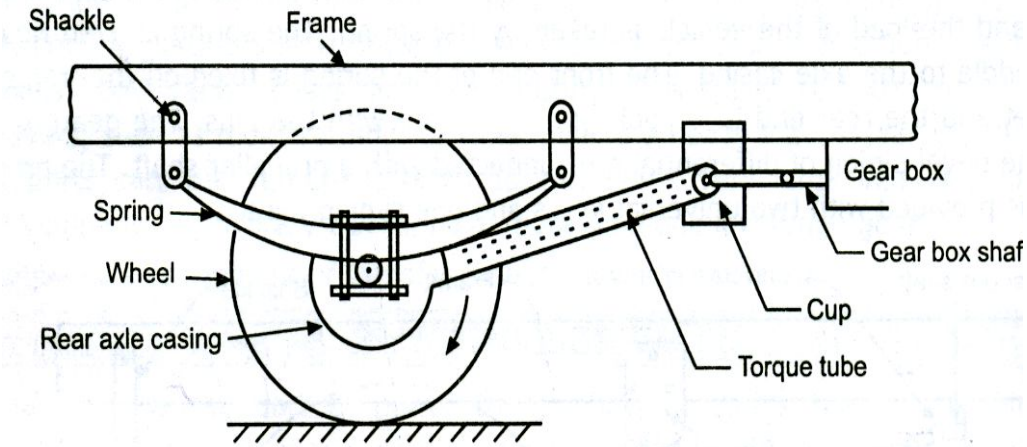
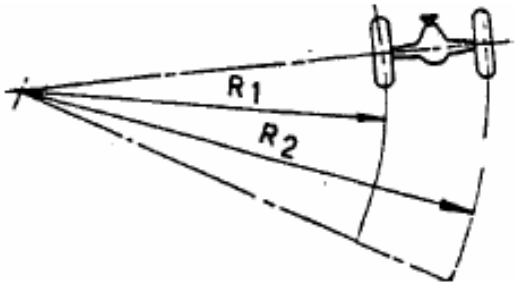


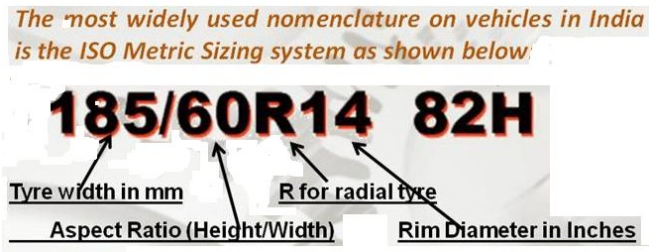
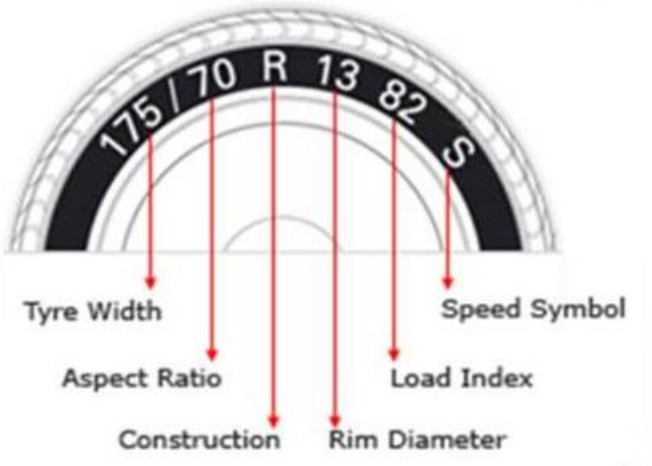
Centrifugal Clutch

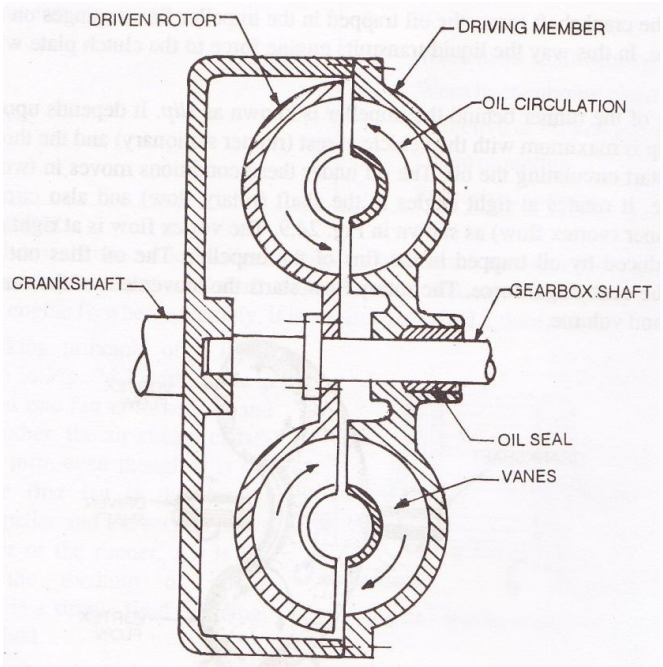
Neat Sketch with labels 04

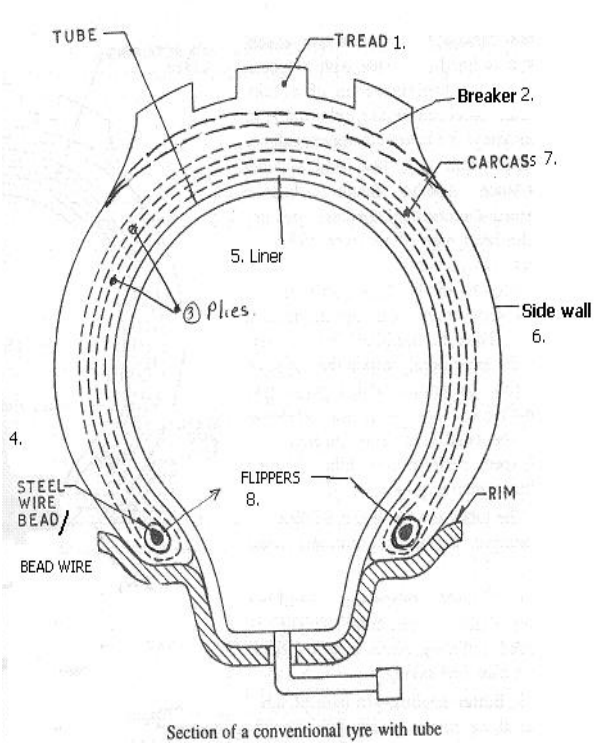
A-Weight, B- Bell crank lever, C &D – Plates, E-Springs, F-Flywheel, G-Spring, H-Stop

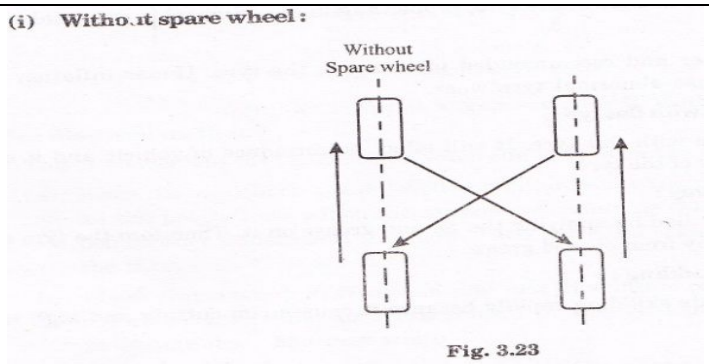
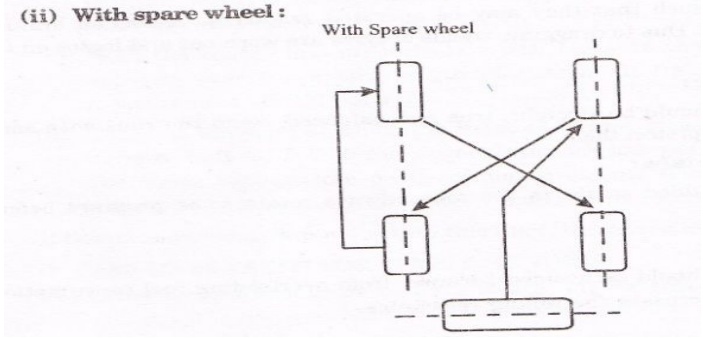
Applications: - This type of clutch is generally used in mopeds or two wheelers without gear and some modern cars.	01
Q 2 c) Describe constant mesh gear box with neat labeled sketch.	08
Construction:- In this type of gear box, all the gears are in constant mesh with the corresponding gears on the layshaft. The gears on the mainshaft which is splined are free. The dog clutches are provided which are free to slide on the mainshaft. The gears on the layshaft are fixed. **Working:-** When the left dog clutch is slide to left by means of the selector mechanism, its teeth are engaged with those on the clutch gear & we get the direct gear. The same dog clutch when slide to right makes contact with the second gear & second gear is obtained. Similarly movement of the right dog clutch to the left results in low gear & towards right in reverse gear. **Advantages:-** 1) As the gears have to remain always in mesh, it is no longer necessary to use straight spur gears .Instead helical gears are used which are quieter running. 2) Wear of dog teeth on account of engaging & disengaging is reduced because here all teeth of dog clutches are involved compared to only two or three teeth in the case of sliding gears.  **Constant mesh gear box**	01 02 01 04

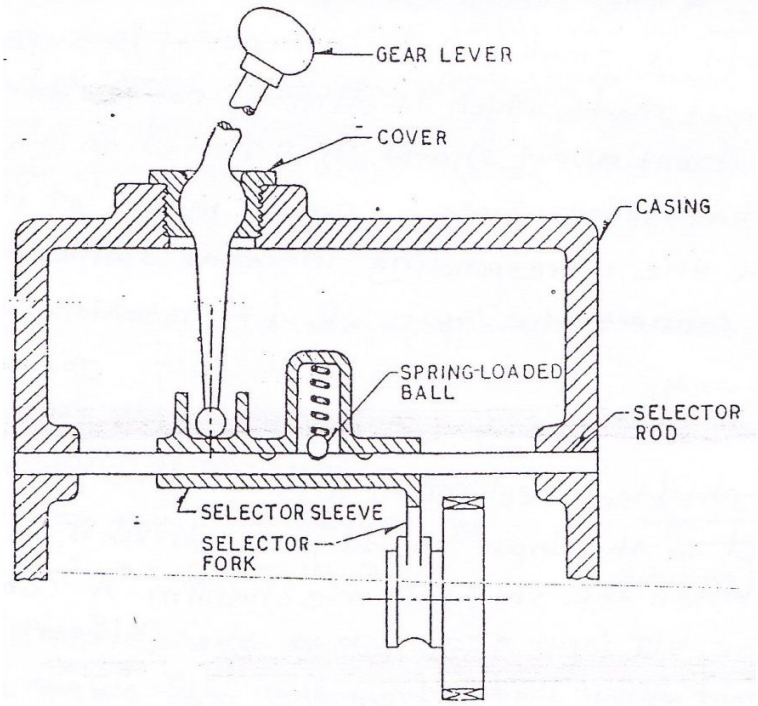
Q.3 a) With neat labeled sketch explain torque tube drive.	08
In this type of drive, the spring takes only the side thrust and weight of the body. The torque reaction, driving torque and braking torque are taken by a member called as torque tube. One end of this tube is attached to the axle casing and the other end which is spherical in shape fits in the cup fixed to the frame .As is seen the torque tube encloses the propeller shaft. As the torque tube takes torque reaction, the centre line of the bevel pinion shaft will not shift and further it will always pass through the centre of the spherical cup. If the propeller shaft is connected to the gear box shaft by means of a universal joint situated exactly at centre of the spherical cup. In this case no universal joint and slip joint are required at the rear end of the propeller shaft.  **Torque tube drive**	04 04
Q.3 b) What is necessity of differential? What is differential lock? Also explain backlash in differential.	08
Necessity of differential- If a vehicle travels in a straight line, the two rear wheels turn exactly at the same speed, and there is no relative movement between them. But when the vehicle takes a turn the outer wheel travels a longer radius than the inner wheel. i.e. there is no relative movement between the two rear wheels. If the two rear wheels are rigidly fixed to the rear axle. The inner wheel will slip which will cause rapid tyre wear, steering difficulty and poor road holding. Therefore there must be some device to provide the relative movement to the rear wheels when vehicle is taking turn.  **Differential Lock-** If one of the rear wheel lying on soft mud or loose dirt and sand, while the other is on the solid ground. At that time, the wheel which is on the soft mud is having less resistance. The wheel lying on the soft ground spins or rotates around its own axis due to differential action, whereas the other wheel lying on the solid ground is not driven and remains stationary. It causes not only the loss of traction but	03 Sketch 01 02

also does not enable the vehicle to move. Therefore to drive out the vehicle from such situations or conditions differential locking is provided. When the differential lock is applied, the differential action is stopped and the whole torque is then applied to the wheel which is gripping on the road. **Backlash in Differential-** Backlash is the play between meshing teeth and it occurs only when teeth are in mesh. The objectives for providing backlash are as follows: 1) Backlash prevents the jamming of meshing teeth together .The meshing teeth do not make contact on both sides simultaneously. This makes the teeth roll together freely and smoothly. 2) Backlash compensates for machining errors. 3) Backlash compensates for thermal expansion of teeth.	02
Q 3 c) Draw a nomenclature of tyre. Explain the tyre inflation and its effects	08
  **Tyre inflation**: The inflation pressures are recommended by the vehicle manufacturer depending upon tyre size, speed and load. Although tires are made up of more or less airtight materials, they still allow minute quantities of air to gradually leak away over time. Therefore, the tire inflation pressure must be checked regularly and adjusted as necessary whenever it differs from the specified pressure. **Effects of Under-inflation:** 1) Uneven tread wear, more wear at tyre sides. 2) Lack of directional stability. 3) Increased rolling resistance leading to increased fuel consumption. 4) Excessive flexing of sidewall causes build up.	Sketch with Lebel- 02 (Any one fig.) 02 02

5) Vehicle will roll on curves. **Effects of Over-inflation:** 1) Reduced tread contact area with road surface. 2) Reduced tyre grip. 3) Increased vibration resulting in uncomfortable ride. 4) Increased stresses may causes tread separation and crack in the side wall. 5) The centre of tyre will be worn rapidly.	02
Q.4 a) Describe principle, construction and working of fluid coupling with neat sketch	08
Principle of fluid coupling- The basic principle of fluid coupling is discussed below in the form of an example. Consider the two fans, the one fan is 'ON' and rotating; the other one is 'OFF'. The rotating fan circulates the air around it. The circulating air impinges on the blades of the other fan and the blade of this fan also begin rotating .in this case the air functions as the fluid. **Construction:** Fluid coupling or hydraulic coupling is used as clutches in cars employing automatic transmissions. It consists of two members, the driving and driven as shown in fig. The driving member is attached to the engine flywheel and the driven member to the transmission shaft. The two members do not have any direct contact with each other. The driven member is free to slide on splines on the transmission shaft. The two rotors are always filled with oil.  **Fluid Coupling**	01 02 03

Working: When the crankshaft rotates, the driving member or impeller also rotates. The driving member is filled with oil and the centrifugal force causes the oil to be forced outward radially. As a result of this, the driven member or turbine is forced to rotate .Thus the engine power is transmitted from crankshaft to the transmission shaft. As the engine speed increases, the thrown out oil from the driving member strikes the driven member with greater force and tends the driven member to rotate at the same speed, becoming one unit by means of oil film which combines both the members. As the engine speed falls down, the oil film between the driving and driven members is broken away and the members are disengaged.	2
Q4 b) Draw a neat sketch of tyre tube construction. Explain tyre rotation procedure for a four wheeler.	8
Tyre tube construction:  Section of a conventional tyre with tube **Tyre rotation procedure for a four wheeler:** The purpose of tyre rotation is to achieve more uniform wear for all the tires on a vehicle. The pattern of tyre rotation differs for the front wheel drive vehicles and rear wheel driven vehicles. A spare wheel is generally a standard fitment on many vehicles but can be an optional attachment on some vehicles. The rotation patterns of tyres for different vehicles are shown in fig.	Sketch-2 Lebel-2 2

(i) Without spare wheel :  Fig. 3.23 (ii) With spare wheel :  	Any one Sketch 2 Marks
Q 4 c) Describe the gear shift mechanism with neat sketch.	8
Types of selector mechanism- 1) Selector mechanism with gear lever on the top of transmission case. 2) Mechanism with gear lever on steering column. **1) Selector mechanism with gear lever on the top of transmission case.** A typical mechanism for a 4-forward speeds and reverse gear box where the gear lever is ball mounted in the gear box cover .this facilitates its movement in any direction. The lower end of gear lever fits into a slot in the selector sleeve. There are forks on the sleeves on three separate selector rods which are supported in the gear box casing. Each selector sleeve can slide on its rod, but just to avoid unwanted engagement of the gears, slots are made on the selector rods and the sleeves are provided with spring –loaded balls. These balls resist the movement of the forks until some force is applied to gear lever to overcome their resistance. In some cases the forks are fixed on the selector rods by means of pins and the assembly can slide. Grooves are provided on the gear bosses where the selector forks can fit in. Transverse motion of the gear lever selects the forks which is to be engaged and the longitudinal movements then slides the fork and its gear to engage the selected gear.	Any one Type (Description-4, Sketch – 4)



Selector mechanism with gear lever on the top of transmission case

2) Mechanism with gear lever on steering column

Mechanism with gear shift lever mounted on steering column is as shown in figure. It consists of gear shift lever rod, tongue and fork. The gear shift lever rod is mounted on the steering column. On this gear shift lever rod, tongue is fixed. By operating shift lever this tongue can be engaged to any fork depending upon the required gear ratio. By giving axial movement to gear lever rod (up and down) the tongue can be engaged with any fork and by giving angular movement to gear shift lever the engaged fork slides in gear box and there by slides the concerned gear to engage with selected gear on the lay shaft. In this, to get first and second speed, respective tongue is engaged with the fork, and top and reverse gear will get by engaging that fork with the respective tongue.

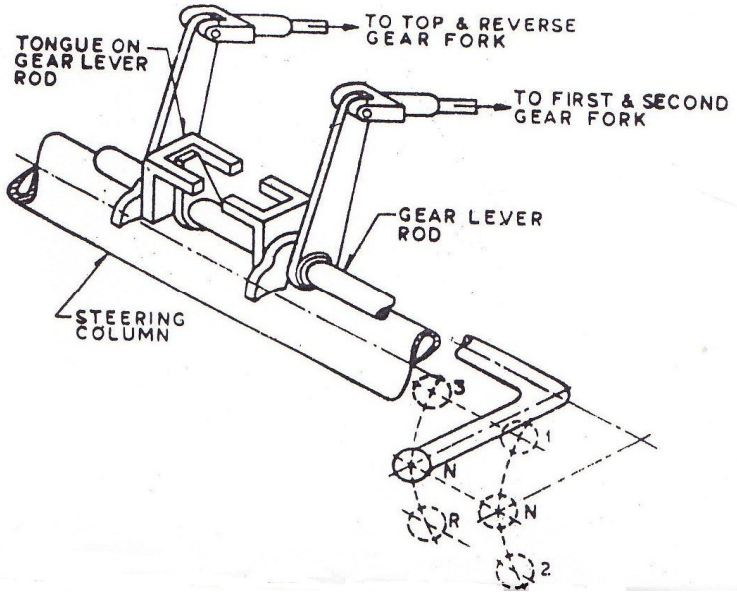
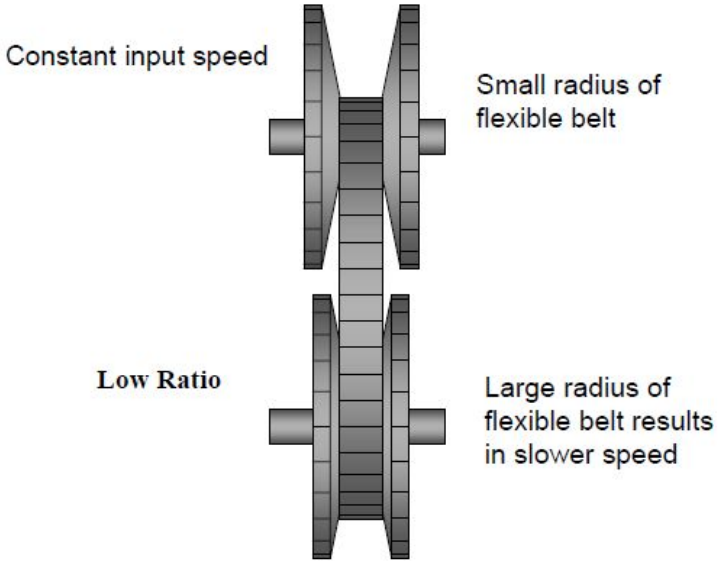
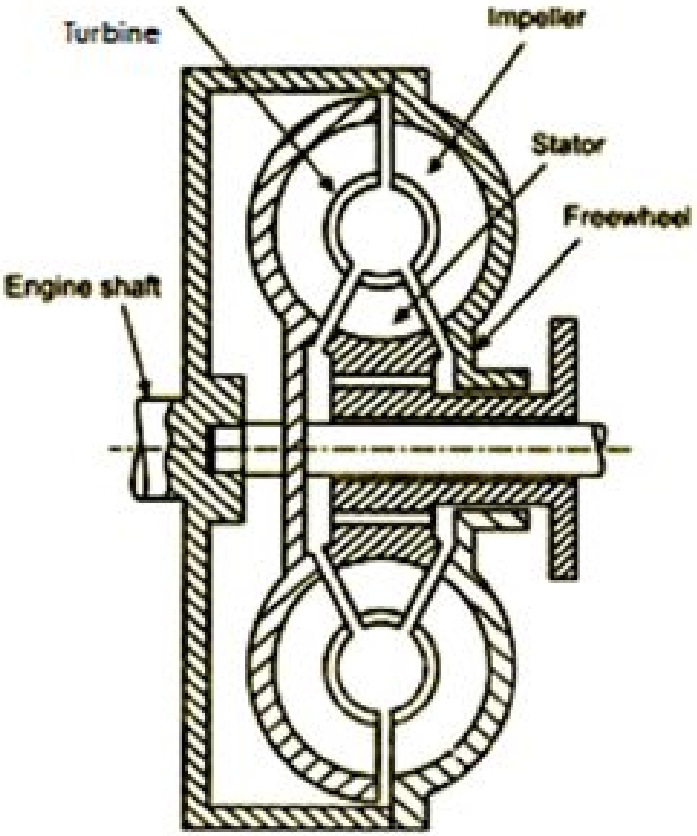


Figure: Selector mechanism with gear lever on steering column

Q5 a) What is Vario drive? Explain its working.	8
Ans. Vario drive- New generation two and three wheelers are available with vario or variomatic drive which avoids gear shifting and manual clutch operation. It provides smooth and comfortable driving. This assembly has rollers which move in and out depending on the load condition and engine rpm giving the differential pulley diameter thus providing the optimum wheel rpm and traction force.	02
 Figure: Pulley based vario drive arrangement	02 04
Working: Vario drive consists three basic components: A high-power metal or rubber belt, A variable-input "driving" pulley which is connected to the crankshaft of the engine, An output "driven" pulley transfers energy to the driveshaft. Each pulley is made of two 20-degree cones facing each other. A belt rides in the groove between the two cones. **V-belts** are preferred if the belt is made of rubber. When the two cones of the pulley are far apart (when the diameter increases), the belt rides lower in the groove, and the radius of the belt loop going around the pulley gets smaller. When the cones are close together (when the diameter decreases), the belt rides higher in the groove, and the radius of the belt loop going around the pulley gets larger. CVTs may use hydraulic pressure, centrifugal force or spring tension to create the force necessary to adjust the pulley halves.	
Q5 b) Draw a neat sketch of torque convertor and explain how it works.	8
Working:- Fluid under pressure enters in the impeller. As the impeller is connected to input shaft or output shaft of engine. It starts rotating as engine shaft rotates. Due to this fluid gets kinetic energy. This high velocity fluid strikes on vanes of turbine. When the centrifugal force is enough to rotate turbine, it will start rotating. As the turbine starts rotating some of the fluid diverts back and strikes on the stator blade, due to this the stator adds into motion. But stator is allowed to rotate in same direction of an impeller; hence fluid again strikes back on the vanes of impeller with high velocity and increased force. Hence as the force on impeller increases the torque developed by turbine is also increases.	04

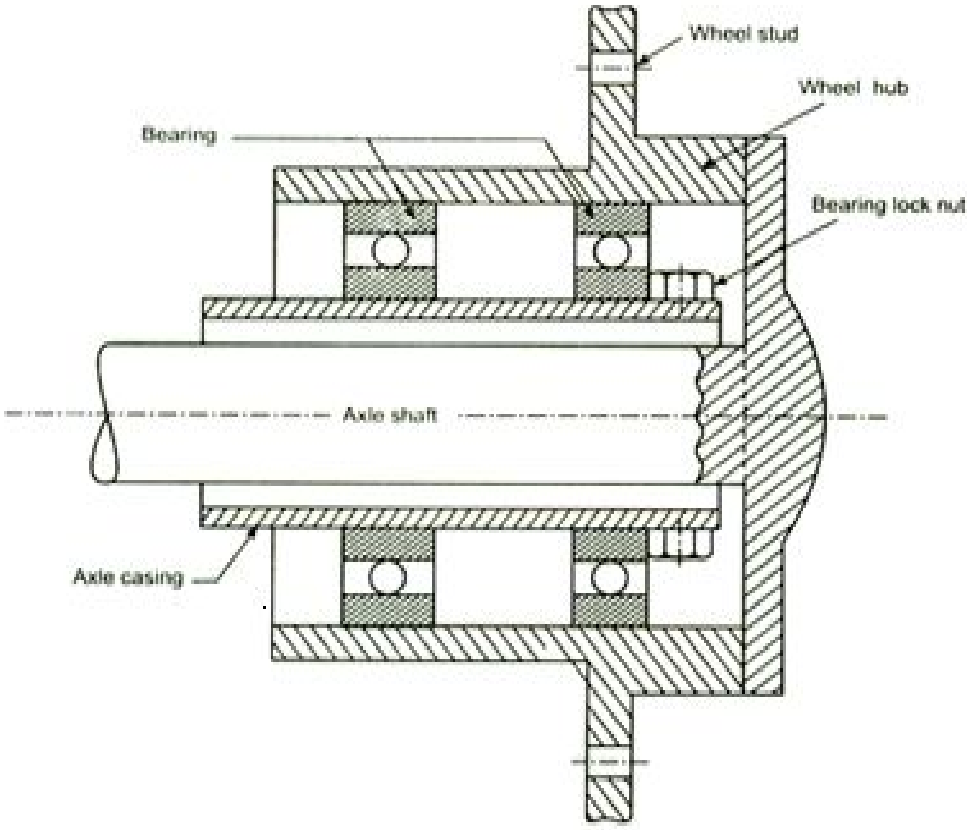


Torque Convertor — 4

Q5 c) Describe the construction and draw neat sketch of full floating type of rear axle. — 08

Full floating type of rear axle: — 04

In this type, the axle shafts have flanges at outer end which are connected to wheel hub by means of bolts. There are two taper roller bearings supporting the axle casing in the hub which take up side load. Thus in this type, the axle shaft carry only the driving torque. The weight of the vehicle and end thrust or side thrust is not carried by the axle shaft. The weight being completely supported by the wheels and the axle casing, as the axle shaft only transmits the driving torque; their failure or removal does not affect the wheel. This is robust in construction and used for heavy vehicles. The details of full floating type rear axle are shown in the figure.



Full floating type of rear axle

04 (Neat Sketch-2, Correct Labels -2)

Q.6 a) List the different types of frame in four wheeler and explain one of them. 04

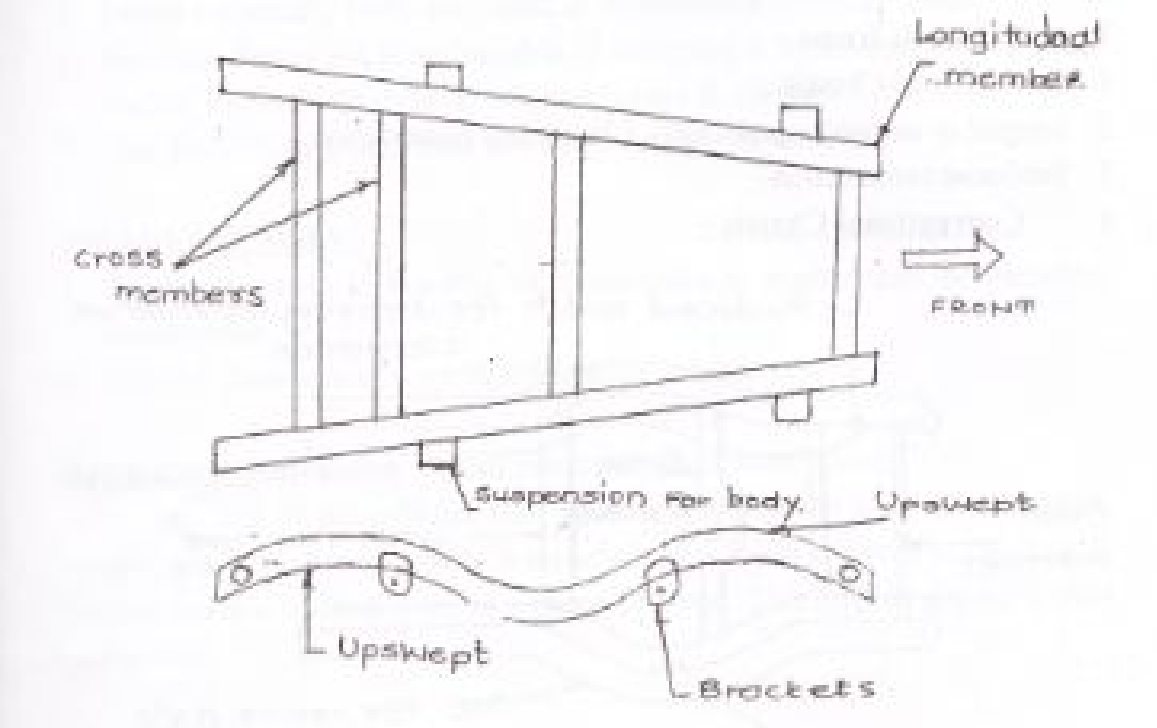
Types of four wheeler frame: The common types of four wheeler chassis frame are- 1

A. Conventional Frame
B. Half Integral and Half Frame
C. Integral or Unitized construction (Frameless Construction)

A. **Conventional Frame:** Any one 3 Marks (Explanation-2 Sketch-1)

As shown in figure this type of frame has two long members and other several cross members (may be 3 to 10) joined together with the help of rivets or bolts. The sections used for making the frame long members and cross members are- Channel section, Box section, Tubular section and I-section.

In the conventional chassis, body is held to frame by means of number of bolts passing through the base of the body and the frame. The pads of anti-quake or vibration material such as rubber are placed between the body and the frame bolts. To prevent quakes and rattle these rubber bushes are important. The frame is made of good steel not only to withstand static and dynamic loads but also impact due to accident. This type of frame is used in Trucks, Buses and mostly in heavy vehicles.



B. Half Integral and Half frame:

In some of the vehicles, half frame is fixed at the front end on which engine, gear box and suspension is mounted. This frame is bolted to the floor and the rear portion of floor work as floor of body. This type of frame is used in old fiat car.

Advantage: In the event of an accident, the front half frame can be taken out easily for replacement instead of replacing the complete chassis frame.

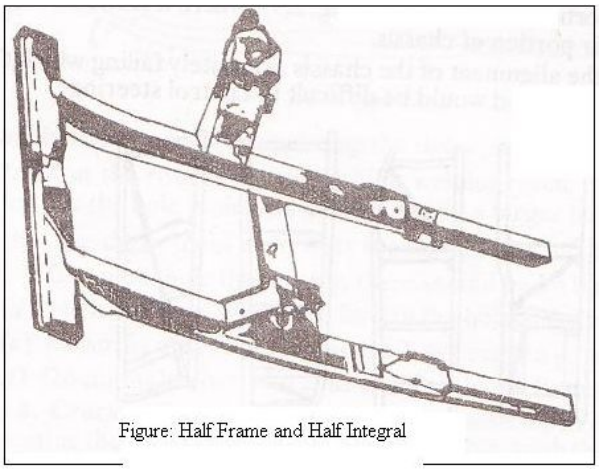
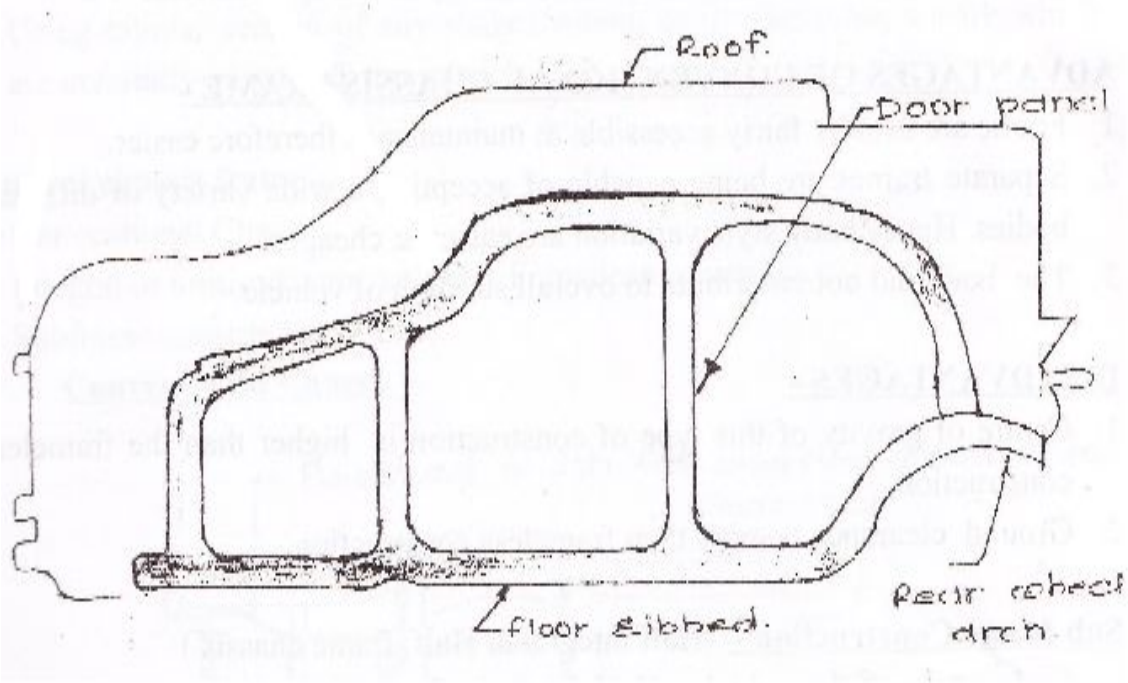


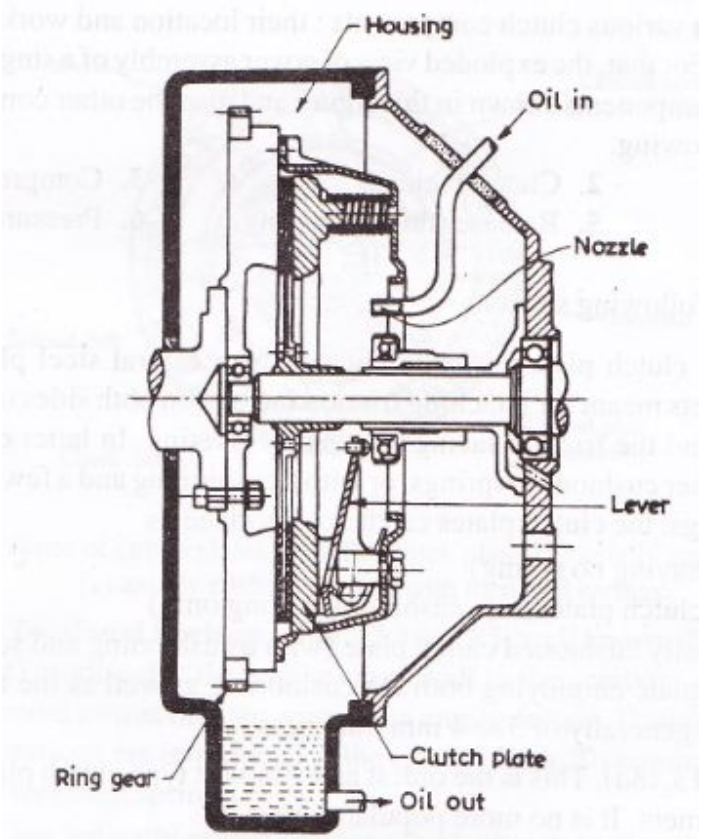
Figure: Half Frame and Half Integral

C. Integral or Unitised frame:

In this type, frame is totally discarded and different units are fixed to the body itself, so it is called as frameless construction. Metal pressings and stiffness members are welded at the suitable places to take up the load of engine, gear box, suspension system and all other main components of the vehicle. The neutral axis passes through nearly centre making the roof - a compression member and the floor – a tensile member. Metal stiffeners used with the roof and the front portion and rear portion to resist the tensional stresses. The body floor is made of ribbed sheet metal to resist bending.



Q.6.b) Explain wet clutch with neat labeled sketch.	04
A wet clutch is always wetted with oil. The oil may be sprayed on the plates by a nozzle, by a gear pump or by other means. For this purpose, special oil is used. This type of clutch used in light –duty and heavy duty trucks as single plate and multiplate clutches. Construction of wet clutch is similar to the dry clutch but with a difference in construction of the clutch plate. These plates are perforated so as to allow spray of oil through them which was not the case with dry plate clutch. This type is suitable only as single plate clutch because the oil distribution will be improper if more number of plates is used.	02



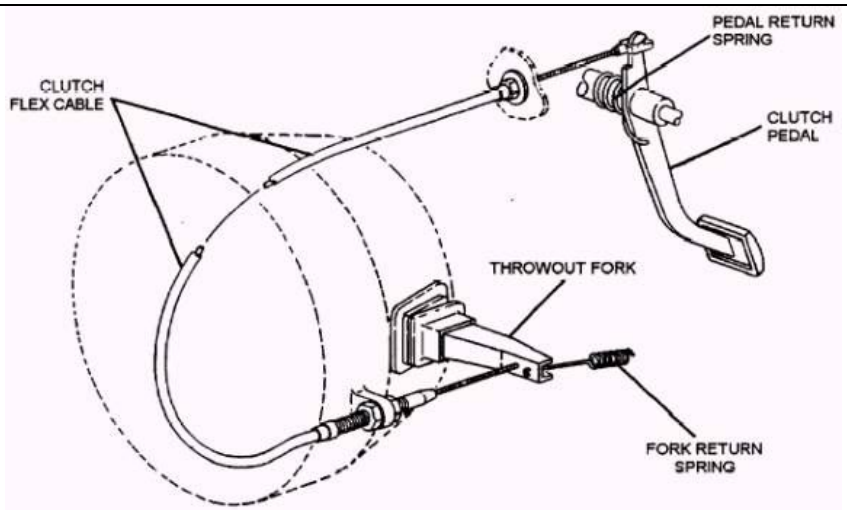
Wet clutch — 2

Q.6 c) Describe cable operated clutch linkage. — 04

Cable operated clutch Linkage-

Cable linkage is a popular and effective method of transferring movement from the pedal to the clutch. The cable assembly uses an inner multi-strand steel-wire core and an outer cable sheath of a spiral wound flexible sleeve normally with nylon end-pieces. The cable is run between the clutch bell-housing and the car bulkhead, where the pedal is normally located. A screw adjustment is incorporated at either the pedal or the bell-housing end to alter the length of the outer cable sleeve, for increasing or decreasing the free-play of the inner cable. — 2

From the cable the leverage is relayed through a pressed steel release-fork lever to the thrust bearing. A spherical headed bolt pivots the lever end. The outer end of the lever extends outside the bell-housing and is connected to the inner cable. When the clutch is disengaged, the inner cable is subjected to tension and the outer sleeve into compression. The fork-lever then tilts about its pivot forcing the release bearing against the release-fingers to disengage the drive.



Cable operated clutch Linkage — 2

Q6.d) Describe the diaphragm clutch with suitable sketch. — 04

In diaphragm clutch, instead of helical springs diaphragm type spring is used, which apply the pressure on the pressure plate for engaging the clutch. The spring is either tapered finger type or crown type and is mounted on the pressure plate. In the conical position of the spring, the clutch plate remains gripped between the flywheel and the pressure plate. — 2

When the clutch pedal is depressed, the throw-out bearing moves towards the flywheel pressing centre portion of the spring which causes the rim to move backward. This removes the pressure on the pressure plate and the clutch is disengaged. — 2

How clutch engages and releases

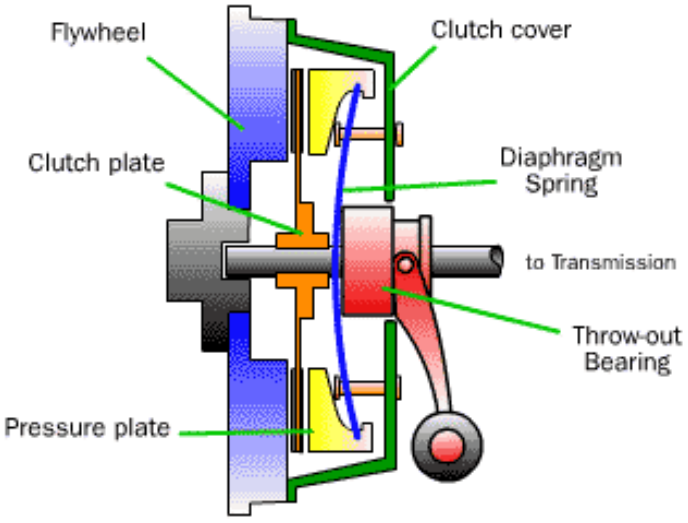
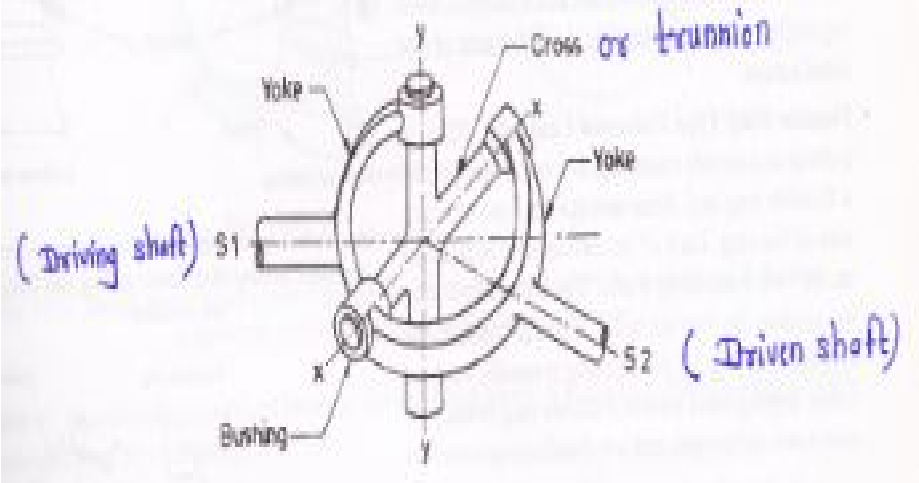
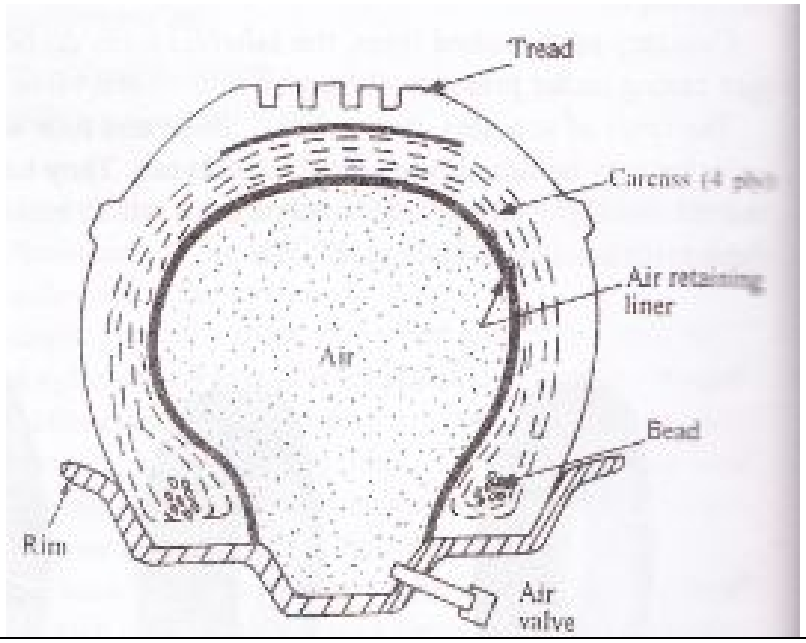


Figure: Diaphragm Clutch

e) Explain universal joint with sketch.	04
Universal joint- Universal joint allows transmission of power and rotary motion at an angle which varies as a vehicle encounters a bump. A propeller shaft connects a gear box and the differential with the help on universal joints. The universal joint is as shown in figure. It is a double hinged joint consisting of two Y-shaped yoke and a cross shaped member called a spider. One yoke connects the driving shaft and other to the driven shaft. The spider consists of four arms. Each end of four arms is well machined to accommodate needle roller bearings enclosed in a bearing cap. These ends connect the yoke. The driving shaft makes the spider to rotate. As the driven shaft is connected to another yoke, it also rotates and power gets transmitted. Two yokes set at 90 degree to each other have two other pair of eyes to accommodate the bearing surfaces of the spider along with the needle-bearing cap. When two shafts rotate at an angle the bearing yoke permits them to swing around on a spider.  	2 2
Q.6 f) Draw a neat sketch of tubeless tyre with sectional details.	04
 	Sketch-2 Correct Lebel-2