WINTER – 13 EXAMINATION

Subject Code: **12159** **Model Answer**

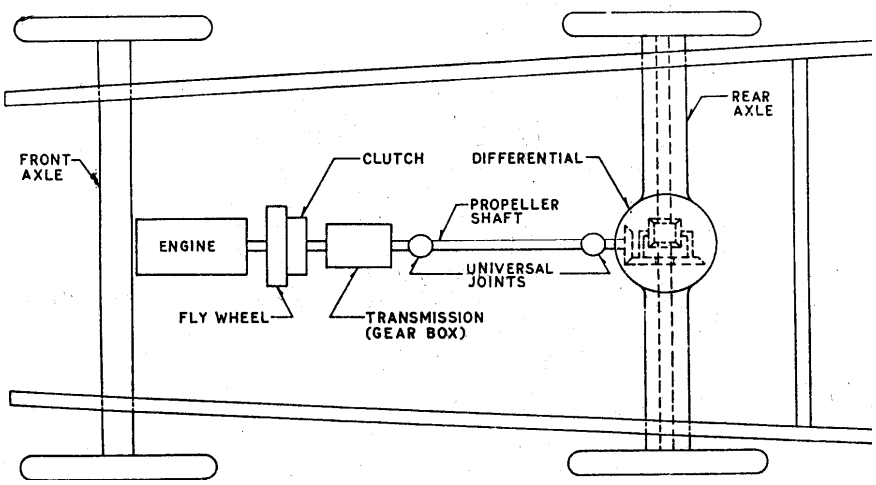
Important Instructions to examiners:

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.

Q. 1 a) i) 1 mark per point

Framed Construction	Frame less construction
• Longitudinal members and cross members form the frame. • Frame is up swept at rear and front to accumulate movement of the axle. • Eg. Tata, ashok leyland vehicles. • Body and frame are not integral units. • Stronger & Heavy construction • Higher impact resistance • Easier body repairs	• Heavy side members are eliminated and floor is strengthened by cross member and body, all are welded together. • In some cases the sub frames are also used along with this type of construction • Eg. Small and medium cars, small buses • Body proper and frameless chassis components are welded together to form a rigid, integral unit for extra strength & durability . • Results in a light but stiff construction. • Less impact resistance • Repaires are expensive

Q. 1 a) ii) Sketch : 03 M , Labeling : 01 M



iii) The answer should reflect following key points. (04 M)

- Aerodynamic shape of body reduces aerodynamic drag air resistance hence fuel efficiency increases, Resistance to vehicle speed decreases.
- Stream line of air flow around the vehicle should be continuous and separation of boundary layer with its attendant vertices should be avoided. Skin drag coefficient should be decreased by smooth and well polished body surface. This is achieved with aerodynamic shape of body.
- Aerodynamic shape of body reduces lift and pitching moment.
- Lift is the vertical component of the resultant force caused by pressure distribution on the vehicle body.
- The lift acting vertically upward, tends to reduce the pressure between tyre and ground. This causes loss of steering on front axle and loss of traction on rear axle.

Q. 1 a) **iv) Battery Capacity :-**

Is defined as amount of current it can deliver. It depends upon i) the number and area of plate in cell and ii) quality of electrolyte present.

Battery capacity decreases with decrease of temperature.

Battery Ratings :- Battery rating is determined by the current it can produce and the time for which it can sustain this current.

Stating common battery ratings

- Twenty hour rate (Ampere hour capacity)
- Twenty minute rate.
- Reserve capacity.
- Cold rate (zero test).

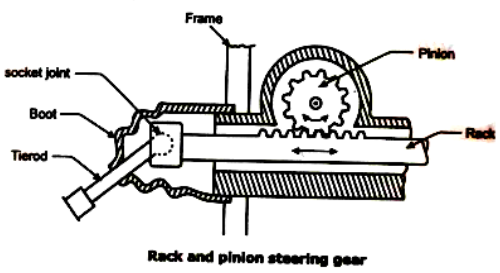
(Definition – 2 marks, stating ratings 2 marks)

Q1(b)

i) Rack and pinion type of gear box.

Construction:

- The rack-and-pinion steering box has a pinion, connected to the steering column. This pinion runs in mesh with a rack that is connected to the steering tie rods.
- Both the pinion and the rack teeth are helical gears. Helical gearing gives smoother and quieter operation for the driver.
- Turning the steering wheel rotates the pinion, and moves the rack from side to side. Ball joints at the end of the rack locate the tie-rods and allow movement in the steering and suspension.
- Mechanical advantage is gained by the reduction ratio. The value of this ratio depends on the size of the pinion.
- A small pinion gives light steering, but it requires many turns of the steering wheel to travel from lock, to lock. A large pinion means the number of turns of the steering column is reduced, but the steering is heavier to turn.



Rack and pinion steering gear

Advantages:

- Provide low gear reduction for car.
- Occupies less space and less number of linkages.

Uses: All most all small cars like maruti 800, Alto, Wagon R, Sweft Dezire, i10 etc houses this type of steering gearbox.

(sketch : 02 M, working : 03 M, uses: 01 M)

ii) **The answer should reflect the following salient areas of use. (02 M for each application))**

Microprocessor is programmable device and can be used anywhere for developing electronic circuit. this can be used as- 1. For performing logical operation 2. Arithmetical operation etc.

- Microprocessors are used in many automotive systems: The electronic fuel injection system uses an elaborate computerized control that takes into consideration engine conditions when metering fuel and it's based on one or more microcontrollers. The system also controls spark advance, EGR valve and other engine functions.

a) **Motronic gasoline ignition system** have a microprocessor based control system and continuous correction of injected fuel quantity, ignition angle as well as air-fuel ratio depending upon engine and external conditions. This ensures optimal engine performance with minimum emission level. The main components are High pressure fuel pump, injector on each cylinder, fuel rail and ECU.
ECU: Electronic Control unit consist of small programmed computer monitors and performs that translates sensor signals in to command signals.

Various sensors employed are crankshaft speed sensor, camshaft speed sensor, knock sensor, mass air flow sensor, manifold absolute pressure sensor, vehicle speed sensor etc.

b) Natural gas motronic system: This type of system is installed on petrol and CNG Cars function sin single ECU. It has advantages like,
i) at any time coordinated change can be made between petrol and CNG operation without any jump in torque.

ii) lower cost

iii) greater potential for optimization.

c) Common Rail System: High pressure accumulator element called as rail is mounted on engine block. This rail feeds all the injectors. The main components are low pressure pump, high pressure pump, common rail and ECU.

d) The anti-lock brake system uses a microcontroller to compare the wheel speed when brakes are applied and pulses the brakes when one or more wheel slips. In real-time

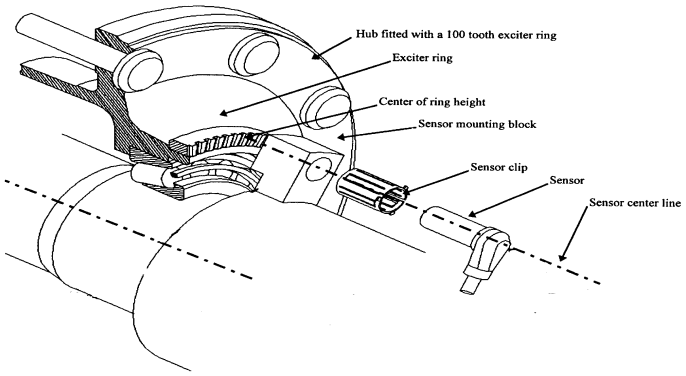
computing systems, microprocessors are embedded in security devices such as the anti-lock braking system (ABS) that are widely used in modern automobiles.
The microprocessor detects motions and changes, that are relative to the surrounding or environment of the security device and sends signals that correspond to the changes that it detected.

Anti-lock brakes today use microprocessor technology to sense when the wheels are about to lock up under braking, and then controls the brake pressure and timing to prevent it.

Each wheel must be controlled independently, although only one axle of a multi-axle configuration needs to be equipped with sensors. An exciter ring (sometimes referred to as a tone ring) is installed on the inside of the hub.

A sensor *reads* the level of magnetism present as the teeth of the exciter ring pass it. Since they don't touch, there is no wear or friction between them.

The sensors provide wheel speed information to the Electronic Control Unit (the ECU or system brain). Input from the sensors is used to determine if a wheel is about to lock during braking. If so, the system can release and apply the brake up to six times per second through the modulator valve.



Wheel End Schematic

e) The radio uses specialized microcontrollers to track signal strength to tune the radio and to lock in For example, Navigation systems provide information using microprocessors and global positioning system (GPS) technology the memory buttons.

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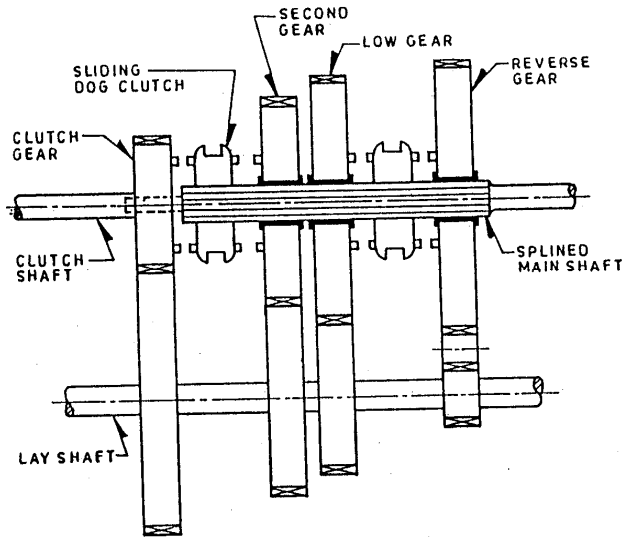
Q. 2 a) sketch : 02 M , working : 02M



Construction :- There will be a lay shaft and splined main shaft. The dag clutches are provided. They are free to slide as main shaft. The gears on lay shaft are fixed. All gears are in constant mesh with corresponding gears on lay shaft.

Working : - when left dog clutch slides to left by means of selector mechanism, its teeth are engaged with those on the clutch gear and we get the direct gear.

Same dag clutch, when slide to right makes contact with second gear.

Similarly movement of the right dog clutch to left results in lower gear and towards right in reverse gear.

Double declutching: - for smooth engagement of dog clutches, it is necessary that speed of main shaft gear and the sliding dog must be equal.

To obtain lower gear First clutch is disengaged and gears are brought to neutral position. Then engage the clutch and press accelerator pedal for increases the speed of main shaft gear, then disengage the clutch and dog clutch moves to required lower gear and engaged.

To obtain higher gear, driver has to wait with the gear in neutral till main shaft speed is decreased sufficiently. Hence clutch is disengaged twice it is called double declutching.

Advantages :-

- Helical gears are used, quieter running.
- High tongue transmission capacity.

Q. 2 b) **(any four points, 01 M for each point)**

Single plate Clutch	**Diaphragm clutch**
• It consists of flywheel, pressure plate, clutch plate with friction lining, along with coil springs. • It requires release of levers. Coil springs are arranged circumferentially to provide axial force on the pressure plate. • Driver needs to exert high pressure to hold clutch out of engagement. • Less compact means of storing energy compared to diaphragm clutch. • Coil spring has tendency to distort in transverse direction at high speeds. • Load deflection curve is linear. With the wear of clutch facing, the springs have less deflection, they apply less force against clutch plate	• To produce required pressure for engaging a conical spring called diaphragm is used. • It requires no release of levers and spring acts as series of levers. • Driver has not to exert as high a pedal pressure to hold clutch out of engagement. • More compact means of storing energy than coil spring. • Less affected by centrifugal force, it can withstand higher rotational speeds. • Load deflection curve is nonlinear. When clutch face wears, force on plate gradually increases

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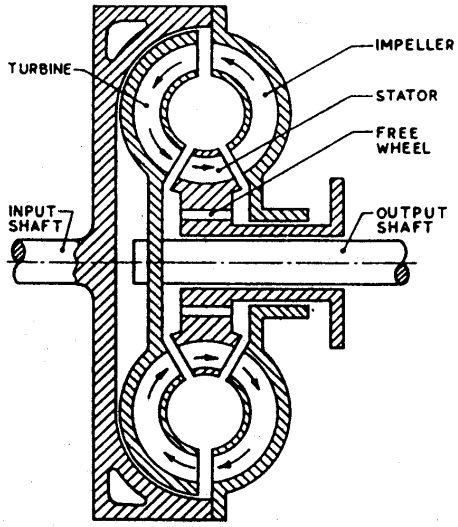
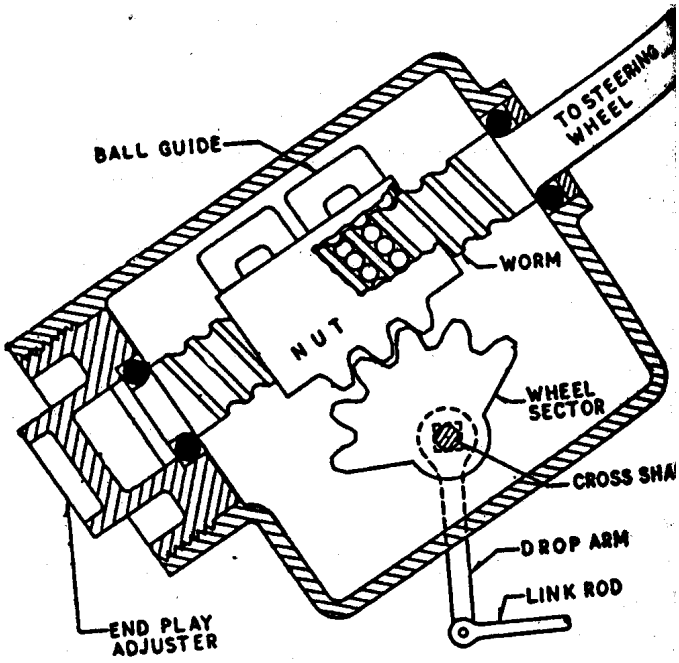
Q. **2 c) sketch 03 marks labeling 01 mark**



Q. 2 d) sketch : 02 marks description : 02 marks



Working :-

- It consists of worm of the end of steering rod. A nut is mounted on worm with two sets of balls in the grooves of the worm in between the nut and worm.
- The function of the bell is to reduce the friction between the worm and the nut. Nut has number of teeth on outside which meshes with the teeth as worm wheel sector.
- Drop arm is mounted on sector, which transfer the motion to steering arms through linkages. When steering wheel turn, the balls in worm grove rolls, causes to nut slide on the worm.
- This linear motion of nut causes the wheel sector turn at an angle and actuate the link rod through drop arm in desired steering of wheels.

Q. 2 e) (nomenclature : 02 M , specification : 02 M)

Specification of tyre :-

Tyres are specified on the basis of internationally recognized nomenclature :

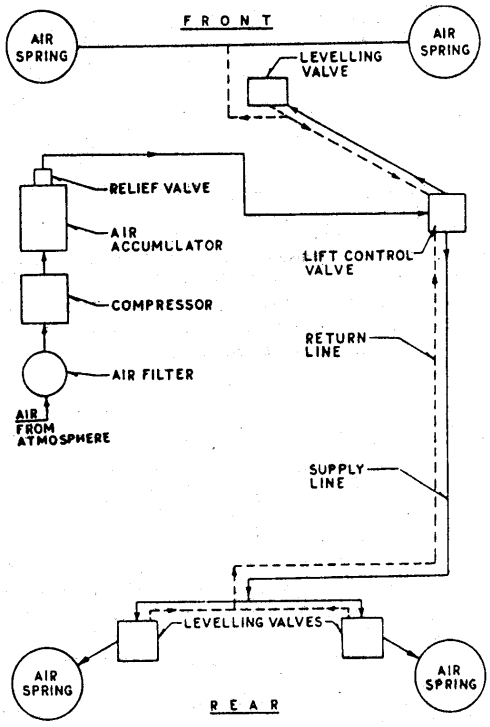
- An optional letter indicating intended tyre use (P for passenger vehicle)
- Width of tyre in mm.
- A slash ie **/**
- Aspect ratio as a percentage.
- Nature of tyre carcass (D-diagonals R – for radial ply)
- Diameter of wheel rim on which tyre is intended to fit in inches.
- Load index.
- Speed rating
- Additional marks i.e traction, tread wear etc.

P205/75R1485H

Passenger car tyre, section width 205 mm.

Aspect ratio 75, radial ply, 14 inches rim wheel dia, load index 85, for maximum speed 130 mph or 210 kph.

Q. 2 f) sketch : 02 M, advantages : 02 M



Advantages over conventional metal springs.

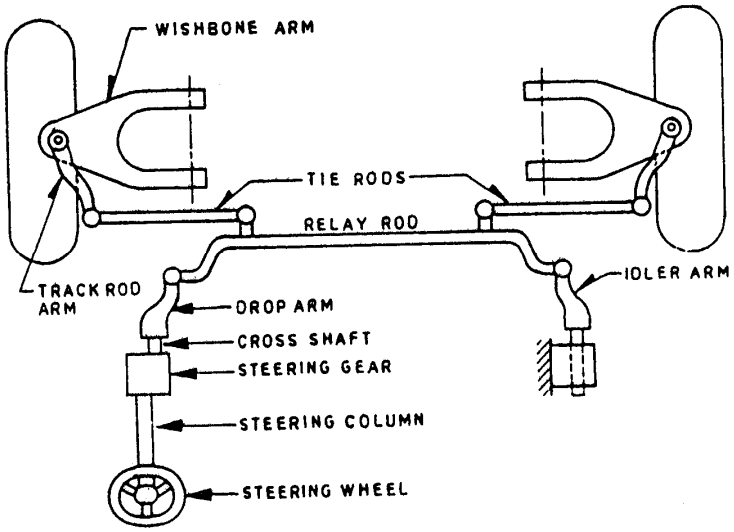
1. A variable space for wheel deflection is put to optimum use by virtue of automatic control device.

2. Change in head lamp alignment due to varying load are avoided.

3. Spring rate varies between the laden and unladen conditions as compared with that of conventional steel springs. This reduces dynamic loading.

4. Improved standard of ride comfort and noise reduction.

Q. 3 a) Explain the construction of steering linkages for independent front suspension with neat sketches.



Sketch : 02 Marks

In the case of independent suspension, the two stub axles can move up or down independent of each other due to which distance between ball joints ends of the two track and arms is continuously varying. On account of this a single track rod cannot be used, instead three track rods are used, the center portion being called the relay rod. Relay rod is connected at one end to an idler arm supported on body structure and to the drop arm of the steering gear at the other end through ball joints. The relay rod is restricted to move in horizontal plane only. Movement in vertical plane is provided by the outer portion, viz, the tie rods about the end ball joints, in case of conventional rigid axle suspension, the main axle beam ensures the movement of stub axle in the horizontal plane only. In this there fore, there is no vertical deflection of the suspension and hence there is no change in effective track rod length.

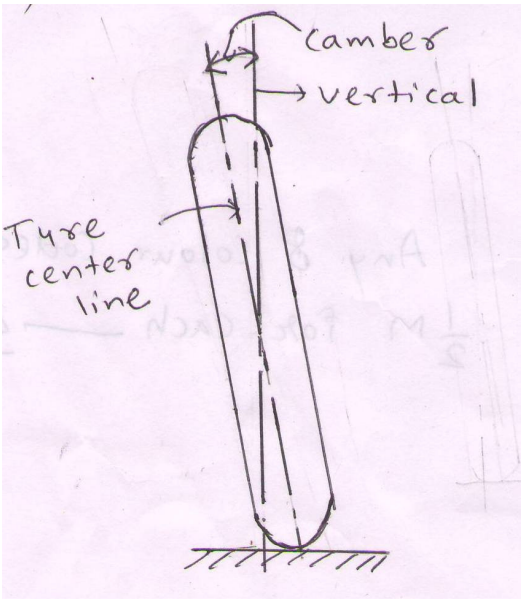
Suitable Explanation 2M

b) Define the following term with suitable sketches.

i) Camber :-

Definition :- Camber is the tilt of the car wheels from the vertical. It is the angle between tyre center line and vertical.

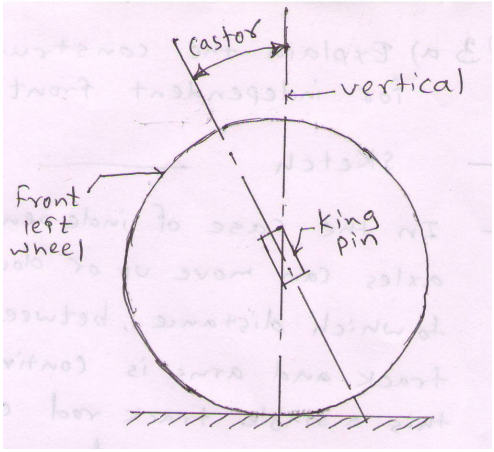
(Def. 01 Mark)



Sketch : 01 Mark

ii) Caster :-

Defin :- The angle between the king pin center line (or steering axis) and the vertical, in the plane of the wheel is called the caster angle. (Def. 01 Mark)



Sketch : 01 Mark

C) Enlist colour codes used in Automobile wiring system.

For quick identification, insulations of various wires in a circuit are assigned different colours. Various colour codes are in use for vehicle wiring. They are as follows.

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Sr. No.	Code	Colour
01	B	Black
02	Br	Brown
03	G	Green
04	L	Blue
05	Lb	Light Blue
06	Lg	Light Green
07	O	Orange
08	R	Red
09	Y	Yellow
10	W	White
11	B/Y	Black / Yellow
12	L/W	Blue / White
13	R/B	Red / Black

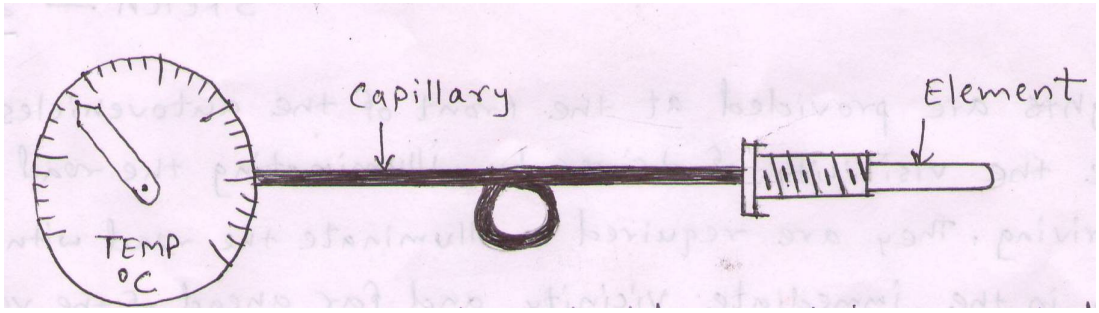
Any 8 colour codes ½ M for each -- 04 M

d) Explain the working of water temperature gauge with neat sketch. (02 marks for sketch, 02 marks for explanation)

It is an important accessory provided on engine but very economical. It gives indication of temperature of cooling water to the driver at all times. It helps the motorist to avoid serious consequences because of clogging of thermostat. When thermostat is clogged, this will stop the circulation of water and results in very high rise in engine temperature. So it is a safeguard accessory against engine overheating and protect from damage.

The temperature gauges are of two types.

01. Bourdon tube type :

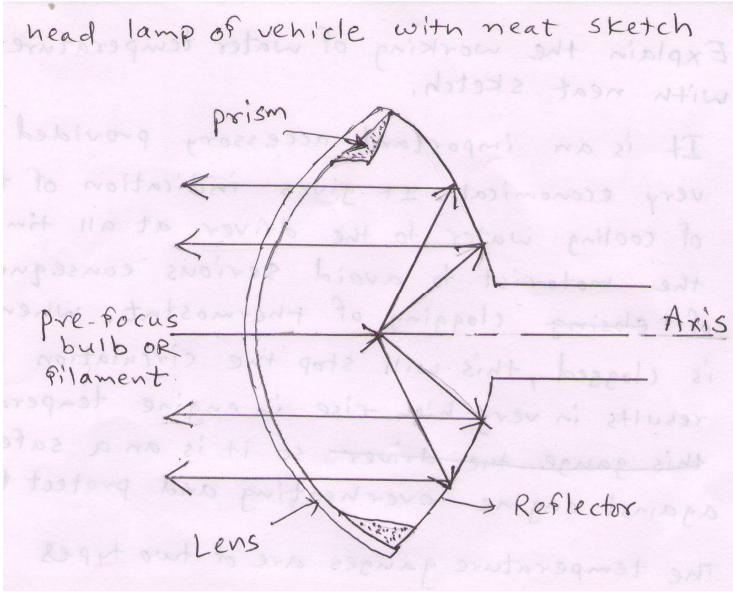


This has a bourdon tube inside, which is connected by a capillary tube to the element, containing some volatile liquid at suitable temperature and which is inserted in the cooling water circuit at an appropriate point, generally on the engine side of the thermostat. As the temperature of cooling water increases, the liquid in the element evaporates and exerts its pressure in the capillary, which is further transmitted to the Bourdon tube Due to this pressure, the bourdon tube tries to straighten out and thus moves a pointer attached to it, to show higher temperature on scale.

02. Electrically operated type : -

(Note :- There are two types of water temperature gauge students can write explanation any one gauge either Bourdon tube type OR electrical gauge)

e) Explain the head lamp of vehicle with neat sketch.



Headlights are provided at the front of the auto vehicles to enhance the visibility of driver by illuminating the road during night driving. They are required to illuminate the road with even intensity in the immediate vicinity and far ahead of the vehicles front. These objectives are achieved by the use of optical devices such as reflector, prism, lens in conjunction with the bulbs fitted with in the headlight assembly. This assembly consists of the following main parts.

01) **Reflector :-** This is made of either glass, or metal having aluminized coating on its concave surface. Due to its curved and highly polished surface it reflects all the rays being radiated from the bulb into a strong beam parallel to its axis.

02) **Pre-Focus bulb or filament: -** Here filament is placed at a particular point F called the focal point of the reflector. If the filament is not located at focal point then the reflected rays also will be non-parallel to the axis of the reflector and will deviate from it.

03) **Lens :-** the powerful beam of reflected light produced combined by the filament and the reflector is not sufficient for proper illumination of the road, also it is essential that the driver feels an identical intensity of reflected light at all the points on the road. Therefore a lens is used to achieve both the effects.

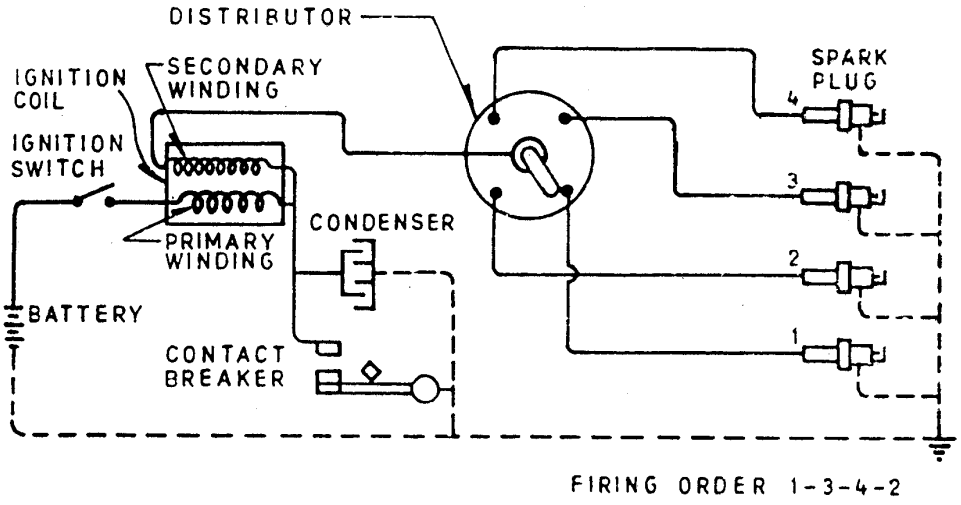
04) **Prism :-** This is a triangular glass piece used to bend the light rays to any required angle which is suitable for road illumination.

Suitable description – 02 M

Q. 04 a)

i) Explain the working of battery coil ignition system with neat sketch.

(02 Marks for sketch, 02 Marks for explanation)



Working :- There are two basic circuits in the system viz, the primary and secondary circuits. The battery, primary winding of the ignition coil, condenser and the contact breaker from the primary circuit, whereas the secondary winding of the ignition coil, the distributor and the spark plugs constitute the secondary circuit.

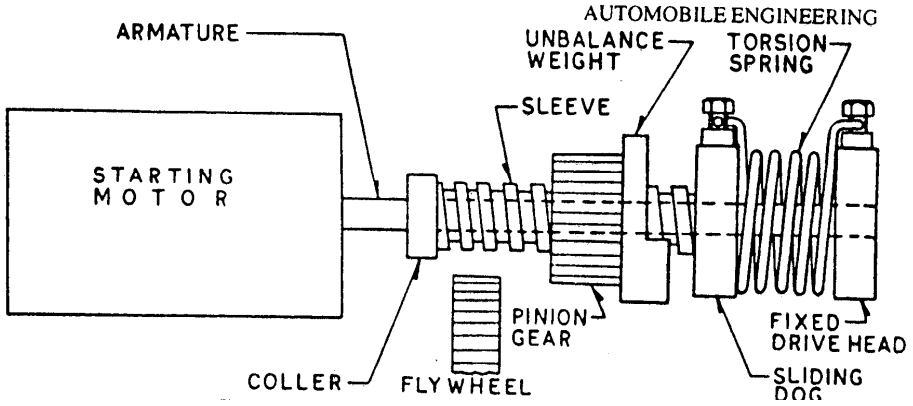
When the ignition switch is in the on position the current flowing in the primary circuit will grow exponentially during the make period of the contact breaker. The electromagnetic energy on account of this build up of current in the primary circuit is

stored in the laminated iron core of the ignition coil. As the contact breaker points open, the magnetic field built up by the growth of the current collapses and the energy stored during the make period is collapses and the every stored during the make period is projected into the secondary circuit. It is this energy, which is suddenly passed onto the secondary, inducing an e.m.f. there. As a result a sudden voltage surge of very high amplitude is produced in the secondary, causing a spark to occur at the spark plug electrodes.

ii) Explain the manufacturers of Automobiles in India and their products (Any four , 01 mark for each)

Manufacturer	Products
1. Maruti Udyog	1. Maruti 800, alto, swift, wagon R
2. Bajaj Automobiles ltd.	2. Scooter, auto, tempo trax, tempo traveler.
3. Tata engg. And locomotive company ltd (TELCO)	3. Truck, tata safari sierra, Indica V2
4. Mahindra and Mahindra ltd.	4. Jeep, car, bolero, scorpio, logan
5. Ashok Leyland ltd.	5. Ashok Leyland truck
6. Hindustan motor	6. Ambassador, lancer
7. Standard motor product of India ltd.	7. Van, bus.
8. Swaraj Mazda Automobile ltd.	8. Swaraj mazda bus, tempo

iii) State the function of Bendix Drive in starting system with neat sketch.



Sketch 2 M

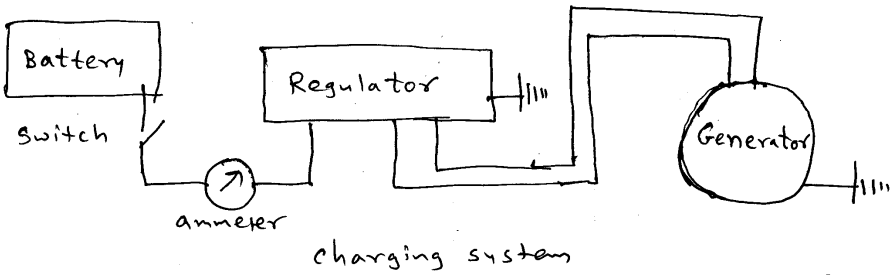
Bendix drives are the inertia drives in which the starter motor pinion is made to engage or disengage with the toothed ring on the periphery of the engine flywheel.

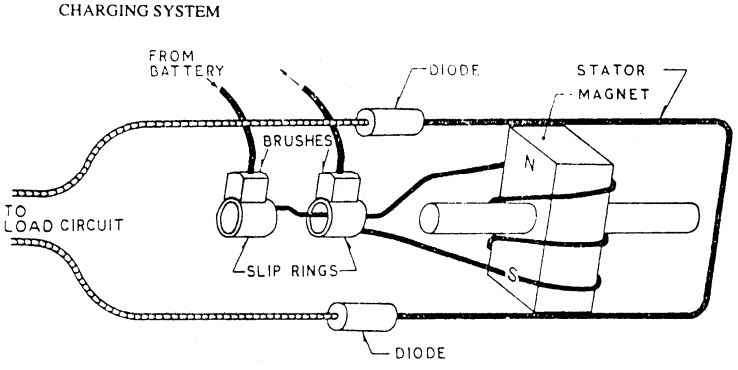
When the motor starts, the armature shaft rotates causing the sleeve to rotate and because the pinion cannot rotate due to unbalance weight, it moves axially towards the motor till it is engaged with flywheel. Further movement of the pinion is prevented by the collar attached on the sleeve and because of this pinion has to start rotating. As it is also in mesh with the engine flywheel, the flywheel is rotated and the engine starts.

When the engine starts, it is the flywheel that rotates the pinion and because of its bigger size, the flywheel rotates the pinion much faster than the armature with the result that the pinion is backed out of mesh with the flywheel. **(02 marks)**

iv) Explain Constructional details of charging system used ,in automobile.

The function of charging system in an automobile is to generate, regulate and supply electrical energy for charging the battery. The charging system consists of a generator for converting mechanical energy from the engine into electrical energy, regulator to control the amount of electrical energy so produced, a relay to regulate the flow of the charging current from the generator to the battery and an ammeter or indicating lamp to indicate whether the system is operating or not.





(Any one of the above figure should be considered, figure preferred, but not essential)(sketch: 01 Mark, suitable description 03 Marks)

In the modern cars, the charging system consists of an alternator only.

An electromagnet is mounted on a shaft and is supplied current for its energisation from a battery through the slip rings and brushes. In series with the stator winding are two diodes which are connected to external circuit.

Frame or housing

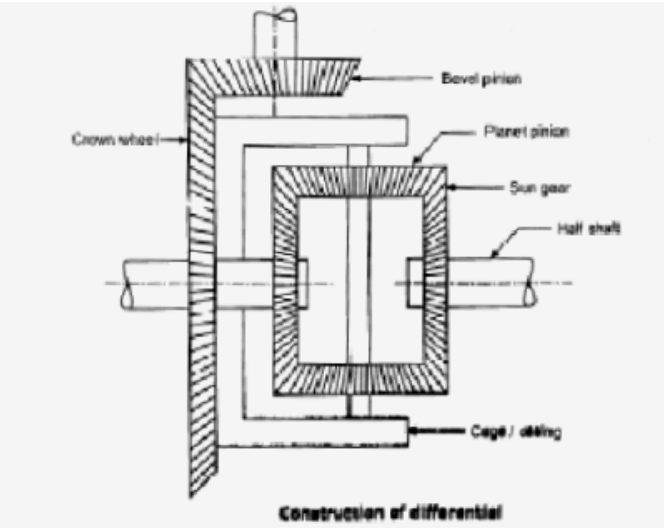
This encloses the entire alternator assembly and is made of cast aluminum in two pieces. Aluminum is light weight, non magnetic and has higher thermal conductivity so as to keep the alternator assembly cool by more efficient transfer of heat.

Rotor :- The most common is the claw pole rotor which consist of an iron core around the rotor shaft many turns of copper wire are wound over the core on both sides of the rotor winding are thick metal plates bent over the winding with triangular fingers called poles.

Slip rings and Brushes :- The current to the rotor winding is carried through the copper slip rings and carbon brushes. The brushes ride the surface of the slip rings on the rotor under spring tension provided by the brush holder.

Stator :- Three phase alternator is commonly used in automobiles. Between two halves of the alternator casing is situated the stator consisting of three sets of winding wound over a laminated iron core.

Q. 4 b) **i) Working of Differential :- (02 marks for working & 02 marks for function)**

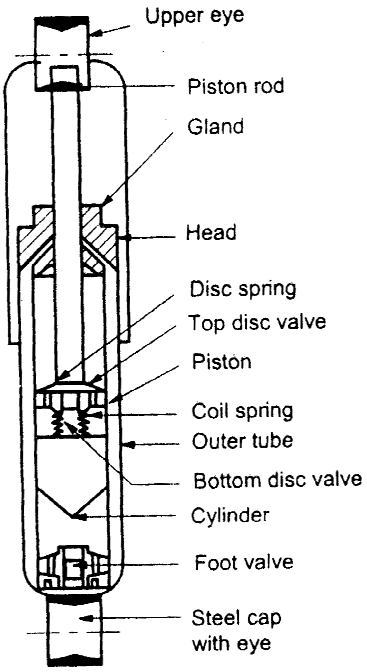


Construction of differential

Arrangement of differential is as shown in figure .The crown wheel is fixed with casing .The inner ends of half shaft pass through the boss of differential case in which they are free to rotate. When vehicle is going straight , there is no relative movement among different gear. The cage & inner gear rotate as single unit & both half shaft revolve at same speed.

When vehicle is taking turn towards left, at this time there will be resistance to the motion of left wheel. The restrictions observed are at "n" rpm. As outer wheel has to cover more distance than inner wheel thus the resultant speed at right wheel be (N+n) rpm and left wheel be (N-n) rpm.

Q. 04 b) **ii) Explain working of telescopic type of shock absorber with neat sketch.**



Sketch:-

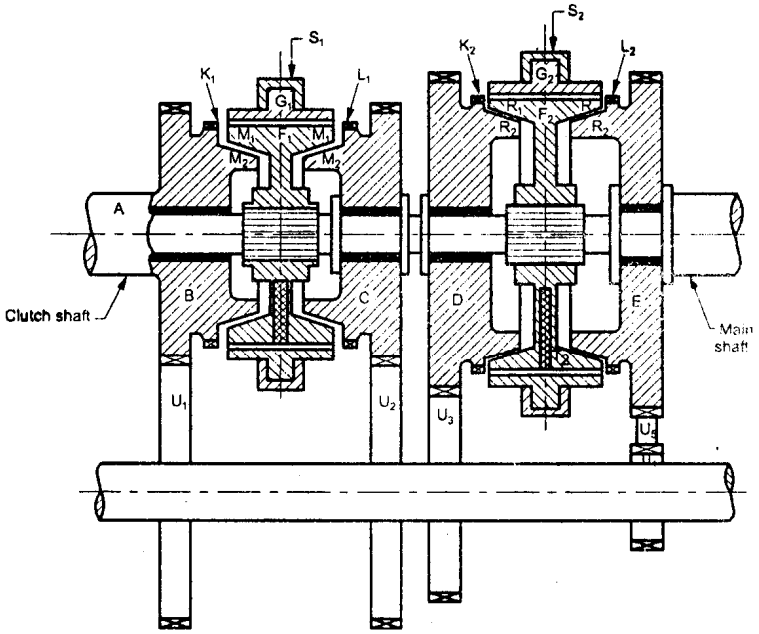
Working :- when a vehicle come across the bump, the bottom eye is moved upwards, then the fluid below the piston must be displaced to the top side of the piston, the fluid will now pass through the outer ring of hole in the piston by lifting the top disc against the disc spring. But the volume above the piston is less due to piston rod. As such, fluid from the bottom of the piston will also get displaced through inner ring of holes in the foot valve and enter the reservoir space between the cylinder and outer tube so the fluid level in the reservoir space will rise. When the cylinder moves down ward, fluid will be displaced form the upper end of the cylinder to lower end through the inner ring of hole in the piston

by opening the lower disc valve against coil spring because of the volume of the piston rod that leaves the cylinder, the fluid will be drawn into the lower end of the cylinder from the reservoir space through the outer ring of hole in the foot valve. This passing of fluid through opening provides damping.

Sketch 2 M

Suitable description 2 M

Q. 5 a) (sketch 03 Marks, description 05 Marks)



To simplify the operation of changing gear so that this can be done by every type of operator, skilled or unskilled driver without occurrence of teeth clashes and their consequent damage, synchromesh gear box is used.

Principle of these devices is to bring the speeds of both the engine driven and gear box output shaft driven gear which are to be engaged to the same rotational speed for moving their dog clutches or equivalent meshing unit into engagement readily and quietly. This gear box is similar with constant mesh gear box that the gear on main shaft, lay shaft are in constantly mesh. In this a synchromesh device is used instead of dog, which equalizes the speed by friction after which these may be engaged smoothly. Sketch is shown in fig. A is the engine shaft having clutch gear B rotate at engine speed, gear B, C, D, E are on main shaft and gear U1, U2, U3, U4 are the gear on layshaft U5, is the intermediate gear. F1 and F2 are the synchromesh members free to slide on main shaft

which is spline internally. G1 and G2 are the ring shape member having internal teeth which fit onto external teeth of member F1 and F2, K1 and K2, L1 and L2 are dog teeth on gear B, C, D, E, T1, and T2 are the ball supported by spring. S1 and S2 are the forks. To obtain low gear member F2 moves toward left which causes the friction contact between the cone shape surface of gear D and member F2. Similarly for second gear the member F1 and G1 slide to the right so that finally the internal teeth on G1 are engaged with L1, then the drive to main shaft from gear B-U1-U2-gear C-G1-F1 to spline. A direct gear is obtained by sliding member F1 toward left.

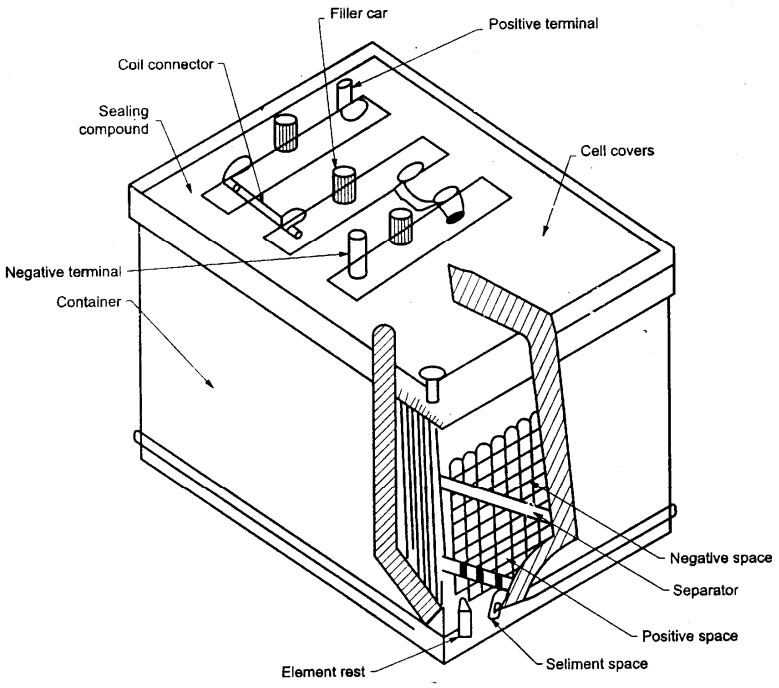
Q. 5 b) (01 mark for each point, 08 marks) alternative suitable points should be considered)

Disc Brake	Drum Brake
1. In disc brakes friction surfaces are directly exposed to the cooling air. 2. Friction pads are flat. 3. There is no loss of efficiency due to expansion. 4. Less weight than drum brakes. 5. Better anti-fade characteristics than drum brake. 6. Simple in design than drum brake. 7. It contains small number of parts to wear. 8. Easy to replace friction pads.	1. In drum brake, the friction occurs on the internal surfaces from which heat can be dissipated only by conduction. 2. Friction linings are curved. 3. There is loss of efficiency due to expansion. 4. More weight than disc brake. 5. Less anti-fade characteristics than disc brake. 6. Complicated in design than disc brake. 7. It contains large number of parts, chances of wear is more. 8. Difficult to replace curved friction linings.

WINTER – 13 EXAMINATION

Subject Code: **12159** **Model Answer**

Q. 5 C)(Function 02 marks, components 02 marks,sketch 02 marks & construction 02 marks)



Constructional details of battery

Battery is the main part of the electrical system in an automobile. Without battery, engine cannot be started with the starting motor. The battery supplies current to various part of the automobile vehicle such as for starting motor, ignition system, head and tail light, brake light, to wiper and other accessories.

Components of battery :

1) Container 2) Plates and grids 3) Separator 4) Cell cover 5) Cell Connector

Construction :-

Container :- It is constructed in single piece and made of acid resistant of hard rubber or plastic or bituminous composition. It is divided by partitions into compartments for individual cell. Ribs are there at the bottom of each compartment. Battery plates rest on these ribs.

Grids and Plates :- Plates are made of lead alloy containing 6 to 8% antimony which gives them resistant to corrosion and gives strength and rigidity. Number of plates of positive and negative types and separetators are there in a cell positive plates are kept one less than the negative plate.

Separator :- Separators are placed between the negative and positive plates. This prevents the positive and negative plates from direct contact with each other. They are porous to permit electrolyte to circulate between the plates. They are made of wood, spun glass, porous glass, porous rubber sheet etc.

Cell Cover :- each cell is sealed by a cover of hard rubber through which the positive and negative terminals are projected. Cover has an opening for filling the electrolyte and a filler cap is provided with an air vent to escape the gases.

Electrolyte :- Electrolyte is a chemically pure sulphuric acid diluted with distilled water. It consist of 40% sulphuric acid and 60% distilled water.

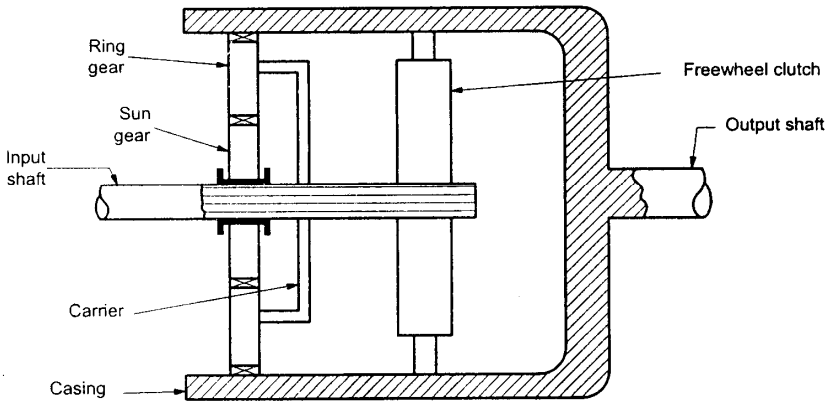
Cell connectors :- connector straps connect the negative and positive terminal post of the adjacent cell just above the cell cover.

Q. 6 A) The automobiles are classified as follows. (any four points, 01 mark for each- 04 M)

1. According to use :- Auto cycle or moped, car & jeep buses and trucks.
2. According to capacity: - Heavy transport vehicle – Trucks & buses.

   Light transport vehicle – Car, Jeep Minibus.
3. According to fuel :- Petrol vehicle, Diesel Vehicle Gas Vehicle, Solar Vehicle.
4. According to wheels :- Two wheeler, there wheeler, four wheeler six wheeler.
5. According to drive :- Left hand drive, Right hand drive front wheel drive, Rear wheel drive ,all wheel drive.
6. According to transmission :- Conventional gear box, semiautomatic gear box. Automatic gear box.
7. According to suspension system :- conventional (Rigid) system, Independent system.
8. According to engine fitting :- Front engine, Rear engine, transverse under floor engine.

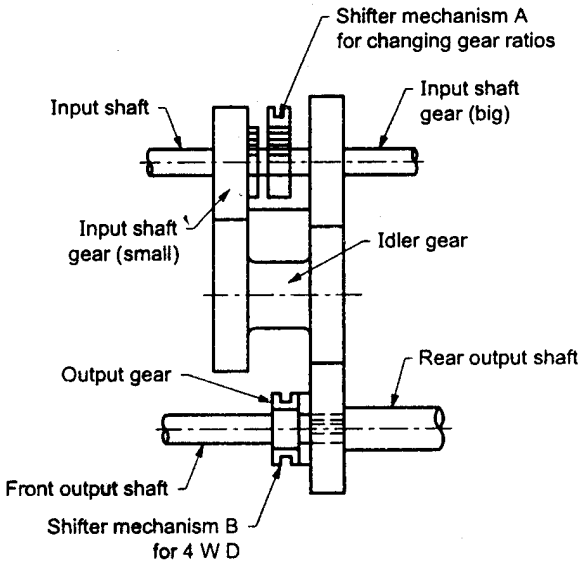
Q. 6 B) Overdrive :-(02 marks for sketch, 02 marks for description)



An over drive

This is a device that helps the propeller shaft to rotate faster than the engine in the transmission. By employing this engine speed can be reduced by 20 to 25 % allowing high cruising at low engine speed. So advantage of this is to increase engine life, improve fuel consumption also reduce noise and vibration. It increases gear ratio available by fitting it to intermediate gear. It can be operated automatically or manually. It reduces engine wear and tear because of driven road speed, the engine speed is less. It is easy for engagement and disengagement.

Q. 6 C) Transfer Case :- (02 marks for use ,02 marks for sketch)



It enables the driver to

i) Drive in two wheel drive on highway or shift to four wheel drive for cross country operation.

ii) To drive in high gear or low gear as required obviously low gear is used for cross – country driving.

There are two output shafts, one going to the front axle and the second going to rear axle.

Q. 6 D) Necessity of wheel alignment :-

1. Provides an easier direction control to the vehicle.
2. Minimum tyre wear.
3. Stability to the vehicle while negotiating a curve.
4. Parallel rolling of front wheels moving straight. **(01 Mark)**

Necessity of Wheel Balancing :- Due to improvements in engine, handling as well as in body aerodynamic it is becoming possible for automobiles to operate at higher and higher speeds every year.

At high speeds, an unbalanced wheel assembly can create vibrations which are transmitted to the body through suspension components, causing annoyance to the driver and passenger. Therefore it is necessary to balance the wheel assemblies properly in order to eliminate such vibrations. **(01 mark)**

Procedure of wheel balancing :- This can be done by using electronic balancer

1. Lift the front wheels on hydraulic jack such that the wheel is freely rotated.
2. Arrange the spinner, which carries the balancer equipment.
3. Move the balancer into position to point to strobe light at the wheel.

4. Position the pickup magnet in contact with a clean flat surface on the front suspension as closed to the wheel as possible.

5. Apply the reference mark on the wheel cap on the tyre.

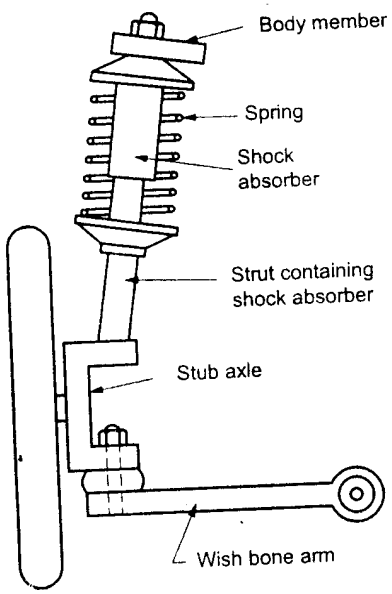
6. Shift the balancer to position I

7. Start the wheel by hand, snap on the switch of the spinner, motor and hold the spinner pulley against the tyre tread to revup the wheel.

8. Repeat the above inspection procedure and note maximum needle reading on meter dial.

9. Repeat the check as directed previously. If the wheel is still out of balance, proceed with the balance procedure, till the meter needle remains in the green area. **(02 marks)**

Q. 6 E)



Mac-pherson strut suspension system

01 mark for sketch

A Macpherson, an engineer, developed a single wishbone with a telescopic strut type suspension system. In this system, there is a telescopic strut type shock absorber, a single arm and a diagonal stay. A strut is fixed to the body structure at the upper end through a flexible mounting and a lower part of the strut is connected at the bottom by a joint to the lower arm. The lower part of the strut also carries the stub axle, which in turn carries the wheel. The steering motion is supplied to the lower part of the strut and it turns the whole strut. A coil spring and a hydraulic damper surround the upper part of the strut which takes care of the road roughness shocks and vibration. **(02 marks)**

Name of vehicles in which this type of suspension is used – Maruti Zen, maruti alto Maruti Swift. **(any two names, 01 mark)**