



SUMMER-2019 EXAMINATION

Subject Name: AEN

Model Answer

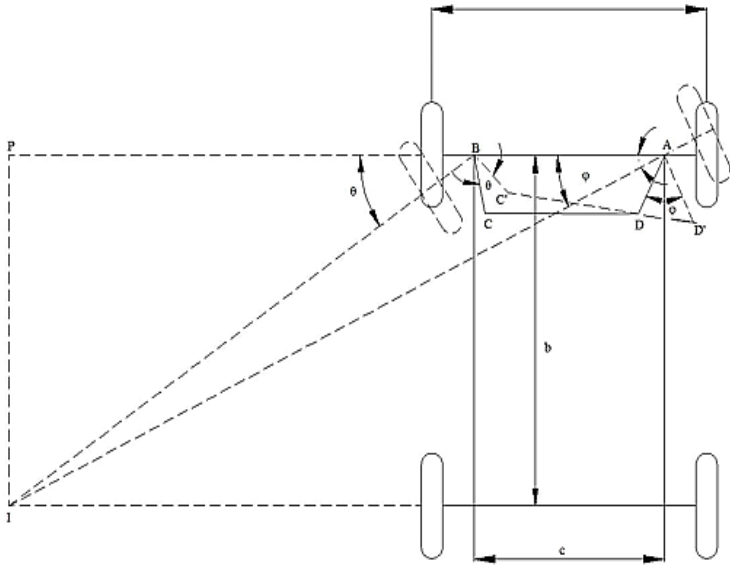
Subject Code:

17526

Important instructions for examiner:

- 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. No.	Sub Q. N.	Answer	Marking Scheme
1	a)	Attempt any THREE of the following.	12
		Draw four wheeler chassis layout and show major components on it.	04
		<p>Answer</p> <p style="text-align: center;">Layout of chassis</p>	04

c)	<p>Explain the Ackerman steering mechanism with line sketch</p>	04
	<p>Answer:</p>  <p style="text-align: center;">Fig. Akermann steering mechanism</p> <p>The Ackerman steering mechanism is placed on the back of the front wheels.</p> <p>In Ackerman steering gear, the mechanism ABCD is a four bar crank chain. The shorter links BC and AD are equally inclined to the longitudinal axis of the vehicle. For the correct steering the following three positions are obtained.</p> <ol style="list-style-type: none"> 1. When the vehicle moves along a straight path, the longer links AB and CD are parallel and the shorter links BC and AD are equally inclined to the longitudinal axis of the vehicle. 2. When the vehicle is moving to the left, the lines of the front wheel axle intersect on the back wheel axle at I for correct steering. 	02
d)	<p>List the factors affecting the tyre life.</p>	04
	<p>Answer: (Enlist any four with brief description, 1 Mark for each)</p> <p>Factors affecting tyre life:</p> <p>The following are the main factors which affect tyre performance and consequently their life;</p> <ol style="list-style-type: none"> 1. Inflation: The tyre must be inflated according to the specification of the original vehicle manufacturer. Both the under inflation and over inflation are detrimental to tyre life. 2. Vehicle Maintenance: The state of vehicle maintenance can also affect the tyre life. Following are the main mechanical irregularities which are revealed by the typical wear of the tyre. 	04



	<ul style="list-style-type: none">i. Wheel Alignmentii. Brake Adjustmentiii. Matching and spacing of dual tyre <p>3. Manner of Driving: Apart from inflation and vehicle maintenance, the manner in which a vehicle is driven, affect the tyre life. Excessive speeding, quick starts and sudden stops all cause faster tread wear.</p> <p>4. Overloading: In case of overloading the tyre has insufficient amount of air to support the dead weight carried. This results in decrease of tyre mileage.</p> <p>5. Miscellaneous Factors: It includes;</p> <ul style="list-style-type: none">i. Heatii. Road conditionsiii. Season (Weather condition)iv. Position of tier	
B)	Attempt any <u>ONE</u> of the following	06
(a)	List any six type of automobile power plants and explain any one with sketch	06
	<p>Answer: (2 Marks for Listing any 6 types, 2 marks for working of TWO or FOUR stroke petrol engine or diesel engine & 2 marks for sketch)</p> <ul style="list-style-type: none">1. Petrol engine2. Diesel engine3. LPG Engine4. CNG Engine5. Electric power plants6. Hybrid power Plants7. Solar Cars8. Fuel Cell <p>1. Petrol engine The petrol engine uses petrol for its running. Petrol or gasoline is a hydrocarbon, made up of hydrogen and carbon compounds. Air-petrol mixture is sucked into the cylinder during the suction stroke of the piston. The correct air- petrol mixture is compressed during the compression stroke, ignited during the power stroke and the exhaust gases pushed out during the exhaust at the top of cylinder which gives spark to ignite the mixture.</p>	<p>2</p> <p>2</p>

Working of TWO stroke Petrol engine :

The air fuel mixture from the carburetor enters the crank case through the inlet port during the upward movement of piston. At the same time the mixture in the cylinder is compressed which is ignited when the piston is just at T.D.C. the combustion takes place and the piston moves imparting motion to the crank shaft. During the downward movement of the piston the mixture in the crank shaft is compressed and pushed into the cylinder through the transfer port which pushes out the exhaust gases through the exhaust port, at the same time filling the cylinder with a new charge. This process is called cross-flow scavenging. Thus whole cycle is completed in two strokes i.e. one revolution of crankshaft.

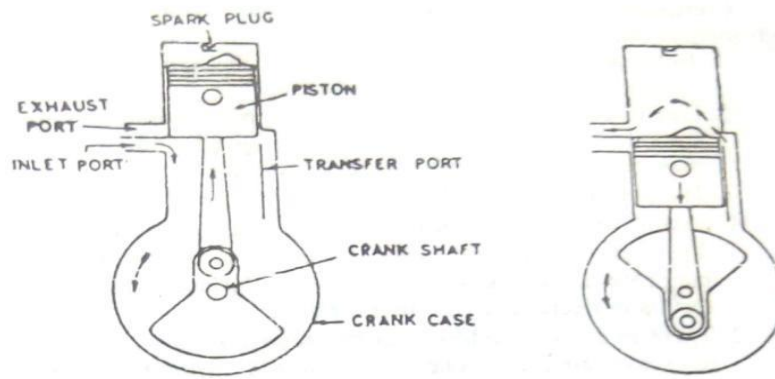


Fig. Two Stroke Petrol Engine.

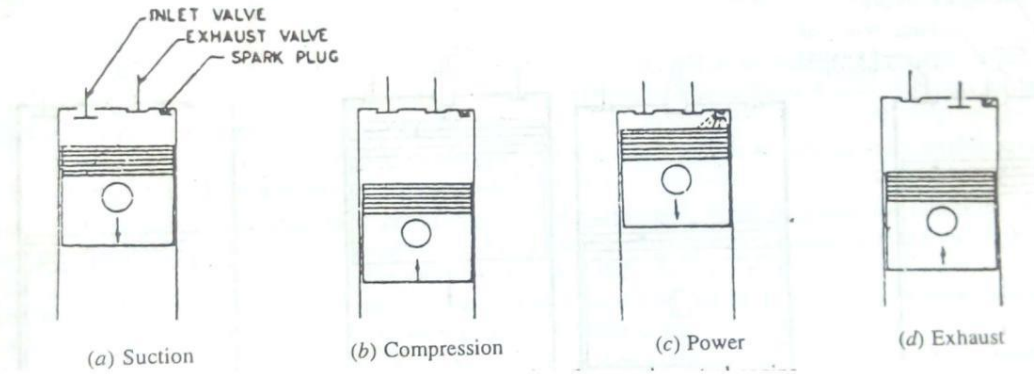
OR

Working of FOUR stroke Petrol engine :

The cycle of events that takes place in 4 stroke petrol engine is shown in figure. Fig. (a) shows the suction of air-fuel mixture in the cylinder during the downward movement of the piston. The piston moving away from cylinder head creates a pressure reduction or below atmospheric pressure. This depression is responsible for sucking the air-fuel mixture in the cylinder in naturally aspirated engine.

In fig. (b) is shown the compression stroke in which both the inlet and exhaust valves are closed at the end of which the typical cylinder pressure will be from 8 bar to 13 bar with engine running under load. Towards the end of the compression stroke, combustion of the charge is ignited by the spark plug occurs. This generate the heat and rises pressure. The burning gases expands as shown in fig (c) pushing the piston downward. This is called the power or expansion stroke.

At the end of power stroke the inlet valve remains closed but exhaust valve opens, the piston moves towards the cylinder head expelling most of the burnt gases to atmosphere (fig. d). Thus whole cycle is completed in four strokes i.e. two revolution of crankshaft.



2. Diesel engine

Working of CI engine:

1. Suction stroke: During this stroke, inlet valve is open and exhaust valve is closed. Only air is sucked into cylinder during this stroke. The piston moves from TDC to BDC and crank shaft rotates through 180° .
2. Compression Stroke: The air inducted in the cylinder is compressed to the clearance volume. Both the valves are closed during this stroke. The piston moves from BDC to TDC and crank shaft rotates through 360° .
3. Power stroke or Working stroke: At the end of the compression stroke the fuel (diesel) is injected into the hot compressed air. The rate of injection is such a that pressure remains constant instead of change in piston position. After injection of the fuel is complete the hot gases expand. The piston moves from TDC to BDC position and crank shaft rotates through 540° .
4. Exhaust Stroke: The inlet valve remains closed and the exhaust valve opens. The piston move from BDC to TDC position which pushes the burnt gases outside the combustion chamber. Crankshaft rotates by two complete revolutions through 720° .

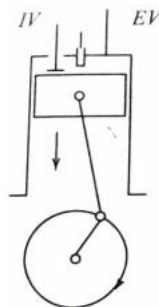
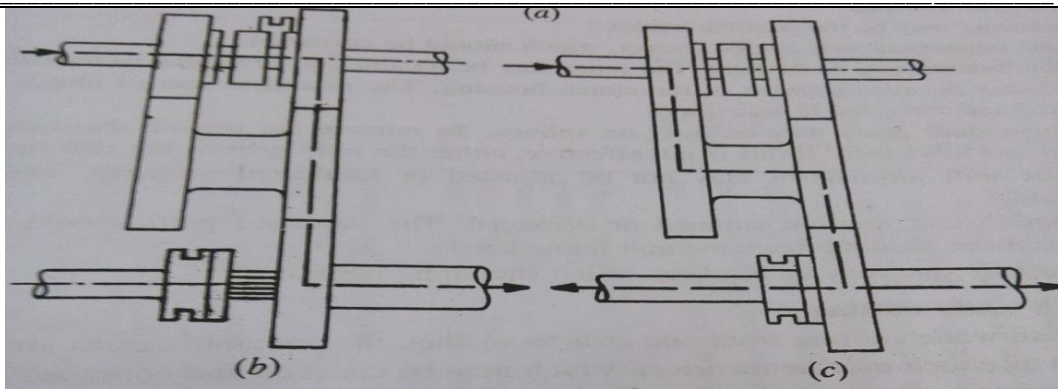


Figure: Working principle of four – stroke C. I. engine

(Note: Same credit should be given to any other equivalent type)

(b)	<p>Explain the working of transfer case with sketch and give its application.</p>	06
	<p>Answer: (sketch : 2 Marks, Working : 3 Marks, Application: 1 Mark)</p> <p>Working of Transfer Case:</p> <p>Transfer Case is the device used in all wheel drive vehicle, that splits the power between the front and rear axles on a four-wheel-drive car. While the differentials handle the speed difference between the inside and outside wheels, the transfer case in an all-wheel-drive system contains a device that allows for a speed difference between the front and rear wheels</p> <p>When the shifter mechanism A is at the center so that no gear is connected to the input shaft, the drive is in neutral as shown Fig. (a). Fig (b) shows a position when the shifter mechanism A connects the input shaft with the big input gear, but the shifter mechanism B disconnects the front output shaft from the rear output shaft. In this position, two-wheel drive with the high gear is obtained.</p> <p>In the same way Fig. (c) depicts the situation with four wheel drive in low gear. Obviously, four-wheel drive with low gear should be used invariably with the low gears on the main transmission. Also, the transfer box gears should be engaged with the vehicle stationary since these are not provided with synchromesh devices.</p> <div data-bbox="592 1150 1068 1646" data-label="Diagram"> </div>	03
	<p>Figure (a): Neutral Position of Transfer Case</p>	02



**Figure (b): 2 WD in High Gear Figure (c): 4 WD in Low Gear
Application of Transfer Case:**

Transfer Case (Gear Box) is an essential element of Four (All) Wheel drive vehicle.

- [1] Mahindra Jeep
- [2] Maruti Gypsy
- [3] Shaktiman Truck (Military Vehicle)

01

Q2.

Attempt any FOUR of the following.

16

- a) **State the importance of aerodynamic body shape in car and write any four advantages of it.**

04

Answer:

Importance of aerodynamic shape in Automobile body of car:

The body of vehicle is designed to protect the passenger as well as various components of the vehicle from the air. An aerodynamic shape of car body is the external shape of car body which will offer least resistance to air motion. Whenever car is moving there is an air resistance to motion of car. This air resistance depends on

(i) Size of car (ii) frontal shape and area (iii) speed and (iv) wind velocity. This air resistance is given by

$$R_a = C_a \cdot \rho \cdot A \cdot V^2$$

Where, R_a - Air Resistance, C_a - coefficient of air resistance and V = Velocity of vehicle (speed) ρ - Density of air

Now as frontal projected area of vehicle increases then vehicle air resistance increases & vice-versa.

02

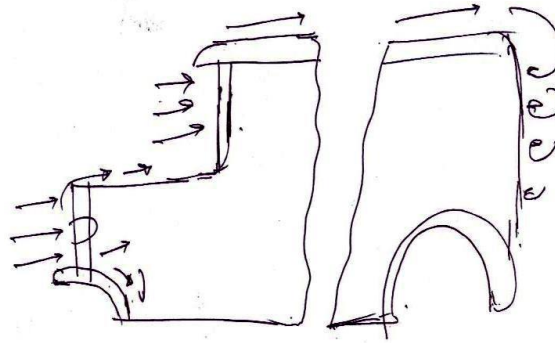


Figure 1.

Figure 1. Indicates frontal area of vehicle which is vertical, flat & offers more air resistance also flat portion at the rear produces drag which pulls the vehicle back reducing the motion of the vehicle.

So frontal area of car & body of car is designed in such a way that front portion is made inclined & body is given smooth curves (using curves instead of flat surfaces). This offers a least resistance to air & called as an aerodynamic shape.

Figure 2. indicates the use of curved surfaces in modern vehicles instead of flat surfaces .This offers less air resistance.

Aerodynamic body shape of Improves,

- There is least air motion resistance due to the aerodynamic shape.
- Engine load is decreased and there is better fuel efficiency & average.
- Air eddies are not formed

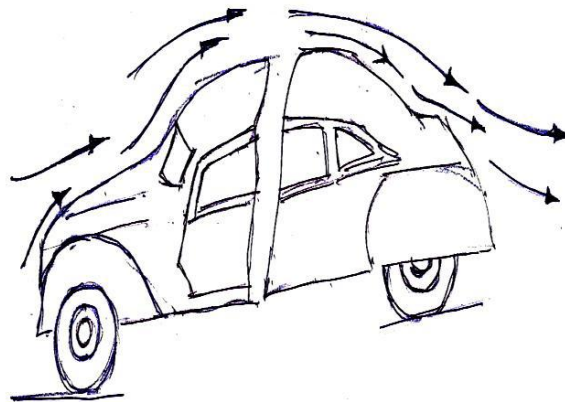


Figure No.2

Advantages of Aerodynamic Shape of Body:

- [1] Reduce Air resistance or air drag.
- [2] Reduce driver effort to drive vehicle.
- [3] Improve speed of vehicle.
- [4] Provide better fuel economy through reducing fuel consumption.



- [5] Provide attractive shapes and better aesthetic appearance to the vehicle.
[6] Reduce noise pollution.
[7] Reduce running cost of vehicle.

b) Compare front engine rear wheel drive with front engine front wheel drive

04

Answer:- (Any four points)

	Front Engine Rear Wheel Drive	Front Engine Front Wheel Drive
1	Easy steering movement - as drive is given to rear wheels	Complicated steering – as load on steered wheels.
2	More luggage space	Design is very compact – vehicle can be shortened by 100 to 300 mm
3	Better stability - as balanced weight distribution at front and rear wheels	Good road adhesion – as maximum weight is on driving wheels
4	More ground clearance	Low ground clearance and low C.G
5	More Center of Gravity	Less Center of Gravity
6	Less space for passenger compartment.	Bigger passenger compartment – as propeller shaft is absent
7	Applications: Ambassador, Premier Padmini and Trucks	Applications: Maruti 800, Santro, Matiz

04

c) Explain construction and working of diaphragm type of clutch

04

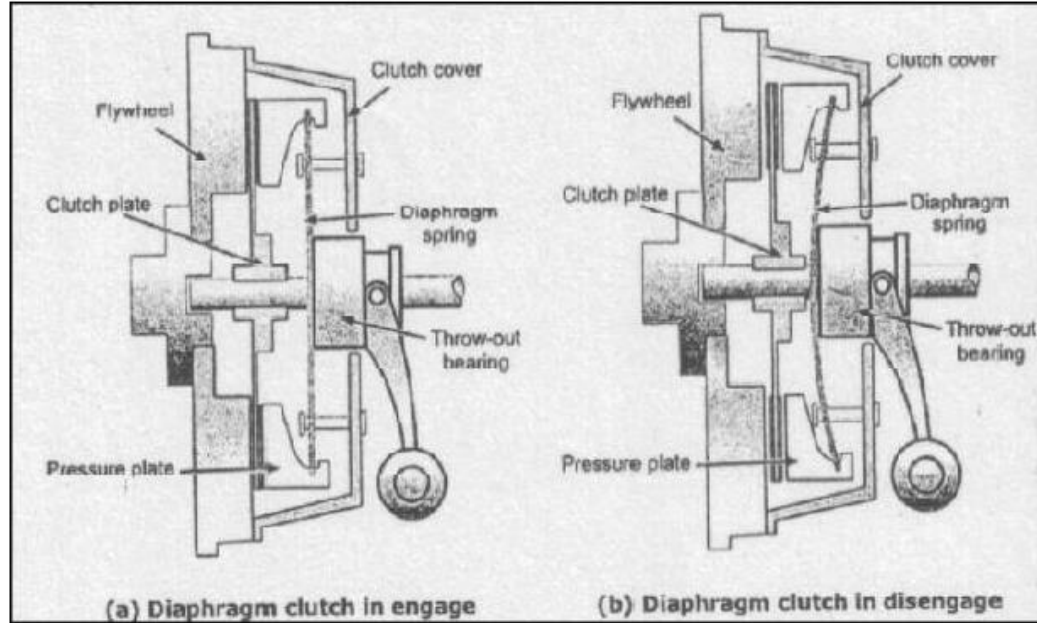
Answer:-

Construction: A simplified diagram of a single plate clutch is as shown in figure. It consist of flywheel attached to engine, pressure plate bolted to flywheel and clutch plate having friction facing is free to slide on clutch shaft. Diaphragm spring is mounted on pressure plate to expand and contract during engage and disengaging action of clutch.

Working: Clutch remains usually in engaged condition. It is required to depress clutch pedal to disengage the clutch. When a driver or an operator drives a vehicle he is required to engage clutch by depressing clutch pedal. As driver depresses the clutch pedal, effort applied gets transmitted either through level or cable to clutch release fork. The fork pushes clutch release bearing towards engine side due to which clutch release levels shown in figure get displaced getting pressure plate in backward direction. This action creates clearance between drive and driven members resulting disengagement of clutch. As the driver leaves clutch pedal it returns

02

to its original position due to which pressure plate put thrust on clutch plate from one side and flywheel on the another. This is how clutch gets engage



02

d) Explain the construction and working of synchronizing gear box.

04

Answer:

Construction:

In construction it is similar to constant mesh gearbox. Here instead of dog clutch provision of synchromesh device is made to avoid necessity of double declutching. The parts which are to be engaged, are first brought into frictional contact which equalizes their speed, after which these may be engaged smoothly

01

Working:-

Neutral : In neutral clutch shaft gear rotates lay shaft, which in turn drives gears on main shaft which are free to rotate on main shaft. The synchronizer units are positioned in such a way that they do not contact the main shaft gears and therefore no drive can be transmitted to the main shaft.

First gear : For engagement of first gear, the synchronizer unit (1) is moved towards gear D. The friction facing M1 and M2 comes in contact and equalizes the speed of gear D and

01

synchronizer. As soon speed equalizes, the sleeve G slides on clutch hub F by overriding the balls and get engaged with dog teeth k, this action locks the first gear wheel to the main shaft. The power flow is A-B-U1-U3-D-Synchronizer 1—main shaft

Second gear : : For engagement of second gear, the synchronizer unit (2) is moved towards gear C. The friction facing M1 and M2 comes in contact and equalizes the speed of gear C and synchronizer. As soon speed equalizes, the sleeve G slides on clutch hub F by overriding the balls and get engaged with dog teeth k, this action locks the second gear wheel to the main shaft. The power flow is A-B-U1-U2-C-Synchronizer 2—main shaft.

Top gear: Top gear is a direct drive obtained by moving the synchronizer unit (2) towards gear B. The friction facing contacts and equalizes the speed and then the sleeve is moved to engage with dog teeth K. This locks clutch shaft to main shaft. The drive is then transmitted directly from the clutch shaft to main shaft with no intermediate gear involved.

Reverse gear: To enable the vehicle to move backward a reverse idler gear (U5) must be employed. Reverse gear is engaged by moving the synchronizer unit (1) towards gear E. The friction facing contacts and equalizes the speed and then the sleeve is moved to engage with dog teeth K. This locks the gear E and synchronizer 1 and power flows to the main shaft. The power flow is A-B-U1-U4-U5-E-Synchronizer 1—main shaft.

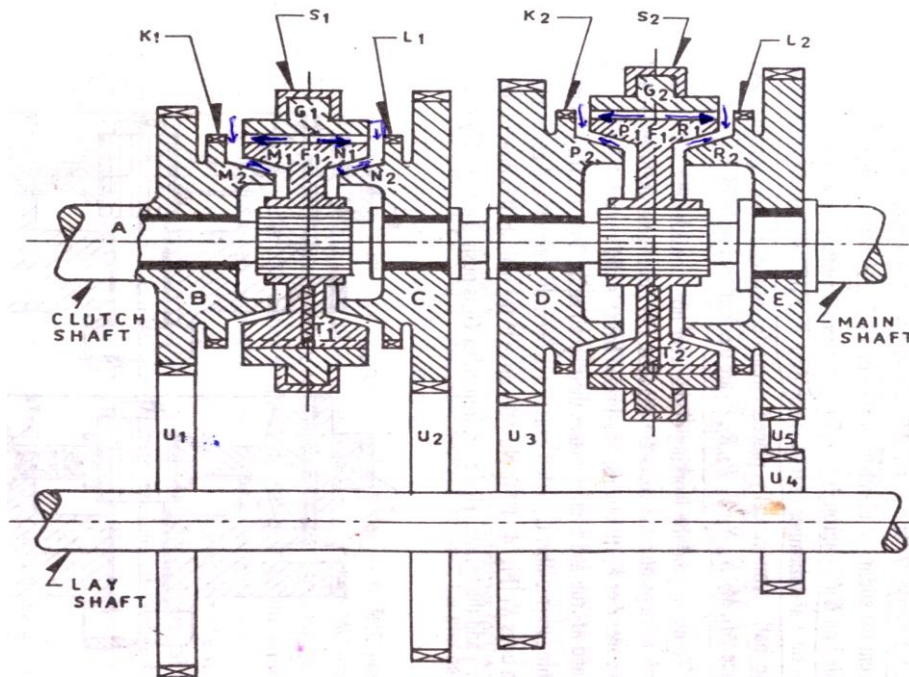


Fig. 4.10. Synchromesh Gear Box.



e)	Differentiate between disc brake and drum brake	04																											
	<p>Answer:- (Any four points:- 1 marks for each)</p> <table border="1" data-bbox="240 306 1419 974"> <thead> <tr> <th data-bbox="240 306 298 375"></th> <th data-bbox="298 306 846 375">Disc brake</th> <th data-bbox="846 306 1419 375">Drum brake</th> </tr> </thead> <tbody> <tr> <td data-bbox="240 375 298 489">1</td> <td data-bbox="298 375 846 489">Friction surface is directly exposed to the cooling air</td> <td data-bbox="846 375 1419 489">Friction occurs on the internal surfaces so it not exposed to the cooling air directly</td> </tr> <tr> <td data-bbox="240 489 298 543">2</td> <td data-bbox="298 489 846 543">Friction pads are flat</td> <td data-bbox="846 489 1419 543">Friction linings are curved.</td> </tr> <tr> <td data-bbox="240 543 298 619">3</td> <td data-bbox="298 543 846 619">No loss of efficiency due to expansion</td> <td data-bbox="846 543 1419 619">Loss of efficiency due to expansion</td> </tr> <tr> <td data-bbox="240 619 298 674">4</td> <td data-bbox="298 619 846 674">Less weight</td> <td data-bbox="846 619 1419 674">More weight.</td> </tr> <tr> <td data-bbox="240 674 298 728">5</td> <td data-bbox="298 674 846 728">Less Pedal load required to apply brake</td> <td data-bbox="846 674 1419 728">More Pedal load required to apply brake</td> </tr> <tr> <td data-bbox="240 728 298 804">6</td> <td data-bbox="298 728 846 804">Less Coefficient of friction.</td> <td data-bbox="846 728 1419 804">More coefficient of friction.</td> </tr> <tr> <td data-bbox="240 804 298 861">7</td> <td data-bbox="298 804 846 861">Simple in design</td> <td data-bbox="846 804 1419 861">Complicated in design.</td> </tr> <tr> <td data-bbox="240 861 298 974"></td> <td data-bbox="298 861 846 974">Replacement of friction pad is easy.</td> <td data-bbox="846 861 1419 974">Replacement of brake lining is difficult as it requires riveting or fixed with adhesives</td> </tr> </tbody> </table>		Disc brake	Drum brake	1	Friction surface is directly exposed to the cooling air	Friction occurs on the internal surfaces so it not exposed to the cooling air directly	2	Friction pads are flat	Friction linings are curved.	3	No loss of efficiency due to expansion	Loss of efficiency due to expansion	4	Less weight	More weight.	5	Less Pedal load required to apply brake	More Pedal load required to apply brake	6	Less Coefficient of friction.	More coefficient of friction.	7	Simple in design	Complicated in design.		Replacement of friction pad is easy.	Replacement of brake lining is difficult as it requires riveting or fixed with adhesives	04
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3	Attempt any TWO of the following.	16																											
a)	Give detail classification of automobile with one example of each	08																											
	<p>Answer: (any four, 1 mark for each)</p> <p>[1] According to Purpose (Use)</p> <p>[1] Passenger Cars</p> <p>1.1.2 Goods Carriage</p> <p>1.1.3 Special Purpose</p> <p>1.1.4 Earth Moving</p> <p>1.1.5 Motor Cycle (Bikes)</p> <p>1.1.6 Mopeds</p> <p>[2] According to Fuel Used:</p> <p>2.1.1 Petrol Vehicles</p> <p>2.1.2 Diesel Vehicles</p> <p>2.1.3 LPG/CNG Vehicles</p> <p>2.1.4 Electric Cars</p> <p>2.1.5 Hybrid Cars</p> <p>2.1.6 Solar Cars</p> <p>2.1.7 Fuel Cell</p>	08																											



	<p>[3] According to Load Carrying Capacity:</p> <p>3.1.1 Heavy Motor Vehicle 3.1.2 Medium Motor Vehicle 3.1.3 Light Motor Vehicle</p> <p>[4] According to Drive Used:</p> <p>4.1.1 Left and Right Hand Drive</p>	
b)	Explain the construction and working of differential with simple line sketch.	08
	<p>Answer: (Sketch 4 marks, Construction 2 mark and working 2 marks)</p> <p>Differential:</p> <p>Construction: The arrangement differential gear is as shown in figure. The crown wheel is fixed to casing. The inner ends of the half shafts pass through the boss of the differential case in which they are rotate. Inside the differential case the shaft carry the bevel sun gear with which bevel pinion mesh. The bevel pinions are free to turn on the pin fixed in the differential case. The differential provides an equal drive to each half shaft, although they may be rotating at different speeds, therefore it allows the outer wheel to rotate faster than inner wheel.</p> <p>Working:</p> <p>1. 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</p> <p>2. 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 to negotiate a turn safely.</p>	<p>02</p> <p>02</p>

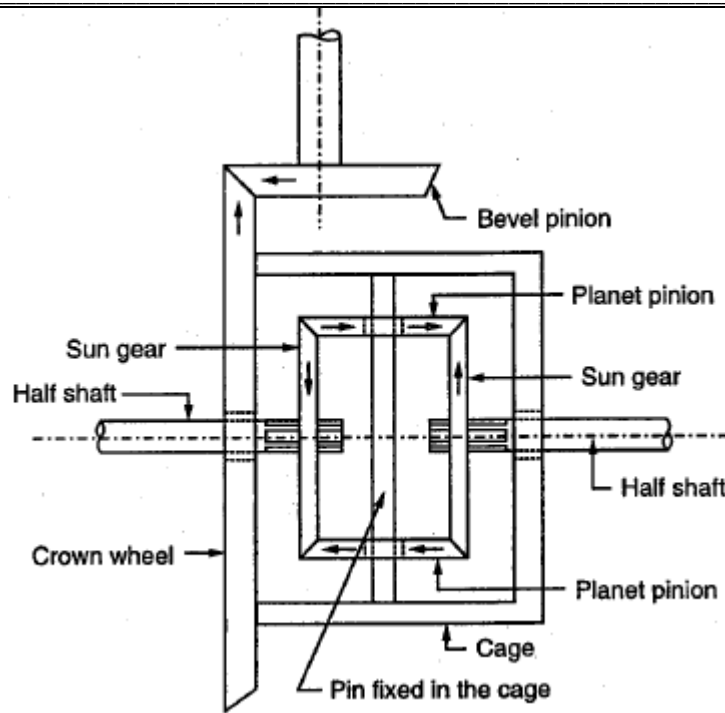


Fig. Differential

04

- c) Explain wheel geometry:
- i. Caster
 - ii. Camber.
 - iii. Toe-In To-Out
 - iv. King pin inclination

08

Answer:

i. **Caster:** It is the angle between king pin Centre line and the vertical, in plane of wheel

OR

It is forward or backward tilt of the wheel from true vertical when viewed from the side of wheel.

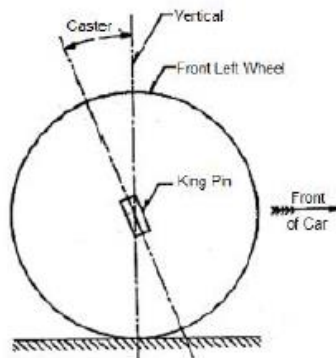


Fig. Caster

02

ii. **Camber.** It is the tilt of car wheels from the vertical when viewed from the front of vehicle.

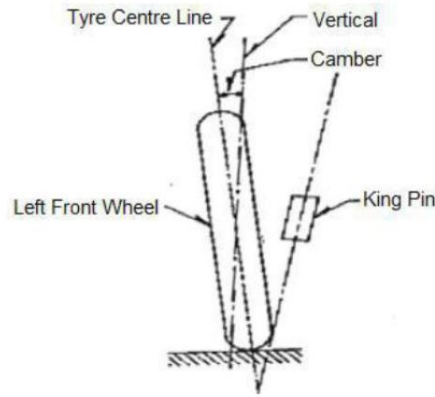
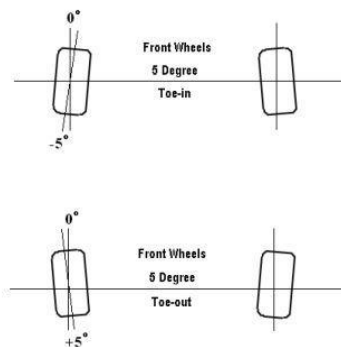


Fig. Camber

02

iii. **Toe-In** Toe-in is the amount by which the wheels are set closer together at the front than the rear when the vehicle is stationary. It should not exceed 3 mm.

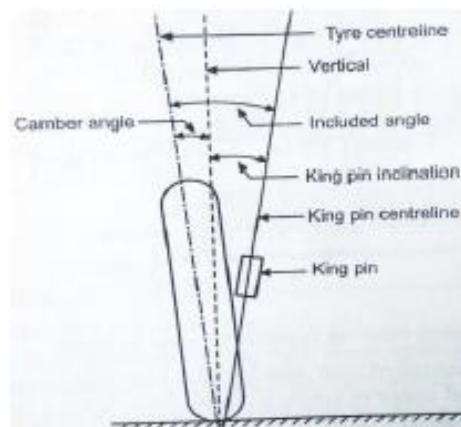
Toe – out: Toe- out is the amount by which the wheels are set closer together at the rear than the front when the vehicle is stationary.



02

Fig. Toe In & Toe Out

iv) **King pin inclination:** The angle between the vertical line and center of the king pin or steering axle, when viewed from the front of the wheel is known as steering axle inclination or king pin inclination.



02

Fig. King pin inclination & Camber angle

Working: 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.

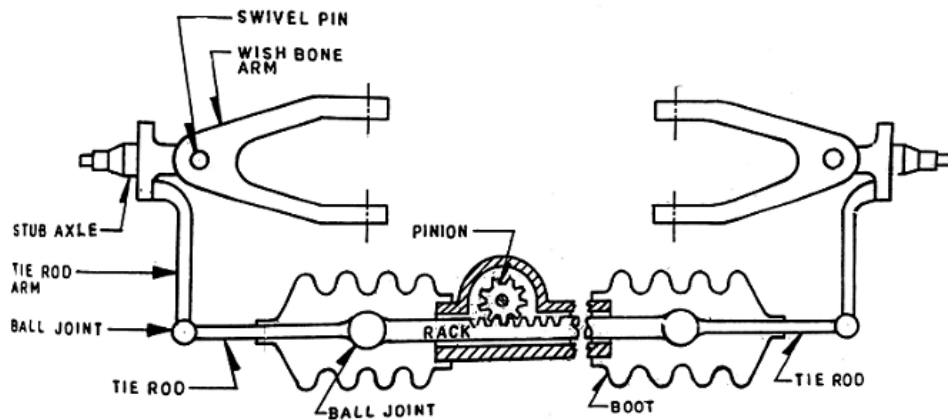


Figure: Rack and Pinion steering gear

2

(c) Sketch telescopic shock absorber and label main parts.

04

Answer:- (Sketch :- 3 marks ,label: 1 marks)

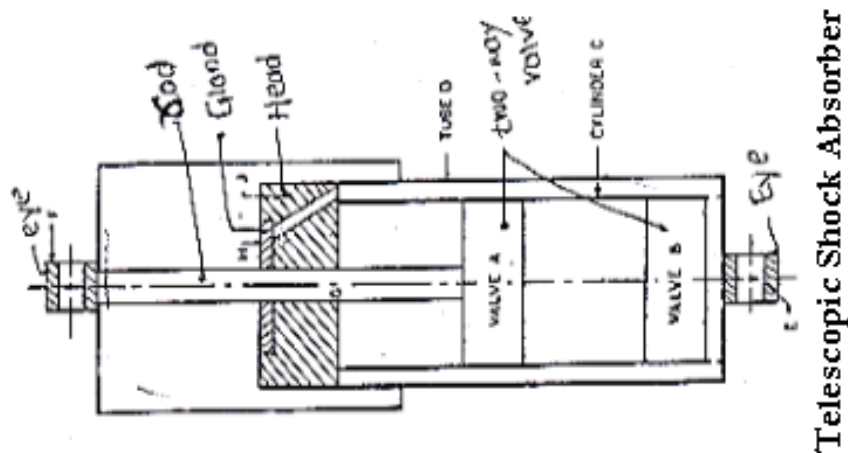


Fig Telescopic Shock Absorber

04



(d)	Explain rating of battery recommended by SAE	04
	<p>Answer: (any four 1 mark for each)</p> <p>Types of Battery ratings (any four)</p> <ol style="list-style-type: none">1) Ampere-hours (A-h)2) Cranking amperes (CA)3) Cold cranking amperes (CCA).4) Hot cranking amperes (HCA)5) Reserve capacity minutes (RCM). <ol style="list-style-type: none">1. Ampere-hours (A-h):- is the product of the time that a battery can deliver a certain amount of current (in hours) times that current (in amperes), for a particular discharge period. This is one indication of the total amount of charge a battery is able to store and deliver at its rated voltage. This rating is rarely stated for automotive batteries, except in Europe where it is required by law.2. Cranking amperes (CA):- also sometimes referred to as marine cranking amperes (MCA), is the amount of current a battery can provide at 32 °F (0 °C). The rating is defined as the number of amperes a lead-acid battery at that temperature can deliver for 30 seconds and maintain at least 1.2 volts per cell (7.2 volts for a 12 volt battery).3. Cold cranking amperes (CCA):-is the amount of current a battery can provide at 0 °F (-18°C). The rating is defined as the current a lead-acid battery at that temperature can deliver for 30 seconds and maintain at least 1.2 volts per cell (7.2 volts for a 12-volt battery). It is a more demanding test than those at higher temperatures.4. Hot cranking amperes (HCA):- is the amount of current a battery can provide at 80 °F (26.7°C). The rating is defined as the current a lead-acid battery at that temperature can deliver for 30 seconds and maintain at least 1.2 volts per cell (7.2 volts for a 12-volt battery).5. Reserve capacity minutes (RCM):- also referred to as reserve capacity (RC), is a battery's ability to sustain a minimum stated electrical load; it is defined as the time (in minutes) that a lead-acid battery at 80 °F (27 °C) will continuously deliver 25 amperes before its voltage drops below 10.5 volts.	04

B)	Attempt any <u>ONE</u> of the following.	06
(a)	Explain construction and working of master cylinder	06
	<p>Answer: (Construction 2 Marks, Working 2 Marks, Sketch 2 Marks)</p> <p>Master cylinder:</p> <p>Construction: There are two main chambers viz. the fluid reservoir and compression chamber in which the piston operates. There are rubber seals on both ends of the piston in the compression chamber. The reduced diameter region of the piston is always surrounded by the fluid. A rubber boot covers the push rod end of the master cylinder to prevent the dust from entering inside. Towards the brake line side of the compression chamber, there is a fluid check valve with a rubber cup inside.</p> <p>Working of master cylinder of Hydraulic brake:</p> <p>1) Brakes applied: When the brake pedal is operated, the push rod moves the piston against the action of spring force. When sufficient pressure is built up, the rubber cap of fluid check valve deflects and the high pressure fluid enters the wheel cylinder through fluid lines and operates the brake shoe against the revolving drum.</p> <p>2) Brakes released: When the pedal is released, the piston return towards its initial position due to the spring force and closes the fluid check valve for a short time to avoid entry of any air. The fluid from the lines also comes back in the compression chamber by lifting the check valve off its seat.</p> <div data-bbox="386 1297 1274 1837" data-label="Diagram"> </div> <p style="text-align: center;">Fig. Master Cylinder</p>	<p style="text-align: center;">2</p> <p style="text-align: center;">2</p> <p style="text-align: center;">2</p>



(b)	Compare radial tyre with cross ply tyre.	06																														
	<p>Answer: (Any 6 points 1 mark each)</p> <table border="1" data-bbox="237 289 1425 900"><thead><tr><th data-bbox="237 289 321 401">Sr. No.</th><th data-bbox="321 289 911 401">Radial ply tyre</th><th data-bbox="911 289 1425 401">Cross ply tyre</th></tr></thead><tbody><tr><td data-bbox="237 401 321 478">1</td><td data-bbox="321 401 911 478">Plies are running radially straight from bead to bead</td><td data-bbox="911 401 1425 478">Plies are running diagonally opposite from bead to bead</td></tr><tr><td data-bbox="237 478 321 520">2</td><td data-bbox="321 478 911 520">Stiffness of tyre is less</td><td data-bbox="911 478 1425 520">Stiffness of tyre is more</td></tr><tr><td data-bbox="237 520 321 598">3</td><td data-bbox="321 520 911 598">It gives ultimate comfort for speed more than 55 Km/hr.</td><td data-bbox="911 520 1425 598">Because of more stiffness tyre is less comfortable.</td></tr><tr><td data-bbox="237 598 321 640">4</td><td data-bbox="321 598 911 640">Steering is harder</td><td data-bbox="911 598 1425 640">Steering is easy</td></tr><tr><td data-bbox="237 640 321 682">5</td><td data-bbox="321 640 911 682">Tyre has firm grip with road</td><td data-bbox="911 640 1425 682">Tyre has lesser grip with road.</td></tr><tr><td data-bbox="237 682 321 760">6</td><td data-bbox="321 682 911 760">Radial ply tyre has more breaking grip</td><td data-bbox="911 682 1425 760">Cross ply tyre has less breaking grip</td></tr><tr><td data-bbox="237 760 321 802">7</td><td data-bbox="321 760 911 802">Parking of vehicle is difficult</td><td data-bbox="911 760 1425 802">Parking of vehicle is easy</td></tr><tr><td data-bbox="237 802 321 844">8</td><td data-bbox="321 802 911 844">It is costlier</td><td data-bbox="911 802 1425 844">It is cheaper than radial</td></tr><tr><td data-bbox="237 844 321 900">9</td><td data-bbox="321 844 911 900">Tread life is more</td><td data-bbox="911 844 1425 900">Tread life is less</td></tr></tbody></table>	Sr. No.	Radial ply tyre	Cross ply tyre	1	Plies are running radially straight from bead to bead	Plies are running diagonally opposite from bead to bead	2	Stiffness of tyre is less	Stiffness of tyre is more	3	It gives ultimate comfort for speed more than 55 Km/hr.	Because of more stiffness tyre is less comfortable.	4	Steering is harder	Steering is easy	5	Tyre has firm grip with road	Tyre has lesser grip with road.	6	Radial ply tyre has more breaking grip	Cross ply tyre has less breaking grip	7	Parking of vehicle is difficult	Parking of vehicle is easy	8	It is costlier	It is cheaper than radial	9	Tread life is more	Tread life is less	06
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5	Attempt any FOUR of the following:	16																														
a)	Write any four advantages of tubeless tyre over tube tyre	4																														
	<p>Answer: (Any 4 advantages 1 mark each)</p> <p>Advantages of Tubeless Tyre over tube tyre.</p> <ol style="list-style-type: none"><li data-bbox="250 1136 824 1171">1. Weight is less due to absence of the tube.<li data-bbox="250 1188 1008 1224">2. Fuel consumption is less as its un-sprung weight is less.<li data-bbox="250 1241 1438 1335">3. The life of tyre is more due to better cooling Conductor of heat. The heat dissipation does not take place due to which life of tyre is less.<li data-bbox="250 1352 729 1388">4. Steering and road holding is good<li data-bbox="250 1404 678 1440">5. Air retaining liner is provided<li data-bbox="250 1457 618 1493">6. Better air sealing quality.<li data-bbox="250 1509 1411 1545">7. Tyre needs not to be removed while tyre punctured. Plug is inserted in case of puncture	4																														
b)	Explain with sketch Trailing link suspension.	4																														

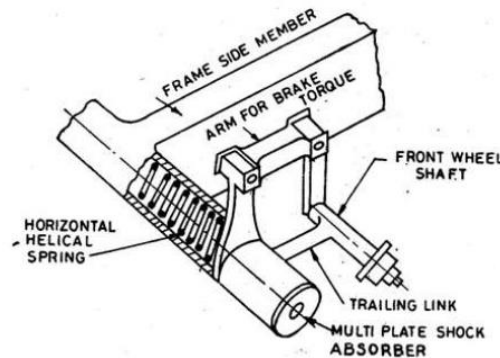
Answer: (Sketch 2 marks, Explanation 2 marks)

Trailing link suspension:

- i) In this type of suspension, a helical coil spring or torsion bar is arranged in horizontal position rather than the vertical position.
- ii) One end of the spring is fixed with the cross member of the frame and the other end with one end of the trailing link.
- iii) The other end of the trailing link is attached to the shaft which carries the wheel hub.
- iv) When the wheel moves up and down, it winds and unwinds the helical spring to absorb the wheel vibrations due to road irregularities.
- v) To check the vibrations of the spring a multi-plate shock absorber is also provided at the end of the cross member.
- vi) In some cases of designs torsion bars are used instead of the helical springs.

02

Trailing link suspension



02

Fig. Trailing link Suspension

c) **State the working principle of alternator and write the difference between alternator and dynamo**

4

Answer: (2 Marks for Working principle and 2 Marks for Difference)

Working principle of alternator: An electromagnetic rotor which is energized from the current of the battery through brush and slip ring assembly. Rotor is rotated by belt and pulley arrangement get power from engine shaft; stator winding is wound around the rotor. The rectifier circuit consisting of diodes is connected to the stator winding. Diodes are electronic device that allows current to flow only in one direction.

When the electromagnetic rotor is turned its magnetic lines of force cut the stationary stator loop. This induces a current in the stator winding. Through the electromagnetic rotor reverses its polarity the alternating current produces in the stator winding. The alternating current may

2



be converted to direct current by the diodes.

Difference between alternator and Dynamo (Any 2 differences)

Sr. No.	Alternator	Dynamo
1	Alternators produce an alternating current, which constantly changes directions.	Dynamos produce a direct current that flows in the same direction.
2	No commutator is needed in an alternator	Dynamo employs a commutator to produce DC output.
3	Phase alternator, armature winding is mounted on the stator and field winding on the rotor.	Its field winding is stationary and armature winding is rotating.
4	An alternator gives same performance at all speeds	Dynamo produces good current at high speeds.
5	Use of alternators for charging the battery and provide the current for the electrical systems of the car when the engine is running	dynamos are not used anymore in automobiles

2

d) Write Different color codes used in automobile wiring system

4

Answer: (Any 4 color code 1 mark each)

Different color codes used in automobile wiring system

Sr. No.	Color	Color Code	Function
1	Brown	BR	Battery Circuit
2	Yellow	Y	Generator Circuit
3	White	W	Ignition Circuit
4	Green	G	Auxiliary Circuit
5	Blue	BL	Head Lamp Circuit
6	Red	R	Side lamp & Tail Lamp Circuit
7	Black	B	Earth ground Circuit

4

e) State any four precautions to be taken while using air conditioning system of a vehicle.

4

Answer: (any four points 1 mark for each)

Important precautions to be taken while using air conditioning system of vehicle:

- i. Operate the air conditioner periodically or at least once a week to keep the internal parts lubricated as well as prevent the hoses from hardening.
- ii. Do not switch ON the A.C. at high speeds which may result in the ceasing of compressor.



	<p>iii. Do not stick anything into the air outlet or the air inlet. As it dangerous and it can cause injury or damage.</p> <p>iv. Avoid exposing a body directly to a continuous cool air flow for long periods- It is not good for health.</p> <p>v. Avoid placing any obstacles near the inlet or outlet- if inlet or outlet is blocked it may causes damage to the unit.</p> <p>vi. Do not run or stop the unit frequently. If run or stop the unit more than 4-5 times an hour, it may cause damage to the unit.</p> <p>vii. The air filter should be cleared at least once every two weeks</p> <p>viii. When the unit is cleaned, set the selector switch at off position</p> <p>ix. Never operate A.C. with heater on.</p> <p>x. Do not charge the refrigerant in the A.C. system before flushing.</p>	4
6	Attempt any TWO of the following:	16
a)	<p>(i) Explain the procedure for wheel balancing of car.</p> <p>(ii) Draw a layout of an air conditioning system of a car and explain its working.</p>	8
	<p>Answer: (Any one procedure 4 marks)</p> <p>(i) Procedure for wheel balancing of car.</p> <p>Wheel and tyre assembly is checked for wheel balance either on or off the vehicle.</p> <p>There are two types of wheel balance.</p> <p>1. Static balance</p> <p>2. Dynamic balance</p> <p>1. Procedure of static balancing:- First remove wheel from the vehicle, place the wheel on bubble or static balancer If the wheel is heavier in one section, the bubble in the center of balancer will move off center. Balance the wheel by adding wheel weights to the rim until the bubble is centered. Steel wheel and aluminum wheels may require different types of clip on weight. Aluminum wheel may require adhesive or stock on weight.</p> <p style="text-align: center;">OR</p> <p>2. Procedure of dynamic balancing:- Check recommended tyre pressure of the wheel, tyre condition/rim for any damage, don't balance, and replace it. If tyre –rim condition ok, mount wheel and lock it, remove stones & old weights from wheel. Set balance for size of tyre. Start balancing machine and stop after some specific rotations (200-300 revolutions). Read the value of imbalance on left & right wheel. Put respective weight on both the wheel. Start balancing</p>	4

3. Machine once again, if reading is zero on both side with green colour, wheel is balanced. If reading does not show zero reading, with some numeric value with red color, repeat the procedure. Remove wheel after complete balancing.

(ii) Layout of an air conditioning system of a car and its working.

Working :-

The main components of the system are compressor, condenser, receiver/dryer, Expansion valve and evaporator. In this system the heat is absorbed and transferred in the following steps

- i. Refrigerant leaves the compressor as high pressure vapour.
- ii. By removing heat via condenser, the vapour becomes low temperature liquid.
- iii. Moisture and contaminants are removed by the receiver dryer, where the clean refrigerant is stored until it is needed
- iv. The expansion valve controls the flow of refrigerant into the evaporator.
- v. Heat is absorbed from the air inside the passenger compartment by the low pressure refrigerant, causing the liquid to vaporize and greatly decreased passenger compartment temperature. The refrigerant returns to the compressor as a low pressure, low temperature vapors and a cycle completed.

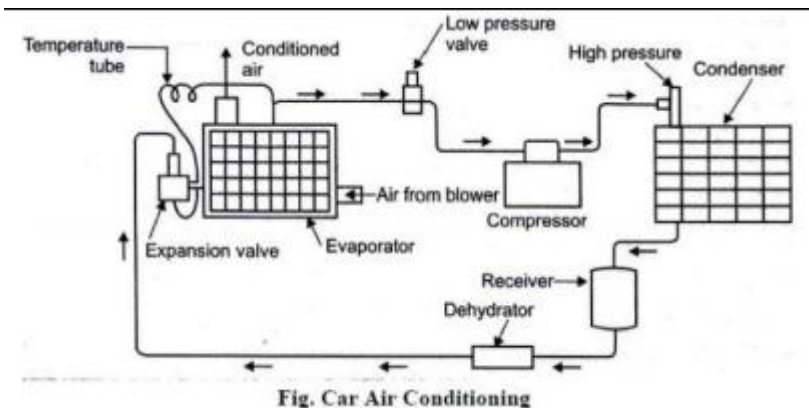


Fig. Layout of an air conditioning system of a car

4

b) Explain the construction and working of Bendix drive.

8

Answer: (Figure 4 Marks, Construction & Working 4 Marks)

Construction of Bendix Drive:

Main Components of Bendix drive are:

- i) Drive shaft
- ii) Spring
- iii) Balanced weight

8

- iv) Pinion gear
- v) Threaded sleeve
- vi) Coller

Working of Bendix Drive:

Bendix drive is an inertia based drive in which the pinion on the starter motor armature engages and disengages with the flywheel depending on the inertia of motor and flywheel. When the ignition switch is turned „ON“, the starter motor armature starts spinning. This causes the sleeve to rotate while the pinion is stationary due to the unbalanced weight. The pinion hence moves axially towards the collar until it engages with the flywheel ring gear. Since the pinion cannot move further axially, its starts to rotate along with the sleeve thereby also rotating the flywheel. When the flywheel starts rotating at above 100 rpm the engine gets starts. After the engine has started the pinion gear is turned by the engine much faster than rotated by starting motor. This causes, the pinion gear to turn back on the threaded sleeve, making it disengaged with the flywheel.

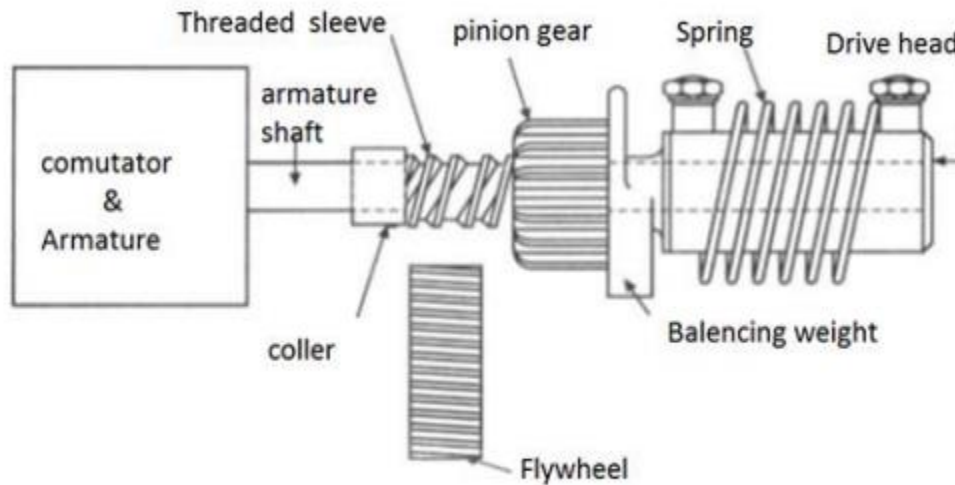


Figure: Bendix Drive

(Note: Equivalent credit shall be given to any other suitable sketch if drawn)

c) Explain the electronic ignition system with sketch.

8

Answer: (Figure 3 Marks, Explanation 5 Marks)

Electronics Ignition system:

Electronics Ignition system is similar to conventional point type Ignition System with a small difference. Electronics Ignition system is provided with Electronic control unit which opens and close the primary circuit instead of contact breaker point as in Contact breaker point

8

ignition system.

Construction:

Electronics Ignition system is having two circuits Primary and Secondary circuit. Battery, primary winding, ECU and the timer forms primary circuit. Whereas secondary winding, distributor and spark plug forms secondary circuit.

A timer is employed in the distributor instead of contact breaker. This timer may be Pulse generator or Hall- effect switch which Triggers the Ignition module also called as electronic control unit.

Working:

This control unit primarily contains transistor circuit whose current is triggered off and on by timer which results in the stopping and starting of the primary circuit.

The secondary circuit worked in the similar manner as in conventional contact breaker type. i.e. when the magnetic field collapses it induces current in the secondary winding having more number of turns. This results in development of very high voltage necessary to generate the spark at the spark plug.

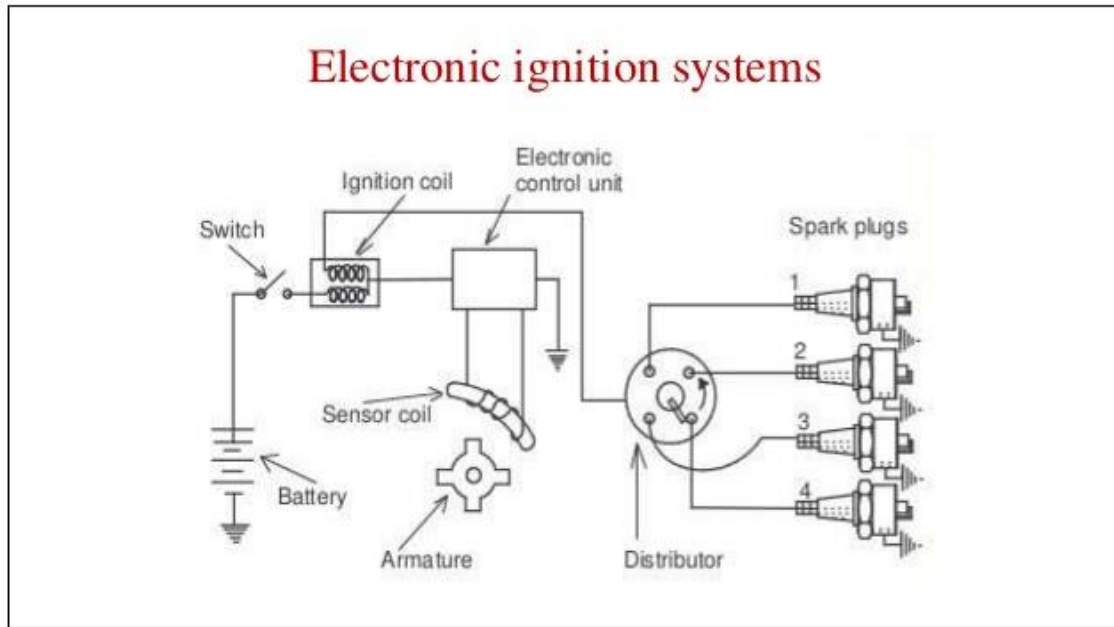


Figure: Electronics Ignition system