



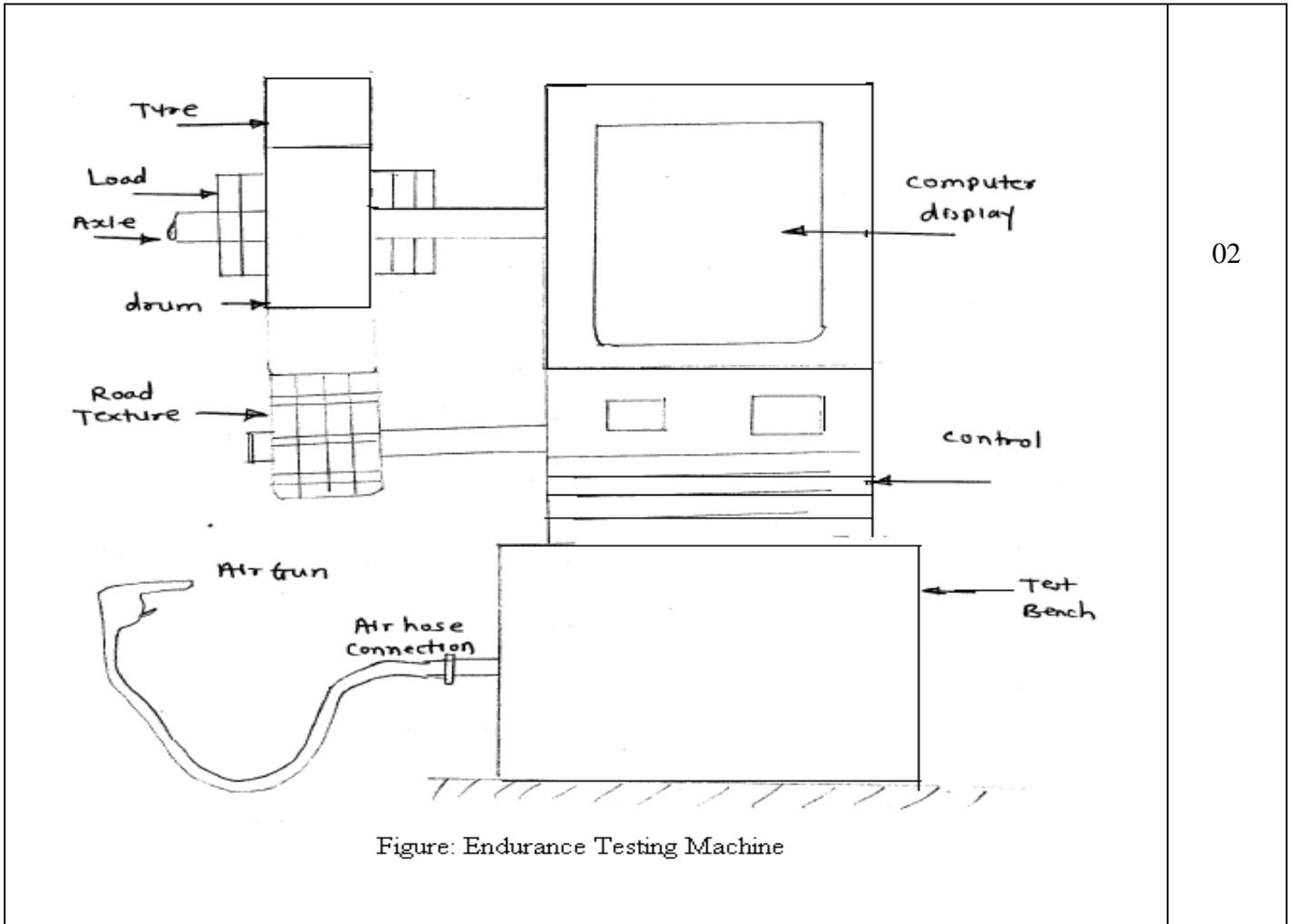
Important Instructions to examiners:

- 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 judgment on part of examiner of relevant answer based on candidate's understanding.
- 7) For programming language papers, credit may be given to any other program based on equivalent concept.

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1. A) Solve any three of the following	12
a) State the significance of vehicle testing.	04
Answer: Significance of vehicle testing: (Any four points) i) Vehicle provide mobility, means with the help of which we can move from one place to another and also performed certain assigned tasks quickly, economically, safely and comfortably. ii) To confirm the design iii) For the development and checking performance, and verified iv) Legislative requirement and certification or validation purpose. v) For homologation which is one type of certification issued by government regulatory bodies such NCAT, CIRT, ARAI.	1 mark each
b) State four vehicle level performance parameter.	04
Answer: Vehicle level performance parameters: (any four) 1. Acceleration:- It is defined as rate of change of velocity with respect to time. Acceleration shall be expressed as a time in second-to cover a distance of 1000 m from start or to achieve a speed of 90 kmph. 2. Drivability:- It's an ability to drive the vehicle on various testing track without much more effort and fatigue. 3. Gradeability:- The gradiability of vehicle is the maximum gradient on which the vehicle can start climbing from stand still condition, with all the wheels of vehicle on the gradient at the start 4. Restartability:- It is ability of vehicle to start the vehicle with loading or without loading condition on different road conditions like gradient, shallow water trough, sand and mud patch 5. Brakes testing:- Brake testing is carried out in laboratory and on testing tracks. In laboratory brake testing are carried out by using roller brake tester and chasis dynamometer. On testing track vehicles brake are tested with ABS, without ABS, on dry and wet surface 6. Steering effort testing:- It means that effort applied to steering control in order to steer the vehicle.	1 mark each
c) Explain endurance test of tyre.	04
Answer: Endurance test of tyre: This test is conducted with the help of test drum having diameter 1708mm. Most of the tyres are inflated to the pressure as specified in the manual. Then observed the tyre in an ambient temperature 20 to 40°. for a minimum period of 3 hour. After observing mount the tyre on a test axle and press the tyre tread against the face of the test drum at the initial stage one. Test load followed by stage two and stage three as shown in table. At the end of each run record reading of tyre inflation pressure. If the inflation pressure drops below he first value the test shall be rejected and repeated with a fresh tyre.	02



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d) How leakage test of cooling system is carried out?

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Answer: Leakage test is carried out by performing following : (Any two tests with description)

1. Visual inspection:- In visual inspection we see the radiator fins pipes, hoses and elbows for crack and other defect from where water leaks.
2. Pressure test:- Fill the radiator to about 13mm below the bottom of the filter neck. Then wipe the neck sealing surface and attach the tester. Operate the pump to apply pressure that does not exceed 21 kpa above the manufacturer's specification. If the pressure hold steady, the system is not leaking. If the pressure drops there are leaks.
3. Flow rate test:- This test is conducted by connecting radiator in a closed circuit. The circuit consists of an open tank connected to a water pump. The other end of water pump is connected to the inlet of radiator through a flow control valve. Below the radiator measuring tank is placed, start the pump and gradually increase the flow till overflow from the outer pipe of radiator is noticed. Now measure the flow rate in this condition. It should not be less than 7000 liter/hour for heavy vehicle.
4. Vibration test
5. Pressure impulse test
6. Heat transfer performance test
7. Internal cleanliness test.

04



B)) Solve **any one** of the following

06

a) Explain the working of chassis dynamometer.

06

Answer:

Working of chassis dynamometer:

A chasis dynamometer measures horse power and torque available at the drive wheels of the vehicle. This dynamometer measures road horse power. The dynamometer consists of two rollers, one is called as idle roll and other is drive roll. A power absorption unit which absorbs the energy and acts as a load on the vehicle and lastly digital indicator which measure both torque and speed.

1) Check all the fluid level of all working fluids including engine oil, fuel, coolant, transmission oil and check tyre pressure

2) Lock the rollers and drive the vehicle to the dynamometer testing.

3) Run the engine at idle rpm.

4) To produce maximum load, increase the load.

5) Using the engine throttle, increase the speed by 100 rpm increment. At each point read the torque.

6) Continue to increase the rpm until the maximum throttle has been reached

7) Plot the torque curve using torque data from the scale for each 100 rpm increments

8) For each 100 rpm increment calculate the horse power

$$\text{H.P} = \frac{\text{Torque} \times \text{RPM}}{5.252}$$

5.252

9) Plot the H.P curve with the calculated data for each 100 rpm increments

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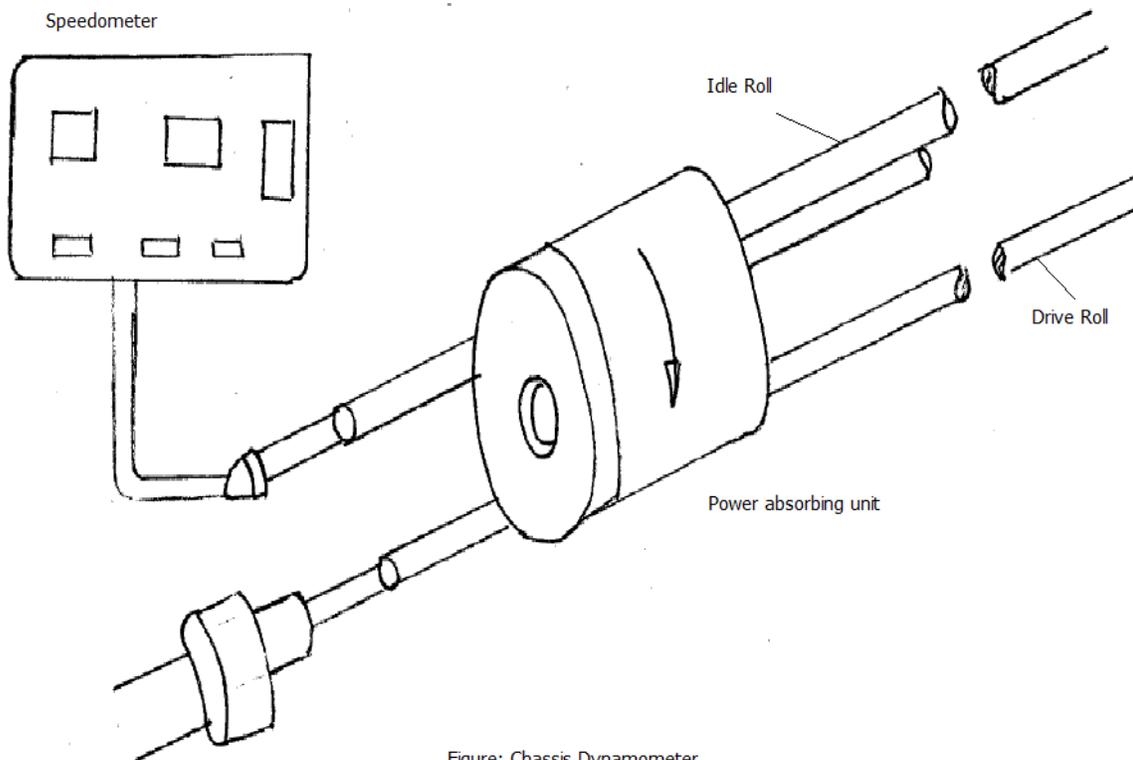
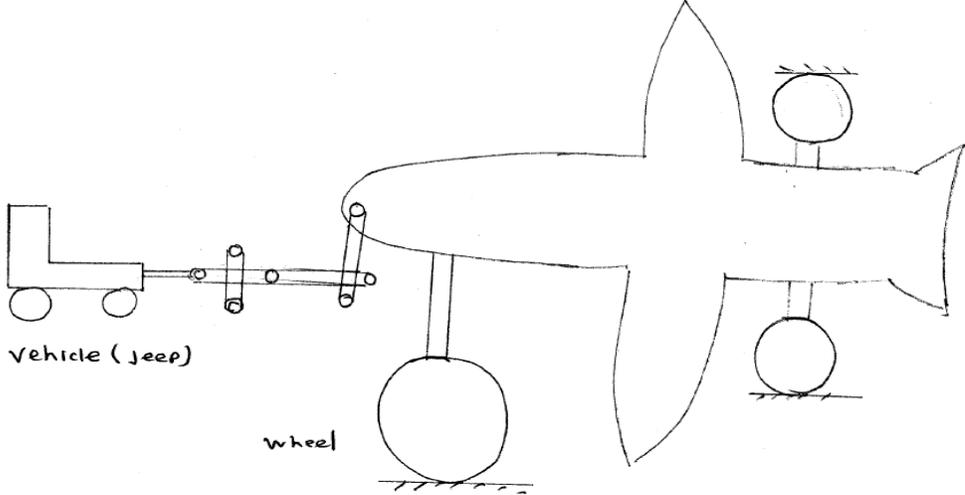


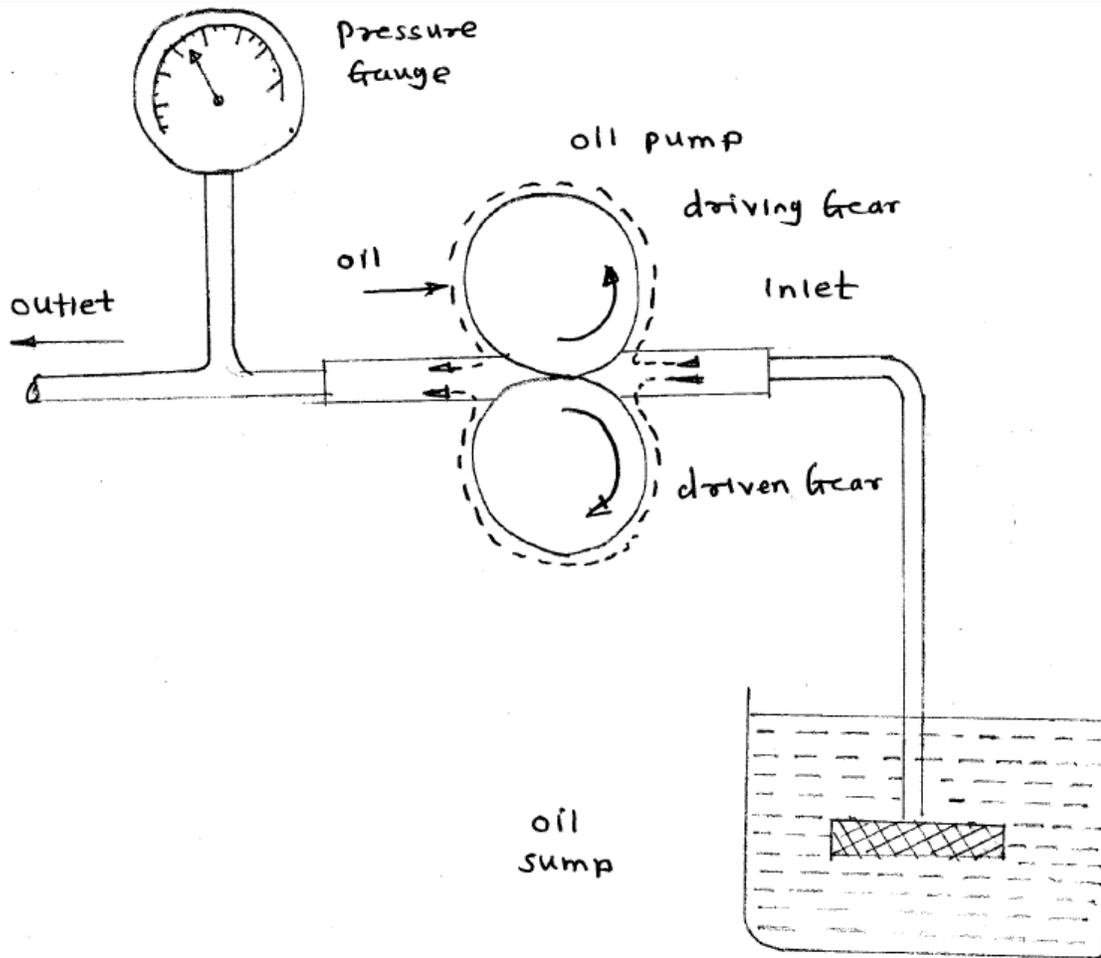
Figure: Chassis Dynamometer

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b) Explain the term Noise, Vibration and Harshness in vehicle testing	06
Answer: 1) Noise: Noise is unwanted sound and unwanted disturbance. In an electronic signal the acoustic noise/sound – It is a energy transmitted to the air which causes audible disturbances.	02
2) Vibration: Vibration is an oscillation which causes noise and disturbances. When an external force is acted on a particle or substance of body it fluctuates in regular interval of time. It is a continuous phenomenon until the force is absorbed by that body.	02
3) Harshness: Harshness is generally used in vehicle side. It is due to the comfort associated with both vibration and noise. It is a qualitative system based on the design characteristics which they are using inside the vehicle.	02
2. Solve any four of the following :	16
a) What is Homologation process?	04
Answer: Homologation Process: For acquiring the homologation certificate of conformity – The producer or authorized representative receives an application form and an “Information Document” which has to complete and also an offer for execution of the ordered homologation tests from testing laboratory. After that testing laboratory agrees about the delivery date of the sample vehicle or sample with the client and starts performing following activities of the homologation test -	04
1) Check up the “Information Document” 2) Identification of the vehicle with the “Information Document” 3) Execution /Start of the homologation tests and measurements. 4) Evaluation of the results and preparation of the homologation technical report. 5) If the homologation test procedure is successfully finished, VRDE or ARAI returns the vehicle (Sample) to the client and issue a technical report with an enclosure “Information document” in three copies that are sent to the homologation authority. If the technical report is positive, authority issues an international approval certificate with the complete technical report in the enclosure. The client/Manufacturer gets the first copy, VRDE/ ARAI/NCAT get the second copy and the homologation authority keeps the third copy.	
b) Describe steering characteristics of vehicle	04
Answer: Vehicle Steering Characteristics- 1) Under steer: When slip angle of the front wheel are greater than those of the rear wheels, radius of turn is increased. This means that vehicle will turn less sharply so to keep vehicle on right path we shall have to steer a little more than theoretically needed. This condition is called under steer. 2) Over steer: When slip angle of front wheel are less than those of the rear wheels, radius of turn is decreased. This means that vehicle will turn more sharply so vehicle will try to move from its normal direction of motion. Therefore to keep it on right path we have to steer less than theoretically needed. This condition is called over steer. 3) It helps in turning the vehicle at the will of the driver. 4) It helps in swinging the wheels to the left or right. 5) It provides directional stability of vehicle and controls wear and tear of tyre	04

<p>6) It multiplies the effort of the driver by leverage in order to make it fairly easy to turn the wheels.</p>	
<p>c) Explain draw bar test.</p>	<p>04</p>
<p>Answer: Draw Bar Test: When the excess power is fully utilized for pulling extra load attached to the vehicle, then Maximum draw bar pull = Tractive effort- Road resistance $= F - R$ Road resistance in this case is made up of rolling resistance and air resistance. Example- A small vehicle is used to park the heavy weight aero plane from runway to its shed, because of that vehicle is having a maximum draw bar pull so that it pull the aero plane easily as shown in figure.</p>  <p style="text-align: center;">Figure Draw Bar Pull - Small vehicle pull Aeroplane</p>	<p>02</p>
<p>d) Explain the pressure test of lubricating oil pump.</p>	<p>04</p>
<p>Answer: Pressure test of lubricating oil pump:</p> <ol style="list-style-type: none"> 1. Check the oil level in the oil sump. Oil pump is connected to oil strainer with steel tubing pipes. Oil strainer prevents dirt and metallic sludge in to the lubricating pump. 2. A pressure gauge is attached to the oil pump at outlet side, which measures the lubricating oil pressure. 3. Run the engine; take reading at idle half throttle and full throttle from pressure gauge. 4. Generally pump delivers oil at pressure about 300-400 kpa 	<p>02</p>



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Figure: Lubricating oil Pump Pressure Test

e) Describe voltage drop test of starter motor.

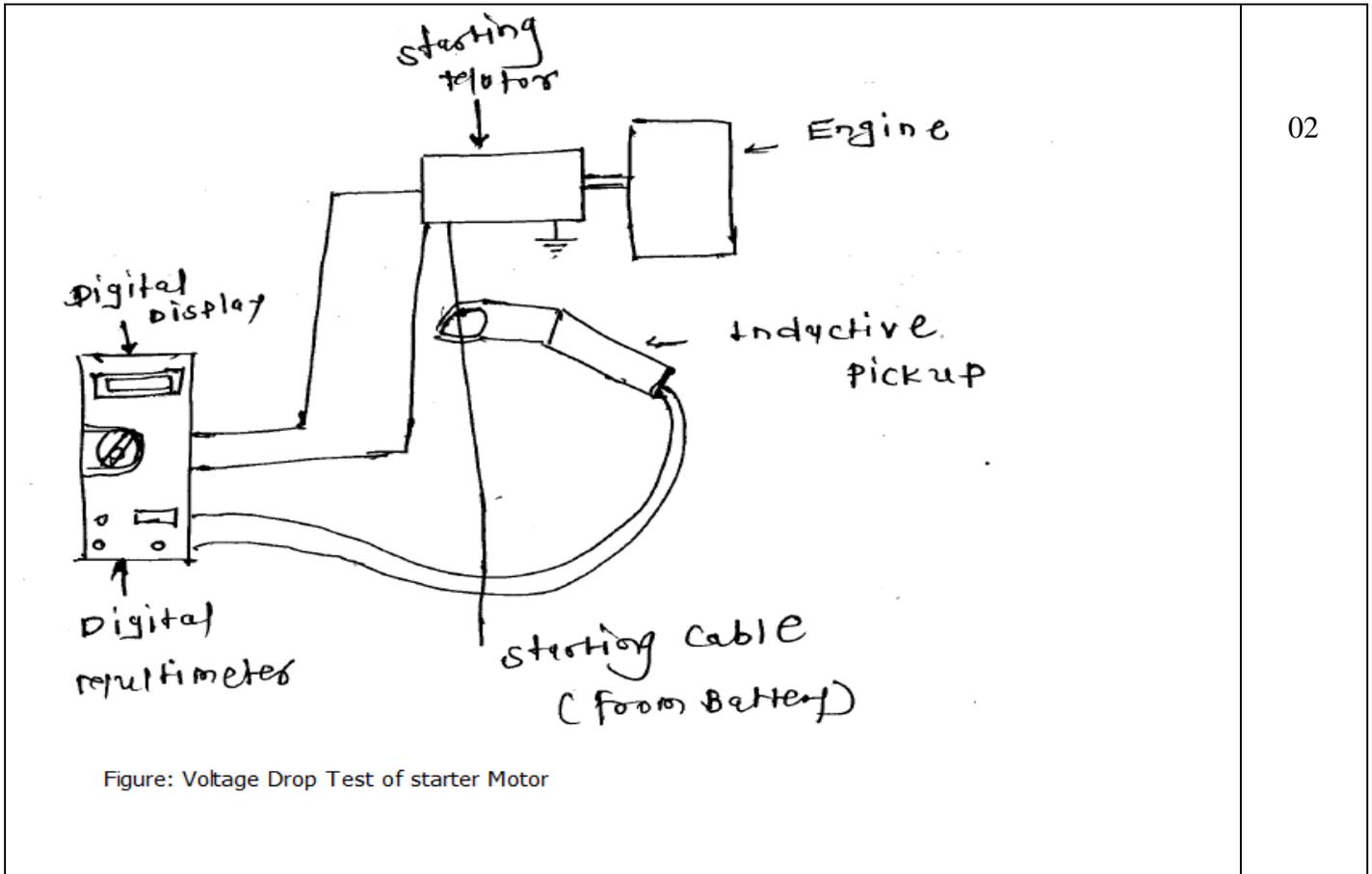
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Answer: Voltage drop test of starter motor

A voltage drop test determines if there is excessive resistance across a cable, component or connection while current flows through it. This test measures current flow to the starting motor while it cranks the engine. If possible the engine should be at normal operating temperature. Disable the ignition and connect the ammeter to the battery cable. Follow the operating instructions for the tester using.

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Turn the ignition key to start and read the current drawn. A reading of 200 amp is typical for some engine. If the reading is higher than specified, the trouble is in the starting motor or engine.



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f) Explain inverted vehicle drop test.

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Answer: Inverted vehicle drop test:

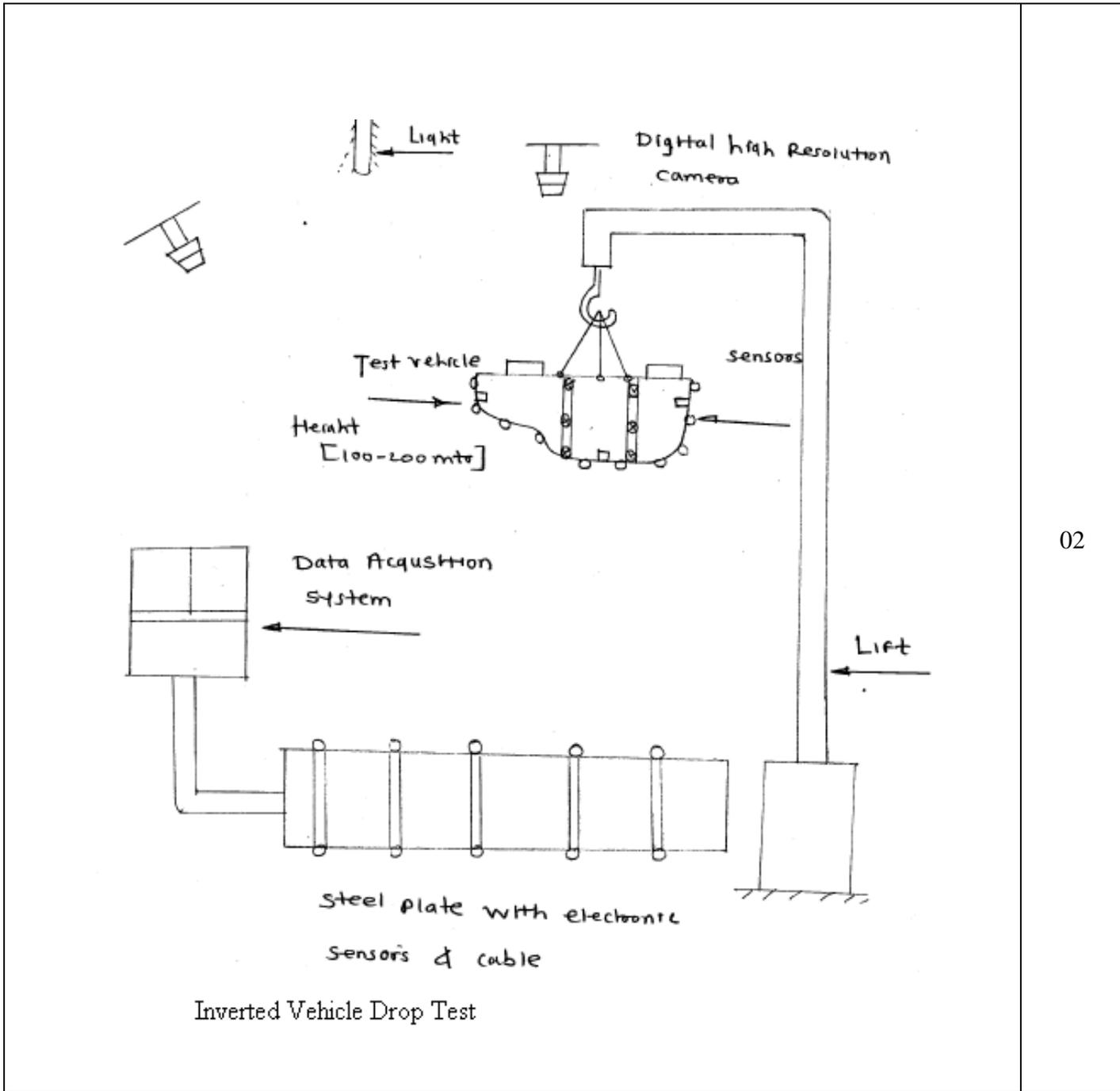
Inverted vehicle drop testing is one of the highly effective means of evaluating the performance of vehicle roof structure. Under a real condition this test is performed to understand the forces and energy applied to it. It may be set to focus the impact on a desired portion of roof structure and drop height can be selected to apply a precise amount of energy.

Instruments required- To conduct this test sophisticated (Special) instruments and procedure are required, high speed digital cameras, load, motion and force sensors, accelerometer, centralized data acquisition computer load cells and quality personnel and engineers are required.

Test preparation- A vehicle which has to be tested should be checked thoroughly. Check the glasses which are assembled on that vehicle should be of laminated glass type. Test site should be at a safe place.

Testing- Hang the test vehicle to the hooks by hydraulic jack. Set the drop height of test vehicle 100-200 mtr. Drop this test vehicle in a steel plate which is mounted on the ground. This steel plate is connected to data acquisition system with the help of load sensors, motion sensors and accelerometer. In this testing we are able to know the percentage deformation of roof, analysis of laminated glass.

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3. Solve **any four** of the following :

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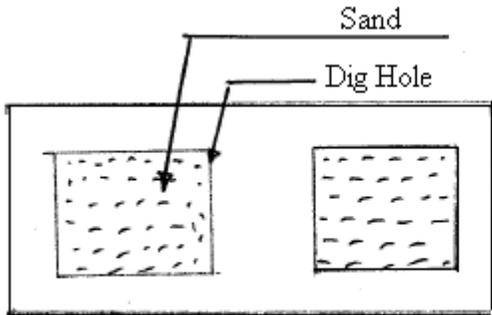
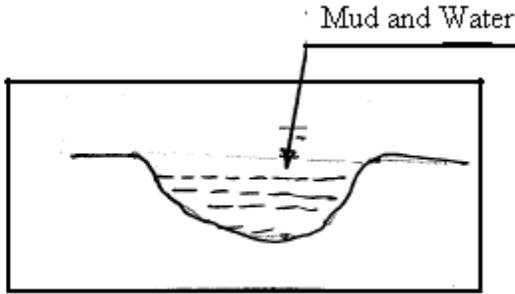
a) Explain sand patch and mud patch.

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Answer: Sand patch and Mud patch:

These patches have been constructed to assess the mobility of army vehicles in sandy and muddy terrain. Both the tracks are 150 mm long and 6 meter wide. The depth of the sand patch is one meter. The depth of mud in mud patch is 150 mm. These test tracks are provided at VRDE Ahmednagar. These tracks are useful to observe the performance of steering, suspension, radiator and directional stability of vehicle.

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<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Figure: Sand Patch</p> </div> <div style="text-align: center;">  <p>Figure: Mud Patch</p> </div> </div>	02										
<p>b) State the different testing instrument required for testing.</p>	4										
<p>Answer: Testing instruments required for vehicle testing: (Any four)</p> <ol style="list-style-type: none"> 1) Digital steering torque measuring device. 2) Digital accelerator pedal force/torque measuring device. 3) Motion, force, speed sensors, and accelerometers. 4) Noise measuring devices like- microphone, recorder, analog to digital signal convertor, transducer etc 5) Engine rpm measuring devices like analog and digital tachometer. 6) Compression gauge, stroboscope, computerized engine analyzer. 7) Petrol /diesel exhaust gas analyzer and smoke meter. 8) Multi-meter, Vacuum tester. 9) Tyre pressure gauge. 10) Engine Scanner. 11) Diesel fuel Injector tester 	1 mark each										
<p>c) State four tyre wear patterns with its causes.</p>	4										
<p>Answer: Tyre Wear Patterns:</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 50%;">Tyre wear pattern</th> <th style="width: 50%;">Causes</th> </tr> </thead> <tbody> <tr> <td> 1) Abnormal tread wear i) Rapid wear ii) One sided wear iii) Scooped wear iv) excessive wear at one point </td> <td> i) operating condition, mechanical condition ii) wheel camber by sagging damage iii) worn or distorted parts iv) Badly adjusted brakes and/or brake drum ovality. Heavy spot repair. </td> </tr> <tr> <td>2) Rapid shoulder wear</td> <td>Under inflation, faulty shock absorbers, weak spring on non-drive wheels.</td> </tr> <tr> <td> 3) Cuts, Damage and separation i) cuts at crown and side wall ii) neglected cuts extending in service iii) Contamination by oil grease </td> <td> i) Loose and sharp stones. ii) deep cuts affecting both tread and plies. iii) softening of rubber to lose its physical properties below satisfactory life </td> </tr> <tr> <td>4) Cracking</td> <td>Due to operation in under inflations /over inflation/ overloading, a going or bad steering conditions</td> </tr> </tbody> </table>	Tyre wear pattern	Causes	1) Abnormal tread wear i) Rapid wear ii) One sided wear iii) Scooped wear iv) excessive wear at one point	i) operating condition, mechanical condition ii) wheel camber by sagging damage iii) worn or distorted parts iv) Badly adjusted brakes and/or brake drum ovality. Heavy spot repair.	2) Rapid shoulder wear	Under inflation, faulty shock absorbers, weak spring on non-drive wheels.	3) Cuts, Damage and separation i) cuts at crown and side wall ii) neglected cuts extending in service iii) Contamination by oil grease	i) Loose and sharp stones. ii) deep cuts affecting both tread and plies. iii) softening of rubber to lose its physical properties below satisfactory life	4) Cracking	Due to operation in under inflations /over inflation/ overloading, a going or bad steering conditions	1 mark each
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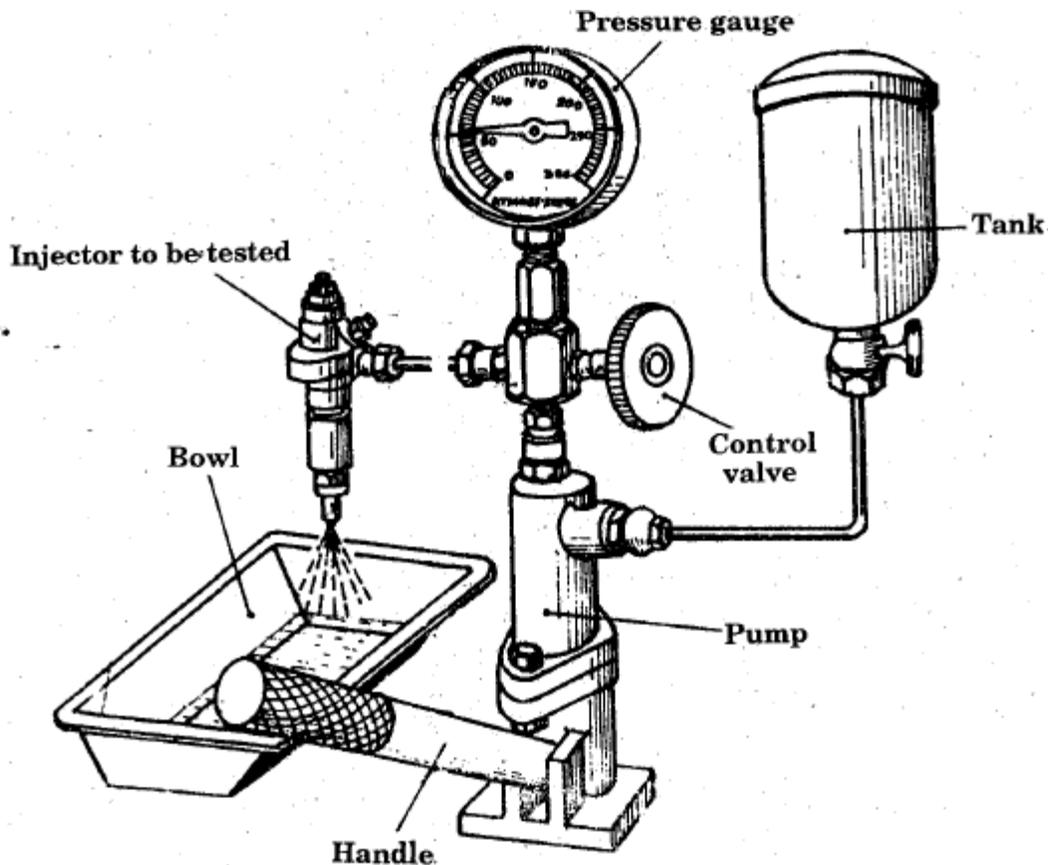
d) How pressure test of fuel injection pump is carried out?

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Answer: Pressure test of fuel injection pump:

- 1) Fix the injector to be tested to the injector pipe of tester shown in figure.
 - 2) Work the hand pump.
 - 3) Note the opening pressure of spray on gauge provided.
 - 4) If the pressure is less, it is increased by loosening the check nut and tightening the adjusting screw.
 - 5) If it is more than the specified, the adjusting screw is loosened.
 - 6) After adjusting pressure, lock the locknut and replace the cap
- In some makes of nozzles, shims are added or removed instead of adjusting screw.

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Figure : Mechanical Fuel Injector Tester

e) What is production part approval process?

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Answer: Production part approval process:

It is used in automotive supply chain to establish confidence in component suppliers and their production processes. To obtain an approval supplier has to provide sample parts and documentary evidence showing that-

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- 1) The client requirement have been understood.
- 2) The product supplied meet those standard/requirements.
- 3) The process is capable of producing conforming product
- 4) The production control plan and quality management system will prevent non- conforming

product reaching the client or compromising the safety and reliability of finished vehicles.

Key Elements of Production Part Approval Process (PPAP) are:

- 1) Design records.
- 2) Authorized Engineering change Note document.
- 3) Engineering Approval.
- 4) Design Failure Mode & Effect Analysis (DFMEA) etc.

4 A) Solve **any three** of the following :

12

a) How speedometer and odometer test is carried out?

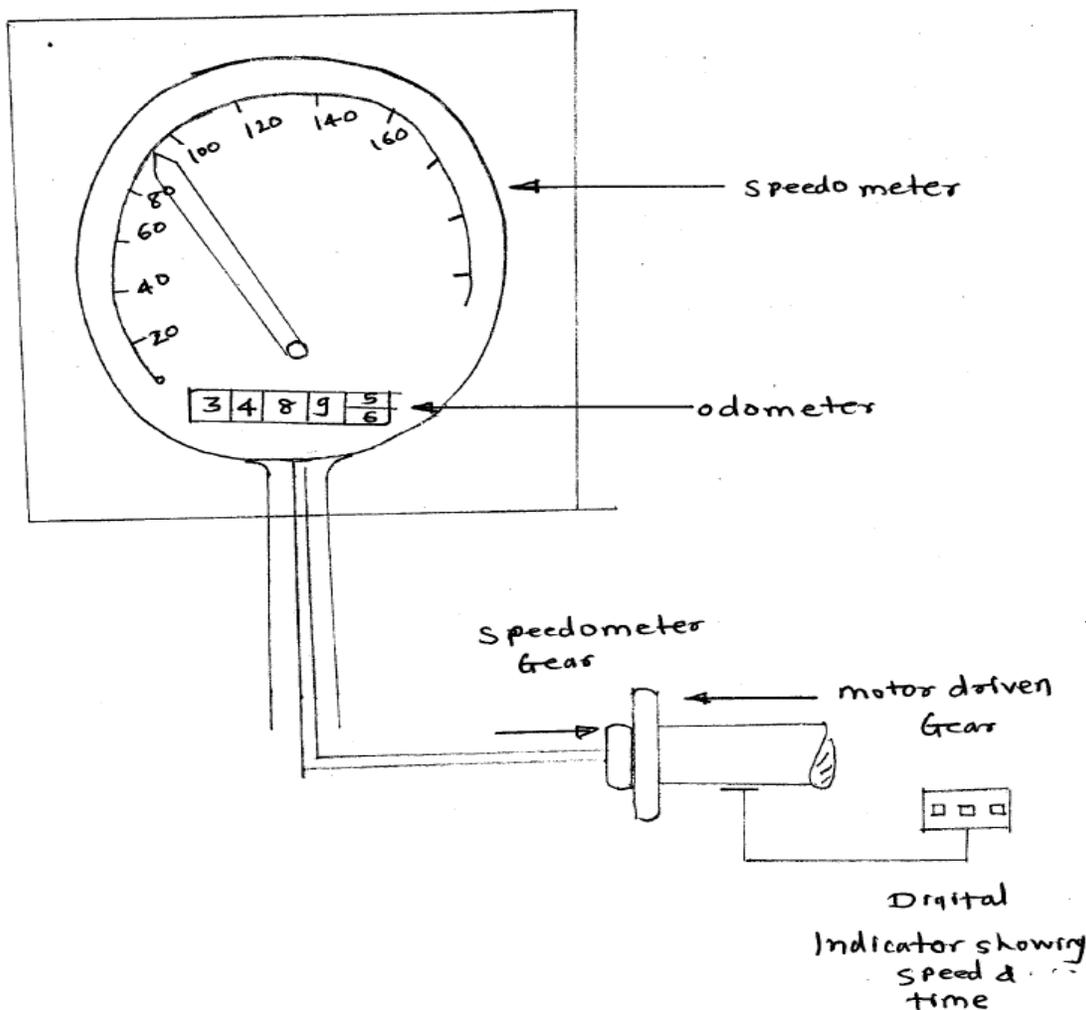
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Answer: Speedometer and odometer testing is carried out in the laboratory as well as on the field

Laboratory Test-

1. Speedometer cable is connected to the electric motor by means of gear and adapter. Electric motor is calibrated.
2. Electric motor shows the speed and time of test, digitally on board.
3. Run the motor at constant speed, consider 5000 rpm, for 10 Min. Find out the distance.
4. Distance and speed shown by motor and speedometer-odometer is equal, we can say odometer is working properly, otherwise malfunctioning.

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Figure: Speedometer and Odometer Test



b) What are the different causes of tyre wear and how it is identified?	4
<p>Answer: Causes of tyre wear: (Any four)</p> <ol style="list-style-type: none">1) Incorrect Inflation - identified by visual inspection2) Incorrect caster, camber or toe-in – identified by actual measurement.3) Excessive road speed – indicated on vehicle speedometer.4) Excessive braking or violent acceleration and braking – experienced during driving.5) Worn out steering mechanism – identified by experiencing noise, vibration and unease.6) Worn out king-pins – identified by checking king-pin inclination.7) Misalignment of wheels – by checking wheel steering geometry factors, frame misalignment.8) Out of balance wheel - by checking wheel imbalance.9) Incorrect tyre inflation – by checking air pressure.10) Defective brakes – by test drive.11) Over-loading – Loading the vehicle beyond its designed load carrying capacity.12) Incorrect toe-out on turn – by actual measurement of toe-out.	1 each
c) State the importance of vehicle testing?	04
<p>Answer: Importance of vehicle testing:</p> <p>Vehicle testing is important because it ensures satisfactory performance, road worthiness, better fuel economy and to meet design standards and customer satisfaction. It is done as a legislative requirement and certification and validation. Parameters like- safety, performance, mobility and endurance running are checked during testing.</p> <ol style="list-style-type: none">1) Routine test-These test are performed by manufacture to determine or demonstrate that vehicle manufacture give a performance of specified standard2) Fault finding test-To assesses the condition of an existing vehicle to diagnose any faults which may have developed with its use overtime.3) Test of a new or modified types of vehicle-To determine the effect of certain changes on engine performance so as to design a new vehicle, engine, component4) Research test-To investigate the new phenomena observed in the running vehicle to design better vehicles.	04
d) Explain calibration and phasing.	04
<p>Answer: Calibration and Phasing :</p> <ol style="list-style-type: none">1) Calibration of F.I.P.: The fuel injection pump is calibrated for efficient delivery. There is a testing machine for this purpose. For testing the pump is first placed on the testing machine. Its engine is then rotated till it attains a speed of 2000 rpm. The quantity of the diesel oil applied from each pump elements is measured. If these quantities are more or less same it may be said that the pump is delivering properly to all cylinders.2) Phasing of F.I.P.: The camshaft of the pump rotates at half the speed of the crankshaft. Therefore the supply of oil from each plunger should be at 90° difference for a four-cylinder engine. This means that the timing of fuel delivery and cut-off between one cylinder and the other should be 90°. The adjusting of fuel pumps at correct timing intervals is known as the ‘phasing of the pump’.	02 02

B) Solve **any one** of the following

06

a) Write barrier collision test with vehicle acceleration and occupant loading.

Answer: Barrier collision test :

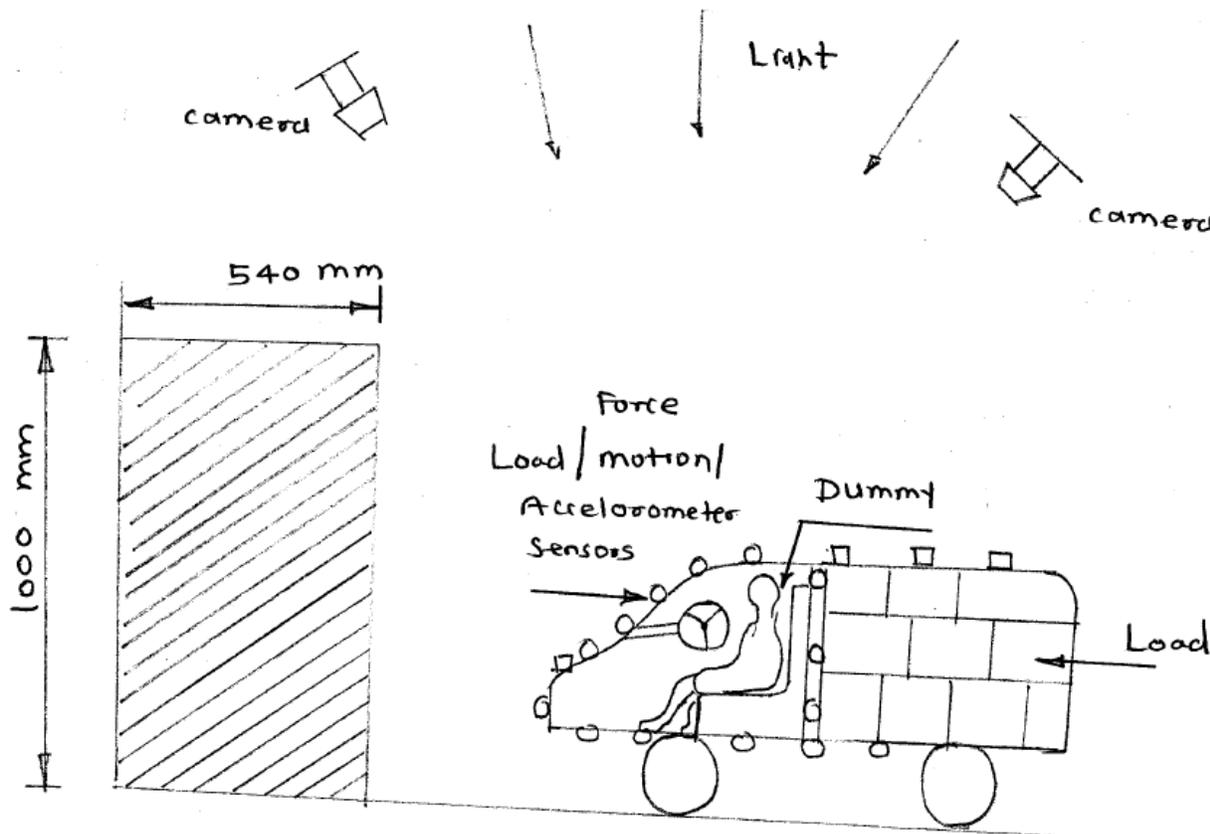
Test preparation-

Consider a concrete wall which has 1000 mm in height and 540 mm in width. At test laboratory there should be sufficient light, high speed cameras, test vehicle with dummies inside, quality personnel. Standard procedure should be followed with testing instruments which are necessary to measure the different parameters for calculation and analysis purpose.

Testing:

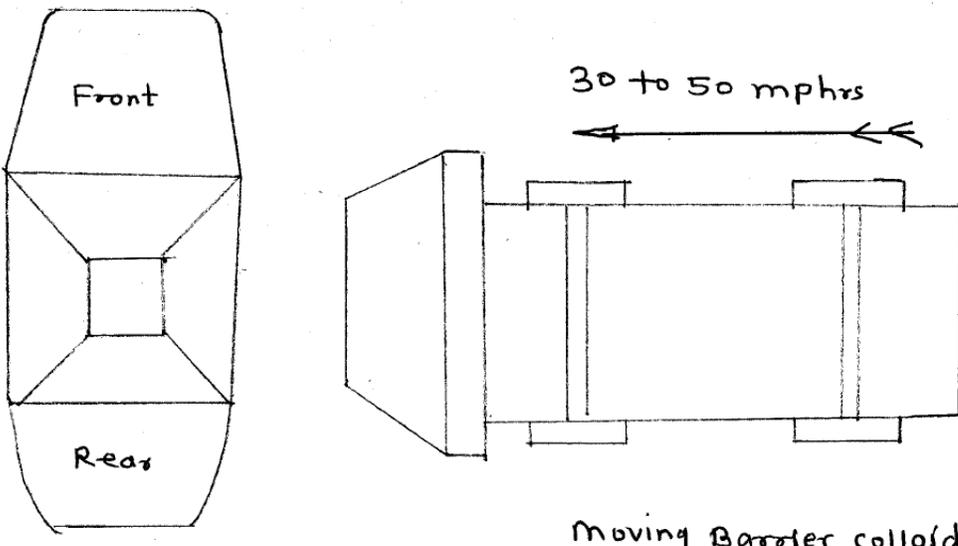
1. Check the test vehicle with brakes, oil, air, fuel, control. Placed dummies inside vehicle at driver seat and passenger seat. Passenger compartment are filled with load (like Boxes).
2. From a specified distance accelerate the test vehicle from 0 to 70 kmph. Impact the test vehicle on this concrete barrier.
3. Record all these data to the data acquisition for further study and analysis.
4. By conducting these test we able to find out the causes which are responsible for death of driver, passenger. By removing these problem star rating vehicle gets improved and accidental death rate is reduced .

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Figure: Collision test with vehicle acceleration and occupant or load

<p>b) State and explain the moving barrier collision test.</p>	<p>06</p>
<p>Answer: moving barrier collision test:</p> <p>Test preparation- The test site should be closed circuit in laboratory. Moving barrier collision test is conducted by placing the test vehicle at center. Moving barrier should be placed at a specified distance. Check its brake, oil, steering, air etc. All testing equipment, quality personnel should be ready and at a safe distance from test site.</p> <p>Testing:</p> <p>Moving barrier collision test is performed by three ways. Moving barrier is collided on a test vehicle (Rest/Moving) from front side, from side and from rear side. Inside the test vehicle dummies are placed. This is like human being. Dummies are exactly like human height, weight, look etc. Impact the collider on test vehicle with a speed of 30 to 50 Miles per hour from sideways as shown in fig. All the records and data are gathered and stored in data acquisition computer system for study, research, development and analysis purpose. These test are important for improving star rating and safety instrument's, better design.</p> <div style="text-align: center;"> <p><u>Lab test.</u></p>  <p>Car</p> <p>Moving Barrier collider</p> <p>moving Barrier collision test</p> </div>	<p>04</p> <p>02</p>
<p>5) Solve any four of the following :</p>	<p>16</p>
<p>a) State any four ARAI Standards.</p>	<p>04</p>
<p>Answer: ARAI Standard: (Credit may be given to any other appropriate ARAI standards).</p> <ol style="list-style-type: none"> 1. AIS 005 Automotive vehicle- Safety belt assemblies-specification 2. AIS 006 Automotive vehicle- Bumper fitment on M1 vehicle-test method 3. AIS 015 Automotive vehicle- Safety belt anchorages specifications 4. AIS 021-Field of vision on motor vehicle drivers for M1 category vehicle 	<p>01 each</p>



b)What is the meaning of sampling test?	04
Answer: Sampling test: All new manufactured vehicles are not tested in industry as well as at VRDE. Only samples means randomly some vehicles are selected. For example 200 vehicles are manufactured in industry, out of them 5-10 nos vehicle are tested thoroughly inside the industry. These vehicles are also tested in industrial tracks and field. When manufacturer send some vehicle to the ARAI and VRDE. Example-Mahindra xylo model equipped with 1.Antilock brake system, 2.Without Antilock brake system 3. With Traction control. 4. Without Traction control 5.With electronic stability program 6. Without electronic stability program etc. for testing purpose	04
c) Define the term yaw, pitching, roll and larch.	04
Answer: 1)Yaw: A yaw rotation is a movement around the yaw axis of a vehicle. 2)Pitching: The moment of vehicle along x-axis due to forces in z-direction is called pitching. 3) Roll: The longitudinal axis passes through the plane from nose to tail. Rotation about this axis is called roll. 4) Lurch: Vehicle Lurch is defined as, an condition of vehicle moving on an abnormal road with lots of obstacle & disturbances or vehicle movement due to sudden rolling & pitching is vehicle Lurch.	01 mark each
d) Define the following terms 1) Acceleration 2) Driveability 3) Gradeability 4) Restatability	04
Answer: 1. Acceleration: It is defined as rate of change of velocity with respect to time. Acceleration at vehicle level performance shall be expressed as a time in second – to cover a distance of 1000 m from start or to achieve a speed of 90 kmph. 2. Driveability:- It is an ability to drive the vehicle on various testing track without much more effort and fatigue. 3. Gradeability:- The gradiability of vehicle is the maximum gradient on which the vehicle can start climbing from stand still condition, with all the wheels of vehicle on the gradient at the start. 4. Restartability:- It is ability of vehicle to start the vehicle with loading or without loading condition on different road conditions like gradient, shallow water trough, sand and mud patch.	01 each

3. **Quality personnel**- It is authorized person who note down the readings, records and changes. His suggestion is written on vehicle test paper.

4. Other essential requirements for testing are accuracy, repeatability, realistic, reproducible, traceable, consistency, versatility and safe

c) How dry and wet test of compression is carried out?

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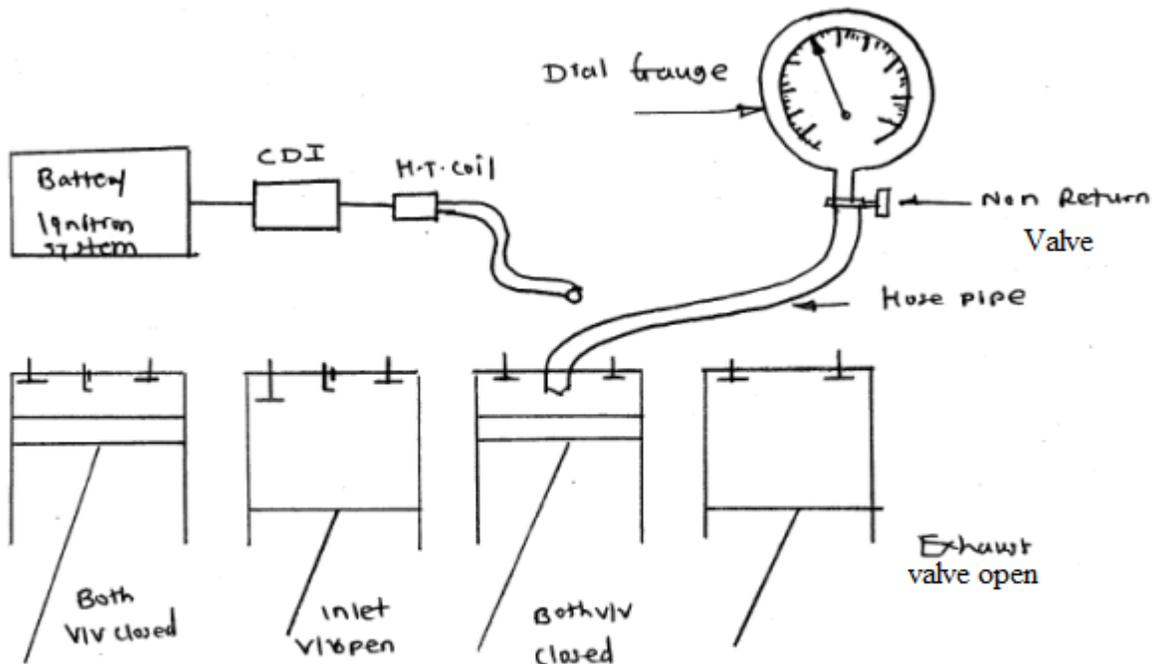
Answer: Dry and wet compression test:

1) **Dry Compression Test:** Connect the gauge with the first cylinder, start the engine with the starter motor and count the number of impulses of the gauge needle before gets it to maximum value. Record the readings and release the gauge pressure. Repeat the procedure for all the other cylinders operating. The stator motor in each case to give the same number of gauge pulses as in the first case.

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2) **Wet compression Test:** It is done in the same way as dry compression test except that a small quantity of heavy oil is injected through the plug/injection hole into the cylinder to be tested. This oil will temporarily seal the piston when it is reciprocating in the cylinder. The cylinder compression test is done for each cylinder, the readings recorded & the results compared with the recommended data. The individual reading should not vary by more than one bar from each other.

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Figure: Wet and Dry Compression

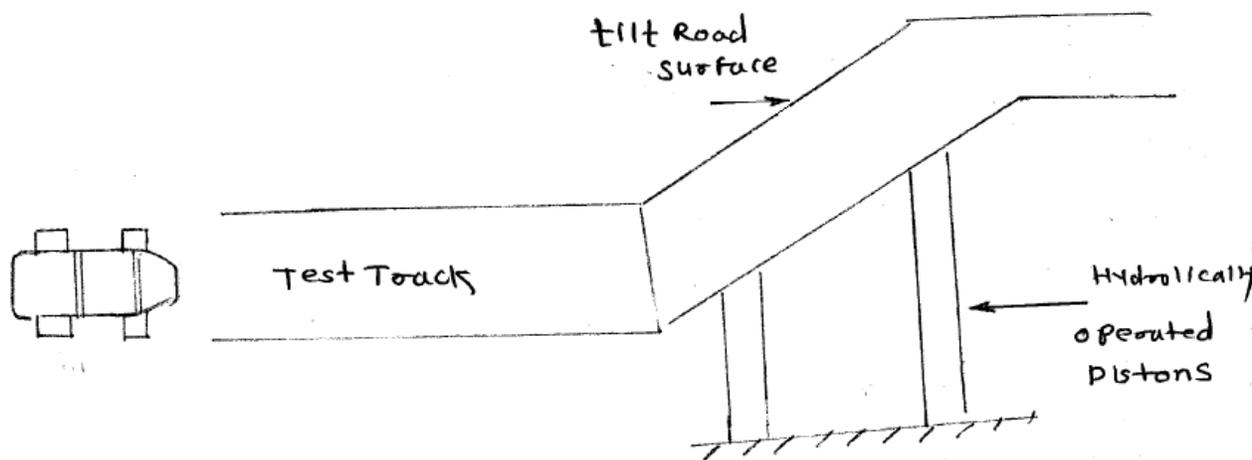
d) Explain Roll over test without collision.

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Answer: Roll over test without collision:

Government highway safety administration, VRDE, NHTSA are organized the 24 full scope Roll over crash tests to investigate the vehicle and occupants dynamics during roll over test. These test are performed by using instrumental dummies seated in driver as well as passenger seat. Vehicle is run on test track at 40-60-80 kmph as shown in figure. Test track is equipped with a tilting platform operated by hydraulically. When vehicle passes these platform and fall down and roll, high speed camera and sensors record all the data to investigate the dynamics of vehicle and safety of passenger and driver

02



02

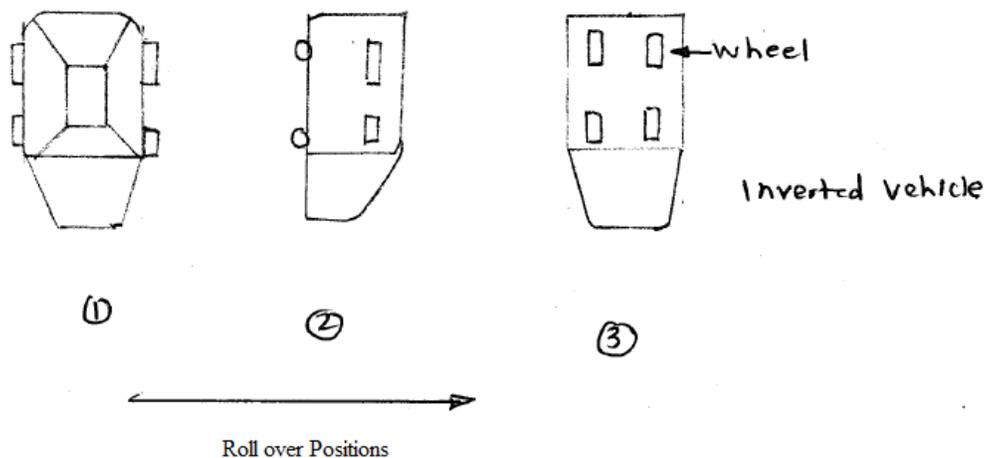


Figure: Roll over Test without collision



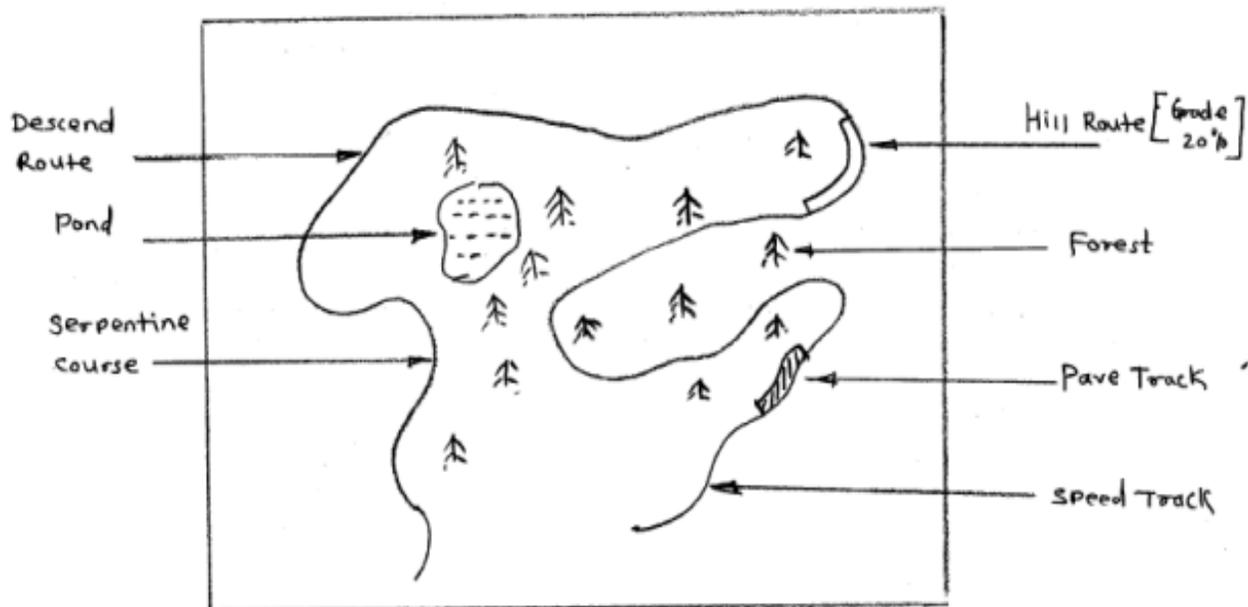
e) Write specification of cross country track.

04

Answer: Specification of cross country track:

A cross country circuit is of about 7 km in length which includes rough roads, loose road metal, marshy patch, severe undulations has been laid along the periphery of the area. The width of track is 3 m.

02



02

Figure: Cross Country Track