

**BHARTIYA SKILL DEVELOPMENT UNIVERSITY**

School of Automotive skills

Session: 2019-20 (Summer Semester)

B. Voc. Program, Third Semester,

End-Sem. Examination

Course Code: AUT1101

Time: 2 Hours

Course Name: Automotive Power Train, Chassis & Suspension

Max. Marks: 50

Instruction:

1. Answer all questions from section – A, each question carries one mark.
2. Answer all questions from section – B, each question carries Four marks.
3. Answer all questions from section – C, each question carries Six marks.

Section – A

10X01 = 10 Marks

1. Full form of ECU is...
 - a) Engine control unit
 - b) Electronic connection unit
 - c) Electrical control unit
 - d) Electric connection unit
2. If the air-fuel ratio in a spark ignition engine is too rich, then air-fuel ratio is about:
 - a) 18:1
 - b) 15:1
 - c) 10:1
 - d) 12:1
3. Hydraulic braking system works on the principle of...
 - a) Pascal's law
 - b) Gas law
 - c) Both a & b
 - d) None of the above.
4. The correct flow of power through a drive train is:
 - a) Engine- gearbox- clutch- differential- propeller shaft- axle- wheels.
 - b) Engine- propeller shaft- gearbox- axle- clutch- differential- wheels
 - c) Engine- clutch- gearbox- propeller shaft- axle- differential, wheels
 - d) Engine- clutch- gearbox- propeller shaft- differential- axle- wheels.
5. When brake is applied, the kinetic energy converts into ...
 - a) Potential energy
 - b) Heat energy
 - c) Mechanical energy
 - d) All of the above
6. The connecting rod is connected to the piston by...
 - a) Cap bolt
 - b) Gudgeon pin
 - c) Ball bearing
 - d) Screw

BHARTIYA SKILL DEVELOPMENT UNIVERSITY

7. In a diesel engine, the function of a fuel injector is to:
 - a) Mix the air and fuel
 - b) Ignite the air-fuel mixture
 - c) Spray atomized fuel in the cylinder
 - d) Provide flame for ignition
8. The motion of the camshaft is transferred to the valves through...
 - a) Rocker arm
 - b) Piston
 - c) Spring
 - d) Bearing
9. The purpose of break bleeding is to...
 - a) Remove the air from pipeline
 - b) Fill the brake fluid in the pipeline
 - c) Both a & b
 - d) Repair the pipeline
10. A gear assembly, which converts the rotational motion into linear motion is called...
 - a) Spur gear
 - b) Helical gear
 - c) Rack & pinion
 - d) Worm gear

Section – B

04X04 = 16 Marks

1. Write the characteristics of brake fluid.
2. Write any six differences between 2-stroke and 4- stroke petrol engine.
3. What are functions of differential? Explain with neat sketch.
4. What are the various safety practices that must be followed in an automobile workshop?

Section – C

04X06 = 24 Marks

5. Explain the process of general service of a vehicle?
6. Explain the major components of exhaust system.
7. Explain the otto and diesel cycle with the help of PV diagram.
8. Explain synchromesh gear box with neat sketch.

A

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Section – A

10X01 = 10 Marks

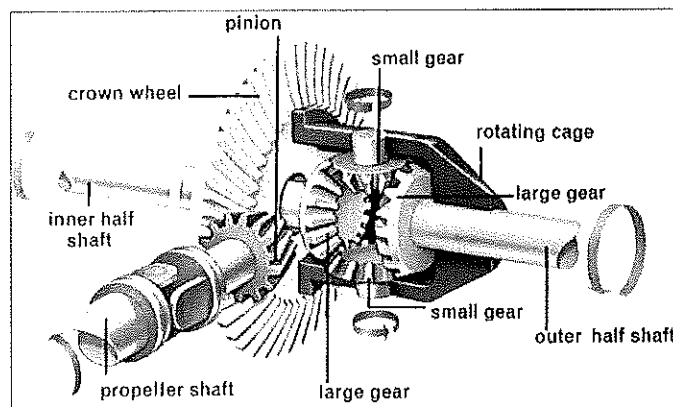
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 - d) 12:1
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 - b) Engine- propeller shaft- gearbox- axle- clutch- differential- wheels
 - c) Engine- clutch- gearbox- propeller shaft- axle- differential, wheels
 - d) **Engine- clutch- gearbox- propeller shaft- differential- axle- wheels.**
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 - a) Cap bolt
 - b) **Gudgeon pin**
 - c) Ball bearing
 - d) Screw

5.	Removal of exhaust gases comparatively difficult.	Removal of exhaust gases easy
6.	Mostly high speed engines are in this type.	All speed types are possible.

3. What are functions of differential? Explain with neat sketch.

Ans. In case of automobiles, the differential has three functions:

- To transfer power from engine to wheels.
- To act as the final gear reduction in the vehicle after the gearbox.
- Allows wheels to **rotate** at different speeds.



4. What are the various safety practices that must be followed in an automobile workshop?

Ans. The various safety practices are as follows:

- Always wear a safety helmet in the workshop, especially when working under the vehicle.
- Wear cotton hand gloves when working or carrying out repairs or service on a vehicle.
- Wear face masks to cover your nose and mouth.
- Wear safety goggles when working under the vehicle.
- Do not wear rings, watches and loose clothes when working on a vehicle.
- Keep the shop floor clean and tidy.
- Wear safety shoes in the workshop.
- Use specific and tool for a specific job.

Section – C

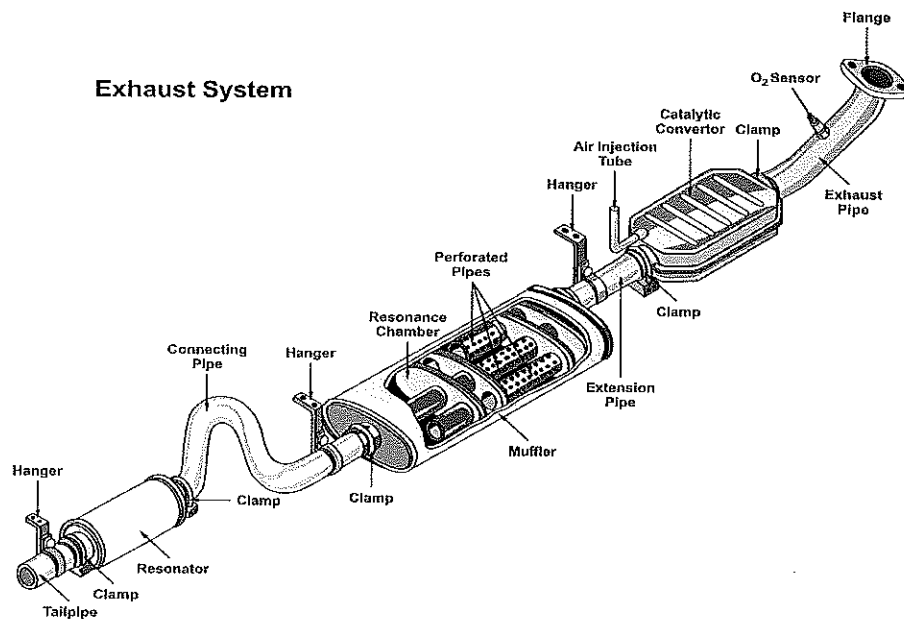
04X06 = 24 Marks

1. Explain the process of general service of a vehicle?

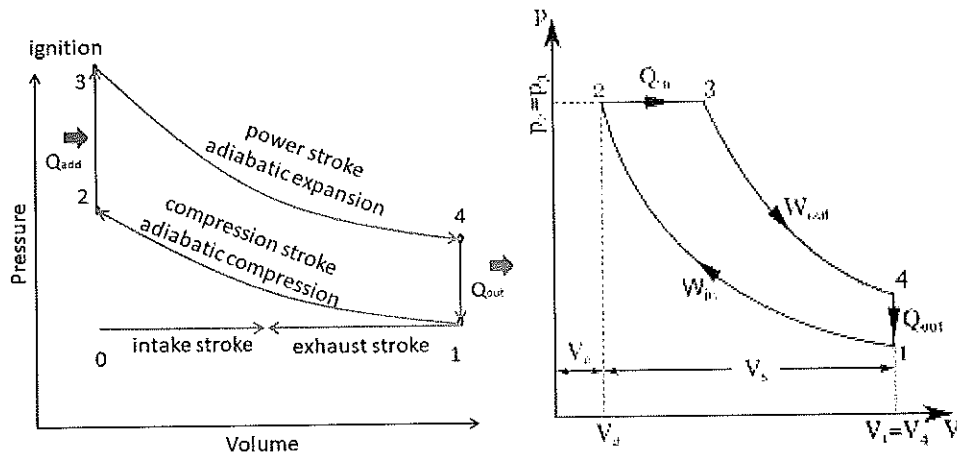
Ans. The engine service includes:

- Engine oil change
- Oil filter /Air filter change
- Cooling system maintenance
- Spark plug/fuel injector check
- Timing chain service
- Sealing /gasket check
- Internal parts like piston rings, bearings, and valve train components check
- Engine removal and installation.

2. Explain the major components of exhaust system.



3. Draw the PV diagram of otto and diesel cycle.

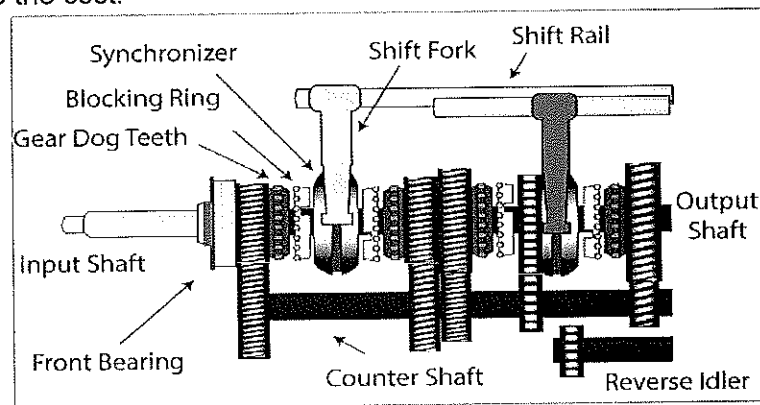


Ans.

4. Explain synchromesh gear box with neat sketch.

Ans. This type of gearbox is similar to the constant mesh type in that all the gears on the main shaft are in constant mesh with the corresponding gears on the lay shaft. The gears on the lay shaft are fixed to it while those on the main shaft are free to rotate on the same.

Its working is also similar to the constant mesh type, but in the former there is one definite improvement over the latter. This is the provision of synchromesh device which avoids the necessity of double-declutching. The parts that ultimately are to be engaged are first brought into frictional contact, which equalizes their speed, after which these may be engaged smoothly. Figure shows the construction and working of a synchromesh gearbox. In most of the cars, however, the synchromesh devices are not fitted to all the gears as is shown in this figure. They are fitted only on the high gears and on the low and reverse gears ordinary dog clutches are only provided. This is done to reduce the cost.





School of Automotive Skills
Session: 2019-20 (Summer Semester)
B. Voc. Program, 1st Semester,
End-Sem. Examination

Course Code: AUT1102

Time: 2 Hours

Course Name: Automotive Wheel Care and Steering System

Max. Marks: 50

Instruction: (if any)

Section – A

10X01 = 10 Marks

Q 1. Weight Positioning Measurement (WPM) is associated with which of the following:

- A. Wheel Alignment
- B. Tyre Changer
- C. Wheel Balancing
- D. Tyre Balancing

Q 2. The purpose of the steering system of an Automobile is to:

- A. Achieve angular motion of the wheels
- B. Provide Directional Stability during straight motion
- C. Straight Ahead recovery after completing the turn
- D. All of the Above

Q 3. Which one of the following is not a tool?

- A. Pincers
- B. Screws
- C. Wrench
- D. Pliers

Q 4. In EPS, the rotating torque according to the required power-assist calculations is provided by:

- A. Reduction Gear
- B. Electric Motor
- C. Hydraulic Pump
- D. ECU

Q5. The device intended primarily for connecting the steering wheel to the steering mechanism or transferring the driver's input torque from the steering wheel is known as:

- A. Universal joint
- B. Worm and wheel
- C. Steering column
- D. Steering bush

Q 6. If a tyre is designed to work below a temperature of 7 degree C, then it is a:

- A. Summer Tyre
- B. Winter Tyre
- C. All season Tyre
- D. Run Flat Tyre



Q 7. Tyre Changer is used for:

- A. Mounting and Dismounting Wheels
- B. Mounting and Dismounting Tyres
- C. Mounting and Dismounting of Clutch
- D. None of the above

Q 8. Angular motion of wheels in an automobile is achieved by:

- A. Suspension System
- B. Steering System
- C. Braking System
- D. All of the Above

Q 9. Which of the following is **not** a function of Steering system?

- A. To achieve angular motion of front wheels
- B. Provide perfect rolling motion to the wheels
- C. Distribute the power in wheels while turning
- D. Straight ahead recovery after turning

Q 10. The Hydraulic Power Steering is based on:

- A. Newton's laws of motion
- B. Bernoulli's theorem
- C. Pascal's law
- D. None of the Above

Section – B

04X04 = 16 Marks

Q 11. What essential safety equipment are required while working in the wheel care section of an Automotive Workshop? Also mention the use of each safety equipment.

Q 12. Write a short note on:

- a. Aspect Ratio
- b. Load Index

Q 13. Define, Camber, Castor & Toe angles of wheel geometry.

Q 14. A) Write the Pascal's law. Which type of steering systems are based on Pascal's law?

B) What will you understand from the following inscription on side wall of a tyre?

"P215/65R15 95H"

Section – C

04X06 = 24 Marks

Q 15. Explain the components & working of a Hydraulic Power Steering System with the help of a diagram.

Q 16. Suppose you are a wheel care technician in a workshop and a customer complaint about pulling of vehicle steering to left side, how will you identify the problem and resolve it? Describe the steps in detail.

Q 17. What are the possible reasons of experiencing vibrations on steering wheel, particularly driving at high speeds? How this problem can be resolved? Explain the steps in detail.

Q 18. Explain the classification of tyres based on season and application.



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- C. Pascal's law**
- D. None of the Above

Section – B

04X04 = 16 Marks

Q 11. What essential safety equipment are required while working in the wheel care section of an Automotive Workshop? Also mention the use of each safety equipment.

➤ Safety goggles:

If you are working in workshop, then you should always wear safety glasses. Because some time stones, dust particles available on wheel and when wheel is rotating then it gone into your eyes so you must wear safety glasses with side protection.

➤ Safety gloves:

This type of glove can provide protection against some moderate concentrated chemicals. The risk of cuts and abrasions also can be minimized by wearing gloves.

➤ Helmet:

Helmet will protect the user's head against: impact from objects falling from above, by resisting and deflecting blows to the head.

➤ Safety shoes:

A steel-toe boot is protective reinforcement in the toe which protects the foot from falling objects or compression, usually combined with a mid-sole plate to protect against punctures from below.

Q 12. Write a short note on:

a. Aspect Ratio

The fourth and fifth digits of the tyre code that immediately follow the tyre width. So an aspect ratio of 55 for example means that the profile height of the tyre is 55% of its width.

b. Load Index

The load index provides information on the maximum weight capability for the tyre. The load index is a numerical code that can be located just after the tyre size marking and before the speed rating.

Q 13. Define, Camber, Castor & Toe angles of wheel geometry.

Camber:

This suspension angle shows how the tire angles away from 0 degrees vertical when viewed from either the front or rear of the vehicle. Expressed in degrees, negative camber means the top of the tire tilts toward the centre of the vehicle, while positive camber means the top of the tire tilts away from centre. A visual cue for a camber problem is excessive tire wear on the inner or outermost ribs.

Caster:

This angle shows the forward or backward slope of a line drawn through the upper and lower steering pivot points, when viewed directly from the side of the vehicle.

Also expressed in degrees, caster is measured by "comparing a line running through the steering system's upper and lower pivot points to a line drawn perpendicular to the ground,"

Toe:

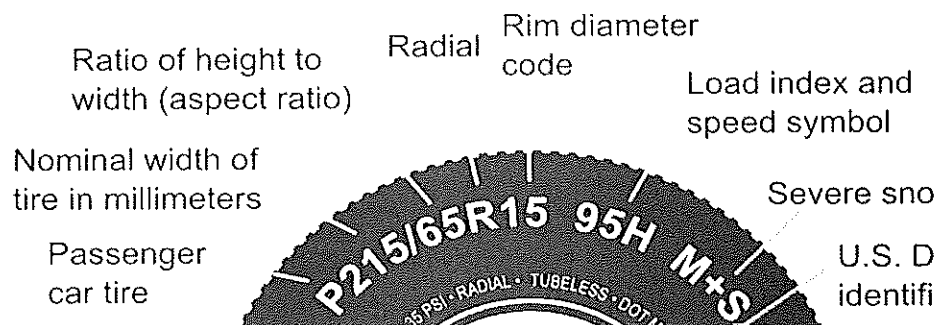
Identifies the direction tires are pointed relative to the centreline of the vehicle, when viewed from directly above. Toe can be expressed in either degrees or fractions of an inch.

Q 14. A) Write the Pascal's law. Which type of steering systems are based on Pascal's law?

In this system fluid pressure from the pump is used to push against a piston. When the wheel is turned, pressure flows to one side and the piston moves. The piston is attached to the **steering** gears. Hydraulic pressure does the **work**, and the driver controls the direction by turning the **steering** wheel.

B) What will you understand from the following inscription on side wall of a tyre?

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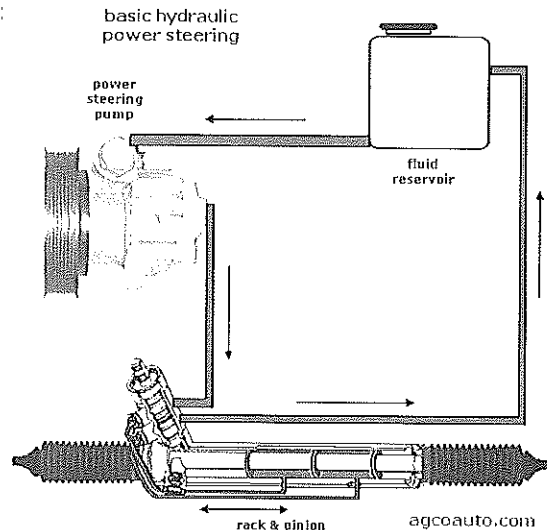


Section – C

04X06 = 24 Marks

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Q 16. Suppose you are a wheel care technician in a workshop and a customer complaint about pulling of vehicle steering to left side, how will you identify the problem and resolve it? Describe the steps in detail.

Step 1: Depending on your alignment equipment, enter the vehicle year, make, model and design into the system's computer to determine the OEM (Original equipment manufacturer) alignment specifications. That data will be compared to the vehicle's actual alignment status to determine necessary corrections. Some systems allow you to simply scan the VIN to recall specs.

Step 2: Next, drive the vehicle onto your alignment rack. Chock wheels and raise lift to a comfortable and safe work height.

Step 3: Next, check and adjust tire pressures to OEM (Original equipment manufacturer) specification; some systems have an automatic inflation feature. Remove hubcaps if present.

Step 4: Mount targets to wheel ends as required by the rack manufacturer. Most alignment racks require the alignment heads be attached to all four wheels, even if no adjustments are made to the rear wheels. With many FWD vehicles, adjustments can be made to the rear and should be performed before the front wheel alignment adjustments are made.

Step 5: Depending on your alignment equipment and system, there are unique procedures that will measure the current camber, caster and toe angles of the vehicle and report that information either on a print-out or on a diagnostic screen. Some systems even print a "symptom report" that you can show the customer, which explains the potential damage to tire health if alignment issues are not corrected.

Step 6: As previously mentioned, if the rear alignment needs to be adjusted, this has to be performed before working on front-end adjustments, analyse each job and presents the optimal action sequence with the minimum steps required.

Step 7: With front-end alignments, correct caster and camber adjustments first. Certain FWD vehicles do not offer caster adjustments, but correcting the camber may bring the caster within specs. Refer to the alignment machine instructions (or a repair manual) for the specific vehicle to perform the correct caster and camber adjustments.

Step 8: With caster and camber adjusted, then adjust toe angles.

Step 9: Restart the car, remove the steering wheel lock, turn the steering wheel back and forth a couple times, then re-centre and replace the steering wheel lock. Recheck alignment specifications, and then readjust angles as necessary.

Step 10: Remove the alignment heads and lower the vehicle.



Step 11: Complete the alignment by taking a test drive to ensure any previously noted symptoms are gone or can be attributed to other vehicle issues (such as vibrations caused by worn suspension parts).

Note: Again, every alignment system maker has its own unique process. It is important that you follow their specific operating instructions, ensure a straight steering wheel without repeated adjustments or using a steering wheel holder."

Q 17. What are the possible reasons of experiencing vibrations on steering wheel, particularly driving at high speeds? How this problem can be resolved? Explain the steps in detail.

Balancing Steps:

Step 1: Put safety first.

Before you can begin to do anything, make sure you are protected by wearing some safety equipment. Make sure you are wearing steel toes boots, long pants, safety glasses or goggles, and gloves.

Step 2: Ensure you have proper tires.

Make sure the tyres that you have on the rims are good for the road. No cracks on the sidewall, and to have at least (50%) of tread depth.

Step 3: Make sure you have no centre caps and wheel weights.

Before mounting the wheel onto the machine, make sure you have your centre caps off (if you have them), and the old wheel weights from the previous balancing off. This is to ensure that you get the most accurate results from the machine.

Step 4: Mount the wheel.

After you have done all the previous steps, you can now safely mount your wheel onto the machine. Once it is on, double check to make sure that the wheel is snug tight.

Step 5: Measure the wheel.

Once the wheel is on, the machine will want to know the size of the rim. You will have to measure the height of the rim, as well as the width.

Step 6: Select your vehicle.

Depending on the machine you're using, it may have a feature which allows you to choose what type of vehicle this wheel will be going on so it can put the proper amount of road force when it's being tested.

Step 7: Enter proper tire pressure accordingly to your vehicle specifications.

If you don't do this before closing down the hood, it will ask you if you have done it or not to be a reminder.

Step 8: Start.

Once you have measure your rims and have chosen the proper type of vehicle, you can simply presses start or close the hood.

Step 9: Install wheel weights.

Once the machine has finished testing the road force and balance the wheel, it will tell you how much weight it wants and what side of the wheel.

Step 10: Rebalance.

Once you have install the wheel weights, you want to rebalance the wheel to make sure you added the proper amount of the wheel weights, and at the proper spot of the rim it has asked.

Step 11: Finish up.

This means now your wheel is balanced.

Q 18. Explain the classification of tyres based on season and application.

1. Summer Tyres:

Summer tyres are designed to work best during the warmer summer months.

They are created with a specific tread pattern for optimal performance on both dry and wet roads when the air temperature is above +7°C.



Winter tyres:

look very similar to summer tyres but are specially developed to provide additional driving performance in winter conditions. It is a common misconception that winter tyres are only for driving in the snow.

Winter tyres are designed to work best in conditions below +7°C, so even in wet and icy conditions, you'll benefit from their superior grip and handling.

3. All season tyres

essentially combine elements of summer tyres and winter tyres.

To create a tyre that has benefits of both so that they can be used all-year round, giving drivers peace of mind whatever the weather throws at them.

While all season car tyres are not likely to match the performance of specialist summer or winter tyres during these respective seasons, they provide a good all-round mix of strengths.



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End-Sem. Examination

Course Code: AUT1103

Time: 2 Hours

Course Name: Automotive Body Repair

Max. Marks: 50

Instruction:

1. Answer all questions from section A, each question carries one mark.
2. Answer all questions from section B, each question carries four marks.
3. Answer all questions from section C, each question carries six marks.

Section – A

10X01 = 10 Marks

- Q.1. Which of the following is the operation of cutting a sheet metal through part of its length and then bending the cut portion?
- a. Slitting
 - b. Lancing
 - c. Bending
 - d. Forming
- Q.2. Which of the following is not a shearing process?
- a. Punching
 - b. Drawing
 - c. Blanking
 - d. Parting
- Q.3. Velocity of plasma stream during plasma cutting operation is close to:
- a. 200m/s
 - b. 400m/s
 - c. 600m/s
 - d. 800m/s
- Q.4. Non consumable electrode is used in which of the following welding process?
- a. MMAW
 - b. MIG
 - c. TIG
 - d. MAG
- Q.5. If diameter of the core wire is 2.5 mm then welding current required is:
- a. 50 A
 - b. 100 A
 - c. 150 A
 - d. 200 A
- Q.6. Solder is an alloy of:
- a. Brass and Copper
 - b. Aluminium and Zinc
 - c. Tin and Lead
 - d. Aluminium and Brass
- Q.7. Which of the following is not used as filler material in brazing?
- a. Copper
 - b. Magnesium
 - c. Lead
 - d. Silver



- Q.8. Which of the car does not have D pillar?
- Saloon
 - Wagon
 - Estate
 - MPV
- Q.9. Two door car that generally has either 2 seats or 4 seats in a 2+2 configuration is known as:
- Convertible
 - Cabriolet
 - Coupe
 - Wagon
- Q.10. Rear section of the car is also known as:
- Dog house
 - Cat house
 - Green house
 - None of the above

Section – B

04X04 = 16 Marks

- Q.1. Differentiate between soldering and brazing.
- Q.2. What are the advantages of GMAW over MMAW?
- Q.3. What are the various types of car body section? Name three aggregates of automotive falling in each type of body section.
- Q.4. Differentiate between estate and wagon.

Section – C

04X06 = 24 Marks

- Q.1. Write a short note on the following:
- Punching
 - Lancing
 - Notching
- Q.2. Define Dent and briefly explain various types of dents.
- Q.3. Explain the working principle of plasma cutter with a suitable diagram.
- Q.4. Differentiate between GMAW and TIG. Write at least 8 points.



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- a. Slitting
- b. Lancing
- c. Bending
- d. Forming

Ans. b. Lancing

Q.2. Which of the following is not a shearing process?

- a. Punching
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Ans. b. Drawing

Q.3. Velocity of plasma stream during plasma cutting operation is close to:

- a. 200m/s
- b. 400m/s
- c. 600m/s
- d. 800m/s

Ans. c. 600m/s

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- a. MMAW
- b. MIG
- c. TIG
- d. MAG

Ans. c. TIG



BHARTIYA SKILL DEVELOPMENT UNIVERSITY

- Q.5. If diameter of the core wire is 2.5 mm then welding current required is:
- a. 50 A
 - b. 100 A
 - c. 150 A
 - d. 200 A
- Ans. b. 100
- Q.6. Solder is an alloy of:
- a. Brass and Copper
 - b. Aluminium and Zinc
 - c. Tin and Lead
 - d. Aluminium and Brass
- Ans. c. Tin and Lead
- Q.7. Which of the following is not used as filler material in brazing?
- a. Copper
 - b. Magnesium
 - c. Lead
 - d. Silver
- Ans. c. Lead
- Q.8. Which of the car does not have D pillar?
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- Ans. c. Coupe
- Q.10. Rear section of the car is also known as:
- a. Dog house
 - b. Cat house
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 - d. None of the above
- Ans. b. Cat house



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Section – B

04X04 = 16 Marks

Q.1. Differentiate between soldering and brazing.

Ans.

S.No.	Soldering	Brazing
1	It is used in electrical industries to joint capacitor, resistor, wire etc. to the electronic plate.	It is used in mechanical industries to joint different metals.
2	soldering is done temperature below 400°C	Brazing is done at temperature above 450°C but below the critical temperature of metal.
3	These joint are weaker than brazing joints.	It forms stronger joints.
4	In soldering an alloy of lead and tin is used known as solder.	In brazing an alloy of copper and zinc is used as a filler metal.
5	It is a cheaper process.	It is a costly process.
6	Soldering does not need to preheat the base metal	This process needs preheating of base metal.
7	It is used to join electronic components.	It is used in automotive industries and pipe fitting.
8	This process is very flexible and easy to automate.	It is not easy for automation except automation is done at automotive industries.

Q.2. What are the advantages of GMAW over MMAW?

Ans.

1. GMAW utilizes a consumable electrode continuously supplied from a wire spool. So no intermittent pause is required to replace electrode.
2. In GMAW, inert or active shielding gas is supplied at the welding zone. Electrode contains no flux to produce gas.
3. No flux is associated with this process. So no slag deposition is observed. Thus it eliminates requirement of post processing.
4. GMAW uses more accessories and thus are not suitable for outdoor applications. It cannot be carried out in overhead position also.
5. It can be automated requiring minimum intervention from operator. So it has less tendency of human error.

Q.3. What are the various types of car body section? Name three aggregate of automotive falling in each type of body section.

Ans. Car body section is divided into three major sections:

Front section - Front section includes everything between front bumper and fire wall.

Also called nose section front clip or doghouse



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Eg. Radiator, Grilles, Headlights.

Mid section - Center section or Mid section includes body parts that form passenger compartment. Also known as greenhouse.

Eg. Evaporator, Windows, Seats.

Rear section- Rear section also called tail section, rear clip or cathouse.

Eg. Spoiler, Tail lights, Rear Bumper.

Q.4. Differentiate between estate and wagon.

Ans. Estates have a similar body style to a sedan, but with an extended rear luggage or cargo area and often share the same frontal design to sedan.

Eg. Skoda Octavia Combi

Wagon is the type of vehicle with good combination of hatchback and sedan. These models have advantage of larger space behind the second row. It can be either used for luggage or for putting additional seats as required.

Eg. Nissan Evalia

Section – C

04X06 = 24 Marks

Q.1. Write a short note on the following:

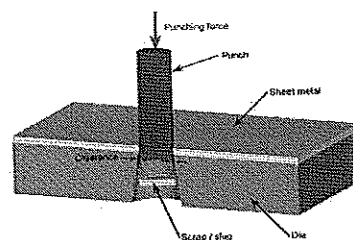
a. Punching

b. Lancing

c. Notching

Ans. a. Punching:

Punching is a shearing process using a die and punch where the interior portion of the sheared sheet is to be discarded.



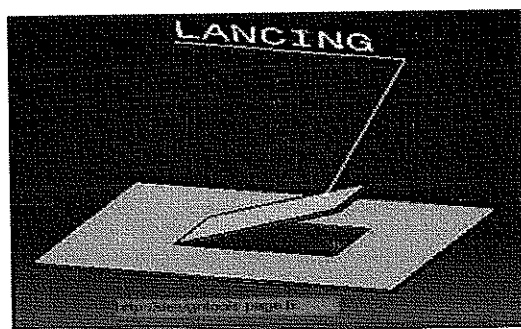
PUNCHING OPERATION

b. Lancing:

Lancing is an operation of cutting a sheet metal through part of its length and then bending the cut portion. i.e. Leaving a tab without removing any material.

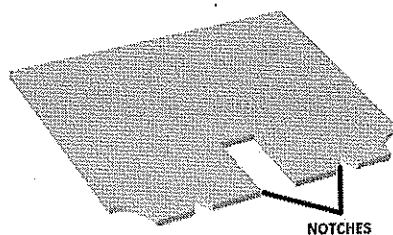


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c. Notching:

Notching is an operation of removing pieces from the edges.



NOTCHING OPERATION

Q.2. Define Dent and briefly explain various types of dents.

Ans. A shallow deformation in the surface of an object, produce by an impact is defined as dent.

The three types of dents you commonly see are:

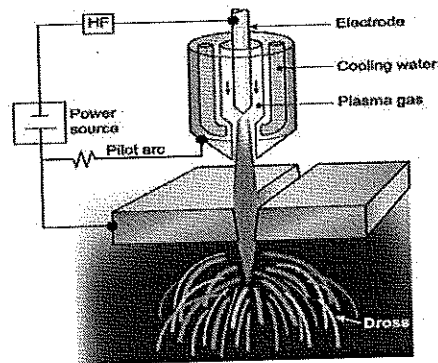
1. Car dings: Car dings are caused by smaller objects and are easy to repair as long as no damage to the vehicles paint has occurred.
2. Round dents: Round dents are caused from hailstones or a similarly round object (football, baseball, basketball, etc.) hitting the car and causing a dimple on the door, bumper, roof or hood.
3. Crease dents: Crease dents usually bends and tears the car's metal. When an automobile acquires a crease type dent, it is possible to lose the metal memory making it hard to repair back to original shape.

Q.3. Explain the working principle of plasma cutter with a suitable diagram.

Ans. Plasma arc cutting is a process resulting from ionizing a column of gas (argon, nitrogen, helium, air, hydrogen or their mixture) with extreme heat of an electric arc. The ionized gas along with the arc is forced through a very small nozzle orifice, resulting into a plasma stream of high velocity (up to 600 m/sec) and high temperature (up to 20000K). When this high speed is reached, high temperature plasma stream and electric arc strike the work piece, and ion in the plasma recombine into gas atoms and liberate a great amount of latent heat. This heat melts the work piece, vaporizes part of the material and the balance is blasted away in the form of molten metal through the heat.



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Q.4. Differentiate between GMAW and TIG. Write atleast 8 points.

Ans.

Gas Metal Arc Welding (GMAW)	Gas Tungsten Arc Welding (GTAW)
GMAW utilizes a consumable electrode. So electrode material melts down and deposits on weld bead.	GTAW or TIG welding uses non-consumable electrode and thus electrode material is not deposited on weld bead.
Metallurgical composition of electrode material is similar to that of parent component.	Electrode is made of tungsten (with minor alloying elements) only.
It cannot be performed in autogenous mode as electrode material deposition is inherent to this process.	It is one favorable arc welding process for autogenous mode welding.
Since electrode provides necessary filler for filling root gap, so no external filler material is applied.	Filler material, if required, is applied externally usually in the form of small diameter rods.
GMAW process can utilize an inert or active shielding gas.	GTAW process mostly utilizes inert shielding gas.
GMAW process is much faster as electrode (or filler) is continuously fed by mechanized system.	GTAW is comparatively slower process. So it is not economically favorable.
GMAW process produces spatter, even if optimum set of parameters are used for welding.	GTAW is one spatter-free welding process.
Weld bead appearance is not so good.	It provides apparently splendid weld bead.
It is comparatively easier process to perform.	An experienced and attentive welder is desired to carry out this process.



School of Automotive Skills
Session: 2019-20 (Summer Semester)
B. Voc. Program, 1st Semester,
End-Sem. Examination

Course Code: AUT1104

Time: 2 Hours

Course Name: Automotive Spray Painting

Max. Marks: 50

Instruction:

1. Answer all questions from section A, each question carries one mark.
2. Answer all questions from section B, each question carries four mark.
3. Answer all questions from section C, each question carries six mark.

Section – A

10X01 = 10 Marks

Q.1 The equipment which is used to purify the breathing air inside a paint booth is known as:

- | | |
|----------------------|----------------|
| a. Mask & respirator | c. Dust mask |
| b. Earplug | d. Hand gloves |

Q.2 Which type of sanding process is recommended by OEM for refinish painting?

- | | |
|----------------|----------------------|
| a. Dry sanding | c. Both (a) & (b) |
| b. Wet sanding | d. None of the above |

Q.3 What is the recommended light intensity inside the paint booth?

- | | |
|----------------|------------------|
| a. 100-200 lux | c. 1000-1500 lux |
| b. 500-800 lux | d. 1500-2000 lux |

Q.4 The equipment used to spread the putty on the surface during surface preparation is known as:

- | | |
|----------------|-------------------------|
| a. Sand block | c. Putty spreader sheet |
| b. Dent puller | d. None of the above |

Q.5 Which nozzle size is required for clear coat application?

- | | |
|-----------|-----------|
| a. 1.2 mm | c. 1.6 mm |
| b. 1.4 mm | d. 1.8 mm |

Q.6 Why plastic panels are used in cars?

- | | |
|--------------------|--------------------------|
| a. Light in weight | c. Reduce the appearance |
| b. More flexible | d. Both (a) & (b) |

Q.7 Which type of paint is environment friendly and safe for the health of paint technician?

- | | |
|---------------|--------------|
| a. Waterborne | c. 2K paint |
| b. NC paint | d. Synthetic |



Q.8 Which sand paper is coarser from the following?

- | | |
|---------|---------|
| a. P800 | c. P320 |
| b. P600 | d. P180 |

Q.9 Which is a best recommended tool for feather edging?

- | | |
|-------------------------|-------------------------|
| a. Angle grinder | c. Double action sander |
| b. Single action sander | d. File |

Q.10 Body filler is applied over.....

- | | |
|--------------------|---------------|
| a. Base coat | c. Clear coat |
| b. Primer surfacer | d. Bare metal |

Section – B

04X04 = 16 Marks

Q.11 Write a short notes on:

- a. DFT
- b. Sander

Q.12 Write about the tools and equipments used in automotive paint shop.

Q.13 What is a self-etching primer? also write its advantages.

Q.14 What are the differences between a primer and a surface primer?

Section – C

04X06 = 24 Marks

Q.15 Explain what is 5S? also explain its advantages in paint shop.

Q.16 Explain different types of hazards associated to refinish painting.

Q.17 Write down the steps of putty application and putty sanding process.

Q.18 What is sanding? Explain types of sanding.



School of Automotive Skills
Session: 2019-20 (Summer Semester)
B. Voc. Program, 1st Semester,
End-Sem. Examination

Course Code: AUT1104

Time: 2 Hours

Course Name: Automotive Spray Painting

Max. Marks: 50

Instruction:

1. Answer all questions from section A, each question carries one mark.
2. Answer all questions from section B, each question carries four mark.
3. Answer all questions from section C, each question carries six mark.

Section – A

10X01 = 10 Marks

Q.1 The equipment which is used to purify the breathing air inside a paint booth is known as:

- | | |
|---------------------------------|----------------|
| a. Mask & respirator | c. Dust mask |
| b. Earplug | d. Hand gloves |

Q.2 Which type of sanding process is recommended by OEM for refinish painting?

- | | |
|-----------------------|----------------------|
| a. Dry sanding | c. Both (a) & (b) |
| b. Wet sanding | d. None of the above |

Q.3 What is the recommended light intensity in the paint booth?

- | | |
|----------------|-------------------------|
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- | | |
|----------------|--------------------------------|
| a. Sand block | c. Putty spreader sheet |
| b. Dent puller | d. None of the above |

Q.5 Which nozzle size is required for clear coat application?

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- | | |
|--------------------|------------------------------|
| a. Light in weight | c. Reduce the appearance |
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Q.7 Which type of paint is environment friendly and safe for the health of paint technician?

- | | |
|----------------------|--------------|
| a. Waterborne | c. 2K paint |
| b. NC paint | d. Synthetic |



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Q.8 Which sand paper is coarser from the following.

- | | |
|---------|----------------|
| a. P800 | c. P320 |
| b. P600 | d. P180 |

Q.9 Which is a best recommended tool for feather edging?

- | | |
|-------------------------|--------------------------------|
| a. Angle grinder | c. Double action sander |
| b. Single action sander | d. File |

Q.10 Body filler is applied over.....

- | | |
|--------------------|----------------------|
| a. Base coat | c. Clear coat |
| b. Primer surfacer | d. Bare metal |

Section – B

04X04 = 16 Marks

Q.11 Write short note on

- a. DFT
- b. Sander

Ans: (a) It is a coating thickness gauge used to measure dry film thickness.

- It is most critical measurements because of its impact on the coating process, quality and cost.

Or

- A coating thickness gauge (also referred to as a paint meter) is used to measure dry film thickness. Dry film thickness measurements can be used to evaluate a coating's expected life, the product's appearance and performance, and ensure compliance with a host of International Standards.

Ans: (b)

A sander is a tool that's used to smooth a vehicle's surface before painting.

- Sanders are useful for a variety of tasks, including removing old paint and varnish, buffing, and polishing.

There are three primary types of sanders for cars:

- Air sanders
- Hand sanders
- Electric sanders

Components of sander:

1. Sanding Pad
2. Air Regulator
3. Trigger
4. Air Inlet
5. Comfort Grip

Q.12 Write about the tools and equipments used in automotive paint shop.

Ans: :

1. **Paint booth**



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Paint booths are walled structures used to safely contain painting and other finishing processes. • Paint booths are present in a variety of industries including automotive, aviation, manufacturing, millworks, and many more.

In general, there are two types of paint booths:

- Non-ducted (open face)
- Directly ducted (enclosed)

2. Paint mixing room:

- Paint mixing room is a place where we mix the paints according to the requirements.
- It should have colour-corrected artificial lighting and downdraft ventilation.
- Paint mix rooms are generally located next to the spray booth to maximise painter productivity.

3. Spray guns:

• The spray gun is the most popular type of spray application equipment used. • A spray gun is a tool which uses compressed air to atomise paint and to apply it to a surface. • Air and material enter the gun through separate passages and are mixed at the air cap in a controlled pattern.

1. Air nozzle assembly
2. Gravity feed cup
3. Gun body
4. Side port control
5. Fluid control knob
6. Air connection

4. Air compressor:

- An air compressor is a device that stores energy in the form of compressed air.
- It converted compressed air back to mechanical energy when using air tools.
- In its basic form, an air compressor has a storage tank, a motor, and pump.

5. Infrared dryer:

What is infrared? • It is a radiant energy/ electromagnetic radiation like X-rays and UV rays.

It is divided into three parts: -

1. Short wave: - less than 2 microns.
2. Medium wave: - between 2 and 4 microns.
3. Long wave: - above 4 microns.

6. Dry film thickness meter:

- It is a coating thickness gauge used to measure dry film thickness.
- It is most critical measurements because of its impact on the coating process, quality and cost.

7. Sander:

A sander is a tool that's used to smooth a vehicle's surface before painting. • Sanders are useful for a variety of tasks, including removing old paint and varnish, buffing, and polishing.



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There are three primary types of sanders for cars:

- Air sanders
- Hand sanders
- Electric sanders

Q.13 What is self-etching primer? also write its advantages.

Ans: This primer is most commonly a lacquer based primer that uses acid to etch bare, clean metal.

- It leaves a good base for urethane primers and top coats and is ideal for small spot repairs.
- When applied over properly prepared metal it has extremely good adhesion qualities.
- Do not apply body filler over top of self-etching primer as it may cause separation of the filler over time.
- Sanding the metal with 80-120 grit sandpaper before applying Self-Etching Primer.

Etches and primes bare, rust-free metal

- Excellent adhesion for top coats
- Do not use with epoxy primers
- Apply over- steel, aluminum, stainless steel, galvanized steel

Q.14 What is the difference between a primer and a primer surfacer?

Ans: **Primer Surfacer** is ideal for improving adhesion of the final topcoat and enhancing paint's color. When brushed or sprayed to metal or fiberglass surfaces, this high build, rust resistant, sandable formula will hide sanding scratches and quickly fills uneven surfaces.

2K Primer Surfacer is a very fast curing, easy sanding **primer** or wet-on-wet sealer, that provides good sand scratch filling, no settling in the can, excellent adhesion and topcoat holdout.

Primer use on bare mettles to protect mettles from rust and other chemicals in refinish painting.

Section – C

04X06 = 24 Marks

Q.15 Explain what is 5S? also explain its advantages in paint shop

Ans: 5 Japanese principles

- All the words begin with an S
- The construction and installation on a long-term basis of an instantaneous visual control system
- Improving the effectiveness of the working environment in all areas of the dealership.

5S Explanation



- Neat & clean workplace
- Smooth working
- No obstruction
- Safety increases
- Productivity improves
- Quality improves
- Wastage decrease
- Machine maintenance
- Visual control system
- Employees motivated
- Workstations become spacious

Q.16 Explain different types of hazards associated to refinish painting.

Ans: Interior Painting Safety Hazards:

- Inadequate ventilation is the first and foremost hazard when painting indoors.
- Take care when placing appropriate warning signs for people place them at a level and in a position where the majority of people can see them easily.

Fire and explosion hazards:

- One of the major safety concerns associated with spray application is the combustible, flammable vapours and mists.
- It is important to ensure that all potential sources of ignition have been removed prior to spraying flammable and combustible products.

Health effects:

- Overexposure to a substance like primer or paint when spraying them means that too much has been breathed in, swallowed or absorbed.
- The possible health effects of overexposure to these products can vary depending on the chemicals they contain.

The main health effects from exposure to these solvents can include:

1. Eye and skin irritation
2. Respiratory tract irritation;
3. Dermatitis/Skin diseases



4. Drowsiness

5. Vomiting.

Potential sources of ignition include:

1. Open flames (work space heating units)
2. Cutting and welding torches
3. Gas fired heaters
4. Electrical outlets and lighting
5. Static electricity
6. Smoking

Q.17 Write down the steps of putty application and putty sanding process.

Ans: Putties are generally applied with a "knife" in a relatively heavy to very heavy layer thickness to the substrate in order to fill larger / deeper damaged areas.

Polyester stopper/putty is basically a filler for indentations or Dents in a panel .

This material is a two component material requiring the addition of a peroxide hardener to convert the paste into a solid matter.

After hardening stopper/putty can be dry sanded to form a very fine smooth and level surface which reproduces the original surface appearance before the damage occurred

- Mix Putty & Hardener -- (1% - 3%) of hardener may be needed depending upon Season & Temperature.
- Mix the stopper/putty well avoiding excessive air being included (slow firm blending together).
- Once mixed (even color) apply quickly to the surface
- Apply to the clean surface with a firm action .
- The angle of your spreader determines the thickness of application. A maximum of 1 millimetre thickness should be observed.can be sanded dry
- After Drying the Putty can be sanded Dry initially with a coarse paper (P80) moving to finer (P180)
- Mix the stopper/putty well avoiding excessive air being
- included (slow firm blending together)
- Polyester/putty is very porous and water will be absorbed giving the possibility of blistering at a later date .
- Wet sanding of stopper/putty may also cause "flash-rusting" of the metal surface which may continue to corrode even after painting.
- Wet sanding is harmful in Putty .
- Coarse sanding paper produces large scratches which must be removed progressively
- Only apply putty on corrosion free substrates
- Never wet sand putty as it is very hydroscopic (water absorbing)



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Apply in thin layers and avoid excessively thick applications as this can lead to problems with adhesion and flexibility

- Remove dust from any craters in the surface before re applying putty or Primer & Filler coats

Q.18 What is sanding? Explain types of sanding.

Ans:

Sanding removes the top layer of your car's paint using abrasive materials. It also helps to make the surface even after the putty application by removing extra putty from the surface.

1. Function of sanding in car repair:

- Removal of material.
- Preparation of surfaces (adhesion promoter).
- Smoothing and surface embellishment.
- Reparation of defects

2. Types of sanding:

1. Manual sanding.

- Wet sanding
- Dry sanding

2. Automatic sanding.

Manual sanding: • Manual or hand sanding is the oldest known method of sanding used.
• It only uses when the machine cannot be used, such as sanding small and hard surfaces access, etc..

The hand sanding can be done using 2 techniques:

- Water sanding or wet sanding
- Dry sanding

1. Water sanding:- • Water or wet sanding is done by immersing the sandpaper in a bucket of water. • It produces less dust, longer life of the sandpaper and allows obtain a smooth surface compared with dry sanding.

2. Dry sanding:- • Dry sanding is applied directly on the surface. • This type of sanding causes excessive dust resulting abrasive action of the grain on the surface.

Automatic sanding is done by sanding machines called as sanders. • Greatly reduces the effort and time of work compared to hand sanding. • The main disadvantage is that sanders not arrive well in difficult areas or edges, where it is necessary sand by hand.

Important points to remind before starting sanding work:-

- Clean/degrease the surface.
- Select the properly sandpaper (more or less abrasive) that fits to the work.



School of Automotive Skills
Session: 2019-20 (Summer Semester)
B. Voc. Program, 1st Semester,
End-Sem. Examination

Course Code: AUT1105

Time: 2 Hours

Course Name: Automotive Electrical Fundamentals and Comfort System

Max. Marks: 50

Instruction:

1. Answer all questions from section – A, each question carries one mark.
2. Answer all questions from section – B, each question carries four marks.
3. Answer all questions from section – C, each question carries six marks.

Section – A

10X01 = 10 Marks

1. What type of specification is used to rate a transducer?
 - a. Transmitting Range.
 - b. Receiving Range.
 - c. Dynamic Range.
 - d. All of the above.
2. TCP is a type of an actuator. What does TCP stand for?
 - a. Torqued and coiled polymer.
 - b. Twisted and coaxial polymer.
 - c. Twisted and coiled polymer.
 - d. None of the above.
3. Which of the term in the following is not a property of refrigerant R134a?
 - a. High heat of vaporization.
 - b. Flammable.
 - c. Non-corrosive.
 - d. Non-toxic.
4. If in a circuit there are three resistors each of 120 ohms connected as two in series and one in parallel with those two, & with a battery of 12 V. Then find out the total current of the circuit?
 - a. 15A.
 - b. 1.5A.
 - c. 115A.
 - d. 0.15A
5. What is the effect of voltage to current in a circuit?
 - a. Voltage increase while current increase.
 - b. Voltage decrease while current increase.
 - c. Voltage increase while current decrease.
 - d. None of the above.
6. Who invented the voltaic pile?
 - a. Alexander Graham Bell.
 - b. Alessandro Volta.
 - c. Albert Einstein.
 - d. A.P.J. Abdul Kalam.



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7. What is the universally accepted cylinder code for R134a?
 - a. Light Green.
 - b. Light Yellow.
 - c. Light Red.
 - d. Light Blue.
8. A parking light takes 0.5A current, its resistance is 24 Ω . What is the voltage of the lamp?
 - a. 12 Volts.
 - b. 24 Volts.
 - c. 10 Volts.
 - d. 48 Volts.
9. Which of the following is not an application of an actuator?
 - a. Electroactive Polymer.
 - b. Electropassive Polymer.
 - c. Thermal Bimorph.
 - d. Shape-memory Alloy.
10. The function of a compressor is to remove the vapor produced by the and to deliver it at a required pressure.
 - a. Evaporator, Lower.
 - b. Evaporator, Higher.
 - c. Expansion Valve, Lower.
 - d. Expansion Valve, Higher.

Section – B

04X04 = 16 Marks

11. Define the following:
 - a. Coefficient of performance.
 - b. Heat Engine.
 - c. Heat Pump.
 - d. Refrigerator.
12. Name any eight sensors with their function used in an automotive vehicle.
13. Write down the advantages and disadvantages of VCRS over Air Refrigeration System.
14. Explain different types of Thermodynamic Systems.

Section – C

04X06 = 24 Marks

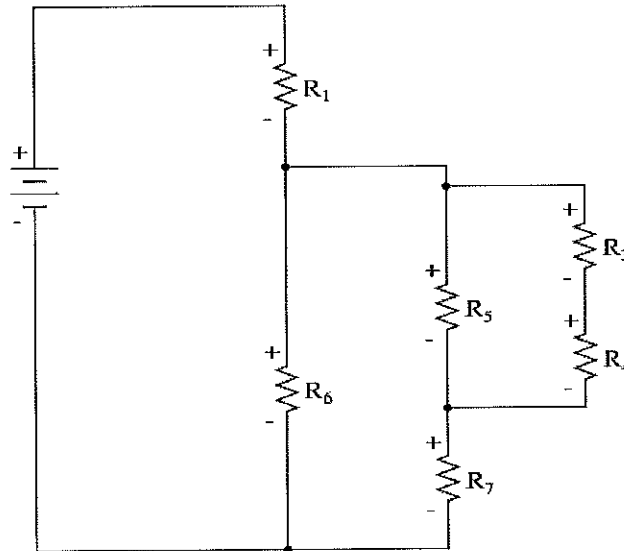
15. Write down the standard operating procedure of AC Gas Recycling through Bosch Robinair ACS 261.
16. Explain the following:
 - a. Electrostatic Effect.
 - b. Multimeter.
 - c. Relay.
17. Define AC Compressor, Condenser & Evaporator in detail.

18. Solve the mixed-circuit wiring diagram, and find out the following quantities as given below:

a. Total Resistance.

b. Total Current.

(Given: $R_1 = 100$ ohms, $R_2 = 120$ ohms, $R_3 = 115$ ohms, $R_4 = 200$ ohms, $R_5 = 100$ ohms, $R_6 = 30$ ohms & $R_7 = 150$ ohms, Voltage of the battery is 24 Volts)



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School of Automotive Skills
Session 2019-20, Summer Semester
B. Voc. Program, 1st Semester,
End-Sem. Examination

Course Code: AUT1105

Course Name: Automotive Electrical Fundamentals & Comfort System

Section – A

10X01 = 10 Marks

1. What type of specification is used to rate a transducer?

Answer: c. Dynamic Range.

2. TCP is a type of an actuator. What does TCP stand for?

Answer: c. Twisted and coiled polymer.

3. Which of the term in the following is not a property of refrigerant R134a?

Answer: b. Flammable.

4. If in a circuit there are three resistors each of 120 ohms connected as two in series and one in parallel with those two, & with a battery of 12 V. Then find out the total current of the circuit?

Answer: d. 0.15A.

5. What is the effect of voltage to current in a circuit?

Answer: a. Voltage increase while current increases.

6. Who invented the voltaic pile?

Answer: b. Alessandro Volta.

7. What is the universally accepted cylinder code for R134a?

Answer: d. Light Blue.

8. A parking light takes 0.5A current, its resistance is 24 Ω . What is the voltage of the lamp?

Answer: a. 12 Volts.

9. Which of the following is not an application of an actuator?

Answer: b. Electropassive Polymer.

10. The function of a compressor is to remove the vapour produced by the and to deliver it at a required pressure.

Answer: b. Evaporator, Higher.

Section – B

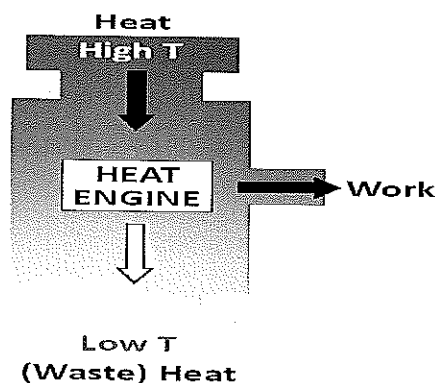
04X04 = 16 Marks

11. Define the following:

- a. Coefficient of performance.
- b. Heat Engine.
- c. Heat Pump.
- d. Refrigerator.

Answer:

- a. A refrigeration system's coefficient of performance (CoP) is very important in determining a system's overall efficiency. It is defined as refrigeration capacity in kW divided by the energy input in kW. While CoP is a very simple measure of performance, it is typically not used for industrial refrigeration in North America. Owners and manufacturers of these systems typically use performance factor (PF).
- b. In thermodynamics and engineering, a heat engine is a system that converts heat or thermal energy—and chemical energy—to mechanical energy, which can then be used to do mechanical work. It does this by bringing a working substance from a higher state temperature to a lower state temperature.



- c. A heat pump is a device that transfers heat energy from a source of heat to what is called a thermal reservoir. Heat pumps move thermal energy in the opposite direction of spontaneous heat transfer, by absorbing heat from a cold space and releasing it to a warmer one.
 - d. A refrigerator (colloquially fridge) consists of a thermally insulated compartment and a heat pump (mechanical, electronic or chemical) that transfers heat from the inside of the fridge to its external environment so that the inside of the fridge is cooled to a temperature below the room temperature. Refrigeration is an essential food storage technique in developed countries.
12. Name any eight sensors with their function used in an automotive vehicle.

Answer:

1. Crankshaft Position Sensor: The functional objective for the crankshaft position sensor is to determine the position and/or rotational speed (RPM) of the crank. Engine Control

Units use the information transmitted by the sensor to control parameters such as ignition timing and fuel injection timing.

2. **Engine Coolant Temperature Sensor:** Coolant temperature sensors are used by the fuel management system to detect the engine's operating temperature. Depending on the sensor information, the control unit adapts the injection time and firing angle to the operating conditions.
3. **Airbag Sensor:** This airbag works as an inflatable seatbelt that inflates upon frontal impact from another vehicle. Activation of automotive airbags is triggered by crash sensors (also known as impact sensors) that work to detect frontal impact and trigger a control unit that deploys the airbag to cushion the passenger.
4. **Camshaft Position Sensor:** The purpose of a camshaft position sensor is to determine the position of the camshaft as it relates to the crankshaft. This data is then sent to the powertrain control module (PCM) for use with fuel injector and/or ignition system control.
5. **Brake Fluid Pressure Sensor:** The sensor has an input port to measure the hydraulic braking pressure and an electrical connector output for a wire connection for feeding the warning light. Some brake failures do not trip the sensor into a fault mode. A brake fluid pressure sensor is used in anti-lock braking system (ABS).
6. **Knock Sensor:** The knock sensor is located on the engine block, cylinder head or intake manifold. This is because its function is to sense vibrations caused by engine knock or detonation. The PCM uses this signal to alter the ignition timing and prevent detonation. Be clear that this sensor affects the ignition timing of an engine.
7. **MAP Sensor:** The Manifold Absolute Pressure (MAP) sensor is a key sensor because it senses engine load. The sensor generates a signal that is proportional to the amount of vacuum in the intake manifold. The engine computer then uses this information to adjust ignition timing and fuel enrichment.
8. **Oxygen Sensor:** The O₂ sensor is mounted in the exhaust manifold to monitor how much unburned oxygen is in the exhaust as the exhaust exits the engine. Monitoring oxygen levels in the exhaust is a way of gauging the fuel mixture. It tells the computer if the fuel mixture is burning rich (less oxygen) or lean (more oxygen).

13. Write down the advantages and disadvantages of VCRS over Air Refrigeration System.

Answer:

Advantages:

- Size is small when compared to an air refrigeration system for a given capacity of refrigeration.
- Volume of refrigerant circulated is low. Hence the running cost is low.
- High coefficient of performance.
- The operating temperature range is huge.

- The temperature at the evaporator can be easily controlled by regulating expansion valve.
- It requires smaller evaporator.

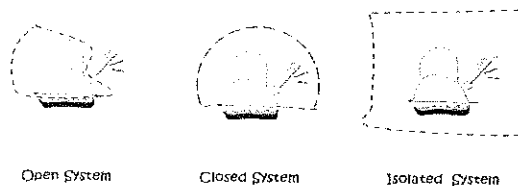
Disadvantages:

- High initial cost, costly refrigerant.
- Environmental hazardous refrigerant involved.
- Must ensure the prevention of leakage of refrigerant.

14. Explain different types of Thermodynamic Systems.

Answer:

- A thermodynamic system is a group of material and/or radiative contents. Its properties may be described by thermodynamic state variables such as temperature, entropy, internal energy, and pressure.
- The simplest state of a thermodynamic system is a state of thermodynamic equilibrium, as opposed to a non-equilibrium state. A system is defined as quantity of matter or a region in space chosen for study. Everything external to the system is surrounding. Thermodynamic system and surrounding is always separated by the boundary.



- The system can be separated from its surrounding by a wall or without a wall.
- When the state of its content varies in space, the system can be considered as many systems located next to each other, each being a different thermodynamical system.
- A thermodynamic system is subject to external interventions called thermodynamic operations; these alter the system's walls or its surroundings; as a result, the system undergoes thermodynamic processes according to the principles of thermodynamics. (This account mainly refers to the simplest kind of thermodynamic system; compositions of simple systems may also be considered.)

Section – C

04X06 = 24 Marks

15. Write down the standard operating procedure of AC Gas Recycling through Bosch Robinair ACS 261.

Answer:

- The student should wear appropriate PPE's like safety goggles, safety gloves, earplugs, nose mask, etc. while working on Robinair ACS 261 A/C recycling machine.
- Check the power supply of the machine, it should be three phase.

- Check the cooling effect of the vehicle by temperature measuring instrument.
- Check the unwanted sound of the compressor.
- Check the compressor oil level (Top-up if required).
- Check the refrigerant amount from the refrigerant tank (if less then fill it up).
- Check the connections of the A/C line.
- Turn ON the machine.
- Connect the high pressure and low pressure valves with hose reel connectors.
- Select A/C Servicing.
- Select Manual / Auto Mode of A/C recycling.
- Select Recovery of refrigerant (PI Time of 1 minute), then select vacuuming of A/C System Line (Vacuum. Creation time for 20 minutes and Vacuum. Holding time for 5 minutes), Oil recharging (10 ml or *as per cabin size and vehicle manual specifications), Refrigerant charging (300 gm to 900 gm as per mentioned in the manual as per cabin size), Hose pipe draining.

Process:

Step 1: Start recovery of refrigerant gas from the A/c System.

Step 2: After recovery start vacuum creation and vacuum holding in the line of A/C System.

Step 3: After step 2, start refilling of the compressor oil and refrigerant in the A/C System.

Step 4: After refilling, remove the hose connectors from the outlet valves, and start the hose draining process to ensure that no refrigerant gas should remain in the hose pipe of the Robinair ACS 261.

Step 5: Note down the summary screen of the Robinair ACS 261 for the final results of A/C Recycling in a vehicle to know the amount recovered and consumed & the time taken for the process to estimate the cost of job work.

Step 6: Switch OFF the machine and remove the power supply.

- Check the cooling effect of the vehicle by temperature measuring instrument after the process of recycling of refrigerant by turning ON the vehicle for 15 minutes.
- Check the workplace properly and manage it from the initial phase of the process for better working of the job.

16. Explain the following:

- Electrostatic Effect.
- Multimeter.
- Relay.

Answer:

- Electrostatic effects: Electrostatics is a branch of physics that studies electric charges at rest. Since classical physics, it has been known that some materials such as amber

attract lightweight particles after rubbing. The Greek word for amber, or electron, was the source of the word 'electricity'. Electrostatic phenomena arise from the forces that electric charges exert on each other. Such forces are described by Coulomb's law. Even though electrostatically induced forces seem to be rather weak, some electrostatic forces such as the one between an electron and a proton, that together make up a hydrogen atom, is about 36 orders of magnitude stronger than the gravitational force acting between them.

- b. **Multimeter:** A multimeter or a multitester, also known as a VOM (volt-ohm-milli-ammeter), is an electronic measuring instrument that combines several measurement functions in one unit. A typical multimeter can measure voltage, current, and resistance. Analog multimeters use a micro-ammeter with a moving pointer to display readings. Digital multimeters (DMM, DVOM) have a numeric display, and may also show a graphical bar representing the measured value. Digital multimeters are now far more common due to their lower cost and greater precision, but analog multimeters are still preferable in some cases, for example when monitoring a rapidly varying value.
 - c. **Relays** are switches that open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit. As relay diagrams show, when a relay contact is normally open (NO), there is an open contact when the relay is not energized. When a relay contact is Normally Closed (NC), there is a closed contact when the relay is not energized. In either case, applying electrical current to the contacts will change their state.
- Relays are generally used to switch smaller currents in a control circuit and do not usually control power consuming devices except for small motors and Solenoids that draw low amps. Nonetheless, relays can "control" larger voltages and amperes by having an amplifying effect because a small voltage applied to a relay's coil can result in a large voltage being switched by the contacts.

17. Define AC Compressor, Condenser & Evaporator in detail.

Answer:

- a. The function of a compressor is to remove the vapour produced by the evaporator and to deliver it at a required higher pressure. The compressor can be compared to a heart pumping the blood (the refrigerant) inside the body (the compression cycle). In the basic compression cycle, the compressor is positioned between the evaporator and the condenser. Compressors can be installed in either single or multistage configuration, and can be connected to each other in series or in parallel. The compressor is one of the most important parts of your air conditioning unit. Not only does the compressor play an important role in the cooling process, but it also ensures that the unit works effectively and continually. **Compressor Location:** The compressor can be found under the hood (Bonnet) of the vehicle, near to the belt drive.

Types of Compressors:

- Positive Displacement Compressor (reduction in volume due to a piston in thermodynamics is considered as positive displacement of the piston).
 - Reciprocating or piston type compressor.
 - Screw compressor.
 - Scroll compressor.
 - Rotary compressor.
 - Dynamic compressor.
 - Centrifugal or turbo compressor.
- b.** In systems involving heat transfer, a condenser is a device or unit used to condense a gaseous substance into a liquid state through cooling. In so doing, the latent heat is released by the substance and transferred to the surrounding environment. Condensers are used for efficient heat rejection in many industrial systems. Condensers can be made according to numerous designs, and come in many sizes ranging from rather small (hand-held) to very large (industrial-scale units used in plant processes). For example, a refrigerator uses a condenser to get rid of heat extracted from the interior of the unit to the outside air.

Condensers are used in air conditioning, industrial chemical processes such as distillation, steam power plants and other heat-exchange systems. Use of cooling water or surrounding air as the coolant is common in many condensers.

Types of Condensers:

- Air-cooled Condenser.
 - Water-cooled Condenser.
 - Evaporative Condenser.
- c.** An evaporator is a device in a process used to turn the liquid form of a chemical substance such as water into its gaseous-form/vapour. The liquid is evaporated, or vaporized, into a gas form of the targeted substance in that process.

The air-conditioning evaporator is a small radiator inside the dashboard that provides cold air for the air-conditioning system. It's called the evaporator because it's where the freezing liquid refrigerant takes on any heat from the air blown through it and changes into a gaseous state (evaporating it) before returning it to the air-conditioning condenser to shed the heat; the process is constantly repeated. The air that emerges from the air conditioner is cold as a result.

The evaporator is typically hidden inside the vehicle's dashboard and can be labour-intensive to replace, which then requires a full system recharge. Unlike a ruptured heater core, which can leak engine coolant into the foot wells, a leak in the evaporator releases only refrigerant vapour. A clogged drainage channel is a common cause of water in the front foot wells.

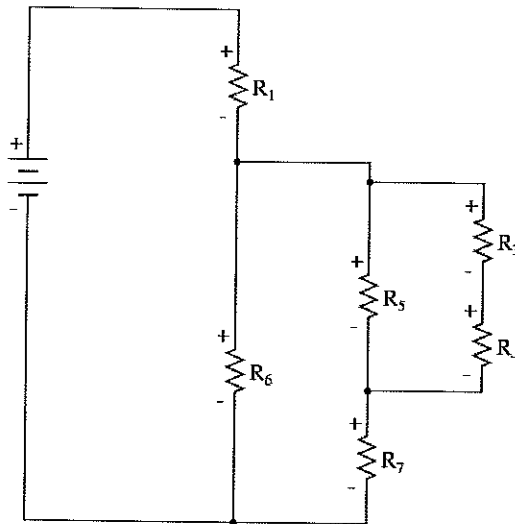
Types of Evaporator:

- Natural/forced Circulation Evaporator.
- Falling Film Evaporator.
- Rising Film (Long Tube Vertical) Evaporator.
- Climbing and Falling-film Plate Evaporators.
- Multiple Effect Evaporators.
- Agitated Thin Film Evaporator.

18. Solve the mixed-circuit wiring diagram, and find out the following quantities as given below:

- Total Resistance.
- Total Current.

(Given: $R_1 = 100$ ohms, $R_2 = 120$ ohms, $R_3 = 115$ ohms, $R_4 = 200$ ohms, $R_5 = 100$ ohms, $R_6 = 30$ ohms & $R_7 = 150$ ohms, Voltage of the battery is 24 Volts)



Solution:

- $R \text{ (Total)} = 126.48 \text{ ohms or } 127 \text{ ohms.}$
- $I \text{ (Total)} = 0.1897 \text{ A or } 190 \text{ mA.}$



BHARTIYA SKILL DEVELOPMENT UNIVERSITY

Registration No.:

School of Automotive Skills
Session: 2019-20 (Summer Semester)
B. Voc. Program, 1st Semester,
End-Sem. Examination

Course Code: AUT1106

Time: 2 Hours

Course Name: Automotive Tools and Measurement

Max. Marks: 50

Instruction:

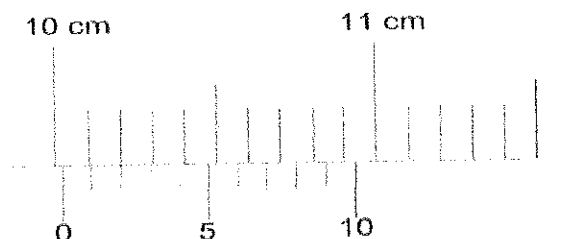
1. Answer all questions from "Section-A", each question carries 01 mark.
2. Answer all questions from "Section-B", each question carries 04 marks.
3. Answer all questions from "Section-C", each question carries 06 marks.

Section – A

Directions: Select any one correct answer from the given options:

10X01 = 10 Marks

- 1) The standard size of A4 drawing sheet as per BIS is:
 - a) 594x841
 - b) 210x297
 - c) 297x420
 - d) 420x594
- 2) Which of the following is generally used to calibrate slip gauges?
 - a) Micrometer
 - b) Bevel protector
 - c) Collimator
 - d) Interferometer
- 3) Which is the correct reading on Vernier caliper as shown in the figure below?



- a) 10.20 cm
 - b) 10.02 cm
 - c) 10.02 mm
 - d) 10.20 mm
- 4) Which of the following is the use of clamps?
 - a) To make uniform surface or bending sheet metal.
 - b) To make job to required shape either cold or hot beats.
 - c) To grip the job while drilling or fixing the components in bench.
 - d) All of the above.
 - 5) In a unilateral system of tolerance, the tolerance is allowed on:
 - a) One side of the actual size
 - b) Both sides of the actual size
 - c) One side of the nominal size
 - d) Both sides of the nominal size

- 6) According to the Indian standard specifications, 100 H6 / g5 means that the:
- a) Actual size is 100 mm
 - b) Basic size is 100 mm
 - c) Difference between actual size and basic size is 100 mm
 - d) None of these
- 7) nuts are used to protect the bolt ends, threads from damages and they also act as protectors for safe working.
- a) Wing nuts
 - b) Cap nuts
 - c) Self-locking nuts
 - d) Knurled nuts
- 8) Which of the following is the correct use for bolt?
- a) To join two metallic sheets.
 - b) For fastening purpose, it having a threaded hold in it.
 - c) For fastening purpose, the cylindrical rod has threaded on one end and head on another end.
 - d) None of the above.
- 9) Which chisel shape is used when creating sharp corners?
- a) Flat
 - b) Cross cut
 - c) Diamond point
 - d) Half round nose
- 10) According to Indian standard specifications, 100 H 6 / g 5 means that:
- a) tolerance grade for the hole is 6 and for the shaft is 5
 - b) tolerance grade for the shaft is 6 and for the hole is 5
 - c) tolerance grade for the shaft is 4 to 8 and for the hole is 3 to 7
 - d) tolerance grade for the hole is 4 to 8 and for the shaft is 3 to 7

Section – B

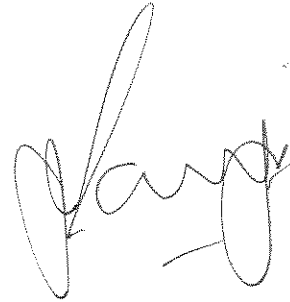
04X04 = 16 Marks

- 11) What is scaling? Write about the different types of scaling used in an engineering drawing.
- 12) Mention the precautions and care that must be taken while handling a Vernier calipers.
- 13) Write down the different types of snips and their applications.
- 14) Define spanner and also mention any six types of spanners with its specific application.

Section – C

04X06 = 24 Marks

- 15) Discuss orthographic projection and also write the differences between first and third angle projection.
- 16) Explain the construction and working of a bevel protector.
- 17) Discuss the Indian Standard System of limits and fits.
- 18) Describe any four type of nuts & bolts.

A handwritten signature in black ink, appearing to be 'P. Singh', is located on the right side of the page.



School of Automotive Skills
Session: 2019-20 (Summer Semester)
B. Voc. Program, 1st Semester,
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Course Code: AUT1106

Time: 2 Hours

Course Name: Automotive Tools and Measurement

Max. Marks: 50

Instruction:

1. Answer all questions from "**Section-A**", each question carries 01 mark.
2. Answer all questions from "**Section-B**", each question carries 04 marks.
3. Answer all questions from "**Section-C**", each question carries 06 marks.

Section – A

Directions: Select any one correct answer from the given options:

10X01 = 10 Marks

- 1) The standard size of A4 drawing sheet as per BIS is:

- | | |
|------------|------------|
| a) 594x841 | c) 297x420 |
| b) 210x297 | d) 420x594 |

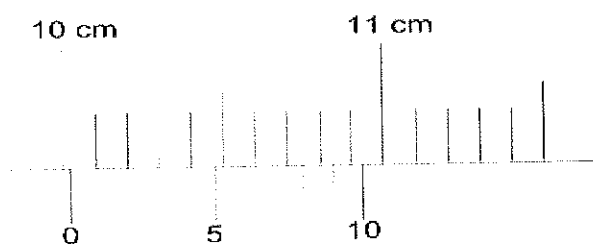
Ans: - b)

- 2) Which of the following is generally used to calibrate slip gauges?

- | | |
|--------------------|-------------------|
| a) Micrometer | c) Collimator |
| b) Bevel protector | d) Interferometer |

Ans: - d)

- 3) Which is the correct reading on Vernier caliper as shown in the figure below?



- | | |
|-------------|-------------|
| a) 10.20 cm | c) 10.02 mm |
| b) 10.02 cm | d) 10.20 mm |

Ans: - b)

- 4) Which of the following is the use of clamps?

- a) To make uniform surface or bending sheet metal.
- b) To make job to required shape either cold or hot beats.
- c) To grip the job while drilling or fixing the components in bench.
- d) All of the above.

Ans: - c)

5) In a unilateral system of tolerance, the tolerance is allowed on:

- a) One side of the actual size
- b) Both sides of the actual size
- c) One side of the nominal size
- d) Both sides of the nominal size

Ans: - c)

6) According to the Indian standard specifications, 100 H6 / g5 means that the:

- a) Actual size is 100 mm
- b) Basic size is 100 mm
- c) Difference between actual size and basic size is 100 mm
- d) None of these

Ans: - b)

7) nuts are used to protect the bolt ends, threads from damages and they also act as protectors for safe working.

- a) Wing nuts
- b) Cap nuts
- c) Self-locking nuts
- d) Knurled nuts

Ans: - b)

8) Which of the following is the correct use for bolt?

- a) To join two metallic sheets.
- b) For fastening purpose, it having a threaded hold in it.
- c) For fastening purpose, the cylindrical rod has threaded on one end and head on another end.
- d) None of the above.

Ans: - c)

9) Which chisel shape is used when creating sharp corners?

- a) Flat
- b) Cross cut
- c) Diamond point
- d) Half round nose

Ans: - c)

10) According to Indian standard specifications, 100 H 6 / g 5 means that:

- a) tolerance grade for the hole is 6 and for the shaft is 5
- b) tolerance grade for the shaft is 6 and for the hole is 5
- c) tolerance grade for the shaft is 4 to 8 and for the hole is 3 to 7
- d) tolerance grade for the hole is 4 to 8 and for the shaft is 3 to 7

Ans: - a)

Section – B

04X04 = 16 Marks

11) What is scaling? Write about the different types of scaling used in an engineering drawing.

Ans: -

The proportion by which the **drawing** of an object is enlarged or reduced is called the **scale** of the **drawing**. A **scale** is **defined** as the ratio of the linear dimensions of the object as represented in a **drawing** to the actual dimensions of the same.

Types of Scale:

1. 1:1 = Actual size
2. X:1 = Enlarging size
3. 1:X = Reducing size

Right Hand side = actual size

Left Hand side = **Drawing size**

12) Mention the precautions and cares for handling Vernier calipers.

Ans: -

- There should not be any play between sliding jaw & the main scale.
- Check the instruments for zero error.
- Parallax or reading error must be avoided.
- Do not apply undue pressure.
- The instruments should be cleaned properly.

13) Write down the different types of snips and their applications.

Ans: -

- A snip also called a hand shear is used like a pair of scissors to cut thin, soft metal sheets.
- Snips are used to cut sheet metal up-to 1.2 mm thickness.
- There are several types of snips available for making straight or circular cuts.
- The most common snips are straight snips and curved/bent snips.
- The choice of snips depends on the shape and type of cut required.

Application:

- **Straight Snips: -**
These are used for making straight cuts and large external curves.
- **Curved Snips:**
These are used for making curve cuts.

14) Define spanner and also mention any six types of spanners.

Ans: -

Spanner is a hand tool used for operating threaded fasteners like nut & bolt.

Types of Spanners

- Open end spanner
- Closed end spanner
- Ring spanner
- Combined spanner
- Tubular spanner
- Socket spanner
- Adjustable spanner

Section – C

04X06 = 24 Marks

15) Discuss orthographic projection and also write the differences between first and third angle projection.

Ans: -

- Orthographic projection is a Parallel Projection Technique in which the plane of projection is perpendicular to the parallel line of sight.
- Orthographic Projection is a method of representing a three dimensional object on paper using several two dimensional views.
- It is the international language of Engineers and Designers
- There are two ways of drawing in orthographic First Angle and Third Angle.

First angle projection	Third-angle projection
Object is kept in the first quadrant.	Object is assumed to be kept in the third quadrant.
Object lies between observer and the plane of projection.	Plane of projection lies between the observer and the object.
The plane of projection is assumed to be non-transparent.	The plane of projection is assumed to be transparent.
Front (elevation) view is drawn above the XY line	Front (elevation) view is drawn below the XY line
Top (plan) view is drawn below the XY line	Top (plan) view is drawn above the XY line
Left view is projected on the right plane and vice versa	Left view is projected on the left plane itself.
Followed in India, European countries	Followed in USA

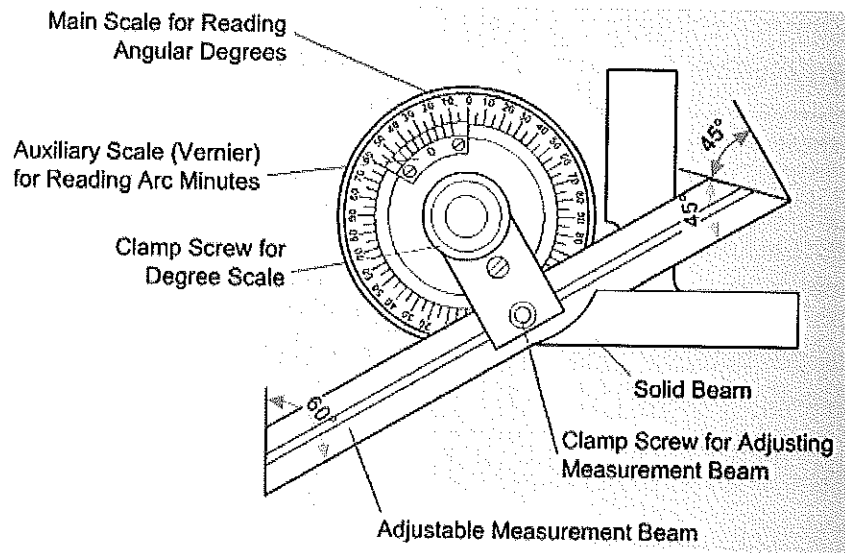
16) Explain the construction and working of bevel protector.

Ans: -

Bevel Protractors are the Angular measuring devices. Vernier Bevel protractor is the simplest angular measuring device which is having a Vernier Scale (Similar principle as the Vernier Caliper) along with the acute angle attachment.

Vernier Bevel protractor consist of the following components.

- Main scale for reading angular degrees
- Auxiliary scale (Vernier scale) for reading Arc minutes
- Clamp screw for degree scale
- Clamp screw for adjusting measurement beam
- Adjustable measurement beam
- Solid beam



17) Discuss the Indian Standard System of limits and fits.

Ans: -

Limits of size:

These are the maximum and minimum permissible sizes acceptable for a specific dimension. The operator is expected to manufacture the component within these limits. The maximum limit of size is the greater of the two limits of size, whereas the minimum limit of size is the smaller of the two.

Fit: - It is the degree of looseness and tightness between two mating parts to perform a definite function.

- The relationship between the two mating parts that are to be assembled, that is, the hole and the shaft, with respect to the difference in their dimensions before assembly is called a fit.
- An ideal fit is required for proper functioning of the mating parts. Three basic types of fits can be identified, depending on the actual limits of the hole or shaft:
 - a. Clearance fit
 - b. Transition fit
 - c. Interference fit

Clearance fit: The largest permissible diameter of the shaft is smaller than the diameter of the smallest hole.

- In case of clearance fit, the difference between the sizes is always positive.

Interference fit: The minimum permissible diameter of the shaft exceeds the maximum allowable diameter of the hole.

- This type of fit always provides interference. Interference fit is a form of a tight fit. Tools are required for the precise assembly of two parts with an interference fit.
- In an interference fit, the difference between the sizes is always negative.

Transition fit: Occurs when two tolerance mating parts are sometimes and interference fit and sometimes clearance fit when assembled.

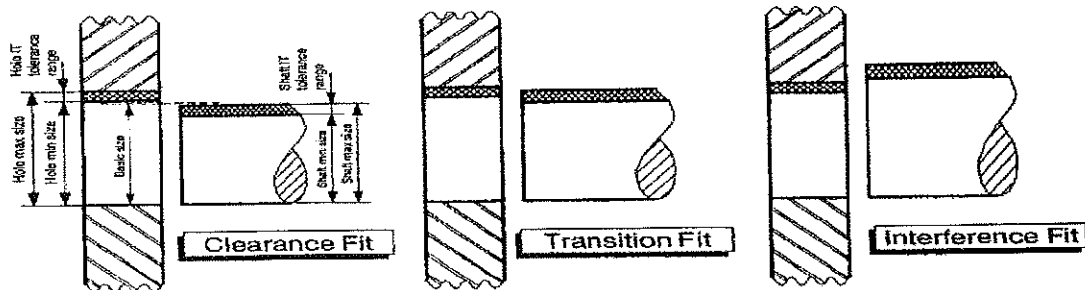


Figure 5.9 Typical clearance, transition and interference fits for a shaft in a hole

18) Describe any four type of nuts & bolts

Ans: -

Type of Nuts:

Hexagonal nuts

- This is the most commonly used nut in structures and machine tool construction
- Hexagonal nuts are available in different thicknesses; thin nuts are used as lock nuts.

Square nuts

- Square nuts are provided with square bolts and are most commonly used in coaches

Self-locking nuts

- This nut has an internal groove cut in which a fiber or nylon ring is inserted
- This ring holds the nut tightly on the bolt and serves as a locking device
- Self-locking nuts are not used with studs.

T- nuts

- T-nuts are used along with studs on machine tools for fixing/holding devices or work-pieces

Slotted & Castle nuts

- Round nuts of different types are available for special applications
 - Slotted round nuts for hook wrench
 - Round nut with set pin holes on sides
 - Round nuts with holes in the face

Type of Bolts:

Bolts with clearance hole

- Most common type of fastening arrangement using bolts
- The size of hole is slightly larger than the bolt (clearance hole)

Body fit bolt

- This type of bolt assembly is used when relative movement between the work pieces has to be prevented
- The diameter of the threaded portion is slightly smaller than shank diameter

Anti-fatigue bolt

- This type of bolt is used when the assembly is subjected to alternating load condition continuously.
- Connection rod big ends in engine assembly are examples of this application.
- The shank diameter is in contact with the hole in a few places and other portions are relieved to give clearances.

Studs