Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2021/2022

COURSE NAME	:	AUTOMOTIVE HVAC SYSTEM
COURSE CODE	:	BNG 40503
PROGRAMME CODE	:	BNG
EXAMINATION DATE	:	JULY 2022
DURATION	:	3 HOURS
INSTRUCTION	:	1. ANSWERS **ALL** QUESTIONS 2. THIS FINAL EXAMINATION IS CONDUCTED VIA **CLOSED BOOK** 3. STUDENTS ARE **PROHIBITED** TO CONSULT THEIR OWN MATERIAL OR ANY AEXTERNAL RESOURCES DURING THE EXAMINATION CONDUCTED VIA CLOSED BOOK

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

Q1 (a) An ideal gas law is a relationship between the amounts of gases and their volumes to calculate the stoichiometry of reactions involving gases if the pressure and temperature are known. Identify **TWO (2)** difference between ideal gas law and real-life situation regarding refrigerant cycle in automotive air-conditioning system.

(4 marks)

(b) A zone is an area of the internal space of the vehicle that can be cooled or heated to a specific temperature. With the aid of simple sketch, produce a working principle of dual zone air-conditioning system use in multi-purpose vehicle (MPV) segment.

(9 marks)

(c) In automotive air-conditioning, each component and how they contribute to that operation was important. Those primary components are the compressor, condenser, evaporator, accumulator (or receiver-drier) and orifice tube (or expansion valve). Outline **THREE (3)** differences in a working system between expansion valve and orifice tube.

(6 marks)

(d) Ammonia refrigeration is one of the older types of refrigeration that is still used today. It is very common for cold storage of food and in many industries that require this type of cooling. However, ammonia was not used as refrigerant in automotive segment. Debate **THREE (3)** factors why ammonia was not suitable to be used as refrigerant in automotive air-conditioning.

(6 marks)

Q2 (a) One of the greatest innovations during this time was air conditioning, which made life easier for people in the humid depths of summer months. An air compressor makes the whole A/C process possible in vehicles. State **FOUR (4)** types of automotive compressor.

(4 marks)

(b) There were several types of compressor use in automotive air-conditioning system as mention in **Q2 (a)**. Illustrate with simple diagram a working principle of scroll (helix) type of automotive compressor.

(9 marks)

(c) Among important components in a car air conditioner system is the condenser and evaporator. Discuss **THREE (3)** similarities between condenser and evaporator.

(6 marks)

(d) The expansion valve is located downstream of the receiver drier and it receives the refrigerant fluid in a 100% liquid state and after it has been filtered. Argue with **THREE (3)** statement whether it is possible to design an automotive air-conditioning system without using expansion valve.

(6 marks)

Q3 (a) At present, the modern automobile design can be done using different types of sensors. These are arranged into the car engine to recognize & solve possible problems like repairs, servicing, etc. Generalize definition of electrical sensors in automotive.

(4 marks)

(b) In recent automotive, sensors are used for detecting as well as responding to changes of the conditions inside & outside of the car. There are different types of sensors used in automotive but knowing the working of these sensors is essential. List **FIVE (5)** electrical sensors related to automotive air-conditioning system.

(5 marks)

(c) Automotive temperature sensors are used to measure temperature at many places in an automobile, and usually consist of either a thermistor (thermally sensitive resistor), thermocouple, resistance temperature detector (RTD), or infrared device. Analyze **THREE (3)** differences between temperature sensor using NTC and PTC.

(6 marks)

(d) Relays are switches controlled by electrical power, like another switch, computer or control module and 12V DC relay switches are the best solution for full voltage applications. Examine a working principle of relays in automotive air-conditioning. Provide simple sketch of relay to aid for explanation.

(6 marks)

(e) Permanent magnet motor is at the heart of many electric motors, powering the rotor of the drivetrain. However, many manufactures slowly replacing magnet motor with stepper motor. Classify **TWO (2)** advantages of stepper motor compare to traditional permanent magnet motor in air-conditioning system.

(4 marks)

Q4 (a) To keep car's cabin cool and conditioned, a colorless (and relatively odorless) refrigerant circulates through the air-conditioning system. Refrigerant can leak at any point in this cycle, especially when parts of the system become loose, worn, or damaged. Analyze **TWO (2)** methods used to detect leaks in air-conditioning system.

(6 marks)

(b) A sight glass is a transparent glass tube or window normally installed in a receiver drier. Sight glasses come in two basic styles: plain and with a moisture indicator. Describe **TWO (2)** functions of sight glass at receiver drier.

(4 marks)

(c) The risks associated with the use of refrigerants in refrigeration and air-conditioning equipment can include asphyxiation and physical hazards. Distinguish **THREE (3)** safety precautions to be made when handling refrigerant during servicing the air-conditioning system.

(9 marks)

(d) Designed to meet today's tough service standards, a standard Refrigerant Management System (RMS) provide services of air-conditioning back to factory specifications. The easy-to-use, portable, full color interface helps technicians to quickly through each step for easy operation and fast service. Explain **THREE (3)** functions of RMS during servicing air-conditioning system.

(6 marks)

- END OF QUESTIONS -