The Open University of Sri Lanka
Faculty of Engineering Technology

Study Programme	:	Bachelor of Technology Honours in Engineering
Name of the Examination	:	Final Examination
Course Code and Title	:	**MEX4142 – Applied automotive electronics** **MEX4242 – Automotive electronics**
Academic Year	:	2015/16
Date	:	15th December 2015
Time	:	0930hr-1230hr
Duration	:	3 hours

General instructions

1. Read all instructions carefully before answering the questions.
2. This question paper has **six** questions.
3. Answer Question **1 (Q1)**, which is **compulsory** and **three** others.
4. Question 01 carries 40 marks whereas others each 20 marks.

Q1 (spend approximately one hour and fifteen minutes)

The article of "Autonomous Emergency Braking (AEB)Systems" given in below taking from "*http://www.cvel.clemson.edu/auto/systems/auto-systems.html*". Read it carefully and answer the following questions.

Autonomous Emergency Braking (AEB)Systems

Basic Description

A study conducted by the German Association of Insurance revealed that 50% of rear-end collisions occur without any braking and as much as 70% occur with braking that is insufficient to stop the vehicle in time. Furthermore, nearly 75% of all accidents that result in injuries happen within city limits at speeds below 20 mph. Autonomous emergency braking (AEB) systems are designed to avoid or minimize the damage caused by these types of accidents.

AEB (also referred to as automatic emergency braking or crash-imminent braking) systems monitor conditions ahead of the vehicle. If a crash appears to be imminent, these systems will automatically apply an appropriate braking pressure. Continental's Emergency Brake Assist system, for example, uses three laser beams level with the rear-view mirror to scan the road for obstacles up to eight meters ahead. The system is capable of preventing collisions if the speed differential between the two vehicles is less than 10

mph. At speeds greater than 10 mph, the system can reduce the severity of impact (assume that rear end vehicle has lower speed).

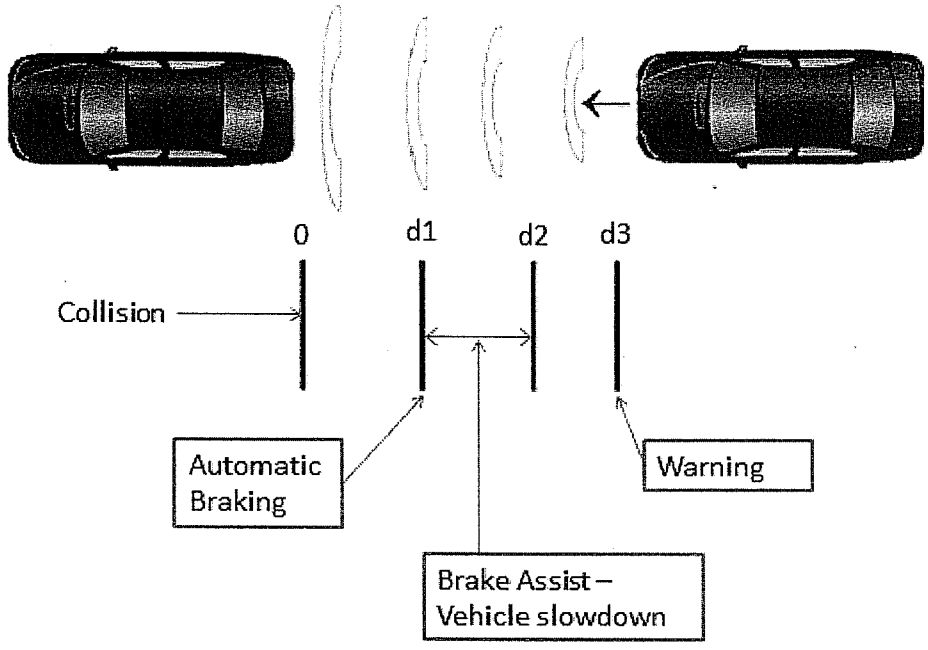


Figure Q1

The Volvo XC60 implements a dual-mode detection technology from Continental that is capable of detecting pedestrians as well as other vehicles and applying full brake pressure at 2 to 18 mph. The system uses an infrared laser located behind the rear-view mirror and high resolution cameras for image detection. The combination of the two sensing technologies enables the system to more accurately assess the situation to further aid in accident prevention. Other systems use radar and/or image sensors to detect potential obstacles in the road ahead.

The first AEB system in a passenger car was introduced on the Volvo XC60 in the 2010 model year. The Highway Loss Data Institute (HLDI) found that Volvo XC60s equipped with this feature had significantly fewer claims compared to other mid-size luxury SUVs. A study by Euro NCAP found that "Real world performance data suggests AEB systems can reduce accidents by up to 27%." Euro NCAP and other agencies that rate vehicle safety now requires that vehicles have AEB in order to receive their top safety rating. In 2014, more than 20% of the vehicle models in HLDI's database offered AEB as an option.

Most AEB systems do not brake until the last possible moment, after warning the driver using acoustic as well as visual warnings. This braking is usually activated later than a normal driver who is concentrating on the road would brake. Hence the system is less

likely to interfere with normal driving and drivers are less likely to become dependent on the system for braking.

(a) Identify the sensors and actuators used in the autonomous emergency braking (AEB) systems. Explain the operation of each sensor and actuators.

[Marks10]

(b) Draw block diagrams of autonomous emergency braking (AEB) systems.

[Marks10]

(c) Design an autonomous emergency braking (AEB) systems by using a microcontroller. Clearly show input/output interface circuit with sensors and actuators.

[Marks10]

(d) Present an algorithm using a flow chart or pseudo-code to fulfill the function of event data recorder and accident recorder.

[Marks10]

Q2

(a) List three different types of linear acceleration sensors available in automobile industry.

[Marks 04]

(b) Write five applications of acceleration sensor. [Marks 05]

(c) Briefly explains the operation of the linear accelerant sensor, and derive necessary equation to explain it. Draw the input signal and output signal relationship of a linear acceleration sensors.

[Marks 11]

Q3

(a) Briefly explains the operation of stepper motor.

[Marks 3]

(b)

i List three advantages of a stepper motor.

[Marks 3]

ii List two disadvantages of a stepper motor.

[Marks 2]

(c) Briefly explains the difference between unipolar and bipolar stepper motors. What are the type of input signals needed to operate each stepper motor?

[Marks 6]

(d) Design a stepper motor drive circuit using any type of transistor or IC. Clearly state necessary step.

[Marks 6]

Q4

(a) What is a battery management system in an automobile? What are the main functions of battery management system in an automobile.?

[Marks 06]

(b) What are the important parameter monitors during charging and discharging of a battery or a battery pack?

[Marks 03]

(c) Draw functional Block diagram of a battery management system. And explain it operation briefly. Write an algorithm or a flow chart of the operation of the battery management system.

[Marks 11]

Q5

(a) Explain briefly what is an electronic power steering system.

[Marks 05]

(b) Explain why electronic power steering system efficient than a hydraulic power steering system. [Marks 05]

(c) Draw a block diagram of the electronic power steering system with necessary sensors and actuators.

[Marks 10]

Q6

(a) Explain the function of an **idle start and stop** system. Why it is important for automobile? [Marks 06]

(b) Draw a block diagram of **idle start and stop** system with necessary sensors and actuators. [Marks 08]

(c) Briefly explain the operation of the **idle start and stop** system using flow chart or algorithm. [Marks 06]

End