The Open University of Sri Lanka
Faculty of Engineering Technology

Study Programme	:	Diploma in Technology/Bachelor of Technology (Engineering)
Name of the Examination	:	Final Examination
Course Code and Title	:	**MEX4242- Automotive electronics**
Academic Year	:	2012/13
Date	:	23rd July 2013
Time	:	0930hr-1230hr
Duration	:	3 hours

General instructions

1. Read all instructions carefully before answering the questions.
2. This question paper consists of six (06) questions
3. Answer **Q1**, which is **compulsory** and **three others**. Question 01 carries 40 marks whereas the others each 20 marks

---

Q1. (Spend approximately one hour) [40 Marks]

Two digital output Hall effect devices are used in combination to determine the direction of rotation of a ring magnet, as shown in Figure Q1.The sensors are located close together along the circumference of the ring magnet.

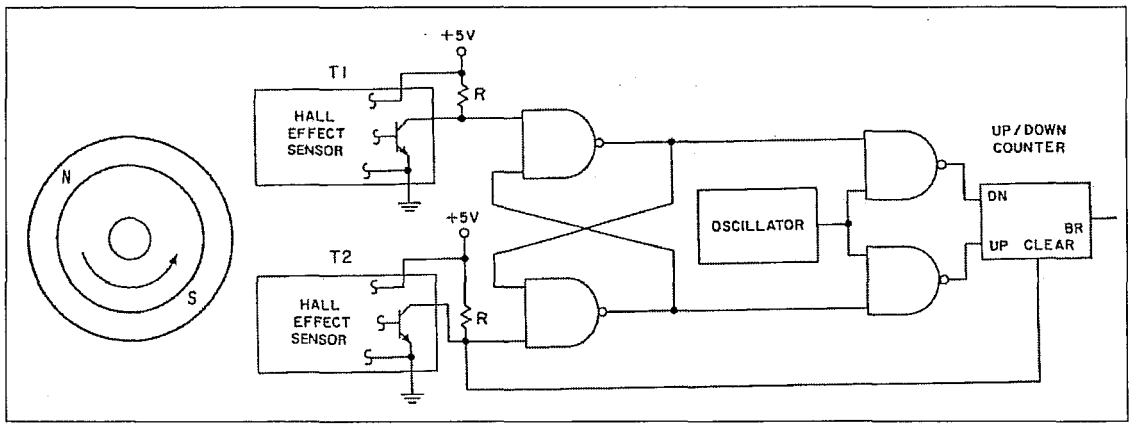


Figure Q1-Digital output direction sensor

(a) Explain the functional operation of the Hall effect sensor.

(b) Draw the block diagram of digital output direction sensor.

(c) Briefly explain the functional operation of the digital output direction sensor.

(d) Design the above digital output direction sensor using two hall effect sensors and a microcontroller. Clearly state your design steps.
(e) Write an algorithm or a flow chart for the new design mention in part (d).

Q2. [20 Marks]

(a) Explain functions of the Electronic ignition system.
(b) Design a microcontroller or microprocessor system for a ignition system.
   i. Using block diagram explain operation of the microcontroller or microprocessor system.
   ii. Clearly show input interfacing and output interfacing circuit with components values and data.
(c) Draw a flow chart or write an algorithm for ignition system.
(d) Write program by using C or assembly language.

Q3. [20 Marks]

Pressure sensors are used at different places in automobiles. They can be used to measure intake manifold pressure, atmospheric pressure, vapor pressure in fuel tank, etc. intake manifold pressure is measured by using MAP sensor which is also a pressure sensor.

(a) Explain the operation of the MAP (Manifold Absolute Pressure) sensor.
(b) Why does the ECM (Electronic Control Module) need the MAP sensor signal?
(c) What are the different voltage signals at Idel level and WOT (Wide Open Throttle) level?
(d) How do you detect a faulty MAP sensor?

Q4. [20 Marks]

(a) Briefly explain with help of circuit diagram function of the ***Voltage Doubler.***
(b) Determine the range of V_{in} that will maintain the Zener of Figure Q4-(b) diode in the "ON" state.

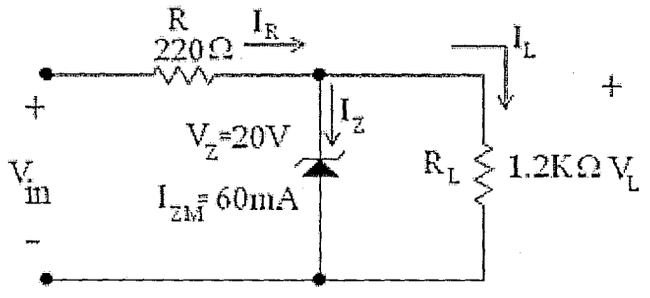


Figure Q4-(b)

(c) Determine the quiescent level of I_{C_Q} and V_{CE_Q} for the circuit show in Figure Q4-(c).

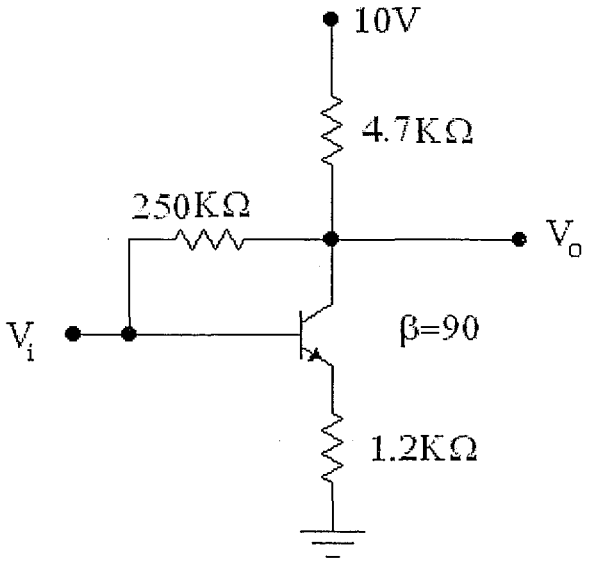


Figure Q4-(c)

Q5. [20 Marks]

(a) List the advantages of an operational amplifier compared to the transistor amplifier circuit.

(b) Two voltages +0.5Vand -1.5V are applied to the two inputs of an ideal operational amplifier act as a summer. The input resistors are 500K and 100K respectively. A feedback resistor of 200K is used. Draw the circuit and derive the output voltage.

(c) State the function of the operational amplifier circuit given in figure Q5. Calculate the output voltage for an input voltage of 6V.

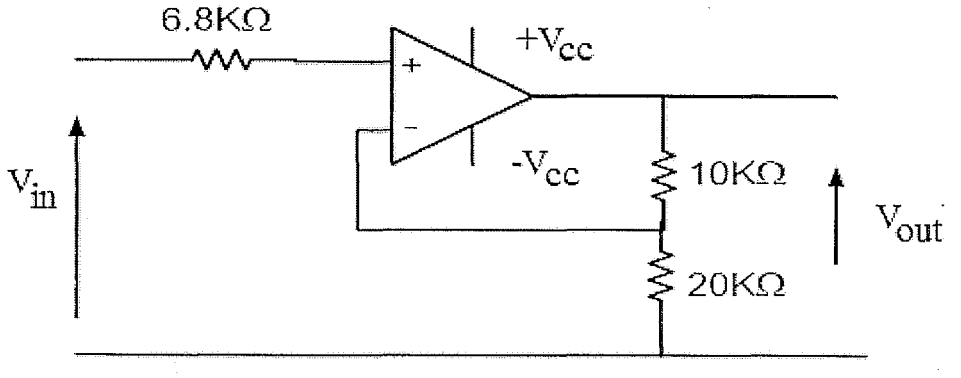


Figure Q5

Q6. [20 Marks]

(a) Convert the following binary numbers to octal and hexadecimal numbers:

110101_2

100110_2

(b) Convert 587_{10} to Binary Coded Decimal (BCD).

(c) Convert the Binary Coded Decimal (BCD) number 0101 0101 0001 to decimal number.

(d) Find the minimum sum of products and product of sums form of the following function using the Karnaugh map.

i) $F(A,B,C,D) = \sum(2,3,7,9,11) + dc_terms(7,1013,15)$

ii) $F(A,B,C,D) = \sum(0,2,5,6,8,10) + dc_terms(3,4,7,15)$

-End-