THE OPEN UNIVERSITY OF SRI LANKA
FACULTY OF ENGINEERING TECHNOLOGY
DIPLOMA IN TECHNOLOGY – LEVEL 4
FINAL EXAMINATION – ACADEMIC YEAR 2007/2008
MEX4242-AUTOMOTIVE ELECTRONICS
ECX 4240

Date : April 29, 2008 **Time : 0930-1230 hrs**

Important:

1. This question paper consist five questions.
2. Answer Question 01, which is compulsory and two others. Each question has two parts, both parts should be attempted.
3. Present briefly important but relevant facts and information. Any missing information can be sensibly and reasonably assumed provided that you state them clearly. Wherever necessary, use neatly drawn sketches to explain answers.

Question 01 **(Compulsory/do not spend more than one and half hours)**

Part A (20 Marks)

Electronic Anti-lock brake systems

Anti-lock brake systems (sometimes called anti-skid systems), through constant monitoring of wheel speeds, intermittently regulate brake fluid pressures to prevent the brakes form locking up the wheel and causing the tyres to lose grip, i.e. skid on the road

When the wheel speed decrease rapidly, a wheel speed sensor detect the condition and the control unit immediately actuates a solenoid pressure controller, effectively turning the brake fluid pressure to that wheel off and on. The reduced brake pressure prevents the wheel from locking.

i. Draw functional Block diagram of an Anti-lock brake system known to you.
ii. Explains Basic principle of operation of the above system.
iii. Write an algorithm or a flow chart for the above system.

Part B (20 Marks)

i. The block diagram shown in Figure Q1-1 is a **Series Voltage Regulator**. Explain operation of the Series Voltage regulator.

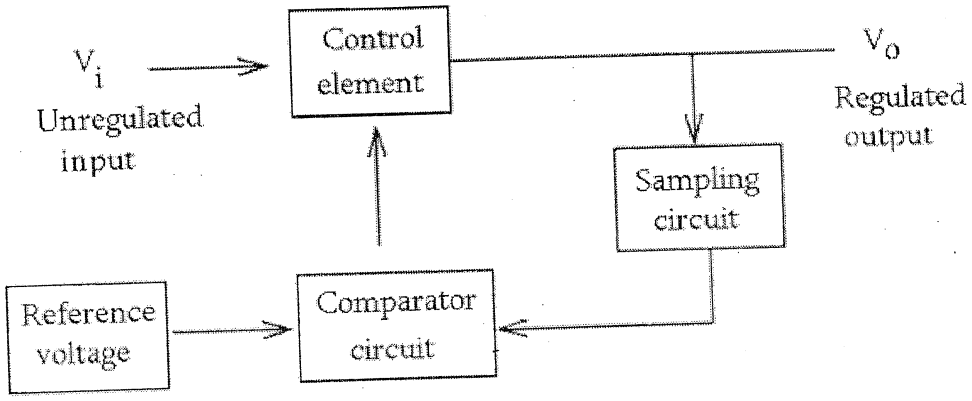


Figure Q1-1

ii. The block diagram shown in Figure Q1-2 is that of a **Shunt Voltage Regulator**. Explain operation of the Shunt Voltage regulator.

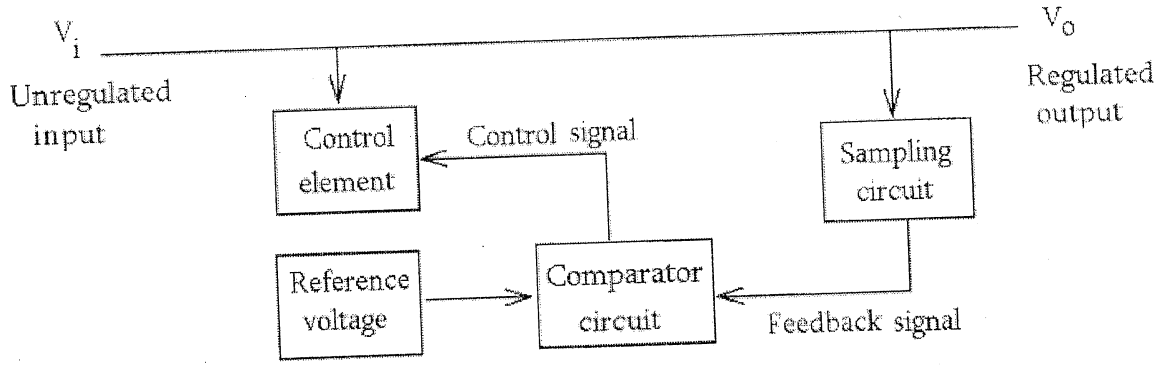


Figure Q1-2

iii. Determine the regulated voltage and load current for the series regulator shown in Figure Q1-3 for $R_L = 1k\Omega$

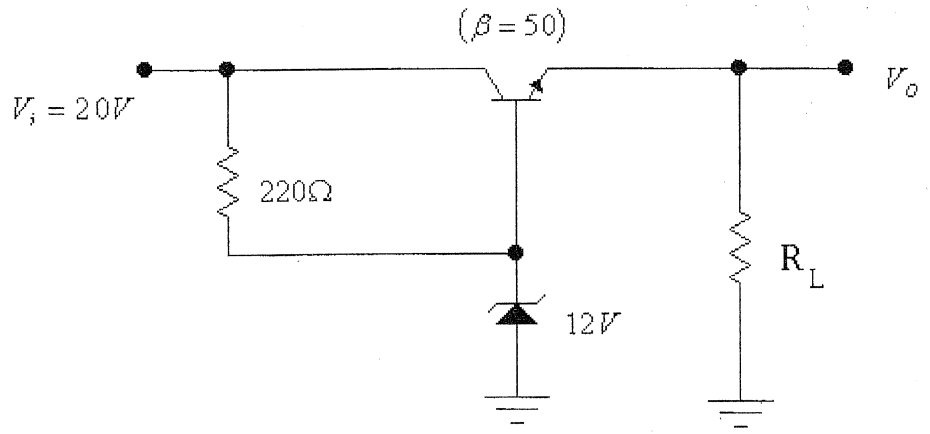


Figure Q1-3

iv. Determine the regulated voltage and circuit currents (I_L, I_C, I_S) for the shunt regulator shown in Figure Q1-4.

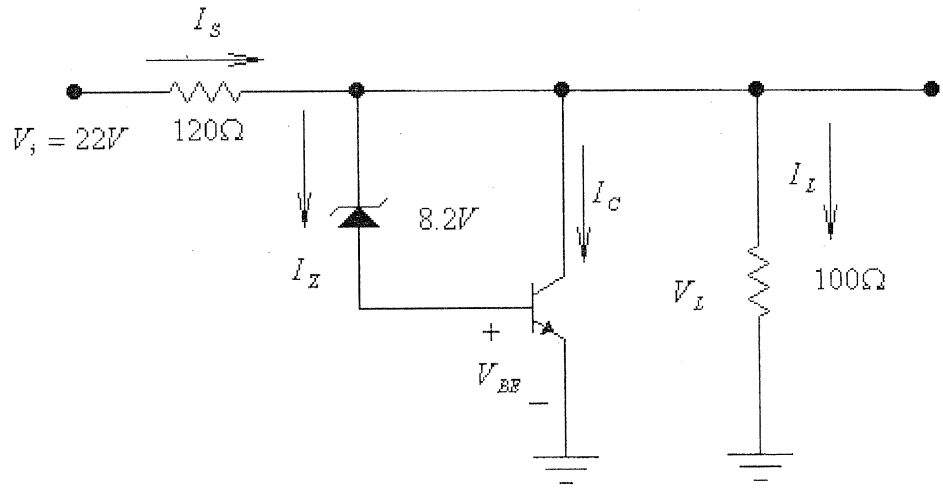


Figure Q1-4

Question 02

Part A (15 Marks)

i. Briefly explain the following terms.
   (a) Digital signal
   (b) Analog to Digital converter
   (c) Digital to Analog converter

ii. Name three types of "resistive sensors" and provide an example for each.

iii. Name two types of "Actuators" and provide an example for each.

Part B (15 Marks)

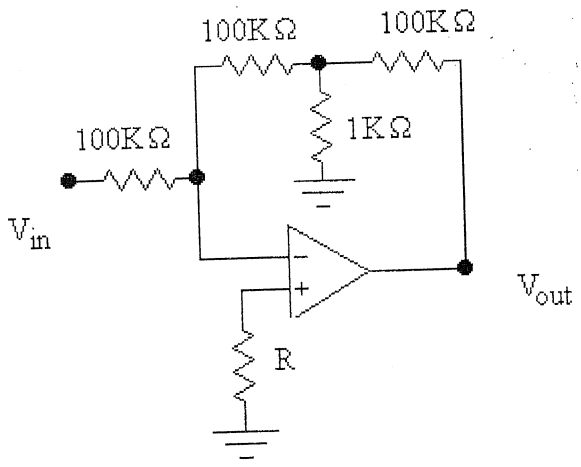


Figure Q2-2

i. Determine the gain of the amplifier shown in the Figure Q2-2.

ii. What should be the value of the single feedback resistor we could use in the conventional design to replace the feedback network consisting of the three resistors shown in Figure Q2-2 to obtain the same gain?

iii. What is the advantage in using feedback network shown in Figure Q2-2 over a single resistor of large value?

Question 3

Part A (15 Marks)

i. (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.

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

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

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

Part B (15 Marks)

i. Draw the transition table and the universal state diagram for a three stage shift register.

ii. Design a sequence generator to generate the binary sequence 11010. Use a shift register and combinational logic. Show the step of your design clearly.

Question 4

Part A (15 Marks)

i. Draw the circuit diagram of a modern automotive alternator charging system showing main functional components.
ii. Draw the output voltage wave form of the alternator.
iii. Draw the schematic diagram of an alternator showing main electrical and electronic components. Show the voltage regulator as a functional block.
iv. What is the function of Diode Bridge?

Part B (15 Marks)

i. Draw a functional block diagram to show the intermediate operations between the mechanical input and the final DC output of an alternator charging system.
ii. The voltage generated by an alternator depends on two parameters. What are these parameters?
iii. The circuit shown in the Figure Q4-1 is an Electronic voltage regulator.

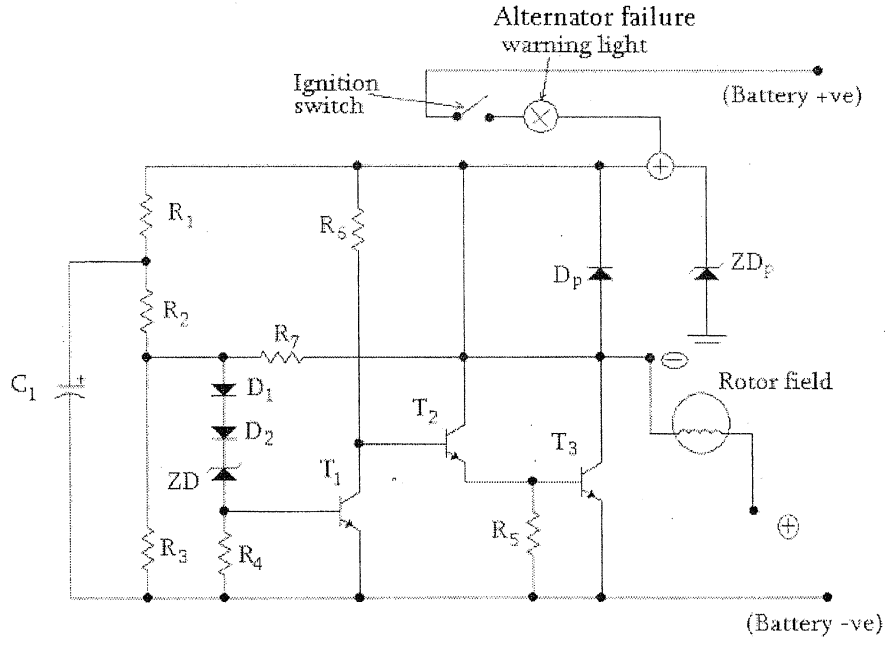


Figure Q4-1

(a) What is the function of T_2 and T_3?
(b) Explain the operation of the voltage regulator.

Question 5

Part A (15 Marks)

i. Explain the advantage of the closed loop control system over the open loop control system.

ii. Subroutines, Memory table (or Memory map) and Interrupts are important factors of microprocessor based automotive control systems. Explain their utilization.

Part B (15 Marks)

i. State the characteristics of an ideal Op-Amp.

ii. The circuit of Figure Q5-3 is a reference voltage source. Assume that the basic op amp is ideal. Find an expression for the output v_o.

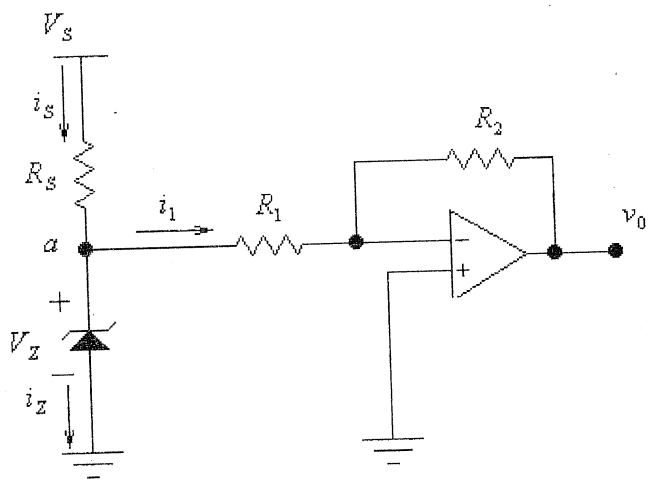


Figure Q5-3

iii. Using above circuit in Figure Q5-3, design an adjustable-output voltage regulator. Show clearly your modification.

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