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OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, STUDENT AFFAIRS AND RESEARCH

UNIVERSITY EXAMINATIONS

2018/2019 ACADEMIC YEAR

SECOND YEAR FIRST SEMESTER REGULAR EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE IN COMPUTER SCIENCE

COURSE CODE: COM 217

COURSE TITLE: ELECTRONICS

DATE: 17TH DECEMBER, 2018 **TIME: 2.00 PM – 5.00 PM**

INSTRUCTION TO CANDIDATES

- SEE INSIDE

THIS PAPER CONSISTS OF 9 PRINTED PAGES **PLEASE TURN OVER**

INSTRUCTIONS TO CANDIDATES

i. *Answer **ALL** Questions from section **A** and any other **THREE** questions.*

ii. *Maps and diagrams should be used whenever they serve to illustrate the answer*

iii. *Do not write on the question paper*

SECTION A (24 MARKS) COMPULSORY

QUESTION ONE (12 Marks)

(a) In the circuit shown in Fig.Q1, determine the values of voltage v., and current $_{IR1}$

(6 marks)

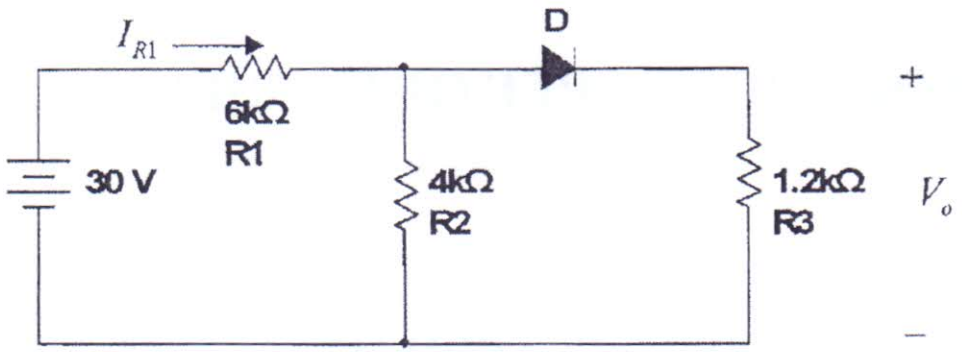

Fig.Q.1a

(a) The burglar alarm circuit shown in Fig. Q.1b is normally powered from the mains voltage. In the event of a mains power blackout~ a backup battery of 12 V supplies the burglar alarm with power. Explain the role of diodes D 1and D2 in this application. (6 marks)

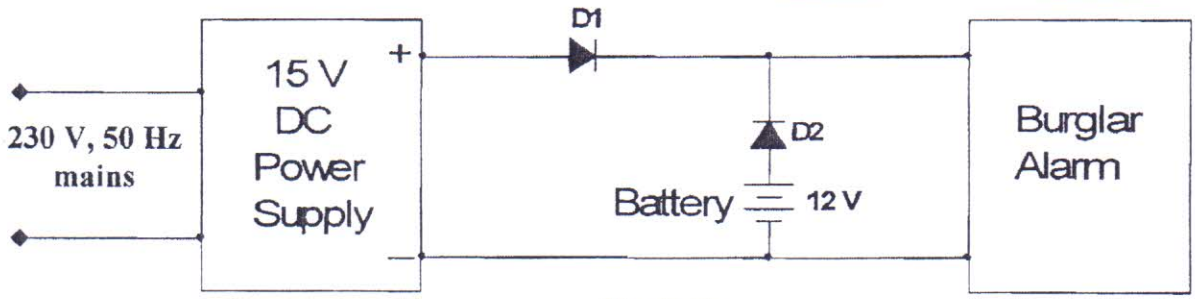

Fig.Q.1b

QUESTION TWO (12 Marks)

For the zener diode circuit shown in Fig.Q.lc:

a. Show that the zener diode is operating in the breakdown region. (3 marks

b. Determine the zener diode current. (2 marks)

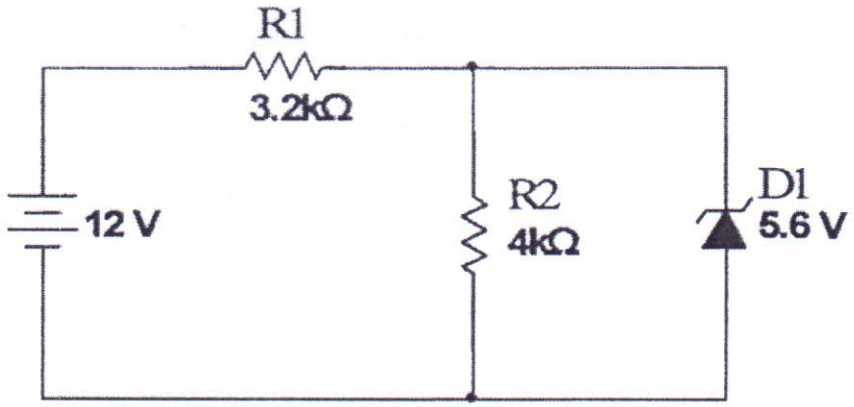

Fig.Q.1c

c. If the supply voltage is reduced slowly, determine the voltage at which the zener diode drops out (stops conducting)? (2Marks)

d.)

(d) In the a.c. application of a signal diode shown in Fig. Q.ld determine the voltage ratio *vo/vin* . Assume that the capacitors are short circuits at frequencies of interest. *(5 marks)*

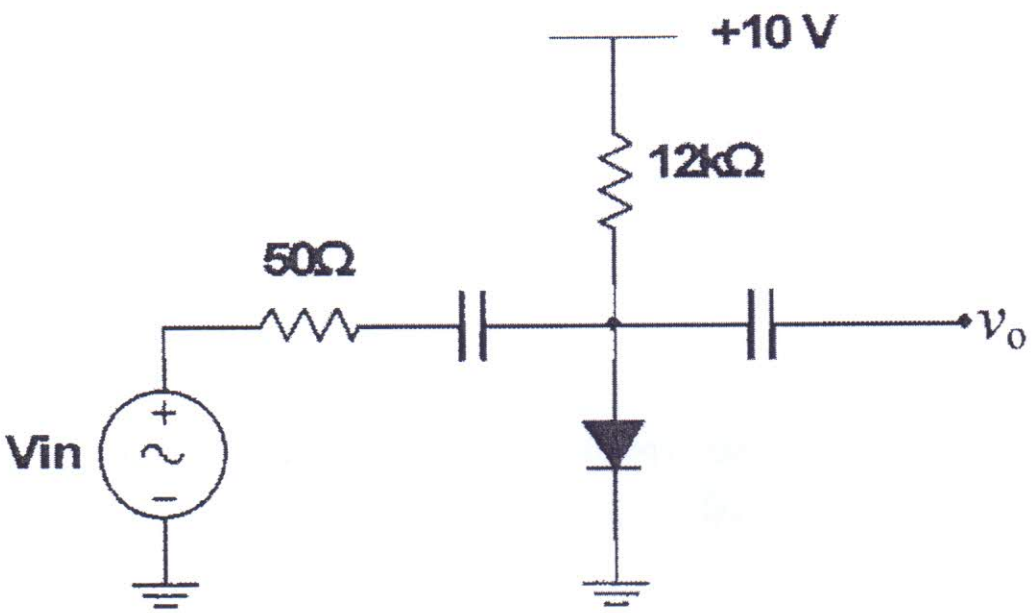

Fig.Q.1d

SECTION B (36 MARKS)

QUESTION THREE (12 Marks)

Determine, stating your arguments, the value ofthe voltage marked VL in Fig. Q.l.e. Note that the transformer turns ratio is 1 :2. (5 marks)

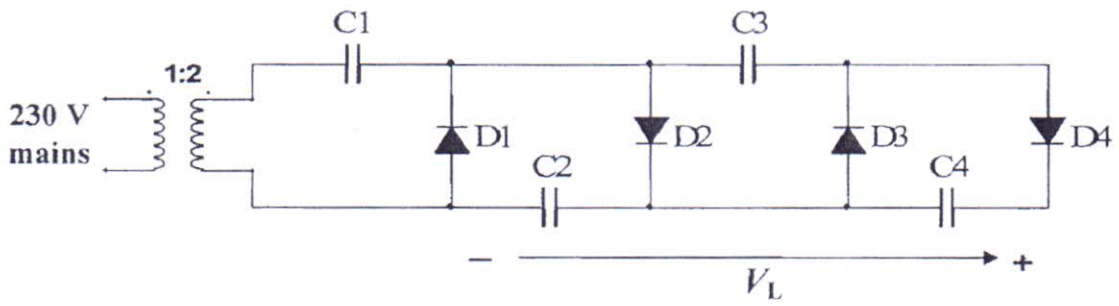

Fig. Q1.e

(f) Design a circuit that lights up all 4 matched light emitting diodes (LEDs). Assume that each the diode has a forward voltage drop of 1.5 V and needs a current of at least 5 rnA to light up well. Use a power supply voltage of 5 V. Hint: Decide whether you want series or parallel arrangement. (5 marks)

(g) Design an opamp based function whose inputs and output can implement the function *(2 marks)*

QUESTION FOUR (12 Marks)

a. Consider the basic transistor circuit shown in Fig. Q.I h. Assume that the transistor used hasβ_{dc} 50. Determine, giving explanations, the operating mode of the transistor with each of the following component values.

(i) *RB* =1 MO, *Rc*=5 kO*(6 marks)*

(ii) *RB* =100 kO, *Rc*=10 Kq*(6 marks)*

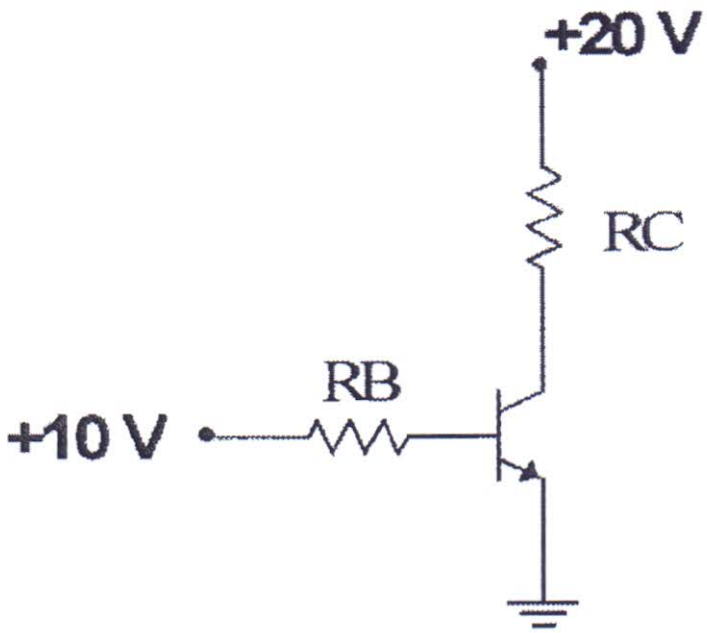

Fig. Q.1h

QUESTION FIVE (12 Marks)

(a) What is the output voltage ofthe circuit shown in Fig. Q.5a *(4 marks)*

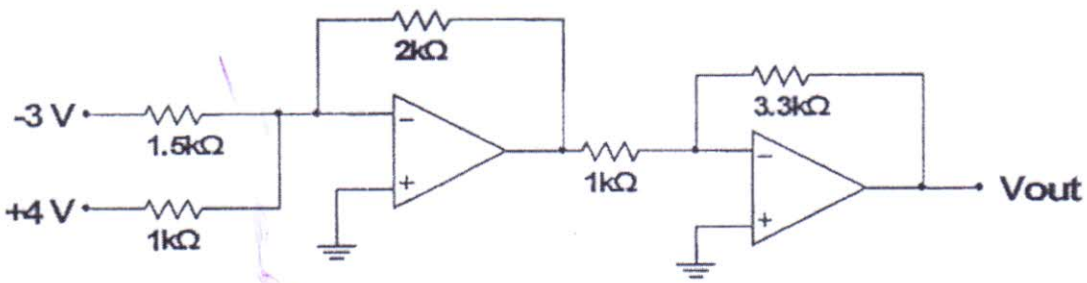

Fig. Q5a

(b) A bipolar 3 V peak-to-peak triangular wave of frequency 109 Hz is applied to the circuit shown in Fig. Q5b. Determine and sketch the output signal ofthe circuit. (8 Marks)

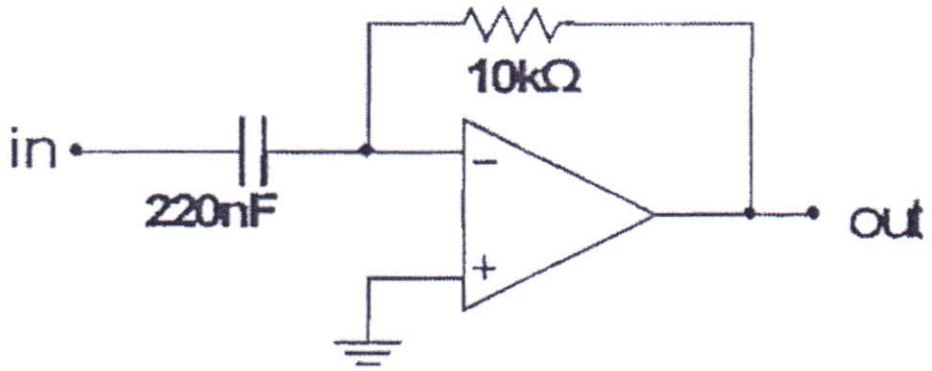

Fig. Q5b

QUESTION SIX (12 Marks)

a) A common emitter npn transistor amplifier works from a 15 V supply. Determine suitable values of *R), R, RE* so that the quiescent operating point is as stable as possible at $_{ICQ}$ =10 rnAand $V_{\alpha\alpha}$ ~ *Vcc*/2 as *f3* varies between 100 and 200.

(6marks)

b) Consider the circuit shown in Fig.Q4. You are given that the transistor used has *f3* 100 and VA 75 V.

i. Perform d.c. analysis to find the operating point, *Ic*and $_{VCE}$, ofthe transistor. *(6marks)*

ii. Assuming that the capacitors used are very large, perform a.c. analysis to find the gain *va/* $_{Vs}$ ofthe circuit. *(6marks)*

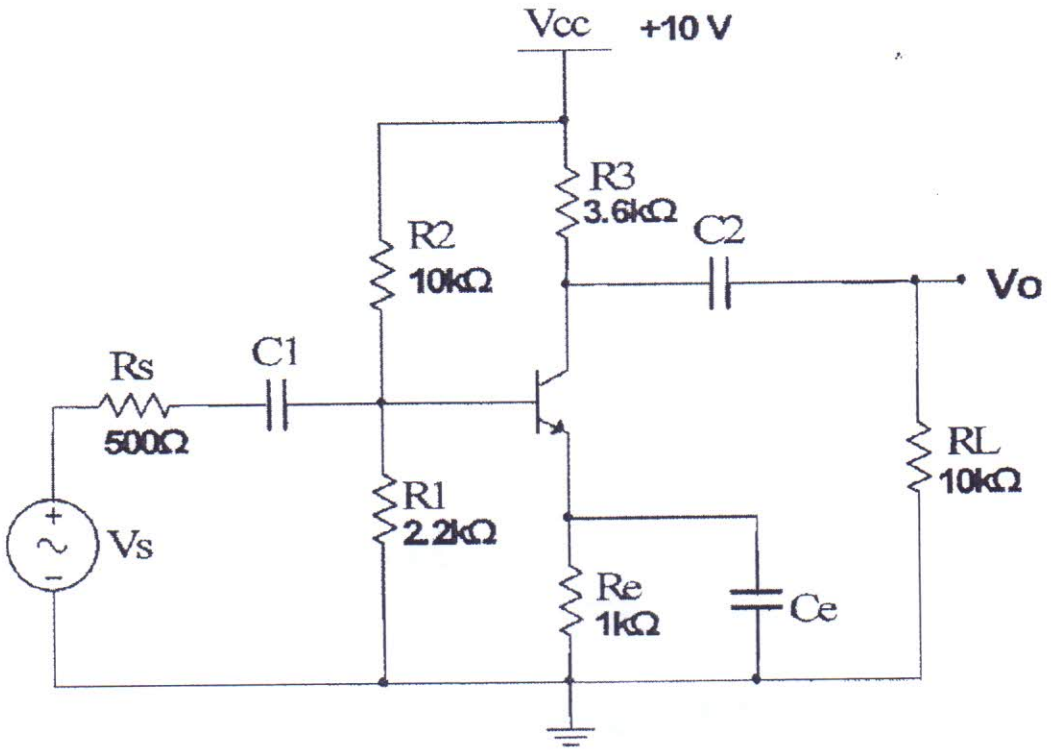

Fig. Q4

QUESTION SEVEN (12 Marks)

A transformer full-wave bridge rectifier is fed from a 230 V, 50 Hz mains supply via a 230VI15V step down transformer. The output ofthe rectifier is connected to a load resistor RL of 820 n in parallel with a smoothing capacitor C of 470 J,1F. Assume that the diodes have a voltage drop of0.7 V when conducting.

Draw the circuit diagram and calculate the following: *(2 marks)*

(I) The average d.c. load current. *(2 marks)*
(II) The ripple voltage at the load. *(2 marks)*
(III) The average d.c. load voltage. *(2 marks)*
(IV) The PIV in a diode. *(2 marks)*
(V) The peak diode current. *(2marks)*

(a) What is the output voltage ofthe circuit shown in Fig. Q.5a *(4 marks)*

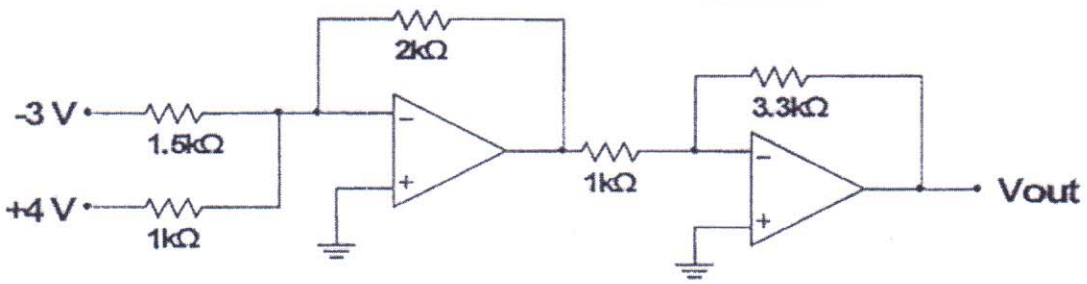

Fig. Q5a