Date of Examination
25/02/2023

No of Questions	09
No of Pages	06

GENERAL SIR JOHN KOTELAWALA DEFENCE UNIVERSITY

MASTER OF SCIENCE IN BIOMEDICAL ENGINEERING DEGREE EXAMINATION

PROGRAMME I - YEAR I – SEMESTER I EXAMINATION – February 2023

ELECTRONICS AND ELECTRICAL ENGINEERING

(BA 5103)

Instructions to Candidates:

Time allowed is three (03) hours.
There are four Parts in this paper. Answer total of five (05) questions based on the following instructions.

From Part A any two (02) questions.
From Part B, Part C and Part D one (01) question from each.

This examination accounts for 60% of the module assessment.
Each question carries equal marks.

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1. ***Draw diagrams when necessary.***
2. ***Diagrams should be appropriately labeled and proportionate.***

Part A

Question 1

A single-phase load consists of a series combination of resistance 25Ω and inductance 50 mH is given in Figure Q1. It is supplied from a 230 V, 50 Hz ac supply. Determine the current, active power and reactive power supplied from the source, and the source power factor. [20 marks]

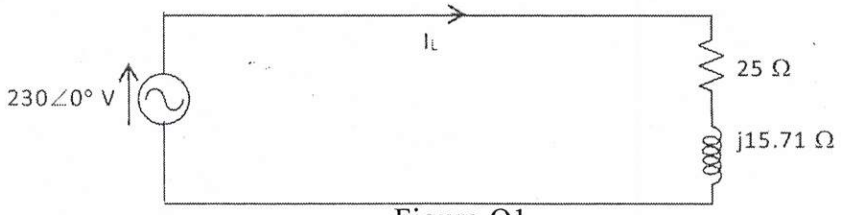

Figure Q1

Question 2

For the circuit shown in Figure Q2, write down the Ohm's Law, Kirchhoff's current law and Kirchhoff's voltage law equations. Hence determine the current i_1. [20 marks]

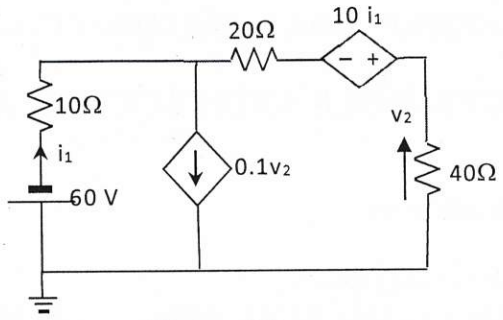

Figure Q2

Question 3

For the circuit shown in Figure Q3, write down an expression for the total impedance seen by the source in terms of angular frequency ω in complex form. Hence determine the unity power factor resonance frequency. [20 marks]

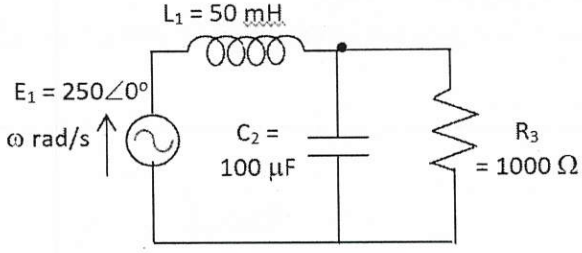

Figure Q3

-End of Part A-

Part B

Question 4

4.1 Explain the function of power electronic converter. [4 marks]
4.2 Explain the main difference of power diodes and power transistors. [4 marks]
4.3 Explain the mode of operation of a Triac with an illustration of VI characteristic. [4 marks]
4.4 Name three applications of Diac. [4 marks]
4.5 Explain the importance of knowing the Peak Inverse Voltage of a diode which is used in a rectification circuit. [4 marks]

Question 5 [20 marks]

5.1 Explain the three main fundamental component of a dc power supply.
5.2 Explain percent ripple in a rectified waveform.
5.3 A diode or a SCR can be used in a half wave rectifying circuit. Explain the advantage of using SCR over a diode in a half rectifying circuit.
5.4 Explain the functionality of the regulating circuit illustrated in Figure Q5.

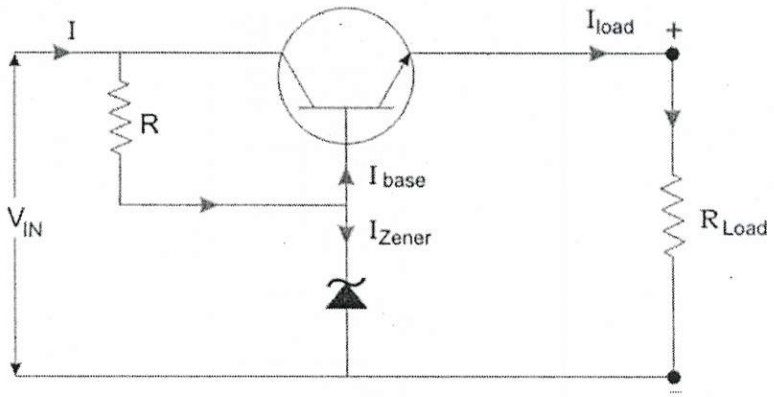

Figure Q5

-End of Part B-

Part C

Question 6

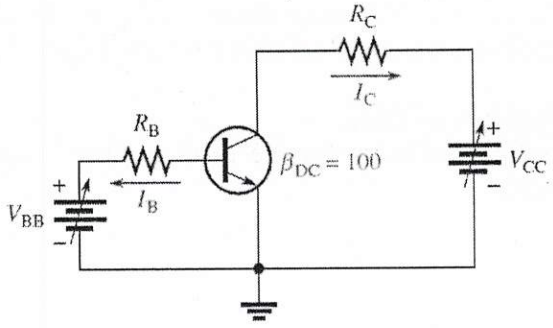

Figure Q6

6.1 Based on the circuit given in Figure Q6, complete the Table Q6 for $I_B = 5\mu A$ to $25\mu A$ in $5\mu A$ increments. Assume $\beta_{DC} = 100$. [10 marks]

Table Q6

I_B	I_C
$5\mu A$	
$10\mu A$	
$15\mu A$	
$20\mu A$	
$25\mu A$	

4.2 Draw the characteristic curve for a given value of I_B, I_C and V_{CE}. [10 marks]

Question 7

A fixed-bias transistor circuit shown in Figure Q7.1 for a Q-point values of I_C and V_{CE} given in Figure Q7.2. Let V_{BE} = 0.7 V.

7.1 Determine the transistor forward current gain (β). [5 marks]
7.2 Define R_C and R_B. [15 marks]

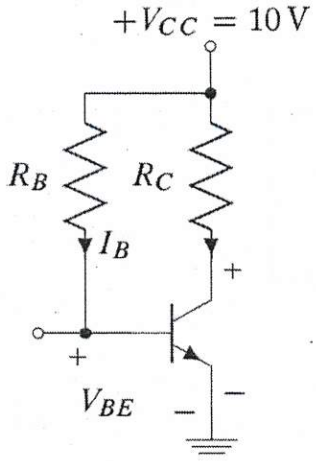

Figure Q7.1

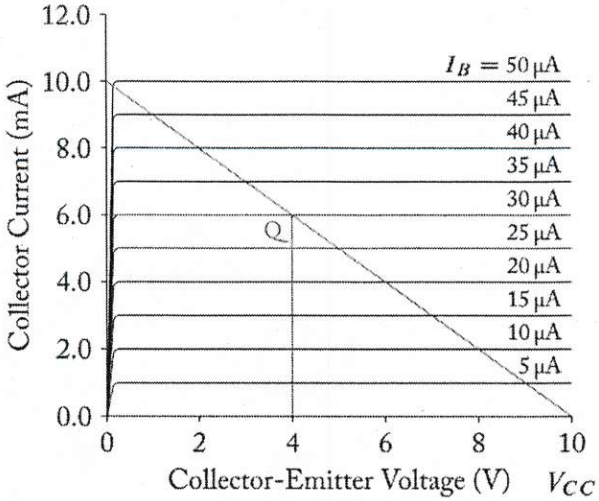

Figure Q7.2

-End of Part C-

Part D

Question 8

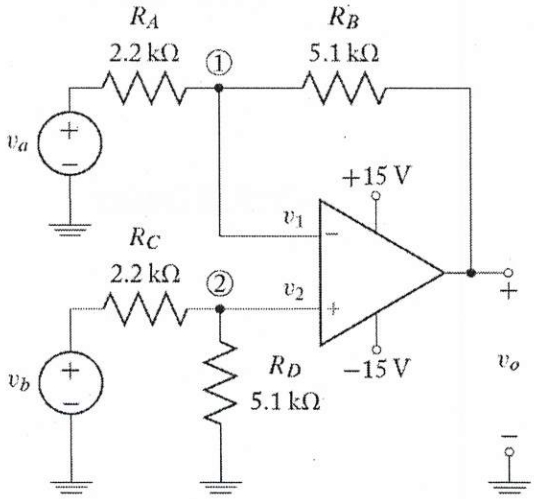

Figure Q6

8.1 Identify the feedback type of Figure Q6. [5 marks]

8.2 For the input voltage of v_a = 3V, what values of v_b will result in operation in the linear region? [10 marks]

8.3 Sate the assumptions that you have made to derive the above expression for section 8.2. [5 marks]

Question 9

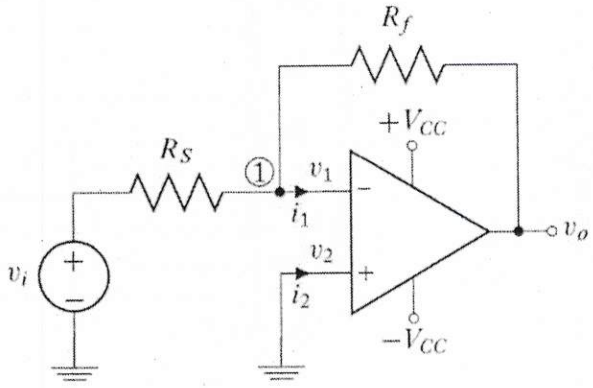

Figure Q7

9.1 Identify the feedback type of Figure Q7. [5marks]

9.2 Derive the expression for v_0/v_i. [10 marks]

9.3 Sate the assumptions that you have made to derive the above expression for section 9.2 [5 marks]

-End of Part D-

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