The Open university of Sri Lanka
B.Sc/B.Ed Degree programme Level -03
Final Examination 2012/1013
PCU1170 / PSU1143 - Electronics for Biology students
Duration : Two hours

Date : 31st May 2013 **Time :1.30 pm to 3.30 pm**

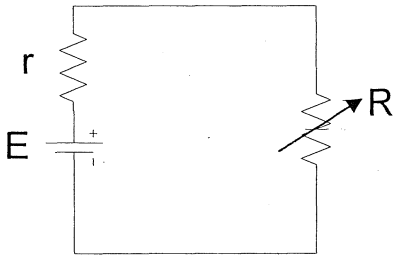
Answer any Four (04) Questions only

1. a) An LED is operated at 2.5V/ 20mA. Draw a diagram of the circuit to light up the LED with a resistor and a 12V battery. Calculate the value of the current limiting resistor used in that circuit.

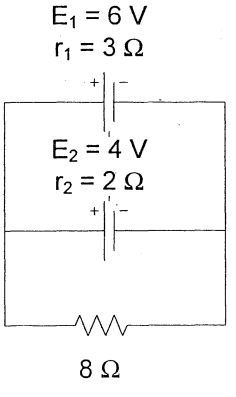
b) The following circuit diagram consists a variable resistor – R and battery having emf –E with internal resistance - r.

(i) Sketch the graph for the variation of power (P) in R vs its resistance R. Mark the resistance value of R when the power dissipation is maximum

(ii) Hence, show that maximum power dissipation of the variable resistor is $P_{max} = \frac{E^2}{4r}$



c) In the following Circuit diagram, two batteries having emf E_1 , E_2 and internal resistance r_1, r_2 are connected in parallel with a 8 Ω resistor .



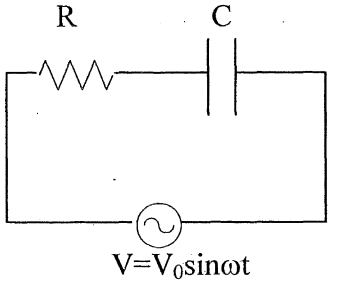
i. Determine the current and voltage through the 8 Ω resistor
ii. Hence find power dissipation of the 8 Ω resistor

2. (a) A capacitor is connected to a sinusoidal voltage source

i Show that capacitive reactance (impedance), $X_c = \frac{1}{2\pi fc}$ where f- frequency of the voltage source, c- capacitance of the capacitor

ii. Sketch the graphs for the variation of current (I) and voltage (V) on the same time axis

(b) The following RC circuit consists of R= 135 Ω, C = 28.0 μF, f=60.0 Hz and V_{rms}= 110 V



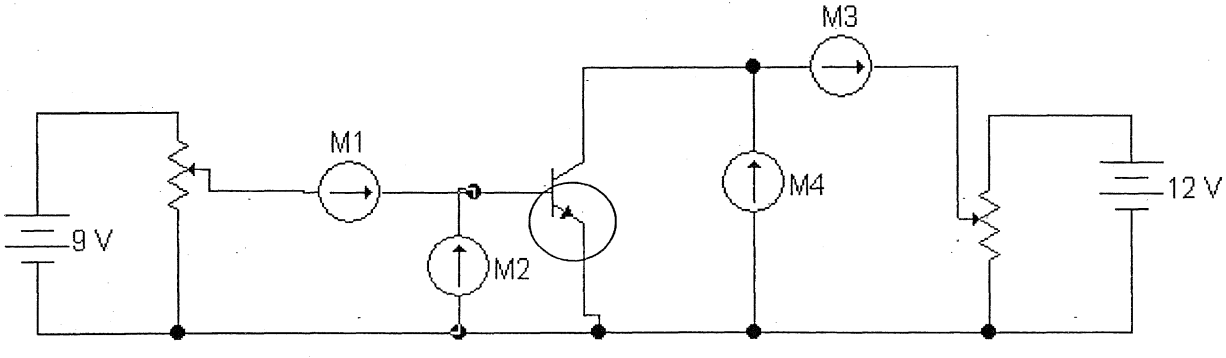
i Find the impedance of each component

ii Hence find the total impedance of the circuit

iii Determine the current through the circuit

iv Calculate the peak voltage across each component

3. The figure shows the circuit diagram to measure the input and output characteristics for a npn transistor .All the measuring devices are digital meters.



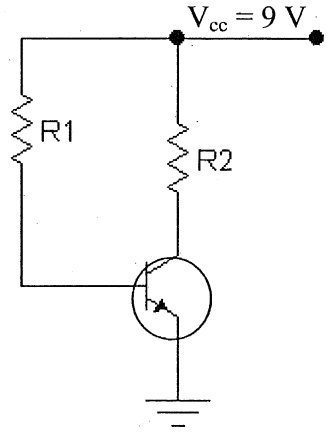
a) Copy the following table in your answer script and fill in the blanks

Meter	Type of the meter **(Most sensitive)**	Physical parameter	Purpose
M1	i).....	v).....	ix).....
M2	ii) millivoltmeter (mV)	vi) V_{BE}	x) to measure the input voltage
M3	iii).....	vii).....	xi).....
M4	iv).....	viii).....	xii).....

b) Discuss how you obtain the measurements to plot the output characteristic of the transistor.

c) The figure shows an npn transistor amplifier circuit with R1, R2 and a dc power supply . Consider the current gain β=100 and V_{BE} = 0.7 V for this amplifier.

(i) When the base current is 10 μA find the suitable value for R1
(ii) Determine the suitable value for R2 maintaining V_{CE} as half of the power supply voltage



4. a) What is an active frequency filter ?

b) Draw the circuit diagrams for the following filter types

i. Low-pass (LP) filters

ii. Band pass (BP) filters

iii. Band rejection (BE) filters

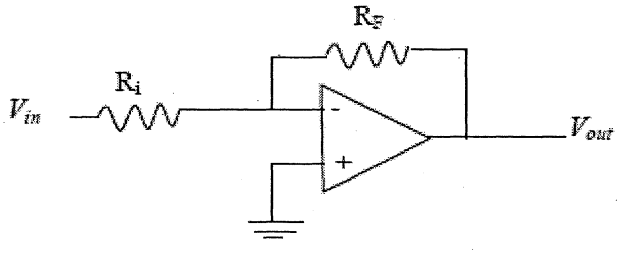
c) Explain one of the applications of LCR circuit used as a frequency tuner in a radio

5. (a) Write down the ideal characteristics of an operational amplifier.

(b) What do you mean by the open loop and closed loop voltage gain?

(c) Write down the two golden rules of operational amplifiers that can be derived from the ideal op amp technique?

(d) Derive a relation between the input and the output of the following inverting amplifier circuit using the two golden rules.

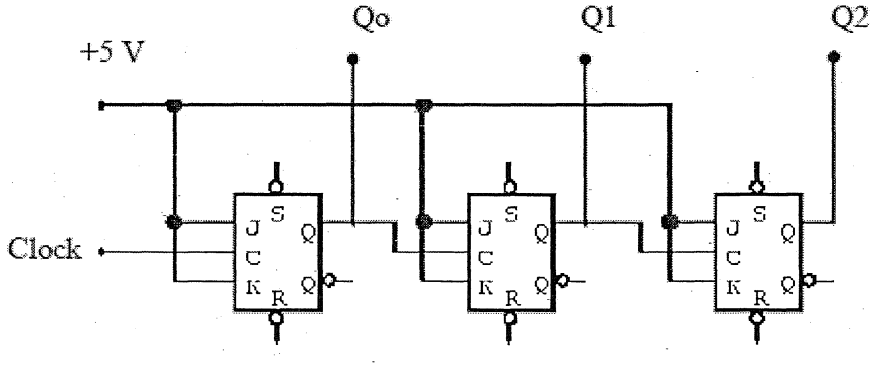


6) (a) Write down the Demogan's theorem in Boolean algebraic form.

(b) What is the difference between combinational logic circuits and sequential logic circuits?

(c) Draw the R-S flip flop which is made using two NOR gates, and write down the Truth table for R-S flip flop.

(d) The following diagram shows a three bit ripple counter.



Draw the waveform at each binary output ; Q0, Q1 and Q2 for seven clock pulses.

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