CALEDONIAN COLLEGE OF ENGINEERING, OMAN

Session : 2003 – '04 **DIET :**

Level : II Module Leader :

Jan 2004 **Duration : TWO Hours**

Analogue Electronics
(ENGE 254)

CANDIDATES SHOULD ATTEMPT ANY FOUR FULL QUESTIONS

PLEASE READ THE QUESTIONS CAREFULLY

MATERIALS TO BE SUPPLIED/ALLOWED:
Question paper (Supplied)
Blank Examination Script (Supplied)
Non-programmable calculator (Allowed)

Q1 *(a)* Explain the characteristics and functions of Emitter, Base and Collector regions of a BJT transistor. [6]

(b) (i) Derive the relation between β_{DC} and α_{DC}. [4]

(ii) For a BJT, $I_B = 40\mu A$, and $I_C = 2.65mA$. Determine β_{DC}, and α_{DC} . [4]

(c) The common emitter short circuit current gain (β_{DC}) of the transistor shown in Fig.Q1-c is 150.

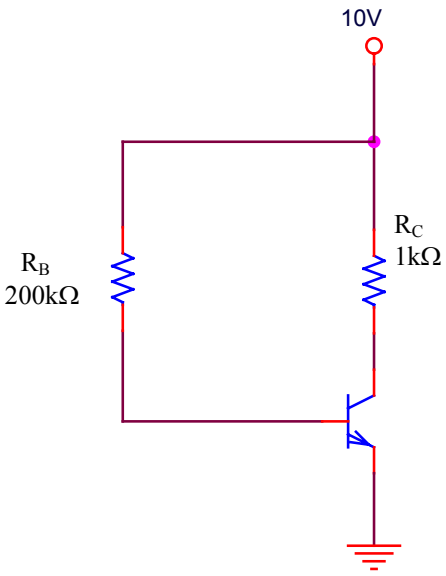

Fig. Q1-c

Determine

(i) the values of I_B, I_C and V_{CE}. [9]

(ii) the region of operation. [2]

Q2 *(a)* Explain with the aid of equations why the base bias circuit is considered an unstable biasing condition. [10]

(b) (i) Sketch the circuit diagram of a tuned amplifier and explain its operation. [4]

(ii) State why a tuned amplifier is not used for audio applications. [4]

(c) With the aid of diagrams explain the operation of an N-channel D-MOSFET. [7]

Q3 *(a)* For the oscillator circuit block diagram shown in fig. Q3-a the feedback factor is 1/29 and the phase shift around the closed loop is 0^o. What should be the gain of amplifier for sustained oscillation? [3]

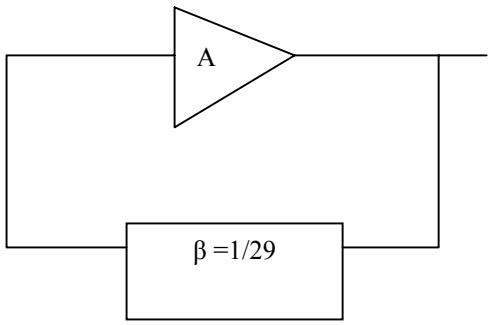

Fig.Q3-a

(b) For the oscillator circuit shown in Fig.Q3-b, identify its type and find the gain required to sustain oscillation. Determine the value of R_f required to sustain this gain. Find the frequency of oscillation. [10]

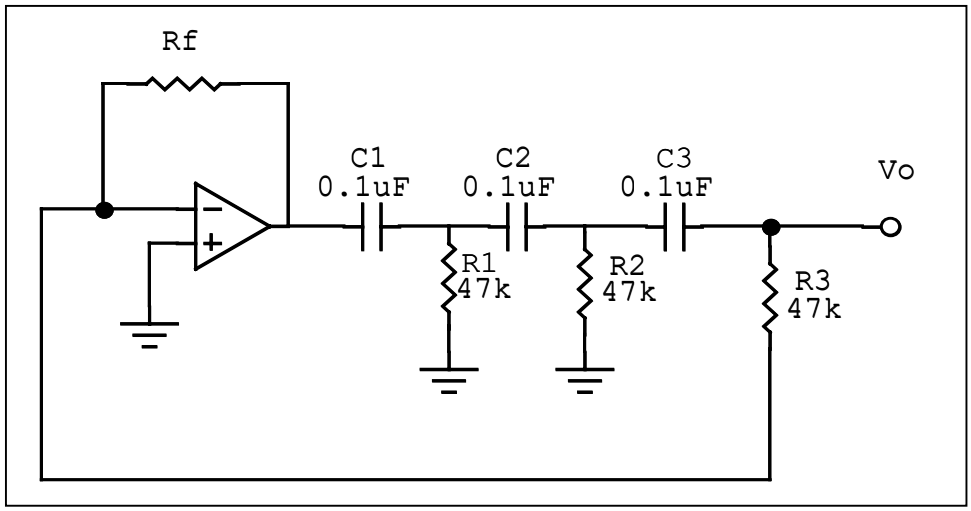

Fig.Q3-b

(c) Sketch a crystal oscillator circuit and explain its operation. [5]

(d) Design a Hartley oscillator to operate on frequency of 45kHz. Sketch the circuit diagram of the oscillator. [7]

Q4 (*a*) Explain with the aid of equations common mode rejection ratio and slew rate. [5]

(b) For the circuit shown in Fig.Q4-b, calculate the magnitude of the output voltage, assuming ideal operational amplifiers. [10]

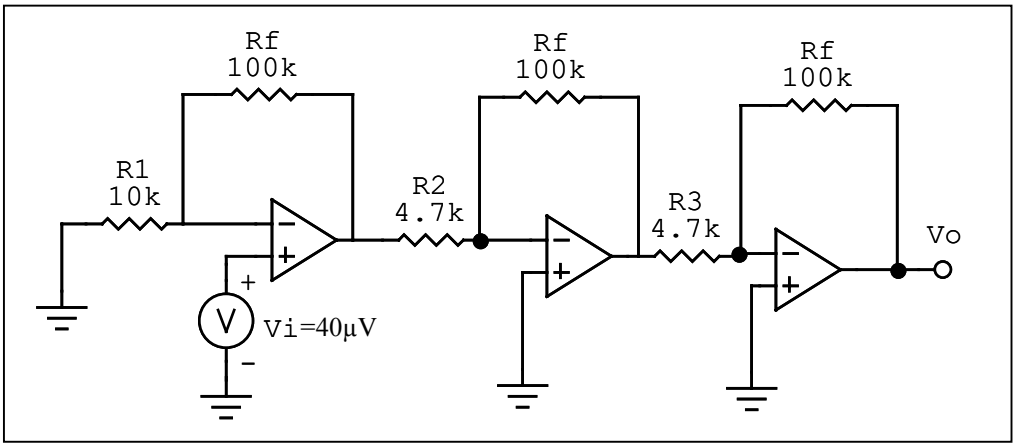

Fig.Q4-b

(c) State the important features and application of the Voltage follower. [5]

(d) Sketch the circuit diagram and the output waveform of the zero level comparator. [5]

Q5 *(a)* State the advantages of active filters over passive filters. [3]

(b) Design a 2nd order LPF with cutoff frequency equal to 15kHz and gain equal to 1.586. Sketch the filter circuit and frequency response. [9]

(c) Sketch the general frequency response curve for a band pass filter. [5]

(d) With the aid of block diagrams explain the operation of a band stop filter and sketch the frequency response. [8]

Q6 *(a)* Identify the circuit shown in Fig.Q6-a. Find the values of Ton, Toff, the frequency of oscillation and the duty cycle. [10]

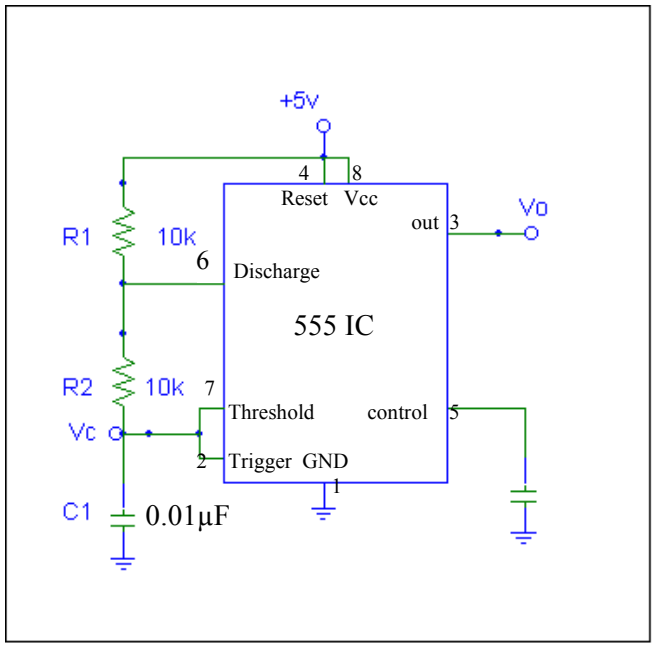

Fig.Q6-a

(b) Sketch the waveforms at pin 2 and pin 3 for the circuit shown in Fig.Q6-a. [4]

(c) Briefly explain how light is conducted through an optical fiber. [5]

(d) State the advantages of using optical fibers over traditional copper wires in communication systems. [6]

END OF QUESTION PAPER