AMIETE – ET (OLD SCHEME)

Code: AE05
Time: 3 Hours

JUNE 2011

Subject: BASIC ELECTRO
Max. Marks:

NOTE: There are 9 Questions in all.

- **Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.**
- **The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.**
- **Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.**
- **Any required data not explicitly given, may be suitably assumed and stated.**

Q.1 Choose the correct or the best alternative in the following: **(2×10)**

a. A load line is a plot that describes

(A) The I-V characteristics curve for a load resistor
(B) A driving circuit
(C) Both **(A)** and **(B)**
(D) Neither **(A)** nor **(B)**

b. The output frequency of a full wave rectifier with a 60Hz sinusoidal input is

(A) 30 Hz **(B)** 60 Hz
(C) 120 Hz **(D)** 0 Hz

c. A diode limiting circuit

(A) Removes part of waveform
(B) Inserts a dc level
(C) Produces a output equal to the average value of the input
(D) Increase the peak value of the input

d. A saturated bipolar transistors can be recognized by

(A) A very small voltage between the collector and emitter
(B) V_{CC} between collector and emitter
(C) A base emitter drop of 0.7V
(D) No base current

e. In normal operation, the gate –source p-n junction for a JFET is

(A) reverse biased **(B)** forward biased
(C) Either **(A)** or **(B)** **(D)** Neither **(A)** nor **(B)**.

f. An amplifier that operates in the linear region at all times is

(A) Class A **(B)** Class AB
(C) Class B **(D)** all of these answers

g. In the common mode

(A) Both inputs are grounded
(B) The outputs are connected together
(C) An identical signal appears on both inputs
(D) The output signals are in phase

h. In differentiator, the feedback element is a

(A) Resistor
(B) Capacitor
(C) Diode
(D) Inductor

i. An oscillator differs from an amplifier because

(A) It has a more gain
(B) It requires no input signal
(C) It requires no dc supply
(D) It always has the same output

j. The basic difference between a series regulator and a shunt regulator is

(A) The amount of current that can be handled.
(B) The position of the control element.
(C) The type of sample circuit.
(D) The type of error detector.

Answer any FIVE Questions out of EIGHT Questions.
Each question carries 16 marks.

Q.2 a. An n-p-n transistor with $\beta = 150$ is to operate in the common (grounded) base configuration. A dc power supply at $V_S = \pm 12$ V is available and with two external resistors. One connected between the collector and V_{CC} and the other between the emitter and V_{EE}, we want to keep the collector current I_C at 1.6 mA and the collector voltage V_C at 4 V. Find the values of the resistors, given that when $V_{BE} = 0.7$ V, $I_C = 1.2$ mA. The circuit operates at $T = 27^\circ$C. **(8)**

b. For the circuit as shown in Fig.1, the diodes are identical and it is known that at $V_D = 0.65$, $I_D = 0.5$ mA. It is also known that the voltage across each diode changes by 0.1 V per decade change of current. Compute the value of R so that $V_{out} = 3$ V. **(4)**

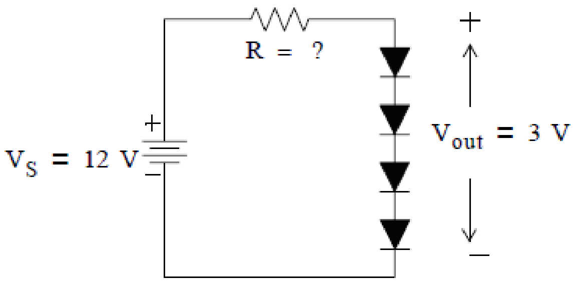

Fig. 1

c. A circuit and its input waveform are shown in Fig.2. Compute and sketch the waveform for the output v_{out}.

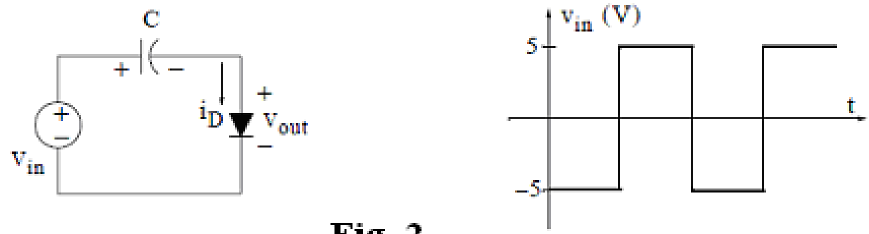

Fig. 2

Q.3 a. For the three-stage amplifier as shown in Fig.3,

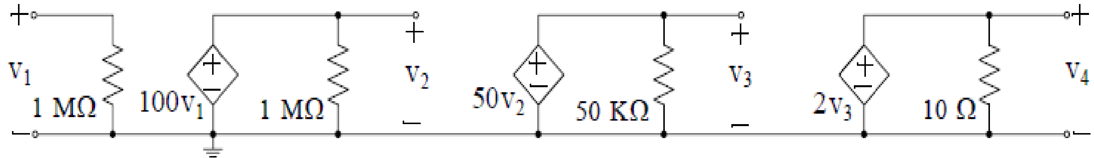

Fig. 3

(i) Find the voltage amplification and power gain of each stage in dB (ii) Find the overall voltage amplification and overall power gain of each stage in dB **(8)**

b. For the JFET amplifier circuit in Fig. 4, prove that the voltage gain A_V depends only on the transconductance g_m and the value of the drain resistor R_D, that is, show that $A_V = -g_m R_D$. **(8)**

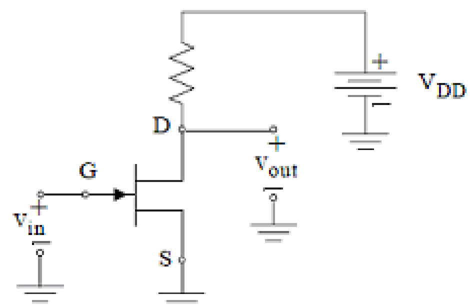

Fig. 4

Q.4 a. The Fig.5 shows a crystal oscillator and its equivalent circuit. **(8)**

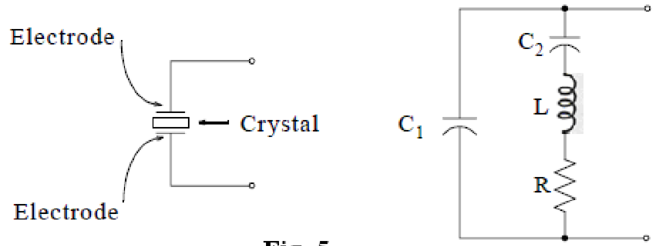

Fig. 5

Prove that $\omega_{0P} = \sqrt{\dfrac{C_1 + C_2}{LC_1C_2}}$

b. Draw and explain the functional diagram of the 555 timer. **(8)**

Q.5 a Obtain input and output resistance in each, the current series and voltage shunt negative feedback topologies. **(8)**

b.

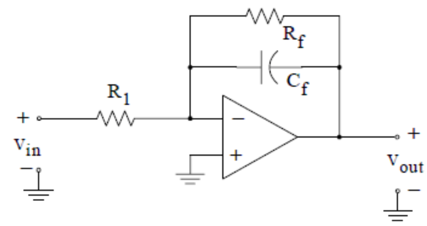

Fig. 6

(i) Derive the closed-loop transfer function (ii) Derive an expression for the dc gain (iii) Derive an expression for the 3 dB frequency (iv) If R_1 =1 kΩ, compute the values of R_f and C_f such that the circuit will have a dc gain of 40 dB and 1 kHz 3 dB frequency.

Q.6 a. For the op-amp as shown in Fig.7, the open-loop is 100,000.

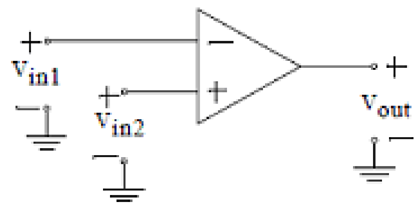

Fig. 7

(i) Find v_{in1} if v_{in2} =3 mV and v_{out} =5 V (ii) Find v_{in2} if v_{in1}=2 mV and v_{out}= –5 V (iii) Find v_{out} if v_{in1}=2 mV and v_{in2}= –3 mV. **(8)**

b. Design a monostable multivibrator using a 555 timer, a capacitor with value C=1 nF and appropriate resistor values to produce an output pulse of 20 μs duration. **(8)**

Q.7 a. Compare push pull and complimentary push pull power amplifiers. **(8)**

b. What value of R_1 is necessary in a 7805 regulator to provide a constant current of 1 A to a variable load that can be adjusted from 0 – 10Ω. **(8)**

Q.8 a. Derive the expression for hybrid -Π parameters of CE amplifier. **(8)**

b. Explain the race around condition in JK flip-flop and also, discuss the methods to avoid it. **(8)**

Q.9 a. Explain the operation of following circuit in Fig.8. **(8)**

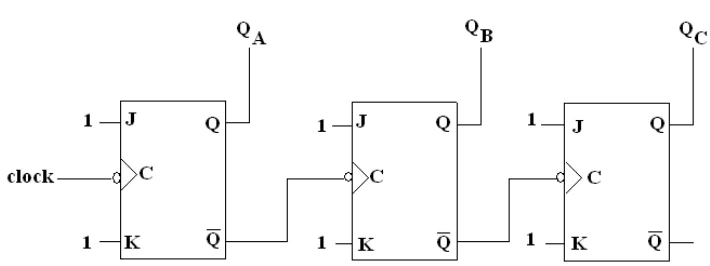

Fig. 8

b. Obtain minimal sum of product for the function given below:
F(w, x y, z) = $\sum(0,2,3,6,7,8,10,11,12,15)$. **(8)**