Code: DE08 **Subject: ANALOG ELECTRONICS**
Time: 3 Hours **Max. Marks: 100**

DECEMBER 2010

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 half an hour 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 transistor circuit employing base bias with collector feedback has greater stability than one without feedback, it is because of

(A) reduction of I_c in magnitude. **(B)** reduction of V_{BE}
(C) I_C becoming independent of β **(D)** negative feedback effect.

b. RC coupling is popular in low-level audio amplifiers, because it

(A) Has better low frequency response.
(B) Is inexpensive and needs no adjustments.
(C) Provides an output signal in phase with the input signal.
(D) Needs low voltage battery for collector supply

c. In a common Emitter amplifier, the unbypassed emitter resistance provides.

(A) voltage shunt feedback **(B)** current series feedback
(C) negative voltage feedback **(D)** positive current feedback

d. A tuned amplifier amplifies

(A) a wide band of frequencies **(B)** audio- frequencies only.
(C) video frequencies only. **(D)** a narrow band of frequencies.

e. Class AB operation is often used in power (large signal) amplifiers in order to

(A) Get maximum efficiency **(B)** remove even harmonics
(C) overcome cross-over distortion. **(D)** reduce collector dissipation.

f. OP-AMP cannot be used as

(A) an adder **(B)** an integrator
(C) a multiplier **(D)** an exponential

g. A crystal oscillator provides very stable frequency because of

(A) high stability of the crystal **(B)** the rigid crystal structure
(C) low X_L/R ratio of the crystal **(D)** high Q of the crystal

h. Heat sink is used in the power amplifier circuit

(A) to increase the output power.
(B) to reduce the heat loss in a transistor
(C) to increase the voltage gain of the power amplifier.
(D) to increase the collector dissipation ratings of the transistor..

i. Schmitt trigger is basically

(A) an Astable multivibrator **(B)** a monostable multivibrator
(C) a bistable multivibrator **(D)** an oscillator

j. The configuration having non-inverting voltage gain of more than unity is

(A) CE **(B)** CB
(C) CC **(D)** CB and CE

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

Q.2 a. What is the need for transistor biasing? Name the various methods used for transistor biasing? Draw the self bias circuit for an NPN BJT transistor and explain how stabilization is achieved by this method. **(10)**

b. Calculate the operating point of the self biased JFET having the supply voltage V_{DD}=20V, maximum value of drain current I_{DSS}=10 mA and V_{GS}=-3V at I_D = 4mA. **(6)**

Q.3 a. Draw a neat circuit diagram of double tuned amplifier and explain its operation with frequency response. What are its advantages over single tuned amplifier? **(9)**

b. For the n-channel depletion MOSFET amplifier circuit shown in Fig.1 has $g_{mo} = 4.5\times10^{-3}$ mhos, I_{DSS}=9mA, $V_P = -4$, $V_{GS_Q} = -1$V and I_{DQ}= 5.1mA then calculate
(i) voltage gain, A_V
(ii) output voltage, V_O
(iii) input impedance , R_i
(iv) output impedance , R_O **(7)**

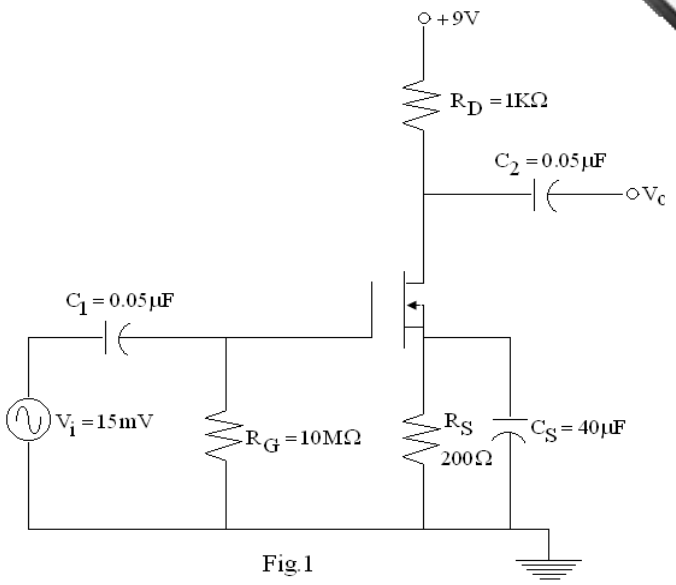

Fig.1

Q.4 a. For a small-si[illegible]s interms of h parameters and draw the h- parameter equivalent model for CB configuration of a transistor. Find out the expressions for h- parameters and give its typical values. **(7)**

b. A 3-stage cascaded amplifier has voltage gains of 50, 100 and 200 for first second and third stage. Find the overall voltage gain of the amplifier in decibels. **(4)**

c. What is thermal runaway associated with a transistor amplifier? How can it be prevented? **(5)**

Q.5 a. What is a push-pull amplifier? Draw the circuit diagram of class-B push-pull power amplifier and explain its operation by drawing the wave forms at different positions. **(8)**

b. A transformer-coupled class-A amplifier operates with $V_{CC} = 20V$, draws a no-signal collector current of 5A and feeds a load of 40Ω through a step-up transformer $\frac{N_2}{N_1} = 3.16$. Find

(i) Whether the amplifier is properly matched for maximum power transfer.
(ii) Maximum a.c signal power output.
(iii) Maximum d.c. power input.
(iv) Conversion efficiency at maximum signal input **(8)**

Q.6 a. Explain the operation of OP-AMP Integrator and derive an expression for its output voltage. Also draw its output waveform when the input is a square wave signal. **(9)**

b. Find the output voltage for the OP-AMP circuit shown in Fig.2, if $R = R_1 = 1K\Omega$, $R_F = 2K\Omega$, $V_a = +2V$, $V_b = -3V$ and $V_c = +4V$ **(7)**

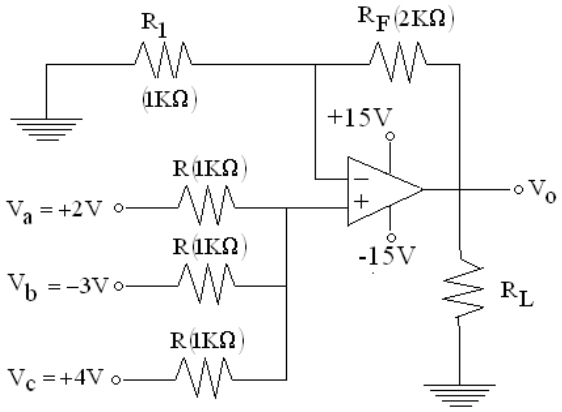

Fig.2

Q.7 a. Draw the circuit diagram of Hartley oscillator and explain its working. **(8)**

b. Determine the frequency of oscillations when a RC phase-shift oscillator has R=10kΩ, C=0.01μF and R_C= 2.2kΩ. Also find the minimum current gain needed for this purpose. **(8)**

Q.8 a. Explain the operation of an astable multivibrator using 555 timer IC and derive an expression for its frequency. **(10)**

b. Draw the output wave form by labelling the voltage for the input of 20V (p-p) square wave input signal wave form shown in Fig.3. Name the circuit and explain its operation. Assume that the diode is ideal and capacitor is lossless. **(6)**

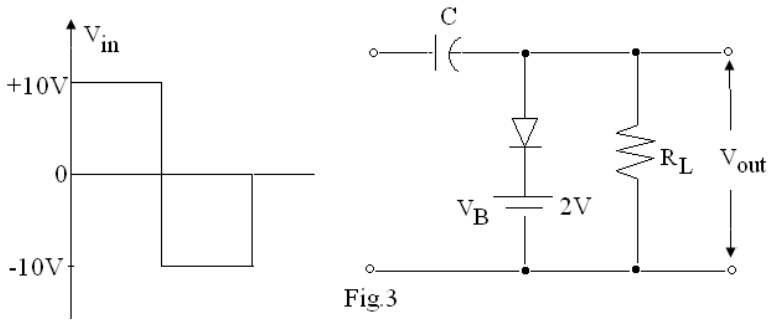

Fig.3

Q.9 a. St **(6)**

b. What are the ideal characteristics of on OP-AMP? **(5)**

c. Determine the power dissipation capability of a transistor which has been mounted with a heat sink having thermal resistance $\theta_{HS-A} = 8^\circ C/W$, $T_A = 40^\circ C$, $T_J = 160^\circ C$, $\theta_{J-C} = 5^\circ C/W$ and $\theta_{C-A} = 85^\circ C/W$. **(5)**