ROLL NO. ______________

Code: AE53/AC53/AT53 Subject: ELECTRONIC DEVICES & CIRCUITS

AMIETE – ET/CS/IT

Time: 3 Hours **DECEMBER 2012** **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

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. Three resistors of value $1K\Omega, 2K\Omega$ and $4K\Omega$ are connected in parallel. If supply voltage is 2V, the total current in the circuit is _________.

(A) 3 mA **(B)** 3.25 mA
(C) 3.5 mA **(D)** 4 mA

b. The value of voltage equivalent of temperature at room temperature $(27^\circ k)$ is

(A) 26 mV **(B)** 37 mV
(C) 100 mV **(D)** 200 mV

c. Ripple factor for Full wave Rectifier without filter is ___________

(A) 0.462 **(B)** 0.432
(C) 0.492 **(D)** 0.482

d. DC current of full wave rectifier is ____________

(A) $\frac{I_m}{\pi}$ **(B)** $\frac{I_m}{\sqrt{2}}$
(C) $\frac{2I_m}{\pi}$ **(D)** $\frac{2I_m}{\sqrt{2}}$

e. Current gain β in terms of α is expressed as

(A) $\frac{\alpha}{1+\alpha}$ **(B)** $\frac{1+\alpha}{\alpha}$
(C) $\frac{\alpha}{1-\alpha}$ **(D)** $\frac{1-\alpha}{\alpha}$

f. A Four layer electronic device is _________

(A) BJT **(B)** SCR
(C) UJT **(D)** FET

g. nMOS transistor with potential divider as biasing circuit havi $R_1 = R_2 = 100K\Omega$ will have gate potential for $V_{DD} = 12V$ as ________

(A) 8V (B) 6V
(C) 10V (D) 12V

h. The elementary JFET amplifier has $g_m = 1600\mu sec$, $r_d = 50K\Omega$, $R_L = 5K\Omega$. The value of small signal voltage gain is _________

(A) 8 (B) 0.8
(C) -8 (D) -0.8

i. For class-B amplifier operation, the operating point Q is at ________ of the load line.

(A) center (B) cut off end
(C) beginning (D) None

j. The length required to fabricate $20K\Omega$ resistor whose width is $25\mu m$ and $R_s = 200\Omega$/square is

(A) $250\mu m$ (B) $1000\mu m$
(C) $25000\mu m$ (D) $2500\mu m$

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

Q.2 a. State superposition and Thevinin's theorem. Give an example for each. **(8)**

b. Find the value of R in Fig.1 such that the power supplied by 100V source to the network is same as the power supplied by 5A source. **(6)**

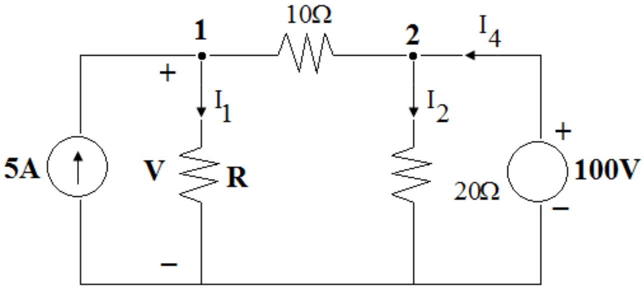

Fig.1

c. Plot Z vs ω response of RLC parallel circuit indicating resonant frequency and half power points. **(2)**

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Q.3 a. With neat diagram explain Zener diode I-V characteristics and how it works as voltage regulator. **(10)**

b. For the circuit shown in Fig.2, determine the current I_1 and I_2 for supply voltage $V_s < 0.7V$ and $V_s > 0.7V$. Assume $V_T = 0.7$ for all diodes. **(6)**

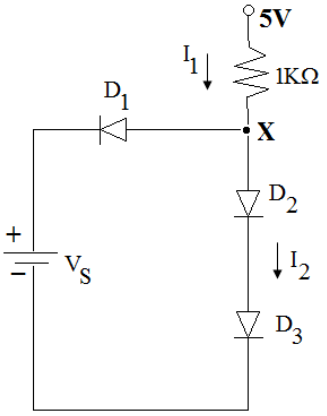

Fig.2

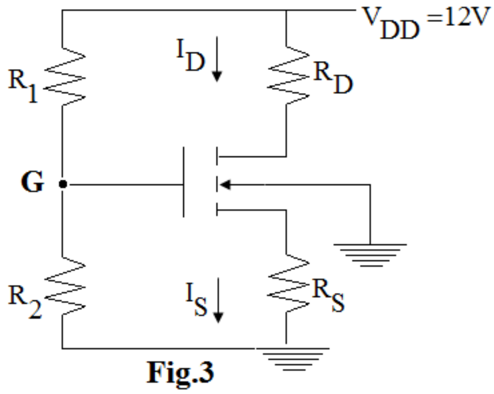

Fig.3

Q.4 a. Explain how MOSFET is different from JFET. **(8)**

b. An nMOS transistor is used in the circuit of Fig.3. MOSFET has device parameter of K = 2. The circuit has $R_D = R_S = 2.5K\Omega$, $R_1 = 100K\Omega$, $R_2 = 200K\Omega$. Determine I_D and V_{DS}. **(8)**

Q.5 a. Write circuit and small signal model of BJT amplifier (CE configuration). Derive an expression for i_c. **(8)**

b. The emitter follower circuit of Fig.4 has $\beta = 98, r_\pi = 1.275K\Omega$, $R_B = 220K\Omega$, $R_E = 3.3K\Omega$, $V_{CC} = +12V$. Calculate:

(i) voltage gain

(ii) input and output impedances. **(8)**

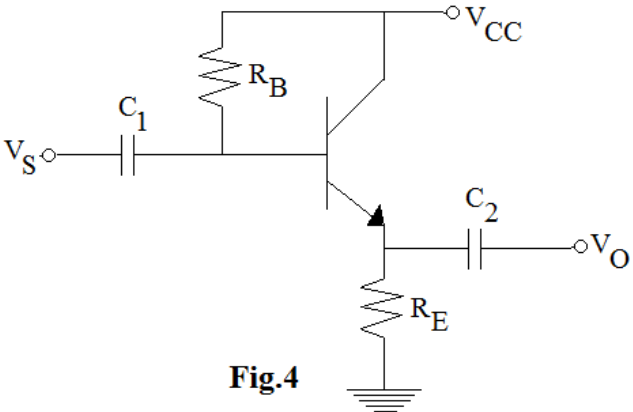

Fig.4

Q.6 a. Briefly explain the importance of the terms 'Quality factor' in Tuned Amplifier. **(8)**

b. The amplifier circuit of Fig.5 uses silicon BJT with $\beta = 100$. The values of other circuit elements are $R_1 = 60K\Omega$, $R_2 = 140K\Omega$, $R_S = 4K\Omega$, $R_E = 3K\Omega$, $R_C = 4K\Omega$. Capacitances are assumed to be large and $V_{CC} = 10V$. Find DC bias current I_C and V_{CE}. **(8)**

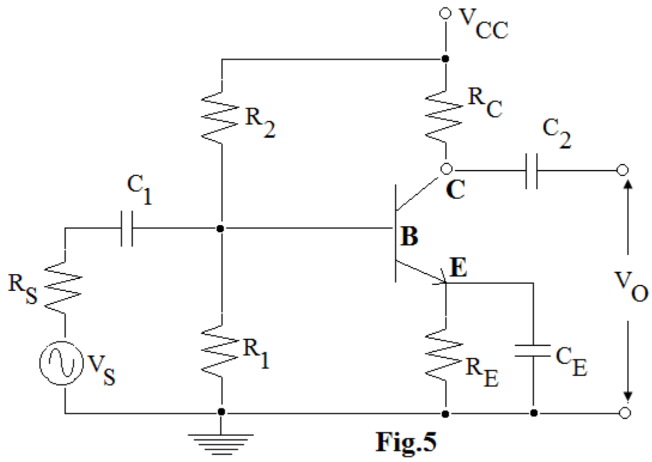

Fig.5

Q.7 a. Explain briefly functioning of series fed class-A large signal amplifier. **(8)**

b. With neat sketch explain the working of class-B push-pull amplifier. **(8)**

Q.8 a. Explain various types of feedback connections. **(8)**

b. A voltage series feedback amplifier has the following data. $A = -500$, $R_I = 1.5K\Omega, R_O = 50K\Omega, \beta = \frac{1}{20}$. Calculate amplifier gain, input and output resistances. **(8)**

Q.9 a. Explain briefly oxidation and photolithography process of IC Fabrication technique. **(6)**

b. What is the length required to fabricate $20K\Omega$ resistor whose width is $25\mu m$, given $R_s = 200\Omega/\text{Square}$? **(4)**

c. Write cross-sectional view of CMOS fabrication and explain briefly. **(6)**