Code: AE53/AC53/AT53/AE103   Subject: ELECTRONIC DEVICES & CIRCUITS

AMIETE – ET/CS/IT (Current & New Scheme)

Time: 3 Hours   **June 2019**   **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. What kind of diode is formed by joining a doped semiconductor region with a metal?
   (**A**) Tunnel   (**B**) Laser
   (**C**) Schottky   (**D**) LED

b. In high-frequency response of RC coupled amplifier bypass capacitor acts as _____ and coupling capacitor as _____.
   (**A**) Open, Open   (**B**) Short, Open
   (**C**) Open, Short   (**D**) Short, Short

c. Complex microprocessor chips are categorized under
   (**A**) SSI   (**B**) MSI
   (**C**) LSI   (**D**) VLSI

d. Depending upon whether the voltage or current is fed back either in series or in parallel, there are _____ types of feedback connection(s).
   (**A**) One   (**B**) Two
   (**C**) Three   (**D**) None of these

e. The Quality Factor (Q) of Tuned Amplifier is
   (**A**) $\dfrac{\omega_0}{RC}$ (**B**) $\omega_0 RC$
   (**C**) $\dfrac{\omega_0}{RLC}$ (**D**) $\omega_0 RLC$

f. Maximum power dissipation $P_{D(max)}$ of a BJT is
   (**A**) $V_{CE}I_C$ (**B**) $V_{BE}I_B + V_{CE}I_C$
   (**C**) $V_{BE}I_B$ (**D**) $V_{BE}I_E + V_{CE}I_C$

g. A germanium diode carries a current of 10 mA when a forward bias of 0.2 V is applied. The reverse saturation current(I_S) is
   (**A**) 100 mA   (**B**) 100 µA
   (**C**) 3.355 mA   (**D**) 3.355 µA

h. A BJT is a:
    (A) current controlled & bipolar device
    (B) voltage controlled & bipolar device
    (C) current controlled & unipolar device
    (D) voltage controlled & unipolar device

i. In common base (CB) configuration of BJT which relation(s) is valid
    (A) $\alpha = \frac{\beta}{1+\beta}$ **(B)** $i_b = \frac{i_e}{1+\beta}$
    (C) $i_c = \alpha i_e$ **(D)** All of these

j. Zener diode is
    (A) Heavily doped   **(B)** lightly doped
    (C) Moderately doped   **(D)** Undoped

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

Q.2 a. Deduce the frequency criterion of RLC parallel circuit for the generation of
         Resonance.   **(6)**

b. Consider the RC series circuit of Figure below which is excited by step of
    magnitude V_i , that is $V_i\, u(t)$ and the output v_0 is taken across the capacitor C.
   Derive the expression for time constant of the circuit.   **(4)**
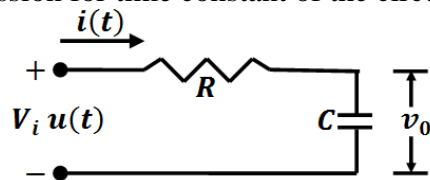
c. Consider the loop of Figure below which forms parts of an electric circuit.
    Find i_3, given $i_1 = 2A, i_2 = 4A$ **(6)**
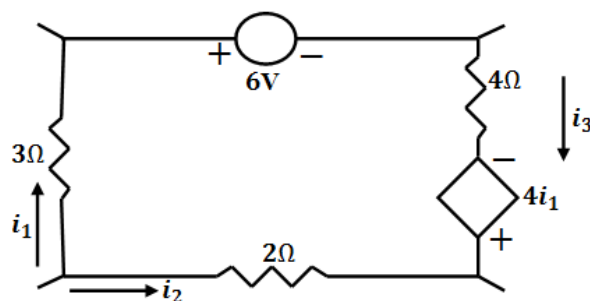
Q.3 a. Explain the formation of P-type Semiconductor.   **(3)**

b. Compare Zener Diode and PN junction Diode.   **(5)**

c. Calculate the ripple factor of a full-wave rectifier with a 120mF capacitor
   connected to a load of 60mA. Assume frequency of ac source = 50Hz.   **(8)**

Q.4 a. Explain construction, operation and characteristics of JFET. **(8)**

b. Consider the transistor (β = 50) circuit of Figure given below which has a resistance included between emitter and ground. Show that the transistor is operating in active mode. Calculate I_C, I_E and I_B. **(8)**
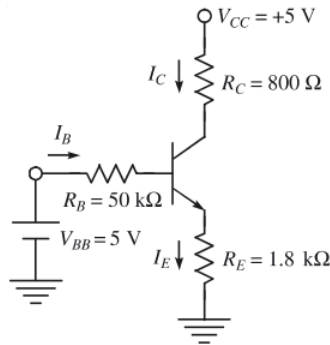
**Q.5** a. Draw and explain the construction, operation and drain characteristic of N-channel JFET. **(8)**

b. The emitter-follower circuit of Figure below has
$\beta = 98, r_\pi = 1.275k\Omega, R_B = 220k\Omega, R_E = 3.3k\Omega \; and \; V_{CC} = +12V$
Calculate voltage gain and input & output impedances. **(8)**
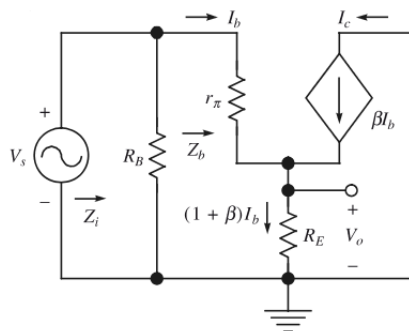
Q.6 a. Explain principle of operation of tuned amplifier. **(7)**

b. What are the reasons of frequency distortion during the amplification process? **(3)**

c. Figure below shows a capacitor coupling a signal from a generator to a load.
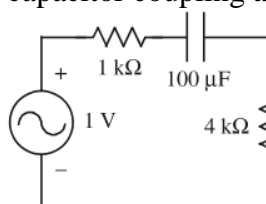
(i) What is the maximum current? **(2)**
(ii) What is the critical frequency? **(2)**
(iii) The lowest frequency at which the capacitor begins to act as a short-circuit? **(2)**

Q.7 a. Draw and explain working of Class C power amplifier. **(8)**

b. A transistor supplies 2W for a 5KΩ load. The zero-signal dc collector current is 35mA and it rises to 49mA when the signal is applied. Determine the percent second harmonic distortion. **(8)**

Q.8 a. Sketch the block diagram of a current series feedback amplifier and derive relation for its closed loop gain. **(8)**

b. A feedback amplifier comprises two amplifying blocks in tandem; each block having a gain of 100. What should be the gain of the feedback block in order for overall gain to be 100? If the gain of each amplifier block reduces to 50% due to parameter variations, what is the % change in the gain of the complete feedback unit? **(8)**

Q.9 a. Explain the various steps involved in fabrication of Monolithic Diodes. **(8)**

b. A thin-film capacitor has a capacitance of $0.4 \text{ pF}/(\mu\text{m})^2$. The thickness of the film is $400 \overset{o}{A}$. Calculate the relative dielectric constant of SiO_2 layer. **(8)**