ROLL NO. _____

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

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

Time: 3 Hours **December - 2017** **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. Find the currents I_1 and I_2 for the network of Fig. 1.1
(A) I_1=3A and I_2=4 A
(B) I_1=3A and I_2=2 A
(C) I_1=4A and I_2=3 A
(D) I_1=2A and I_2=4 A

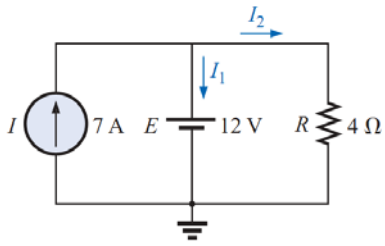

Fig.1.1

b. Avalanche breakdown in a Zener diode occurs when
(A) potential barrier is reduced to zero
(B) forward current exceeds certain value
(C) reverse bias exceeds a certain value
(D) None of these

c. The CE BJT amplifier circuit is preferred over CB BJT amplifier circuit because it has
(A) lower amplification factor
(B) larger amplification factor
(C) high input resistance and low output resistance
(D) None of these

d. Generally, the gain of a transistor amplifier falls at high frequency due to the
(A) internal capacitance of the device
(B) coupling capacitor at the input
(C) Skin effect
(D) coupling capacitor at the output

e. A Bipolar Junction Transistor is a:
(A) current controlled & bipolar device
(B) voltage controlled device & bipolar device
(C) current controlled & Unipolar device
(D) voltage controlled device & Unipolar device

f. Determine the voltage gain with feedback for a voltage-series feedback having $A = -100$, $R_1 = 15\ k\Omega$, $R_o = 20\ k\Omega$, and a feedback of $\beta = -0.25$
(A) 3.85 **(B)** -3.85
(C) -9.09 **(D)** 9.09

g. Calculate the value of $C_1 = C_2$ for the Wien bridge oscillator to operate at a frequency of 20 kHz. Assume $R_1 = R_2 = 50\ k\Omega$ and $R_3 = 3R_4 = 600\Omega$.
(A) 153 pF **(B)** 155 pF
(C) 157 pF **(D)** 159 pF

h. Calculate the efficiency of a class B amplifier for a supply voltage of $V_{CC} = 20$ V with peak output voltage of $V_L(p) = 18$ V. Assume $R_L = 16\ \Omega$.
(A) 78.54% **(B)** 75%
(C) 70.69% **(D)** 50%

i. A capacitive coupled amplifier has a midband gain of 1000 V/V, a single high-frequency pole at 10kHz, and a single low frequency pole at 100 Hz. Negative feedback is employed so that the midband gain is reduced to 10. What are the upper and lower 3dB frequencies of the closed loop gain?
(A) 1Hz and 1MHz **(B)** 2Hz and 2MHz
(C) 3Hz and 3MHz **(D)** 4Hz and 4MHz

j. In an intrinsic semiconductor, the Fermi level
(A) lies at the center of forbidden energy gap
(B) is near the conduction band.
(C) is near the valence band
(D) may be anywhere in the forbidden energy gap

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

Q.2 a. Solve for the current i1 flowing through the 2 ohm resistor in the circuit shown in Fig. 2.1 using superposition theorem. **(8)**

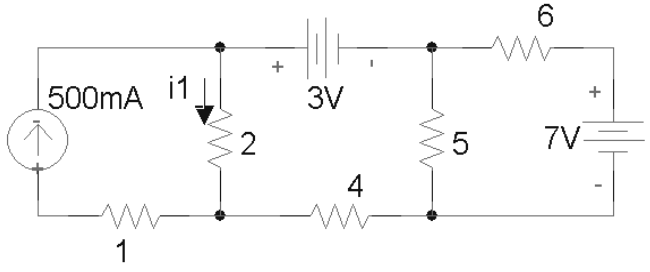

Fig.2.1

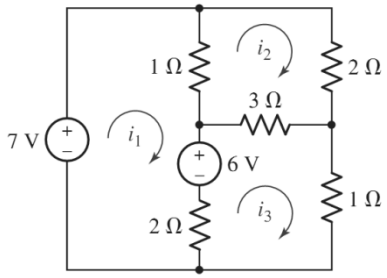

Fig. 2.2

b. Determine the mesh currents i_1, i_2, and i_3 in the circuit of Fig. 2.2. **(3)**

c. A telephone line carries both voice band (0-4 kHz) and data band (25 kHz to1 MHz). Design a fillter that lets the voice band through and rejects the data band. The filter must meet the following specifications: (i) For the voice band, the change in transfer function should be at most 1 dB; and (ii) The transfer function should be as small as possible at 25 kHz, the low end of the data band. **(5)**

Q.3 a. Determine the minimum and the maximum load currents for which the zener diode in Fig. 3.1 will maintain regulation. What is the minimum value of R_L that can be used? V_Z = 12 V, I_{ZK} = 1 mA, and I_{ZM} = 50 mA. Assume an ideal zener diode where Z_Z =0Ω and V_Z remains a constant 12 V over the range of current values, for simplicity. **(8)**

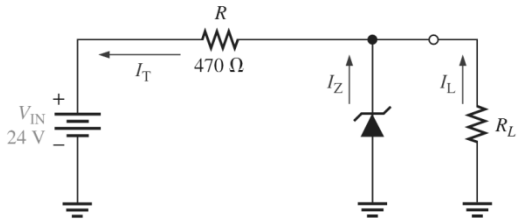

Fig.3.1

b. Explain the working of Full wave rectifier with suitable diagram. **(8)**

Q.4 a. Determine the dc level of I_B, I_C, $I_{C(SAT)}$ and V_C for the network of Fig. 4.1. and also check whether the transistor is in the saturation mode or not. **(8)**

b. Explain construction, operation and characteristics of n-channel enhancement type MOSFET with neat circuit diagram. **(8)**

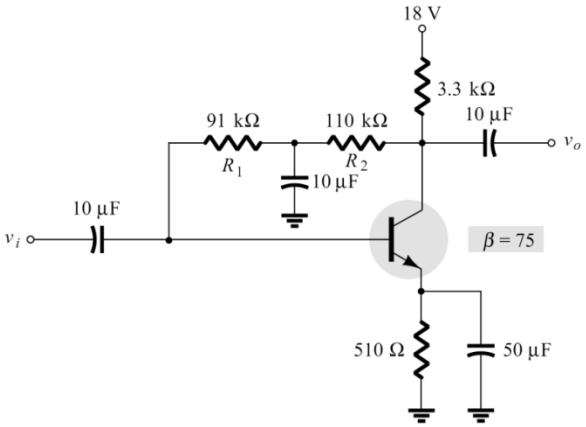

Fig.4.1

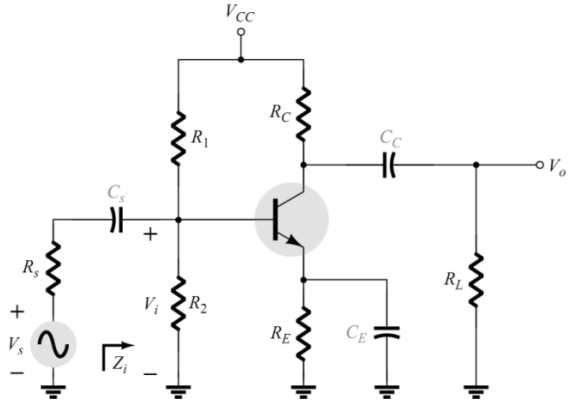

Fig. 5.1

Q.5 a. In the potential divider biasing circuit of transistor, the element values are: R_{B1}=36kΩ, R_{B2}=12kΩ, R_C=4kΩand R_E=1.8kΩ. The supply voltage is 12V. Determine I_{CQ} and V_{CEQ} (quiescent) for (a) β=50 and (b) β=50. What do you conclude from these results? Assume that V_{BE}=0.7V. **(8)**

b. Explain Darlington transistor as amplifier with circuit diagram. Write advantages, disadvantages, and application of Darlington Pair. **(3+2+2+1)**

Q.6 a. Explain working of single stage RC coupled amplifier. **(8)**

b. A single tuned RF amplifier uses a transistor with an output resistance of 50 KΩ, output capacitance of 15pF and input resistance of next stage is 20KΩ. The tuned circuit consists of 47pF capacitance in parallel with series combination of 1μH inductance and 2Ω resistance. Determine the followings:
(i) Resonant frequency
(ii) Effective quality factor
(iii) Bandwidth of the circuit **(8)**

Q.7 a. Sketch the circuit diagram of a Class B push-pull power amplifier using transformer-coupling. The power amplifier circuit shown in the Fig. 7.1 is producing a peak sine wave output of 4 V. Determine its dc input power, ac output power and the efficiency. **(2+2+2+2)**

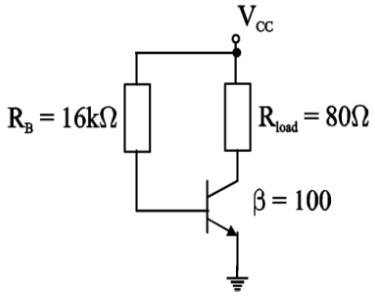

Fig. 7.1

b. Sketch Class A transformer coupled amplifier. In this circuit, if transistor used has power dissipation (PD) =10W.
(i) What maximum signal output power it can produce under ideal conditions?
(ii) If two such identical transistors are used in Class B push pull amplifier, what maximum signal output this transistor pair can produce under ideal condition? **(8)**

Q.8 a. Calculate the gain without and with feedback for the FET amplifier circuit of Fig.8.1 having following circuit values: R_1=80kΩ, R_2=20kΩ, R_o=10kΩ, R_D=10kΩ and g_m=4000μS. **(4+4)**

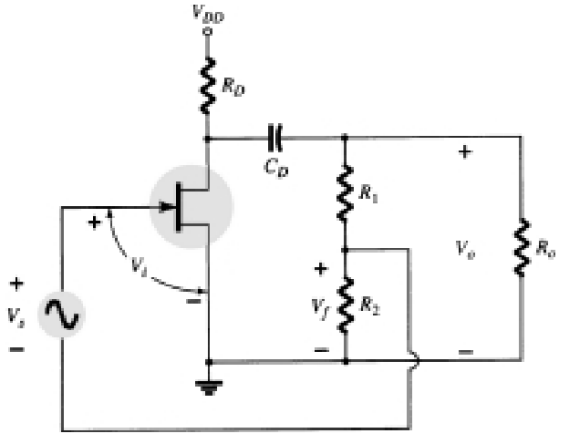

Fig.8.1

b. Sketch the practical circuit of BJT Phase Shift Oscillator and also Calculate the operating frequency of a BJT phase-shift oscillator with parameter values of R= 6 kΩ, C =1500 pF, and R_C =18 kΩ. **(2+2)**

c. Explain, how Uni-junction Transistor works as relaxation oscillator with neat diagram and waveforms. **(4)**

Q.9 a. Explain the various steps involved in IC fabrication. Explain ion implantation IC fabrication technique and also write its advantages. **(4+4+2)**

b. Explain the Oxidation and Photolithography process with diagram for device fabrication. **(3+3)**