ROLL NO. _____

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

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

Time: 3 Hours **June 2018** **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. If 1 A current flows in a circuit, the number of electrons flowing through this circuit is
(A) 0.625×10^{19} **(B)** 1.6×10^{19}
(C) 1.6×10^{-19} **(D)** 0.625×10^{-19}

b. The resistance of a conductor of diameter d and length l is R Ω. If the diameter of the conductor is halved and its length is doubled, the resistance will be
(A) R ohm **(B)** 2R ohm
(C) 4R ohm **(D)** 8R ohm

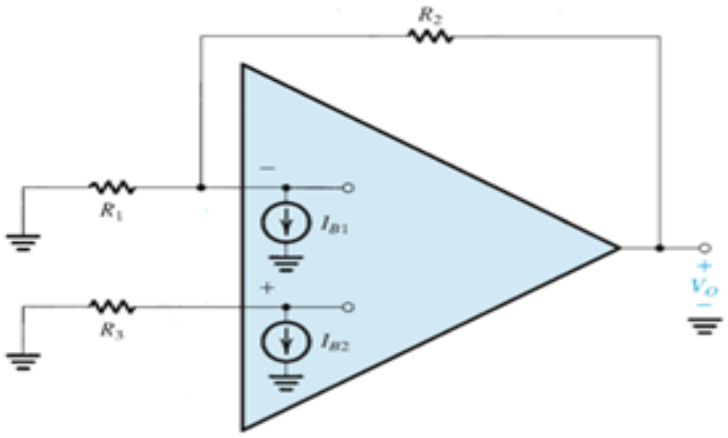
c. A capacitor carries a charge of 0.1 C at 5 V. Its capacitance is
(A) 0.02 F **(B)** 0.5 F
(C) 0.05 F **(D)** 0.2 F

d. A 9.1-V zener diode exhibits its nominal voltage at a test current of 28 mA. At this current the incremental resistance is specified as 5 Ω. Find V_{Z0} of the Zener model.
(A) 8.96V **(B)** 9.03V
(C) 9.17V **(D)** 9.24V

e. A shunt regulator utilizing a zener diode with an incremental resistance of 5 Ω is fed through an 82-Ω resistor. If the raw supply changes by 1.0 V, what is the corresponding change in the regulated output voltage?
(A) 72.7 mV **(B)** 73.7 mV
(C) 74.7 mV **(D)** 75.7 mV

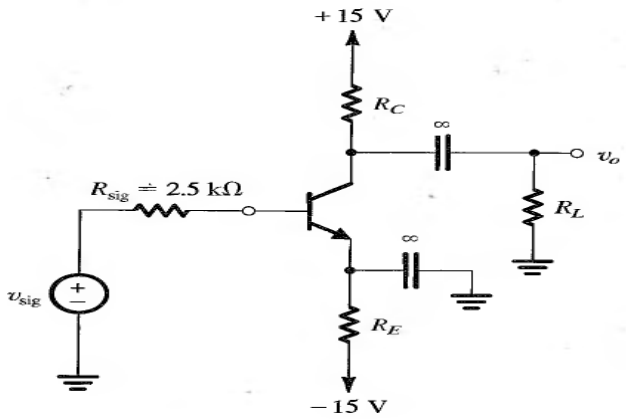
f. The circuit is to operate at a temperature in the range 0°C to 75°C and the temperature coefficient of V_{OS} is 10 μV/°C?
(A) 8.5 mV **(B)** 9 mV
(C) 9.5 mV **(D)** 10 mV

g. Consider the circuit shown below which reduces the impact of the input bias current. If $I_{B1} = I_{B2}$ = Input bias current, then determine the value of R_3 so that the output voltage (v_0) is not impacted by the input bias current.



(A) (R1 R2)/(R1+R2)
(B) (R1 R2)/(R1-R2)
(C) R1-(R1 R2)/(R1+R2)
(D) R2- (R1 R2)/(R1+R2)

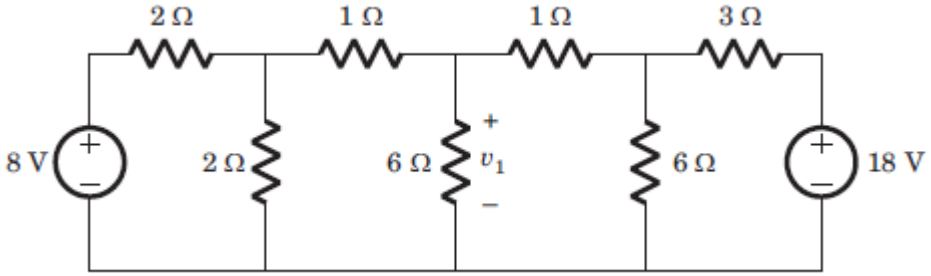
h. The circuit shown below is applied with small sine wave signal having zero average. The transistor ß =100. For R(L) = 10 kΩ and transistor Ro = 200 kΩ, determine the overall voltage gain.



(A) -21 V/V **(B)** -42 V/V **(C)** -86 V/V **(D)** -123 V/V

i. A battery has a short-circuit current of 30 A and an open circuit voltage of 24 V. If the battery is connected to an electric bulb of resistance 2 ohm, the power dissipated by the bulb is
(A) 80 W **(B)** 1800 W **(C)** 112.5 W **(D)** 228 W

j. For the following circuit, determine the value of v_1



(A) 6 V **(B)** 7 V **(C)** 8 V **(D)** 10 V

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

Q.2 a. Define α_{dc} and β_{dc} of BJT. Derive the relation between these two parameters. **(5)**

b. A BJT with measured current levels of I_C =16mA, I_E = 16.04 mA is replaced with another BJT which has β_{dc} =25. Calculate the new level of I_C and I_E assuming that the base current remains constant. **(5)**

c. Why biasing is required in BJT circuit? Draw the circuit of different biasing arrangements available. **(6)**

Q.3 a. Draw the circuits and the corresponding waveforms of half wave, bridge, centre tap full wave rectifiers and discuss the working principle of these circuits. **(12)**

b. What is transconductance? Prove $g_m = g_{mo}(I_D / I_{DSS})^{1/2}$, where the terms denote their original meaning. **(4)**

Q.4 a. Calculate the current through Zener diode if the load resistance RL =30 kΩ for the circuit given below (Figure 5): **(6)**

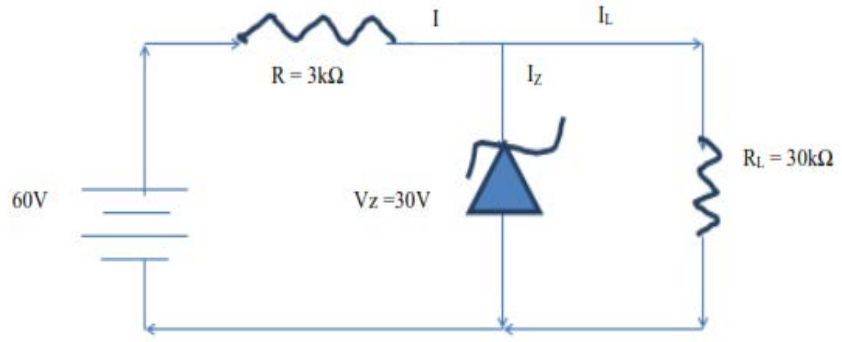


Figure 5

b. Calculate the resistivity of Si at 300K, if donor impurity to the extent of 1 part in 10^8 atoms of Si is added, find the density of minority carriers and the resistivity. **(5)**

c. Explain the concept of Tunnel diode and Schottky Diode with the help of their I-V characteristic. **(5)**

Q.5 a. Explain the concept of Cascade amplifier with the help of its circuit diagram. Also, define its applications. **(8)**

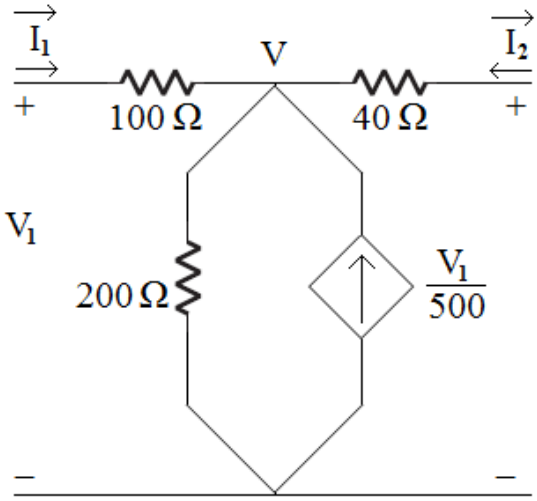
b. Explain working of single stage RC coupled amplifier. **(8)**

Q.6 a. Sketch the circuit diagram of a Class B push-pull power amplifier using transformer-coupling. Derive relation for its dc input power, ac output power and the efficiency. **(8)**

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.7 a. What are the basic laws of the Circuit Theory? On what principle are they based? **(8)**

b. Distinguish between natural and forced response of an RC Circuit.
Determine the y-parameters of the network of figure given and then draw its equivalent circuit accordingly. **(8)**



Q.8 a. Draw and explain the operation of a Phase shift oscillator. **(8)**

b. Draw the circuit of a Wien-bridge oscillator using Op-Amp and describe its working. Find an expression for the frequency of oscillation. **(3+5)**

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. **(6)**