Subject: ELECTRONIC DEVICES AND CIRCUITS

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

JUNE 2011

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. The reverse recovery time t_{rr} in a PN junction diode is equal to_____.

(A) Storage time t_s **(B)** Transition time t_t

(C) t_s+t_t **(D)** t_s-t_t

b. In a full wave bridge rectifier the minimum reverse breakdown voltage that each diode should have, when the input is $V_m \sin \omega t$, is _____.

(A) $2V_m$ **(B)** V_m

(C) $V_m/2$ **(D)** $4V_m$

c. In the Zener diode regulator circuit shown in Fig.1, the power dissipation in the Zener diode is_____.

(A) 630mW **(B)** 270mW

(C) 900mW **(D)** 1.7W

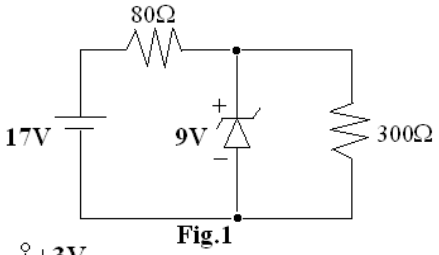

Fig.1

d. In the circuit of Fig.2, the base terminal of the transistor is kept open. If the transistor has α =0.98 and I_{CO} = 40nA, then V_{CE} of the transistor = _____.

(A) 2.6V
(B) 2.8V
(C) 3V
(D) 0.7V

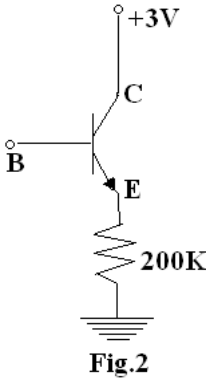

Fig.2

e. An amplifier has an open loop gain of 40dB and a bandwidth of 100kHz. Bandwidth needs to be increased to 0.6MHz by providing suitable negative feedback. The amount of negative feedback should be_____.

(A) 0.5% **(B)** 0.05%

(C) 50% **(D)** 5%

f. Three amplifiers are cascaded to provide an overall gain of 10,000. The first two stages have a gain of 40dB and 26dB respectively. The gain of the third stage is equal to _____ dB.

(A) 5 **(B)** 14
(C) 54 **(D)** 66

g. In the circuit of Fig.3, if g_m=3mA/V, the voltage gain v_o/v_i is equal to _____.

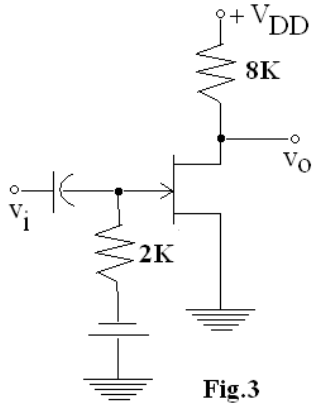

Fig.3

(A) +24
(B) -24
(C) +6
(D) -6

h. An amplifier has an open loop gain of 60dB and a gain stability of 20% due to temperature variations. If 1.9% negative feedback is given, the gain stability of the amplifier with feedback is equal to _____.

(A) 10% **(B)** 1%
(C) 0.1% **(D)** 0.01%

i. If the intrinsic stand-off ratio, η, of a UJT is 0.55, and its R_{B2} is equal to 20KΩ, its R_{B1} is equal to_____.

(A) 10K **(B)** 24.4k
(C) 11K **(D)** 36.4K

j. A thin-film capacitor has a capacitance of 0.4pF/(μm)^2. The thickness of the film is 400Å.The relative dielectric constant for SiO_2 layer is equal to_____.

(A) 3.52 **(B)** 4.52
(C) 5.52 **(D)** 8.52

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

Q.2 a. For the RC circuit shown in Fig.4, derive the expression for the output voltage, V_o across the capacitor C, if the input is a step of magnitude $V_i u(t)$. **(8)**

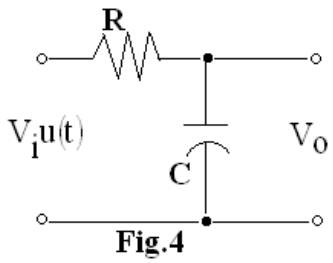

Fig.4

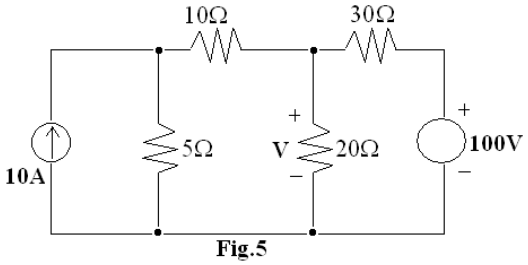

Fig.5

b. For the circuit shown in Fig.5, find the voltage V across 20Ω resistance, using mesh analysis. **(8)**

Q.3 a. Draw the circuit diagram of a full wave bridge rectifier and sketch the output waveform across the load resistance, when the input to the rectifier is a sinusoidal voltage, V_m Sin ωt. **(6)**

b. A half wave rectifier with a capacitor filter is supplying a resistive load of 500Ω. It is supplied from 230V, 50Hz ac mains. For the ripple factor to be equal to 2%, determine the value of the filter capacitor needed. Also calculate (i) dc load voltage (ii) dc load current and (iii) peak to peak ripple voltage across the capacitor. **(10)**

Q.4 a. Draw the output and input characteristics of an NPN transistor in common emitter configuration and explain about the different regions of operation. **(8)**

b. Explain the operation of an enhancement MOSFET with suitable diagrams. **(8)**

Q.5 a. In a typical voltage divider bias circuit for a transistor, derive the expression for the stability factor $S(I_{CO})$. **(5)**

b. Design the values of R_C, R_1 and R_2 in the amplifier circuit of Fig.6, so that the operating point is fixed at V_{CE} = 4V and I_C = 1mA with a bias stabilization factor $S(I_{CO})$=20. **(8)**

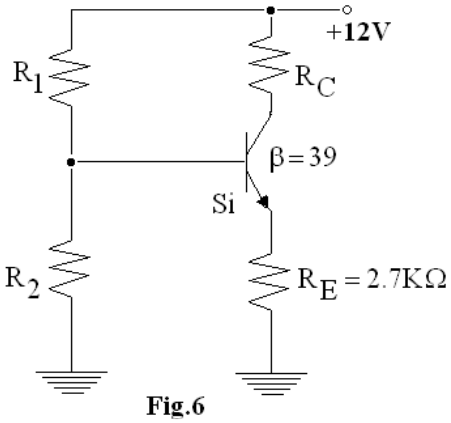

Fig.6

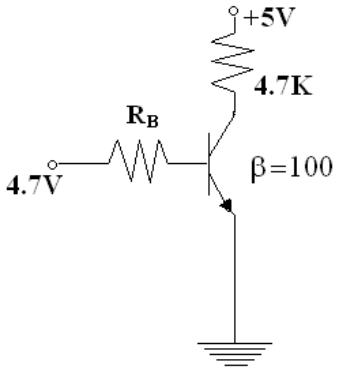

Fig.7

c. In the circuit of Fig.7, determine the maximum value of R_B so that the transistor is in saturation. **(3)**

Q.6 a. Draw the circuit diagram of a single stage RC coupled amplifier and explain the purpose of each of the components used in the circuit. **(8)**

b. In the RC coupled amplifier circuit of Fig.8, determine the cut-off frequencies, $f_{LC_{c1}}$ and $f_{LC_{c2}}$ due to C_{c1} and C_{c2} respectively. **(8)**

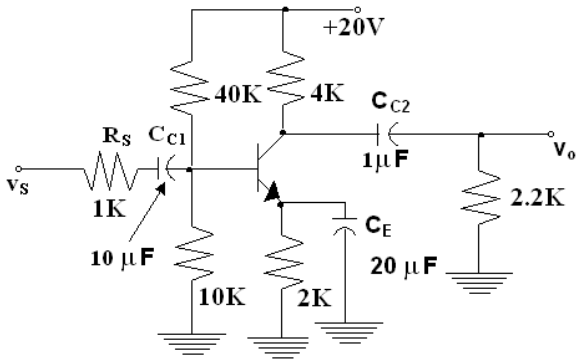

Fig.8

Q.7 a. Draw the transformer coupled power amplifier and calculate its maximum possible efficiency. **(8)**

b. A complementary symmetry class B output stage operated from a single supply voltage of +18V is to deliver power to a loud speaker load of 4Ω. If the input voltage is 5V rms, calculate the ac power output, dc power input, conversion efficiency and power dissipation in each of the transistors. **(8)**

Q.8 a. Write six advantages of giving voltage series negative feedback to a voltage amplifier. **(6)**

b. An amplifier has a gain of 60dB, bandwidth of 300 KHz, distortion of 15%, input impedance of 20KΩ and an output impedance of 1KΩ. If voltage series negative feedback of 3.9% is given to this amplifier, calculate the gain, bandwidth, distortion, input impedance and output impedance of the amplifier with negative feedback. **(6)**

c. In an RC phase shift oscillator using an ideal voltage amplifier, calculate the value of R, if C = 5nF and the frequency of oscillation = 5KHz. **(4)**

Q.9 a. Describe the photolithographic process in semiconductor fabrication using necessary sketches. **(8)**

b. What is the length required to fabricate a 30KΩ resistor whose width is 20μm, given R_S=200Ω/square? What is the width required to fabricate a 5KΩ resistor whose length is 25μm. **(8)**