COLLEGE OF ENGINEERING PUNE

END SEMESTER EXAMINATION 2011-2012

ET 201 – Electronic Devices & Circuits

Program: S.Y.B.Tech (E & TC)
Date: 25 /11/2011

Time: 08.00 am – 11.00 am
Max marks: 50

Instructions:

1. All questions are compulsory.
2. Draw appropriate circuit diagram and waveform wherever necessary.
3. Numbers in Square brackets reflects marks.

Q1. A) Indicate whether the statements are true or false. Correct the statement if necessary and Justify. **[04]**

a) To remove any one of the free electrons from a metal, it is necessary only to give this electron an amount of energy equal to the work function of the metal.

b) The symbol E_F used in the energy distribution function represents the maximum number of free electrons per cubic meter of metal at absolute zero.

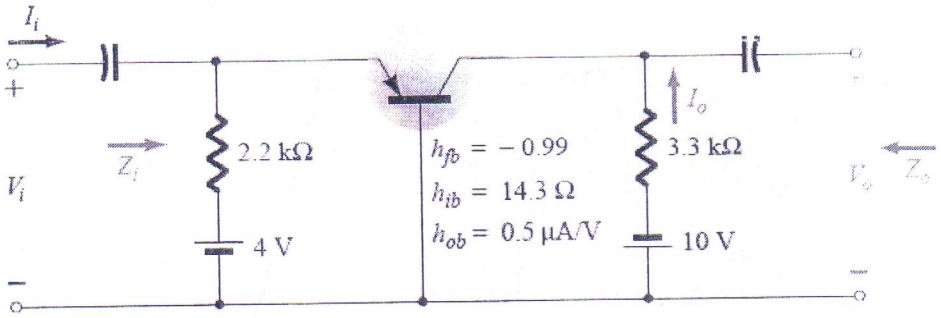
c) Schottky diode switches ON faster than Bipolar junction diode.

d) At absolute zero, the electrons in a metal all have zero energy.

B) The resistivities of p-region and n-region of Ge diode are 6Ω-cm and 4 Ω-cm respectively. Calculate contact potential Vo. Given $n_i = 2.5X10^{13}/cc$, $\mu_n = 3800cm^2/V\text{-}s$, $\mu_p = 1800cm^2/V\text{-}s$ and V_T=0.026V at 300K. **[02]**

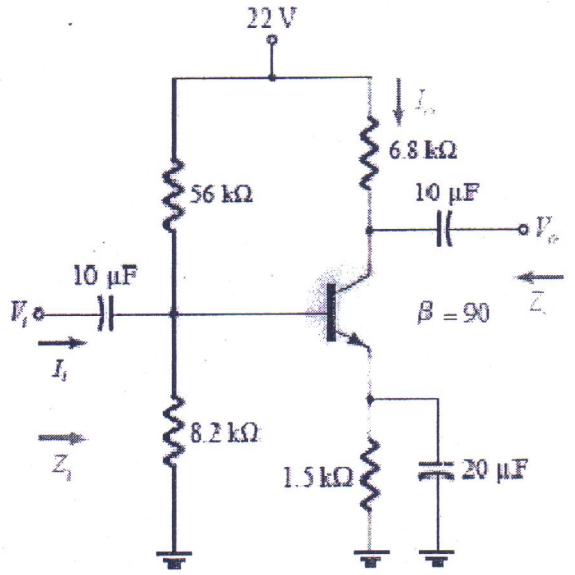
C) For the network of Fig given below, determine: **[04]**

(a) *Zi.*
(b) *Zo.*
(c) *Av.*
(d) *Ai.*

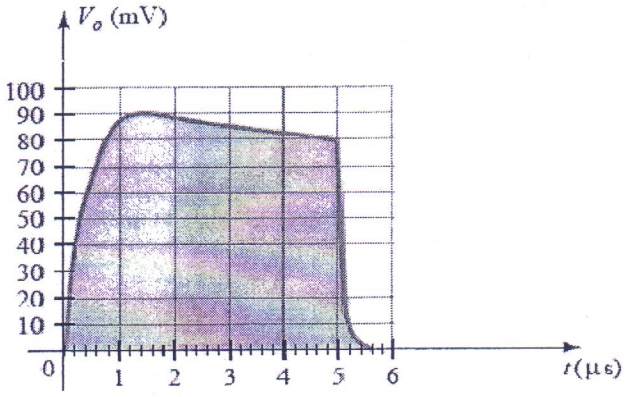


Q2. A) Given I_E= 2.5 mA, h_{fe}=140, h_{oe}=20μS (μmho), and h_{ob}= 0.5μS, determine: **[04]**
(i) The common-emitter hybrid equivalent circuit. r_e model
(ii) The common-base *re* model.

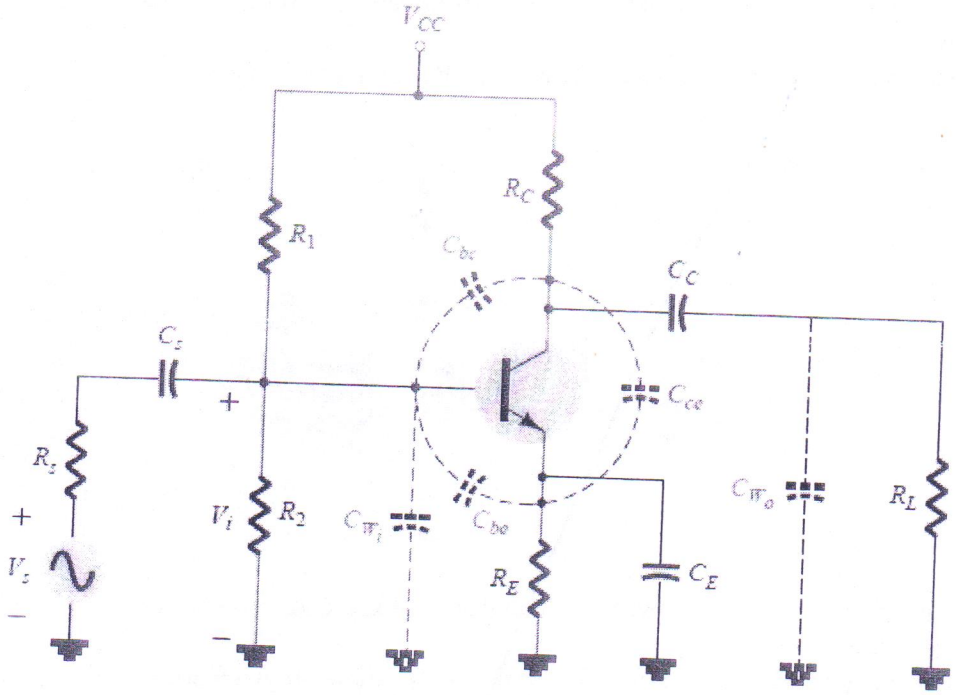
B) For the network in Fig. Given below, determine: **[06]**
(i) *re*.
(ii) *Zi*.
(iii) *Zo* (*ro*= ∞ Ω).
(iv) *Av* (*ro* = ∞ Ω.
(v) *Ai* (*ro* = ∞ Ω).
(vi) The parameters of parts (ii) through (v) if *ro* = *1/hoe* = 50 kΩ and compare results.



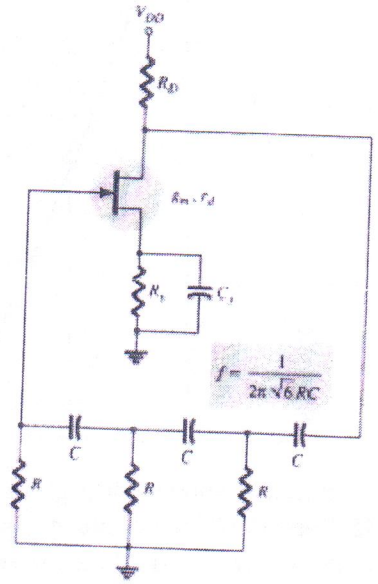
Q3. A) The application of a 10-mV, 100-kHz square wave to an amplifier resulted in the output waveform of Fig. given below **[03]**
(i) Write the Fourier series expansion for the square wave through the ninth harmonic.
(ii) Determine the bandwidth of the amplifier to the accuracy available by the waveform.
(iii) Calculate the low cutoff frequency.



B) For the network of Fig. with parameters: R_s = 1 kΩ, R_1 = 40 kΩ, R_2 = 10 kΩ, R_E =2 kΩ, R_C = 4 kΩ, R_L = 2.2 kΩ, Cs =10μF, C_C = 1 μF, C_E =20 μF, β=120, r_o = ∞ Ω, VCC =20 V with the addition of C_{be} = 36 pF, C_{bc} = 4 pF, C_{ce} = 1 pF, C_{Wi} =6 pF, C_{Wo} = 8 pF. Determine f_{Hi} , f_{Ho} . f_β **[05]**



C) It is desired to design a phase-shift oscillator using a FET having gm = 5000 μS, rd = 40 kΩ, and feedback circuit value of R =10 kΩ. Select the value of C for oscillator operation at 1 kHz and RD for A ≥29 to ensure oscillator action. **[02]**

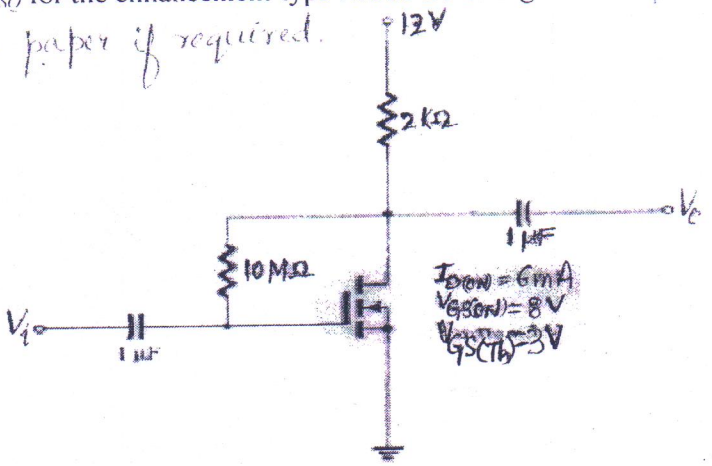


Q4. A) Calculate the harmonic distortion components for an output signal having fundamental amplitude of 2.5 V, second harmonic amplitude of 0.25 V, third harmonic amplitude of 0.1 V, and fourth harmonic amplitude of 0.05 V. **[02]**

B) Write short note on Depletion MOSFET **or** Enhancement MOSFET. State the major difference between the two. **[04]**

C) Determine I_{DQ} and V_{DSQ} for the enhancement-type MOSFET of Fig. below **[04]**

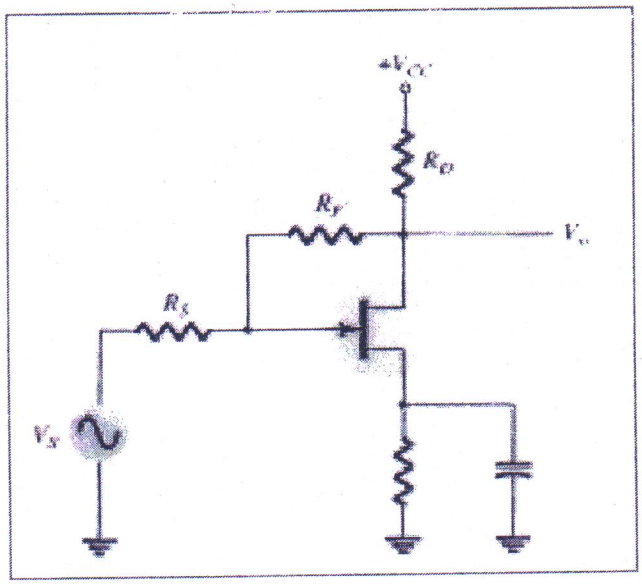
Take Graph paper if required.

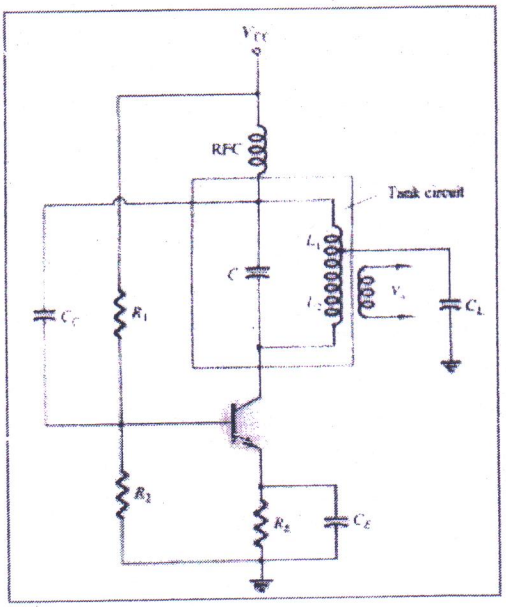


Q5. A) Given g_m =5mS, R_D = 5.1 kΩ, R_S = 1 kΩ, and R_L= 20 kΩ. Calculate from Fig. 1 **[03]**

(i) The topology

(ii) The voltage gain with and without feedback for the circuit shown below:





B) The following low-frequency parameters are known for a given transistor at I_C = 10mA, V_{CE}= 10V, and at room temperature. hie = 500Ω, hoe=4X10^{-5} A/V, hfe = 100, hre = 10^{-4}. At the same operating point, f_T = 50MHz and C_{ob} = 3pF, compute the values of all the hybrid-Π parameters. **[05]**

C) Calculate the oscillation frequency for the transistor Hartley circuit of Fig. 2 and the following circuit values: L_{RFC} =0.5 mH, L_1 = 750 H, L_2 = 750 H, M =150 H and C =150 pF. **[02]**