Name of the course : B. Tech Electronics
Semester : III
Name of the paper : Analog Electronics-I
Unique Paper Code : 2511303
Duration : 3 hours
Maximum Marks : 75

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Instructions for the candidates:

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Attempt FIVE questions in all.
3. Question No. 1 is compulsory.
4. Use of Scientific Calculator is allowed.

Q1(a) Sketch the output of the given circuit with suitable explanation   (3 Marks)
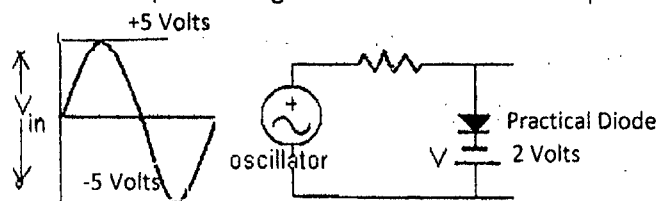
Q1(b) Describe the characteristics of an Ideal Diode. Give the short-circuit and open-   (3 Marks)
circuit equivalent of the same.

Q1(c) Draw and explain the Output Characteristics of Common Base (CB) transistor   (3 Marks)
(n-p-n type).

Q1(d) A colpitts oscillator is used as the local oscillator to produce frequencies from   (3 Marks)
1MHz to 2Mhz. What must be the inductance of the coil if the minimum C
obtainable is 43pF. What must be the maximum desired value of capacitor to
produce desired frequency range?

Q1(e) Explain why Class B amplifier is preferred over Class A for high power   (3 Marks)
applications such as audio power amplifier.

Q2(a) What are Clampers? Give one application. Draw and explain the circuit of   (6 Marks)
biased negative clamper.

Q2(b) Define ripple factor. Draw the circuit for the following and derive an   (6 Marks)
expression of ripple factor
     (i) Full wave rectifier (FWR), (ii) Half wave rectifier (HWR)

Q2(c) What is the ripple factor of a Full Wave Rectifier (FWR) with capacitor filter if   (3 Marks)
the value of R_L=2KΩ and C=5μF.

Q3(a) Derive the expression of Voltage gain for Low-, Mid- and High-Frequency   (8 Marks)
ranges for RC coupled amplifier. Draw the frequency response of the same.

Q3(b) Find the operating point and draw the load line of a fixed bias circuit using   (5 Marks)
n-p-n transistor for
     (a) β=100 (b) β=300
     Given V_{CC}=15 V, R_B=200 KΩ, R_C=1KΩ.

Q3(c) What is the difference between AC and DC load line?   (2 Marks)

Q4(a) Derive the expression of Input Resistance, Current Gain, Voltage Gain and Output Resistance for Voltage Shunt Feedback circuit. (8 Marks)

Q4(b) Find the Input Resistance, Voltage Gain and Output Resistance of a Voltage Series Feedback amplifier. Given A_V=750, β=0.1, R_i=1KΩ and R_o=10KΩ. (3 Marks)

Q4(c) Internal gain of a basic amplifier is 60dB. A negative feedback with a feedback factor of 0.005 is applied to it. Calculate the percentage change in the overall gain of the feedback amplifier if the internal gain reduces by 10%. (4 Marks)

Q5(a) Draw and explain the functioning of single tuned voltage amplifier if output is taken from inductive load or a capacitive load. What are the limitations of single tuned amplifier? (8 Marks)

Q5(b) Draw the output characteristics of n-channel JFET and give suitable explanation. (4 Marks)

Q5(c) For a class B amplifier, providing a 20V peak signal to a 16 Ω speaker and a power supply of V_{cc} = 30V, determine the input power, output power and efficiency? (3 Marks)

Q6(a) Draw and Explain the piecewise linear model for a diode. (4 Marks)

Q6(b) Determine V_L, I_L, I_Z and I_R for the circuit given below. Given R_L=180Ω. (6 Marks)
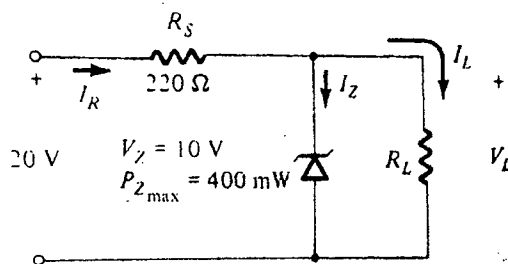
Q6(c) Assume that a n-p-n Si-transistor based Voltage divider circuit with β=50, V_{BE}=0.6V, V_{CC}=22.5V and R_C=5.6KΩ, it is desired to establish a Q-point at V_{CE}=12V, I_C=1.5mA and a stability factor S $\leq$6. Find R_1, R_2 and R_E. (5 Marks)

Q7(a) Draw the circuit diagram of RC-Phase shift Oscillator (transistor based) circuit and derive the expression of the frequency of oscillation for the same. (8 Marks)

Q7(b) Explain using i_c-i_b relationship, why higher order harmonics distortion terms like 2ω, 4ω, 6ω.... exist in power amplifiers. (3 Marks)

Q7(c) Explain the following terms in case of Power Amplifiers: (4 Marks)
  i. Frequency Distortion
  ii. Phase Distortion