EC33

RAMAIAH
Institute of Technology

USN	1	M	S							

(Autonomous Institute, Affiliated to VTU)
(Approved by AICTE, New Delhi & Govt. of Karnataka)
Accredited by NBA & NAAC with 'A+' Grade

SEMESTER END EXAMINATIONS – MARCH 2024

Program	:	**B.E. – Electronics and Communication Engineering**	**Semester**	:	**III**
Course Name	:	**Analog Electronics Circuits**	**Max. Marks**	:	**100**
Course Code	:	**EC33**	**Duration**	:	**3 Hrs**

Instructions to the Candidates:

- Answer one full question from each unit.

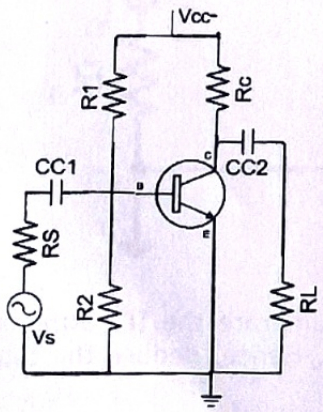
UNIT – I

1. a) Derive the expressions for current gain (Ai), input impedance (Zi), voltage gain (Av), and output impedance (Z0) of a transistor in Common Emitter (CE) configuration using the h-parameter model. CO1 (08)

   b) With no feedback, a voltage amplifier exhibits the following parameters: Open circuit voltage gain (A) = -500; Input resistance (Ri) = 2 KΩ; Output resistance (Ro) = 3 KΩ; Bandwidth (BW) = 300 KHz. Upon applying a 10% negative voltage series feedback, calculate the feedback parameters: Feedback voltage gain (Avf), Feedback input resistance (Rif), Feedback output resistance (Rof), and Feedback bandwidth (BWf). CO1 (04)

   c) Emphasize the significance of tank circuits and discuss the operational principles of a Transistorized Hartley oscillator with relevant illustrations. Subsequently, find the oscillation frequency in such an oscillator, if the inductor values are 5mH and 2mH and the capacitor value is 0. 47μF. CO1 (08)

2. a) Examine a single-stage Common Emitter (CE) amplifier depicted in the given figure shown below, with the following component values: Rs = 1KΩ, R1 = 50KΩ, R2 = 2KΩ, Rc = 1KΩ, RL = 1.2KΩ, hfe = 50, hie = 1.1KΩ, hoe = 25 μA/V, and hre = 2.5×10^{-4}. Calculate the amplifier parameters: Current gain (Ai), Input resistance (Ri), Voltage gain (Av), and Output resistance (R0 and R0'). CO1 (10)



   b) Enumerate the effect of negative feedback on the input, and output impedance of a voltage series feedback amplifier with necessary expressions. CO1 (06)

   c) With a neat block diagram, explain the concept of oscillators and state the Barkhausen criterion for sustained oscillations. CO1 (04)

UNIT – II

3. a) Show that a transformer coupled Class A power amplifier has maximum conversion efficiency of 50%. CO2 (06)

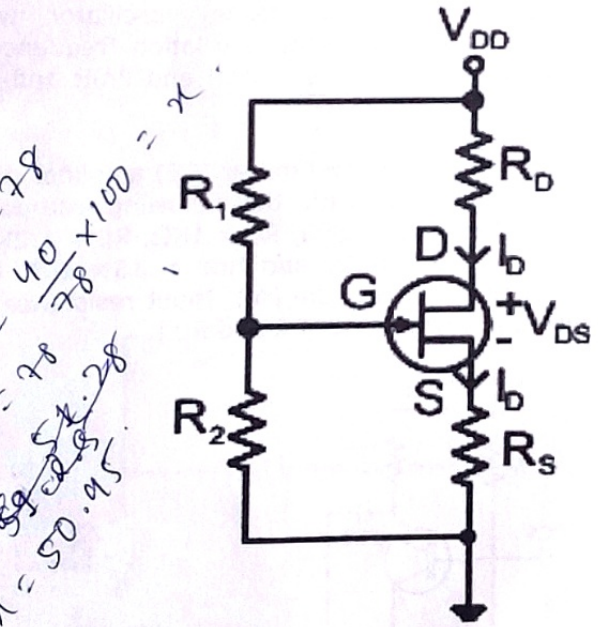
   b) For a class B amplifier, providing a 20V peak signal to a 16Ω load and which has a power supply of 30V, determine (i) Input Power (ii) Output Power (iii) Circuit Efficiency (iv) maximum input power (v) Maximum Output Power (vi) Power dissipation across each transistor. CO2 (08)

   c) How does the JFET self-bias configuration work, and derive the expressions for the gate-to-source voltage, drain voltage, source voltage, and drain-source voltage in this configuration? CO2 (06)

4. a) Describe the functioning of a Class B push-pull amplifier, illustrating its operation through a circuit diagram and relevant waveform diagrams. CO2 (06)

   b) In an ideal class B push-pull power amplifier with input and output transformers (where Vcc = 20V, N2 = 2N1, RL = 20Ω, and transistors' hfe = 20), and considering a sinusoidal input with the maximum output signal at Vp = Vcc, calculate the output signal power, power dissipation in each transistor, and the conversion efficiency. CO2 (04)

   c) Find the following parameters for the depicted figure shown below: (i) Drain current (ID); (ii) Gate Voltage (VG); (iii) Source voltage (Vs); (iv) Gate source Voltage (VGS), given: VDD = 12 V; VD = 7V; RD = 3.3 KΩ; Rs= 1.8KΩ; R1 = 6.8 KΩ; R2= 1 MΩ. CO2 (04)



   d) Define harmonic distortion and enumerate the II harmonic distortion mathematically in Power amplifiers. Hence, deduce the total power in terms of total harmonic distortion. CO2 (06)

UNIT - III

5. a) Derive the expression for A_v, Z_i and Z_o of JFET common source amplifier with un bypassed RS. CO3 (10)

b) Determine Zi, Zo, and Av for the network of Fig. 5(b) if r_d=60KΩ. CO3 (10)

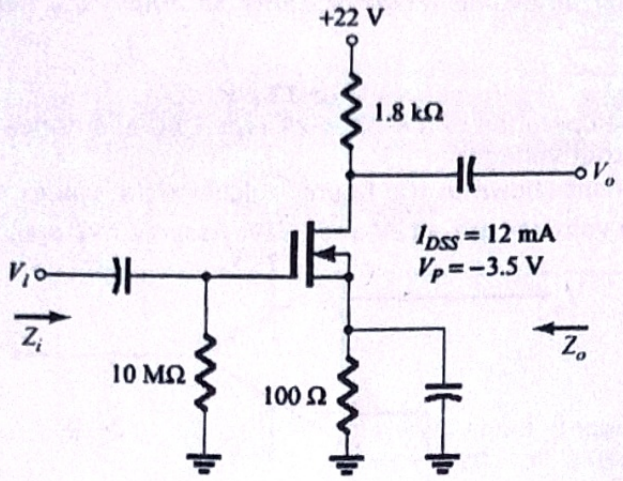


Fig. 5(b)

6. a) Derive the expression for A_v, Z_i and Z_o of JFET common drain amplifier. CO3 (10)
   b) Determine Zi, Zo, and Vo for the network of Fig. 6(b) if Vi =20 mV. CO3 (10)

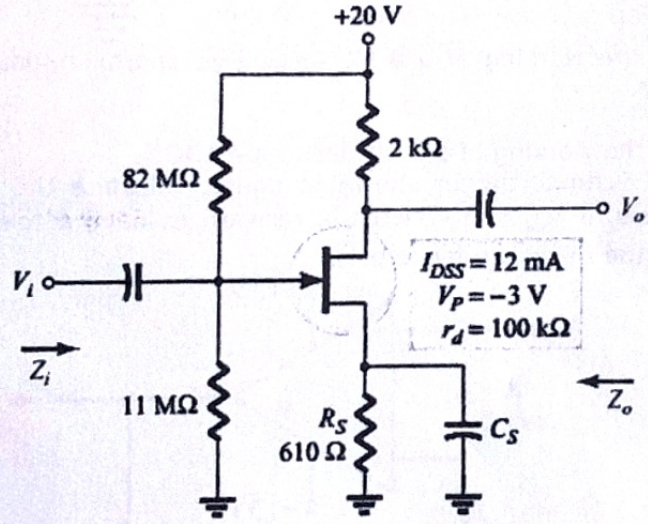


Fig. 6(b)

UNIT- IV

7. a) With a neat circuit diagram and expressions, explain the operation of a difference amplifier. Also discuss about its input resistances, common mode voltages and output level shifting. CO4 (06)
   b) Define CMRR of an operational amplifier. An LM308 op-amp circuit with closed loop gain of 30 has a common mode input of 1 volt. Calculate the maximum output voltage this might produce. The minimum CMRR of LM308 is 80dB. CO4 (06)
   c) Explain the working of a complete instrumentation amplifier with relevant circuits and expression. CO4 (08)

8. a) Draw the modified version of a sample and hold circuit with FET switch and Op-amps. Explain with waveforms. CO4 (08)
   b) Design a first order low pass active filter with cut-off frequency of 2KHz. Use 741 op-amp. CO4 (06)