B.E. ELECTRONICS AND TELE-COMMUNICATION ENGINEERING SECOND YEAR FIRST SEMESTER EXAM - 2025

ANALOG CIRCUITS- I

Time: Three hours **Full Marks: 100**

(*All parts of the same question must be answered together*)

Module I [Answer any one (1×10=10)] CO1

1. Explain the necessity of a filter in rectifier circuits. Illustrate a centre-tapped full wave rectifier with a capacitive filter. Draw the output waveforms for two different load conditions and justify. [2+4+4]

OR

Discuss the role of a capacitor in clamper circuits. Identify the circuit in fig. 1. Explain its operation and draw the output waveform for sinusoidal input. [2+1+(4+3)]

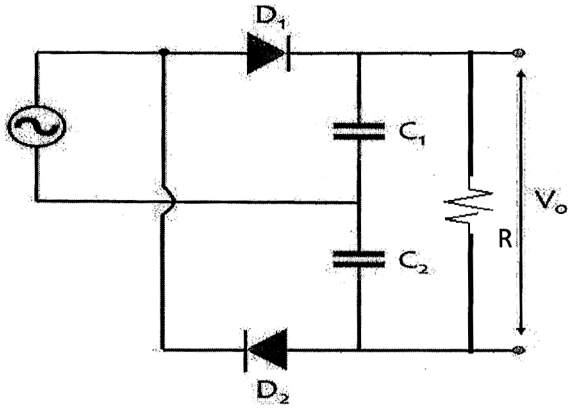

Figure 1

Module II [Answer any one (1×10=10)] CO2

2. Analyze the response of a low-pass RC circuit to a square wave input (10 V amplitude, 4 ms period). Sketch and annotate the capacitor voltage waveform (V_C (t)) over two cycles. [5+5]

OR

Explain RC circuit as differentiator and integrator with examples. For a differentiator circuit (R=1kΩ,C=0.1μF), sketch the output waveform for a 1 kHz triangular wave input. [6+4]

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Module III [Answer any five from Q3A and any five from Q3B (5×6+5×2=40)] CO3

3.A

a) Explain how temperature variation affects the stability of operating point in a BJT biasing circuit. [6]

b) Explain a biasing circuit to mitigate the effects of temperature on Q-point. [6]

c) Find the operating point of the circuit in fig. 2. V_{CC}=10V, R_C=2 KΩ, R_E=1 KΩ and R_B=47KΩ. Show the operating point on load line. [4+2]

d) With the help of small signal (g_m-r_π) equivalent circuit find the expressions for input impedance, output impedance and voltage gain of a CE amplifier. [6]

e) Draw the frequency response of RC-coupled amplifier and explain different regions of operation. [6]

f) Determine voltage gain, input impedance and output impedance of an MOSFET amplifier with R_D =1$k\Omega$, R_S = 220Ω, V_{DD}= 5V, V_D = 2.5V, V_{GS} = 1V and V_{th}=0.5 V. [6]

g) Compare CS, CD and CG amplifier configurations with respect to A_v, R_i & R_o. [6]

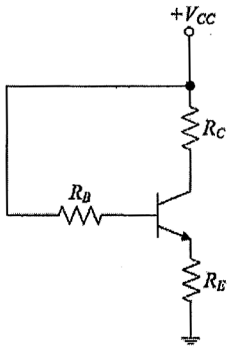

Figure 2

3.B

a) Explain the impact of source loading on the performance of a voltage amplifier. [2]

b) Discuss the origin of output resistance in a CE amplifier. [2]

c) Mention advantages of h-parameter model over pi model in small signal analysis. [2]

d) Compare biasing mechanisms of E-MOSFET and JFET. [2]

e) "A positive gate to source voltage cannot be applied for JFET biasing". Explain. [2]

f) What is the purpose of a bypass capacitor in an emitter bias circuit? [2]

g) Why is the bandwidth of a CD amplifier greater than CS amplifier? [2]

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Module IV [Answer any questions totaling 25 marks] [CO4]

4. a) Draw and explain a balanced differential amplifier using BJT. [6]
   b) Explain the importance of very high differential gain and very high input impedance of OP-Amp. [4]
   c) Explain virtual short with example. [5]
   d) Draw and explain clamper circuit using OP-Amp. Mention its advantages over clamper without using OP-Amp. [4+1]
   e) Draw and explain the circuit diagram of an Instrumentation amplifier using op-amp. Derive the expression for the output voltage. [10]
   f) Define line and load regulation of a voltage regulator. Explain their importance. [5]
   g) Explain a short circuit protection circuit in a series voltage regulator. [5]
   h) Write characteristics of an ideal voltage buffer. Draw and explain a voltage buffer using OP-Amp. Mention applications. [5]

Module V [CO5]

5. Design a circuit to implement (3x+5y-2x.y)/5z using OP-Amp. [15]

OR

Design a regulated power supply with 10V output. V_Z=6V, P_Z=1W. Input is 220V 50Hz signal. Assume diodes are ideal. [15]