Ref. No.: Ex/ET/PC/B/T/221/2023

B.E. ELECTRONICS AND TELE-COMMUNICATION ENGINEERING
SECOND YEAR SECOND SEMESTER EXAM, 2023

ANALOG CIRCUITS- II **Time: Three hours** **Full Marks: 100**

Module I (30)

1. Explain the following (**Any ten**) 3×10=30

a) Advantages of multistage over single stage amplifiers.
b) Advantages of capacitive coupling over other coupling methods.
c) The input stage of a voltage amplifier is better with MOSFET than BJT.
d) Importance of distortion analysis in large signal amplifier.
e) Efficiency of class B power amplifier is higher than class A power amplifier.
f) Class-C Amplifiers cannot be used in audio frequency range.
g) Q-factor of tuned amplifier is very high.
h) Advantages of negative feedback.
i) Barkhausen Criterion for oscillations.
j) The hysteresis in Schmitt-trigger circuit.
k) Advantages of crystal oscillator over RC and LC oscillators.
l) Role of the 3rd capacitor in Clapp oscillator circuit.
m) Lock range and capture range of PLL.

Module II Any three (30)

2. a) Using small signal equivalent circuit calculate the midband-gain and input impedance without considering the effect of biasing resistances of a Cascode amplifier. Given that I_C=1 mA, β=150 (both transistors), $R_C \| R_L$=1kΩ. [5+5]
b) Draw and compare frequency response characteristics of R-C coupled multistage CC-CE and CE-CE amplifier for all regions of operation. [5]

3. a) Compute 2nd order harmonic distortion of a class A power amplifier. Given that zero signal current I_{CQ}=20 mA, DC current after the application of the input signal is 25 mA. Peak-to-peak output current is 30 mA. [5]
b) The class-A power amplifier is biased at V_{CE}=12 V. β=100, V_{CC}=24V, R_C=50Ω. Load, R_L=50 Ω, is capacitive coupled. Calculate the maximum power conversion efficiency of the amplifier. [5]
c) Compare class-A and B power amplifiers with respect to different distortions present.

[Turn over

4 a) Sketch and illustrate the frequency response of a single-tuned and stagger-tuned amplifier. [10]

b) Determine the bandwidth and quality factor of a 4-stage single-tuned amplifier. Given that the quality factor of each identical stage is 4 and the resonant frequency is 100 kHz. [5]

5. a) Calculate the voltage gain, input and output impedance of a voltage sampling and voltage mixing negative feedback circuit. Loop gain, Open loop voltage gain, input impedance and output impedance are 10, 100, 50kΩ and 1 kΩ respectively. [10]

b) Identify the applications of a bistable and astable multivibrators. [5]

Module III (20)

6. **(Any two)** 10×2=20

a) Develop the expression for output voltage if the transfer characteristic of MOSFET is given by a parabolic form ($v_{out} = A_0 v_{in} + B_0 v_{in}^2$), where A_0 and B_0 are constants and input is sinusoidal.

b) Derive the expression for the input resistance of the amplifier with current-sampling and voltage-mixing feedback topology.

c) Develop the expression for frequency of oscillation of a Wein-Bridge oscillator.

d) Develop the expression for the frequency of oscillation of a astable MV using BJTs.

Module IV (20)

7. **(Any two)** 10×2=20

a) Design a class AB push-pull complementary symmetry power amplifier with the following specification. I_{CQ}=40 mA, R_L=16 Ω, V_{CC}=20 V. Choose practical values of components. Calculate the maximum efficiency. Assume diode drop=0V.

b) Design a Schmitt trigger using Op-Amp with a hysteresis width of 4 V.

c) Construct a Pulse-width modulator with the help of monostable MV using 555 timer. Explain.

d) Design a class-C tuned amplifier with oscillation frequency of 100 kHz and efficiency of 99.5%