B.E. ELECTRONICS AND TELE-COMMUNICATION ENGINEERING SECOND YEAR SECOND SEMESTER EXAM, 2024

ANALOG CIRCUITS- II **Time: 3 hours** **Full Marks: 100**

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

use separate answer script for each part

PART-I

Answer Any Three (3×20=60)

1.	a)	Draw and explain frequency response of R-C Coupled multistage amplifier.	CO1	[5]
	b)	Discuss the advantages of using FETs in multistage amplifier configurations.	CO1	[3]
	c)	Derive the expression for the overall voltage gain of a cascaded multistage amplifier consisting of two identical CE amplifier stages.	CO2	[8]
	d)	Given the following parameters for each CE amplifier stage: Rin=10 kΩ, R_C =2 kΩ, R_E=200Ω, β=100, and r_π=1 kΩ, R_S=500Ω, R_L=12kΩ, determine the overall voltage gain of the multistage amplifier. Assume coupling capacitors have negligible impedance at the operating frequency.	CO3	[4]
2.	a)	Write the advantages of cascode amplifier over CE/CS amplifier.	CO1	[3]
	b)	Draw cascode amplifier using FET and explain that Miller effect can be reduced in cascode amplifier.	CO1	[5]
	c)	Derive the expression for voltage gain of a cascode amplifier with the help of small signal analysis.	CO2	[8]
	d)	Determine midband gain of a cascode amplifier using FET. Given that V_{DD}=10V, g_m=5mS (both), R_D= 5kΩ, R_S=1kΩ (bypassed) and R_L=5kΩ.	CO3	[4]
3.	a)	Classify power amplifiers with respect to their conduction angle and conversion efficiency.	CO1	[4]
	b)	Draw and explain cross-over distortion in class B push-pull power amplifier.	CO1	[4]
	c)	Derive the expression for power conversion efficiency of class B power amplifier.	CO2	[8]
	d)	Determine the quiescent current (I_Q) and rms load current (I_l) in a Class AB power amplifier. Given that $\pm V_{CC}$=10V, R_L=16Ω, R_1=R_2=1kΩ and V_{BE}=0.5V.	CO3	[4]

[Turn over

4. a) Classify tuned amplifiers and define them. CO1 [3]

b) Draw and explain the operation of single tuned amplifier. CO1 [5]

c) Prove that Band width of n-stage single tuned amplifier is $BW_n = BW_1 \sqrt{2^{\frac{1}{n}} - 1}$ CO2 [8]

d) Determine the resonant frequency of a single tuned amplifier. Given that the tank circuit consists of L=1mH with coil resistance of 50Ω and C=1μF. CO3 [4]

5. a) Draw and explain a feedback amplifier using the voltage sampling-series mixing feedback topology. CO1 [3]

b) Explain the effect of negative feedback on the input and output impedance of the amplifier. CO1 [5]

c) Formulate the closed-loop voltage gain (A_{CL}) expression for a feedback amplifier using the voltage sampling-series mixing feedback topology. CO2 [8]

d) Derive the expression for time period of a collector coupled astable multivibrator with the help of proper circuit diagram and waveforms. CO3 [4]

Answer Any One (1×10=10)

6. Design an audio amplifier (only gain stage) to deliver an average power of 0.1 W to an 8 Ωspeaker from a microphone that produces a 10 mV peak sinusoidal signal and has a source resistance of 1 kΩ.V_{CC}=12V, β = 100. Consider I_{C1} =5mA and I_{C2}=15mA. CO4 [10]

7. Design a function generator that can generate sine, square and triangular wave. Choose proper components to set the time period of the signal to 1msec. CO4 [10]

PART-II

8. **Answer <u>either</u> part (a) <u>or</u> part (b) (15)**

(a) Discuss on the differences between a relaxation oscillator and a sinusoidal oscillator with representative diagrams. CO1

[7+8]

Derive the expression of the loop-gain and oscillation frequency of a Wien-Bridge Oscillator. CO2

(b) Draw the circuit diagram of a Pierce oscillator and discuss its operation. CO1

[7+8]

Derive the general expression of the frequency of oscillation of a Hartley oscillator with appropriate diagrams and explanations. CO2

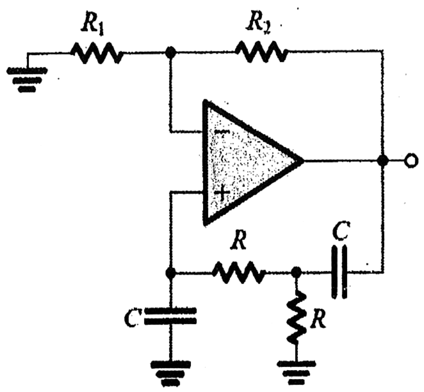
9. Answer <u>either</u> part (a) <u>or</u> part (b) (15)

(a) Design a scheme to convert a bistable multivibrator to an astable multivibrator (provide a supporting schematic as well). CO4

[5+10]

Consider that the inductor in the tank circuit of a BJT based Colpitts Oscillator is replaced by a crystal having $L = 0.6$ H, $C_s = 0.012$ pF, $C_p = 4$ pF. If one of the capacitors in the tank circuit be fixed at10pF while the other is variable in a range of 2 pF to 20 pF, find the range over which the oscillation frequency of the Colpitts Oscillator maybe tuned.

(b) For the following circuit, find the loop gain $L(s)$, the frequency for zero loop phase, and the ratio $R_2/R_1$for oscillation. CO4 [15]



CO		CO1	CO2	CO3	CO4	Total
Marks	Part I	24	24	12	10	70
	Part II	7	8	00	15	30
	Total	31	32	12	25	100