Model Question Paper-2 with effect from 2019-20 (CBCS Scheme)

USN | | | | | | | | | |

Fourth Semester B.E. Degree Examination

Subject Title: Analog Circuits

TIME: 03 Hours **Max. Marks: 100**

Note: Answer any **FIVE** full questions, choosing at least **ONE** question from each **MODULE**.

		Module -1	***Bloom's Taxonomy Level**	**Marks**
Q.01	a	Derive the following relations with respect to small signal operation of BJT: i)Transconductance ii)Voltage gain	L2	6
	b	A BJT having β=100 is biased at a DC collector current of 1mA. Find the value of g_m, r_e and r_Π at the bias point.	L3	6
	c	With the small signal equivalent model of MOSFET, derive an expression for voltage gain and transconductance.	L2	8
		OR		
Q.02	a	Derive the following relations with respect to small signal operation of BJT: i)Input resistance ii) Emitter resistance Also derive the relation between emitter and base resistance.	L2	8
	b	A MOSFET is to operate at I_D=0.1mA and is to have g_m=1mA/V. If $k_n' = 50\mu A/V^2$. Find the required W/L ratio and the overdrive voltage.	L3	6
	c	State the disadvantage of fixed V_{GS} biasing technique and explain how stability of operating point is achieved in drain to gate feedback resistor biasing technique in a MOSFET amplifier	L1 , L2	6
		Module-2		
Q. 03	a	With a neat circuit diagram and ac equivalent circuit, derive the expressions for R_{in}, A_{vo}, A_v and R_o for a Source follower.	L2	8
	b	A CS amplifier utilizes a MOSFET biased at I_D=0.25mA with V_{OV}=0.25V and R_D=20k**Ω**. The device has V_A=50V. The amplifier is fed with a source having R_{sig}=100k**Ω**, and a 20-k**Ω** load is connected to the output. Find R_{in}, A_{vo}, A_v and R_o and G_V. If to maintain reasonable linearity, the peak of the input sine-wave signal is limited to 10% of ($2V_{OV}$) what is the peak of the sinewave voltage at the output?	L3	8
	c	In an RC Phase shift oscillator, R=200k**Ω** and C=200pF. Find the frequency of the BJT based oscillator.	L3	4
		OR		
Q.04	a	Draw and explain the complete frequency response of a common source amplifier. Derive the expression for its lower cutoff frequency	L1,L2	10
	b	Find the midband gain A_M , and the upper 3-dB frequency f_H of a CS amplifier fed with a signal source having an internal resistance R_{sig} = 100 kΩ. The amplifier has R_G = 4.7M**Ω**, $R_D = R_L$ = 15 kΩ, , g_m=1mA/V, r_o=150k**Ω** , C_{gs}=1pF and C_{gd}=0.4pF	L3	6
	c	Explain the working of a Colpitts oscillator.	L1	4
		Module-3		

Q. 05	a	With a neat block diagram explain the working of a Voltage series feedback amplifier. How are the overall gain, input and output impedances affected in these amplifiers?	L1,L2	8
	b	Show how Gain can be desensitized and bandwidth increased with the application of negative feedback.	L3	8
	c	Draw the circuit of a practical Voltage Shunt (or transresistance) feedback amplifier and explain its working.	L2	4
OR				
Q. 06	a	Explain a Class B Output stage. Prove that the maximum conversion efficiency of a Class B transformer coupled amplifier is 78.5%.	L1,L2	8
	b	A transformer coupled class A power amplifier supplies to an 80**Ω** load connected across the secondary of a step down transformer having a turns ratio 5:1. Determine the maximum power output for a zero signal collector current of 120mA.	L3	6
	c	What is cross over distortion? How can it be eliminated?	L2	6
Module-4				
Q. 07	a	Explain with a neat diagram and relevant expressions, an opamp voltage series feedback amplifier	L1,L2	8
	b	Explain the following: 1) Virtual ground 2) Opamp AC amplifier	L1	6
	c	For an opamp non-inverting amplifier using 741 IC with R_L=1 KΩ and R_F=10KΩ, A= 200,000; Ri =2MΩ, Ro = 75Ω, fo =5 Hz; supply voltages ±15V, output voltage swing = ±13V, Compute A_F, R_{if}, R_{of}, f_F.	L3	6
OR				
Q. 08	a	Explain an Instrumentation amplifier using transducer bridge with relevant equations.	L1	8
	b	Explain the basic comparator circuit using an opamp. How can this circuit be used in an application as a zero crossing detector?	L1	6
	c	For a Schmitt trigger circuit; R_1= 150Ω and R_2= 68kΩ, v_{in} =500mVp-p sine wave and saturation voltages are = ±14 V. Determine the threshold voltages V_{ut} and V_{lt}. Draw the output waveforms.	L3	6
Module-5				
Q. 09	a	Explain the operation of 4-bit R-2R DAC with neat circuit. For the R-2R DAC, with R=10kΩ and R_F=20kΩ and V_{REF}=5V, determine the output voltage when the inputs b0=b1=5V and b2=b3=0V	L2,L3	8
	b	Explain the operation of a Successive -approximation ADC with neat circuit diagram.	L2	6
	c	Draw the circuit and frequency response of a first order low pass filter. Design a first order low pass filter to have a cutoff frequency of 1kHz with a passband gain of 2.	L1,L3	6
OR				
Q. 10	a	Draw and Explain the circuit and frequency response of a wide band-pass filter.	L1	6
	b	Explain the operation of a monostable multivibrator with relevant diagrams and waveforms.	L1,L2	8

	c	In the astable multivibrator R_A=2.2kΩ, R_B=3.9kΩ and C=0.1µF. Determine the positive pulse width t_c, negative pulse width t_d and free-running frequency.	L3	6

*Bloom's Taxonomy Level: Indicate as L1, L2, L3, L4, etc. It is also desirable to indicate the COs and POs to be attained by every bit of questions.