Basavarajeswari Group of Institutions

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

USN											Course Code	2	1	E	C	3	4

Third Semester B.E. Degree Examinations, September / October 2024

ANALOG ELECTRONIC CIRCUITS

Duration: 3 hrs **Max. Marks: 100**

Note: ***1. Answer any* FIVE *full questions, choosing* ONE *full question from each module.***
2. Missing data, if any, may be suitably assumed

Q. No		*Question*	*Marks*	*(RBTL:CO:PI)*
		MODULE – 1		
1.	**a.**	Describe the characteristics of pn-junction with necessary equations.	**06**	(1 :1 : 1.3.1)
	b.	Explain the half wave rectifier with circuit diagram, necessary waveforms and calculate efficiency for the same.	**08**	(2 :1 : 1.3.1)
	c.	Explain the construction and operation of Bipolar Junction Transistor (BJT) with carrier flow diagram.	**06**	(2 :1 : 1.3.1)
		OR		
2.	**a.**	Explain in detail about the negative series clipper with circuit diagram and necessary waveform.	**04**	(1 :1 : 1.3.1)
	b.	Define voltage regulator and explain different types of voltage regulators.	**10**	(2 :1 : 1.3.1)
	c.	Explain the construction and operation of MOSFET.	**06**	(2 :1 : 1.3.1)
		MODULE – 2		
3.	**a.**	Explain the voltage divider biasing for BJT using a single power supply. How does R_E provide a negative feedback action to stabilize the bias current with necessary supporting mathematical equations?	**08**	(2 :2 : 1.3.1)
	b.	Draw the small signal equivalent circuit model for MOSFET and obtain the expression for voltage gain and transconductance.	**08**	(2 :2 : 1.3.1)
	c.	A BJT having β=120 is biased at DC collector current of 1mA. Find the Value of g_m, r_e and r_π at the bias point.	**04**	(3 :2 : 2.1.2)
		OR		
4.	**a.**	Explain biasing of MOSFET by fixing V_{GS}.	**04**	(2 :2 : 1.3.1)
	b.	Derive the following relation with respect to small signal operation of BJT: (i) Input resistance (ii) Emitter resistance Also derive the relation between emitter and base resistance.	**08**	(2 :2 : 1.3.1)
	c.	For the circuit shown in Fig. Q4 (c), find the required value of V_{GS} to establish a dc bias current I_D = 0.5 mA. Device parameters are: V_t=1V, $K_n'\left(W/L\right)$ = 1 mA/V^2 and λ=0. What is the percentage change in I_D obtained when transistor is replaced with another having V_t = 1.5V.	**08**	(3 :2 : 2.1.2)

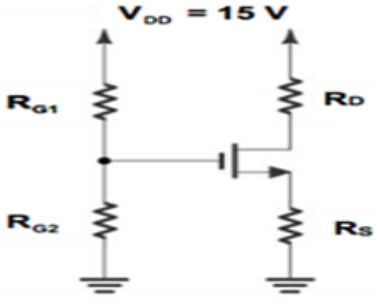

Fig. Q4(c)

Note: (**RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI - Performance Indicator)**

MODULE – 3

5.	**a.**	With the neat circuit diagram and AC equivalent circuit, derive the expression for R_{in}, A_{vo}, A_v and R_o for a source follower.	**08**	(2 :3 : 1.3.1)
	b.	With mathematical equations, explain the different internal capacitances in the MOSFET.	**06**	(2 :3 : 1.3.1)
	c.	For the n-channel MOSFET with t_{ox}=10 nm, L=1µm, W=10 µm, L_{OV} = 0.05 µm, C_{sbo} = C_{dbo}=10 pF, V_O = 0.6 V, V_{SB} = 1V and V_{DS} = 2V. Calculate i) C_{OX} ii) C_{OV} iii) C_{gs} iv) C_{gd} v) C_{sb} vi) C_{db}	**06**	(3 :3 : 2.1.2)

OR

6.	**a.**	A Common Source amplifier utilizes a MOSFET biased at I_D=0.25 mA with V_{OV}=0.25 V and R_D=20 KΩ. The device has V_A= 50V. The amplifier is fed with source having R_{sig}=100 KΩ and a 20 KΩ load is connected to the output. Find R_{in}, A_{vo}, G_v, A_v and R_o. 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 sine wave voltage at the output?	**10**	(2 :3 : 2.1.2)
	b.	Write a Short note on: (i) Current Source (ii) Current Mirror	**10**	(3 :3 : 1.3.1)

MODULE – 4

7.	**a.**	Determine the voltage gain, input and output impedance with feedback for a voltage series feedback amplifier having A= -100, R_i=10 KΩ, R_o=20 KΩ for the feedback of (i) β= 1 and (ii) β= -0.5.	**10**	(3 :4 : 2.1.2)
	b.	Explain the four basic Feedback topologies.	**10**	(2 :4 : 1.3.1)

OR

8.	**a.**	Explain the operation of Class B amplifier. Prove that the maximum conversion efficiency of Class B transformer coupled amplifier is 78.5%.	**10**	(3 :4 : 1.3.1)
	b.	What is output stage and discuss the classification of output stages based on the Collector current?	**10**	(2 :4 : 1.3.1)

MODULE – 5

9.	**a.**	What is an instrumentation amplifier? Explain an instrumentation amplifier.	**10**	(2 :5 : 1.3.1)
	b.	Explain the operation of monostable multivibrator with relevant diagram and waveform.	**10**	(2 :5 : 1.3.1)

OR

10.	**a.**	What is R-2R network type DAC? Explain with relevant expression.	**10**	(2 :5 : 1.3.1)
	b.	Design an Astable Multivibrator using 555 timer with (i) f_0 = 1 kHz and Duty Cycle = 40% (ii)f_0 = 2kHz and Duty Cycle = 50% (iii) f_0 = 1kHz and Duty Cycle = 70% Assume C = 0.01µF for all cases.	**10**	(2 :5 : 1.3.1)

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Note: (**RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI - Performance Indicator)**