

BALLARI INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institute under Visvesvaraya Technological University, Belagavi)

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Course Code

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Fifth Semester B.E. Degree Examinations, February 2025

OPERATIONAL AMPLIFIERS & LINEAR IC's

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

<u>Q. No</u>	<u>Question</u>	<u>Marks</u>	<u>(RBTL :CO :PI)</u>
<u>Module-1</u>			
1.	a. Explain the block diagram of operational amplifier and represent the symbol for 741 op-amp.	06	(2 :1 :1.3.1)
	b. Explain voltage series amplifier with feedback. Represent the circuit gain and show how gain of the circuit is controlled.	07	(2 :1 :1.3.1)
	c. For practical inverting 741C amplifier having $R_1 = 300 \Omega$, $R_F = 4 \text{ k}\Omega$, $A=200,000$, $R_i = 2 \text{ M}\Omega$, $R_O = 75 \Omega$, single break frequency = 5 Hz, supply voltage = $\pm 18 \text{ V}$, output voltage swing $\pm 16 \text{ V}$, calculate A_F , R_{iF} , R_{oF} , f_F , and V_{OOT} .	07	(3 :1 :1.3.1)
(OR)			
2.	a. Explain noninverting AC amplifier with feedback and obtain the expression for bandwidth.	07	(2 :1 :1.3.1)
	b. Explain summing, scaling and averaging amplifier using inverting amplifier with feedback.	06	(2 :1 :1.3.1)
	c. For AC inverting Op-Amp, $R_{in} = 50 \Omega$, $R_1 = 2 \text{ k}\Omega$, $C_i = 0.1 \mu\text{F}$, $R_F = 4.7 \text{ k}\Omega$, $R_L = 10 \text{ k}\Omega$ and supply voltage = $\pm 12 \text{ V}$. Determine the bandwidth of the amplifier.	07	(3 :1 :1.3.1)
<u>Module-2</u>			
3.	a. Explain advantages of active filters over passive filters.	06	(2 :2 :1.3.1)
	b. Define following:	06	(2 :2 :1.3.1)
	(i) Operating frequencies	(ii) High cut-off frequency	
	(iii) Low cut-off frequency	(iv) Pass band frequency	
	(v) Stop band frequency	(vi) Order of the filter	
	c. Explain first-order low-pass Butterworth filter with necessary equations and frequency response.	08	(2 :2 :1.3.1)
(OR)			
4.	a. Briefly explain the following classification of filters:	06	(2 :2 :1.3.1)
	(i) Analog or Digital	(ii) Passive or Active	
	(iii) Audio (AF) or Radio frequency (RF).		
	b. Briefly explain all pass filter.	06	(2 :2 :1.3.1)
	c. Explain second-order high-pass Butterworth filter with necessary equations and frequency response.	08	(2 :2 :1.3.1)

Module-3

5. a. Explain the circuit of triangular/rectangular waveform generator. Draw the output waveforms and derive time period and frequency. 08 (2 :3 :1.3.1)
- b. Explain the Wien bridge oscillator with design consideration. 06 (2 :3 :1.3.1)
- c. Design phase shift oscillator to have an output of 800 Hz. Consider 741 IC with supply voltage of ± 12 V. 06 (3 :3 :1.3.1)

(OR)

6. a. With neat diagram explain the noninverting comparator with $+V_{ref}$ and represent neat waveforms. 06 (2 :3 :1.3.1)
- b. Explain the inverting Schmitt trigger with waveforms, equations and plot hysteresis curve. List the applications of Schmitt trigger. 08 (2 :3 :1.3.1)
- c. Design triangular wave generator with $f_0 = 3$ kHz and $V_{0(p-p)} = 6$ V with supply voltage ± 12 V. 06 (3 :3 :1.3.1)

Module-4

7. a. Explain non-saturation precision half wave rectifier and how the saturation problem is overcome. 06 (2 :4 :1.3.1)
- b. Explain R-2R ladder DAC with neat circuit and waveform for full scale output. 07 (2 :4 :1.3.1)
- c. With neat diagram, illustrate the operation of successive approximation type ADC. 07 (2 :4 :1.3.1)

(OR)

8. a. Explain precision full wave rectifier with a summing circuit and half wave precision rectifier with relevant equations and voltage waveforms. 07 (2 :4 :1.3.1)
- b. Briefly explain the performance parameters of ADC and DAC. 06 (2 :4 :1.3.1)
- c. With block diagram, illustrate the operation of single slope linear ramp ADC. 07 (2 :4 :1.3.1)

Module-5

9. a. Draw pin details and block diagram of IC 555 timer and explain the operation of each pin. 07 (2 :5 :1.3.1)
- b. Explain the operation of monostable multivibrator using IC 555. 07 (2 :5 :1.3.1)
- c. Design monostable 555 timer circuit to produce an output of 10 sec wide, draw circuit diagram. 06 (3 :5 :1.3.1)

(OR)

10. a. Explain the features of IC 555 timer. 07 (2 :5 :1.3.1)
- b. Explain the operation of free-running ramp generator using astable multivibrator with neat circuit and waveforms. 07 (2 :5 :1.3.1)
- c. In the astable multivibrator with $R_a = 2.2$ k Ω , $R_b = 3.9$ k Ω and $C = 0.1$ μ F. Determine the positive pulse width t_c , negative pulse width t_d and free-running frequency f_0 . 06 (3 :5 :1.3.1)

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