Ref No: **Ex/PG/EE/T/115A/2025**

M. E. ELECTRICAL ENGG. FIRST YEAR 1ST SEMESTER EXAM, 2025
MASTER IN ILLUMINATION ENGG. FIRST YEAR 1ST SEMESTER EXAM, 2025
MASTER OF NUCLEAR ENGG. FIRST YEAR 1ST SEMESTER EXAM, 2025

SUBJECT: - ACTIVE CIRCUITS AND SYSTEMS

Time: Three hours | Full Marks 100

No. of Questions		Marks
	Answer any FOUR questions.	
1. (a)	Describe in detail the operation of a 111/311 precision comparator. Also describe in detail how can a window detector circuit be developed using comparators.	06+06
(b)	How can an instrumentation amplifier circuit be designed using a single resistor gain control? What are the highlighting features of AD8221 precision instrumentation amplifier?	06+07
2. (a)	How are signal isolation and power isolation carried out in isolation amplifiers? What are the characteristic features of AD202 and AD204 isolation amplifiers?	07+06
(b)	With a suitable diagram, describe in detail the operating principle of Ring modulator and mathematically derive to show that this circuit generates a DSB-SC AM signal at its output.	12
3. (a)	Derive the frequency spectrum of the modulated signal in conventional DSB AM. Plot amplitude spectra of message signal and conventional DSB AM signal vs. frequency. What are the drawbacks of conventional DSB AM?	13
(b)	Differentiate between generation of direct FM and indirect FM signals. Then describe in detail a scheme for generation of indirect FM signals. How can we differentiate between narrowband and wideband FM on the basis of modulation index?	12

[Turn over

Ref No: **Ex/PG/EE/T/115A/2025**

No. of Questions		Marks
4. (a)	How can a state-variable filter be designed using a chain of integrators? Hence show that a state variable configuration using two op-amp integrators and one op-amp summer can simultaneously provide second order low-pass, band-pass and high-pass responses.	13
(b)	How are switched capacitor circuits employed to design (*i*) switched capacitor integrator, (*ii*) summing integrator and (*iii*) lossy integrator?	12
5. (a)	Give generalized transfer functions of second order low-pass, high-pass and band-pass filters. Then describe a detailed step-by-step procedure of how can a second order low-pass active filter be designed using VCVS.	12
(b)	Describe the role of Butterworth polynomial employed in Butterworth filter approximation technique. Hence discuss in detail the pole locations of a Butterworth filter, when the filter order n is even and when the filter order n is odd.	13
6.	Write short notes on ***any two*** of the following:	12.5×2 =25
(*i*)	Demodulation of SSB AM signals.	
(*ii*)	Chopper amplifiers and chopper-stabilized amplifiers.	
(*iii*)	Transdiode antilog amplifiers.	