SARVAJANIK UNIVERSITY
Sarvajanik College of Engineering and Technology
Bachelor of Engineering

SARVAJANIK UNIVERSITY
INCLUSIVE | INTEGRATED | INNOVATIVE

B. Tech. Year II: Semester – 4

Subject Name: Analog Signal Processing **Subject Code: BTIC13402**

Type of course: PCC

Prerequisite (if any): Basics of electrical engineering

List of Courses where this course will be prerequisite : Industrial Measurement - I, Process Control,Biomedical Instrumentation

Rationale: This subject deals with how to process sensor's output and make it suitable for next stage of any measurement system.

TEACHING SCHEME				Theory Marks			Practical Marks		Total
L	T	P	C	TEE	CA1	CA2	TEP	CA3	
3	0	2	4	60	25	15	30	20	150

CA1: Continuous Assessment (assignments/projects/open book tests/closed book tests CA2: Sincerity in attending classes/class tests/ timely submissions of assignments/self-learning attitude/solving advanced problems TEE: Term End Examination TEP: Term End Practical Exam (Performance and viva on practical skills learned in course) CA3: Regular submission of Lab work/Quality of work submitted/Active participation in lab sessions/viva on practical skills learned in course

BSC: basic science course /ESC: Engineering Science Course /HSM: Humanities and management /PCC: Professional Core course /PEC: professional Elective course /OEC: Open Elective course/ MD: mandatory noncredit course

Content:

Sr. No.	Content	Total Hrs	
1	**Op-Amp Fundamentals:** Brief overview of op-amp with its open loop configuration. **Definition and explanation to the terms of op-amp as:-** Input offset voltage, Input offset current, Input bias current, Total output offset voltage, Thermal drift, Differential input resistor, Input capacitance, Offset voltage adjustment range, Input voltage range, Common mode rejection ratio, Supply voltage rejection ratio, Output voltage swing, Output resistance, Output short circuit current, Supply current, Slew Rate	**3**	**6%**
2	**Op-amp with Negative Feedback (Closed Loop):** Introduction, Block diagram representation of feedback configurations,Voltage series feedback amplifier(Non-inverting amplifier with feedback),Voltage shunt feedback amplifier(Inverting amplifier with feedback), Differential amplifier with one op-amp	**6**	**14%**
3	**Active Filters:** -Introduction to active and Passive filters, Introduction to low pass and high pass filters,Active First order & Second order low pass butter worth filter with its transfer function,filter design,Active First & second order High pass butter worth filter with its transfer function, filter design.Band Pass Filters :- 1) Wide Band Pass Filter and 2) Narrow band pass filtersBand–Reject Filters :- 1) Wide band-reject filter and 2) Narrow band-reject filter(Notch Filter),All pass filter	**8**	**17%**

4	**OSCILLATORS** Introduction to oscillator, Oscillator principles, Oscillator block diagram,Phase shift oscillator, Wien bridge oscillator, Quadrature oscillator, Square wave generator, Triangular wave generator, Sawtooth wave generator ,Voltage - controlled oscillator NE/SE 566	**7**	**15%**
5	**Linear application:** -The Peaking Amplifier, -Summing Scaling and Averaging Amplifier : Inverting configuration:-Summing amplifier, Scaling amplifier, Averaging amplifier ,Non-inverting configuration:- Summing amplifier, Averaging amplifier Differential configuration:- A subtractor, Summing amplifier -Voltage to Current Converter with Floating Load -Voltage to Current Converter with Grounded Load -Current to Voltage Converter,Integrator & Differentiator -Instrumentation amplifier using three op-amp for resistive transducer and bridge,Logarithmic amplifier, Isolation amplifier	**7**	**16%**
6	**Comparators and Converters** Basic comparator, Zero crossing detector, Schmitt trigger -Clippers:- - Positive clippers, Negative clippers -Clampers: Positive and negative clampers -Absolute value output circuit, Peak detector, Sample and hold circuit -Digital to Analog Converter(DAC):D/A converter with binary - weighted resistor D/A converter with R and 2R resistor -Analog to Digital Converters (ADC):- - Successive approximation A/D converter	**7**	**16%**
7	**Specialized IC Applications:** -The 555 Timer,Introduction to 555 timer,555 timer as aMonostable multivibrator 555 timer as an Astable multivibrator -Voltage Regulators :Fixed Voltage Regulators (78XX, 79XX series devices) Adjustable Voltage Regulators (LM 317 series devices) , Design of ± 5V and	**7**	**16%**

	±15V Regulated Power Supply		

Suggested Specification table with Marks (Theory): (For BE only)

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
21	**21**	**14**	**7**	**7**	**7**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

Sr no	Title of book /article	Author(s)	Publisher and details like ISBN	Year of publication	Publication Edition
1.	Op-amps and Linear Integrated Circuits	Ramakant A. Gayakward	Prentice Hall India ISBN-81-203-2058-1	2004	4th
2	The Art of Electronics	Paul Horowitz and Winfield Hill	Cambridge University Press ISBN-0521809266	2015	3rd
3	Operational Amplifiers and Linear Integrated circuits	R.F. Coughlin & F.F. Driscoll	PHI ISBN: 0-13-014991-8	1996	

4	Design with operational amplifiers and Analog integrated circuits	Sergio Franco	McGraw Hill ISBN : 9781259253133	2014	4th

Course Outcomes:

Sr. No.	CO statement At the end of this course students will demonstrate the ability to	Marks % weightage
CO-1	Introduce the basic building blocks of linear integrated circuits	5%
CO-2	design the linear and non-linear applications of Op-Amp	30%
CO-3	introduce the concepts of waveform generation & converters.	25%
CO-4	classify and comprehend the working principle of data converters.	25%
CO-5	analyze application specific ICs such as Voltage regulators,555 timer	15%

List of Open learning website:

https://onlinecourses.nptel.ac.in/noc22_ee15/preview

List of Open Source Software:

CircuitLogix

FOR LAB SESSIONS:

List of Experiments:

1. To study and perform inverting and non-inverting and differential amplifier using op-amp without feedback.
2. To study and perform inverting and non-inverting and differential amplifier using op-amp with feedback.
3. To study and perform summing amplifier and subtractor.
4. To study and perform voltage to current converter with grounded load and with floating load.
5. To study and perform current to voltage converter.
6. To study and perform Schmitt trigger circuit using op-amp.
7. To study and perform positive and negative clippers.
8. To study and perform positive and negative clampers.
9. To study and perform the integrator and the differentiator.
10. To study and design first order low pass filter and high pass filter using op-amp.
11. To measure frequency using Wien bridge oscillator.
12. Design and study of monostable, and astable multivibrators using IC555.

Major Equipment Needed:

741 IC, Voltage Regulator IC, NE555 IC, CRO, Function Generator,Bread Board

Mapping of CO-POs:

Course	Program Outcome	Program Specific Outcome

Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3											1	1	1	
CO2	3	2	3	2					2			1	2	2	
CO3	3	2	3	2					2			1	2	2	
CO4	3	2	3	2					2			1	2	2	
CO5	3	2	3	2					2			1	2	2	