

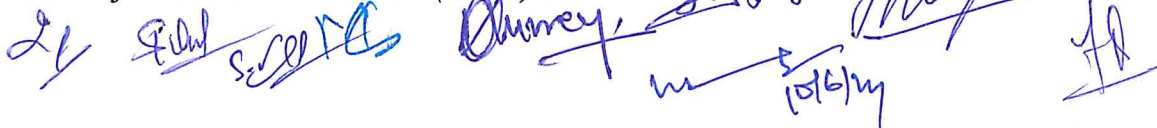
FOUR YEAR UNDERGRADUATE PROGRAM (2024 – 28)

DEPARTMENT OF PHYSICS

COURSE CURRICULUM

PART-A: INTRODUCTION			
Program : Bachelor in Science <i>(Honors/Honors with Research)</i>		Semester -VII	Session: 2024-2025
1	Course Code	PHSE- 08 T	
2	Course Title	Operational Amplifier & Its Applications	
3	Course Type	Discipline Specific Elective	
4	Pre-requisite (if, any)	<i>As per Program</i>	
5	Course Learning Outcomes (CLO)	After completion of the course students will be able to – <ul style="list-style-type: none"> ➤ The Idea and concepts of differential amplifier ➤ Basic concepts of Ideal operational amplifier and Practical operational amplifier with its electrical parameters ➤ Gain the knowledge of op-amp with feedback and its effect on different parameters ➤ Understand the concept of various oscillators and their applications ➤ Know the uses of Timer circuits and their applications 	
6	Credit Value	3 Credits	<i>Credit = 15 Hours - learning & Observation</i>
7	Total Marks	Max. Marks: 100	Min Passing Marks: 40
PART -B: CONTENT OF THE COURSE			
TotalNo.of Teaching–learning Periods (01 Hr. per period) - 45 Periods (45 Hours)			
Unit	Topics (Course Contents)		No. of Period
I	Differential amplifier: Basic idea of direct coupled amplifier and its drawbacks, Circuit configurations of Differential amplifier, need for dual power supply, Basics of different configurations, dual input-balanced output differential amplifier, Its DC analysis and AC analysis. Inverting and Non-Inverting inputs, CMRR, need for constant current bias level transistor circuit Level translator		11
II	Operational Amplifier: Introduction, Block diagram, Functions of each block, Electrical parameters, Ideal op-amp, it's characteristics and equivalent circuit, Open-loop configurations: Differential, Inverting and Non-inverting amplifiers, Op-Amp with negative feedback: Block diagrams of feedback configurations, Voltage series feedback and its effect on Input resistance, Output resistance, Bandwidth, Total output offset voltage. Voltage follower, Voltage shunt feedback, Inverting input terminal at virtual ground, its effect on Input resistance, Output resistance, Bandwidth, Total output offset voltage		12
III	Practical Op-Amp: Input offset voltage, Input bias current, Input offset current, Total output offset voltage, Thermal drift, Error voltage, Common mode configuration and CMMR, Linear Applications: Summing, Scaling and Averaging amplifiers, Basics of Instrumentation amplifier, Instrumentation amplifier using Transducer bridge, Its uses, Voltage to current converter, Theory of Integrator and Differentiator		11
IV	Active Filters Using Op-Amp: Idea of active filters and their classification, First order and Second order low-pass Butterworth filter Op-Amp Oscillators: Oscillator block diagram and condition for sustained oscillations, Phase Shift oscillator, Wien Bridge oscillator and calculation for their frequency of oscillations. Square-wave generator, Triangular wave generator. The 555 Timer: Block diagram of 555, The 555 as a Monostable Multivibrator, Its use as pulse stretcher, 555 as a Stable Multivibrator, Its use as Square-wave oscillator		11
<i>Keywords</i>	<i>Differential Amplifier, Operational Amplifier, Configuration, Feedback, Practical op-amp, Integrator, differentiator, Filters, Oscillators.</i>		

Signature of Convener & Members (CBoS) :



PART-C: LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended-

1. Op-amps and Linear Integrated Circuits- Ramakant A Gayakwad, Prentice Hall, India
2. Op-amps and Linear Integrated Circuits- R F Coughlin & F F Driscoll, Prentice Hall, India
3. Op- Amp and Linear Integrated circuits: K. Lal. Kishore, Pearson Education, Delhi
4. Op- Amp with Linear Integrated circuits: William D. Stanly, Pearson Education, Delhi
5. Linear Integrated circuits: D. Roy Choudhury and Shail B. Jain, New Age International Publications, New Delhi.
6. Op- Amp and Linear Integrated circuits: concept and applications- James N Flore, Cengage Learning India Pvt. Ltd

Reference Books Recommended-

1. Microelectronic Circuits by Adel S. Sedra and Kenneth C. Smith
2. Electronic Devices and Circuit Theory by Robert L. Boylestad and Louis Nashelsky
3. Operational Amplifiers and Linear Integrated Circuits by Robert F. Coughlin and Frederick F. Driscoll
4. Design with Operational Amplifiers and Analog Integrated Circuits by Sergio Franco
5. Op-Amps and Linear Integrated Circuits by Ramakant A. Gayakwad
6. Operational Amplifiers with Linear Integrated Circuits" by William D. Stanley**
7. Analog Filter Design" by M.E. Van Valkenburg\

Online Resources-

e-Resources / e-books and e-learning portals

1. https://www.reddit.com/r/AskElectronics/comments/aevtj1/looking_for_some_books_to_learn_about_opamps/
2. <https://open.umn.edu/opentextbooks/textbooks/574>
3. <https://community.element14.com/learn/publications/ebooks/w/documents/27823/a-quick-beginner-s-introduction-to-op-amps---ebook>
4. <https://www.analog.com/en/resources/technical-books/op-amp-applications-handbook.html>
5. <https://mgcub.ac.in/pdf/material/202004041708263c4d2b87a6.pdf>
6. https://mrcet.com/downloads/digital_notes/ECE/III%20Year/10082021/LINEAR%20&%20DIGITAL%20IC.pdf
7. <https://alan.ece.gatech.edu/ECE3040/Lectures/Lecture28-Operational%20Amplifier.pdf>

PART -D:ASSESSMENT ANDEVALUATION

Suggested Continuous Evaluation Methods:

Maximum Marks: 100 Marks

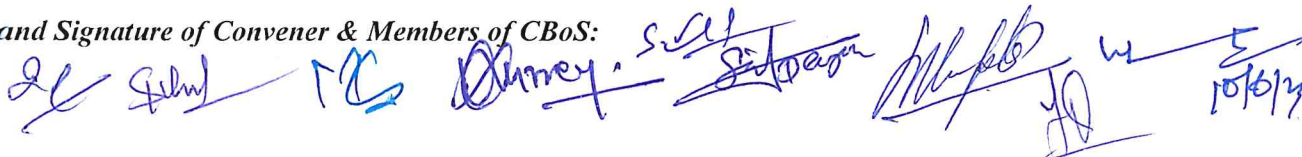
Continuous Internal Assessment (CIA): 30 Marks

End Semester Exam (ESE): 70 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2):	20 +20	Better marks out of the two Test / Quiz + obtained marks in Assignment shall be considered against 30 Marks
	Assignment / Seminar - Total Marks -	10 30	

End Semester Exam (ESE):	Two section – A & B Section A: Q1. Objective – 10 x1= 10 Mark; Q2. Short answer type- 5x4 =20 Marks Section B: Descriptive answer type qts., 1out of 2 from each unit-4x10=40 Marks
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Name and Signature of Convener & Members of CBoS:



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DEPARTMENT OF PHYSICS
COURSE CURRICULUM

PART-A: INTRODUCTION			
Program: Bachelor in Science <i>(Honors/ Honors with Research)</i>		Semester - VII	Session: 2024-2025
1	Course Code	PHSE- 08 P	
2	Course Title	Operational Amplifier & Its Applications	
3	Course Type	Discipline Specific Elective	
4	Pre-requisite (if, any)	As per Program	
5	Course Learning Outcomes(CLO)	After completion of this course a student will be able to- <ul style="list-style-type: none"> ➤ Understand the working of differential amplifier and its inverting and non-inverting configurations. ➤ Know the importance of negative feedback ➤ Know the uses of op-amp IC. Understand the idea of Oscillators ➤ Understand the working of active filters ➤ Have the idea about Multivibrators 	
6	Credit Value	1 Credits	<i>Credit =30 Hours Laboratory or Field learning/Training</i>
7	Total Marks	Max.Marks:50	Min Passing Marks:20

PART -B: CONTENT OF THE COURSE

Total No. of learning-Training/performance Periods - Periods (30 Hours)		
Module	Topics(Course Contents) At least 10 of the following or related Experiments	No. of Period
Lab./ Experiment Contents of Course	<ol style="list-style-type: none"> 1. To study the differential amplifier and to find the voltage gain 2. To study Inverting and Non-Inverting op-amp 3. To study Voltage series feedback and its effect on Input resistance, Output resistance using op-amp 4. To study Summing op-amp (IC741) and verify their theoretical and practical output 5. To study Subtractor op-amp (IC741) and verify their theoretical and practical output 6. To study Scaling op-amp (IC741) and verify their theoretical and practical output 7. To study the operation of the Integrator & differentiator using op-amp and trace the output wave forms for sine and square wave inputs 8. To study the operation of RC phase shift oscillators using op-amp and trace the output wave forms 9. To study the operation of Wien bridge oscillators using op-amp and trace the output wave forms 10. To study the First order low-pass Butterworth filter 11. To study the Second order low-pass Butterworth filter 12. To study the function of Square wave generator and trace the expected wave form 13. To study the function of Triangular wave generator and trace the expected wave form 14. To use 555 timer as Monostable multivibrator and trace the expected wave form 15. To use 555 timer as Astable multivibrator and trace the expected wave form 	30
Keywords	Differential amplifier, Feedback, Op-amp, Integrator, Differentiator, Oscillator, Waveforms, Filters, Multivibrators.	

Signature of Convener & Members (CBoS):

PART-C:LEARNING RESOURCES

Text Books, Reference Books and Others

Text Books Recommended-

1. Handbook of operational amplifier applications- Bruce Carter and Thomas R. Brown, Texas Instruments
2. Operational Amplifier: Theory and Experiments- Shrikrishna Yawale & Sangita Yawale, Springer
3. Op-Amps for Everyone- Ron Mancini, Texas Instruments

Reference Books Recommended-

1. Op-Amps and Linear Integrated Circuits by Ramakant A. Gayakwad
2. Design with Operational Amplifiers and Analog Integrated Circuits by Sergio Franco
3. Operational Amplifiers and Linear Integrated Circuits by Robert F. Coughlin and Frederick F. Driscoll
4. Op Amps for Everyone by Ron Mancini
5. Op Amp Applications Handbook by Analog Devices Inc.
6. Practical Electronics for Inventors by Paul Scherz and Simon Monk
7. Electronic Devices and Circuits by David A. Bell
8. Electronic Principles by Albert Malvino and David J. Bates

Online Resources-

e-Resources / e-books and e-learning portals

1. <https://www.scribd.com/document/370796028/Op-Amp-Lab-Manual>
2. [https://gnindia.dronacharya.info/ECE/Downloads/Labmanuals/EC_%20LAB_\(EE-451\)_IVSem_18012013.pdf](https://gnindia.dronacharya.info/ECE/Downloads/Labmanuals/EC_%20LAB_(EE-451)_IVSem_18012013.pdf)
3. https://www.researchgate.net/publication/282055366_7_Lab_Experiments_with_Op-amp_A_manual_for_undergrad_students_teaching_staff
4. <https://www.utdallas.edu/~rmh072000/EE3101/exp5.pdf>
5. <https://www.csun.edu/sites/default/files/ECE340%20Lab%20Manual.pdf>
6. <https://link.springer.com/book/10.1007/978-981-16-4185-5>

PART-D:ASSESSMENT ANDEVALUATION

Suggested Continuous Evaluation Methods:

Maximum Marks: 50 Marks

Continuous Internal Assessment (CIA): 15 Marks

End Semester Exam (ESE): 35 Marks

Continuous Internal Assessment (CIA): (By Course Teacher)	Internal Test / Quiz-(2):	10 & 10	Better marks out of the two Test / Quiz *obtained marks in Assignment shall be considered against 15 Marks
	Assignment/Seminar +Attendance- total Marks -	05 15	

End Semester Exam (ESE):	Laboratory / Field Skill Performance: On spot Assessment		Managed by Course teacher as per lab. status
	A. Performed the Task based on lab. work	- 20 Marks	
	B. Spotting based on tools& technology (written) -	10 Marks	

C. Viva-voce (based on principle/technology) - 05 Marks

Name and Signature of Convener & Members of CBoS:

