E.G.S. PILLAY ENGINEERING COLLEGE (Autonomous)

Approved by AICTE, New Delhi

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Accredited by | NBA T1 (B.E. – CIVIL, CSE, ECE, EEE, MECH & B. Tech – IT)

NAGAPATTINAM – 611002

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

R2023 - SECOND YEAR CURRICULUM

SEMESTER IV

COURSE CODE	COURSE NAME	CATEGORY	L	T	P	C	MAX. MARKS		
							CA	ES	TOTAL
THEORY COURSES									
2302EC401	Analog Integrated Circuits	PCC	3	0	0	3	40	60	100
2302EC402	Analog Communication	PCC	3	0	0	3	40	60	100
2302EC403	Control systems	PCC	3	1	0	4	40	60	100
2302EC404	Digital Signal Processing	PCC	3	1	0	4	40	60	100
2302EC405	Electronic Circuits (Oscillator, Amplifiers, Multi vibrator)	PCC	3	1	0	4	40	60	100
2301HSX01	Universal Human Values and Ethics	HSMC	1	0	2	2	100	-	100
2301MC40X	Mandatory Course - I	MC	3	0	0	-	-	-	-
PRACTICAL COURSES									
2302EC451	Analog Integrated Circuits Laboratory	PCC	0	0	3	1.5	60	40	100
2302EC452	Digital Signal Processing Laboratory	PCC	0	0	2	1	60	40	100
2302EC453	Electronic Circuits Lab	PCC	0	0	3	1.5	60	40	100
2304GE401	Professional Development - II	EEC	0	0	2	1	100	-	100
2301LS401	Life Skills - IV	LS	-	-	-	-	-	-	-
TOTAL						**25**	**580**	**420**	**1000**

2302EC401	ANALOG INTEGRATED CIRCUITS	L	T	P	C
		3	0	0	3

PREREQUISITE:

1. Electron Devices

COURSE OBJECTIVES:

1. To study the fundamental concepts of Operational amplifiers.
2. To learn the linear and non-linear applications of operational amplifiers.
3. To introduce the theory and application of analog multiplier and Phase Locked Loop.
4. To describe about the theory of ADC and DAC.
5. To study the performance metrics of waveform generator.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Implement the basic applications of Op-amp using IC 741.
CO2:	Interpret the concept of active filter for analog integrated circuits.
CO3:	Design applications using analog multiplier and PLL.
CO4:	Design ADC and DAC using Op-Amps.
CO5:	Describe the working of waveform generator and special ICs circuit function.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	3	3	2	-	-	-	-	-	-	-	-
CO3	1	-	-	2	-	-	-	-	-	-	-	-
CO4	1	-	2	1	-	-	-	-	-	-	-	-
CO5	1	2	3	2	-	-	-	-	-	-	-	-

COs Vs PSOs MAPPING:

COs	PSO1	PSO2
CO1	2	1
CO2	1	1
CO3	2	1
CO4	2	1
CO5	1	1

COURSE CONTENTS:

MODULE I DIFFERENTIAL AMPLIFIERS **9 Hours**

Operational Amplifiers, Basic information about op-amps – Ideal Operational Amplifier- General operational amplifier stages - and internal circuit diagrams of IC741. Typical op-amp parameters: Finite gain, Finite bandwidth, Offset voltages and currents, Common-mode rejection ratio, Power supply rejection ratio, Slew rate, DC and AC characteristics, Open and closed loop configurations.

MODULE II APPLICATIONS OF OPERATIONAL AMPLIFIERS **9 Hours**

Applications of Op-amp: Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-I and I-to-V converters, adder, sub tractor, Instrumentation amplifier, Integrator, Differentiator, Logarithmic

amplifier, Anti-logarithmic amplifier, Comparators, Schmitt trigger, Precision rectifiers, Clipper and Clamper Active filters: Low pass, High pass, band pass filters.

MODULE III	**PHASE LOCKED LOOP AND TIMER**	**9 Hours**

PLL-Basic block diagram and operation, Phase detector, VCO, Monolithic PLL IC 565, Applications of PLL: Frequency synthesizers, AM detection, FM detection and FSK demodulation, Timer IC 555 and Monostable and Astable multivibrator using 555 timer.

MODULE IV	**ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS**	

Analog and Digital Data Conversions, D/A converter – specifications - weighted resistor type, R-2R Ladder type, Voltage Mode and Current Mode - R-2R Ladder types - switches for D/A converters, high speed sample-and-hold circuits, A/D Converters – specifications - Flash type – Successive Approximation type - Single Slope type – Dual Slope type - A/D Converter using Voltage-to-Time Conversion.

MODULE V	**WAVEFORM GENERATORS AND SPECIAL FUNCTION ICS**	**9 Hours**

Sine-wave generators, Multi vibrators and Triangular wave generator, Saw-tooth wave generator,ICL8038 function generator - IC 723 general purpose regulator - Monolithic switching regulator, Frequency to Voltage and Voltage to Frequency converters, Audio Power amplifier, Video Amplifier, Isolation Amplifier, Opto-couplers and fibre optic IC.

TOTAL: 45 HOURS

REFERENCES:

1. *Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 4th Edition, Tata McGraw - Hill, 2016.*
2. *D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 2018, 5th Edition.*
3. *S.Salivahanan & V.S. Kanchana Bhaskaran, "Linear Integrated Circuits", TMH, 2nd Edition, 4th Reprint, 2016.*
4. *Sedra and Smith, "Microelectronics Circuits", 1st Edition, Oxford Univ. Press, 2004.*
5. *Robert F. Coughlin, Frederick F.Driscoll, "Operational Amplifiers and Linear Integrated Circuits", 6th Edition, PHI, 2001.*
6. *John D Ryder, "Electronic fundamentals and Applications: Integrated and Discrete systems", 5th Edition, PHI, 2003.*
7. *Donald .A. Neamen, "Electronic Circuit Analysis and Design", Second edition, Tata McGraw Hill, 2009.*

2302EC402	ANALOG COMMUNICATION	L	T	P	C
		3	0	0	3

PREREQUISITE:

1. Basic Electronic Circuits

COURSE OBJECTIVES:

1. To impart students the need, design, analysis and applications of Linear modulation Systems
2. To introduce angle Modulation , Demodulation and the concepts of Pre-emphasis and De emphasis
3. To elaborate the types of noise, Figure of merit of AM,DSB-SC,SSB-SC, FM Receivers and Pulse modulation Systems

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Design AM, DSB-SC and SSB Modulators and Demodulators.
CO2:	Comprehend and Compare FM and PM generation and Design.
CO3:	Classify different types of noise and design FOM of AM and FM Demodulation.
CO4:	Design Radio Transmitters and Receivers.
CO5:	Determine the Nyquist Sampling rate of a signal. Comprehend and Compare Pulse Modulation Systems.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	-

COs Vs PSOs MAPPING:

COs	PSO1	PSO2
CO1	-	3
CO2	-	3
CO3	-	2
CO4	-	3
CO5	-	3

COURSE CONTENTS:

MODULE I **INTRODUCTION TO COMMUNICATION SYSTEMS** **9 Hours**

Need and Importance of Communication, Elements of Communication systems, Representation of signals in time and frequency domain using Fourier analysis. Need for Modulation. Amplitude Modulation, Frequency Spectrum of AM, Power in AM wave, Generation of AM signal -Square law Modulator, Switching Modulator, AM demodulation- Envelope and Square law demodulation. DSB-SC Modulation, Synchronous Detection. SSB-SC, VSB. Comparison of Linear Modulation Systems

MODULE II	**ANGLE MODULATION**	**9 Hours**
Principle of frequency and Phase modulation, Relation between FM and PM wave, Frequency Deviation and bandwidth of waveform, Narrow band and wideband FN. Bessel Functions and Carlson's rule. Generation of FM and PM wave. Comparison of AM, FM and PM. FM Detectors – Slope detectors, Frequency discriminators, Ratio Detectors. Feedback Demodulators-The Phase Locked Loop-Frequency Compressive feedback demodulator- Pre emphasis and Deemphasis		
MODULE III	**NOISE AND RANDOM PROCESS**	**9 Hours**
Noise and its types-Noise Voltage-Signal to Noise ratio-Noise Figure- Noise Temperature. Gaussian and White noise Characteristics, Narrowband Noise Representation, Figure of merit in AM, DSB-SC, SSB and FM Demodulation.		
MODULE IV	**TRANSMITTERS AND RECEIVERS**	**9 Hours**
Transmitter characteristics & Classification - Low Level and High Level transmitters - AM broadcasting transmitters - Pilot carrier technique- FM transmitters. Receiver -characteristics and Classification- Tuned radio frequency receiver - Super heterodyne receiver – AM and FM receivers.		
MODULE V	**PULSE MODULATION**	**9 Hours**
Sampling Theorem, Pulse Modulation Schemes -PAM, PWM and PPM Generation and Detection – Conversion of PWM to PPM. Multiplexing Techniques – TDM and FDM.		
		TOTAL: 45 HOURS

REFERENCES:

1. *Simon Haykin, "Communication systems", 5th Edition, ISBN:978-0-471-69790-9, Wiley.*
2. *H.Taub & Schilling, Gautam Sahe, "Principles of Communication Systems", TMH, 2007, 3rd Edition.*
3. *George Kennedy and Bernard Davis, "Electronics and Communication System", 4th Edition, TMH, 2009.*
4. *Dennis Roddy, John Coolen , "Electronic Communications", Prentice Hall of India, 2013.*
5. *H.P.Hsu, "Schaum Outline Series Analog and Digital Communication", TMH, 2006.*

2302EC403	CONTROL SYSTEMS	L	T	P	C
		3	1	0	4

PREREQUISITE:

1. Laplace transform and Inverse Laplace transform, Basic of matrix functions

COURSE OBJECTIVES:

1. To introduce the components and their representation of control systems
2. To learn various methods for analyzing the time response, frequency response and stability of the systems.
3. To learn the various approach for the state variable analysis.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Determine transfer function of mechanical and electrical systems using block diagram reduction technique, signal flow graph.
CO2:	Analyze the time domain specifications and calculate the steady state error
CO3:	Determine different frequency domain specifications using Bode, Polar and Nyquist plot
CO4:	Determine the stability of a control system using Routh-Hurwitz Criterion and Root Locus Technique.
CO5:	Illustrate the state space model of a physical system and calculate Controllability and Observability of control system

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	-	-	-	2	1	-	1
CO2	3	2	1	-	-	-	-	-	2	1	-	1
CO3	3	2	1	-	-	-	-	-	2	1	-	1
CO4	3	2	1	-	-	-	-	-	2	1	-	1
CO5	3	2	1	-	-	-	-	-	2	1	-	1

COs Vs PSOs MAPPING:

COs	PSO1	PSO2
CO1	1	-
CO2	1	-
CO3	1	-
CO4	1	-
CO5	1	-

COURSE CONTENTS:

MODULE I	CONTROL SYSTEMS REPRESENTATION	9 Hours

Introduction to control systems- Open loop and closed loop control systems-Transfer function-Modelling of control systems – Mechanical translational and rotational systems - Electrical systems -Block diagram reduction techniques – Signal flow graph reduction using Masons gain formula.

MODULE II	TIME RESPONSE ANALYSIS	9 Hours

Standard test signals-Type and order of a system - Time response of First order and second control systems

for step input-Time domain specifications-Steady state error- Controllers - PI, PD, PID controllers.		
MODULE III	**FREQUENCY RESPONSE ANALYSIS**	**9 Hours**
Frequency domain specifications-Frequency response of standard second order system-Frequency response analysis using Polar plot-Bode Plot and Nyquist Plot.		
MODULE IV	**STABILITY ANALYSIS OF CONTROL SYSTEMS**	**9 Hours**
Introduction to stability-Roots of characteristic equation-Routh Hurwitz stability criterion-Conditionally stable systems-Concepts of root locus-Guidelines for sketching root locus.		
MODULE V	**STATE SPACE ANALYSIS**	**9 Hours**
State variable representation-Conversion of state variable models to transfer functions-Solution of state equations-Equivalence between transfer function and state variable representations-Concepts of Controllability and Observability.		
		TOTAL: 45 HOURS

REFERENCES:

1. *Nagrath I.J. and Gopal.M, "Control Systems Engineering", 5th Edition, New Age International Publishers, New Delhi, 2008.*
2. *Kuo,B.C, "Automatic Control Systems", 8th Edition, John Wiley and Sons, New York, 2003.*

2302EC404	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	1	0	4

PREREQUISITE:

1. Digital Electronics
2. Signals and Systems

COURSE OBJECTIVES:

1. To learn discrete Fourier Transform, properties and its computation.
2. To know the characteristics of IIR filter and to learn the design of IIR filters for filtering undesired signals.
3. To know the characteristics of FIR filter and to learn the design of FIR filter for filtering undesired signals
4. To understand Finite word length effects and DSP Applications
5. To study about a programmable Digital signal processor.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Compute DFT using FFT algorithms and derive DFT properties.
CO2:	Design of IIR filters for filtering undesired signals.
CO3:	Design of FIR filters for filtering undesired signals.
CO4:	Solve the complex problem using Finite word length effects.
CO5:	Explain the architecture and programming of ADSP processors.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	-	-	-	-	-	-	3
CO2	3	3	3	3	3	-	-	-	-	-	-	3
CO3	3	3	3	3	3	-	-	-	-	-	-	3
CO4	3	3	3	3	3	-	-	-	-	-	-	3
CO5	3	3	3	-	-	-	-	-	-	-	-	3

COs Vs PSOs MAPPING:

COs	PSO1	PSO2
CO1	3	3
CO2	3	3
CO3	3	3
CO4	3	3
CO5	3	3

COURSE CONTENTS:

MODULE I **DISCRETE FOURIER TRANSFORM** **9 Hours**

Introduction to DFT and IDFT – Properties of DFT –Filtering methods based on DFT – FFT Algorithms – Decimation in time Algorithms, Decimation in frequency Algorithms.

MODULE II **IIR FILTER DESIGN** **9 Hours**

Structures of IIR – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by

Impulse Invariance, Bilinear transformation, Approximation of derivatives – (LPF, HPF, BPF, BRF) filter design using frequency translation.		
MODULE III	**FIR FILTER DESIGN**	**9 Hours**
Structures of FIR – Linear phase FIR filter – Fourier Series - Filter design using windowing techniques (Rectangular Window, Hamming Window, Hanning Window), Frequency sampling techniques.		
MODULE IV	**FINITE WORDLENGTH EFFECTS**	
Finite wordlength effects in digital Filters: Errors, Limit Cycle, Noise Power Spectrum, Fixed point and floating point number representations – Quantization- Truncation and Rounding errors - Quantization noise – quantization error – Overflow error – Round-off noise power - limit cycle oscillations due to product round off and overflow errors		
MODULE V	**DSP APPLICATIONS**	**9 Hours**
Introduction – TMS320C5X Architecture – Features – Addressing Formats – Functional modes - Introduction to Commercial DSP Processors – TMS320C64XX, TMS320C54X. Multirate Signal Processing – Decimation, Interpolation, Sampling rate conversion by a rational factor - Adaptive Filters.		
		TOTAL: 45 HOURS

REFERENCES:

1. *J.G. Proakis and D.G. Manolakis, Digital Signal Processing Principles, Algorithms and Applications, Pearson Education, New Delhi, PHI. 2003.*
2. *S.K. Mitra, Digital Signal Processing – A Computer Based Approach, McGraw Hill Edu, 2013.*
3. *B.Venkataramani and M.Bhaskar, Digital Signal Processors – Architecture, Programming and Applications, Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.*
4. *Robert Schilling & Sandra L.Harris, Introduction to Digital Signal Processing using MATLAB, Cengage Learning, 2014.*
5. *P. Ramesh Babu, Digital Signal Processing, Scitech Publications Pvt Ltd, Fourth Edition, 2011.*

2302EC405	ELECTRONIC CIRCUITS (Oscillator, Amplifiers, Multi vibrator)	L	T	P	C
		3	1	0	4

PREREQUISITE:

1. Electron Devices

COURSE OBJECTIVES:

1. To learn the fundamental concepts behind transistor biasing and to differentiate small signal and large signal circuit models
2. To study the performance metrics of Tuned amplifiers, Power amplifiers and oscillators.
3. To discuss various applications of analog circuits

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Explain different biasing methods for Bipolar Junction Transistors and Field Effect Transistors.
CO2:	Examine various parameters of transistor amplifier circuits using small signal analysis and frequency response.
CO3:	Design power amplifiers and tuned amplifiers.
CO4:	Analyze different types of oscillators.
CO5:	Experiment with analog circuits for product development.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	1	-	-	-	-	-	3
CO2	3	3	2	2	-	2	-	-	-	-	-	3
CO3	3	2	1	1	-	2	-	-	-	-	-	3
CO4	3	3	2	2	-	2	-	-	-	-	-	3
CO5	3	2	1	1	1	1	-	-	-	-	-	3

COs Vs PSOs MAPPING:

COs	PSO1	PSO2
CO1	3	-
CO2	3	-
CO3	3	-
CO4	3	-
CO5	3	-

COURSE CONTENTS:

MODULE I	OVERVIEW OF SEMICONDUCTOR DEVICES AND BIASING	9 Hours

Reviews on semiconductor physics, bipolar junction transistor (BJT); Different types of biasing- Design and analysis of BJT amplifiers; FET transistor; biasing, design and analysis of FET amplifiers.

MODULE II	SMALL SIGNAL ANALYSIS AND FREQUENCY RESPONSE OF AMPLIFIERS	9 Hours

Small signal Analysis of CE, CC and CB amplifier.Frequency response of amplifiers, Differential Amplifiers, CMRR, Differential amplifiers with active load, Two stage amplifiers, stagger tuned amplifiers

MODULE III	**TUNED AMPLIFIERS AND POWER AMPLIFIERS**	**9 Hours**
Small signal tuned amplifiers – Analysis of capacitor coupled single tuned amplifier – double tuned amplifier – Stagger tuned amplifiers. Power amplifiers - class A, class B, class AB, Biasing circuits, class C and class D		
MODULE IV	**OCILLSATORS**	**9 Hours**
Sinusoidal oscillators, General form of oscillator circuit (Hartley & Colpitts), Barkhausen Criterion, Design and analysis of RC phase shift (FET/ BJT) oscillator, Wien bridge oscillators, Resonant circuit oscillators, Crystal oscillator.		
MODULE V	**APPLICATIONS OF ANALOG ELECTRONICS**	**9 Hours**
Selection of Components and Circuit Elements in an Application - Automatic Switch on of Lamp in the Dark Using a BJT - Automatic Switch-On of Lamp in the Presence of Light Using a BJT - Humidity Detector - Smoke Detector - Future Advances in Applications of Analog Electronics – Case study: Analog Electronics Sees a Revival in the Music Industry.		
		TOTAL: 45 HOURS

REFERENCES:

1. *A. Sedra and K. Smith, Microelectronic Circuits, 7th Eition. Oxford Univ. Press, 2016*
2. *Hernando Lautaro Fernandez-Canque by Taylor & Francis Group, LLC, 2017*
3. *Jacob Millman, C. Halkias and Satyabrata Jit, Electronic Devices and Circuits, 4th Edition, Tata McGraw-Hill, 2015.*
4. *Salivahanan, N. Suresh Kumar and A. Vallava Raj, Electronic Devices and circuits, TMH, 2nd Edition 2008.*

2301HSX01	UNIVERSAL HUMAN VALUES AND ETHICS	L	T	P	C
		1	0	2	2

PREREQUISITE:

1. Professional Ethics

COURSE OBJECTIVES:

1. Reinstate India's rich cultural legacy and human values of which we are the custodians.
2. Focus on professional ethics, which help citizens to discern desirable and undesirable actions.
3. Re-emphasize constitutional values, universal values, and holistic education to create integrated citizens.
4. Lay down broader guidelines of human values and ethics for internal and external stakeholders.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Apply critical thinking skills to solve problems and make informed decisions in various contexts.
CO2:	Analyze the principles of effective self - governance and evaluate their implementation in different scenarios.
CO3:	Understand the importance of a fair and transparent system of rewards and reprimand in constitution of India and apply these principles in real-world situations.
CO4:	Analyze the role of an individual to develop social reliability and create awareness about their assertiveness and self - confidence.
CO5:	Understand the knowledge of inner qualities and instruments of one's self in stress management and analyze the effects of meditation in one's physical, mental, social and spiritual well - being.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	-	-	1	2	3	1	2	-	2
CO2	3	3	2	-	-	1	2	2	1	2	-	2
CO3	2	1	-	-	-	2	1	2	1	2	-	1
CO4	3	3	2	-	-	1	1	2	2	2	-	1
CO5	2	1	-	-	-	2	2	3	1	2	-	1

COs Vs PSOs MAPPING

COs	PSO1	PSO2
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-
CO5	-	-

COURSE CONTENTS:

MODULE I	**INTRODUCTION TO INDIAN ETHOS**	**8 Hours**
Meaning of ethos and cultural essence of India – Scriptures as the base of the Indian Knowledge System (IKS) – Integrating the two methodologies: interiorization process for self-exploration, and exterior scientific pursuit for the prosperity of world – The Law of Karma and Nishkama Karma (The Law of action and selfless action). **Practical**: Five hours of Yoga practice per week, Ethics through Music and Indian Poetry, Community Engagement.		
MODULE II	**HUMAN VALUES AND ETHICS**	**9 Hours**
Knowing the Self and the universal values that we stand for - This is self-enquiry & self-discovery – Background conversations and deep listening - recognizing the assumptions that we make - the biases we have - and the implications for ethical action – Self-identity: distinguishing and embracing oneself (and others) four profiles (inner-potential, social, professional, personality) – Distinguish ideology, perspectives beliefs from embodying values. **Practical:** Self-discovery, self-enquiry and Mindfulness, Yama & Niyama of Ashthang Yoga.		
MODULE III	**CONSTITUTIONAL VALUES AND GLOBAL CITIZENSHIP**	**9 Hours**
Values embedded in the Preamble of the Indian Constitution Integration of Human Rights and duties – Directive principles and responsibilities as citizens of India – Sensibility and responsibilities towards global environment, Loksangraha and Vasudhaiva Kutumbakam. **Practical:** Debates and Theatre on diversity and plurality, research on similarities and differences in the ethos of different countries.		
MODULE IV	**VALUES AND SKILLS FOR YOUTH**	**9 Hours**
Designing to make a difference through strategies using the Conscious Full Spectrum Response model – Listening for commitment behind complaints to transform contentious arguments and create a space for listening and change – Distinguishing judgments from discernment – Being assertive and confident (assertiveness incorporates self-confidence). **Practical :** Development of concentration among students through music, fine arts, mathematics, sports, yoga and mindfulness		
MODULE V	**INTEGRATED PERSONALITY AND WELL-BEING**	**10 Hours**
The three gunas (qualities of sattva—purity and harmony, rajas —activity and passion, tamas —darkness and chaos), the four antah-karanas (inner instruments), and panchkosha (five sheaths) – Stress management: meditated personality and agitated personality – Oneness, non-duality, and equanimity – Physical, mental, social, and spiritual well-being. **Practical :** Talks on importance of the Ayurvedic concept of wellbeing and nutrition,sports activities		
		TOTAL: 45 HOURS

REFERENCES:

1. Blanchard, Kenneth and Peale, Norman Vincent. 1988. The Power of Ethical Management. New York: William Morrow and Company, Inc.

2. Gandhi, Mohandas Karamchand. 1971. Pathway to God compiled by MS Deshpande. Ahmedabad: Navajivan Mudranalaya, Navjivan Trust.

3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Note.php

2302EC451	ANALOG INTEGRATED CIRCUITS LABORATORY	L	T	P	C
		0	0	3	1.5

PREREQUISITE:

1. Electron Devices

COURSE OBJECTIVES:

1. To expose the students to linear and integrated circuits
2. To understand the basics of linear integrated circuits and available ICs
3. To understand characteristics of operational amplifier.
4. To apply operational amplifiers in linear and nonlinear applications
5. To acquire the basic knowledge of special function IC.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Design oscillators and amplifiers using operational amplifiers.
CO2:	Design filters using Op-amp and perform experiment on frequency response.
CO3:	Analyze the working of PLL and use PLL as frequency multiplier.
CO4:	Design Regulated power supply using ICs.
CO5:	Analyze the performance of oscillators and multi vibrators using PSPICE

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	3	3	2	-	-	-	-	-	-	-	-
CO3	1	-	-	2	-	-	-	-	-	-	-	-
CO4	1	-	2	1	-	-	-	-	-	-	-	-
CO5	1	2	3	2	-	-	-	-	-	-	-	-

COs Vs PSOs MAPPING:

COs	PSO1	PSO2
CO1	2	1
CO2	1	1
CO3	2	1
CO4	2	1
CO5	1	1

LIST OF EXPERIMENTS:

1. Inverting, Non inverting and Differential amplifiers	**2 Hours**
2. Integrator and Differentiator	**3 Hours**
3. Instrumentation amplifier and series , shunt feedback amplifier	**2 Hours**
4. Active low-pass, High-pass and band-pass filters.	**3 Hours**
5. Comparator and Schmitt Trigger using op-amp	**3 Hours**
6. RC Phase shift and Wien bridge oscillators using op-amp.	**2 Hours**
7. D/A and A/D converter, Sine – wave generator.	**3 Hours**
8. 555 Timer – Astable and Monostable multivibrator.	**3 Hours**
9. PLL characteristics and its use as Frequency Multiplier.	**2 Hours**

10. Simulation of Experiments 1, 2, 3, 4, 6 and 7.	**3 Hours**
11. D/A and A/D converters (Successive approximation)	**2 Hours**
12. Analog multiplier	**2 Hours**
Virtual Lab Experiments:	
1. Instrumentation amplifier and series , shunt feedback amplifier	
2. Active low-pass, High-pass and band-pass filters.	
3. Comparator and Schmitt Trigger using op-amp.	
Additional Experiments:	
1. Mini project using Op-Amp and Specialized IC's.	
2. Design an instrumentation amplifier for body temperature detection	
3. Design a PLL circuit for a simple application.	
TOTAL: 30 HOURS	
REFERENCES:	
1. S.Franco, Design with Operational Amplifiers and Analog Integrated Circuits, Third edition TMH, 2003.	
2. Sedra and Smith, Microelectronics Circuits, First edition, Oxford Univ. Press, 2004.	
3. Coughlin, Driscoll, OP-AMPS and Linear Integrated Circuits, First edition, Prentice Hall, 2001.	
4. John D Ryder, Electronic fundamentals and Applications: Integrated and Discrete systems, 5th Edition, PHI, 2003.	
5. Donald .A. Neamen, Electronic Circuit Analysis and Design –Second edition, Tata McGraw Hill, 2009.	

2302EC452	DIGITAL SIGNAL PROCESSING LABORATORY	L	T	P	C
		0	0	2	1

PREREQUISITE:

1. Digital Electronics, Signals and Systems

COURSE OBJECTIVES:

1. To learn discrete Fourier Transform, properties and its computation.
2. To know the characteristics of digital filter and to learn the design of digital filters for filtering undesired signals.
3. To demonstrate the digital signal processor and emulate the different types of basic signals.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Compute the DFT, FFT, and signal generation.
CO2:	Experiment the correlation and convolution.
CO3:	Demonstrate the pre-processing, spectrogram and modulation of a signal.
CO4:	Design of digital filters using MATLAB.
CO5:	Devise the digital filter realization using Simulink.
CO6:	Experiment the DSP processor and MATLAB by interfacing with android devices.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	3	-	-	-	2	1	-	1
CO2	3	2	3	3	3	-	-	-	2	1	-	1
CO3	3	2	3	3	3	-	-	-	2	1	-	1
CO4	3	2	3	3	3	-	-	-	2	1	-	1
CO5	3	2	3	3	3	-	-	-	2	1	-	1
CO6	3	2	3	3	3	-	-	-	2	1	-	1

COs Vs PSOs MAPPING:

COs	PSO1	PSO2
CO1	3	2
CO2	3	2
CO3	3	2
CO4	3	2
CO5	3	2
CO6	3	2

LIST OF EXPERIMENTS:

1. Simulate the Signal Generation and visualization.	**2 Hours**
2. Compute the Fast Fourier Transforms	**2 Hours**
3. Simulate the Cross correlation and Autocorrelation.	**2 Hours**
4. Simulate the Linear and Circular Convolution.	**2 Hours**
5. Design the Pre-processing of signal.	**2 Hours**

6. Simulate the Spectrogram to demonstrate the signal frequency over a time.	**2 Hours**
7. Design the Modulation of a different signal.	**2 Hours**
8. Compute the DFT Estimation of signal.	**2 Hours**
9. Design a different IIR filter.	**2 Hours**
10. Design different types of FIR Filter.	**2 Hours**
11. Realize the Filter design for cascade, Direct form 1 & 2 using simulink.	**3 Hours**
12. Realize the IIR Filter design for direct form and cascade form.	**3 Hours**
13. Study about the DSP processor with some basic experiments.	**2 Hours**
14. Study the MATLAB interfacing with android or embedded system.	**2 Hours**

ADDITIONAL EXPERIMENTS:

1. Study of MATLAB onramp online certification program.
2. Study of Signal processing onramp online certification program.
3. Study of Simulink onramp online certification program.

REFERENCES:

1. *J.G. Proakis and D.G. Manolakis, Digital Signal Processing Principles, Algorithms and Applications, Pearson Education, New Delhi, PHI, 2003.*
2. *S.K. Mitra, Digital Signal Processing – A Computer Based Approach, McGraw Hill Edu, 2013.*
3. *B.Venkataramani and M.Bhaskar, Digital Signal Processors – Architecture, Programming and Applications, Tata McGraw Hill Publishing Company Limited. New Delhi, 2003.*
4. *Robert Schilling & Sandra L.Harris, Introduction to Digital Signal Processing using MATLAB, Cengage Learning, 2014.*
5. *P. Ramesh Babu, Digital Signal Processing, Scitech Publications Pvt Ltd, Fourth Edition, 2011.*

2302EC453	ELECTRONIC CIRCUITS LABORATORY	L	T	P	C
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PREREQUISITE:

1. Electron Devices

COURSE OBJECTIVES:

1. To Be exposed to the characteristics of basic electronic devices
2. To Study the characteristic of amplifier and oscillator.
3. To gain hands on experience in designing electronic circuits.
4. To learn simulation software used in circuit design.

COURSE OUTCOMES:

On the successful completion of the course, students will be able to

CO1:	Calculate the frequency of oscillators for diverse commercial applications.
CO2:	Analyze various types of amplifiers for product development.
CO3:	Simulate amplifiers and oscillators using Spice.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	-	-	-	-	-	-	-	-	3
CO2	3	3	2	2	-	-	-	-	-	-	-	3
CO3	3	-	1	2	-	-	-	-	-	-	-	3

COs Vs PSOs MAPPING:

COs	PSO1	PSO2
CO1	2	-
CO2	1	-
CO3	2	-

LIST OF EXPERIMENTS:

1. Design of RC Phase shift oscillator and Wien Bridge Oscillator.	**3 Hours**
2. Design of Hartley Oscillator and Colpitts Oscillator.	**3 Hours**
3. Design of Single Tuned Amplifier.	**3 Hours**
4. Design of Clipper, Clamper, RC Integrator.	**3 Hours**
5. Differentiator and Multivibrator circuits.	**3 Hours**
6. Active low-pass, High pass & Band pass filters	**3 Hours**
7. Class A and Class C tuned Amplifiers.	**3 Hours**
SIMULATION USING SPICE (Using Transistor):	
8. Simulation of CE,CC amplifiers, Wein Bridge Oscillator.	**2 Hours**
9. Simulation of Double and Stagger tuned Amplifier.	**2 Hours**
10. Simulation of Monostable Multivibrator.	**2 Hours**
11. Simulation of Bistable Multivibrator	**3 Hours**
	TOTAL: 30 HOURS

VIRTUAL LAB EXPERIMENTS:

1. Design of RC Phase shift oscillator and Wien Bridge Oscillator.

2. Design of Hartley Oscillator and Colpitts Oscillator.
3. Design of Single Tuned Amplifier.
ADDITIONAL EXPERIMENTS:
1. Design of Power inverter.
2. Design of Function Generator
REFERENCES:
1. Donald A Neaman, Semiconductor Physics and Devices, Third Edition, Tata McGraw Hill Inc. 2007.
2. Donald.A. Neamen, Electronic Circuit Analysis and Design, 2nd Edition, Tata McGraw Hill, 2009.
3. Adel.S. Sedra, Kenneth C. Smith, Micro Electronic Circuits, 6th Edition, Oxford University Press, 2010.
4. Jacob Millman, C. Halkias and Satyabrata Jit Electronic Devices and Circuits, 3rd Edition, Tata McGraw-Hill, 2011.