VELAGAPUDI RAMAKRISHNASIDDHARTHA ENGINEERING COLLEGE

DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

SCHEME OF INSTRUCTION FOR FOUR YEAR UG PROGRAMME

VR23

Second Year –Third & Fourth Semester Syllabus

Effective from 2023-24

Velagapudi Ramakrishna Siddhartha Engineering College

ELECTRONICS & INSTRUMENTATION ENGINEERING

Scheme of Instructions for Four Year B.Tech Programme-VR23

SEMESTER I **CONTACT HOURS: 26**

S. No	Course Code	Course	Subject	L	T	P	Credits
1.	23BS1101	Basic Science	Linear Algebra & Calculus	3	0	0	3
2.	23BS1102B	Basic Science	Chemistry	3	0	0	3
3.	23BS1103B	Basic Science	Basic Electrical & Electronics Engineering	3	0	0	3
4.	23ES1104	Engineering Science	Introduction to Programming	3	0	0	3
5.	23ES1105	Engineering Science	Engineering Graphics	1	0	4	3
6.	23BS1151B	Basic Science	Chemistry Lab	0	0	2	1
7.	23ES1152	Engineering Science	Computer Programming Lab	0	0	3	1.5
8.	23ES1153	Engineering Science	Electrical and Electronic Engineering Lab	0	0	3	1.5
9.	23BS1154B	Basic Science	Health and wellness, Yoga and Sports	0	0	1	0.5
Total				**13**	**0**	**13**	**19.5**
10.	23MC1106	Mandatory Course	Induction Program				**-**

Category	Credits
Basic Science Courses	3+3+3+1+1.5= 11.5
Engineering Science Courses	3+3+1.5+0.5=8
Humanities and Social Science	0
Mandatory Courses	0
TOTAL CREDITS	**19.5**

SEMESTER II **CONTACT HOURS: 27**

S.No	Course Code	Course	Subject	L	T	P	Credits
1.	23BS2101	Basic Science	Differential Equations & Vector Calculus	3	0	0	3
2.	23BS2102	Basic Science	Engineering Physics	3	0	0	3
3.	23ES2103A	Engineering Science	Basic Civil and Mechanical Engineering	3	0	0	3
4.	23PC2104C	Professional Core	Network Analysis	3	0	0	3
5.	23HS2105	Basic Science	Communicative English	2	0	0	2
6.	23BS2151	Basic Science	Engineering Physics Lab	0	0	2	1
7.	23PC2152C	Professional Core	Network Analysis & Simulation Lab	0	0	3	1.5
8.	23HS2153	Basic Science	Communicative English Lab	0	0	2	1
9.	23ES2154	Engineering Science	Engineering Workshop	0	0	3	1.5
10.	23ES2155	Engineering Science	IT Work shop	0	0	2	1
11.	23BS2156	Basic Science	NSS/NCC/Community Service	-	-	1	0.5
Total				**14**	**0**	**13**	**20.5**

Category	Credits
Basic Science Courses	3+3+2+1+1+ 0.5=10.5
Engineering Science Courses	3+1.5+1=5.5
Humanities and Social Science	0
Mandatory Courses	0
Professional Core	3+1.5=4.5
TOTAL CREDITS	**20.5**

II Year I Semester (Semester III) **CONTACT HOURS: 28**

S.No	Course Code	Course	Subject	L	T	P	Credits
1.	23BS3101C	Basic Science	Complex Analysis and Numerical Methods	3	0	0	3
2.	23HS3102	Humanities and Social Sciences	Universal Human Values – Understanding Harmony	2	1	0	3
3.	23ES3103F	Engineering Science	Analog Electronic Circuits	2	0	0	2
4.	23EI3304	Professional Core	Digital Circuits and Systems	3	0	0	3
5.	23EI3305	Professional Core	Sensors and Transducers	3	0	0	3
6.	23TP3106	Soft Skills - 1	Logic and Reasoning	0	0	2	1
7.	23MC3107	Audit	Environmental Science	2	0	0	-
8.	23EI3651	Skill Enhancement	Numerical Computing using MATLAB	0	0	2	1
9.	23ES3152	Engineering Science	Electronic Circuits Lab	0	0	2	1
10.	23EI3353	Professional Core	Digital System Design Lab	0	0	3	1.5
11.	23EI3354	Professional Core	Transducers Lab	0	0	3	1.5
			Total	**15**	**1**	**12**	**20**

Category	Credits
Basic Science Courses	3
Engineering Science Courses	2+1=3
Humanities and Social Science	3
Mandatory Courses	-
Professional Core	3+3+1.5+1.5 =9
Elective: Skill Enhancement course	1+1= 2
TOTAL CREDITS	**20**

II Year II Semester (Semester IV) **CONTACT HOURS: 28**

S.No	Course Code	Course	Subject	L	T	P	Credits
1.	23HS4101	Humanities and Social Sciences	Engineering Economics and Management	2	0	0	2
2.	23ES4102C	Engineering Science	Linear Integrated Circuits and Applications	2	0	0	2
3.	23EI4303	Professional Core	Control Systems	3	0	0	3
4.	23EI4304	Professional Core	Industrial Instrumentation	3	0	0	3
5.	23EI4305	Professional Core	Electrical and Electronic Measurements	3	0	0	3
6.	23TP4106	Soft Skills - 2	English for Professionals	0	0	2	1
7.	23EI4651	Skill Enhancement course	Virtual Instrumentation Lab	0	0	2	1
8.	23ES4152	Engineering Science	Design Thinking & Innovation	1	0	2	2
9.	23EI4353	Professional Core	Linear Integrated Circuits Lab	0	0	3	1.5
10.	23EI4354	Professional Core	Control Systems Lab	0	0	2	1
11.	23EI4355	Professional Core	Measurements Lab	0	0	3	1.5
Total				**14**	**0**	**14**	**21**

Category	Credits
Basic Science Courses	-
Engineering Science Courses	2
Humanities and Social Science	2+2 =4
Mandatory Courses	-
Professional Core	3+3+3+1+1.5+1.5 =13
Elective: Skill Enhancement course	1+1= 2
TOTAL CREDITS	**21**

Second Year
(III Semester)

23BS3101C - Complex Analysis and Numerical Methods

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	23BS1101LinearAlgebra & Calculus 23BS2101DifferentialEquations& Vector Calculus	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes

Upon successful completion of the course, the student will be able to:

CO1	Determine analytic, non-analytic functions and evaluate complex integrals
CO2	Analyze Taylor, Laurent series and apply residue theorem for computing real definite integrals
CO3	Find solutions for algebraic, transcendental equations and estimate functions using polynomial interpolation
CO4	Solve initial value problems numerically

Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2													
CO2	3	2													
CO3	3	2			2								L		
CO4	3	2			2								L		

Course Content

UNIT- I

Complex Analysis: Introduction, Continuity, Cauchy-Riemann equations. Analytic functions, Harmonic functions, Orthogonal systems, Applications to flow problems, Complex integration, Cauchy's integral theorem, Cauchy's integral formula

UNIT- II

Taylor's series, Laurent's series, Zeros and Singularities of an analytic function, Residue theorem, Calculation of Residues, Evaluation of real definite integrals:(i) Integration around the unit circle (ii) Integration around a small semi-circle, Bilinear transformation

UNIT- III

Numerical Methods & Interpolation: Solution of Algebraic and Transcendental Equations with Newton - Raphson method, Interpolation Introduction, Finite Differences-Forward, Backward and Central differences, Symbolic Relations, Newton’s interpolation formulae-forward and backward differences, Central difference interpolation formulae-Gauss’s, Stirling’s, Bessel’s formulae, Interpolation with unequal intervals - Lagrange’s and Newton’s divided difference formulae

	UNIT- IV **Numerical Differentiation:** First and second order derivatives using Newton's forward and backward difference formulae, Numerical integration with Trapezoidal rule and Simpsons 1/3 Rule, Numerical Solutions of Differential Equations-Taylor's series method, Euler's method, Modified Euler's method and Runge - Kutta method of 4th order.
Text books and Reference books	**Text Book:** [T1] B.S.Grewal, "Higher Engineering Mathematics", 44th Ed., Khanna Publishers, 2019 **Reference Books:** [R1] Erwin Kreyzig, "Advanced Engineering Mathematics", 10th Ed., John Wiley & Sons, 2015. [R2] R.K.Jain, S.R.K.Iyengar, "Advanced Engineering Mathematics", 5th Ed., Narosa Publishers, 2016. [R3] N.P.Bali, Manish Goyal, "A Textbook of Engineering Mathematics", 9th Ed., Lakshmi Publications (P) Limited, 2016. [R4] H. K. Das, Er. Rajnish Verma, "Higher Engineering Mathematics", 3rd Revised Ed., S.Chand & Co., 2014. [R5] S. S. Sastry, "Introductory Methods of Numerical Analysis", 5th Ed., PHI Learning, 2012.
E-resources and other digital material	1. Prof.Pranav Haridas, Kerala School of Mathematics, Complex Analysis, Available: https://onlinecourses.nptel.ac.in/noc21_ma39/preview 2. Prof. Ameeya Kumar Nayak, Sanjeev Kumar, IIT Roorkee, Numerical methods, Available: https://onlinecourses.nptel.ac.in/noc21_ma45/preview 3. Jeremy Orloff, Massachusetts Institute of Technology: MIT Open Courseware, Complex Variables with Applications, Available: https://ocw.mit.edu. 4. Henrik Schmidt, Massachusetts Institute of Technology: MIT Open Courseware, Introduction to Numerical Analysis for Engineering, Available: https://ocw.mit.edu.

23HS3102 – Universal Human Values – Understanding Harmony

Course Category:	Humanities and Social Sciences	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2 - 1- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Understand and aware of themselves and their surroundings (family, society and nature).													
	CO2	Handle problems with sustainable solutions, while keeping human relationships and human nature in mind													
	CO3	Exhibit critical ability and become sensitive to their commitment towards their understanding of human values, human relationship and human society													
	CO4	Apply what they have learnt to their own self in different day-to-day settings in real life													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
	CO1						1			1						
	CO2			3												
	CO3						2									
	CO4								3				2			
Course Content	**UNIT- I** **Course Introduction, Need, Basic Guidelines, Content and Process for Value Education:** **Part-1**: Purpose and motivation for the course, recapitulation from UHV-I, Self-exploration: What is it? Its content and process, 'Natural acceptance' and experiential validation- As the process for self-exploration. Continuous happiness and prosperity – A look at basic human aspirations. **Part-2**: Right understanding, Relationship and physical facility – The basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding happiness and prosperity correctly – A critical appraisal of the current scenario, Method to fulfill the above human aspirations: Understanding and living in														

	harmony at various levels. (Practice sessions are to be included to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking). **UNIT- II** **Understanding Harmony in the Human Being – Harmony in Myself:** **Part-1**: Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of self ('I') and 'body' – Happiness and physical facility, Understanding the body as an instrument of 'I' (I being the doer, seer and enjoyer). **Part-2**: Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the body: Sanyam and health; Correct appraisal of physical needs, Meaning of prosperity in detail, Programs to ensure sanyam and health. (Practice sessions are to be included to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs. dealing with disease). **UNIT- III** **Understanding Harmony in the Family and Society – Harmony in Human-Human Relationship:** **Part-1:** Understanding values in human-human relationship; Meaning of justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and respect as the foundational values of relationship, Understanding the meaning of trust; Difference between intention and competence, Understanding the meaning of respect, Difference between respect and differentiation; The other salient values in relationship. **Part-2**: Understanding the harmony in the society (society being an extension of family); Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive human goals, Visualizing a universal harmonious order in society–Undivided society, Universal order– From family to world family. (Practice sessions are to be included to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education, etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives). **UNIT- IV** **Part-1: Understanding Harmony in Nature & Existence – Whole existence as Coexistence:** Understanding the harmony in the nature, Interconnectedness and mutual fulfillment among the four orders of nature – Recyclability and self-regulation in nature,

	Understanding existence as co-existence of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence. **Part-2: Implications of the above Holistic Understanding of Harmony on Professional Ethics:** Natural acceptance of human values, Definitiveness of ethical human conduct, Basis for humanistic education, Humanistic constitution and humanistic universal order, Competence in professional ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c) Ability to identify and develop appropriate technologies and management patterns for above production systems, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to universal human order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations. (Part-1: Practice sessions are to be included to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology, etc. Part-2: Practice exercises and case studies are to be taken up in practice (tutorial) sessions eg. to discuss the conduct as an engineer or scientist, etc.).
Text books and Reference books	**Text Book:** [T1] R. R. Gaur, R. Sangal and G. P. Bagaria, "Human Values and Professional Ethics", Excel Books Private Limited, New Delhi (2010). **Reference Books:** [R1] A. Nagaraj, Jeevan Vidya Prakashan, Amarkantak, "Raman Jeevan Vidya: Ek Parichaya (1999). [R2] A. N. Tripathi, "Human Values", New Age International Publishers, New Delhi (2004). [R3] Annie Leonard, "The Story of Stuff: The Impact of Overconsumption on the Planet, our Communities, and our Health and how we can make it better",Free Press, New York (2010). [R4] Mohandas Karamchand Gandhi, "The Story of my Experiments with Truth: Mahatma Gandhi Autobiography", B. N. Publishing (2008). [R5] E. F. Schumacher, "Small is Beautiful: A Study of Economics as if People Mattered", Vintage Books, London (1993). [R6] Cecile Andrews, "Slow is Beautiful: New Visions of Community", New Society Publishers, Canada (2006). [R7] J. C. Kumarappa, "Economy of Permanence", Sarva-Seva-Sangh Prakashan Varanasi (2017). [R8] Angreji Raj, Pandit Sunderlal, Prabhath Prakashan, "Bharat Mein"Delhi (2018). [R9] Dharampal, "Rediscovering India Society for Integrated Development of Himilayas" (2003).

	[R10] M. K. Gandhi, "Hind Swaraj or Indian Home Rule",Navajivan Publishing House, Ahmedabad (1909) [R11] Maulana Abul Kalam Azad, "India Wins Freedom: The Complete Version",Orient Blackswan (1988). [R12] Romain Rolland, "The Life of Vivekananda and the Universal gospel",Advaitha Ashrama, India (2010). [R13] Romain Rolland, "Mahatma Gandhi: The Man who become one with the Universal Being", Srishti Publishers &Distributors, New Delhi (2002).
E-resources and other digital material	1. AICTE – SIP Youtube Channel https://www.youtube.com/channel/UCo8MpJB_aaVwB4LWLAx6AhQ 2. AICTE – UHV Teaching Learning Material https://fdp-si.aicte-india.org/download.php#1

23ES3103F – Analog Electronic Circuits

Course Category:	Engineering Science	**Credits:**	2
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2 - 0- 0
Prerequisites:	Basic Electronics, Network Theory	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Analyze various stability biasing techniques in BJT and FET													
	CO2	Analyze amplifier circuits at low frequencies													
	CO3	Design different oscillator circuits													
	CO4	Analyze various power amplifier circuits with respect to efficiency													
	CO5	Develop analog electronic circuits using modern tools													
Contribution of Course Outcomes towards achievement of Program Outcomes **(L – Low, M – Medium, H – High**		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	CO1		3												2	
	CO2	3													2	
	CO3			2											2	
	CO4		2												2	
	CO5					2										2

Course Content

UNIT- I

Transistor & FET Biasing: Introduction**,** Operating point, Biasing circuits - Fixed bias, Collector to base bias, Self bias; Stability factors, Bias compensation circuits - Diode compensation for V_{BE} and I_{CO}, Thermistor and Sensistor compensation; Thermal runaway and thermal stability, JFET biasing circuits - Fixed bias, Voltage divider bias.

UNIT- II

Transistor Amplifiers at Low frequencies

BJT Amplifiers: Hybrid parameter model of transistor, Analysis of transistor amplifier using h parameter model, Simplified CE hybrid model, Simplified calculations for CC & CB configurations, Cascaded stage (CE-CE), Cascode (CE-CB), Darlington Pair(CC-CC).

FET Amplifiers: FET small signal model, Analysis of FET amplifiers at low frequencies - CS/CD/CG configurations.

UNIT- III

Feedback Amplifiers:

Feedback concepts, General characteristics of Negative feedback Amplifiers, Input resistance & output resistance, Method of analysis of feedback amplifiers - Voltage series, Current series, Voltage shunt, Current shunt feedback amplifiers.

Oscillators:
Classification of Oscillators, Sinusoidal oscillators, Barkhausen criteria, RC phase shift

	oscillator using BJT, Wein bridge oscillator, LC oscillators- Hartley and Colpitts Oscillator. **UNIT- IV** **Power Amplifiers**: Classification of Power amplifiers, Class A series fed and Transformer Coupled, Second Harmonic distortion, Class B Transformer coupled Push-Pull and Complementary Symmetry Push-Pull, Cross over distortion.
Text books and Reference books	**Text Book** [1] Jacob Millman and Christos C Halkias, "Integrated Electronics: Analog and Digital Circuits and Systems", 12th ed, TMH, 1991. [2] G.K.Mithal, "Electronic Devices and circuits", 23rd ed, Khanna Publishers 2010. **Reference books** [1]A.P.Godse and U.A.Bakshi "Electronic Circuit Analysis", 1st ed, fourth reprint, Technical Publications,2010. [2] Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", 6th ed, PHI 2000.
E-resources and other digital material	http://nptel.iitm.ac.in/courses.php?branch=Ece

23EI3304 – Digital Circuits and Systems

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Analyze digital electronic circuits using analytical tools													
	CO2	Design digital electronic circuits with and without memory elements													
	CO3	Select suitable memories and logic families for digital system design													
	CO4	Use the spice software to design the digital electronic circuits													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1		3												1	
	CO2		3												2	
	CO3	2													1	
	CO4					2										2

Course Content

UNIT- I

Digital Fundamentals: 1's and 2's complements, Minterms and Maxterms, Canonical forms, Standard forms, Simplification of Boolean functions using algebraic techniques Karnaugh map minimization and Quine-McCluskey method of minimization.

UNIT- II

Combinational Logic Design: Parallel adder, Carry Look-ahead adder, Half - Subtractor, Full - Subtractor, BCD to 7 segment decoder, Design of a Binary to G++ray and Gray to Binary code converters

Combinational Logic Design Using MSI Circuits: Multiplexer, Combinational logic design using multiplexers, Demultiplexers / Decoders and their use in combinational logic design, Encoders, Priority encoder.

	UNIT- III **Flip-Flops**: Clocked S-R flip-flop, Preset and clear, J-K flip-flop, Race around condition, Master slave J-K flip-flop, D flip-flop, T flip-flop, Excitation table of a flip-flop, Flip-Flop conversions. **Sequential Logic Design**: Shift register, Bi-directional shift register, Applications of shift resisters: Ring counter, Twisted ring counter, Sequence generator. Asynchronous counters – Up/Down counters, Modulus of the counter, Design of synchronous counters. **UNIT- IV** **Memory Devices**: Functional block diagram and operation - ROM, PROM, EPROM, EEPROM, Flash memory, RAM: Static and dynamic RAM, ROM as a PLD, PAL and PLA Programming. **Digital Integrated Circuits**: Characteristics of Digital ICs, Logic Families: MOS and CMOS logic families
Text books and Reference books	**Text Book:** [T1] R P Jain "Modern Digital Electronics", 4th Ed., TMH **Reference Books:** [R1] M. Morris Mano, "Digital Logic and Computer Design", PHI,2003 [R2] A. Anand Kumar, "Fundamentals of Digital Circuits", PHI, 2006
E-resources and other digital material	

23EI3305 – Sensors and Transducers

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:															
	CO1	Analyze various performance characteristics of instrument and the quality of measurement.														
	CO2	Identify the type of transducer based on transduction principles														
	CO3	Select a relevant transducer for measurement of various physical parameters														
	CO4	Apply the concepts of signal conditioning circuit for various transducers														
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1		2											1		
	CO2	2												1		
	CO3		3											2		
	CO4	2														1
Course Content	**UNIT- I** **Instrument Characteristics:** Block diagram of generalized instrument system, Static characteristics - Desirable & Undesirable characteristics; Dynamic characteristics - Transfer function, Dynamic response of Zero order, First order and Second order instruments to step input. **Measurement Errors and Statistical Analysis:** Definition of parameters, Combination of limiting error, Statistical treatment, Curve fitting methods **UNIT- II** **Transducers:** Classification of transducers, Characteristics of transducers. **Variable Resistance Transducers**: Principle of operation, Construction details, Characteristics and applications of Resistance potentiometers, Strain gauge, Resistance thermometer, Thermistors, Hot-wire anemometer, Resistive hygrometer and Signal conditioning of resistive transducers															

	UNIT- III **Reactance Transducers** **Variable Inductance Transducers**: Principle of operation, Construction, Characteristics and applications of LVDT - RVDT, Variable reluctance accelerometer, Signal conditioning of inductive transducers **Capacitive Transducers** – Principle of operation, Construction, Characteristics and applications of Variable air gap, Variable distance, Variable permittivity capacitive transducer, Frequency response, Signal conditioning of capacitive transducers **UNIT- IV** **Special Sensors:** Introduction, Smart sensors, Micro Sensors, IR radiation Sensors, Ultrasonic Sensors, Fiber optic sensors, Colour sensor, Proximity sensors, Chemical sensor, IC sensor, Bio Sensors.
Text books and Reference books	**Text Book:** [T1] A.K.Sawhney & Puneet Sawhney,"A Course In Electrical And Electronic Measurements And Instrumentation", 19th Ed., Dhanapat Rai & Co., 2015 [T2] D.V.S.Murty, "Transducers & Instrumentation", 2nd Ed., PHI, 2013 **Reference Books:** [R1]A.K.Ghosh, "Introduction to Measurements & Instrumentation",3rd Ed., PHI, 2009 [R2] Raman Pallas & John G.Webster, "Sensors & Signal Conditioning", 2nd Ed., J. Wiley,2012
E-resources and other digital material	1. https://nptel.ac.in/courses/108/108/108108147

23TP3106 – Logic and Reasoning

Course Category:	Soft Skills-1	**Credits:**	1
Course Type:	Learning by Doing	**Lecture - Tutorial - Practice:**	0 - 0- 2
Prerequisites:		**Continuous Evaluation:**	100
		Semester end Evaluation:	0
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Think reason logically in any critical situation													
	CO2	Analyze given information to find correct solution													
	CO3	To reduce the mistakes in day to day activities in practical life													
	CO4	Develop time management skills by approaching different shortcut methods													
	CO5	Use mathematical based reasoning to make decisions													
	CO6	Apply logical thinking to solve problems and puzzles in qualifying exams for companies and in other competitive exams													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1						2									
	CO2		2													
	CO3								2							
	CO4									2						
	CO5	2														
	CO6	1														
Course Content	**UNIT- I** 1. Series Completion 2. Coding-Decoding 3. Blood Relation Blood 4. Puzzles test 5. Direction sense test **UNIT- II** 1. Logical Venn diagrams														

	2. Number test, Ranking test 3. Mathematical operations 4. Arithmetical Reasoning 5. Syllogism **UNIT- III** 1. Binary Logic 2. Inserting missing character 3. Data sufficiency 4. Analogy 5. Classification **UNIT- IV** 1. Water images, 2. Mirror images, 3. Paper folding, 4. Paper cutting, 5. Embedded Figures, 6. Dot situation, 7. Cubes & Dice
Text books and Reference books	**Text Book:** [T1] S. Aggarwal, "Verbal and Non-Verbal reasoning", S Chand Publication, 2017
E-resources and other digital material	1. https://www.indiabix.com/ 2. https://treeknox.com/ 3. https://www.examveda.com/

23MC3107 – Environmental Science

Course Category:	Audit Course	**Credits:**	-
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2 - 0- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	100 0 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Identify various factors causing degradation of natural resource and control measures													
	CO2	Identify various ecosystem and need for biodiversity													
	CO3	Realize and explore the problems related to environmental pollution and its management													
	CO4	Apply the information and technology to analyse social issues, use acts associated with environment													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	1							1							
	CO2		1	1							1					
	CO3				1	1										
	CO4						1	1	1							

Course Content

UNIT- I

The multidisciplinary nature of environmental studies, Definition, Scope and importance, Need for public awareness.

Natural Resources :

Renewable and Non-renewable Resources: Natural resources and associated problems.

(a)**Forest resources**: Use and over-exploitation, Deforestation. Timber extraction, Mining, Dams and their effects on forests and tribal people.

(b) **Water Resources**: Use and over-utilization of surface and ground water, Floods, Drought, Conflicts over water, Dams-benefits and problems.

(c) **Mineral Resources**: Use and exploitation, Environmental effects of extracting and using mineral resources.

(d) **Food Resources:** World food problems, Changes caused by agriculture and overgrazing, Effects of modern agriculture, Fertilizer-pesticide problems, Water logging, Salinity.

	(e) Energy Resources: Growing energy needs, Renewable and non-renewable energy sources, Use of alternate energy sources. **(f) Land Resources:** Land as a resource, Land degradation, Man induced landslides, Soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles **UNIT- II** **Ecosystems:** Concept of an ecosystem. Structure and function of an ecosystem. Producers, Consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, Food webs and ecological pyramids. Introduction, Types, Characteristic features, Structure and function of the following ecosystem: (a) Forest ecosystem (b)Grassland ecosystem (c)Desert ecosystem (d)Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) **Biodiversity and its Conservation** Introduction, Definition: Genetic, Species and ecosystem diversity. Biogeographically classification of India. Value of biodiversity: Consumptive use, Productive use, Social, Ethical, Aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: Habitat loss, Poaching of wildlife, Man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity **UNIT- III** **Environmental Pollution:** Definition, Causes, Effects and control measures of (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards **Solid waste management:** Causes, Effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. **Disaster management**: Floods, Earthquake, Cyclone and landslides **UNIT- IV** **Social Issues and the Environment:** From unsustainable to sustainable development. Urban problems related to energy. Water conservation, Rain water harvesting, Watershed management. Resettlement and rehabilitation of people; Its problems and concerns. **Environmental ethics** Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation, Consumerism and waste products. **Environment Protection Act:** Air (Prevention and control of pollution) act. Water

	(Prevention and control of pollution) act. Wildlife protection act. Forest conservation act. Issues involved in enforcement of environmental legislation. **Public awareness:** Human population and the environment, Population growth, Variation among nations, Population explosion - Family Welfare Programme. **Environment and Human Health:** Human rights, Value education, HIV/AIDS, Women and child welfare, Role of information technology in environment and human health. **Field Work/ Case Studies:** Visit to a local area to document environmental assets – River/ Forest/ Grassland/ Hill/ Mountain. Visit to a local polluted site – Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds. Study of simple ecosystems - Pond, river, hill slopes, etc. **Self-Study**: Water resources, Threats to biodiversity, Solid waste management, Role of information technology in environment and human health
Text books and Reference books	**Text Book:** [T1] "Grants Commission", New Delhi, Bharati Vidyapeeth Institute of Environment Education and Research **Reference Books:** [R1]AnjaneyuluY. "Introduction to Environmental Sciences", B S Publications PVT Ltd, Hyderabad [R2].Anjireddy.M "Environmental Science & Technology", BS Publications PVT Ltd, Hyderabad. [R3]Benny Joseph, "Environmental Studies", The Tata McGraw- Hill publishing company limited, New Delhi, 2005. [R4]. P.VenuGopalaRao, "Principles of Environmental Science. &Engineering", Prentice-Hall of India Pvt. Ltd., New Delhi, 2006. [R5]Santosh Kumar Garg, RajeswariGarg, "Ecological and Environmental Studies", Khanna Publishers, New Delhi 2006. [R6] Kurian Joseph & R Nagendran, "Essentials of Environmental Studies",Pearson Education publishers, 2005. [R7] A.K Dee, "Environmental Chemistry",New Age India Publications. [R8] BharuchaErach, "Biodiversity of India", Mapin Publishing Pvt.Ltd
E-resources and other digital material	

23EI3651 – Numerical Computing using MATLAB

Course Category:	Skill Enhancement	**Credits:**	1
Course Type:	Learning by Doing	**Lecture - Tutorial - Practice:**	0 -0- 2
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	100 0 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Develop a program using MATLAB													
	CO2	Develop a solution using MATLAB for linear algebra													
	CO3	Develop a solution using MATLAB for curve fitting and interpolation													
	CO4	Develop a solution using MATLAB for differential equations													
Contribution of Course Outcomes towards achievement of Program Outcomes (1– Low, 2 - Medium, 3 – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PS O3
	CO1			3		3									3	
	CO2			3		3									3	
	CO3			3		3									3	
	CO4			3		3									3	
Course Content	**Week 1:** Introduction to MATLAB **Week 2:** Error estimation and methods of roots finding **Week 3:** Order of convergence of various methods **Week 4:** Solving System of Linear Algebraic equations **Week 5:** Continuing...Solving System of Linear Algebraic equations **Week 6:** Curve fitting and Interpolation **Week 7:** Continuing... Curve fitting and Interpolation **Week 8:** Continuing... Curve fitting and Interpolation **Week 9:** Numerical differentiation **Week 10:** Numerical Integration **Week 11:** Numerical solution to ordinary differential equations (ODE's) **Week 12:** Continuing with numerical solution to ODE's														
Text books and Reference books	**Text Book** **[1] Gerald & Wheatley, "Applied Numerical Analysis", Pearson- 7th Edition, 2003.** **[2] R.S. Gupta "Elements of Numerical Analysis", second edition, Cambridge university press, 2015** **Reference books** [1] Mathew & Fink, "Numerical Methods Using MATLAB", Pearson, 1998. [2] Rudra Pratap, "Getting started with MATLAB: A quick introduction for scientist & engineers", Oxford, 2010.														
E-resources and other digital material	https://in.mathworks.com/														

23ES3152 – Electronic Circuits Lab

Course Category:	Engineering Science	**Credits:**	1
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0 - 0- 2
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Design various analog electronic circuits													
	CO2	Analyze the outputs and intercept the data generated by electronic circuits, such as waveforms and characteristics of devices.													
	CO3	Conduct experiments as an individual or team using discrete components and using spice software such as NI Multisim													
	CO4	Prepare an effective report based on experiments.													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1				3										3	
	CO2				3										3	
	CO3					3				1		1				3
	CO4										1					
Course Content	**List of Experiments** **A. Hardware Module:** 1. Characteristics of transistor in common emitter configuration. 2. Design of transistor self-bias circuit. 3. Drain and transfer characteristics of junction field effect transistor. 4. Design of unbiased clampers. 5. Design of clippers. 6. Characteristics of Uni Junction Transistor. 7. Characteristics of SCR Characteristics. 8. Frequency response of CE amplifier. 9. Frequency response of CS Amplifier. 10. Design of Hartley Oscillator. 11. Design of Wein Bridge oscillator. 12. CRO Operation and its Measurements														

23EI3353 – Digital System Design Lab

Course Category:	Professional Core	**Credits:**	1.5
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Construct scalar and wide combinatorial circuits using HDL and FPGA													
	CO2	Construct the sequential circuits using HDL and FPGA													
	CO3	Analyze outputs and interpret the data for a given problem													
	CO4	Conduct experiments as an individual or team by using modern tools													
	CO5	Prepare an effective report based on experiments.													
Contribution of Course Outcomes towards achievement of Program Outcomes **(L – Low, M – Medium, H – High**		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
	CO1			3		2										
	CO2			3		2										
	CO3				3											
	CO4									3			2			
	CO5										3					

Course Content

List of Experiments

1. Modeling Concepts- Write models to read switches and push buttons, and output on LEDs and 7-segment displays
2. Numbering Systems Create a 4-bit ripple carry adder using dataflow modeling.
3. Multi-Output Circuits-Design and implement a popular IC, 74138, functionality using dataflow modeling and the decoder.
4. Design an 8-to-3 priority encoder.
5. Design a 2-bit comparator that compares two 2-bit numbers.
6. Implement 2-bit by 2-bit multiplier using a ROM. Output the product in binary on four LEDs.
7. Tasks, Functions, and Testbench- Develop tasks for modeling a combinational circuit, develop functions for modeling a combinatorial circuit, develop a test bench to test and validate a design under test.
8. Modeling Latches and Flip-Flops.
9. Modeling Registers- Model a 4-bit register with synchronous reset, set, and loadsignals. Assign Clk, D input, reset, set, load, and output Q. Verify the design in hardware.
10. Modeling Counters
11. Behavioral Modeling and Timing Constraints- Use various language constructs using behavioral modeling, Communicate timing expectations through timing constraints.
12. Architectural Wizard and IP Catalog- Use the Architectural Wizard to configure clocking resource, Use the IP Catalog tool to configure and use counters and memories.
13. Counters, Timers, and Real-Time Clock- Generate several kinds of counters, timers, and

	real-time clocks. 14. Finite State Machines- Model Mealy FSMs, Model Moore FSMs. 15. Sequential System Design using Algorithmic State Machine (ASM) Charts.
Text books and Reference books	**Text Book** [T1] M. Rafiquzzaman, Steven A. McNinch, "Digital Logic: With an Introduction to Verilog and FPGA-Based Design", 1st Ed., Wiley, 2019. [T2] Cem Unsalan, Bora Tar, "Digital System Design with FPGA: Implementation Using Verilog and VHDL", 1st Ed., McGraw Hill Professional, 2017. [T3] Frank Bruno, "FPGA Programming for Beginners: Bring your ideas to life by creating hardware designs and electronic circuits with SystemVerilog", Packt Publishing Ltd., 2021
E-resources and other digital material	1.https://www.xilinx.com/ 2.https://digilent.com/reference/learn/programmable-logic/tutorials/start

23EI3354 – Transducers Lab

Course Category:	Professional Core	**Credits:**	1.5
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:	--	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Use transducers for measurement of various parameters													
	CO2	Analyze the characteristics of various transducers													
	CO3	Conduct experiments as an individual or team.													
	CO4	Write an effective report based on experiments.													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	3				1								3		
	CO2				3									2		
	CO3									1			1	2		
	CO4										2					

Course Content

List of Experiments

1. Characteristics of Resistance Temperature Detector (RTD)
2. Temperature measurement using Thermocouple
3. Characteristics of Light Dependent Resistor (LDR) and phototransistor
4. Measurement of magnetic flux density using Hall effect transducer
5. Speed measurement using magnetic pick-up and photoelectric pick-up
6. Flow measurement using Ultrasonic flow transmitter
7. Calibration of pressure gauges using dead weight tester.
8. Displacement measurement using Linear Variable Differential Transformer (LVDT)
9. Pressure measurement using strain gauge
10. Interfacing a Passive Infrared (PIR) sensor with Arduino for motion detection
11. Interfacing an inductive proximity sensor with Arduino for object detection
12. Interfacing a soil moisture sensor with Arduino

Note: Any 10 of the experiments in the above list, need to be completed by the student for him/her to be eligible to write University Practical Examinations

Text books and Reference books	[T1] A.K.Ghosh, "Introduction to Measurements & Instrumentation", 3rd Ed., PHI, 2009. [T2] A.K.Sawhney & Puneet Sawhney, "A Course in Mechanical Measurements & Instrumentation", 7th Ed., Dhanapat Rai & Co., 2012
E-resources and other digital material	https://create.arduino.cc/ https://www.allaboutcircuits.com/

Second Year
(IV Semester)

23HS4101 – Engineering Economics and Management

Course Category:	Humanities and Social Sciences	**Credits:**	2
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2 - 0- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Understand various forms of organizations and principles of management.													
	CO2	Understand the various aspects of business economics.													
	CO3	Perceive the knowledge on Human resources and Marketing functions.													
	CO4	Evaluate various alternatives economically.													
Contribution of Course Outcomes towards the achievement of Program Outcomes (1– Low, 2– Medium, 3 – High)		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	2														
	CO2	2				3										
	CO3	2														
	CO4	2				3										
Course Content	**UNIT- I** **Forms of Business Organization:** Salient features of sole proprietorship, Partnership, Joint stock company, Co-operative society and public sector. **Management:** Introduction to management, Functions of management, Principles of scientific management, Modern principles of management. **UNIT – II** **Introduction to Economics:** Introduction to basic economic concepts, Utility analysis: Marginal utility and total utility, Law of diminishing marginal utility, Law of equi marginal utility. **Demand Analysis:** Theory of demand: Demand function, Factors influencing demand, Demand schedule and demand curve, Shift in demand, Elasticity of demand: Elastic and inelastic demand, Types of elasticity. **Supply Analysis:** Supply schedule and supply curve, Factors influencing supply, Supply function.														

	UNIT – III **Human Resource Management:** Meaning and difference between personnel management and human resource management, Functions of human resource management. **Marketing Management:** Concept of selling and marketing – Differences, Functions of marketing, Product life cycle, Concept of advertising, Sales promotion, Types of distribution channels, Marketing research, Break-Even analysis **UNIT – IV** **Financial Management:** Functions of financial management, Time value of money with cash flow diagrams, Concept of simple and compound interest. **Depreciation:** Causes of depreciation, Factors influencing depreciation, Common methods of depreciation: Straight line method, Declining balance method, Sum of year's digits method –Problems. **Economic Alternatives:** Methods of evaluating Alternatives under present worth method, Future worth method, Annual equivalent method - Problems.
Textbooks and Reference books	**Text Book:** [T1] M.Mahajan, "Industrial Engineering and Production Management", 2nd Ed., DhanpatRaiPublications [T2]MartandTelsang" Industrial & Business Management" S.Chand publications **Reference Books:** [R1] R.Paneerselvam "Production and Operations Management" PHI [R2]Philip Kotler & Gary Armstrong "Principles of Marketing", Pearson Prentice Hall,NewDelhi,2012 [R3] IM Pandey, "Financial Management", 11th Ed., Vikas Publications [R4]B.B.Mahapatro, "Human Resource Management",New Age International
E-resources and other digital material	1.https://www.toppr.com/guides/fundamentals-of-economics-and-management/supply/supply-function/ 2.https://keydifferences.com/difference-between-personnel-management-and-human-resource- management.html 3.http://productlifecyclestages.com/ 4.https://speechfoodie.com/cash-flow-diagrams/

23ES4102C – Linear Integrated Circuits and Applications

Course Category:	Engineering Science	**Credits:**	2
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2 - 0- 0
Prerequisites:	Electronic Devices and Circuits, Network Theory	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Understand the characteristics of 741IC.													
	CO2	Apply the concepts of 741IC to implement various linear and non-linear applications.													
	CO3	Design different IC circuits using 741,555 and 723 ICs.													
	CO4	Illustrate the operation of Special purpose ICs and their applications.													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	2													2	
	CO2	3													2	
	CO3		3												3	
	CO4	2													2	
Course Content	**UNIT- I** **Operational Amplifier:** Integrated circuits - Package types and temperature ranges, Power supplies; Block diagram representation of Op amp, Ideal Op amp, Ideal and practical Op-amp specifications, 741 Op-amp features and specifications, Op-amp characteristics - DC and AC Characteristics of an Op Amp - Frequency Response, Slew Rate. **Linear applications of Op-Amp** - Inverting amplifier, Non-inverting amplifier, Voltage follower, Differential amplifier, Summing amplifier, Instrumentation amplifier, Integrator, Voltage to current converter and current to voltage converter. **UNIT- II** **Non-linear applications of Op-Amp:** Precision diode, Applications - Precision full wave rectifier, Clippers and Peak Detector; Sample and hold circuit. **Comparators and Waveform Generators:** Basic comparator, Applications – Zero crossing detector, Window detector, Voltage limiters; Schmitt trigger, Waveform generators - Square wave generator, Triangular wave generator. **UNIT- III** **Active Filters:** Active LP and HP filters, Sallen key LP and HP filters, Band pass filters - Wide band pass and Narrow band pass filters; Band stop filters - Wide band stop and														

	notch filters. **Analog to Digital and Digital to Analog Converters:**Introduction, Basic DAC techniques - Weighted resistor DAC, R-2R ladder D/A converter; A/D conversion - Parallel comparator type ADC, Successive approximation ADC and Dual slope ADC;DAC and ADC specifications **UNIT- IV** **Special Purpose ICs and Applications:** 555 Timer - 555 as Monostable and Astable operation, Applications, Schmitt trigger;IC 566 Voltage controlled oscillator; Phase locked loops - Operating principle,565 Monolithic PLL, 565 PLL Applications.
Text books and Reference books	**Text Book:** [T1] D. Roy Choudhry and Shail B. Jain, "Linear Integrated Circuits"- (4/e), New Age International Pvt. Ltd, 2011. [T2] Rama Kant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", 4th Ed,PHI, 2012. **Reference Books:** [R1] S. Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", TMH, 2016. [R2] R. F. Coughlin & F. F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits", 6thEd,PHI, 2012. [R3] Jacob, "Applications and Design with Analog Integrated Circuits", 2nd Ed., PHI 1996 [R4] Sanjay Sharma, "Op-Amps and Linear Integrated circuits",1st Ed, Katson educational series,2008. [R5] S.Salivahanan & V.S. KanchanaBhaskaran, Linear Integrated Circuits, TMH, 2nd edition, 2015.
E-resources and other digital material	1. www.analog.com 2. https://nptel.ac.in/courses/108106068/ 3. https://www.allaboutcircuits.com/ 4. https://www.linkwitzlab.com/filters.htm

23EI4303 – Control Systems

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Laplace transforms and integral calculus, Network theory	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:													
	CO1	Define and explain the concepts of control systems.												
	CO2	Model the transfer functions of physical systems using block diagram and signal flow graph approaches												
	CO3	Analyze the responses and stability of control systems using time and frequency domain approaches												
	CO4	Analyze the stability of the given control system using modern tools.												
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 – Medium, 3 – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 3
	CO1													2	
	CO2	2												2	
	CO3		3												2
	CO4		2			2									2

Course Content

UNIT- I

Introduction: Control system terminology, Examples of simple control systems – Open loop and closed loop control systems, Effect of feedback on overall gain, Stability, Sensitivity and external noise.

Mathematical Models of Physical Systems: Formulation of differential equations for electrical, mechanical and electromechanical systems, Poles, Zeros, Characteristic equation, Block diagram representation of control systems, Signal flow graphs and Mason's gain formula.

UNIT – II

Time Domain Analysis: Standard test signals – Step, ramp, parabolic and impulse, Time response of first-order system to standard test signals, Step response of second order systems-undamped, under damped, critically damped and over damped systems, Time domain specifications, Expressions for time domain specifications, Steady state error and static and dynamic error constants, Proportional, Integral and derivative control actions

UNIT – III

Stability Analysis in Complex Plane: Stability definitions – Bounded Input and Bounded Output (BIBO) stability, Stability study based on poles of closed-loop transfer function, Absolute and relative stability, Routh–Hurwitz criterion.

	Root Locus Technique: The root locus concept, Magnitude and angle conditions, Properties and construction of the root loci (For positive K only),Effect of adding poles and zeros to root locus **UNIT – IV** **Frequency Domain Analysis:** Frequency domain specifications, Correlation between time and frequency response, Bode plot – Magnitude plot, Phase plot, Determination of phase margin and gain margin, Stability analysis from Bode plots, Polar plots, Nyquist stability criterion, Nyquist Plot.
Text books and Reference books	**Text Book:** [T1] A.Anand Kumar, "Control Systems", 2nd Ed., PHI, 2014 [T2] I J Nagrath& M Gopal, "Control Systems Engineering", 5th Ed., New Age International, 2008 **Reference Books:** [R1] Katsuhiko Ogata, "Modern Control Engineering", 4th Ed., Pearson Education, 2003 [R2] A.NagoorKani, "Control Systems", 2nd Ed., RBA Publications, 2006
E-resources and other digital material	1 http://www.nptelvideos.com/control_systems/ 2 https://nptel.ac.in/courses/108101037/

23EI4304 – Industrial Instrumentation

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Sensors and Transducers	**Continuous Evaluation:**	30
		Semester end Evaluation:	70
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:													
	CO1	Explain the basic concepts of industrial process variables												
	CO2	Apply the concepts of industrial process variables to solve the engineering problems												
	CO3	Identify suitable transducer for measurement of industrial process variables												
	CO4	Analyze the performance of various measurement techniques in industrial process variables												
Contribution of Course Outcomes towards achievement of Program Outcomes **(L – Low, M - Medium, H – High**		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
	CO1														
	CO2	3													
	CO3	3													
	CO4		2												
Course Content	**UNIT- I** **Temperature Measurement:** Introduction, Classification of temperature sensors based on change in dimensions - Bimetals & Liquid-in-Glass thermometers; Change in electrical properties – RTD, Thermistor; Thermoelectricity – Thermocouples; IC sensors, Radiation pyrometers, Fiber-optic sensors, Quartz thermometer, Ultrasonic thermometer. . **UNIT- II** **Pressure Measurement:** Introduction, pressure standards, Manometers; Force summing devices – Diaphragms, Bellows, Bourdon tubes; Secondary transducers – Resistive, Inductive, Capacitive, Piezoelectric and Hall Effect; Low pressure measurement - Mcleod, Knudsen, Pirani & Ionization gauges**;** Calibration of pressure gauges using dead weight tester. **UNIT- III** **Flow Measurement**: Introduction, Head type flow meters - Orifice plate, Venturi tube and Pitot tube; Variable area type flow meters – Rotameter; Velocity measurement type flow meters - Electromagentic, Turbine, Ultrasonic flow meters, Anemometers; Mass flow measurement type – Coriolis and Thermal mass flow meters; Positive displacement flow meters - Nutating disc and lobed impeller; Open channel flow meters- Weirs, Flumes. **UNIT- IV**													

	Level Measurement: Introduction, Mechanical level indicators - Differential pressure type; Optical level sensors; Electrical type - Resistive, inductive and Capacitive; Acoustic Level Sensors – Ultrasonic; Radiative methods - Gamma ray and Radar Level Sensors. **Humidity, Density & Viscosity Measurement:** Introduction, Hygrometers-Wet and dry bulb, Electrolytic, piezoelectric hygrometers; Moisture Analyzer-Neutron back scatter Moisture analyzer; Densitometers- Ultrasonic and gamma ray densitometers; Viscometers-Say bolt, Rotational and Float viscometers.
Text books and Reference books	**Text Book:** [T1] A.K.Ghosh, "Introduction to Measurements & Instrumentation", IIIrd ed, PHI, 2009. [T2] A.K.Sawhney & Puneet Sawhney,"A Course in Mechnanical Measuremnets & Instrumentation", XIIth ed, Dhanapat Rai & Co., 2012. **Reference Books:** [R1] Ernest O Doebelin/Dhanesh, N Manik, "Measurement systems", VIth ed,Tata Mc Grawhill. [R2] C.S.Rangan, G.R.Sarma & V.S.V.Mani "Instrumentation Devices & Systems", IInd ed, TMH, 2011.
E-resources and other digital material	[1]http://nptel.ac.in/courses/108105064 [2]http://nptel.ac.in/courses/108106074

23EI4305 – Electrical and Electronic Measurements

Course Category:	Professional Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Circuit analysis	**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Apply suitable Null or Deflection type technique to measure prescribed electrical parameter.													
	CO2	Select a suitable digital instrument to measure physical and electrical parameters.													
	CO3	Compare the operation of various oscilloscopes and probes.													
	CO4	Explain the principles of various signal generators and wave analyzers.													
Contribution of Course Outcomes towards achievement of Program Outcomes **(L – Low, M - Medium, H – High**		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
	CO1	3													
	CO2		3												
	CO3		2												
	CO4														

Course Content

UNIT- I

Electromechanical Indicating Instruments: Suspension type galvanometer- Torque equation at steady state deflection, Dynamic behavior, Damping mechanisms; Permanent magnet moving coil mechanism – Torque equation, Taut-band suspension, Temperature compensation.

Electrical Measurements: DC ammeters - Shunt resistor, Ayrton shunt, Multirange ammeters, The Ayrton shunt, DC voltmeters - Multiplier resistor, Multirange voltmeter, Ohms per volt rating, Loading effect, Series type ohmmeter, Shunt type ohmmeter, Calibration of dc instruments, Alternating current indicating instruments - Electrodynamometer, Thermo Instruments, Electrodynamometers in power measurements, Watt hour meter, Power factor meters.

UNIT- II

Bridges: Wheatstone bridge, Kelvin bridge, Maxwell bridge, Hay bridge, Schering bridge, Wien bridge, Wagner ground connection.

Electronic Instruments: AC Voltmeter using rectifiers, True RMS voltmeter, Digital voltmeters - Ramp technique, Dual slope integrating type DVM, Staircase ramp DVM, Successive approximation type DVM, Q Meter - Impedance measurement using Q Meter, Analog pH meter – pH measurement using hydrogen electrode.

	UNIT- III **Oscilloscopes:** Block diagram of oscilloscope, Cathode Ray Tube, Vertical amplifier, Horizontal deflecting system, Typical CRT connections, Delay line in triggered sweep, Dual beam CRO, Dual trace oscilloscope (basic block diagram), Sampling oscilloscope, Digital storage oscilloscope, Probes for CRO - Direct probes, Passive voltage probe, Active probes, Attenuators - Uncompensated attenuators, Simple compensated attenuator **UNIT- IV** **Signal Generators**: Basic standard sine wave generator, Standard signal generator, Function generator, Laboratory square wave and pulse generator. **Wave Analyzers:** Basic wave analyzer, Frequency selective wave analyzer, Heterodyne wave analyzer, Harmonic distortion analyzers, Spectrum analyzer. **Frequency Counters And Time-Interval Measurements**: Digital frequency meter - Principle of operation, Basic circuit of a digital frequency meter, Digital measurement of time - Principle of operation, Time base selector, Period measurement..
Text books and Reference books	**Text Book:** [T1] W D Cooper & A D Helfrick, "Electronic Instrumentation and Measurement Techniques", PHI, 1998 (Unit-I) [T2] H.S.Kalsi, "Electronic Instrumentation", 2ndEd., TMH. (Units-II, III and IV) **Reference Books:** [R1] A.K. Sawhney, "A Course in Electrical and Electronic Measurements and Instrumentation",Dhanpat Rai & Co [R2] Oliver & Cage, "Electronic Measurements and Instrumentation", Mc Graw Hill, 1975
E-resources and other digital material	https://www.youtube.com/watch?v=3eYmFjHnQjY&list=PLbRMhDVUMngcoKrA4sH-zvbNVSE6IpEio

23TP4106 – English for Professionals

Course Category:	Soft Skills-2	**Credits:**	1
Course Type:	Learning by Doing	**Lecture - Tutorial - Practice:**	0 - 0- 2
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	100 0 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Present themselves effectively in the professional world by shedding off their inhibitions about communicating in English													
	CO2	Introduce themselves as well as others appropriately													
	CO3	Use vocabulary to form sentences and narrate stories by using creative thinking skills													
	CO4	Involve in practical activity-oriented sessions and respond positively by developing their analytical thinking													
	CO5	Learn about various expressions to be used in different situations													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1										3	3				
	CO2									3	3	3				
	CO3										3	3				
	CO4								2		3	3				
	CO5										3	3				
Course Content	**UNIT- I** 1. Beginners, Functional, Situational conversations 2. Practicing on functional conversations **UNIT- II** 1. Errors in usage of parts of speech with a thrust on verbs, adjectives and conjunctions, idioms/phrases. 2. Introducing basic grammar 3. Practicing on functional conversations **UNIT- III** 1. Introducing self & Others 2. Structures and forming sentences														

	3. Telephonic etiquette, Social etiquette and table manners 4. Practicing on functional conversations **UNIT- IV** 1. Direct, Indirect/Reporting speech 2. Public speaking basics 3. Versant test preparation 4. Practicing on situational conversations
Text books and Reference books	**Text Books:** [T1] Swaroopa, Polineni, "Practicing on Situational Conversations - Strengthen Your Communication Skills", 1st Ed., Maruthi Publications, 2013. [T2] Mamta Bhatnagar & Nitin Bhatnagar, "Communicative English", 1st Ed., Pearson India, 2010.
E-resources and other digital material	

23EI4651 – Virtual Instrumentation Lab

Course Category:	Skill Enhancement	**Credits:**	1
Course Type:	Learning by Doing	**Lecture - Tutorial - Practice:**	0 - 0- 2
Prerequisites:		**Continuous Evaluation:**	100
		Semester end Evaluation:	0
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:															
	CO1	Understand the graphical programming terminology and able to create a virtual instrument for simple problems														
	CO2	Able to use the various looping constructs, arrays, matrices and clusters														
	CO3	Able to use various data plotting techniques and structures														
	CO4	Able to use the data acquisition device to acquire the measurement data from real world into PC														
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	3				3										
	CO2				2	3										
	CO3				2	3										
	CO4				2	3										
Course Content	**List of Experiments** 1.Introduction to Virtual Instrumentation and LabVIEW 2.Programs on controls and indicators 3.Programs on arithmetic operations 4.Programs on Boolean operations 5.Programs on sub VI's 6.Programs on repetition and loops 7.Programs on arrays 8.Programs on matrices 9.Programs on clusters 10. Programs on data plotting 11. Programs on structures 12. Programs on formula nodes and math script nodes 13.. Programs on strings, file I/O 14. Temperature acquisition using 3-wire RTD. 15. Programs on data logging 16.Programs using NI myDAQ.															

	Note: Any 10 of the experiments in the above list need to be completed by the student, by choosing a minimum of 3 experiments from part- A and 7 from part-B for him/her to be eligible to write University Practical Examinations
Text books and Reference books	**Text Books:** [T1] Jovitha Jerome, "Virtual Instrumentation using LabVIEW", 1st Ed., PHI, 2013. **Reference Books:** [R1] Sanjay Gupta, Joseph John, "Virtual Instrumentation using LabVIEW", 1st Ed., TataMcGraw-Hill, 2005 [R2] Gary Johnson, Richard Jennings, "LabVIEW Graphical Programming", Tata McGraw-Hill, 2006
E-resources and other digital material	http://www.ni.com

23ES4152 – Design Thinking & Innovation

Course Category:	Humanities and Social Sciences	**Credits:**	2
Course Type:	Theory	**Lecture - Tutorial - Practice:**	1 - 0- 2
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

23EI4353 – Linear Integrated Circuits Lab

Course Category:	Professional Core	**Credits:**	1.5
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Design linear applications of op-amp circuits,													
	CO2	Design non-linear applications of op-amp circuits,													
	CO3	Design applications of 555 timer and IC voltage regulators													
	CO4	Conduct the experiment as well as analyze the outputs for given specifications as an individual or a team.													
	CO5	Prepare an effective report based on experimental results.													
Contribution of Course Outcomes towards achievement of Program Outcomes (1 – Low, 2 - Medium, 3 – High)		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO 12	PS O 1	PS O 2	PSO 3
	CO1				3										2	
	CO2				3										2	
	CO3				3											
	CO4				3					2		1			2	
	CO5										2				2	
Course Content	**List of Experiments** **<u>Analog ICs Experiments using discrete components</u>** 1. Basic applications of 741IC –Inverting amplifier, Non Inverting amplifier and summing amplifier. 2. Design of Instrumentation Amplifier using 741IC 3. Design of Integrator using 741IC 4. Precision Full wave rectifiers using Op-Amp 741IC 5. Basic applications of comparator using 741IC 6. Waveform generation using 741IC (square, triangular) 7. Design of Wein bridge Oscillator using 741IC 8. Design of First order Active Low pass and high pass filter using 741IC 9. Design of IC 555 Timer Astable circuit 10. Design of Schmitt trigger using IC 555 Timer 11. Design of a voltage Regulator using IC 723 12. D/A Converters using 741IC 4 bit R-2R ladder circuit.														
Note:	Any 10 of the experiments in the above list need to be completed by the student to be eligible to write University Practical Examinations.														

23EI4354 – Control Systems Lab

Course Category:	Professional Core	**Credits:**	1
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0 - 0- 2
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:														
	CO1	Apply control system techniques/approaches to solve problems													
	CO2	Analyze the responses and stability of the given control system													
	CO3	Conduct the experiments as individual or team													
	CO4	Make an effective report based on experiments													
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	2				2										1
	CO2				3	2										2
	CO3									2			1			
	CO4										2					
Course Content	**List of Experiments** **<u>Part-A</u>** 1.Determination of transfer functions of first order systems. 2.Time response P, PI and PID controllers of second order systems. 3.Characteristics of synchro transmitter and receiver. 4.DC motor position control using PI controller 5.Characteristics of Magnetic Amplifier **<u>Part-B</u>** **1.** Using MATLAB/SIMULINK for control systems Part I: Introduction to MATLAB/SIMULINK/LabVIEW Part II: Polynomials in MATLAB Part III: Scripts, Functions & flow control in MATLAB **2.** Block diagram reduction techniques for determination of transfer function of a given system using MATLAB/LabVIEW. **3.** Simulation of standard test signals using MATLAB/LabVIEW **4.** Determination of step, impulse and ramp responses for first order unity feedback system using MATLAB/LabVIEW **5.** Determination of step, impulse and ramp responses for second order unity feedback system using MATLAB/LabVIEW **6.** Determination of step and impulse responses for a type ‘0’,type ‘1’ and type ‘2’ systems **7.** Root locus plot for a given transfer function using MATLAB/LabVIEW														

	8. Stability studies using Bode and Nyquist plots for a given transfer function using MATLAB/LabVIEW **Note**: Any 10 of the experiments in the above list need to be completed by the student, by choosing a minimum of 3 experiments from part- A and 7 from part-B for him/her to be eligible to write University Practical Examinations
Text books and Reference books	**Text Book:** [T1] A.Ananda Kumar, "Control Systems", PHI Learning, 2nd Ed. [T2] I.J.Nagrath & M.Gopal, "Control systems Engineering", New Age publisher, 5th Ed **Reference Books:** [R1] B.C.Kuo, "Automatic Control Systems", 7th Ed., PHI.
E-resources and other digital material	1. www.linearcontrolsystems.com 2. www.linearcontrols.net

23EI4355 – Measurements Lab

Course Category:	Professional Core	**Credits:**	1.5
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	30 70 100

Course outcomes	Upon successful completion of the course, the student will be able to:															
	CO1	Apply the basic measurement techniques to measure the parameters such as resistance, capacitance, inductance, etc														
	CO2	Analyze the outputs and integrate the data generated from the bridge measurements														
	CO3	Conduct the experiments as individual or team														
	CO4	Make an effective report based on experiments														
Contribution of Course Outcomes towards achievement of Program Outcomes (L – Low, M - Medium, H – High		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
	CO1	3														
	CO2				3											
	CO3									1	2					
	CO4											1				

Course Content

List of Experiments

1.DC meters using D'Arsonval galvanometer and their range extension.
2. AC meters using D'Arsonval galvanometer and their range extension.
3. Measurement of voltage, frequency, phase angle and phase shift using a CRO.
4. Simulation of CRO, Function generator using Analog discovery kit.
5. Measurement of resistance of small resistors using Kelvin double bridge.
6. Measurement of inductance using Maxwell bridge.
7. Measurement of capacitance using Shearing bridge.
8. Simulation of Spectrum analyzer using Analog discovery kit.
9. Measurement of resistance, inductance and capacitance using a LCR meter.
10. Measurement of amplitude and frequency of different types of waveforms using function generator.
11. Measurement of amplitudes of different types of waveforms using True RMS voltmeter.
12. Measurement of inductance of high Q coils using Hay bridge.
13. Measurement of frequency using a Wien bridge.
14. Calibration of voltmeter using potentiometer.
15. Calibration of ammeter using potentiometer

	Note: Any 10 of the experiments in the above list need to be completed by the student, by choosing a minimum of 3 experiments from part- A and 7 from part-B for him/her to be eligible to write University Practical Examinations
Text books and Reference books	
E-resources and other digital material	