VELAGAPUDI RAMAKRISHNA SIDDHARTHA ENGINEERING COLLEGE

DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

SCHEME OF INSTRUCTION FOR FOUR YEAR UG PROGRAMME [VR20]

Syllabus for

Ist- IVth Semesters

Effective from 2020-21

Velagapudi Ramakrishna Siddhartha Engineering College

ELECTRONICS & INSTRUMENTATION ENGINEERING

Program Outcomes

1. An ability to apply knowledge of mathematics, science and engineering fundamentals appropriate to the discipline.
2. An ability to identify, formulate and solve problems by applying the principles of electronic instrumentation and control systems.
3. An ability to design and implement instrumentation and control systems to meet desired needs with appropriate consideration for public health and safety, environment, society, economics and sustainability.
4. An ability to design and conduct experiments as well as to analyse and interpret data.
5. An ability to use the techniques, skills and modern engineering tools necessary for his engineering practice.
6. The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context.
7. Knowledge of contemporary issues.
8. An understanding of professional, ethical, legal and social issues and consequent responsibility relevant to professional engineering practice.
9. An ability to function on multidisciplinary teams.
10. An ability to communicate effectively with a range of audience in his professional engineering practice.
11. A recognition of the need for and an ability to engage in lifelong learning.
12. An ability to use engineering and management principles to one's own work, as a member and leader in a team to manage projects

Program Specific Outcomes

PSO1: Use basic engineering principles, concepts of measurement and sensor selection applicable to an industrial process.

PSO2: Apply basic knowledge related to circuits and devices for designing electronic systems to solve engineering problems.

PSO3: Demonstrate proficiency in the use of software and hardware required in industrial automation systems

Velagapudi Ramakrishna Siddhartha Engineering College

ELECTRONICS & INSTRUMENTATION ENGINEERING

Scheme of Instructions for Four Year B.Tech Programme-VR20

SEMESTER I **CONTACT HOURS: 26**

S. No	Course Code	Course	Subject	L	T	P	Credits
1.	20BS1101	Basic Science Course	Matrices and Differential Calculus	3	0	0	3
2.	20BS1102	Basic Science Course	Engineering Physics	3	0	0	3
3.	20ES1103	Engineering Science Course	Programming for Problem Solving	3	0	0	3
4.	20ES1104	Engineering Science Course	Basics of Electrical Engineering	3	0	0	3
5.	20HS1105	Humanities and Social Science	Technical English and Communication Skills	2	0	0	2
6.	20BS1151	Basic Science Course	Engineering Physics Laboratory	0	0	3	1.5
7.	20ES1152	Engineering Science Course	Programming for Problem Solving Laboratory	0	0	3	1.5
8.	20HS1153	Humanities and Social Science	Technical English and Communication Skills Laboratory	0	0	3	1.5
9.	20ES1154	Engineering Science Course	Computing and Peripherals Laboratory	0	0	2	1
10.	20MC1106	Mandatory Course	Technology and Society	1	0	0	-
Total				**15**	**0**	**11**	**19.5**
11.	20MC1107	Mandatory Course	Induction Program				-

Category	Credits
Basic Science Courses	7.5
Engineering Science Courses	8.5
Humanities and Social Science	3.5
Mandatory Courses	0
TOTAL CREDITS	**19.5**

SEMESTER II **CONTACT HOURS: 27**

S. No	Course Code	Course	Subject	L	T	P	Credits
1.	20BS2101	Basic Science Course	Laplace Transforms and Integral Calculus	3	0	0	3
2.	20BS2102	Basic Science Course	Engineering Chemistry	3	0	0	3
3.	20ES2103	Engineering Science Course	Object Oriented Programming using Python	3	0	0	3
4.	20ES2104C	Engineering Science Course	Network Theory	3	0	0	3
5.	20ES2105	Engineering Science Course	Engineering Graphics	1	0	4	3
6.	20BS2151	Basic Science Course	Engineering Chemistry Laboratory	0	0	3	1.5
7.	20ES2152	Engineering Science Course	Object Oriented Programming using Python Laboratory	0	0	3	1.5
8.	20ES2153	Engineering Science Course	Engineering Workshop	0	0	3	1.5
9.	20MC2106	Mandatory Course	Professional Ethics and Practice	1	0	0	-
Total				**14**	**0**	**13**	**19.5**

Category	Credits
Basic Science Courses	7.5
Engineering Science Courses	12
Mandatory Courses	0
TOTAL CREDITS	**19.5**

SEMESTER III **CONTACT HOURS: 28**

S.No	Course Code	Course	Subject	L	T	P	Credits
1.	20BS3101	Basic Science	Complex Analysis & Numerical Methods	3	0	0	3
2.	20ES3102	Engineering Science	Electronic Devices and Circuits	3	0	0	3
3.	20EI3303	Program Core	Digital Circuits and Systems	3	0	0	3
4.	20EI3304	Program Core	Sensors and Transducers	3	0	0	3
5.	20EI3305	Program Core	Electrical and Electronic Measurements	3	0	0	3
6.	20ES3151	Engineering Science Lab	Electronic Circuits Lab	0	0	3	1.5
7.	20EI3352	Program Core Lab 1	Digital System Design Lab	0	0	3	1.5
8.	20EI3353	Program Core Lab 2	Measurements Lab	0	0	3	1.5
9.	20TP3106	Soft Skills – 1	Logic and Reasoning	0	0	2	1
10.	20MC3107A	Mandatory Course (AICTE suggested)	Environmental Studies	2	0	0	-
			Total	**17**	**0**	**11**	**20.5**

Category	Credits
Basic Science Courses	3
Engineering Science Courses	4.5
Program Core Courses	12
Soft OrientedCourses	1
Mandatory Courses	0
TOTAL CREDITS	**20.5**

SEMESTER IV **CONTACT HOURS: 28**

S.No	Course Code	Course	Subject	L	T	P	Credits
1.	20BS4101	Basic Science	Analog Electronic Circuits	3	0	0	3
2.	20EI4302	Program Core	Integrated Circuits and Applications	3	0	0	3
3.	20EI4303	Program Core	Control Systems	3	0	0	3
4.	20EI4304	Program Core	Industrial Instrumentation	3	0	0	3
5.	20HS4105	Humanities and Social Sciences	Universal Human Values	3	0	0	3
6.	20EI4351	Program Core Lab1	Transducers Lab	0	0	3	1.5
7.	20EI4352	Program Core Lab 2	Control Systems Lab	0	0	3	1.5
8.	20EI4353	Program Core Lab 3	Integrated Circuits Lab	0	0	3	1.5
9.	20TP4106	Soft Skills – 2	English for Professionals	0	0	2	1
10.	20EI4607	Skill Oriented Course -1	Virtual Instrumentation	1	0	2	2
11.	20MC4108B	Mandatory Course (AICTE suggested)	Indian Constitution	2	0	0	-
Total				**18**	**0**	**13**	**22.5**
	Summer Internship six weeks (Mandatory) during summer vacation (EPICS)						
Honors/Minor Courses (the hours distribution can be 4-0-0, 3-0-2 or 3-1-0 also)				**4**	**0**	**0**	**4**

Category	Credits
Basic Science Courses	3
Program Core Courses	13.5
Engineering Science Courses	0
Skill Oriented Courses	3
Humanities and Social Science Courses	3
Mandatory Courses	0
TOTAL CREDITS	**22.5**

SEMESTER V **CONTACT HOURS: 33**

S.No	Course Code	Course	Subject	L	T	P	Credits
1	20EI5301	Program Core	Analytical Instrumentation	3	0	0	3
2	20EI5302	Program Core	Process Control	3	0	0	3
3	20HS5103	Humanities and Social Sciences	Engineering Economics and Management	2	0	0	2
4	20EI5404	Program Elective 1		3	0	0	3
5	20EI5205	Open Elective /Job oriented Elective -1		2	0	2	3
6	20EI5351	Program Core Lab 1	Advanced Instrumentation Lab I	0	0	3	1.5
7	20EI5352	Program Core Lab 2	Process Control Lab	0	0	3	1.5
8	20HS5153	Humanities and Social Sciences	English Communication Skills Lab	0	0	2	1
9	20TP5106	Soft Skills – 3	Personality Development	0	0	2	1
10	20EI5354	Internship/Project (6 Weeks)	EPICS/Internship	0	0	3	1.5
11	20EI5607	Skill Oriented Course -2		1	0	2	2
12	20MC5108A	Mandatory Course (AICTE suggested)	Humanities Elective	2	0	0	-
Total				**16**	**0**	**17**	**22.5**
Honors/Minor Courses (the hours distribution can be 3-0-2 0r 3-1-0 also)				**4**	**0**	**0**	**4**

List of Humanities Elective Courses			
20MC5108A1	Foreign Languages (German/French)	20MC5108A5	Law for Engineers
20MC5108A2	Biology for Engineers	20MC5108A6	Sanskrit Bhasa
20MC5108A3	Human Rights & Legislative Procedures	20MC5108A7	Yoga & Meditation
20MC5108A4	Philosophy	20MC5108A8	Psychology

Category	**Credits**
Program Core Courses	9
Humanities and Social Sciences	3
Program Elective Courses	3
Open Elective Courses	3
Skill Oriented Courses	3
Internship/Project	1.5
Mandatory Course (AICTE)	0
TOTAL CREDITS	**22.5**

S.No	**Course Code**	**Program Elective – 1**	**L**	**T**	**P**	**Credits**
1.	20EI5404/A	Fiber Optic Sensors	3	0	0	3
2.	20EI5404/B	VLSI Design	3	0	0	3
3.	20EI5404/C	Robotics and Control	3	0	0	3
4.	20EI5404/D	Industrial Communication Networks	3	0	0	3

S.No	Course Code	Open Elective – 1	L	T	P	Credits
1.	20EI5205/A	Biomedical Electronics	3	0	0	3
2.	20EI5205/B	Control System Components	3	0	0	3

SEMESTER VI **CONTACT HOURS:34**

S.No	Course Code	Course	Subject	L	T	P	Credits
1	20EI6301	Program Core	Microcontrollers and Embedded Systems	3	0	0	3
2	20EI6302	Program Core	Digital Signal Processing	3	0	0	3
3	20EI6303	Program Core	Industrial Automation	2	0	0	2
4	20EI6404	Program Elective 2		3	0	0	3
5	20EI6205	Open Elective /Job oriented elective-2		2	0	2	3
6	20EI6351	Program Core Lab 1	Microcontrollers and Embedded Systems Lab	0	0	3	1.5
7	20EI6352	Program Core Lab 2	Industrial Automation Lab	0	0	3	1.5
8	20EI6353	Program Core Lab 3	Advanced Instrumentation Lab II	0	0	3	1.5
9	20TP6106	Soft Skills-4	Quantitative Aptitude	0	0	2	1
10	20EI6554	Internship/Project	Mini Project –I	0	0	2	1
11	20MC6107B	Mandatory Course (AICTE suggested)	Innovation, Incubation & Startup	2	0	0	0
Total				**15**	**0**	**15**	**20.5**
Industrial/Research Internship six weeks (Mandatory) during summer vacation							
Honors/Minor Courses (the hours distribution can be 4-0-0, 3-0-2 or 3-1-0 also)				**4**	**0**	**0**	**4**

Category	Credits
Program Core Courses	12.5
Humanities and Social Sciences	0
Program Elective Courses	3
Open Elective Courses	3
Skill Oriented Courses	1
Mandatory Course (AICTE)	0
Internship/ Project	1
TOTAL CREDITS	**20.5**

S.No	Course Code	Program Elective – 2	L	T	P	Credits
1.	20EI6404/A	Biomedical Instrumentation	3	0	0	3
2.	20EI6404/B	Industrial Electronics	3	0	0	3
3.	20EI6404/C	Process Modeling and Simulation	3	0	0	3
4.	20EI6404/D	Renewable Energy	3	0	0	3

S.No	Course Code	Open Elective – 2	L	T	P	Credits
1.	17EI6205/A	Instrumentation Engineering	3	0	0	3
2.	17EI6205/B	Fundamentals of Industrial Automation	3	0	0	3

SEMESTER VII **CONTACT HOURS: 25**

S.No	Course Code	Course	Subject	L	T	P	Credits
1	20EI7301	Program Core	Computer Control of Processes	3	0	0	3
2	20EI7402	Program Elective 3		3	0	0	3
3	20EI7403	Program Elective 4		3	0	0	3
4	20EI7404	Program Elective 5		3	0	0	3
5	20EI7205	Open Elective /Job Oriented Elective - 3		2	0	2	3
6	20EI7206	Open Elective /Job Oriented Elective - 4		2	0	2	3
7	20EI7607	Skill Advanced Course		1	0	2	2
8	20EI7551	Internship/Project	Mini Project – II	0	0	3	1.5
9	20EI7552	Internship/Project	Industrial/Research Internship	0	0	3	1.5
			Total	**17**	**0**	**12**	**23**
Honors/Minor Courses (the hours distribution can be 4-0-0, 3-0-2 0r 3-1-0 also)				**4**	**0**	**0**	**4**

Note: Open Elective Courses 3 and 4 are self-learning. Students may opt from any MOOCs platform. They have to submit the certificate before the last instruction day of VII semester.

Category	**Credits**
Program Core	3
Program Electives	9
Open Electives	6
Skill Oriented Courses	2
Internship/Project	3
TOTAL CREDITS	**23**

S.No	**Course Code**	**Program Elective – 3**	**L**	**T**	**P**	**Credits**
1.	20EI7402/A	Power Plant Instrumentation	3	0	0	3
2.	20EI7402/B	Industrial Internet of Things	3	0	0	3
3.	20EI7402/C	Wireless Sensor Networks	3	0	0	3
4.	20EI7402/D	Drives and Control for Industrial Automation	3	0	0	3

S.No	Course Code	Program Elective – 4	L	T	P	Credits
1.	20EI7403/A	Advanced Sensors	3	0	0	3
2.	20EI7403/B	Database Management Systems	3	0	0	3
3.	20EI7403/C	Intelligent Systems and Control	3	0	0	3
4.	20EI7403/D	Digital Image Processing	3	0	0	3

S.No	Course Code	Program Elective – 5	L	T	P	Credits
1.	20EI7404/A	Instrumentation and Control in Paper Industries	3	0	0	3
2.	20EI7404/B	Computer Networks	3	0	0	3
3.	20EI7404/C	Sensor Signal Conditioning	3	0	0	3
4.	20EI7404/D	AI &Machine Learning	3	0	0	3

S.No	Course Code	Open Elective – 3	L	T	P	Credits
1.	17EI7205/A	MOOCS	3	0	0	3
2.	17EI7205/B	MOOCS	3	0	0	3

S.No	Course Code	Open Elective – 4	L	T	P	Credits
1.	17EI7206/A	MOOCS	3	0	0	3
2.	17EI7206/B	MOOCS	3	0	0	3

SEMESTER VIII **CONTACT HOURS: 12**

S.No	Course Code	Course	Subject	L	T	P	Credits
1	20EI8551	Internship/Project	Major Project & Internship (6 Months)	0	0	24	12
Total				**12**			

The student should undergo internship and parallelly he/she should work on a project with well-defined objectives. At the end of the semester the candidate shall submit an internship completion certificate and a project report**.**

CREDIT DISTRIBUTION

Year	Semester I Credits	Semester II Credits	Total Credits
I	19.5	19.5	39
II	20.5	22.5[82]	43
III	22.5	20.5[125]	43
IV	23	12	35
Total			160
Non-Credit Courses			
Mandatory Courses (7)		1. Induction Program 2. Technology and Society 3. Professional Ethics & Human Values 4. Environmental Studies 5. Indian Constitution 6. Biology for Engineers 7. Innovation, IPR and Entrepreneurship	
Mandatory Student Practice Courses (2)		(1) Co-curricular participation (2) NCC / NSS / Games and Sports / Art and Cultural / Professional Society activities / Industry training certificate.	

Contact Hours:

	ODD Semester	EVEN Semester
1st Year	26	27
2nd Year	28	31
3rd Year	33	30
4^{th} year	29	24

First Year
(I Semester)

20BS1101 – Matrices and Differential Calculus

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Fundamentals of Matrices, Fundamentals of Calculus, Integration, Differentiation-1.0	**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 Eigen values, Eigen vectors of a matrix											
	CO2	Estimate Maxima and Minima of Multivariable functions											
	CO3	Solve the Linear differential equations with constant coefficients.											
	CO4	Solve the Linear differential equations with variable coefficients-12											
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 10
	CO1	3	2			1							
	CO2	3	2			1							
	CO3	3	2			1							
	CO4	3	2			1							
Course Content	**UNIT- I** **Matrices:** Consistency of linear system of equations, Linear transformations, Vectors, Eigen values and Eigen vectors, Properties of Eigen values, Finding inverse and powers of a matrix by Cayley- Hamilton theorem. Reduction to diagonal form, Reduction of quadratic form to canonical form, Nature of a quadratic form, Complex matrices **UNIT- II** **Differential Calculus:** Fundamental theorems - Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem and Taylor's theorem, Expansions of functions- Maclaurin's series and Taylor's series. **Application:** Curvature, Radius of curvature**.** **Functions of Two or More Variables:** Taylor's theorem for function of two variables, Maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers **UNIT- III**												

	Differential Equations of First Order: Exact differential equations, Equations reducible to exact equations. **Applications:** Orthogonal trajectories, Newton's law of cooling. **Linear Differential Equations of Higher Order:** Definitions, Operator D, Rules for finding the complementary function, Inverse operator, Rules for finding particular integral, Working procedure to solve the equation **UNIT- IV** Method of variation of parameters, Method of undetermined coefficients, Equations reducible to linear equations with constant coefficients: Cauchy's homogeneous linear equation, Legendre's linear equation, Linear dependence of solutions, Simultaneous linear equations with constant coefficients. **Application:** L-C-R Circuits.
Text books and Reference books	**Text Book:** [T1] B.S.Grewal, Higher Engineering Mathematics, 44th Ed., Khanna Publishers, 2019. **Reference Books:** [R1] Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Ed., John Wiley & Sons, 2015 [R2] B.V.Ramana, "Higher Engineering Mathematics", 1st Ed., Tata MC Graw Hill, 2007 [R3] N.P.Bali, Dr. Manish Goyal, "A Text Book of Engineering Mathematics, 9th Ed., Laxmi Publications, 2014
E-resources and other digital material	1. https://www.nptelvideos.com/mathematics/ 2. https://nptel.ac.in/courses/122/104/122104017/ 3. https://nptel.ac.in/courses/111/105/111105035/

20BS1102 – Engineering Physics

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	10+2 level Physics	**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	Employ physical laws of electrostatics and compute problems related to static electric fields											
	CO2	Illustrate the laws of magneto statics and solve various problems involving static magnetic fields											
	CO3	Describe various types of electric and magnetic materials											
	CO4	Understand the time varying electric and magnetic fields by applying appropriate Maxwell's equations											
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
	CO1	3	2										
	CO2	3	2										
	CO3	3											
	CO4	3	1										

Course Content

UNIT- I

Electrostatics: Coulomb's law and field intensity, Electric field due to continuous charge distributions, Electric flux density, Gauss's law, Applications of Gauss law - Line charge, Surface charge, Volume charge, Electric potential, Relation between E and V, Maxwell's equation for static electric fields (qualitative), Potential and field of electric dipole, Energy Density in electrostatic fields

UNIT- II

Magnetostatics: Biot-Savart's law, Ampere's circuit law - Maxwell's equation, Applications of Ampere's law - Infinite line current, Infinite sheet of current, Magnetic flux density - Maxwell's equation for static magnetic field, Magnetic vector and scalar potentials, Force due to magnetic fields - Force on a charged particle, Current element, Force between two current elements, Magnetic dipole, Magnetic energy

UNIT- III

Types of Electric and Magnetic Materials: Properties of electric materials - Conductors

	and dielectrics, Convection and conduction currents, Polarization in dielectrics, Dielectric constant and strength, Continuity equation and relaxation time, Poisson's and Laplace's equations, Electro static boundary conditions, Dielectric - Dielectric, Conductor - Dielectric, Conductor - Free space. Types of magnetic materials, Magnetization in materials, Magnetic boundary conditions. **UNIT- IV** **Time Varying Fields and Electro Magnetic Waves** **Time Varying Fields:** Faraday's law, Transformer and motional electromotive forces, Displacement current, Maxwell's equations in final forms, Time harmonic fields. **Electro Magnetic Waves**: Wave propagation in lossy dielectrics, Lossless dielectrics, Free space, Good conductors, Poynting theorem
Text books and Reference books	**Text Book:** [T1] Resnick, Halliday and Krane, "Physics", 5th Ed., Wiley India Pvt. Ltd, New Delhi, 2016. [T2]Matthew.N.O.Sadiku,"Principles of Electromagnetics", 4th Ed., Oxford University Press, New Delhi,2009 **Reference Books:** [R1] R.K.Gaurand, S.L.Gupta, "Engineering Physics", 8th Ed., Reprint, Dhanpat Rai Publications Ltd , New Delhi,2013 [R2] W.H.Hayt and J.A.Buck, "Engineering Electromagnetics", 7th Ed., Tata Mc Graw Hill, New Delhi, 2006 [R3] Joseph. A. Edminister, "Electromagnetics – Theory and problems", 2nd Ed., Schaum's outline series, MC Graw Hill, 1993
E-resources and other digital material	1. http://www.mike-willis.com/Tutorial/PF2.htm

20ES1103 – Programming for Problem Solving

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	10+2 level Physics	**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	Understand the different types of problem solving approaches											
	CO2	Apply the selections, loops, arrays and string concepts in C to solve problems.											
	CO3	Apply functions and pointer concepts in C to solve problems.											
	CO4	Solve problems using num, structures, unions and file handling functions.											
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
	CO1	3	1										
	CO2		2	3									
	CO3		2	3									
	CO4		2	3									

Course Content

UNIT- I

Introduction to Computer – Based Problem Solving: Requirement of problem solving by computers, Problem definition, Use of examples for problem solving, Similarities between problems, Problem solving strategies, Steps involved in problem solving.

Program Design and Implementation Issues: Programs and algorithms, Top-down design and step-wise refinement, Construction of loops - Basic programming constructs, Implementation, Programming environment.

Algorithms for Problem Solving: Exchanging values of two variables, Summation of a set of numbers, Decimal to binary base conversion, Reversing the digit of an integer, To find greatest common divisor (GCD) of two numbers, To verify whether an integer is prime or not, Organize a given set of numbers in ascending order, Find the square root of an integer, Factorial of a given number, Generate the Fibonacci sequence for n terms, Evaluate sin(x) as sum of series, To find the value of the power of a number raised by another integer, Reverse order elements of an array, Find largest number in an array, Print

	elements of upper triangular matrix, Multiplication of two matrices, To compute to roots of a quadratic equation $ax^2+bx+c=0$. **UNIT- II** **Introduction to the C Language:** Background of C program, Identifiers, Types, Variables, Constants, Memory layout, Input/Output, Programming examples. **Structure of a C Program:** Logical data and operators, Expressions, Precedence and associatively, Evaluating expressions, Type conversion, Statements, Storage class. **Selection:** Two-way selection, Multi way selection, More standard functions. **Repetition:** Concept of a loop, Loops in C, Loop examples, Recursion, The calculator program. **Arrays:** Array concepts in C, Inter function communication, Array applications, Two dimensional arrays, Multi dimensional arrays **UNIT- III** **Strings:** String concepts, C strings, String Input/Output functions, Arrays of strings, String manipulation functions, String – Data conversion. **Functions:** Functions in C, User defined functions; Call by value, Call value reference, Inter-Function communication, Standard functions, Scope. **Pointers*:*** Introduction to pointer, Pointers for inter-function communications, Pointers to pointers, Compatibility, L value and R value. **Pointer Applications:** Arrays and pointers, Pointer arithmetic and arrays, Passing an array to a function, Memory allocations Functions, Array of pointers. **UNIT- IV** **Enumerations:** The type definition (Typedef), Enumerated types: Declaring an enumerated type, Operations on enumerated types, Enumeration type conversion, Initializing enumerated constants, Anonymous enumeration constants, Input/Output operators. **Structures:** Structure type declaration, Initialization, Accessing structures, Operations on structures, Complex structures, Structures and functions, Sending the whole structure, Passing structures through pointers. **Unions:** Referencing unions, Initializers, Unions and structures, Internet address, Programming applications. **File Handling:** Files, Streams, Standard library input/output functions, Formatting input/output functions and character input/output functions, Command-Line arguments.

Text books and Reference books	**Text Book:** [T1] Harsha Priya, R.Ranjeet, " Programming and Problem Solving Through "C" Language", Firewall media 2006 [T2] Behrouz.A.Forouzan, Richard.F.Gilberg, "Computer Science A Structured Programming Approach Using C", 3rd Ed., Cengage Learning **Reference Books:** [R1] Anil.B.Chaudhuri, "Flowchart and Algorithm Basics: The Art of Programming", Mercury Learning & Information, 2020. [R2] R.G.Dromey, "How to Solve it by Computer", Prentice – Hall International Series in Computer Science, 1982. [R3] Yashwant Kanetkar,"Let us C", 16th Ed., BPB Publications, 2017. [R4] Kernighan and Ritchie, "The C programming language", The (AnsiCVersion), 2nd Ed., PHI. [R5] Paul.J.Dietel and Harvey.M.Deitel, "C : How to Program", Prentice Hall, 8th Ed., 2021. [R6] K.R.Venugopal, Sundeep.R.Prasad, "Mastering C", 2nd Ed., McGraw Hill, 2015
E-resources and other digital material	1.ComputerScienceandEngineering-Noc:problemSolvingThroughProgramminginC https://nptel.ac.in/courses/106/105/106105171/ 2. Computer Science and Engineering- Noc: Introduction to Programming in C https://-nptel.ac.in/courses/106/104/106104128/ 3. C For Everyone: Structured Programming https://www.coursera.org/learn/c-structured-programming 4. Advanced C Programming Course Tim Academy-Jason Fedin. https://www.udemy.com/-course/advanced-c-programming-course/

20ES1104 – Basics of Electrical Engineering

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**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	Analyze electric circuit fundamentals.											
	CO2	Understand the basic concepts of alternating quantities and magnetic circuits.											
	CO3	Analyze the basic concepts of electric machines											
	CO4	Understand measuring instruments & solar photo voltaic system concepts											
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
	CO1	3	3			2							
	CO2	3	3										
	CO3	2	1			2							
	CO4	2	1										

Course Content

UNIT- I

Introduction to Electrical Engineering: Electric current, Electromotive force, Electric power and energy, Basic circuit components – Resistors – Inductors - Capacitors. Electromagnetic phenomenon and related laws, Kirchhoff's laws.

Network Analysis: Network sources - Ideal independent voltage source, Ideal independent current source, Dependent sources, Practical voltage and current sources, Source conversion, Voltage and current division rule, Series and parallel connection of R, L and C, Star – Delta or Delta – Star transformation. Mesh and nodal analysis (with independent sources only).

UNIT- II

Alternating Quantities: Introduction, Generation of A.C voltages, Waveforms and basic definitions, Relationship between frequency, speed and number of poles, Root mean square and average values of alternating current and voltages, Form factor and peak factor, Phasor representation of alternating quantities

Magnetic Circuits: Introduction, Magnetic circuits, Magnetic field strength (H),

	Magnetomotive force, Permeability, Reluctance, Analogy between electric and magnetic circuits, Magnetic potential drop, Magnetic circuit computations, Self and mutual inductance, Energy in linear magnetic systems (Derivation for pure inductor). **UNIT- III** **DC Machines:** Introduction, Construction of DC machines, Armature windings, Generation of DC voltage and Torque production in a DC machine, Operation of a DC machine as a generator, Operation of DC machine as a motor. **Induction Motors:** Introduction, Constructional features of three phase induction motors, Principle of operation of three phase induction motor - Slip and rotor frequency, Voltage and current equations and Equivalent circuit of an induction motor. **UNIT- IV** **Measuring Instruments:** Introduction, Classification of instruments, Operating principles, Essential features of measuring instruments, Ammeters and voltmeters, Measurement of power. **Solar Photo Voltaic Systems:** Solar cell fundamentals, Characteristics, Classification, module, Panel and array construction, Maximizing the solar PV output and load matching, Maximum power point tracker basic algorithm and flowchart, PV system components, Solar PV systems and solar PV applications
Text books and Reference books	**Text Book:** [T1] T.K.Nagasarkar and M.S.Sukhja, "Basic Electric Engineering", 2nd Ed., Oxford University Press 2011 **Reference Books:** [R1] B.H.Khan,"Non Conventional Energy Resources", 2nd Ed., Mc.Graw Hill Education Pvt Ltd., NewDelhi, 2013. [R2] Ashfaq Hussain, Haroon Ashfaq, "Fundamentals of Electric Engineering", 4th Ed., Dhanpat Rai & Co, 2014. [R3] I.J.Nagarath and Kothari, "Theoy and Problems of Basic Electric Engineering", 2nd Ed., PHI Pvt. Ltd., 2016.
E-resources and other digital material	1. https://nptel.ac.in/courses/108/108/108108076/

20HS1105 – Technical English and Communication Skills

Course Category:	Humanities and Social Science	**Credits:**	2
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2 - 0- 0
Prerequisites:	Basic understanding of the language skills viz Listening, Speaking, Reading and Writing, including Sentence construction	**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	Develop administrative and professional compilations with felicity of expression											
	CO2	Demonstrate proficiency in advanced reading and context oriented writing											
	CO3	Apply the elements of functional English with sustained understanding for authentic use of language in any given academic and/or professional environment											
	CO4	Execute tasks in technical communication with competence											
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
	CO1						2				3		
	CO2						2			2	3		
	CO3						2			2	3		
	CO4										3		
Course Content	**UNIT- I** **Professional Writing Skills** **Professional Letters:** Business complaint and transmittal – Purpose, Style and format with special reference to block format and modified block format **Paragraph and Essay Writing: Linkers, Descriptive and Analytical with Illustrations** **Effective Writing Practice:** Appropriateness, Brevity, Clarity, Cogency and coherence with guided and semi-controlled compilations including the use of idiomatic expressions. **UNIT- II** **Reading Comprehension and Discourse Development Skills** **Analytical and Critical Reading:** Critical, Creative and lateral thinking – Language and												

	thinking – Thinking process and language development. **Effective Reading Strategies:** Skimming, Scanning, Eye span, Fixation, Taming regression, Issues and challenges of vocalization and sub-vocalization. **Context-Oriented Dialogue/Argument Writing:** Extending invitation, Reciprocation, Acceptance, Concurrence, Disagreeing without being disagreeable - Discourse/Dialogue, Development and identification of inconsistencies in pre-prepared dialogues **UNIT- III** **Vocabulary and Functional English** **Vocabulary for Competitive Examinations:** (A list of 500 high frequency words) Synonyms, Antonyms, Matching homonyms, Homophones and nearer words along with root words **Verbal Analogies: (**Single Unit) – Synonym relation, Antonym relation, Object- Operator relation, Object - Obstacle/Obstruction relation, Sequence relation, Place – Monument relation, Science – Area of activity relation, Profession – Tool relation, Gender relation, Diminutive relation, etc. **Functional Grammar:** With special reference to tense, Concord, Articles, Pronoun referent, Prepositions, Use of Gerund, Parallelism etc (A representative collection of 100 sentences). **UNIT- IV** **Technical Communication Skills:** **Technical Proposal Writing:** Characteristics, Proposal, Superstructure, Checklist, Formal proposal **Technical Vocabulary**: Basic explanations and description **Technical Report Writing:** Informational reports and feasibility report - Types, Components, Style and formats
Text books and Reference books	**Text Book:** [T1] Martin Cutts, "Oxford Guide to Plain English", 7th Impression, Oxford University Press, 2011 [T2] M.Ashraf Rizvi, "Effective Technical Communication", Tata Mc Graw-Hill, New Delhi, 2005. [T3] John Langan, " College Writing Skills", 9th Ed., Mc Graw Hill, 2014 [T4] Eclectic Learning Materials Offered by the Department

	Reference Books: [R1] Erwin Kreyszig, Randolph Quirk, "Use of English Longman", 1st Ed., 2004. [R2] Thomson.A.J and A.V,Martinet, "Practical English Grammar", 3rd Ed., Oxford University Press, 2001. [R3] V.Sethi and P.V.Dhamija, "A Course in Phonetics and Spoken English", 2ND Ed., PHI, 2006
E-resources and other digital material	1. Learn English | British Council 2. www.natcorp.ox.ac.uk/Wkshops/Materials/specialising.xml?ID=onlin 3. www.uni-marburg.de/de/sprachenzentrum

20BS1151 – Engineering Physics Laboratory

Course Category:	Basic Science	**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	Test optical components using principles of interference and diffraction of light											
	CO2	Use spectrometer, travelling microscope and function generator in various experiments											
	CO4	Determine the V-I characteristics of photocells and appreciate the accuracy in measurements											
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
	CO1				1								
	CO2				1								
	CO3	2			1								
	CO4				1								
Course Content	**List of Experiments:** 1. Figure of merit of a galvanometer 2. LCR circuit – Study of resonance 3. Variation of magnetic field along the axis of current – Carrying circular coil 4. Wedge method – Measurement of thickness of a foil 5. Solar cell – Determination of Fill factor 6. AC Sonometer – Verification of vibrating laws 7. B – H curve unit – Determination of hysteresis loss 8. Hall effect – Hall coefficient measurement 9. Diffraction grating – Measurement of wavelength 10. Torsional pendulum – Measurement of rigidity modulus 11. Photocell – Study of V-I characteristics, Determination of work function 12. Optical fiber – Determination of numerical aperture												
Text books and Reference	**Text Books:** [T1] Madhusudhan Rao,"Engineering Physics Lab Manual", ist Ed., Scitech Publications,												

books	2015 [T2] Ramarao Sri, Choudary Nityanand and Prasad Daruka, "Lab Manual of Engineering Physics", 5th Ed., Excell Books,2010
E-resources and other digital material	1. www.physicsclassroom.com/The-Laboratory 2. http://facstaff.cbu.edu/~jvarrian/physlabs.html 3. https://vlab.amrita.edu/?sub=1&brch=201&sim=366&cnt=1 4. https://vlab.amrita.edu/?sub=1&brch=195&sim=840&cnt=1 5. https://vlab.amrita.edu/?sub=1&brch=195&sim=840&cnt=1

20ES1152 – Programming for Problem Solving Laboratory

Course Category:	Engineering Science	**Credits:**	1.5
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:		**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	Implement the use of programming constructs in a structural programming language.											
	CO2	Apply the selections, loops, arrays and string concepts in C to solve problems.											
	CO3	Apply functions, pointer and Enum concepts in C to solve problems.											
	CO4	Solve problems using structures, unions and file handling functions.											
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
	CO1	1		3									
	CO2		1	3									
	CO3		1	3									
	CO4		1	3									

Course Content

List of Experiments

Week–1: Introduction to C Programming

a) The structure of C program with a sample program
b) Use identifiers, data yypes, format specifiers, constants and variables declaration and initialization to write simple c programs
c) Write simple C programs using preprocessor commands and simple I/O statements

Week–2: Data Types and Variable Declarations

a) Use void, integral and floating point data types in different scenarios to write programs.
b) Use various primitive data types for performing different mathematical operations
c) Programs to perform mathematical operations using various operators in C

Week–3: Selection Making Decisions

a) Write Programs using the If...Else selection statements
b) Use nested If...Else statement to solve problems that need multi-level selection making decisions**.**
c) Write programs that use Switch...Case and Else...If multiway statements to select one out of several options

Week–4: Looping Constructs and Their Applications

a) To have a clear idea on loop initialization, validation and updation
b) Write programs using the While, For or Do...While loops
c) To understand the logic and adopt best looping construct for different kinds of problems
d) Design and develop programs based on iterative loops using While, Do While, For, Nested For

Week–5: Unconditional Control Transfer Statements

a) Write programs using of (break and continue) unconditional control transfer statements
b) Use the Go To statement to transfer the control from one part to another part of a program and the use of return statement to end the execution of a called function

Week–6: Arrays and Their Applications

a) To utilize one dimensional and multi-dimensional arrays to solve problems that use set(s) of similar type input data
b) To write programs that performs multiple classical operations like searching, sorting, updation or deletion on array elements**.**

Week–7: Strings, String I/O and Manipulation Functions

a) To write programs that work on read, write and manipulate fixed length and variable- length strings and/or arrays of strings
b) To write programs that use predefined string i/o functions
c) To write programs that use string manipulation functions from the string library

Week–8: Concepts of User Defined Functions

a) Design and develop programs depending on functions both user defined and standard library functions in c with different approaches.
b) To write a program using more than one function with or without parameters and function return type

Week–9: Pointers and Their Applications

a) Programs on declaration of pointers and their usage in c.
b) Programs to relate between arrays and pointers and use them efficiently in a program

	c) To pass pointers as an argument to a function and use it efficiently in a program. d) To write programs using static and dynamic memory allocation. **Week–10: Structure, Union and Enumeration** a) Programs to define, declare and access structure and union variables b) Design and develop programs to work with pointers to access data within a structure c) Programs to pass structure as an argument to a function d) To write c programs using enumeration data types, an easiest way of mapping symbolic names to integer values**.** **Week–11: File Handling Operations** a) Programs to open and close text and binary files using file i/o commands. b) Write programs to perform read and write operations using the formatting i/o and character i/o functions. c) Apply file positioning, status and system commands based on a problem requirements **Week–12: Command Line Arguments** a) To use command line arguments to pass inputs in a single line while executing a program through the dos command prompt or linux terminal. b) To use ATOI function to convert a default string value argument to an integer value inside the main function in a program. c) To use ATOF function to convert a default string value argument to a float value inside the main function in a program
Text books and Reference books	**Text Book:** [T1] Behrouz.A.Forouzanand, Richard.F.Gilberg, "Computer Science A Structured Programming Approach Using C", 3rd Ed., Cengage Learning. **Reference Books:** [R1] Anil B. Chaudhuri, "Flowchart and Algorithm Basics: The Art of Programming", Mercury Learning & Information, 2020. [R2] R.G.Dromey, "How to Solve it by Computer", Prentice-Hall International Series in Computer Science, 1982. [R3] Yashwant Kanetkar, "Let Us C", 16th Ed., BPB Publications, 2017. [R4] Kernighan and Ritchie, "The C Programming Language", The (Ansi C Version), 2nd Ed., PHI. [R5] Paul.J.Dietel and Harvey.M.Deitel, "C: How to Program", 8th Ed., Prentice Hall, 2021. [R6] K.R.Venugopal, Sundeep.R.Prasad, "Mastering C", 2nd Ed., Mc Graw Hill, 2015.
E-resources	1. Computer Science and Engineering -Noc: Problem Solving Through Programming in C

and other digital material	https://nptel.ac.in/courses/106/105/106105171/ 2. Computer Science and Engineering - Noc: Introduction to Programming in C https://-nptel.ac.in/courses/106/104/106104128/ 3. C For Everyone: Structured Programming https://www.coursera.org/learn/c-structured-programming 4. Advanced C Programming Course Tim Academy – Jason Fedin. https://www.udemy.com/-course/advanced-c-programming-course/

20MC1106 – Technology and Society

Course Category:	Mandatory	**Credits:**	-
Course Type:	Theory	**Lecture - Tutorial - Practice:**	1 - 0- 0
Prerequisites:		**Continuous Evaluation:**	100
		Semester end Evaluation:	-
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:												
	CO1	Understand the origins of technology and its role in the history of human progress.											
	CO2	Know the industrial revolution and its impact on society											
	CO3	Interpret the developments in various fields of technology till twentieth century.											
	CO4	Distinguish the impacts of technology on the environment and achievements of great scientists.											
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
	CO1	3							1				
	CO2	3				2		1					
	CO3	3							1				
	CO4	3				2		1					
Course Content	**UNIT- I** **Introduction**: Origins of technology, The agriculture revolution, Technological contributions of ancient civilizations - Mesopotamians, Egyptians, Greeks, Romans, Indians and Chinese. **UNIT- II** **Industrial Revolution**: The social and political background, The technical background, Steam: The power behind the industrial revolution, The revolution in textile industry, The impact of industrial revolution on society **UNIT- III** **The Flowering of Modern Technology:** Manufacturing technologies, Prime movers, Internal combustion engines, Production of metals and alloys, The birth of electrical technology, Twentieth century: The flowering of modern technology like information												

	technology and biotechnology and its implications on society. **UNIT- IV** **Technology, Science and Society**: Impact of technology on society, The impacts of technology on the environment, Sustainable development. **Achievements of Famous Scientists**: (**World**): Einestein, Newton, Faraday, GrahamBell, Edison, S.Hawking (**India**):CVRaman, S.Chandrasekhar, Aryabhatta, Homi.J.Bhabha, Vikram Sarabhai, APJ Abdul Kalam, S.Ramanujan, M.Visweswarayya
Text books and Reference books	**Text Book:** [T1] Dr.R.V.G Menon,"Technology and Society", PearsonEducation,2011. **Reference Books:** [R1] Quan-Haase, A, "Technology and Society: Inequality, Power and Social Networks", Oxford University Press, 2013
E-resources and other digital material	

20MC1107 – Induction Program

Course Category:	Mandatory	**Credits:**	-
Course Type:	Theory	**Lecture - Tutorial - Practice:**	
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	

First Year
(II Semester)

20BS2101 – Laplace Transforms and Integral Calculus

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Vectors, Integration, Curve Tracing	**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	Solve the linear differential equations using Laplace Transforms.											
	CO2	Evaluate areas and volumes using double, triple integrals.											
	CO3	Evaluate Grad, Div & Curl of scalar and vector point functions.											
	CO4	Convert line integrals to area integrals and surface integrals to volume integrals.											
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
	CO1	3	2			1							
	CO2	3	2			1							
	CO3	3	2			1							
	CO4	3	2			1							
Course Content	**UNIT- I** **Laplace Transforms**: Introduction, Definition, Conditions for the existence, Transforms of elementary functions, Properties of Laplace transforms, Transforms of periodic functions, Transforms of derivatives, Transforms of integrals, Multiplication by t^n, division by 't', Inverse transforms – Method of partial fractions, Other methods of finding inverse transform, Convolution theorem, Unit step and unit impulse functions. **Applications**: Evaluation of integrals, Solving differential equations by Laplace transforms. **UNIT- II** **Integral Calculus**: Double integrals, Change of order of integration, Double integrals in polar coordinates, Triple integrals, Change of variables. **Applications:** Area enclosed by plane curves, Volumes of solids												

	UNIT- III **Vector Differential Calculus**: Scalar and vector point functions, Del applied to scalar point functions - Gradient, Del applied to vector point functions, Physical interpretation of divergence and curl, Del applied twice to point functions, Del applied to products of point functions **UNIT- IV** **Vector Integral Calculus**: Integration of vectors, Line integral, Surface integral, Green's theorem in the plane, Stokes's theorem, Volume integral, Gauss divergence theorem, Irrotational fields.
Text books and Reference books	**Text Book:** [T1] B.S.Grewal, Higher Engineering Mathematics, 44th Ed., Khanna Publishers, 2019. **Reference Books:** [R1] Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Ed., John Wiley & Sons, 2015 [R2] B.V.Ramana, "Higher Engineering Mathematics", 1st Ed., Tata MC Graw Hill, 2007 [R3] N.P.Bali, Dr. Manish Goyal, "A Text Book of Engineering Mathematics, 9th Ed., Laxmi Publications, 2014
E-resources and other digital material	1. https://www.nptelvideos.com/mathematics/ 2. https://nptel.ac.in/courses/122/104/122104017/ 3. https://nptel.ac.in/courses/111/105/111105035/

20BS2102 – Engineering Chemistry

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Chemistry knowledge at Intermediate level	**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 water treatment methods and boiler troubles.											
	CO2	Apply the concept of phase equilibrium to different materials and the knowledge of working of electrodes and batteries in various technological fields.											
	CO3	Evaluate corrosion processes as well as protection methods.											
	CO4	Apply the knowledge of conventional fuels and mechanistic aspects of conducting polymers for their effective and efficient utilization.											
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
	CO1		3										
	CO2	2											
	CO3			3									
	CO4					2							
Course Content	**UNIT- I** **Water Technology - I:** WHO Standards – Water treatment for drinking purpose - Sedimentation, Coagulation, Filtration, Disinfection by chlorination, Breakpoint chlorination and its significance – Desalination of brackish water – Principle and process of electro dialysis and reverse osmosis, Advantages and disadvantages. **Water Technology - II:** Boiler troubles – Scales - Formation, Disadvantages and internal conditioning methods – Phosphate conditioning, Calgon conditioning and sodium aluminate, Caustic embrittlement - Reasons, Mechanism and its control and boiler corrosion causes and control **UNIT- II** **Phase Rule and Applications:** Definition and explanation of the terms – Phase, component and degree of freedom, Phase rule equation, Phase equilibria of single component system – Water system, Two component system – Silver – Lead system, Applications of phase rule.												

	Electrochemistry: Construction and working of Calomel electrode, Silver-Silver Chloride electrode and principle, Construction and working of glass electrode, Determination of ph using glass electrode. Chemistry of modern batteries - $LI/SOCL_2$ battery and $LI_XC/LICOO_2$ battery – Construction, Working and advantages. Fuel cells: General working principle of a fuel cell, Examples, Chemistry of H_2-O_2 fuel cell. **UNIT- III** **Corrosion Principles:** Introduction, Definition, Reason for corrosion, Examples – Types of electrochemical corrosion – Hydrogen evolution and oxygen absorption –Corrosion due to dissimilar metals, Galvanic series – Differential aeration corrosion – Pitting corrosion and concept of passivity. **Corrosion Control Methods:** Cathodic protection - Principle and types - Impressed current method and sacrificial anode method, Anodic protection – Principle and method, corrosion inhibitors – Types and mechanism of inhibition – Principle, Process and advantages of electroplating and electroless plating. **UNIT- IV** **Conducting Polymers:** Definition, Examples, Classification – Intrinsically conducting polymers and extrinsically conducting polymers – Mechanism of conduction of undoped polyacetylene, Doping of conducting polymers - Mechanism of conduction of p-doped and n-doped polyacetylenes – Applications of conducting polymers. **Fuel Technology:** Fuel - Definition, Calorific value - Lower and higher calorific values and numericals on calculation of HCV and LCV relation, Analysis of coal – Proximate analysis and ultimate analysis, Flue gas analysis by orsat's apparatus, Numericals based on calculation of air required for combustion.
Text books and Reference books	**Text Book:** [T1] Shikha Agarwal, "Engineering Chemistry–Fundamentals and Applications", 1st Ed., Cambridge University Press, New Delhi, 2015. **Reference Books:** [R1] Sunita Rattan, "A Text Book of Engineering Chemistry", 1st Ed., S.K.Kataria & Sons, New Delhi, 2012. [R2] P.C.Jain, "Engineering Chemistry", 15th Ed., Dhanpat Rai Publishing Company (P) Limited, NewDelhi. [R3] B.S.Bahl, G.D.Tuli and Arun Bahl, "Essentials of Physical Chemistry", S. Chand and Company Limited, NewDelhi. [R4] O.G.Palanna, "Engineering Chemistry", Tata Mc Graw Hill Education Pvt .Ltd., NewDelhi.
E-resources and other digital	1. http://nopr.niscair.res.in/bitstream/123456789/5475/1/JSIR%2063%289%29%20715-728.pdf 2. https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_(Analytical_Chemistry)/Electrochemistry/Basics_of_Electr

material	ochemistry 3. https://www.filtronics.com/blog/tertiary-treatment/stages-in-typical-municipal-water-treatment/

20ES2103 – Object Oriented Programming using Python

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Programming for Problem Solving Programming for Problem Solving Laboratory	**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	Interpret the python syntax and semantics of control flow statements											
	CO2	Apply functions and modules in python to solve a problem											
	CO3	Apply 3rd party packages for developing solutions for real time problems											
	CO4	Implement the problems in terms of real world objects using OOPs concept											
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
	CO1	3	2	2						2			3
	CO2	2	2	2						2			3
	CO3	2	2	2						2			3
	CO4	2	2	2						2			3
Course Content	**UNIT- I** **Introduction**: History - Origins of Python, Features of Python - Why choose Python, What can I do with Python, Installing, Python 2 & 3 installation on windows **Variables, Expressions & Statements**: Variables, Variable names & keywords, Operators & operands, Expressions, Order of operations, Modulus operator, String operations. **Conditional Execution**: Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, Exceptions using try and except, Short circuit evaluation of logical expressions. **Iterations**: The while statement, Infinite loops, "Infinite loops" and break, Finishing iterations with continue, Definite loops using for. **UNIT- II** **Functions**: Function calls, Built-in functions, Type conversion functions, Random												

	numbers, Math functions, Adding new functions, Definition and uses, Flow of Execution, Parameters & arguments, Fruitful and void functions, Why functions?, Recursion, Scope of a variable. **Modules**: Packages small description about modularity, Third party packages, A brief tour of standard library, Command line arguments, Error output redirection and program termination, String pattern matching, Mathematics, Internet access, Dates & times, Data Compressions **UNIT- III** **Lists**: Syntactically, Accessing element from list, Slicing a list, Lists are mutable sequences, Deleting items in a list and deleting list, Methods, Searching **Dictionaries:** Creating a dictionary, Dictionary operations, Dictionary methods, Aliasing and copying **Tuples:** Tuples are immutable, Comparing tuples, Tuple assignment, Dictionaries and tuples, Multiple assignment with dictionaries, Using tuples as keys in dictionaries **Strings**: A string is a sequence, Getting the length of a string using len, Traversal through a string with a loop, String slices, Strings are immutable, Looping and counting, The in operator, String comparison, String methods **Sets**: Modifying a set, Removing items from set, Set operations. **UNIT- IV** **Object Oriented Programming in Python**: Python classes, Methods, Constructors, Class variables & instance variables, Basic inheritance, Special methods, Data hiding
Text books and Reference books	**Text Books:** [T1] Vamsi Kurama, "Python Programming: A Modern Approach", Pearson India, 2017. [T2] Charles Severance, "Python for Informatics –Exploring Information", 1st Ed., Shroff Publishers, 2017. **Reference Books:** [R1] Mark Lutz, "Learning Python", 5th Ed., Orielly, 2013. [R2] Allen Downey "Think Python, How to Think Like a Computer Scientist", 2nd Ed., Green Tea Press, 2015. [R3] W.Chun, "Core Python Programming", 2nd Ed., Prentice Hall, 2006. [R3] Kenneth.A.Lambert, "Introduction to Python", 1st Ed., Cengage Learning, 2011
E-resources and other digital material	1. Charles Severance: University of Michigan, "Python for Everybody"-Coursera https://www.coursera.org/ 2. Prof. Sudarshan Iyengar, IIT Ropar, Prof. Yayati Gupta, IIIT Dharwad, "The Joy of Computing using Python–Nptel https://nptel.ac.in/courses/106/106/106106182/#

20ES2104C – Network Theory

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Calculus, Basics of Electrical Engineering	**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 network concepts to solve electric circuit problems.											
	CO2	Analyse DC and AC electrical circuits using various network problems.											
	CO3	Analyse the Transient behavior and Resonant condition of electrical circuits.											
	CO4	Derive the two port network parameters and their relationship.											
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
	CO1	2											
	CO2		3										
	CO3		2										
	CO4		2										

Course Content

UNIT- I

Introduction of Circuit Elements: Circuit concepts, Active and passive circuit elements; Ideal, Practical and dependent sources and their V-I characteristics, Source transformation, Voltage and current division, V-I characteristics of passive elements and their series / parallel combination; Star Delta transformations and problems. Energy stored in inductors and capacitors

UNIT- II

Network Theorems: Mesh and nodal analysis having independent and dependent sources with problems, Application of theorems to DC circuits, Superposition theorem, Thevenin's and Norton's theorems, Reciprocity, Maximum power transfer theorems.

UNIT- III

Sinusoidal Steady State Analysis: 'j' notation and concept of phasor, Phasor notation of voltage, Current and circuit elements in single phase and three phase circuits, Mesh and nodal analysis of obtaining steady state response of R, L, C circuits with problems, Application of network theorems such as superposition theorem, Thevenin's and Norton's theorems, Maximum power transfer theorems to AC circuits. Computation of active

	power, Power factor **UNIT- IV** **Resonance and Transients:** Series and parallel resonance, Selectivity, Bandwidth and Q factor, Series and parallel RLC circuits. Transient analysis of RL, RC, RLC circuits with DC using Laplace transforms. Two-port networks: Calculation of Z, Y and h parameters and their conversions.
Text books and Reference books	**Text Book:** [T1] A.Sudhakar and S.P.Shyam Mohan, "Circuits and Networks: Analysis and Synthesis", 2nd Ed., TMH, 2002 **Reference Book:** [R1] Fraklin F.Kuo, "Network Analysis and Synthesis", 2nd Ed., John Wiley & Sons, 2003 [R2] William H. Hayt, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuit Analysis", 6th Ed., TMH, 2002
E-resources and other digital material	

20ES2105 – Engineering Graphics

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory & Practice	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**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	Understand the scales and conics											
	CO2	Draw orthographic projections of points, lines and planes											
	CO3	Draw orthographic projections of solids and to understand basics of AutoCAD											
	CO4	Understand the sections, development of solids and draw isometric views using AutoCAD											
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
	CO1	3		3				3					
	CO2	2		3				3					
	CO3	2		3				3					
	CO4	1		3				3					
Course Content	**UNIT- I** **Introduction to Engineering Drawing:** Principles of engineering graphics and their significance **Scales**: Construction of plain and diagonal scales **Conic Sections**: Construction of ellipse, parabola and hyperbola (Treatment is limited to eccentricity or general method only) **UNIT–II** **Orthographic Projections:** Principles of orthographic projections –projections of points, Lines (Treatment is limited to first angle projection) and projections of plane regular geometric figures (Upto plane inclined to both of the reference planes)												

	UNIT–III **Projections of Solids**: Projections of simple solids such as cubes, Prisms, Pyramids, Cylinders and Cones with varying positions (Limited to solid inclined to one of the reference planes) **Introduction to AutoCAD:** Basic introduction and operational instructions of various commands in AutoCAD. **(**Internal evaluation only**)** **UNIT–IV** **Sections and Development of Surfaces of Right Angular Solids**: Sections and sectional views of right angular solids of Prism, Pyramid and Cone, Development of surfaces of right regular solids of prism, Pyramid and cone. **Isometric Projections**: Conversion of isometric views into orthographic projections of simple castings using AutoCAD. (Treatment is limited to simple objects only, Internal Evaluation only).
Text books and Reference books	**Text Books:** [T1] Basanth Agrawal & C.M.Agrawal, "Engineering Drawing", McGraw Hill Education Private Limited, New Delhi. [T2] N.D.Bhatt "Engineering Drawing", 53rd Ed., Charotar Publishing House, Anand, 2019 **Reference Books:** [R1] K.L.Narayana & P.Kannaiah, "Text Book on Engineering Drawing", 2nd Ed., Scitech publications (India) Pvt.Ltd., Chennai, 2006. [R2] K.Venugopal, "Engineering Drawing and Graphics + AutoCAD", New Age International, New Delhi. [R3] D.M.Kulkarni, A.P.Rastogi, A.K.Sarkar, "Engineering Graphics with AutoCAD", PHI Learning Private Limited, Delhi, 2013.
E-resources and other digital material	1.http://www.me.umn.edu/courses/me2011/handouts/drawing/blanco-tutorial.html#isodrawing. 2.https://onlinecourses.nptel.ac.in/noc20_me79/preview 3. https://nptel.ac.in/courses/112/103/112103019/

20ES2152 – Object Oriented Programming using Python Laboratory

Course Category:	Engineering Science	**Credits:**	1.5
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:	Programming for Problem Solving, Programming for Problem Solving Laboratory	**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	Implement python programming constructs to build small to large applications.											
	CO2	Implement the problems in terms of real world objects using OOPs concept											
	CO3	Evaluate and handle the errors during run time involved in a program											
	CO4	Extract and import packages for developing different solutions for real time problems											
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
	CO1	3		2						2			3
	CO2	3	2	2						2			3
	CO3	2	2	2						2			3
	CO4	2	2	2						2			3
Course Content	**List of Experiments:** **Week 1: Fundamental Programs** Running instructions in interactive interpreter and a Python script Write a program to purposefully raise indentation error and correct it **Week 2: Operations** Develop Python programs using basic operations in Python **Week 3 & 4 : Conditional & Control Flow** Develop Python programs that make use of conditional and control flow structures. **Week 5: Functions** Develop Python programs using recursive and non-recursive functions												

	Week 6, 7 & 8: Data Structures Develop Python programs using suitable data structures **Week 9: Modules** Illustrate installing packages via PIP and develop Python programs using modules **Week 10& 11:** Application oriented case studies **Week 12: Classes, Inheritance** Illustrate class variables and instance variable Develop Python programs to exemplify the concepts of inheritance and overloading
Text books and Reference books	**Text Books:** [T1] Vamsi Kurama, "Python Programming: A Modern Approach", Pearson India, 2017. [T2] Charles Severance, "Python for Informatics – Exploring Information", 1st Ed., Shroff Publishers, 2017 **Reference Books:** [R1] Mark Lutz, "Learning Python", 5th Ed., Orielly, 2013. [R2] Allen Downey "Think Python, How to Think Like a Computer Scientist", 2nd Ed., Green Tea Press, 2015. [R3] W.Chun, "Core Python Programming", 2nd Ed., Prentice Hall, 2006. [R4] Kenneth.A.Lambert, "Introduction to Python", 1st Ed., Cengage Learning, 2011.
E-resources and other digital material	1.Charles Severance: University of Michigan, "Python for Everybody", Coursera https://www.coursera.org/ 2.Prof .Sudarshan Iyengar, IIT Ropar, Prof. Yayati Gupta, IIIT Dharwad, "The Joy of Computing Using Python" NPTEL https://nptel.ac.in/courses/106/106/106106182/# 3.Charles Russell Sevarance, University of Michigan, "Python for Everybody", 2019. https://www.coursera.org/learn/python

20ES2153 – Engineering Workshop

Course Category:	Engineering Science	**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	Understand the basic joints using wood and familiarize with various fundamental aspects of house wiring.											
	CO2	Prepare basic models using sheet metal and practice joining of metals using arc welding technique.											
	CO3	Familiarize with various manufacturing processes such as injection moulding and 3D printing											
	CO4	Understand the preparation of PCB											
	CO5	Understand simple IOT applications using Arduino											
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
	CO1			2					1			3	2
	CO2			2					1			3	2
	CO3			2					1			3	2
	CO4						1						
	CO5							2					
Course Content	**List of Experiments:** **Part-A** **Carpentry:** Demonstration of cross half lap and T joints. (1class) Demonstration of power tools. **Electrical Wiring:** Fundamentals of electric wiring and practice of series wiring. (1class) Practice of staircase wiring and connecting a fluorescent tube. **Sheet Metal & Soldering:**												

	Preparation of complete funnel using sheet metal and practice of soldering. (2classes) Preparation of a square box using sheet metal and practice of soldering. **Welding:** Preparation of corner joint using arc welding process. (1class) Preparation of "T" joint using arc welding process. **Manufacturing Processes:** Preparation of a small plastic part using injection moulding process. (1class) Demonstration of manufacturing a simple model using 3D printing process. **Electronic Circuits:** **To prepare PCB for the given electronic circuit** To prepare the layout and printing it on copper clad board To etch and drill the holes on PCB (2classes) **To solder the components on the PCB prepared and test the circuit** To identify and solder the components on the PCB prepared To test the operation of the circuit. **Basic IOT:** **Demonstration of Arduino board** Demonstrate different components & pin configuration of Arduino To set up Arduino IDE for programming. **To measure Temperature & Humidity** Interfacing of temperature & humidity sensor with Arduino. (2classes) Execute the program on Arduino IDE & display the measured values. T**o measure Distance** Interfacing of ultrasonic sensor with Arduino Execute the program on Arduino IDE & display the measured value. **Part-B** **Group Activity** (4classes) Students must prepare a working model / assembly using the knowledge gained from the above trades.
Text books and Reference books	**Text Books:** [T1] Kannaiah.P & Narayana.K.C, "Manual on Workshop Practice", Scitech Publications, Chennai, 1999.

	[T2] Venkatachalapathy.V.S., " First year Engineering Workshop Practice", Ramalinga Publications, Madurai, 1999. **Reference Books:** [T1] Gopal.T.V, Kumar.T and Murali.G, " A First Course on Workshop Practice – Theory, Practice and Work Book", Suma Publications, Chennai, 2005
E-resources and other digital material	1. https://dsceme.files.wordpress.com/2016/08/workshop-practice-manual-2016-17-1.pdf 2. https://www.protosystech.com/rapid-prototyping.htm 3. https://www.arduino.cc/en/Tutorial/Foundations 4. https://www.tutorialspoint.com/arduino/index.htm

20MC2106 – Professional Ethics & Practice

Course Category:	Mandatory	**Credits:**	-
Course Type:	Theory	**Lecture - Tutorial - Practice:**	1 - 0- 0
Prerequisites:		**Continuous Evaluation:**	100
		Semester end Evaluation:	-
		Total Marks:	100

Course outcomes	Upon successful completion of the course, the student will be able to:												
	CO1	Know the moral autonomy and uses of ethical theories.											
	CO2	Understand engineering as experimentation											
	CO3	Understand about safety, risk and professional rights.											
	CO4	Know the ethics regarding global issues related to environment, computers and weapons development. Understand general principles of contracting.											
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
	CO1												
	CO2												
	CO3												
	CO4												
Course Content	**UNIT- I** **Engineering Ethics**: Senses of 'Engineering Ethics' - Variety of moral issues- Types of inquiry – Moral dilemmas – Moral autonomy - Kohlberg's theory - Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action – Self interest – Customs and religion – Uses of ethical theories. **UNIT- II** **Engineering as Social Experimentation**: Engineering as experimentation – Engineers as responsible experimenters – Codes of ethics – A balanced outlook on law –The challenger case study **UNIT- III** **Safety, Responsibilities and Rights:** Safety and risk-assessment of safety and risk-risk benefit analysis and reducing risk – The three mile island and chernobyl case studies. Collegiality and loyalty – Respect for authority - Collective bargaining - Confidentiality - Conflicts of interest - Occupational crime – Professional rights – Employee rights- Intellectual Property Rights (IPR) - Discrimination												

	UNIT- IV **Global Issues**: Multinational corporations – Environmental ethics – Computer ethics – Weapons development - Engineers as managers - Consulting engineers - Engineers as expert witnesses and advisors - Moral leadership – Sample code of ethics (Specific to a particular engineering discipline). **General Principles of Contracts Management:** Indian contract act, 1972 and amendments covering general principles of contracting.
Text books and Reference books	**Text Books:** [T1] Mike Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, NewYork (1996). [T2] Govindarajan.M, Natarajan.S, Senthil Kumar.V.S., "Engineering Ethics", Prentice Hall of India, New Delhi (2004). **Reference Books:** [R1] Baum, R.J. and Flores, A., "Ethical Problems in Engineering, Center for the study of the Human Dimensions of Science and Technology", Rensellae Polytechnic Institute, Troy, New York, 1978. [R2] Beabout.G.R, Wennemann.D.J, "Applied Professional Ethics: A Developmental Approach for Use with Case Studies", University Press of America Lanham, MD, 175pp , 1994. [R3] Dutt, "Indian Contract Act", Eastern Law House, 1994.
E-resources and other digital material	

Second Year
(III Semester)

20BS3101 – Complex Analysis & Numerical Methods

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Algebra of complex numbers, Convergence of infinite series, Theory of equations	**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 evaluate real definite integrals using residue theorem											
	CO3	Solve algebraic, transcendental, system of 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
	CO1												
	CO2												
	CO3												
	CO4												
Course Content	**UNIT- I** **Complex Analysis:** Introduction, Continuity, Cauchy-Riemann equations. Analytic functions, Harmonic functions, Orthogonal systems, Application 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**: Solution of algebraic and transcendental equations with Newton - Raphson method, Solution of simultaneous linear equations with Gauss - Seidel iterative 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 4^{th} order.
Text books and Reference books	**Text Book:** [T1] B.S.Grewal, "Higher Engineering Mathematics", 44^{th} Ed., Khanna Publishers, 2019. **Reference Books:** [R1] ErwinKreyzig, "Advanced Engineering Mathematics", 10^{th} Ed', John Wiley & Sons, 2015. [R2] R.K.Jain, S.R.K.Iyengar, "Advanced Engineering Mathematics", 5^{th} Ed., Narosa Publishers, 2016. [R3] N.P.Bali, Manish Goyal, "A Textbook of Engineering Mathematics", 9^{th} Ed., Lakshmi Publications (P) Limited, 2016. [R4] H.K.Das, Er.Rajnish Verma, "Higher Engineering Mathematics", 3^{rd}R Ed., S.Chand & Co., 2014. [R5] S.S.Sastry, "Introductory Methods of Numerical Analysis", 5^{th} Ed., PHI Learning, 2012
E-resources and other digital material	1. Prof. Pranav Haridas, Kerala School of Mathematics, Complex Analysis https://onlinecourses.nptel.ac.in/noc21_ma39/preview 2. Prof. Ameeya Kumar Nayak, Prof. Sanjeev Kumar, IIT Roorkee, Numerical methods https://onlinecourses.nptel.ac.in/noc21_ma45/preview 3. Jeremy Orloff, Massachusetts Institute of Technology: MIT Open Course Ware, Complex Variables with Applications https://ocw.mit.edu. 4. Henrik Schmidt, Massachusetts Institute of Technology: MIT Open Course Ware, Introduction to Numerical Analysis for Engineering https://ocw.mit.edu

20ES3102 – Electronic Devices and Circuits

Course Category:	Engineering Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Engineering Physics	**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	Apply the basic concept of semiconductor devices											
	CO2	Analyze the operation of V I characteristics of semiconductor devices											
	CO3	Analyze various stability biasing techniques in BJT and FET											
	CO4	Design diode circuit for various applications											
	CO5	Use SPICE simulator to implement a circuit for diode applications											
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
	CO1	2											
	CO2		2										
	CO3		2										
	CO4		3										
	CO5					2							
Course Content	**UNIT- I** **Conduction in Semiconductors:** Conductivity of a semiconductor, Carrier concentrations in an intrinsic semiconductor, Donor and acceptor impurities, Charge densities in a semiconductor, Diffusion. **Semiconductor Diode Characteristics:** Qualitative theory of P-N junction, p-n Junction as a Diode, The Volt Ampere Characteristics, The temperature dependence of P-N Characteristics, Diode Resistance, Space Charge or Transition Capacitance, Diffusion capacitances. Breakdown Diodes. Volt Ampere Characteristics of Zener diode **UNIT- II** **Diode Applications:** Diode approximations, Series diode configurations with DC inputs, Parallel and series – Parallel configurations with DC inputs, Clippers, Clampers. **Rectifiers:** Diode as a rectifier, Half wave, Full wave - Centre-tapped, Bridge rectifiers												

	without filter and with filters - Inductor filter, Capacitor filter, L section, Zener regulator. **UNIT- III** **Transistor Characteristics:** The Junction transistor**,** Characteristics of common base, Common emitter and Common collector configuration. **Transistor Biasing & Thermal Stabilization:** The operating point, Bias stability, Collector to base bias, Self - bias, Bias compensation, Thermistor & Sensistor compensation, Thermal runaway and thermal stability **UNIT- IV** **Field Effect Transistors:** Construction and Characteristics of JFETs, Transfer characteristics, Specification sheets (JFETs), Depletion - type MOSFET and Enhancement - type MOSFET. **FET Biasing**: Introduction, Fixed bias configuration, Self - bias configuration, Voltage divider biasing, Depletion - type MOSFET and Enhancement - type MOSFET
Text books and Reference books	**Text Books:** [T1] Jacob Millman, Christos C Halkias & Satyabrata JIT, "Millman's Electronic Devices and Circuits", 4th Ed., TMH, 2015. (Unit I, II& III) [T2] Robert L Boylested and Louis Nashelsky, "Electronic Devices and Circuit Theory", 10th Ed., Pearson India, 2009. (UNIT IV). **Reference Books:** [R1] Nandita Das Gupta and Amitava Das Gupta, "Semiconductor Devices Modelling and Technology", PHI Learning Pvt. Ltd., 2013 [R2] David A Bell., "Electronic Devices and Circuits", 5th Ed., Oxford University Press, 2008
E-resources and other digital material	1. http://www.nptelvideos.in/2012/12/basic-electronics-drchitralekha-mahanta.html 2. https://nptel.ac.in/courses/117/103/117103063/ 3. https://nptel.ac.in/courses/117/106/117106033/ 4. https://nptel.ac.in/courses/117/102/117102061/

20EI3303 – Digital Circuits & Systems

Course Category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**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	Demonstrate proficiency in codes and number system converting circuits											
	CO2	Analyze digital electronic circuits using analytical tools											
	CO3	Design digital electronic circuits with and without memory elements.											
	CO4	Select suitable memories and logic families for digital system design											
	CO5	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		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	CO1	2											
	CO2		3										
	CO3			3									
	CO4	2											
	CO5					2							
Course Content	**UNIT- I** **Digital Fundamentals:** Number systems – Decimal, Binary, Octal, Hexadecimal, 1‘s and 2‘s complements, Codes – BCD, Excess 3, Gray, Boolean laws & theorems, Logic gates, Universal gates, 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**: Half - Adder, Full - Adder, Half - Subtractor, Full - Subtractor, BCD to 7 segment decoder, Design of a binary to gray 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. **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. **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. **Digital Integrated Circuits:** Characteristics of Digital ICs, Logic Families: MOS and CMOS logic families. **Computer Aided Design of Digital Systems:** Computer Aided Design (CAD) concepts, CAD tools, Introduction to VHDL, Combinational Circuits using VHDL, Sequential circuits using VHDL.
Text books and Reference books	**Text Book:** [T1] R P Jain "Modern Digital Electronics", 4th Ed., TMH. **Reference Books:** [R1] A. Anand Kumar, "Fundamentals of Digital Circuits", PHI, 2006 [R2] M. Morris Mano, "Digital Logic and Computer Design", PHI,2003
E-resources and other digital material	

20EI3304 – Sensors and Transducers

Course Category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**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	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		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	CO1		2										
	CO2	2											
	CO3		3										
	CO4	2											
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, Piezoresistive sensors, Photovoltaic cell, Hall transducer, Resistive humidity sensor, Signal conditioning of resistive												

	transducers **UNIT- III** **Reactance Transducers** **Variable Inductance Transducers**: Principle of operation, Construction details, Characteristics and applications of Induction potentiometer - Variable reluctance transducer – LVDT - RVDT, Variable reluctance accelerometer, Signal conditioning of inductive transducers **Capacitive transducers** – Principle of operation, Construction details, Characteristics and applications of variable air gap, Variable area, Variable permittivity capacitive transducer, Capacitor microphone 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, IC sensor, SQUID sensors, Film sensors, Nano sensors and Bio sensors
Text books and Reference books	**Text Book:** [T1] A.K.Sawhney & Puneet Sawhney,"A Course In Electrical And Electronic Measurements And Instrumentation", 12th Ed., Dhanapat Rai & Co., 2016 **Reference Books:** [R1] D.V.S.Murty, "Transducers & Instrumentation", 2nd Ed., PHI. [R2] A.K.Ghosh, "Introduction to Measurements & Instrumentation", 3rd Ed., PHI, 2009 [R3] 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

20EI3305 – Electrical and Electronic Measurements

Course Category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:	Circuit analysis	**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	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		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	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, The Owen bridge, De-sauty 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, Electrostatic deflection, 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, Measure of frequency by lissajous method. **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, Digital tachometer, Digital pH meter
Text books and Reference books	**Text Books:** [T1] W D Cooper & A D Helfrick, "Electronic Instrumentation and Measurement Techniques", PHI, 1998 (Unit-I) [T2] H.S.Kalsi, "Electronic Instrumentation", 2nd Ed., 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	1. https://www.youtube.com/watch?v=3eYmFjHnQjY&list=PLbRMhDVUMngcoKrA4sH-zvbNVSE6IpEio

20ES3151 – Electronic Devices and Circuits Lab

Course Category:	Engineering Science	**Credits:**	1.5
Course Type:	Lab	**Lecture - Tutorial - Practice:**	0 - 0- 3
Prerequisites:	Engineering Physics	**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	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		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	CO1			3									
	CO2				3								
	CO3					3				1		1	
	CO4										2		
Course Content	**List of Experiments** **A. Hardware Module:** 1. Characteristics of PN Junction diode and Zener diode. 2. Characteristics of transistor in common emitter configuration. 3. Design of transistor self-bias circuit. 4. Drain and transfer characteristics of junction field effect transistor. 5. Design of unbiased clampers. 6. Design of clippers. **B. Software (Multisim) Module:** 7. Design Voltage regulator using Zener diode. 8. Verification of half-wave rectifier operation with and without filter. 9. Verification of full-wave rectifier operation with and without filter. 10. Frequency response of CE amplifier. 11. Frequency response of CS Amplifier.												

	12. Design of Voltage Series Feedback amplifier
Text books and Reference books	--
E-resources and other digital material	--

20EI3352 – Digital System Design Lab

Course Category:	Program 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 knowledge of Boolean algebra to demonstrate the truth table of logic circuits											
	CO2	Design various combinational and sequential logic circuits											
	CO3	Analyze outputs for a logic circuit											
	CO4	Conduct experiment with an individual or team by using modern tools like Multisim, VHDL											
	CO5	Prepare an effective report based on an experiment											
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
	CO1	2											
	CO2			3									
	CO3		2										
	CO4					2				2			2
	CO5										2		
Course Content	**List of Experiments** **A. Digital Electronics Module:** 1. Realization of logic gates using discrete components and universal gates. 2. Implementation of Adders/ Subtractor using IC 7483 3. Verification of Flip-Flops using gates 4. Design of synchronous counters using flip flops and IC 74163 5. Design of asynchronous counters using flip flops and IC 74163 6. UP/DOWN counters using IC 74193 7. Design of MUX and DEMUX **B. P-Spice Module:** 1. Verification of logic gates using discrete components. 2. Implement the given Boolean function using logic gates in SOP and POS forms.												

	3. Design binary to gray and gray to binary code converters. 4. Design BCD-to 7 segment decoder 5. Design and verify the 4-bit synchronous counter 6. Realization of shift registers 7. Design and implement BCD counter using JK Flipflops. **C. VHDL Module:** 1. Implement the full adder and verify the functionality using VHDL 2. Design of Encoder and decoder using VHDL 3. Design of multiplexer and demultiplexer using VHDL 4. Implement the 4-bit comparator using VHDL 5. Implement the 3 bit up/down counter using VHDL 6. Implement the Arithmetic logic Unit(ALU) using VHDL 7. Implement the clock generator and verify the functionality using VHDL
Text books and Reference books	--
E-resources and other digital material	--

20EI3353 – Measurements Lab

Course Category:	Program 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 electrical parameters											
	CO2	Analyze the outputs and interpret the data generated from the null and deflection techniques											
	CO3	Conduct various experiments as an individual or team.											
	CO4	Prepare an effective report based on experimental outcome											
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
	CO1	3											
	CO2		3										
	CO3				1					1		1	
	CO4										2		
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 Schearing bridge. 8. Simulation of spectrum analyzer using analog discovery kit. 9. Measurement of amplitude and frequency of different types of waveforms using function generator. 10. Measurement of inductance of high Q coils using Hay bridge. 11. Measurement of frequency using a Wien bridge. 12.Calibration of voltmeter using potentiometer												

Text books and Reference books	--
E-resources and other digital material	--

20TP3106 – Logic and Reasoning

Course Category:	Soft Skills	**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	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		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	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/

20MC3107A – Environmental Studies

Course Category:	Mandatory Course	**Credits:**	
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2 - 0- 0
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	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		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	CO1	1							1				
	CO2		1	1							1		
	CO3				1	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.Venu Gopala Rao, "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] Bharucha Erach, "Biodiversity of India", Mapin Publishing Pvt.Ltd
E-resources and other digital material	

Second Year
(IV Semester)

20BS4101 – Analog Electronic Circuits

Course Category:	Basic Science	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 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	Analyze amplifier circuits at low & high frequencies											
	CO2	Determine various parameters of the amplifier circuits											
	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		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	CO1		3										
	CO2	3											
	CO3			2									
	CO4		2										
	CO5					2							
Course Content	**UNIT- I** **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- II** **Transistor Amplifiers at High frequencies:** The hybrid-pi (π) Common Emitter Transistor Model, hybrid-pi (π) conductances, the hybrid-pi (π) capacitances, validity at hybrid-pi (π) model, variation of Hybrid-pi (π) parameters, the CE short circuit current gain, current gain with Resistive load, single stage CE transistor amplifier response, the Gain-Bandwidth product, Emitter follower at high frequencies.												

	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 Books:** [T1] Jacob Millman and Christos C Halkias, "Integrated Electronics: Analog and Digital Circuits and Systems", 12th Ed., TMH, 1991. [T2] G.K.Mithal, "Electronic Devices and circuits", 23rd Ed., Khanna Publishers 2010. **Reference Books:** [R1] A.P.Godse and U.A.Bakshi "Electronic Circuit Analysis", 1st Ed., fourth reprint, Technical Publications, 2010. [R2] Robert Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory", 6th Ed., PHI 2000
E-resources and other digital material	

20EI4302 – Linear Integrated Circuits and Applications

Course Category:	Program Core	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 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	Analyze the characteristics of 741IC											
	CO2	Apply the concepts of 741IC in various applications											
	CO3	Design different linear and non-linear op-amp circuits using 741IC, 555 timer IC and voltage regulator IC.											
	CO4	Apply the concepts of Special purpose ICs in various applications											
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
	CO1		2										
	CO2	3											
	CO3		3			2							
	CO4	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: Sample and hold circuit, Precision diode, Applications - Precision full wave rectifier, Clippers, Peak detector and Absolute value output 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 multiple feedback band pass filters; Band stop filters - Wide band stop and notch filter; State variable filter. **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- I** **Special Purpose ICs and Applications:** 555 Timer - 555 as Monostable and Astable operation, Applications, Schmitt trigger; Voltage controlled oscillator (IC566), ICL8038 Function generator, Frequency to voltage converters. IC voltage regulators - Fixed voltage regulators- LM78XX, LM79XX; Variable voltage regulators – LM 317, LM 723 IC
Text books and Reference books	**Text Books:** [T1] D. Roy Choudhry and Shail B. Jain, "Linear Integrated Circuits", 4th Ed., 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", 6th Ed, 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. Kanchana Bhaskaran, Linear Integrated Circuits, TMH, 2nd Ed., 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

20EI4303 – Control Systems

Course Category:	Program 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 (L – Low, M - Medium, H – High		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	CO1												
	CO2	2											
	CO3		3										
	CO4		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, Time domain specifications, Steady state error and error constants, Effect of adding poles and zeros to transfer function, 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 Books:** [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. Nagoor Kani, "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/

20EI4304 – Industrial Instrumentation

Course Category:	Program 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		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	CO1												
	CO2	3											
	CO3	3											
	CO4		2										
Course Content	**UNIT- I** **Temperature Measurement:** Introduction, Classification of temperature sensors based on change in dimensions - Bimetals; Change in electrical properties – RTD, Thermistor; Thermo electricity – Thermocouples; IC sensors, Radiation pyrometers, Fiber-optic sensors, SAW thermometer, Ultrasonic thermometer, Problems **UNIT- II** **Pressure Measurement:** Introduction, pressure standards, Manometers; Force summing devices – Diaphragms, Bellows, Bourdon tubes; Secondary transducers – Resistive, Inductive, Capacitive, Piezoelectric; Low pressure measurement **-** Mcleod,Knudsen, Pirani & Ionization gauges**;** Calibration of pressure gauges using dead weight tester, Problems. **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, Anemometers; Mass flow measurement type – Coriolis; Positive displacement flow meters - Nutating disc and lobed impeller; Open channel flow meters- Weirs, Flumes, Problems **UNIT- IV** **Level Measurement:** Introduction, Mechanical level indicators - Differential pressure type; Optical – Laser sensors; Electrical type - Resistive, inductive and Capacitive; Radiative methods - Ultrasonic, Gamma; Problems. **Humidity, Density & Viscosity Measurement:** Introduction, hygrometers - Wet and dry bulb, Electrolytic hygrometers; Moisture analyzer - Neutron back scatter moisture analyzer; Densitometers - Electromagnetic suspension, Ultrasonic densitometers; Viscometers - Saybolt and Float viscometers.
Text books and Reference books	**Text Book:** [T1] A.K.Ghosh, "Introduction to Measurements & Instrumentation", IIIrd Ed., PHI, 2009 **Reference Books:** [R1] A.K.Sawhney & Puneet Sawhney, "A Course in Mechnanical Measuremnets & Instrumentation", 12th Ed., Dhanapat Rai & Co., 2012. [R2] Ernest O Doebelin / Dhanesh, N Manik, "Measurement systems", 6th Ed., Tata Mc Grawhill. [R3] C.S.Rangan, G.R.Sarma & V.S.V.Mani "Instrumentation Devices & Systems", 2nd Ed., TMH, 2011
E-resources and other digital material	1. http://nptel.ac.in/courses/108105064 2. http://nptel.ac.in/courses/108106074

20HS4105 – Universal Human Values

Course Category:	Humanities and Social Sciences	**Credits:**	3
Course Type:	Theory	**Lecture - Tutorial - Practice:**	3 - 0- 0
Prerequisites:		**Continuous Evaluation:** **Semester end Evaluation:** **Total Marks:**	50 50 100

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		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	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

20EI4351 – Transducers Lab

Course Category:	Program 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	Demonstrate the measurement of various physical quantities using a suitable transducer.											
	CO2	Develop simple sensor interfacing applications using Arduino											
	CO3	Conduct experiments as individual or team to analyze the characteristics of various transducers.											
	CO4	Write an effective report based on experiments											
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
	CO1	3											
	CO2	3											
	CO3				3	1				1		1	
	CO4										2		
Course Content	**List of Experiments** 1. Temperature measurement using RTD and thermistor 2. Temperature measurement using thermocouple and IC temperature sensor 3. Characteristics of LDR, photodiode and phototransistor 4. Measurement of magnetic flux density using Hall 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 LVDT 9. Interfacing a PIR sensor for motion detection 10. Interfacing a gas sensor and display on LCD/Serial Monitor 11. Interfacing a soil moisture sensor and display on LCD /Serial Monitor 12. Interfacing an inductive proximity sensor for detecting the presence of objects **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	**Text 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	1. https://store.arduino.cc/digital/create 2. https://www.allaboutcircuits.com/

20EI4352 – Control Systems Lab

Course Category:	Program 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 control system techniques/approaches to solve problems											
	CO2	Analyze the responses and stability of the given control system											
	CO3	Conduct and analyze the experiments as individual or team by using modern tools like Matlab/ Simulink/LabVIEW											
	CO4	Make an effective report based on experiments											
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
	CO1	3											
	CO2		3										
	CO3				3	3				2		1	
	CO4										2		
Course Content	**List of Experiments** **<u>Part-A</u>** 1.Dynamic characteristics of first order systems 2. Time response of second order systems 3. Characteristics of synchro transmitter and receiver 4. Speed torque characteristics of DC servomotor 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.** Mathematical modeling of physical systems using MATLAB/LabVIEW **3.** Block diagram reduction techniques for determination of transfer function of a given system 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 **9.** Study the effect of addition of zeros to the forward path transfer function of a closed loop system **10.** Study the effect of addition of poles to the forward path transfer function of a closed loop system **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] I.J.Nagrath & M.Gopal "Control systems Engineering", New Age publisher, 5th Ed. [T2] A.Ananda Kumar, "Control Systems", PHI **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

20EI4353 – Linear Integrated circuits Lab

Course Category:	Program 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	Analyse various characteristics of op-amp											
	CO2	Design linear and non-linear applications of op-amp circuits, 555 timer and IC voltage regulators											
	CO3	Conduct the experiment as well as analyze the outputs for given specifications as an individual or a team											
	CO4	Prepare an effective report based on experimental results											
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
	CO1		2										
	CO2	3											
	CO3				3					2			
	CO4										2		
Course Content	**List of Experiments** **<u>Analog ICs Experiments using Discrete Components</u>** 1. Measurement of Op-amp parameters 2. Design inverting amplifier, Adder circuit and comparator using Op-Amp IC741. 3. Design a precision full wave rectifiers using Op-Amp 741IC 4. Design an instrumentation amplifier using 741IC 5. Design an integrator using 741IC 6. Design a waveform generation using 741IC (square, triangular) 7. Design a Wein bridge oscillator using 741IC 8. Design of first order active low pass and high pass filter using 741IC 9. Design an IC 555 timer astable circuit 10. Design a schmitt trigger using IC 555 Timer 11. Design a voltage regulator using IC 723 12. Design a D/A converters using 741IC using 3 bit R-2R ladder circuit technique												

	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	**Text Books:** [T1] D. Roy Choudhry and Shail B. Jain, "Linear Integrated Circuits", 4th Ed., New Age International Pvt. Ltd, 2011. [T2] Rama Kant A. Gayakwad, "Op-Amps and Linear Integrated Circuits", 4th Ed., PHI, 2012
E-resources and other digital material	

20TP4106 – English for Professionals

Course Category:	Soft Skills	**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		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	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	

20EI4607 – Virtual Instrumentation

Course Category:	Skill Oriented Course	**Credits:**	2
Course Type:	Theory	**Lecture - Tutorial - Practice:**	1 - 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	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		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	CO1					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
Text books and Reference books	**Text Book:** [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	1. http://www.ni.com

20MC4108B – Indian Constitution

Course Category:	Mandatory Course	**Credits:**	
Course Type:	Theory	**Lecture - Tutorial - Practice:**	2 - 0- 0
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	Know the fundamental law of the land											
	CO2	Understand how fundamental rights are protected											
	CO3	Perceive the structure and formation of the Indian government system											
	CO4	Explain when and how an emergency can be imposed and what are the consequences											
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
	CO1												
	CO2												
	CO3												
	CO4												

Course Content

UNIT- I

Introduction to Constitution of India: Meaning of the constitution law and constitutionalism, Historical perspective of constitution of India, Salient features of constitution of India.

UNIT- II

Fundamental rights: Scheme of the fundamental rights, Scheme of the fundamental right to equality, Scheme of the fundamental right to certain freedoms under Article 19, Scope of the right of life and personal liberty under Article 21, writs jurisdiction

UNIT- III

Nature of the Indian constitution: Federal structure and distribution of legislative and financial powers between the union and states

Parliamentary form of Government in India: The constitution powers and status of the President of India, Amendment of the constitutional powers and procedure, Historical perspectives of the constitutional amendments in India

	Local Self Government: Constitutional scheme in India **UNIT- IV** **Emergency Provisions:** National emergency, President rule, Financial emergency
Text books and Reference books	**Text Book:** [T1] Dr. J.N. Pandey, "Constitutional Law of India" published by Central law Agency, Allahabad, Edition 2018 **Reference Books:** [R1] V.N Shukla's, "Constitution of India" Eastern Book Company, Lucknow. [R2] M.P. Jain, "Indian Constitution Law", Wadhwa and Company, Nagpur. [R3] D.D. Basu, "Constitution of India", Wadhwa and Company, Nagpur
E-resources and other digital material	