GAYATRI VIDYA PARISHAD COLLEGE FOR DEGREE AND PG COURSES (A)

(Approved by AICTE, Permanently Affiliated to Andhra University)

Rushikonda, Visakhapatnam-530045 | Website: www.gvpcdpgc.edu.in

ENGINEERING & TECHNOLOGY PROGRAM

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Academic Regulations and Syllabi for B.Tech

With effect from 2019-20 admitted batch

About College

The Gayatri Vidya Parishad College for Degree and PG Courses (GVPCDPGC) was established in 1989 under the parent society Gayatri Vidya Parishad (GVP). The Engineering and Technology programs – B.Tech in Civil Engineering (CE), Computer Science and Engineering (CSE), Electronics and Communication Engineering (ECE) and Mechanical Engineering (ME) courses, were added to the Institute in 2011 as under-graduate courses with approval of AICTE and affiliation from Andhra University. The Engineering and Technology program got permanent affiliation from Andhra University in 2018. The laboratories are well equipped with up-to-date equipment and the students are encouraged to perform experiments by a dedicated team of faculty and staff. All courses are granted autonomy from the academic year 2019-20.

Vision of the Institute

"Creating Human Excellence for a Better Society"

Mission of the Institute

"Unfold into a World class organization with strong academic and research base, producing responsible citizens to cater to the changing needs of the society."

Academic Regulations 2019 for B.Tech Program under Autonomous Status with effect from 2019-20 Admitted Batch

Admissions

Admissions into first year of B.Tech. Programs and admissions into second year (lateral entry) of B.Tech. Programs of the Institute will be as per the norms stipulated by Andhra University (AU), Andhra Pradesh State Council for Higher Education (APSCHE) and Govt. of Andhra Pradesh. The duration of the program is for four/three years. However the candidate shall complete the same in not more than eight/six years from the year of first admission for regular/lateral entry respectively. These regulations will be effective from the Academic Year (AY) 2019-20 and 2020-21 for regular/lateral admitted students respectively.

Programs

The B.Tech. Programs being offered by the institute (Institute) are

1. B.Tech in Civil Engineering (CE)
2. B.Tech in Computer Science and Engineering (CSE)
3. B.Tech in Electronics and Communication Engineering(ECE)
4. B.Tech in Mechanical Engineering (ME)

Structure

The program consists of courses of different categories such as Basic Science Course (BSC), Engineering Science Course (ESC), Mandatory Course (MC), Professional Course (PC), Professional Core Course (PCC), Professional Elective Course (PEC), Open Elective Course (OEC), Massive Open Online Course (MOOC) and Laboratory Course (LC).

Each course is assigned a certain number of credits based on the number of classes assigned for the course (theory or lab). The classes conducted per week for theory reflects the number of credits. The number of credits for labs is half of the number of lab sessions conducted per week. The credits allotted for Mini-Project/Internship/Project Work are given in the course structure.

Mandatory course (MC) is a course that is apart from Professional Elective (PE), Professional Core Course (PCC) and Open Elective (OE).

Open Elective (OE) course is a course offered by any other department apart from the home department.

Professional Elective Course (PEC) is a course that is offered by the department and the student has to choose in the electives offered and have to complete one of the elective offered for the semester.

Professional Core Course (PCC) are all the courses that belong to the said program and have highest weightage among all other courses.

Laboratory Course (LC) is a compulsory course that is offered by the department in each of the semesters of study.

The student is expected to register for at least three MOOC courses in the three semesters of their study. There will be two credits to each of the MOOC courses.

Regular student has to complete two audit courses, one mandatory course, and all the lab courses, all the professional core courses and professional electives for the successful completion of course work for the award of the degree. The completion of MOOCs courses in their course duration will yield a certificate, certifying that the student is capable of pursuing a degree in the mentioned vertical. The student is expected to pursue MOOCs courses in such a fashion that it will yield complete knowledge of a subject in the three semesters. A regular student should acquire total credits as per the course structure of the program.

Registration

The student can register to the courses in the said semester according to the courses offered by the department.

Attendance regulations

The student shall put in a minimum attendance of 75% in all the subjects of the semester computed by totaling the number of periods of lectures, workshops, laboratories, drawing, tutorials, project and any other practical's, held in every subject during the semester.

However, in special cases and for sufficient cause shown, the Principal may, on the recommendation of the Head of the Department, condone the shortage of attendance to the extent of 9% for reasons such as ill-health, if the application for condonation is submitted at the time of actual illness or immediately after the resumption of classes by the student, and is supported by a certificate from an authorized Medical Officer.

In case of students, who participate in activities like N.S.S., N.C.C., Inter-collegiate tournaments, Inter-University tournaments, training and placement, career planning and any such other activities involving the representation of the College/University with the prior approval of the Head of the Department/Principal, the candidate may be deemed to have attended the college during the actual period of such activity, solely for the purpose of attendance.

A candidate who cannot satisfy the attendance requirements as specified above, because of late admission under special circumstances, reasonable and acceptable to the University on the basis of documents, shall attend at least 50% of the total scheduled periods during that academic year and shall have attended at least 90% of the total periods of instructions held from the date of admission.

Shortage of attendance between 65-74% will be condoned on payment of fee as fixed by the competent authority and the student concerned will be permitted to take the end semester examination.

The student shall be deemed detained if he/she does not satisfy the attendance requirements as decided by an attendance committee constituted by the Principal for each semester.

Examination and evaluation process

The performance of each student shall be evaluated for a maximum of 100 marks for theory and practical/drawing subjects, mini project, project work and internship.

Theory Course:

For all lecture based courses the continuous evaluation (internal assessment) shall be for 30 marks and 70 marks through semester-end examination.

1. **Internal Evaluation**

   There will be two mid examinations of descriptive type and average mark of two will be considered as final mark. The continuous evaluation (internal assessment) is carried out by the faculty concerned for the subject and is performed as following for the 30 marks to be awarded to the student.

   i) Internal assessment (Mid semester/Sessional) for 20 marks

   ii) Any of the two methodologies as informed by the faculty teaching the course at the start of instruction by assignments, project work, quiz, viva-voce, drawing sheet assignments is for 10 marks.

   Under no circumstances re-examination shall be conducted for internal assessment (Mid semester examinations/Sessionals).The average mark of two mid examinations will be considered as final mark.

2. **External Evaluation**

   The question papers shall be set externally and the answer scripts shall be evaluated through a single valuation system. The results will be declared within 45 days from the conduct of the last examination in the semester end examinations. The candidate has to apply for Revaluation within 15 days from the publication of results.

   Free electives/MOOCs shall be evaluated internally for 100 marks, and the student has to put up a minimum attendance of 75%.

Laboratory Course

Each Laboratory course shall be evaluated for 100 marks, out of which 50 marks are by internal assessment and 50marks through external evaluation. The internal assessment of 50 marks is distributed as 25 marks for continuous assessment, record, student attendance and 25 marks for internal lab examination. The external examination shall be held by two examiners, one internal (from the department) and an external examiner nominated by the Principal from a list of examiners recommended by the Board of Studies.

Project Work

The project work shall be spread over the entire VIII semester and should be innovative in nature, with research / industry orientation. A project batch shall comprise not more than four students. A mid-term evaluation is conducted on the progress by the Head of the Department and the supervisor for 25 marks. On completion of the project, a second evaluation is conducted before submission of the report and it is for 25 marks. The final evaluation, done by an external examiner appointed by the Principal shall be for 50 marks and based on the project report and performance at viva-voce.

Minimum academic requirements

The pass mark shall be 40% for theory and 50% for lab courses. There shall be a minimum of 40% and 50% respectively for semester end theory and lab examinations. In addition to these the candidate shall secure an aggregate of 50% in all theory and lab courses put together. The candidate who do not satisfy these conditions, shall have to appear in semester end examinations for the same semester held subsequently.

Criteria for achieving minimum credits

A student who satisfies the above shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory subject.

A student shall be promoted to the next semester, if only he/she satisfies the minimum attendance requirements. The attendance requirements are as follows:

i) A Candidate is required to put up a minimum of 75% of attendance to be eligible to write the semester end examination.

ii) A Candidate is permitted to write the examination on medical grounds if the attendance is between 66% and 74% on payment of condonation fees of Rs 1000/- (One thousand only).

iii) Even if a candidate is having more than 74% of attendance and he has not paid the examination fess, he/she will not be permitted to write the semester end examinations.

iv) If a candidate is detained due to lack of required attendance, he/she has to repeat the semester and will not be promoted to the subsequent semester.

Award of grades

Absolute grading system is followed for awarding of grades to the students.

Grade point: It is the numerical weightage that is attracted by a grade allotted on a 10 point scale.

Letter Grade: it is an index of the performance of students in a said course. The grades are denoted by the following letters and their respective marks range is given hereunder.

Sl.No.	Range of Marks	Grades	Grade Point	
1	$> 90 \; and \; \leq 100$	O	10	Outstanding
2	$> 80 \; and \; \leq 90$	A+	9	Excellent
3	$> 70 \; and \; \leq 80$	A	8	Very Good
4	$> 60 \; and \; \leq 70$	B+	7	Good
5	$> 55 \; and \; \leq 60$	B	6	Above Average
6	$\geq 50 \; and \; \leq 55$	C	5	Average
7	$\geq 40 \; and \; < 50$	P	4	Pass
8	< 40	F	0	Fail
9			0	Ab(Absent)

The performance of each student at the end of the semester is indicated by Semester Grade Point Average (SGPA). The SGPA is calculated as

$$\boldsymbol{SGPA = \frac{\sum Credits\ of\ a\ course \times Grade\ Points\ awarded\ for\ the\ course}{\sum Credits\ of\ a\ course}}$$

SGPA shall be calculated for the candidates who have passed in all the courses of the semester. Cumulative Grade Point Average (CGPA) shall be calculated from the II Semester onwards up to the final semester. CGPA is calculated for those students who have SGPA in all the courses. The conversion of CGPA to percentage is by multiplying the CGPA with 10.

CGPA is calculated as

$$\boldsymbol{CGPA = \frac{\sum Credits\ of\ a\ course \times Semester\ Grade\ Point\ Average}{\sum Credits\ of\ a\ course}}$$

A candidate shall be declared to have passed in a course if he/she secures "P" grade in theory examination and "C" grade in laboratory course/Project/Mini Project/Internship.

A candidate has to secure a minimum of 5.0 SGPA for a pass in each semester. If the SGPA is less than 5.0 in a semester the candidate should appear for the requisite subject(s) and improve the SGPA by appearing during the supplementary examinations in the subsequent semesters.

Award of class

The student depending on the CGPA acquired will be awarded the class as follows

Sl.No.	Class	CGPA
1	First Class with Distinction	7.0 and more
2	First Class	6.0 or more but less than 7.0
3	Second Class / Pass	5.0 or more but less than 6.0

Malpractices

The Controller of Examinations/Dean of Examinations shall refer the cases of suspected malpractices in mid semester examinations/semester-end examinations to Examination Committee constituted by the Institute. The committee shall follow the approved scales of punishment. The Principal shall take necessary action in case of erring students based on the recommendations of the committee.

Eligibility for award of the degree

A student shall be eligible for the award of B.Tech. degree if he/she fulfills the following conditions

1. Register/successfully completes all the courses prescribed within the stipulated period.
2. His/her CGPA shall be greater than 5.0 (Minimum requirement for pass)
3. No disciplinary action is pending against him/her
4. Has paid the prescribed fee for all the years of study.

Academic calendar

The dates of all important events, such as commencement of class work, examinations, vacations, etc., during the academic year shall be specified in the Academic Calendar of the Institute by the Academic Planning and Infrastructure Committee (AQAC).

Amendments to regulations

The Institute may, from time to time, revise, amend, or change the Regulations, Scheme of Examinations, Syllabi and the same shall be applicable to all the students with effect from the dates notified.

General

1. These regulations shall be read as a whole for the purpose of any interpretation.
2. In the case of any ambiguity in the interpretation of the above rules, the decision of the Chairman, Academic Council is final.

Transitory Regulations

1. After readmission, the student is required to study the courses as prescribed in the new regulations for the re-admitted program at that level and thereafter.
2. If the student has already passed any courses of readmitted program in the earlier regulation/semester of study, such courses are exempted.
3. The courses that are not done in the earlier regulations/semester as compared with readmitted program need to be cleared after readmission by appearing for the examinations conducted time to time under the new regulations.
4. In general, after transition, course composition and number of credits/semester shall be balanced between old and new regulations on case to case basis.
5. In case the students who do not have option of acquiring required credits with the existing courses offered as per the curriculum under autonomy, credit balance can be achieved by clearing the additional courses offered. The additional courses that are offered can be of theory or laboratory courses and shall be offered during semester or summer break. Theory courses shall be offered with 2/4 credits and lab courses with 2 credits based on the contact hours.

About The Department:

The Department of Electronics and Communication Engineering was started in the year 2011 in School of Engineering, Gayatri Vidya Parishad College for Degree & PG Courses, Technical Campus. This department offers B.Tech. in Electronics and Communication Engineering course. Electronics and Communication Engineering is the branch of Engineering in which the students are trained in the science of practical and theoretical foundations of Electronics Devices & Circuits, Communication Engineering, Analog & Digital ICs, Microprocessors, Digital Signal Processing and Microwave & Fiber Optic Communication. The students are exposed to sophisticated laboratories and latest trends in Communication Engineering.

The Electronics and communication engineering program strives to graduate engineers of the highest quality and to conduct state-of-the-art research. The Electronics and Communication Engineering program dedicates itself to providing students with a set of skills, knowledge and attitudes that will permit its graduates to succeed and thrive as engineers and leaders. The Program strives to prepare its graduates to pursue life-long learning, serve the profession and meet intellectual, ethical and career challenges and to maintain a vital, state-of-the-art research enterprise to provide its students and faculty with opportunities to create, interpret, apply and disseminate knowledge.

Vision

"*To achieve academic excellence and make significant contribution to the society through quality education and research in the field of Electronics and Communication Engineering".*

Mission

"*To empower the students with quality education (M1), to achieve excellence in research to develop models that meet the needs of the society (M2) and to become team leaders with better communication skills, ethics and social responsibility (M3)".*

Program Educational Objectives

- **PEO1:** Provide strong foundations in the domain of Electronics and Communication Engineering technologies.
- **PEO2:** Graduates shall provide appropriate solutions for society and industry relevant problems by using current engineering techniques and tools.
- **PEO3:** Graduates shall be employable by training them in domain Knowledge, soft skills and leadership /managerial skills.
- **PEO4:** Engage in professional development through Communication skills, Team spirit, integrity, social responsibility, lifelong learning, Professional ethics and human values in career.

Program Specific Outcomes

1. The ability to apply fundamental knowledge of core subjects in design and development of electronic circuits and communication systems.
2. Competence in using electronic modern IT tools (Simulation software) for design and analysis of complex electronic system for research activities.
3. Adaptability to change in work environment, good interpersonal skills and professional ethics.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. Engineering knowledge: *Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.*

2. Problem analysis: *Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.*

3. Design/development of solutions*: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.*

4. Conduct investigations of complex problems: *Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.*

5. Modern tool usage: *Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.*

6. The engineer and society: *Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.*

7. Environment and sustainability: *Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.*

8. Ethics: *Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.*

9. Individual and team work: *Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.*

10. Communication: *Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.*

11. Project management and finance: *Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.*

12. Life-long learning: *Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.*

SCHEME OF INSTRUCTION & EXAMINATIONFOR **I/IV B.TECH**
(With effect from 2019-20 admitted batches)

I-SEMESTER

CODE NUMBER	COURSE	HOURS PER WEEK			MAXIMUM MARKS			Credits
		L	T	P	Ses.	Ext.	TOTAL	
1909101	Mathematics-I	3	0	0	30	70	100	3
1909102	Mathematics-II	3	0	0	30	70	100	3
1909104	Physics	3	1	0	30	70	100	4
1909106	Engineering Graphics	2	0	4	30	70	100	4
1909108	Professional Ethics & Moral Values	2	0	-	30	70	100	0
1909104P	Physics Lab	0	0	3	50	50	100	1.5
1909110P	Workshop	0	0	3	50	50	100	1.5
	Total	**13**	**1**	**10**	280	520	**700**	**17**

II-SEMESTER

CODE NUMBER	COURSE	HOURS PER WEEK			MAXIMUM MARKS			Credits
		L	T	P	Ses.	Ext.	TOTAL	
1909201	Mathematics-III	3	1	0	30	70	100	4
1985202	Basic Electronics Engineering	3	1	0	30	70	100	4
1909203	Chemistry	3	0	0	30	70	100	3
1909205	Computer Programming using C and Numerical Methods	3	1	0	30	70	100	4
1909207	Essence of Indian Traditional Knowledge	2	0	0	30	70	100	0
1909209	English	3	0	0	30	70	100	3
1909203P	Chemistry Lab	0	0	3	50	50	100	1.5
1909205P	Computer Programming using C and Numerical Methods Lab	0	0	3	50	50	100	1.5
	Total	**17**	**3**	**6**	280	520	**800**	**21**

1909101 MATHEMATICS-I

Credits	*Periods*			*Total Contact Hrs/Week*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
3	3	-	-	3	30	70	100

PREREQUISITE (s)

Knowledge of Trigonometry, Differentiation and Integration.

COURSE OBJECTIVES

- To impart the knowledge of partial differentiation involving two or more variables, Euler's theorem, change of variables, Jacobians, Geometrical interpretation.
- To apply the concept of partial differentiation in finding the errors and approximations, maxima and minima of two variables, to introduce the Lagrange's method of undetermined constants and Leibnitz's rule.
- To solve the ordinary differential equations of first order and first degree, Bernoulli's equation, exact differential equations, and equations reducible to exact equations.
- To get knowledge about the applications of differential equations of first order like orthogonal trajectories, simple electric circuits, law of natural growth and decay.
- To solve the linear differential equations of higher order and Simultaneous Differential Equations.

COURSE OUTCOMES

At the end of the course student will be able to

CO 1 Analyze problems involving two or more variables and their interpretation

CO 2 Apply the techniques of multivariable differential calculus to determine extrema and series expansions etc. of functions of several variables.

CO 3 Understand some basic definitions and terminology associated with differential equations and their solutions.

CO 4 Solve practical problems which give rise to differential equations of the first order.

CO 5 Develop the ability to solve linear differential equations of higher order.

Unit-I

Partial Differentiation:
Functions of two or more variables - Partial derivatives - Homogeneous functions – Euler's theorem - Total derivative. Change of variables – Jacobians.

Unit-II

Applications of Partial Differentiation:

Taylor's theorem for functions of two variables - Errors and approximations, Maxima and Minima of functions of two variables - Lagrange's method of undetermined multipliers - Leibnitz's rule.

Unit-III

Ordinary Differential Equations of First Order and First Degree:

Formation of the ordinary differential equations(ODEs) - Solution of an ordinary differential equation - Equations of the first order and first degree - Linear differential equation - Bernoulli's equation - Exact differential equations - Equations reducible to exact equations.

Unit-IV

Applications of Differential Equations of First Order:

Orthogonal Trajectories - Simple Electric (LR & CR) Circuits - Newton's Law of Cooling - Law of Natural growth and decay.

Unit-V

Linear Ordinary Differential Equations of Higher order:
Solutions of Linear Ordinary Differential Equations with Constant Coefficients - Rules for finding the complimentary function - Rules for finding the particular integral - Method of variation of parameters – Cauchy's Linear Equation – Legendre's Linear Equations and Simultaneous linear differential equations.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, Khanna Publishers, 43rd Edition.

REFERENCE BOOKS:

1. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, Inc.
2. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
3. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
4. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
5. Higher Engineering Mathematics by Dr. M.K.Venkataraman, National Publishing Co., Chennai.

1909102 MATHEMATICS-II

Credits	*Periods*			*Total Contact Hrs/Week*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
3	3	-	-	3	30	70	100

PREREQUISITE (s)

Knowledge of algebra of matrices, Trigonometry, Differentiation and Integration.

COURSE OBJECTIVES

The students are introduced with matrix algebra, Laplace transforms and Fourier series to enable them to use in their further studies.

- In matrix algebra, Consistency and inconsistency of system of equations by the use of rank of a matrix, Obtaining Eigen values and Eigen vectors of a square matrix and application of Cayley- Hamilton's theorem, Quadratic and canonical forms, Properties of complex matrices, Solution of system of equations by direct methods are thoroughly discussed.
- In Laplace transforms, Properties of Laplace transforms, Properties of Inverse Laplace transforms, Applications of Laplace transforms are presented.
- Whereas in Fourier Series, Euler's Formula, Conditions for a Fourier Expansion, Functions having points of discontinuity, Expansions of Odd or Even Functions, Half-Range Series, Parseval's Formula.

COURSE OUTCOMES

At the end of the course, student will be able to

CO 1 Solve the linear system of equations analytically and compute Eigen values and eigenvectors of a square matrix.
CO 2 Reduce the Quadratic Form to Canonical Form and find the nature of a Quadratic Form
CO 3 Evaluation of integrals by using Laplace Transforms.
CO 4 Appraise the Laplace transform technique and use it to solve various engineering problems.
CO 5 Find Fourier series for certain functions.

Unit-I

Matrices-I

Rank of a matrix- Echelon form, Normal Form - Solution of Linear System of Equations - Consistency of Linear System of Equations - Direct & Indirect Methods: Gauss elimination method, LU Factorization method, Eigen Values and Eigen Vectors of a Matrix - Cayley-Hamilton theorem - Inverse and Powers of a Matrix using Cayley-Hamilton's theorem and its applications.

Unit-II

Matrices-II

Diagonalization of a Matrix - Quadratic Forms - Reduction of Quadratic Form to Canonical Form - Nature of a Quadratic Form - Complex Matrices: Hermitian, Skew-Hermitian and Unitary Matrices and their Properties.

Unit-III

Laplace Transforms - I

Introduction - Existence Conditions - Transforms of Elementary Functions - Properties of Laplace Transforms - Laplace Transforms of Periodic Functions -Transforms of Derivatives - Transforms of Integrals - Multiplication by t^n - Division by t – Evaluation of integrals by Laplace Transforms.

Unit-IV

Laplace Transforms - II

Inverse Laplace Transform – Convolution Theorem –Applications of Laplace Transforms in solving Ordinary Differential Equations - Second Shifting Theorem - Laplace Transforms of Unit Step Function, Unit Impulse Function

Unit-V

Fourier Series

Introduction - Euler's Formulae - Conditions for a Fourier Expansion - Functions having points of discontinuity - Change of Interval - Odd and Even Functions - Expansions of Odd or Even Periodic Functions, Half-Range Series - Parseval's Formula.

TEXT BOOK:

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S.Grewal, Khanna Publishers, 43rd Edition.

REFERENCE BOOKS:

1. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, Inc.
2. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal, Lakshmi Publications.
3. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.

4. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.

1909104 PHYSICS

Credits	*Periods*			*Total Contact Hrs/Week.*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
4	3	1	-	4	30	70	100

PREREQUISITE (s)

Knowledge of theoretical and experimental Physics from +2 Level. Application of Physics theory and calculations to required course

COURSE OBJECTIVES

The fundamentals of sciences are essential to learn as the application of science in solving problems is technology. The physics curriculum is designed in such a way that all branches of engineering will study the basic fundamentals of technology from where it is originated. The course objectives are

1. Make the student familiar with the basic concepts, principles and laws in Waves and Oscillations, Electromagnetism, Wave Optics, Lasers and Fiber Optics, Super conductivity, Quantum Mechanics and Semiconductor Physics.
2. Make the student to realize the importance of fundamental concepts and make him learn how to apply these in solving problems.
3. To impart knowledge for the student how these basic concepts are related to engineering applications.

COURSE OUTCOMES

By the end of this course, student would have

CO1. Learnt the fundamental laws and their applications in Waves and Oscillations.
CO2. Gained the basic and origin of electromagnetism from electrostatics and magnetism and summarize the basic theories of electrostatics and electromagnetics to solve a variety of problems
CO3. Learnt the basics of physical optics and its corresponding applications.
CO4. Known how a laser light is different from ordinary light, how a laser light can be produced and its different applications in present day technology and the principles of Optical Fiber.
CO5. Learnt the concepts of modern physics and its applications in technology.

Unit-I

Waves and Oscillations (CO1)

Simple Harmonic Motion, Velocity, Acceleration and Energy of a Simple Harmonic Oscillator, Damped harmonic oscillator: heavy, critical and light damping, Coupled Oscillators, Longitudinal and Transverse waves, Reflection and Transmission of Waves, Electromagnetic Waves, The Spectrum of Electromagnetic Radiation.

Unit-II

Electromagnetism and Magnetic Properties of Materials (CO2)

Electric Flux, Gauss's law of Electrostatics in Free Space and its applications, Biot-Savart Law, Ampere's Law- Magnetic Induction on the axis of a circular current loop, Hall effect, Faraday's Law of Induction, Lenz's Law, Induced magnetic fields, Displacement Current, Maxwell's Equations in Integral Form (no derivation), Magnetization, Permeability and Susceptibility, Classification of magnetic materials, Ferromagnetism and ferromagnetic domains, Hysteresis, Applications of magnetic materials.

Unit-III

Wave Optics (CO3)

Interference: Principles of superposition – Young's Experiment – Coherence - Interference in thin films, Wedge shaped film, Newton's Rings, Michelson Interferometer and its applications.

Diffraction: Diffraction, differences between interference and diffraction, two classes of diffraction, Fraunhofer diffraction due to Single slit (Qualitative and quantitative treatment).

Polarisation: Polarisation by double refraction in uniaxial crystals, Nicol prism, Quarter and Half wave plate, circular and elliptical polarization and detection.

Unit-IV

Lasers and Fibre Optics & Super conductivity (CO4)

Lasers and Fibre Optics: Introduction, spontaneous and stimulated emissions, population inversions, pumping, Ruby laser, Gas laser (He-Ne Laser), Semiconductor laser, Applications of lasers. Optical Fibre and Total Internal Reflection, Acceptance Angle and cone of a fibre, Numerical aperture, Fibre optics in communications, Application of optical fibers.

Super conductivity: Super conductivity, Meissner Effect, Types of Superconductors and Applications of Superconductors.

Unit-V

Quantum Mechanics & Semiconductor Physics (CO5)

Quantum Mechanics: Introduction, Photoelectric effect, de-Broglie‘s hypothesis, Wave-particle duality, Davisson and Germer experiment, Heisenberg‘s Uncertainty principle, Born‘s interpretation of the wave function, Schrodinger‘s time independent wave equation, Particle in one dimensional box.

Semiconductor Physics: Energy bands in solids, Types of electronic materials: metals, semiconductors, and insulators. Intrinsic and Extrinsic semiconductors, Diode: p-n junction diode device structure, materials, characteristics, and figures of merit, LED: device structure, materials, characteristics, and figures of merit. Photo diode, Solar cell.

BOOKS RECOMMENDED

1. Physics by David Halliday and Robert Resnick – Part I and Part II - Wiley.
2. A textbook of Engineering Physics, Dr. M. N. Avadhanulu, Dr. P.G. Kshirsagar - S. Chand
3. Engineering Mechanics, 2nd ed.- M K Harbola, Cengage Learning
4. I. G. Main, ―Vibrations and waves in physics‘, 3rd Edn, Cambridge University Press

REFERENCE BOOKS

1. Engineering Physics by M.N. Avadhanulu & P.G. Kshirsagar, S Chand & Company Ltd.
2. Modern Engineering Physics by A.S. Vasudeva, S Chand & Company Ltd.
3. University Physics by Young & Freedman, Pearson Publications.

1909106 ENGINEERING GRAPHICS

Credits	*Periods*			*Total Contact Hrs/Week*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
4	2	-	4	6	30	70	100

Course Objectives

COB 1 The course is aimed at developing Basic Graphic skills.

COB 2 Develop Skills in Preparation of Basic Drawings

COB 3 Skills in Reading and Interpretation of Engineering Drawings

COURSE OUTCOMES

At the end of the course, the student will be able to:

CO 1	Graphically construct and understand, the importance of mathematical curves in Engineering applications
CO 2	Graphically visualize and construct orthographic projection of points and lines
CO 3	Visualize and construct different views of planes and solids in different orientations
CO 4	Construct and develop the sectioned surfaces of geometrical solids
CO 5	Interpret and draw the Orthographic and Isometric views of different solids.

SYLLABUS

UNIT-I

Introduction: Lines, Lettering and Dimensioning, Geometrical Constructions.

Curves: Construction of Conic sections, cycloids and involutes. Normal and tangent to the curves.

UNIT – II

Projections of Points and Straight Lines: Principal or Reference Planes, Projections of a point situated in any one of the four quadrants. Projections of straight lines parallel to both reference planes, perpendicular to one reference plane and parallel to other reference plane, inclined to one reference plane and parallel to the other reference plane. Projections of straight line inclined to both the reference planes. Traces.

UNIT – III

Projections of Planes: Projection of Perpendicular planes: Perpendicular to both reference planes, perpendicular to one reference plane and parallel to other reference plane and perpendicular to one reference plane and inclined to other reference plane. Projection of Oblique planes. Introduction to Auxiliary Planes.

Projections of Solids: Types of solids: Polyhedral and Solids of revolution. Projections of solids in simple positions: Axis perpendicular to horizontal plane, Axis perpendicular to vertical plane and Axis parallel to both the reference planes, Projection of Solids with axis inclined to one reference plane and parallel to other and axes inclined to both the reference planes.

UNIT – IV

Sections of Solids: Perpendicular and inclined section planes, Sectional views and True shape of section, Sections of solids (Prism, Pyramid, Cylinder and Cone) in simple position only.

Development of Surfaces: Methods of Development: Parallel line development and radial line development. Development of a cube, prism, cylinder, pyramid and cone.

UNIT – V

Isometric Views: Isometric projection, Isometric scale and Isometric view. Isometric view of Prisms, Pyramids, cylinder, cone, sphere and their combinations.

TEXT BOOK

Elementary Engineering Drawing by N.D. Bhatt, Charotar Publishing House.

REFERENCE BOOK

Engineering Graphics by K.L. Narayana and P. Kannaiah, Tata Mc-Graw Hill.

1909108 PROFESSIONAL ETHICS & MORAL VALUES

Credits	*Periods*			*Total Contact Hrs/Week.*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
0	2	-	-	2	30	70	100

Objectives of the Course:

- To inculcate Ethics and Moral Values into the youngminds.
- To develop moral responsibility and mould them as bestprofessionals.
- To create ethical vision and achieve harmony inlife.

Course outcomes:

CO 1- Student will exhibit and promote Universality of values and take ethical decisions at appropriate situations.

CO 2- student will become a better professional and will also conduct oneself according to the code of Ethics in their professional life.

CO 3- student will perform better in showcasing life skills and will also have a better perspective in balancing work and life.

CO 4- student will execute and promote professional Rights.

CO 5- student will be adapting oneself to the global professional scenario and still be able to maintain harmony in life.

Learning outcome: By the end of the course student should be able to understand the importance of ethics and values in life and society.

UNIT – I

Ethics and Moral Values: Ethics and Values, Ethical Vision, Ethical Decisions, **Moral Values** – Classification of Values, Universalityof Values.

UNIT – II

Engineering Ethics: Nature of Engineering Ethics, Profession and Professionalism, Professional Ethics, Code of Ethics, Sample Codes – IEEE, ASCE, ASME and CSI.

UNIT – III

Engineering as Social Experimentation: Engineering as social experimentation, Engineering Professionals – life skills, Engineers as Managers, Consultants and Leaders, Role of engineers in promoting ethical climate, balanced outlookon law.

UNIT – IV

Safety Social Responsibility and Rights: Safety and Risk, moral responsibility of engineers for safety, case studies – Bhopal gas tragedy, Chernobyl disaster, Fukushima Nuclear disaster, Professional rights, Gender discrimination, Sexual harassment at workplace.

UNIT – V

Global Issues: Globalization and MNCs, Environmental Ethics, Computer Ethics, Cyber Crimes, Ethical living, concept of Harmonyin life.

TEXT BOOKS

1. Govindharajan, M., Natarajan, S. and Senthil Kumar, V.S., Engineering Ethics, Prentice Hall of India, (PHI) Delhi,2004.
2. Subramainam, R., Professional Ethics, Oxford University Press, New Delhi,2013.

REFERENCES

1. Charles D, Fleddermann, "Engineering Ethics", Pearson / PHI, New Jersey 2004 (IndianReprint).

1909104P PHYSICS LAB

Credits	*Periods*			*Total Contact Hrs/Week.*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
1.5	-	-	3	3	50	50	100

PREREQUISITE (s)

Knowledge of theoretical and experimental Physics from +2 Level. Application of Physics theory and calculations to required course.

Course Objectives:

To train the student in acquiring skills, techniques of using instruments to observe the physical phenomena, to measure certain physical quantities and constants.

Course Outcomes:

By the end of the course the student will be able to

CO1. Experiment and evaluate basic principles of physics by observing and analyzing the data, plotting graphs and interpreting the results.

List of Laboratory Experiments:

1. Determination of Radius of Curvature of a given Convex Lens By forming Newton‘s Rings.
2. Determination of Wavelength of Spectral Lines in the Mercury Spectrum by Normal Incidence method.
3. Study the Intensity Variation of the Magnetic Field along axis of Current Carrying Circular Coil.
4. Determination of Cauchy‘s Constants of a Given Material of the Prism using Spectrometer.
5. Determination of Refractive Index of Ordinary ray μo and Extraordinary μe ray.
6. Determination of Thickness Given Paper Strip by Wedge Method.
7. Calibration of Low Range Voltmeter.
8. Calibration of Low Range Ammeter.
9. Determination of Magnetic Moment and Horizontal Component of Earth‘s Magnetic Field.
10. Lees Method - Coefficient of thermal Conductivity of a Bad Conductor.

11. Carey Foster‘s Bridge – Verification of laws of Resistance and Determination of Specific Resistance.
12. Melde‘s Apparatus – Frequency of electrically maintained Tuning Fork.
13. Photoelectric cell-Characteristics.
14. Planks Constants.
15. Laser- Diffraction.

1909110P WORKSHOP

Credits	*Periods*			*Total Contact Hrs/Week.*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
1.5	-	-	3	3	50	50	100

COURSE OUTCOMES

CO 1 Identify and use various tools required for performing operations in Carpentry for making various components

CO 2 Identify and use various tools required for performing operations in Fitting for making various components

CO 3 Identify and use various tools required for performing operations in Tinsmithy for making various components.

LIST OF EXPERIMENTS:

Minimum of three exercises have to be conducted from each trade.

Trade	Experiment (Job)
1. Carpentry	(a) Cross Lap Joint (b) Corner Dovetail Joint (c) Mortise and Tenon Joint (d) Bridle Joint
2. Fitting	(a) V-Fit (b) Square Fit (c) Half Round Fit (d) Dovetail Fit
3. Tin Smithy	(a) Taper Tray (b) Square Tray (c) 90^{o} Elbow (d) Funnel

REFERENCE

1. Elements of workshop technology, Vol.1 by S. K. and H. K. Choudary.
2. A course in Workshop Technology ,Vol.1 by B.S.Raghuwanshi, Danpat Rai

II-SEMESTER

CODE NUMBER	COURSE	HOURS PER WEEK			MAXIMUM MARKS			Credits
		L	T	P	Ses.	Ext.	TOTAL	
1909201	Mathematics-III	3	1	0	30	70	100	4
1985202	Basic Electronics Engineering	3	1	0	30	70	100	4
1909203	Chemistry	3	0	0	30	70	100	3
1909205	Computer Programming using C and Numerical Methods	3	1	0	30	70	100	4
1909207	Essence of Indian Traditional Knowledge	2	0	0	30	70	100	0
1909209	English	3	0	0	30	70	100	3
1909203P	Chemistry Lab	0	0	3	50	50	100	1.5
1909205P	Computer Programming using C and Numerical Methods Lab	0	0	3	50	50	100	1.5
	Total	**17**	**3**	**6**	280	520	**800**	**21**

1909201 MATHEMATICS-III

Credits	*Periods*			*Total Contact Hrs/Week*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
4	3	1	-	4	30	70	100

PREREQUISITE (s)

Knowledge of Complex numbers and it's properties, Trigonometry, Differentiation and Integration. How to sketch the graph of function.

COURSE OBJECTIVES

The main objective of Engineering Mathematics is to make the students familiar with mathematical thinking and realization of the background of their problems.

- Multiple Integral is a natural extension of a definite integral to a function of more than one real variable.
- The students should be able to evaluate Double and Triple Integrals, volumes of solids and area of curved surfaces.
- They should know the concepts of analyticity, Complex integration, and complex power series classification of singularities.
- The student should know the applications of the calculus of residues in the evaluation of real definite integrals.

COURSE OUTCOMES

At the end of the course, student will be able to

CO 1 Calculate the double and triple integral of a function of two or three variables.

CO 2 Apply the knowledge of multiple integral, to find areas, volumes and moment of inertia.

CO 3 Have deal with some elementary complex functions.

CO 4 Solve the complex integration of a function and find the singularities of a function

CO 5 Acquire the skill of contour integration to evaluate complicated real definite integrals via residue calculus.

Unit-I

Multiple Integral –I

Double Integrals - Change of Order of Integration - Double Integrals in Polar Coordinates. Triple Integrals - Change of Variables.

Unit-II

Multiple Integral -II

Area enclosed by plane curves - Volumes of solids - Calculation of mass - Center of gravity - Moment of inertia Beta Function - Gamma Function - Relation between Beta and Gamma Functions.

Unit-III

Complex Analysis -I

Introduction - Limit and continuity of f(z)- Derivative of f(z), Cauchy-Reimann Equations, Analytic Functions, Harmonic functions, Orthogonal systems. Introduction to Conformal transformation, Bilinear transformation w □ (az +b) / (cz □ d)

Unit-IV

Complex Analysis -II

Integration of complex functions, Cauchy's theorem, Cauchy's integral formula and their applications. Complex terms -Taylor's and Laurent's series (without proofs), Zero's and Singularities of analytic functions.

UNIT V

Complex Analysis -II

Residues and Calculations of residues, Cauchy's Residue Theorem, Evaluation of real definite integrals: Integration around unit circle, semi-circle.

TEXT BOOK

Scope and Treatment as in "Higher Engineering Mathematics", by Dr. B.S. Grewal, Khanna Publishers, 43rd Edition.

REFERENCE BOOKS

1. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, Inc.
2. A text book of Engineering Mathematics, by N.P. Bali and Dr. Manish Goyal; Lakshmi Publications.
3. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
4. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
5. Advanced Mathematics for Engineers″, by Chandrika Prasad, Pothishala Pvt. Ltd., Allahabad.

1985202 BASIC ELECTRONICS ENGINEERING

Credits	*Periods*			*Total Contact Hrs/Week*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
4	3	1	-	4	30	70	100

COURSE OBJECTIVES

- To give a comprehensive exposure to Passive Components and Circuit laws.
- Introduction to PN junction diode and special semiconductor diodes.
- To give a comprehensive exposure to Fundamentals of BJT.
- To give a comprehensive exposure to Fundamentals of FET and MOSFET.
- To describe Basic concepts of Power devices and Integrated Circuits.

COURSE OUTCOMES

At the end of the course the student will be able to

CO1: Understand the behavior of passive components and analyze electrical circuits by using circuit laws.

CO2: Understand the properties of conductors, insulators and semiconductor materials as well as characteristics and applications of different types of semiconductor diodes.

CO3: Understand the construction, operation and characteristics of BJT.

CO4: Understand the construction, operation and characteristics of JFET and MOSFET.

CO5: Understand the characteristics of power devices and basic concepts of integrated circuits.

Syllabus

UNIT I: Passive Components, Circuit laws and Basic meters:

Types of passive components, types of resistors, resistor color code, capacitors, concept of charging and discharging, types of capacitances, inductors, KCL, KVL, common meters (Volt Meter, Ammeter, Ohm Meter, Megger), CRO Construction and its working.

UNIT II: Fundamentals of diodes and special diodes (Elementary concepts):

Conductors, Insulators, Semi-Conductors, Intrinsic, Extrinsic semiconductors, conduction in semiconductors, V-I characteristics and applications of PN junction diode, Zener diode, Tunnel diode, PIN diode, Varactor diode, Schottky diode, LED and Photo diode.

UNIT III: Fundamentals of BJT (Elementary concepts)

Transistor construction, operation of the transistor, transistor configuration, input and output characteristics, applications of transistor in three configurations.

UNIT IV: Fundamentals of FET and MOSFET(Elementary concepts)

Comparison of BJT and JFET, JFET construction, operation of FET, JFET characteristics, JFET configurations and applications, concept of MOSFET, types of MOSFETs.

UNIT V: Basic concepts of Power devices and Integrated Circuits (ICs)

Construction, applications and features of UJT, SCR, DIAC and TRIAC, introduction to Integrated Circuits, classification of ICs, salient features of OP-AMP, characteristics of an ideal OP-AMP and applications, salient features of 555 timer and applications.

Text Books:

1. Electronic Devices and Circuits Theory by Robert L. Boylestad & Louis Nashelsky, PHI edition
2. Electronic Devices and Circuits by G.S.N.Raju, IK International, New Delhi.
3. Electronic Devices and Circuits by Sanjeev Gupta, Dhanapat Rai Publications.

Reference Books:

1. Electronic Devices and Circuits by Millman and Halkias, International Student edition, McGraw Hill publishers.
2. Basic Electronics by Bernard Grob, 4th edition, International Student edition, MC Graw Hill publishers.

1909203 CHEMISTRY

Credits	*Periods*			*Total Contact Hrs/Week*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
4	3	1	-	4	30	70	100

PREREQUISITE (s)

Knowledge of theoretical and experimental chemistry from +2 Level.

COURSE OBJECTIVES

1. To apply the basic knowledge of Chemistry to the Engineering Discipline.
2. To develop knowledge about water and its treatment for industrial and potable purposes.
3. To develop understanding in the areas of solid state chemistry, polymers, mechanism of corrosion of metals and corrosion control methods, fuels, lubricants and building materials, conducting polymers, bio-degradable polymers and fiber reinforced plastics and apply the knowledge for solving existing challenges faced in various engineering and societal areas.

COURSE OUTCOMES

CO.1: Analyze and determine the water quality and prescribe the remedial measures for domestic as well as industrial usage.

CO.2: Obtain the knowledge on design and development of materials with pre-required properties based on understanding the structure of solids.

CO.3: Student will differentiate the moulding techniques of plastic materials & classify the polymers and can apply to specific purposes.

CO.4: Students can able to design the metallic materials to prevent corrosion.

CO.5: Student will apply suitable lubrication mechanisms for various machinery parts.

CO.6: To understand the properties of engineering materials and their applications.

Chapter – 1: Water Chemistry (8 Hrs)
Sources of Water – Impurities and their influence of living systems – WHO Limits – Hardness and its Determination – Boiler Troubles and their removal – Water Softening Methods – Lime-Soda, Zeolite and Ion Exchange - Municipal Water Treatment-Break Point Chlorination – Desalination of Sea Water – Reverse Osmosis Method, Electro-dialysis. **(CO1)**

Chapter – 2: Solid State Chemistry (8 Hrs)
Solids - Classification of Solids – Types of Crystals – Fundamental Laws of Crystal Structure –X-Rays and Bragg's Law – Imperfections in Crystals – Band Theory of Solids – Chemistry of Semiconductors – Intrinsic, Extrinsic, Compound and Defects – Organic Semiconductors – Super Conductivity – Purification of Solids by Zone refining – Liquid Crystals. **(CO2)**

Chapter – 3: Polymers and Plastics (8 Hrs)
Polymers: Definition – Types of Polymerization (Addition & Condensation) – Mechanisms of Addition Polymerization – Radical and Ionic – Thermodynamics of Polymerization Process.

Plastics: Thermosetting and Thermoplastics – Effect of Polymer Structure on Properties of Cellulose Derivatives – Vinyl Resins – Nylon (6,6), Reinforced Plastics – Conducting Polymers. **(CO3)**

Chapter – 4: Corrosion (8 Hrs)
Corrosion: Origin and Theory – Types of Corrosion: Chemical and Electrochemical; Pitting, Inter granular, Waterline, Stress – Galvanic Series – Factors Effecting Corrosion.

Corrosion Controlling Methods: Protective Coatings: Metallic Coatings, Electroplating and Electroless Plating – Chemical conversion Coatings – Phosphate, Chromate, Anodized, Organic Coatings – Paints and Special Paints. **(CO4)**

Chapter – 5: Fuels and Lubricants (8 Hrs)
Solid Fuels: Wood and Coal, Ranking of Coal – Analysis (Proximate and Ultimate) Coke Manufacture – Otto Hoffmann's Process – Applications.

Liquid Fuels: Petroleum Refining – Motor Fuels – Petrol and Diesel Oil – Knocking – Octane number – Cetane Number.

Gaseous Fuels: Biogas, LPG and CNG – Characteristics – Applications.

Rocket Fuels: Propellants – Classification – Characteristics.

Lubricants: Classification – Mechanism – Properties of Lubricating Oils – Selection of Lubricants for Engineering Applications. **(CO5)**

Chapter 6: Building Materials(8 Hrs)

Portland Cement: Manufacture of Cement - Dry and Wet Processes – Chemical Composition of Cement - Setting and hardening of cement - Cement concrete - RCC - Decay of concrete and Protective Measures - Special Cements.

Refractories: Classifications - Properties - Engineering Applications.

Ceramics: Classification - Properties - Engineering Applications. **(CO6)**

Text Books

1. Engineering Chemistry – P.C. Jain and M. Jain, 16th Ed., Dhanpath Rai and Sons, New Delhi (2015).
2. A Text book of Engineering Chemistry, S.S. Dara, 12th Ed., S. Chand & Co. New Delhi (2010).

Reference Books

1. Engineering Chemistry, B.K. Sharma, Krishna Prakashan, 6th Ed., Meerut (2005).
2. Engineering Chemistry - B.L. Tembe, Kamaluddin and M.S. Krishnan (NPTEL).

1909105 COMPUTER PROGRAMMING WITH C AND NUMERICAL METHODS

Credits	*Periods*			*Total Contact Hrs/Week*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES

i. Aims to provide exposure to problem-solving through C programming.

ii. Aims to train the student to the basic concepts of the C-programming language & Numerical Methods.

COURSE OUTCOMES

CO1.Student will be able to write code using control structures & arrays

CO2. Student will be able to write code using strings & functions

CO3.Student will be able to write code using user defined data types

CO4.Student will be able to write code using Pointers for operations on files

CO5.Student will be able to write code for Numerical & Integral Methods

SYLLABUS

Unit – I

Introduction to C, Decision Making, Branching, Looping, Arrays

Basic structure of C program, Constants, Variables and data types, Operators and Expressions, Arithmetic Precedence and associativity, Type Conversions. Managing Input and Output Operations, Formatted Input, Formatted Output, Decision making with if statement, Simple if statement, The if…else statement, Nesting of if…else statement, the else if ladder, switch statement, the (?:) operator, the GOTO statement., The while statement, The do statement, The for statement, Jumps in Loops, One, Two-dimensional Arrays.

Unit – II

Functions & Strings

Definition of Functions, Return Values and their Types, Function Calls, Function Declaration, Category of Functions: No Arguments and no Return Values, Arguments but no Return Values, Arguments with Return Values, No Argument but Returns a Value, Functions that Return Multiple Values. Nesting of functions, recursion, passing arrays to functions, passing strings to functions, The scope, visibility and lifetime of variables, Character Arrays. Declaration and initialization of Strings, reading and writing of strings, String handling functions, Table of strings.

Unit – III

Structure and Unions

Defining a structure, declaring structure variables, accessing structure members, structure initialization, copying and comparing structure variables, arrays of structures, arrays within

structures, structures within structures, structures and functions and unions, size of structures and bit-fields- Program applications.

Unit – IV

Pointers & File handling

Accessing the address of a variable, declaring pointer variables, initializing of pointer variables, accessing variables using pointers, chain of pointers, pointer expressions, pointers and arrays, pointers and character strings, array of pointes, pointers as function arguments, functions returning pointers, pointers to functions, pointers to structures-Program Applications, File handling: Defining and opening a file, closing a file, Input/ Output operations on files, Error handling during I/O operations, random access to files and Command Line Arguments-Program Applications.

Unit – V

Numerical Methods & Integrations

Solutions of Algebraic and Transcendental Equations: Bisection Method, Newton Raphson Method. Interpolation: Newton's forward and backward Interpolation, Lagrange's Interpolation in unequal intervals, Trapezoidalrule, Simpson's 1/3 rule. Solutions of Ordinary First Order Differential Equations: Euler's Method, Modified Euler's Method and Runge-Kutta Method.

TEXT BOOKS

1. Programming in ANSI C, E Balagurusamy, 6th Edition. McGraw Hill Education (India) Private Limited.

2. Introduction to Numerical Methods, SS Sastry, Prentice Hall.

REFERENCE BOOKS:

1. Let Us C, YashwantKanetkar, BPB Publications, 5th Edition.

2. Computer Science, A structured programming approach using C", B.A.Forouzan and R.F.Gilberg, 3rd Edition, Thomson, 2007.

3. The C –Programming Language' B.W. Kernighan, Dennis M. Ritchie, PHI

4. Scientific Programming: C-Language, Algorithms and Models in Science, Luciano M. Barone (Author), Enzo Marinari (Author), Giovanni Organtini, World Scientific.

1909207 ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Credits	*Periods*			*Total Contact Hrs/Week*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
0	2	-	-	2	30	70	100

COURSE OBJECTIVES

1. To know the contributions of scientists for the development of society over a period of time.
2. To understand the Science and Technological developments that lead to human welfare.
3. To appreciate the Science and Technological contributions for the development of various sectors of the economy.
4. To identify the technological transfer versus economic progress of the countries.

COURSE OUTCOMES

CO1 - Demonstrate knowledge of broad concepts in the history of science, technology ranging over time, space and cultures and appreciate the science and technological contributions for the development of various sectors of the economy.

CO2 - Recognize the values of a wide range of methodologies, conceptual approaches and policies for the development of science and technology.

CO3 - Think independently and critically, using appropriate methodologiesand technological developments in the critical areas of science andtechnology that lead to human welfare.

CO4 - Proficiently use contemporary technologies.

UNIT-I

Historical Perspective of Science and Technology

Nature and Definitions; Roots of Science – In Ancient Period and Modern Period (During the British Period); Science and Society; Role of Scientist in the Society**.**

UNIT-II

Policies and Plans after Independence: Science and Technology Policy Resolutions

New Technology Fund; Technology Development (TIFAC); Programs aimed at Technological Self Reliance; Activities of Council of Scientific and Industrial Research**.**

UNIT-III

Science and Technological Developments in Critical Areas

Space – The Indian Space Program: India‘s Geostationary Satellite Services – INSAT System And INSAT Services; Defense Research and Technology – Research Coordination, Research efforts and Development of technologies and Spin-off technologies for civilian use; Nuclear Energy –Effects of a nuclear explosion and India‘s safety measures.

UNIT-IV

Impact of Science and Technology in Major Areas

Ocean Development: Objectives of Ocean Development, Biological and Mineral resources, Marine Research and Capacity Building; Biotechnology: Meaning, Biotechnology techniques-Bioreactors, Cell fusion, Cell or Tissue Culture, DNA Fingerprinting, Cloning, Artificial Insemination and Embryo Transfer Technology and Stem Cell Technology; Application of Biotechnology – Medicine, Biocatalysts, Food Biotechnology, Fuel and Fodder and Development of Biosensors**.**

UNIT-V

Technology Transfer and Development

Transfer of Technology – Types, Methods, Mechanisms, Process, Channels and Techniques; Appropriate Technology - Criteria and Selection of an Appropriate Technology; Barriers of Technological Change

Text Books:

1. Kalpana Rajaram, Science and Technology in India, Published and Distributed by Spectrum Books (P) Ltd., New Delhi-58. 2. Srinivasan, M., Management of Science and Technology (Problems & Prospects), East – West Press (P) Ltd., New Delhi.

1909209 ENGLISH

Credits	*Periods*			*Total Contact Hrs/Week*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
3	3	-	-	3	30	70	100

PREREQUISITE (s)

Knowledge of literature and grammar from +2 Levels. Application of syntactical principles and phonetic techniques to the required course.

COURSE OBJECTIVES

CO - 1

- Addressing explicit and implicit meanings of a text on current topics.
- Understanding the context.

- Learning new words and phrases.
- Using words and phrases in different contexts.

CO - 2

- Using the basic structure of a sentence.

- Applying relevant writing formats to create paragraphs, essays, letters, emails, reports and presentations.

- Retaining a logical flow while writing.
- Planning and executing an assignment creatively.
- Participating in discussions and influencing them and communicating ideas effectively.
- Examining self-attributes and identifying areas that require improvement: self-diagnosis and self-motivation.

CO - 3

- Analyzing a topic of discussion and relating it to time management skills.
- Participating in discussions and influencing them.
  Communicating ideas effectively.
  Presenting ideas coherently within a stipulatedtime.

CO - 4

- Examining self-attributes and identifying areas that require improvement: self-diagnosis and self-motivation.

- Adapting to a given situation and developing a functional approach to finding solutions: adaptability and problem solving.

- Understanding the importance of helping others: community services and enthusiasm.

CO – 5

- The student will learn to avoid redundancy will learn common abbreviations useful for competitive exams and will acquire basic proficiency in English including reading, comprehension and writing skills.

- The student will be motivated with a sense of purpose throughout the course by learning life skills.

DETAILED SYLLABUS

UNIT-1

Reading	:	On the conduct of life: William Hazlitt
Grammar	:	Prepositions
Vocabulary	:	Word Formation I: Introduction to Word Formation
Writing	:	Clauses and Sentences
Life skills	:	Values and Ethics -If: Rudyard Kipling

UNIT - 2

Reading	:	The Brook: Alfred Tennyson
Grammar	:	Articles
Vocabulary	:	Word Formation II: Root Words from other Languages
Writing	:	Punctuation
Life skills	:	Self-Improvement

How I Became a Public Speaker: George Bernard Shaw

UNIT-3

Reading	:	The Death Trap: Saki
Grammar	:	Noun-Pronoun Agreement, Subject- Verb Agreement
Vocabulary	:	Word Formation III: Prefixes and Suffixes
Writing	:	Principals of Good Writing

Life skills	:	Time Management: On saving Time: Seneca

UNIT-4

Reading	:	ChinduYellama
Grammar	:	Misplaced Modifiers
Vocabulary	:	Synonyms; Antonyms
Writing	:	Essay Writing
Life skills	:	Innovation - Muhammad Yunus

UNIT-5

Reading	:	Politics and the English Language: George Orwell
Grammar	:	Clichés; Redundancies
Vocabulary	:	Common Abbreviations
Writing	:	Writing a Summary
Life skills	:	Motivation - The Dancer with a White Parasol: Ranjana Dave

Prescribed Textbook

Language and Life: A Skills Approach Board of Editors, Orient Black Swan Publishers, India. 2018.

WRITING SKILLS:

Paragraph, Letters (Formal, Enquiry, Complaint) E-mail Writing, Dialogue Writing, Story Writing with hints.

Suggested Readings:

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan.2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
5. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

1909203P CHEMISTRY LAB

Credits	*Periods*			*Total Contact Hrs/Week*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
1.5	-	-	3	3	50	50	100

PREREQUISITE (s)

Knowledge of theoretical and experimental chemistry from +2 Level.

COURSE OBJECTIVES

1. To develop the fine skills of quantitative determination of various chemicalcomponents through titrimetric analysis
2. To prepare and use ion exchange/zeolite columns for the removal of hardness of water
3. To develop the skill of organic synthesis through the preparation of a polymer/drug

COURSE OUTCOMES

At the end of the course student will be able to

CO.1 Quantitatively determine the amount of various chemical species in solutions bytitrations.

CO.2 Conduct the quantitative determinations with accuracy

CO.3 Develop novel materials to be used as zeolite and prepare columns for removal of hardness of water

CO.4 Synthesize a polymer or a drug

List of Laboratory Experiments

1. Determination of sodium hydroxide with HCl (with Na_2CO_3 as primary standard)
2. Determination of alkalinity (carbonate and hydroxide) of water sample
3. Determination of Fe(II)/Mohr's salt by permanganometry
4. Determination of oxalic acid by permanganometry
5. Determination of chromium(VI) by Mohr's salt solution
6. Determination of zinc by EDTA method
7. Determination of hardness of water sample by EDTA method

8. Determination of chlorine in water by iodometric titration

9. Ion exchange/zeolite column for removal of hardness of water

10. Synthesis of a polymer (bakelite)/drug (aspirin)

REFERENCE BOOKS

- Vogel's Quantitative Chemical Analysis – V Edition – Longman
- Experiments in Applied Chemistry (For Engineering Students) – Sinita Rattan – S. K. Kataria & Sons, New Delhi.

1909205P COMPUTER PROGRAMMING WITH C AND NUMERICAL METHODS LAB

Credits	*Periods*			*Total Contact Hrs/Week*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
1.5	-	-	3	3	50	50	100

COURSE OUTCOMES

CO1.Ability to implement the programs using control structures & arrays
CO 2.Ability to implement the programs using strings & functions
CO 3.Ability to implement the programs using user defined data types
CO 4.Ability to implement the programs using pointers and operations on files
CO 5. Ability to implement the programs using numerical &integral methods

LIST OF EXPERIMENTS

1. a) Write a C program to find the roots of a quadratic equation
   b) Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +, -, *, /, % and use Switch statement.
   c) Write a C program to find the sum of individual digits of that number and also print and save it in reverse order.
2. Write a program to read x, y coordinates of 3 points and then calculate the area of a triangle formed by them and print the coordinates of the three points and the area of the triangle. What will be the output from your program if the three given points are in a straight line?
3. Write a program which generates 100 random real numbers in the range of 10.0 to 20.0 and sort them in descending order.
4. Write a function for transporting a square matrix in place (in place means that you are not allowed to have full temporary matrix).
5. Write a program to add two matrices with the dimension of the matrix specified by the user at the time of executing the program.
6. Write a program e.g. for getting a sub-string from a given position, copying one string to another, reversing a string and adding one string to another with and without using string manipulation functions.
7. Write a program to read the data of four students, each students has a name (string), roll number (string), age (integer), use an array of structure. Later find the average age of the students.
8. Write a program to demonstrate the difference between pointer to an array and array of pointers.
   a) Store your name, address and phone number in a 2-D character array and display the same using pointer notations.
   b) Use pointer to an array and array of pointers.

9. First use an editor to create a file with some integer numbers. Now write a program, which reads these numbers and determines their mean and standard deviation.
10. Implement bisection method to find the square root of a given number to a given accuracy.
11. Implement Newton Raphson Method to determine a root of polynomial equation.
12. Given a table of x and corresponding f(x) values, write a program which will determine f(x) value at an intermediate x value using Lagrange Interpolation.
13. Implement Simpson's $1/3^{rd}$ rule for numerical integration.
14. Implement Trapezoidal rule for numerical integration.
15. Write a program to solve a differential equation using Runge-Kutta Method.

II/IV B.TECH ECE (FOUR YEAR COURSE)
(With effect from 2019-2020 admitted batch onwards)

B.TECH. (ECE) 2nd YEAR I-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION									
CATEGORY	**COURSE CODE**	**COURSE**	**HOURS PER WEEK**			**MAXIMUM MARKS**			**CREDITS**
			THEORY	**TUTORIAL**	**LAB**	**EXAM**	**SESSIONALS**	**TOTAL**	
BSC	1909301	Mathematics IV	3	0	0	70	30	100	3
PCC	1985302	Network Theory and Analysis	3	0	0	70	30	100	3
ESC	1909303	Electrical Machines	3	0	0	70	30	100	3
PCC	1985304	Electronic Devices and Circuits	3	0	0	70	30	100	3
PCC	1985305	Signals & Systems	3	0	0	70	30	100	3
ESC	1909306	Data Structures	3	0	0	70	30	100	3
LC	1985302P	Network Theory and Machines Lab	0	0	3	50	50	100	1.5
LC	1985304P	Electronic Devices & Circuits Lab	0	0	3	50	50	100	1.5
		Total	**18**	0	**6**	**520**	**280**	**800**	21

1909301 MATHEMATICS-IV

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSES OBJECTIVES

In general, the students are introduced with a knowledge on - Vector Calculus, The Foundations-Logic and Proof, Advanced Counting Techniques and Relations to facilitate them to use these concepts in their core subjects.

COURSE OUTCOMES

After successful completion of this course, the students will be able to

CO1	**Evaluate** the multiple integrals and apply the concept to find areas, volumes, centre of mass and Gravity for cubes, sphere and rectangular parallelepiped.
CO2	**Evaluate** the line, surface and volume integrals and converting them from one to another.
CO3	**Rewrite** mathematical arguments using logical connectives and quantifiers and verify the validity of logical flow of arguments using propositional, predicate logic.
CO4	**Solve** problems using permutations and combinations.
CO5	**Determine** isomorphism of graphs and spanning tree of a given graph using BFS/DFS algorithms. Also determine minimal spanning tree of a given graph.

SYLLABUS

UNIT-I : VECTOR CALCULUS-1

Differentiation of vectors, curves in space, velocity and acceleration, relative velocity and relative acceleration, scalar and vector point functions, vector operator ∇ applied to scalar point functions- gradient, ∇ applied to vector point functions- divergence and curl. Physical interpretation of gradient, divergence and curl (i.e., ∇f, $\nabla.\overline{F}$, $\nabla\times\overline{F}$), Irrotational and Solenoidal fields, the relations obtained after ∇ applied twice to point functions, ∇ applied to products of two functions.

UNIT-II : VECTOR CALCULUS-2

Integration of vectors, line integral, circulation, work done, surface integral-flux, Green's theorem in the plane, Stoke's theorem, volume integral, Gauss Divergence theorem. Introduction of orthogonal curvilinear coordinates, cylindrical and spherical polar coordinates

UNIT-III : INTRODUCTION OF PARTIAL DIFFERENTIAL EQUATIONS

Formation of partial differential equations, solutions of partial differential equations- equations solvable by direct integration, linear equations of first order: Lagrange's Linear equation, non-linear equations of first order, Charpit's method.

Homogeneous linear equations with constant coefficients- rules for finding the complementary function, rules for finding the particular integral (working procedure), non- homogeneous linear equations.

UNIT-IV : APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Method of separation of variables, One dimensional wave equation-vibrations of a stretched string, one dimensional Heat flow equation, Two dimensional heat flow in steady state - solution of Laplace's equation in Cartesian and polar coordinates (two dimensional).

UNIT-V : INTEGRAL TRANSFORMS

Introduction, definition, Fourier integral, Sine and Cosine integrals, Complex form of Fourier integral, Fourier transform, Fourier Sine and Cosine transforms, Finite Fourier Sine and Cosine transforms, properties of Fourier transforms.

Convolution theorem for Fourier transforms, Parseval's identity for Fourier transforms, Fourier transforms of the derivatives of a function, simple applications to Boundary value problems.

TEXT BOOKS:

1. Dr. B.S. Grewal "Scope and treatment as in Higher Engineering Mathematics", 43rd Edition, Khanna Publishers

REFERENCE BOOKS:

1. N.P. Bali and Dr. Manish Goyal "A text book of Engineering Mathematics", Lakshmi Publications.
2. Kanti B.Dutta, "Mathematical Methods of Science & Engineering aided with MATLAB", Cengage Learning India Pvt. Ltd.,
3. Advanced Engineering Mathematics by Erwin Kreyszig.
4. B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Company.
5. H.K.Dass "Advanced Engineering Mathematics", S.Chand Company.
6. Higher Engineering Mathematics by Dr. M.K.Venkataraman.

1985302 NETWORK THEORY AND ANALYSIS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES

To make the students capable of

1. Analyzing any given linear DC and AC electrical network.
2. Determining the stability of any given linear electrical network

COURSE OUTCOMES

After successful completion of this course, the students will be able to

CO1	**Solve** linear DC network by applying Kirchhoff's laws, Network Theorems and Two-Port Parameters..
CO2	**Analyze** transient and steady-state behavior of linear RL, RC and RLC network (series and parallel) with DC excitation
CO3	**Analyze** steady-state behavior of a linear network excited by sinusoidal forcing function using concept of phasors.
CO4	**Evaluate** the stability of single and two port networks using pole- zero concepts.
CO5	**Evaluate** a given function for its positive realness.

SYLLABUS

UNIT-I : ANALYSIS OF DC CIRCUITS

Active elements, Passive elements, Reference directions for current and voltage, Kirchoffs Laws, Voltage and Current Division Nodal Analysis, Mesh analysis, Linearity and superposition, Thevenin's theorem and Norton's theorem, Reciprocity theorem, Z,Y,H-parameters.

UNIT-II : DC TRANSIENTS

Inductor, Capacitor, source free RL, RC and RLC response, Evaluation of Initial conditions, Application of unit-step function to RL, RC and RLC circuits, concepts of Natural, Forced and Complete response.

UNIT-III : SINUSOIDAL STEADY STATE ANALYSIS

The sinusoidal forcing function, Phasor Concept, Average and Effective value of Voltage and Current, Instantaneous and Average Power, Complex Power, Steady State Analysis using mesh and node analysis, Application of network theorems to AC circuits, resonance, Concept of Duality.

UNIT-IV : NETWORK FUNCTIONS

Network functions for single port and two port, Calculation of Network functions for Ladder and General Networks, Poles and Zeroes, Restriction of Poles and Zeroes for Driving point and Transfer functions, Time Domain Behavior from Pole Zero plot, Transfer Functions in terms of Y and Z functions, Scaling Network Functions.

UNIT-V : POSITIVE REAL FUNCTIONS

Positive real function and other properties, Herwitz polynomials, Computation of residues, even and Odd functions, Test for Positive Real Functions.

TEXTBOOKS:

1. William H.Hayt Jr. and Jack E. Kemmerley "Engineering Circuit Analysis", 8th Edition, McGraw Hill International Edition.
2. M. E. Van Valkenburg "Network Analysis", Revised 3rd Edition, PHI.
3. M. E. Van Valkenburg "Modern Network Synthesis", Wiley Eastern.

REFERENCE BOOKS:

1. A.Chakrabarthy, Dhanpat Rai and Company "Circuit theory Analysis and Synthesis" .
2. BL Theraja and AK Theraja "A Text Book of Electrical Technology Volume 1".
3. A. Sudhakar "Network Analysis & Synthesis", 3rd Edition, McGraw Hill.

1909303 ELECTRICAL MACHINES

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES

1. To learn about basic concepts and principles of direct current machine characteristics and its applications.
2. To impart the knowledge of basic concepts of transformer and its behavior and its applications.
3. To understand the behavior of 3-phase induction motor and analyze the working and its performance characteristics.
4. To impart the knowledge of synchronous machines and analyze the working under loaded conditions.
5. To learn about the basic knowledge of single phase motor and analyze the operation and its applications.

COURSE OUTCOMES

After successful completion of this course, the students will be able to

CO1 **Understand** the behavior of direct current machines and its operation under no load and loaded conditions.

CO2 **Analyze** basic concepts of transformer and its operation under loaded and unloaded conditions.

CO3 **Analyze** the working of 3-phase induction motor and its performance characteristics.

CO4 **Distinguish** the operation of synchronous machines under loaded and unloaded conditions.

CO5 **Explain** the concepts of single phase motors and its applications.

SYLLABUS

UNIT-I : DC MACHINES

Constructional Features, Function of Commutator, Induced EMF and Torque Expressions, Relationship Between Terminal Voltage and Induced EMF for Generator and Motoring Action, Different Types of Excitation and Performance Characteristics of Different Types of DC Machines, Starting and Speed Control of DC Motors, Losses and Efficiency, Efficiency by Direct Loading, Swinburne's Test and Hopkinson's Test, Applications of DC Machines.

UNIT-II : TRANSFORMERS

Constructional Details, EMF Equation, Equivalent Circuit, Voltage Regulation, Losses and Efficiency, Auto – Transformers, Instrument Transformers, Open/Short – Circuit Tests and Determination of Efficiency and Regulation.

UNIT-III : THREE – PHASE INDUCTION MACHINES

Construction, Rotating Magnetic Field and 3ph Induction Motor, Power Flow Diagram, Torque and Torque-slip Characteristics, Condition for Max. Torque and its Value, Starting and Speed Control, Losses and Efficiency, Equivalent Circuit and Circle Diagram of Induction Motor, No – Load and Rotor – Blocked Tests and Efficiency and Torque – Speed Characteristics.

UNIT-IV : THREE – PHASE SYNCHRONOUS MACHINES

Generation of EMF, Constructional Details, Induced EMF, Synchronous Generator on No – Load and Load, Synchronous Impedance and Voltage Regulation. V – Curves and Inverted V – Curves, Synchronous Condenser, Starting of Synchronous Motors, Applications of Synchronous Machines.

UNIT-V : SINGLE – PHASE MOTORS

Double Revolving Field Theory, Methods of Starting Single Phase Induction Motors, Universal Motor, Stepper Motor.

TEXT BOOKS:

1. S. K. Bhattacharya, “Electrical Machines”,TMH Publications N. Delhi.

2. S. M. Tiwari, A. S. Binsaroor, “A First Course in Electrical Engineering”, Wheeler Publication

REFERENCE BOOKS:

1. P.S Bimbra, “Electrical Machinery”, Khanna Publications, 7th Edition, 2009 V.K.Mehta,

2. B.L. Theraja and A.K. Thereja, “ Electrical Technology”, Volume-II, S.Chand Publishers.

1985304 ELECTRONIC DEVICES AND CIRCUITS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES

1. To understand operation of semiconductor devices
2. To apply concepts for the design of Regulators and Amplifiers

COURSE OUTCOMES

After successful completion of this course, the students will be able to

CO1 **Understand** the Characteristics of semiconductor materials and PN junction Diode..
CO2 **Design** regulated DC power supply using Rectifiers and Filters.
CO3 **Analyze** the characteristics of BJT and Design of biasing circuits for a BJT.
CO4 **Analyze** the characteristics of FET and Design of biasing circuits for a FET.
CO5 **Design** small signal Low frequency single stage amplifier using BJT.

SYLLABUS

UNIT-I : SEMICONDUCTOR DIODE

Intrinsic and Extrinsic Semiconductors, Doping, Doping Materials, Carrier Mobility, Conductivity, Diffusion and continuity equation, Hall – Effect and its Application.

Band structure of PN Junction, Volt – Amp. Characteristics, Temperature Dependence, Transition and Diffusion Capacitance of PN Junction.

UNIT-II : DIODE RECTIFIERS

Half-wave, Full-wave and Bridge Rectifiers with and without Filters, Ripple Factor and Regulation Characteristics.

UNIT-III : BIPOLAR JUNCTION TRANSISTOR

NPN and PNP junction Transistor, Current Flow across the Base Regions, Minority and Majority Carrier Profiles, Characteristics of CB, CE and CC Configurations. Comparison of CE, CB and CC Configurations. Junction Biasing for Saturation, Cutoff and Active Region, α and β Parameters and the relation between them, various Biasing circuits, stabilizations, thermal runaway, thermal stability, Transistor series and shunt voltage regulators.

UNIT-IV : JUNCTION FIELD EFFECT TRANSISTOR

JFET and its characteristics, Pinch off Voltage, Drain Saturation Current, JFET biasing, MOSFET – Enhancement and Depletion Modes, Small signal models of FET.

UNIT-V :SMALL SIGNAL–LOW FREQUENCY TRANSISTOR AMPLIFIER CIRCUITS

Transistor as an Amplifier, h – parameter model, Analysis of Transistor Amplifier Circuits using h – parameters. CB, CE and CC Amplifier configurations and performance factors. Analysis and design of Single Stage Amplifier, RC Coupled Amplifiers. Effects of Bypass and Coupling Capacitors. Frequency Response of CE Amplifier, Emitter – Follower, Cascaded Amplifier.

TEXT BOOKS:

1. Jacob Millman and D. Halkias," Integrated Electronics, Analog Digital Circuits and systems", 2nd Edition, McGraw Hill.

2. Jacob Millman and D. Halkias," Electronic Devices and Circuits Theory",5th Edition, Prentice Hall Publications.

REFERENCE BOOKS:

1. Sanjeev Gupta "Electronic Devices and Circuits", Dhanpat Rai Publications (P) Ltd, New Delhi 2000.
2. K. Venkat Rao, K. Rama Sudha "Electronic Devices and Circuits", McGraw Hill education, Edition-2015.

1985305 SIGNALS AND SYSTEMS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES

1. To understand the properties of CT and DT signals and systems
2. To understand spectral characteristics of signals using Fourier analysis.
3. To analyze Convolution, Correlation and Sampling process.
4. To understand Laplace transforms and Z Transforms for analyzing CT and DT systems

COURSE OUTCOMES

After successful completion of this course, the students will be able to

CO1	**Classify** the signals as Continuous time and Discrete time.
CO2	**Analyze** the spectral characteristics of signals using Fourier analysis.
CO3	**Classify** systems based on their properties and determine the response of LTI system using convolution.
CO4	**Apply** Laplace transform techniques to analyze continuous-time signals and systems
CO5	**Interpret** Sampling theorem and to apply Z transform techniques to analyze discrete-time signals and systems.

SYLLABUS

UNIT- I : INTRODUCTION TO SIGNALS AND SYSTEMS

Continuous –Time and Discrete –Time signals: The Impulse function, step function, ramp function, complex Exponential and Sinusoidal Signals, Classification of Signals, Basic operations on Signals, Continuous –Time and Discrete –Time Systems, Classification of Systems.

UNIT-II : FOURIER ANALYSIS OF SIGNALS

Introduction, Fourier Series Representation of continuous time Periodic Signals, convergence of the Fourier Series, Properties of continuous time Fourier Series, Fourier Series representation of discrete time periodic signals, Properties of discrete time Fourier Series, Representation of Aperiodic signals, The continuous time Fourier Transform, The Fourier Transform for periodic signals, Properties of the continuous time Fourier Transform, Systems

characterized by linear constant-coefficient differential equations. Discrete time Fourier Transform, Representation of Aperiodic signals discrete time Fourier Transform, Fourier Transform for periodic signals, Properties of the Discrete time Fourier Transform, Systems characterized by linear constant co-efficient difference equations.

UNIT-III : CONVOLUTION AND CORRELATION OF SIGNALS

System analysis by Convolution, Convolution as a superposition of impulse response, some Convolution relationships, Graphical interpretation of Convolution, Convolution of a function with a unit impulse, Signal comparison, Correlation and Convolution, Some properties of correlation functions.

UNIT-IV : LAPLACE TRANSFORM

Introduction, The Laplace transform, the region of convergence for Laplace transforms, The Inverse Laplace transform, Geometrical evaluation of the Laplace transform from the Pole-Zero plot, properties of Laplace transforms, the initial and Final value theorems, Analysis and characterization of LTI systems using the Laplace Transforms.

UNIT-V : SAMPLING THEOREM AND Z-TRANSFORM

Introduction, Reconstruction of a signal from its samples using interpolation, the effect of Under sampling: aliasing, Discrete time processing of continuous time signals, sampling of Discrete time signals. The Z Transform, The Inverse Z-Transform, Geometrical evaluation of the Z-Transform from the Pole-Zero plot, Properties of Z-Transform, The initial value and final value theorems, some common Z-transform pairs, Analysis and characterization of LTI systems using the Z-Transforms, System function algebra and block diagram representation, The unilateral Z-Transform.

TEXTBOOKS:

1. Alan V. Oppenheim, Alan S. Willsky and Ian T. Young, “Signals and Systems”, 5th Edition,PHI.
2. B. P. Lathi “Signals Systems and Communication”, 4th Edition , BS Publication

REFERENCE BOOKS:

1. Simon Haykin and Van Veen “Signals and Systems”, 2nd Edition, Wiley
2. Rodger E Ziemer,D Ronald Fannin, “Signals and Systems Continuous and Discrete” Pearson Publication.

1909306 DATA STRUCTURES

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	-	3	30	70	100

COURSE OBJECTIVES

1. To understand recursive algorithms and programming constructs of C language.
2. To learn linear data structures such as Stacks, Queues and Linked lists.
3. To learn Nonlinear data structures such as Trees and Graphs.
4. To understand and solve searching techniques.
5. To solve problems using linear and non-linear data structures.

COURSE OUTCOMES

After successful completion of this course, the students will be able to

CO1 **Understand** problem solving using C language and concept of Recursion.

CO2 **Develop** programs using structures, pointers and files in C**.**

CO3 **Explain** the implementation of linear data structures Stacks, Queues and Linked lists.

CO4 **Describe** how graphs are represented in memory and implementation of various non-linear data structures.

CO5 **Discuss** searching techniques and **Solve** real time problems using concepts of graphs.

SYLLABUS

UNIT-I : Revision of C Language Overview. **Arrays and Functions**: Organization and use of One Dimensional, Two Dimensional and Multi-Dimensional Arrays, Handling of Character Strings, String Operation, Concept of Function, Parameter Passing, Recursion.

UNIT-II : Structures, Pointers and Files: Definition of Structure and Union, Programming examples; Pointers, Pointer Expressions, Programming examples; File Operations, Preprocessor.

UNIT-III : Linear Data Structures: Stack Representation, Operations, Infix to Postfix conversion, Postfix Evaluation, Queue Representation, Operations, Circular Queue, List, Representation, Operations, Double Linked and Circular Lists.

UNIT-IV : Non-Linear Data Structures: Trees, Binary Tree Representation, Tree Transversals, Conversion of a General Tree to Binary Tree, Binary Search Trees, Representation of Graphs.

UNIT-V : Searching Techniques: Basic Search Techniques, Tree Searching Graphics, Linked Representation of Graphics, Graph Transversal and Spanning Trees.

TEXT BOOKS:

1. E. Balaguruswamy "Data Structures using C", Tata McGraw-Hill.
2. A. M. Tanenbaum "Data Structures Using C", Pearson publishers.

REFERENCE BOOKS:

1. Trembly and Sorenson "An Introduction to Data Structures With Applications".
2. Kerningham "The C – Programming Language".

1985302P NETWORK THEORY AND MACHINES LAB

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
1.5	-	-	3	3	50	50	100

COURSE OBJECTIVES

1. To verify the network theorems.
2. To study the calibration of wattmeter
3. To determine 2-port network parameters
4. To determine the load characteristics and no-load characteristics of D.C Machine.
5. To determine the performance of A.C Machines by indirect method of testing.

COURSE OUTCOMES

After successful completion of this course, the students will be able to

CO1	**Calibrate** a UPF wattmeter and verify Ohm's law and Kirchhoff's law for a given resistive network excited by a D.C. source.
CO2	**Verify** superposition, reciprocity and Thevenin's theorems for a given resistive network excited by a D.C. source**.**
CO3	**Determine** load characteristics and efficiency of a DC machine.
CO4	**Determine** the performance of A.C Machines by indirect method of testing (transformer, alternator, induction motor)
CO5	**Determine** the performance of D.C machine under no-load.

LIST OF EXPERIMENTS

I. NETWORK LAB EXPERIMENTS

1. Verification of Superposition Theorem
2. Verification of Reciprocity Theorem
3. Verification of Thevenin's Theorem
4. Calibration of UPF Wattmeter
5. Verification of Ohm's law
6. Verification of Kirchhoff's law

II. ELECTRICAL MACHINES LAB EXPERIMENTS

7. No load and blocked rotor tests on 3-phase squirrel cage Induction motor
8. Regulation of alternator by synchronous Impedance method
9. Open circuit test and short circuit test on 1-phase transformer
10. Swin burner's test
11. No load and load characteristics of self-excited Shunt generator

1985304P ELECTRONIC DEVICES AND CIRCUITS LAB

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
1.5	-	-	3	3	50	50	100

COURSE OBJECTIVES

1. To study basic electronic components
2. To observe characteristics of electronic devices

COURSE OUTCOMES

After successful completion of this course, the students will be able to

CO1	**Generate** sine, square and triangular waveforms with required frequency and amplitude using function generator.
CO2	**Analyze** the characteristics of different semi-conductor devices such as Diodes, transistors and FET.
CO3	**Design** half wave and full wave rectifiers with and without filters.

LIST OF EXPERIMENTS

1. Study of CRO and Applications.
2. V-I Characteristics of PN Junction Diode.
3. V-I Characteristics of Zener Diode and Zener regulator characteristics.
4. V-I Characteristics of LED and Photo diode.
5. Characteristics of Half-wave rectifier with and without filter.
6. Characteristics of Full-wave rectifier with and without filter.
7. Common Emitter characteristics of BJT, h-parameters.
8. Common Base characteristics of BJT, h-parameters.
9. Drain and transfer characteristics of JFET.
10. Frequency response of CE amplifier.

B.TECH. (ECE) 2nd YEAR II-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION									
CATEGORY	**COURSE CODE**	**COURSE**	**HOURS PER WEEK**			**MAXIMUM MARKS**			**CREDITS**
			THEORY	**TUTORIAL**	**LAB**	**EXAM**	**SESSIONALS**	**TOTAL**	
BSC	1909401	Mathematics V	3	0	0	70	30	100	3
PCC	1985402	Electromagnetic Field Theory & Transmission Lines	3	0	0	70	30	100	3
PCC	1985403	Analog Electronics Circuits	3	0	0	70	30	100	3
PCC	1985404	Probability Theory & Random Process	3	0	0	70	30	100	3
PCC	1985405	Switching Theory and Logic Design	3	0	0	70	30	100	3
MC	1909406	Environmental Studies	3	0	0	70	30	100	0
HSC	1909407	Universal Human Values	3	0	0	70	30	100	3
LC	1985403P	Analog Electronics & Circuits Lab with Simulation	0	0	3	50	50	100	1.5
LC	1985405P	Digital ICs and Verilog HDL Lab	0	0	3	50	50	100	1.5
		Total	**21**	0	**6**	**590**	**310**	**900**	21

1909401 MATHEMATICS- V

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	0	3	30	70	100

COURSE OBJECTIVES

The student should be able to use the concepts of difference equations, Z-transforms, Numerical differentiation and Sampling theory. The student should know the applications of the difference equations in the deflection of a loaded string. The student should be able to estimate unknown parameters of population and apply the tests of hypothesis. They should be able to evaluate Z-transform, inverse Z-transforms and apply these transforms to solve difference equations. The student should be able to know the techniques in the evaluation of numerical solution of ordinary differential equations.

COURSE OUTCOMES

After successful completion of this course, the students will be able to

CO1 **Discuss** and demonstrate difference equations to discrete systems.

CO2 **Evaluate** Z-Transforms and apply inverse Z-transforms to solve difference equations rising in Engineering Problems

CO3 Numerically **solve** linear system of equations and compute Eigen values and vectors of a square matrix.

CO4 **Calculate** correlation coefficient for the given bivariate data

CO5 **Prepare** Null and alternative hypothesis concerning two means, proportions and variables and test its validity based on random samples.

SYLLABUS

UNIT-I : DIFFERENCE EQUATIONS

Introduction - Formation of difference equations - Linear difference equations - Rules for finding complementary function - Rules for finding particular integral - simultaneous difference equations with constant coefficients - Applications to deflection of a loaded string.

UNIT-II : Z-TRANSFORMS

Introduction - Definition-Some standard Z-transforms-Linear Property - Damping Rule - Shifting U_n to the right and to the left-multiplication by n-Two basic theorems - Some useful Z-transforms - Inverse Z-transformation - Convolution theorem - Convergence of Z-transform - Two sided Z-transform - Evaluation of inverse Z-transform - Application to Difference equations.

UNIT-III : CORRELATION AND REGRESSION

Introduction - Definition of correlation - Bivariate population - Coefficient of correlation -Lines of regression - Standard error of estimate rank correlation.

UNIT-IV : NUMERICAL DIFFERENTIATION

Numerical differentiation - Forward and Backward differences - Formula for derivatives -Maxima and Minima of a tabulated function.

NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

Introduction - Picards method - Taylor's series method - Euler's method - Modified Euler's method - Runge-Kutta method - Predictor-corrector methods - Milne's method - Adams bash forth method - Simultaneous first order differential equations.

UNIT-V : SAMPLING THEORY-I

Introduction - Testing of hypothesis - Level of significance - Confidence limits - Test of significance of large samples - comparison of large samples- Test of significance for means of two large samples

SAMPLING THEORY-II

Student t-distribution - Significance test of sample mean - Significance test of difference between sample means - Chisquare test - Goodness of fit - F-distribution.

TEXT BOOKS:

1. Dr.B.S.Grewal "Scope and treatment as in Higher Engineering Mathematics",43rd Edition, Khanna Publications.

REFERENCE BOOKS:

1. Advanced Engineering Mathematics by Erwin Kreyszig.
2. A text book of Engineering Mathematics by N.P. Bali and Dr.Manish Goyal; Lakshmi publications.
3. Advanced Engineering Mathematics by H.K. Dass. S. Chand Company.
4. Higher Engineering Mathematics by B.V. Ramana, Tata Mc Graw Hill Company.
5. Engineering Mathematics series by Chandrica Prasad.

1985402 ELECTROMAGNETIC FIELD THEORY & TRANSMISSION LINES

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
4	3	1	-	3	30	70	100

COURSE OBJECTIVES

1. To introduce students with different coordinate systems.
2. To familiarize the students with the different concepts of electrostatic, magneto static and time varying electromagnetic systems.
3. To expose the students to the ideas of electromagnetic waves and structure of transmission line

COURSE OUTCOMES

After successful completion of this course, the students will be able to

CO1 **Describe** static electric and magnetic fields, their behavior in different media, associated laws and electromagnetic potentials.

CO2 **Utilize** integral and point form of Maxwell`s equations for solving the problems of electromagnetic field theory.

CO3 **Explain** the concept of Electromagnetic wave and its characteristics in different propagation media.

CO4 **Determine** the basic transmission line parameters and analyze transmission line systems using Smith Chart.

CO5 **Evaluate** the characteristics of Rectangular waveguides.

SYLLABUS

UNIT –I : ELECTROSTATICS

Coulomb’s Law, Electric Field Intensity – Fields due to Different Charge Distributions, Electric Flux Density, Gauss Law and Applications, Electric Potential, Maxwell’s Two Equations for Electrostatic Fields, Energy density, Convection and Conduction Currents, Continuity Equation, Relaxation Time, Poisson’s and Laplace’s Equations; Capacitance.

UNIT –II : MAGNETOSTATICS

Biot-Savart Law, Ampere's Circuital Law and Applications, Magnetic Flux Density, Maxwell's Two Equations for Magneto static Fields, Magnetic Scalar and Vector Potentials, Forces due to Magnetic Fields, Inductances and Magnetic Energy.

UNIT –III : MAXWELL'S EQUATIONS

Faraday's Law and Transformer emf, Inconsistency of Ampere's Law and Displacement Current Density, Maxwell's Equations in Different Final Forms and Word Statements. Conditions at a Boundary Surface: Dielectric-Dielectric and Dielectric-Conductor Interfaces. Related Problems.

UNIT –IV : ELECTROMAGNETIC WAVES

Wave Equations for Conducting and Perfect Dielectric Media, Uniform Plane Waves, Wave Propagation in Lossless and Conducting Media, Conductors & Dielectrics – Characterization, Polarization, Reflection and Refraction of Plane Waves – Normal and Oblique Incidences for both Perfect Conductor and Perfect Dielectrics, Brewster Angle, Critical Angle and Total Internal Reflection, Surface Impedance. Poynting Vector and Poynting Theorem

UNIT –V : TRANSMISSION LINES &WAVEGUIDES

Introduction to Transmission line equations, Primary & Secondary constants Expressions for Characteristic Impedance, Propagation Constant, Phase and Group Velocities, Losslessness /Low Loss Characterization, Distortion , Loading, SC and OC Lines, Reflection Coefficient, VSWR, $\lambda/8$, $\lambda/4$, $\lambda/2$ line impedance Transformations, Smith Chart – Configuration and Applications.

Rectangular Waveguides, electric and magnetic field patterns in TE10 and TE11 mode configuration, modes of TE wave in rectangular waveguide, field equations, impossibility of TEM wave propagation in waveguides, cutoff frequency of rectangular waveguide, propagation constant, wave impedance, phase velocity, group velocity, dominant mode and degenerate modes, related problems.

TEXTBOOKS

1. Gottapu SasibhushanaRao "Electromagnetic Field Theory and Transmission Lines",1st Ed.,Wiley India Pvt. Ltd., New Delhi, 2012.
2. Kraus and Fleisch "Electromagnetics with Applications", McGraw Hill, 1999.
3. G.S.N. Raju "Electromagnetic Field Theory and Transmission Lines", Pearson Education (Pvt., Ltd., New Delhi, 2005.
4. William H. Hayt, Jr. . John A. Buck "Engineering Electromagnetics", Sixth Edition, McGraw Hill.

REFERENCE BOOKS:

1. Matthew N.O. Sadiku "Elements of Electromagnetic", 3rd Edition, Oxford Univ. Press, 2001.

1985403 ANALOG ELECTRONIC CIRCUITS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES

1. To understand high frequency circuits and their analysis using hybrid model.
2. To understand the operation and analysis of multistage amplifier.
3. To understand the effects of negative feedback on amplifier circuits.
4. To understand the different RC and LC oscillator circuits to determine the frequency of oscillation.
5. To understand the operation of tuned amplifier and various types of power amplifier circuits.

COURSE OUTCOMES

After successful completion of this course, the students will be able to

CO1 **Analyze** high frequency BJT and FET amplifier using hybrid model.

CO2 **Analyze** frequency response characteristics of multistage amplifiers.

CO3 **Analyze** the feedback amplifiers using BJT.

CO4 **Design** low and high frequency oscillators.

CO5 **Analyze** power and tuned amplifiers

SYLLABUS

UNIT-1 : SMALL SIGNAL HIGH FREQUENCY TRANSISTOR AMPLIFIER MODELS:

BJT: Transistor at high frequencies, Hybrid-π common emitter transistor model, Hybrid-π conductances, Hybrid-π capacitances, validity of Hybrid-π model, determination of high frequency parameters in terms of low frequency parameters, CE short circuit current gain, current gain with resistive load, cut-off frequencies, frequency response and gain bandwidth product. **FET:** Analysis of common source and common drain amplifier circuits at high frequencies.

UNIT-II : MULTISTAGE AMPLIFIERS

BJT and FET RC Coupled Amplifiers – Frequency Response. Cascaded Amplifiers. Calculation of Bandwidth of Single and Multistage Amplifiers. Concept of Gain Bandwidth Product.

UNIT-III : FEEDBACK AMPLIFIERS

Concept of Feedback Amplifiers – Effect of Negative feedback on the amplifier Characteristics. Four Feedback Amplifier Topologies. Method of Analysis of Voltage Series, Current Series, Voltage Shunt and Current Shunt feedback Amplifiers.

UNIT-IV : SINUSOIDAL OSCILLATORS

Condition for oscillations –LC Oscillators – Hartley, Colpitts, Clapp and Tuned Collector Oscillators –Frequency and amplitude Stability of Oscillators – Crystal Oscillators – RC Oscillators -- RC Phase Shift and Weinbridge Oscillators.

UNIT-V : POWER AMPLIFIERS AND TUNED AMPLIFIERS

Classification of Power Amplifiers – Class A, Class B and Class AB power Amplifiers. Series Fed, Single Ended Transformer Coupled and Push Pull Class A and Class B Power Amplifiers. Cross-over Distortion in Pure Class B Power Amplifier, Class AB Power Amplifier – Complementary Push Pull Amplifier, Derating Factor – Heat Sinks.
Single Tuned and Stagger Tuned Amplifiers – Analysis – Double Tuned Amplifier – Bandwidth Calculation.

TEXT BOOKS:

1. Jacob Millman and D. Halkias "Integrated Electronics, Analog Digital Circuits and systems", McGraw Hill, 1972.
2. Salivahanan, N.Suresh Kumar and A.Vallava Raj "Electronic Devices and Circuit" 2nd Edition, TMH, 1998.
3. B.V.Rao, K.Raja Rajeswari et.al, "Electronic Circuit Analysis", Pearson Publishers.

REFERENCE BOOKS:

1. G.S.N. Raju "Electronic Devices and Circuits", IK International Publications, New Delhi, 2006.
2. G.K.Mithal "Electronic Devices and Circuits", 23rd Edition, Khanna Publishers, 2004.

1985404 PROBABILITY THEORY & RANDOM PROCESS

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	0	3	30	70	100

COURSE OBJECTIVES

1. To understand the fundamentals of Probability Theory and concept of random variables and probability density and distribution functions.
2. To know some important operations that can be performed on a random variable or multiple random variables.
3. To understand the mathematical concepts and analysis related to random processes and its basic applications to the signal processing in the communication system.
4. To be able to analyze the response of random inputs to linear time invariant (LTI) systems.

COURSE OUTCOMES

After successful completion of this course, the students will be able to

CO1 **Analyze** the axiomatic formulation of modern Probability Theory.

CO2 **Analyze** probability models and functions of random variable.

CO3 **Analyze** probability models and functions of multiple Random Variables.

CO4 **Investigate** the characteristics of random processes.

CO5 **Apply** the theory of random processes to analyze linear systems.

SYLLABUS

UNIT-I: PROBABILITY THEORY

Sample spaces, Events, Probability definition and Axioms, Mathematical model of experiments, Probability as relative frequency, Joint and conditional probability, Properties of joint probability and conditional probability, Total probability, Bayes' theorem, Independent events: Two events and multiple events, properties of independent events.

UNIT-II: RANDOM VARIABLES AND OPERATIONS ON ONE RANDOM VARIABLE

Random variable concept, Distribution function, Density function, Gaussian random variable, Conditional distribution and density function, Expectation, Moments, Functions that give moment, Transformations of a random variable.

UNIT-III: MULTIPLE RANDOM VARIABLES AND THEIR OPERATIONS

Vector random variables, Joint distribution and its properties, Joint density and its properties, Conditional distribution and density, statistical independence, Distribution and density of a sum of random variables, Central limit theorem. Expected values of a function of random variables: Joint moments about the Origin, joint central moments, Joint characteristic functions, Joint Gaussian random variables: Two random variables, n-random variables, properties of Gaussian random variables, Transformations of multiple random variables: One function, Multiple functions, Inequalities of Chebyshev and Schwartz.

UNIT-IV: RANDOM PROCESSES

The Random Process Concept, Classification of Processes, Deterministic and Nondeterministic Processes, Distribution and Density Functions, concept of Stationarity and Statistical Independence, First-Order Stationary Processes, Second- Order and Wide-Sense Stationarity, (N-Order) and Strict-Sense Stationarity, Time Averages and Ergodicity, Mean-Ergodic Processes, Autocorrelation Function and Its Properties, Cross-Correlation Function and Its Properties, Covariance Function and their properties, Weiner-Kinchine Theorem ,Gaussian Random Processes, Poisson Random Process.

UNIT-V: LINEAR SYSTEMS WITH RANDOM INPUTS

System Response – Convolution, Mean and Mean-squared Value of System Response, autocorrelation Function of Response, Cross-Correlation Functions of Input and Output, Power Density Spectrum of Response, Cross-Power Density Spectrums of Input and Output, Band pass, Band-Limited and Narrowband Processes.

TEXT BOOKS:

1. Athanasios Papoulis and S. Unnikrishna Pillai “Probability, Random Variables and Stochastic Processes”, 4th Edition, PHI, 2002.
2. Peyton Z. Peebles, Jr “Probability Theory and Random Signal Principles”, 4th edition Tata McGrew Hill Publishers,2002.
3. S. P. Eugene Xavier” Probability Theory and Random Processes”, S. Chand and Co. New Delhi, 1998(2nd Edition).

REFERENCE BOOKS:

1. Oliver C.Ibe “Fundamentals of Applied Probability and Radom processes”,Elsevier Publications, 2007.
2. B.Prabhakara Rao, T.S.R.Murthy “Probability theory and Stochastic Processes”, BS Publications, Hyderabad, 2012.

1985405 SWITCHING THEORY AND LOGIC DESIGN

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVE

1. To understand common forms of number representation in digital electronic circuits, to study various logic and switching devices and their realization.
2. To understand the concepts of basic theorems and K-map.
3. To Study the concept of Combinational circuits and Programmable Logic Devices.
4. To study the sequential logic circuits design both in synchronous and Asynchronous modes.
5. To impart the concepts of sequential circuits, enabling them to analyze sequential systems in terms of state machines.

COURSE OUTCOMES

After successful completion of this course, the students will be able to

CO1	**Convert** a number from one number system to other Number system and Implement logic circuits using basic Logic gates or universal Logic gates.
CO2	**Simplify** logic expressions using basic theorems, K-map and Tabular method.
CO3	**Design** Combinational logic circuits and also realize logic expressions using Multiplexers, Decoders and PLDs.
CO4	**Design** Sequential logic circuits using flip-flops.
CO5	**Design** Finite State machines.

SYLLABUS

UNIT-I : NUMBER SYSTEM AND CODES

Number systems, Base conversion methods, Complement of numbers, Codes: Binary, Non binary, Decimal, Alphanumeric, Gray. Logic Gates: AND, OR, NOT, NAND, NOR, XOR, XNOR and Universal Gates.

UNIT-II : MINIMIZATION OF BOOLEAN FUNCTIONS

Fundamental postulates of Boolean algebra, Basic theorems, Simplification of Boolean equations, Min terms, Max terms, Standard form of Boolean functions. Simplification of functions: Karnaugh map method and Quine-McClusky methods (up to six variables), Multiple Output functions, and incomplete specified functions.

UNIT-III : COMBINATIONAL LOGIC-CIRCUIT DESIGN

Introduction to Digital ICs. Logic design of combinational circuits: Adders and Subtractors: Binary, BCD, Excess -3 and Look –ahead-carry adder, Code converters, Multiplexers, De multiplexers, Encoders, Decoders and priority encoders, Realization of Boolean functions using multiplexers, De multiplexers and Decoders. Design of 4-bit comparator, Parity checker/Generator, Seven segment decoders, Hazards in combinational circuits, Hazard free realizations. Basics of PLDs: Basic structure of PROM, PAL, PLA, CPLD, FPGAs, Realization of Boolean functions with PLDs and their merits and demerits.

UNIT-IV : SEQUENTIAL CIRCUITS

Classification of sequential circuits, SR-latch, Gated latches, Flip flops: RS, JK, D, T and Master slave flip flops, Excitation tables, flip flop conversion from one type to another. Design of counters: Ripple counters, Synchronous counters, asynchronous counters, up-down counters, Johnson counter, ring counter. Design of registers: Buffer registers, Shift registers, Bi directional shift registers, Universal shift register.

UNIT-V : ANALYSIS AND DESIGN OF FINITE STATE MACHINES

Mealy and Moore Machines, State assignment, State tables, State Diagram, Equivalent states, Elimination of Redundant states, Determination of state equivalence, Reduction using implication table, ASM Chart.

TEXT BOOKS:

1. ZuiKohavi “Switching and finite Automatic theory”,3rd Edition, Tata McGrew Hill Publishers
2. Frederick.J.Hill and Gerald.R.Peterson “Introduction to Switching theory and logic design” .
3. A Anand Kumar “Switching theory and logic design”, PHI. 2016.

REFERENCE BOOKS:

1. R.P.Jain “Modern Digital Electronics”, 15th Reprint, , TMH.
2. Charles.H.Roth. and Larry L Kinney “Fundamentals of Logic Design”7th Edition.
3. Morris Mono “Digital Design”, 5th Edition, PHI.

1909406 ENVIRONMENTAL STUDIES

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
0	3	0	0	3	30	70	100

COURSE OBJECTIVE:

1. To Make the students get awareness on environment
2. To understand the importance of protecting natural resources, ecosystems for future generations
3. To know about the causes of pollution due to the day to day activities of human life
4. To get an idea about the measures for sustainable development

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1	**Learn** about the scope and importance of Environmental studies. The students understand about different kinds of ecosystems.
CO2	**Learn** about biodiversity and its conservation. They also learn about types of biodiversity, values of biodiversity and threats to biodiversity.
CO3	**Understand** about the types of natural resources and problems associated with them.
CO4	**Gain** knowledge about different types of environmental pollutions, their causes, effects and control measures.
CO5	**Gain** knowledge about characteristics of human population growth and its impact on environment. The students develop deep understanding about the environmental legislation.

SYLLABUS

UNIT-1: INTRODUCTION TO ENVIRONMENTAL STUDIES AND ECOSYSTEMS

Definition, Scope and importance of environmental studies. Concept of an Eco system, Biotic and Abiotic components of ecosystem, structure and function of an ecosystem. Food Chains, Food webs and Ecological Pyramids Forest ecosystem, Grassland ecosystem, Desert ecosystem, Pond ecosystem and Marine ecosystem.

UNIT-2: BIO-DIVERSITY AND ITS CONSERVATION

Introduction – Definition and types of biodiversity – value of biodiversity - India as mega diversity nation – Hot spots of biodiversity – Threats to biodiversity – Conservation methods of biodiversity – In-situ & Ex – situ methods of conservation - Concept of sustainable development.

UNIT-3: ENVIRONMENT AND NATURAL RESOURCES MANAGEMENT

Soil erosion and desertification, Effects of modern agriculture, fertilizer-pesticide problems, Forest Resources : Use and over-exploitation, Mining and dams – their effects on forest and tribal people, Water resources : Use and over-utilization of surface and ground water, Floods, droughts, Water logging and salinity, Dams – benefits and costs, Conflicts over water, Energy Resources : Energy needs, Renewable and non-renewable energy sources.

UNIT-4: ENVIRONMENTAL POLLUTION – CLIMATE CHANGE AND ENVIRONMENTAL PROBLEMS

Definition, causes, effects and control measures of (a) air pollution (b) water pollution (c) soil pollution (d) noise pollution. Global Warming – Acid Rain – Ozone depletion – Photochemical smog. Drinking water, Sanitation and public health, Effect of activities of the quality of environment Urbanization, transportation, Industrialization. Water scarcity and ground water depletion, Controversies on major dams –resettlement and rehabilitation of people problems and concerns

UNIT-5: HUMAN POPULATION AND ENVIRONMENTAL LEGISLATIONS

Population Explosion – characteristics of population explosion. Impact of population growth on Environment – Role of Information technology in Environment and Human Health, Environmental Ethics .Environmental acts: Water (Prevention and control of pollution) act, air (Prevention and control of pollution) act, Environmental Protection Act, Wild life protection act, Forest conservation act.

TEXT BOOK:

1. Kaushik – Kaushik, Anubha

REFERENCE BOOK:

1. Deswal & Deswal, Raja Gopal, Dharmaraj Publishers.

1909407 UNIVERSAL HUMAN VALUES

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	0	0	3	30	70	100

COURSE OBJECTIVE:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence.
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1	**Becom**e more aware of themselves, and their surroundings (family, society, nature);
CO2	They would **become** more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
CO3	They would have **better** critical ability.
CO4	They would also **become** sensitive to their commitment towards what they have understood (human values, human relationship and human society).
CO5	It is hoped that they would be able to **apply** what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

SYLLABUS

UNIT-1: COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of
   aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions 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-2: UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF!

1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
2. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
4. Understanding the characteristics and activities of 'I' and harmony in 'I'
5. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
6. Programs to ensure Sanyam and Health.

Include practice sessions 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-3: UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN-HUMAN RELATIONSHIP

1. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
2. Understanding the meaning of Trust; Difference between intention and competence
3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
4. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
5. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include practice sessions 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-4: UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self regulation in nature
3. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
4. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.,

UNIT-5: IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
4. 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.
5. Case studies of typical holistic technologies, management models and production systems
6. 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
7. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g. to discuss the conduct as an engineer or scientist etc.

TEXT BOOK:

1.R R Gaur, R Sangal, G P Bagaria "Human Values and Professional Ethics", Excel Books, New Delhi, 2010

REFERENCE BOOKS:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

1985403P ANALOG ELECTRONICS & CIRCUITS LAB WITH SIMULATION

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
1.5	0	0	3	3	50	50	100

COURSE OBJECTIVES

This laboratory course enables students to get practical experience in design, assembly, testing and evaluation of

1. Frequency response Characteristics of Single stage and Multi Stage Amplifiers'
2. Power Amplifiers
3. RC-Phase shift, Hartley, Colpitts and Crystal Oscillators

COURSE OUTCOMES

After successful completion of this course, the students will be able to

CO1 **Design** and test various types of oscillators.

CO2 **Design** and verify Frequency response characteristics of single stage, multi stage Amplifiers and Feedback Amplifiers.

CO3 **Simulate** and analyze the characteristics of Amplifiers

CO4 **Simulate** and analyze the characteristics of Oscillators.

LIST OF EXPERIMENTS

Hardware Experiments

1. Current series feedback Amplifier
2. Colpitts oscillator
3. Wein bridge oscillator
4. Class-B Push pull Amplifier
5. Common source FET Amplifier
6. Tuned Voltage Amplifier

Software Simulation

Tools used: NI MultiSim 2014

1. Common emitter and common source Amplifier
2. Two stage RC coupled Amplifier
3. RC Phase shift oscillator using transistors
4. Class-A Power Amplifier (transformer less)
5. Class-B complementary symmetry Amplifier
6. High frequency common base (BJT) and common gate (JFET) Amplifier

1985405P DIGITAL ICS AND VERILOG HDL LAB

Credits	Periods			Exam Hrs	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
1.5	0	0	3	3	50	50	100

COURSE OBJECTIVE

1. To learn how to write VHDL code for digital circuits and synthesizing and simulating the written code using Xilinx Vivado.
2. To learn how to design different digital circuits using digital IC's and verifying its functionality.

COURSE OUTCOMES

After successful completion of this course, the students will be able to

CO1 **Simulate** and synthesize combinational circuits using Xilinx vivado.

CO2 **Simulate** and synthesize sequential circuits using Xilinx vivado.

CO3 **Design** and observe the hardware functionality of combinational circuits using digital IC's.

CO4 **Design** and observe the hardware functionality of sequential circuits using digital IC's.

LIST OF EXPERIMENTS

HARDWARE EXPERIMENTS

1. Logic Gates
2. Realization of Gates by using universal building blocks
3. Realization of SOP and POS
4. Verification of Demorgan's Laws
5. Half Adder & Full adder
6. Function generation by using Decoders & Multiplexers.
7. Realization of Flip - flops
8. 4-bit Ripple counter
9. Mod-8 Synchronous counter.
10. 4 - bit Shift-register
11. Seven segment display

SIMULATION EXPERIMENTS

Tools used: Xilinx Vivado 2016 Edition

1. Simulation of Logic gates
2. Simulation of Full adder
3. Simulation of Multiplexer & De-Multiplexer
4. Simulation of Decoder & Encoder
5. Simulation of Flip flops (SR & D)
6. Simulation of Up-down counter& Shift register

III//IV B. TECH I SEM (5thSemester)

B.TECH. (ECE) 3RD YEAR I-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION									
CATEGORY	CODE NUMBER	COURSE	HOURS PER WEEK			MAXIMUM MARKS			CREDITS
			THEORY	TUTORIAL	LAB	EXAM	SESSIONALS	TOTAL	
PCC		Linear ICs & Applications	3	0	0	70	30	100	3
PCC		Control Systems	3	0	0	70	30	100	3
PCC		Antenna & Wave Propagation	3	0	0	70	30	100	3
PCC		Pulse and Digital Circuits	3	0	0	70	30	100	3
PCC		Analog and Digital Communications	3	0	0	70	30	100	3
PEC		Professional Elective-I	3	0	0	70	30	100	3
MC		MOOCs-I	0	0	3	100	0	100	1.5
PCC		Linear ICs and Pulse Circuits Lab	0	0	3	50	50	100	1.5
PCC		Analog and Digital Communications Lab	0	0	3	50	50	100	1.5
		Total	**18**	0	**09**	**620**	**280**	**900**	**22.5**

Professional Elective-I:
1. OOPS Through JAVA
2. Computer Network Engineering
3. Internet & Web Technology
4. Software Engineering

LINEAR ICs AND APPLICATIONS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To design and analyze different linear, non-linear and mathematical application circuits using operational amplifier.
2. To design and analyze different filters using operational Amplifier.
3. To introduce the operation and applications of timers and PLL.
4. To discuss the concept and applications of ADC and DAC

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Understand the characteristics of op-amp **(L2)**.

CO2: Analyze linear applications using op-amps **(L4)**.

CO3: Analyze non-linear applications and filters using op-amps **(L4)**.

CO4: Design Timers and PLL using functional ICs **(L4)**.

CO5: Design A/D and D/A converters using Op-amp **(L4).**

SYLLABUS

UNIT-I: OPERATIONAL AMPLIFIERS

Design Aspects of Monolithic Op-Amps, Ideal Characteristics, AC and DC Characteristics, Data sheet Specifications, Offset Voltages and Currents, Frequency Compensation Techniques, Measurement of Op-Amp Parameters.

UNIT-II: LINEAR APPLICATIONS OF OP-AMPS

Inverting and Non-Inverting Amplifiers, adder, Subtractor, Instrumentation Amplifiers, Voltage to Current and Current to Voltage Converters, Integrator, Differentiator, Oscillators, RC phase shift Oscillator, Wein-bridge Oscillator.

UNIT-III: NON-LINEAR APPLICATIONS OF OP-AMPS

SIGNAL CONDITIONING CIRCUITS: Rectifiers, Peak Detection, Logarithmic Amplifier, Wave form Generators, Multi vibrators, Square Wave Generators, Comparators and Schmitt trigger, Analog Multiplexers, Sample and Hold Circuit.

ACTIVE FILTERS: Low pass filter, High pass filter, Band pass filter, Band elimination filter, All-pass Filters, Higher Order Filters and their Comparison.

UNIT-IV: SPECIAL ICs

555 Timers, 556 Function Generator ICs and their Applications, Three Terminal IC Regulators, IC 1496 (Balanced Modulator), IC 565 PLL and its Applications, Function Generators.

UNIT-V: DIGITAL TO ANALOG AND ANALOG TO DIGITAL CONVERTERS

DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, Different types of ADCs-parallel Comparator type ADC, Counter type ADC, Successive approximation ADC and dual type ADC, DAC and ADC specifications.

TEXT BOOKS:

1. Ramakant A.Gayakward, "Op-Amps and Linear Integrated Circuits", 4th Edition, PHI, 2010.
2. Choudhary D. Roy, Shail B. Jain "Linear Integrated Circuits", 5th Edition New Age International Publishers.
3. G B Clayton, "Operational Amplifiers", 5th Edition, Elsevier science, 2003.

REFERENCES:

1. K.R. Botkar, "Integrated Circuits", 5th Edition, Khanna Publications 2010.
2. Jacob Millman, Arvin Grabel, "Microelectronics" 2nd Edition, McGraw Hill.

WEB RESOURCES:

1. http://nptel.ac.in/courses/117108038/
2.http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-01sc-introduction-to-electrical-engineering-and-computer-science-i-spring-2011/unit-3-circuits/op-amps/

CONTROL SYSTEMS

Credits	*Periods*			*Exam Hrs.*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
4	3	1	-	3	30	70	100

COURSE OBJECTIVES:

1. To introduce different types of system and identify a set of algebraic equations to represent and model a complicated system into a more simplified form to interpret different physical and mechanical systems in terms of electrical system to construct equivalent electrical models for analysis.
2. To employ time domain analysis and diagnose transient performance parameters of the system for standard input functions.
3. To formulate different types of analysis in frequency domain to explain the nature of stability of the system.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: **Analyze** Block Diagram systems and Signal Flow graphs modelling **(L4)**

CO2: Interpret different physical and mechanical systems in terms of electrical system to construct equivalent electrical models for analysis **(L2)**

CO3: Examine time domain analysis to predict and diagnose transient performance parameters of the system for standard input functions **(L3)**

CO4: Analyze stability of system by using RH Criteria and Root Locus. **(L4)**

CO5: Correlate different types of analysis in frequency domain to explain the nature of stability of the system**. (L4)**

SYLLABUS

UNIT-I: INTRODUCTION TO CONTROL SYSTEMS

Introduction to Mathematical Modeling of Physical Systems, Equations of Electrical Networks, Modeling of Mechanical Systems, Equations of Mechanical Systems, Analogous Systems.

UNIT-II: TRANSFER FUNCTIONS OF LINEAR SYSTEMS

Impulse Response of Linear Systems, Block Diagrams of Control Systems, Signal Flow Graphs (Simple Problems), Reduction Techniques for Complex Block Diagrams and Signal Flow Graphs (Simple Examples).

UNIT-III: TIME DOMAIN ANALYSIS

Time Response of First and Second Order Systems with Standard Input Signals, Steady State Error Constants, Effect of Derivative and Integral Control on Transient and Steady State Performance of Feedback Control Systems.

UNIT-IV: STABILITY ANALYSIS

Concepts of stability, Necessary conditions for Stability, Routh-Hurwitz Criterion, Relative Stability Analysis, the Concept and Construction of Root Loci, Analysis of Control Systems with Root Locus (Simple Problems to understand theory).

UNIT-V: FREQUENCY DOMAIN ANALYSIS AND STABILITY

Correlation between time and frequency response, Bode Plots, Polar Plots, Nyquist Stability Criterion, Constant M and N Circles.

TEXT BOOKS:

1. Control Systems Engineering, I. J. Nagrath and M. Gopal, Wiley Eastern Ltd.
2. Automatic Control Systems, Benjamin C. Kuo, PHI Publication (5^{th} Edition).

REFERENCES:

1. Modern Control Engineering, Ogata, PHI.
2. Control Systems Principles and Design, M.Gopal, McGrawHill.

WEB RESOURCES:

1. http://nptel.ac.in/courses/108101037/
2. http://ocw.mit.edu/courses/aeronautics-and-astronautics/16-30-feedback-control-systems-fall-2010/

ANTENNAS AND WAVE PROPAGATION

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To understand various parameters of Antenna and its principle of operation.
2. To understand point sources, array of two isotropic sources and Uniform Linear Array and to understand the principle of operation of V-antenna, rhombic antenna, helical antenna and their practical usage.
3. To understand the concept of Micro strip antennas, Reflector antennas, lens and horn antennas and their features, characteristics and design relations and to understand the concept of measurement of various antenna parameters.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Identify the importance of antenna parameters and mechanism of radiation **(L1)**.

CO2: Analyze the characteristics of wire and loop antennas **(L4)**.

CO3: Analyze radiation patterns of antenna arrays **(L4)**.

CO4: Design HF, VHF, UHF antennas and microwave antennas for given specifications. Illustrate techniques to measure antenna parameters **(L4)**.

CO5: Understand the concepts of radio wave propagation **(L2)**

SYLLABUS

UNIT-I: RADIATION AND ANTENNAS

Antenna definition and Functions, Network theorems, Properties of antennas, Antenna parameters, Polarization, Basic antenna elements, Radiation mechanism, Radiation fields of alternating current element, Radiated power and radiation resistance of current element, Radiation, induction and electrostatic fields, Hertzian dipole, Different current distributions in linear antennas, Radiation from half-wave dipole, Radiation from quarter wave monopole, Radiation characteristics of dipoles.

UNIT-II: ANALYSIS OF LINEAR ARRAYS

Directional characteristics of dipole antennas, Radiation pattern of alternating current element, Radiation pattern expressions of centre-fed vertical dipoles of finite length, Radiation patterns of centre-fed vertical dipoles, Radiation patterns of centre-fed horizontal dipoles, Radiation patterns of vertical dipoles, Two-element uniform array, Uniform linear arrays, Field strength of a uniform

linear array, First sidelobe ratio (SLR), Broadside and End-fire arrays, Patterns of array of non-isotropic radiators, Multiplication of patterns, Generalized expression for principle of pattern multiplication, Radiation pattern characteristics, Binomial arrays, Effect of earth on vertical patterns, Effect of earth on radiation resistance, Methods of excitation, Impedance matching techniques, Transmission loss between transmitting and receiving antennas - FRIIS formula, Antenna temperature and signal-to-noise ratio.

UNIT-III: HF, VHF AND UHF ANTENNAS

Introduction, Isotropic radiators, Directional antennas, Omni-directional antennas, Resonant antennas, Non-resonant antennas, LF antennas, Antennas for HF, VHF and UHF, Dipole arrays, Folded dipole, V-Antennas, Inverted V-antennas, Rhombic antenna, Yagi-Uda antenna, Log-periodic antennas, Loop antenna, Helical antenna, Whip antenna, Ferrite rod antenna, Turnstile antennas, Discone antennas, Notch antenna.

UNIT-IV: MICROWAVE ANTENNAS AND ANTENNA MEASUREMENTS

Introduction, Rod reflector, Plane reflector, Corner reflector, Parabolic reflector, Types of parabolic reflectors, Feed systems for parabolic reflectors, Shaped beam antennas, Horn antennas, Corrugated horns, Slot antennas, Impedance of a few typical dipoles, Slots in the walls of rectangular waveguides, Babinet's principle, Lens antennas, Microstrip antennas, Measurement ranges, Indoor and outdoor ranges, Antenna impedance measurements, Measurement of radiation resistance, Gain measurements, Measurement of antenna bandwidth, Directivity measurement, Measurement of sidelobe ratio, Measurement of radiation efficiency, Measurement of antenna aperture efficiency, Measurement of polarization of antenna, Phase measurement.

UNIT-V: WAVE PROPAGATION

Propagation characteristics of EM Waves, Factors involved in the propagation of radio waves, Ground wave propagation, Ground wave field strength by Maxwell's equations, Reflection of radio waves by the surface of the earth, Roughness of earth, Reflection factors of earth, Wave tilt of the ground wave, Tropospheric wave propagation, Atmospheric effects in space wave propagation, Duct propagation, Radio horizon, Troposcatter, Fading of EM waves in Troposphere, Line of sight (LOS), Ionospheric propagation, Characteristics of ionosphere, Refractive index of ionosphere, Phase and group velocities, Mechanism of Ionospheric propagation, reflection and refraction, Characteristic parameters of Ionospheric propagation, Sky wave field strength, Fading and diversity techniques, Faraday's rotation, Effect of earth's magnetic field.

TEXT BOOKS:

1. G.S.N. Raju, "Antennas and Wave Propagation", Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2007.

2. C.A. Balanis, “Antenna theory”, 3rd Edition, John Wiley & Sons, 2009.

REFERENCES:

1. E. C. Jordan and K. G. Balmain “EM Waves and Radiation Systems”, PHI – N. Delhi, 1997.

2. John D. Kraus, Antennas, 2nd Edition, McGraw Hill, 1988.

3. K.D.Prasad, Satya Prakashan, “Antennas and Wave Propagation”, Tech Publications, 3rd Edition, 2001.

WEB RESOURCES:

1. http://nptel.ac.in/courses/117107035/

PULSE AND DIGITAL CIRCUITS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To impart basic knowledge on linear non-linear wave shaping circuits.
2. To enable the students to know non-linear wave shaping circuits.
3. To make the students to design different types of Multivibrators using transistors
4. To make the students to acquire knowledge on basic concept of time base generators.
5. To make the students to know the working of voltage time base generators and sampling gates.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO 1: **Analyze** the linear wave shaping circuits **(L4)**.
CO 2: **Analyze** the non-linear wave shaping circuits **(L4)**.
CO 3: **Design** Bistable Multivibrator using transistors **(L4).**
CO 4: **Design** Multivibrator using Monostable and Astable circuits **(L4).**
CO 5: **Examine** the voltage time base generators, sampling gates and logic families **(L4)**.

SYLLABUS

UNIT-I: LINEAR WAVE SHAPING

High pass, low pass RC circuits, their response for sinusoidal, step, pulse, square, ramp and exponential inputs. RC network as differentiator and integrator, Attenuators, its application in CRO probe, RL and RLC circuits and their response for step input, Ringing circuit.

UNIT-II: **NON-LINEAR WAVE SHAPING**

Diode clippers, Transistor clippers, clipping at two independent levels, Transfer characteristics of clippers, Emitter coupled clipper; Clamping operation, clamping circuits using diode with different inputs, Clamping circuit theorem, practical clamping circuits, effect of diode characteristics on clamping voltage, Transfer characteristics of clampers.

UNIT-III: BISTABLE MULTIVIBRATOR

Analysis And Design of Fixed Bias, Self-Bias Bistable Multi Vibrator, Collector Catching Diodes, Commutating Capacitors, Triggering of Binary Circuits, Emitter Coupled Bistable Multivibrator (Schmitt Trigger).

UNIT-IV: MONOSTABLE MULTIVIBRATOR

Analysis and Design of Collector Coupled Monostable Multi vibrator, Triggering of Monostable Multivibrator, Applications of Monostable Multivibrator. Astable Multivibrator: Analysis and Design of Collector Coupled Astable Multivibrator, Application of Astable Multivibrator as a Voltage to Frequency Converter.

UNIT-V: VOLTAGE TIME BASE GENERATORS

Basic principles in Miller and Bootstrap time base generators, Transistor Miller time base generator, Transistor Bootstrap time base generator.

Sampling Gates: Basic Operating Principles of Sampling Gates, Diode Unidirectional Sampling Gate and Two-Diode Bi-Directional Sampling Gate, Four-Diode gates, Six- Diode Gates, Applications of Sampling Gates. Logic Families: Diode Logic, Transistor Logic, Diode-Transistor Logic, Transistor- Transistor Logic, Emitter Coupled Logic, CMOS Logic, Comparison of Logic Families.

TEXT BOOKS:

1. Pulse, Digital and Switching Waveforms, J. Millman and H. Taub, Mothiki, S. Prakash Rao, Mc Graw Hill, 2nd Edition, 2008.
2. Pulse and Digital Circuits, A. Anand Kumar, PHI, 2nd Edition, 2008.
3. Pulse & Digital Circuits, Venkata Rao.K, Ramasudha.K, Manmadha Rao G, Pearson, 1st Edition, 2010.

REFERENCES:

1. Solid State Pulse circuits, David A. Bell, PHI, 4th Edition, 2002.
2. Wave generation and shaping, L. Strauss, International Student Edition.
3. Digital Principles and Applications, Leach & Malvino, SIE, 5th Edition, 1994.

WEB LINKS:

1 https://www.smartzworld.com/notes/pdc-pulse-and-digital-circuits/
2 http://nptel.ac.in/courses/117103064/22
3 http://www.electronics-tutorials.ws/filter/filter_1.html
4 https://electronicspost.com/v-i-characteristics-of-pn-junction-diode/

ANALOG AND DIGITAL COMMUNICATIONS

Credits	*Periods*			*Exam Hrs.*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
4	3	1	-	3	30	70	100

COURSE OBJECTIVES:

To develop ability to analyze analog modulation systems.
To develop ability to analyze pulse analog and digital modulation systems.
To develop ability to analyze digital modulation systems.
To develop ability to analyze spread spectrum systems

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Analyze generation of amplitude modulated signals and their demodulation (L4).
CO2: Analyze generation of angle modulated signals and their demodulation (L4).
CO3: Understand transmission and reception of amplitude and angle modulated Signals (L2).
CO4: Analyze process of analog to digital conversion and pulse analog & digital modulation techniques (L4)
CO5: Analyze generation of digital modulated signals and their demodulation (L4), and understand principles of spread spectrum systems (L2)

SYLLABUS

UNIT-I: AMPLITUDE MODULATION SYSTEMS

Introduction to Communication Systems: Need for Modulation, Frequency Translation, Method of Frequency Translation, Amplitude Modulation, Modulation Index, Spectrum of AM Signal, Modulators and Demodulators (Diode detector), DSB-SC Signal and its Spectrum, Balanced Modulator, Synchronous Detectors, SSB Signal, SSB Generation Methods, Power Calculations in AM Systems, Application of AM Systems. Principle of Vestigial side band modulation. Noise: Source of Noise, External Noise, Internal Noise.

UNIT-II: ANGLE MODULATION SYSTEMS

Angle Modulation, Phase and Frequency Modulation and their Relationship, Phase and Frequency Deviation, Spectrum of an FM Signal, Bandwidth of Sinusoidally Modulated FM Signal, Effect of the Modulation Index on Bandwidth, Spectrum of Constant Bandwidth FM, Phasor Diagram for FM Signals, FM Generation: Parameter variation method, Indirect method of Frequency Modulation (Armstrong Method), Frequency Multiplication, PLL FM Demodulator, Pre – emphasis and De – emphasis, Comparison of FM and AM.

UNIT-III: TRANSMITTERS AND RECEIVERS

Classification of Radio Transmitters, Principle of a Radio Transmitters, AM and FM Transmitters, Radio receiver Types, AM Receivers, RF Section, Frequency Changing and Tracking, Intermediate Frequency and IF Amplifiers, Automatic Gain Control (AGC); FM Receivers, Amplitude Limiting, FM Demodulators, Ratio Detectors, ISB Receiver, Comparison with AM Receivers

UNIT-IV: PULSE MODULATION METHODS

Sampling and it's types, Quantization and it's types, Quantization Noise, Pulse Analog Modulation: PAM, PWM and PPM. Comparison of FDM and TDM. Pulse Code Modulation: PCM Generation and Reconstruction, Companding, DPCM, Adaptive DPCM, DM and Adaptive DM

UNIT-V: Digital Modulation Techniques and Spread Spectrum Modulation

ASK Modulator, Coherent ASK Detector, FSK- Modulator, Non Coherent FSK Detector, BPSK Modulator, Coherent BPSK Detection. Similarity of BFSK and BPSK, Principles of QPSK, M-ary PSK, M-ary, FSK, Minimum Shift Keying (MSK), Duo-binary Encoding.

Direct Sequence (DS) Spread Spectrum, Use of Spread Spectrum with Code Division, Multiple Access (CDMA), Ranging using DS Spread Spectrum, Frequency Hopping (FH) Spread Spectrum, Generation and Characteristics of PN Sequences

TEXT BOOKS:

1. An introduction to Analog and Digital Communications, Simon Haykin, John Wiley, 2005
2. Principles of Communication Systems, H. Taub , D. L. Schilling and Goutham Sahe, TMH 3rd edition, 2007.
3. Principle of Communication Systems, Simon Haykins (2nd Edition).
4. Electronic Communication Systems, G. Kennedy, McGraw Hill, 1977 (2nd Edition).

REFERENCES:

1. Modern Digital and Analog Communication Systems, B. P. Lathi (2nd Edition).
2. Communication systems, R.P.Singh and S.D.Sapre 2nd edition TMH 2008
3. Electronic Communications Modulation and Transmission, Robert J. Schoenbeck, PHI N. Delhi,1999.
4. Analog and Digital Communication – K. Sam Shanmugam, Willey, 2005.

PROFESSIONAL ELECTIVE-I

OOPS Through JAVA

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To understand the significance of object-orientation in designing a s/w.
2. To design object-oriented applications using C++ and Java.
3. To understand the importance of Unified Modeling Language in s/w design.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Understand the importance of object-oriented concepts, UML and C++ programming basics **(L2)**.

CO2: Design applications using inheritance and polymorphism in C++ **(L4)**.

CO3: Explain how exception handling, File I/O are handled in C++ **(L2)**.

CO4: Familiarize with Object-Orientation using Java **(L2)**.

CO5: Understand how to design applications using packages, interfaces and multithreading in Java **(L2).**

SYLLABUS

UNIT-I: OBJECT ORIENTED PARADIGM

Procedural Paradigms, Introductions to OOPs, Concept of Data Abstraction Encapsulation, Inheritance and Polymorphism, Introduction to U.M.L, Description of various U.M.L. Diagrams with examples. C++ Programming Basics: data types, declarations, expressions and operator precedence, functions, scope of variables.

UNIT-II: OBJECT ORIENTATION USING C++

Classes and objects, Constructors & Destructors, Operator overloading & type conversions. Inheritance: Derived classes, syntax of derived classes, making private members inheritable, single, multilevel, multiple, hierarchical, hybrid. Polymorphism: Pointers, virtual functions and polymorphism-pointers to objects, this pointer, pointers to derived classes, virtual and pure virtual functions.

UNIT-III: TEMPLATES, EXCEPTION HANDLING, CONSOLE I/O AND FILE I/O

Class templates, Function templates, member function templates, exception handling, managing console I/O operations, working with files.

UNIT-IV: INTRODUCTION TO JAVA

Introduction, Classes and Objects, Arrays, strings and Vectors, Exception Handling, Managing I/O files in Java.

UNIT-V: PACKAGES AND INTERFACE, AND MULTI-THREADING

Packages, Interfaces, creating, extending, stopping, blocking threads, thread states, thread methods, exceptions, priority in threads, synchronization, Runnable interface.

TEXT BOOKS:

1. Herbert Schildt and F. Naughton, "JAVA 2.0- Complete Reference".
2. Y.Daniel Liang, "Introduction to JAVA PROGRAMMING", PHI.
3. E. Balagurusamy, "Object oriented Programming using C++", PHI.
4. E. Balagurusamy, "Programming with JAVA- A primer", PHI
5. Grady Booch Etal, "The Unified Modeling Languages User Guide", Pearson Education.

REFERENCES:

1. N. Barkakati, "Object Oriented Programming in C++", PHI.
2. Robat Laphore, "Object Oriented Programming through C++".
3. Andrew Haigh, "Object Oriented Analysis and Design", Tata McgrawHill.

PROFESSIONAL ELECTIVE-I

COMPUTER NETWORK ENGINEERING

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. Describe how computer networks are organized with the concept of layered approach.
2. Explain the Physical layer, protocols and its functionalities.
3. Describe the Data link layer, protocols and its functionalities.
4. Explain the Network layer, protocols and its functionalities.
5. Summarize the functionalities of Transport layer and Application layer.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Describe the functions of each layer in OSI and TCP/IP model. **(L2)**

CO2: Explain the types of transmission media with real time applications**. (L2)**

CO3: Discuss the methods of error detection and correction. **(L2)**

CO4: Implement LAN using hubs, bridges and switches. **(L4)**

CO5: Analyze the protocols in Transport layer and application layer**. (L4)**

SYLLABUS

UNIT-I: INTRODUCTION

Uses of Computer Networks, Network Structure, Architectures, Services, Standardization, Functions of Various Network Layers, Network models.

UNIT-II: PHYSICAL LAYER

Theoretical Basis for Data Communication, Transmission Media, Analog and Digital Transmission, Transmission and Switching ISDN.

Medium Access Sub-layer: LAN, MAN, Protocol, ALOHA, IEEE Standard for 802 for LANs, Fiber Optic Networks, Satellite Networks.

UNIT-III: DATA LINK LAYER

Design Issues, Error Detection and Correction, Protocols and their Performance, Specifications and Examples.

UNIT-IV: NETWORK LAYER

Design Considerations, Difference between Gateway, Ethernet Switch, Router, Hub, Repeater, Congestion Control Internetworking and Examples, Details of IP addressing schemes, TCP/IP Protocol details.

UNIT –V: TRANSPORT AND APPLICATION LAYERS

The Transport Service, Elements of Transport Protocols, the Internet Transport Protocols; UDP, the Internet Transport Protocols; TCP.

The Application Layer**:** The Domain Name System, Electronic Mail, the World Wide Web.

TEXT BOOKS:

1. Data Communications and Networking by Behrouz A. Forouzan, 2nd Edition, Tata McGraw Hill.

REFERENCES:

1. Computer Networks, A. S. Tannenbaum, PHI – New Delhi.
2. Computer Networking Terminology Products and Standards, R. P. Suri and J. K. Jain, Tata McGraw Hill.

PROFESSIONAL ELECTIVE-I

INTERNET & WEB TECHNOLOGY

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To get familiar with basics of the Internet Programming.
2. To acquire knowledge and skills for creation of web site considering both client and server side programming
3. To gain ability to develop dynamic web applications

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO 1: Understand the various HTML tags, CSS to build static web pages and various JavaScript functions for dynamic web page development **(L2).**

CO 2: Apply XML, Java beans and Servlets to develop the dynamic web pages **(L3).**

CO 3: Understand and development of web pages using JSP functionalities **(L2).**

CO 4: Develop the web applications using JSP **(L6).**

CO 5: Develop the web applications using Database and understands the Struts frame work **(L6).**

SYLLABUS

UNIT I: HTML

Common tags List, Tables, images, forms, Frames; Cascading Style sheets; Java Script: - Introduction to Java Scripts, Objects in Java Script, Dynamic HTML with Java Script

UNIT-II: XML

XML: Document type definition, XML Schemas, Document Object model, Presenting XML, Using XML Processors: DOM and SAX.

Java Beans: Introduction to Java Beans, Advantages of Java Beans, BDK, Introspection, Using Bound properties, Bean Info Interface, Constrained properties Persistence, Customizes, Java Beans API, Introduction to EJB's

UNIT-III: WEB SERVERS AND SERVLETS

Tomcat web server, Introduction to Servelets: Lifecycle of a Serverlet, The Servelet API, The javax.servelet Package, Reading Servelet parameters, Reading Initialization parameters. The javax.servelet HTTP package, Handling Http Request & Responses, Using Cookies-Session Tracking, Security Issues

UNIT-IV: JSP APPLICATION DEVELOPMENT

Generating Dynamic Content, Using Scripting Elements Implicit JSP Objects, Conditional Processing – Displaying Values Using an Expression to Set an Attribute, Declaring Variables and Methods Error Handling and Debugging Sharing Data Between JSP pages, Requests, and Users Passing Control and Date between Pages – Sharing Session and Application Data – Memory Usage Considerations

UNIT-V: DATABASE ACCESS

Database Programming using JDBC, Studying Javax.sql.* package, Accessing a Database from Servlets & JSP Page , Application – Specific Database Actions, Deploying JAVA Beans in a JSP Page, Introduction to struts framework.

TEXT BOOKS:

1. Dietel and Nieto, "Internet and World Wide Web – How to program", Pearson Education Asia, 2008.
2. Deitel, Santry "Advanced Java™ 2 Platform How to Program", Pearson Publication, 2001.
3. Hans Bergsten, SPD O'Reilly, "Java Server Pages", SPD/O'Reilly Reprints

REFERENCES:

1. Steven Holzner "HTML Black Book: The Programmer's Complete HTML Reference Book", Coriolis Group, 2000.
2. Marty Hall and Larry Brown "Core Servelets and Java Server Pages Volume2: Core Technologies", Pearson Education.

PROFESSIONAL ELECTIVE-I

SOFTWARE ENGINEERING

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. Learn the importance of Object Oriented Software Engineering in Software Development.
2. Learn to develop problem statement and requirements elicitation.
3. Learn to design UML Diagrams.
4. Learn about analyzing, architectural models and design patterns.
5. Learn different testing methodologies.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Understand the concepts related to development of Software Engineering **(L2)**.

CO2: Understand the knowledge of requirements elicitation process **(L2)**.

CO3: Draw the UML Diagrams for improving communication between client and developer **(L3)**.

CO4: Study different architecture models and design patterns by performing analysis **(L1)**.

CO5: Study various testing strategies on the developed products and configuration management **(L1)**.

SYLLABUS

UNIT-I: SOFTWARE ENGINEERING

Software related problems, software engineering, concepts, and development activities

UNIT-II: PROJECT ORGANIZATION, COMMUNICATION AND REQUIREMENTS

Project Organization & communication concepts and their activities, Requirements elicitation & its activities and managing requirements elicitation

UNIT-III: MODELING

Concepts, Modeling with UML

UNIT-IV: ANALYSIS, SYSTEM DESIGN AND OBJECT DESIGN

Analysis overview, concepts, activities and managing analysis, Design overview, concepts, and activities, addressing design goals and managing system design, Object reuse, its activities & managing reuse, Interface specification concepts & its activities and Managing object design

UNIT-V: TESTING AND SOFTWARE CONFIGURATION MANAGEMENT

Testing concepts, activities and managing testing, Configuration Management overview, concepts, activities and managing configuration management

TEXT BOOKS:

1. Bernd Bruegge and Allen H. Dutoit, "Object-Oriented Software Engineering: Using UML, Patterns and Java", 2nd Edition, Pearson Education Asia.

REFERENCES:

1. Timothy C. Lethbridge and Robert Laganiere, "Object-Oriented Software Engineering: Practical software development using UML and Java", McGraw-Hill Higher education.

2. Stephen R Schach, "An Introduction to Object Oriented Systems Analysis and Design with UML and the Unified Process", Tata McGraw-Hill

LINEAR ICs & PULSE CIRCUITS LAB

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
1.5	-	-	3	3	50	50	100

COURSE OBJECTIVES:

The main objectives of this course is

1.To know the Linear and Non Linear characteristics of Wave shaping circuits

2.To Measure the Parameters of Op-Amp

3.To Measure the frequency response of Active Filters

4.To check the working of Op-Amp in different applications

COURSE OUTCOMES:

After successful completion of the Course students able to

CO1: **Understand** the linear and Non Linear behavior of the wave shaping circuits

CO2: Analyze and design the frequency response of active filters

CO3: Measure the parameters of Op Amp

CO4: Demonstrate the applications of Op Amp and special IC circuits

LIST OF EXPERIMENTS

1. Linear wave shaping
2. Non-linear wave shaping
3. UJT as a Relaxation oscillator
4. Measurement of parameters of Op-amp
5. Schmitt trigger
6. Frequency response of Active filters
7. Op-amp as Wave form generator
8. IC-555 as an Astable Multivibrator
9. Study of Instrumentation Amplifier
10. Voltage regulator using IC-723
11. Monostable Multivibrator using IC-555

ANALOG AND DIGITAL COMMUNICATIONS LAB

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
1.5	-	-	3	3	50	50	100

COURSE OBJECTIVES:

1. To be able to observe different Analog Modulation and Demodulation techniques
2. To be able to determine frequency response of filters
3. To be able to perform Pulse Analog and Digital Modulation and Demodulation
4. To be able to observe different Digital Modulation and Demodulation techniques

COURSE OUT COMES:

At the end of the course the students will be able to

CO1: Analyze the operation of various Amplitude modulation and Demodulation Systems **(L4).**

CO2: Analyze various Filtering techniques **(L4).**

CO3: Implement various Pulse Modulation techniques **(L3)**

CO4: Demonstrate various Digital modulation & demodulation systems **(L3)**

LIST OF EXPERIMENTS

1. Generation and Detection of Amplitude Modulation Signal.
2. Generation and Detection of frequency Modulation signal.
3. SSB-SC modulation and demodulation.
4. Low Pass Filter using passive components.
5. High Pass Filter using passive components
6. Generation and Detection of PAM signal.
7. Generation and Detection of PWM signal.
8. Generation and Detection of PPM signal.
9. Verify the operation of PCM.
10. Generation and Detection of ASK signal.
11. Generation and Detection of FSK signal.
12. Generation and Detection of PSK signal.

III/IV BTECH- II SEM (6thSemester)

B.TECH. (ECE) 3RD YEAR II-SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION									
CATEGORY	CODE NUMBER	COURSE	HOURS PER WEEK			MAXIMUM MARKS			CREDITS
			THEORY	TUTORIAL	LAB	EXAM	SESSIONALS	TOTAL	
HSC		VLSI Design	3	0	0	70	30	100	3
PCC		Digital Signal Processing	3	0	0	70	30	100	3
PCC		Microprocessors & Microcontrollers	3	0	0	70	30	100	3
PEC		Professional Elective-II	3	0	0	70	30	100	3
PEC		Professional Elective-III	3	0	0	70	30	100	3
OEC		Open elective-I	3	0	0	70	30	100	3
PCC		Digital Signal Processing Lab	0	0	3	50	50	100	1.5
PCC		Microprocessors & Microcontrollers Lab	0	0	3	50	50	100	1.5
		Total	**18**	0	**6**	**520**	**280**	**800**	**21**

Professional Elective-I:
1. Digital Image Processing
2. Information Theory & Coding
3. Electronic Measurements and Instrumentation
4. EMI/EMC

Professional Elective-III:
1. Cellular and Mobile Communications
2. Smart Antenna Systems
3. Satellite Communication
4. Artificial Neural Networks

Open Elective-I :
1. Offered by Department of CSE
2. Offered by Department of Mechanical
3. Offered by Department of Civil Engineering
4. Offered by Department of MBA

VLSI DESIGN

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
4	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1.Give exposure to different steps involved in the fabrication of ICs.
2.Explain electrical properties of MOS and Bi-CMOS devices to analyze the behavior of inverters designed with various loads.
3.Give exposure to the design rules to be followed to draw the layout of any logic circuit.
4.Provide design concepts to design building blocks of data path of any system using gates.

COURSEOUTCOMES:

After successful completion of this course, the students will be able to

CO1: Acquire the knowledge about the fabrication of integrated circuits using MOS transistors **(L2)**.

CO2: Understand the electrical properties of MOS and Bi MOS circuits **(L2)**.

CO3: Design the layout and stick diagrams for MOS circuits and analyze the basic circuit concepts **(L4)**.

CO4: Analyze the scaling of MOSFET and structural design of combinational logic **(L4)**.

CO5: Design and analysis of subsystems **(L4)**.

SYLLABUS

UNIT-I: INTRODUCTION TO MOS TECHNOLOGY

Introduction to IC technology, MOS and related VLSI technology, NMOS, CMOS, BiCMOS Technologies, Thermal aspects of processing, Production of E beam marks.

UNIT-II: BASIC ELECTRICAL PROPERTIES OF MOS AND BICMOS CIRCUITS

I_{ds}–V_{ds} relationships, Aspects of MOS transistor threshold voltage, MOS Trans conductance and output conductance, MOS Transistor Figure of merit, The PMOS transistor and The NMOS inverter, Determination of pull– up to pull–down ratio for NMOS, inverter driven by another NMOS inverter, Alternative forms of pull up, The CMOS Inverter, Bi–CMOS Inverters.

UNIT-III: MOS CIRCUIT DESIGN PROCESSES

MOS layers, Stick diagrams, Design rules, and layout, 2 & 1.2 micro meter CMOS rules, Layout diagrams, Symbolic diagram. Basic Circuit concepts: Sheet resistance, Area capacitances of layers, Delay unit, Wiring Capacitances, Choice of layers.

UNIT-IV: SCALING OF MOS CIRCUITS

Scaling models, Scaling function for device parameters, Limitations of scaling. Sub system design and Layout: Architectural issues, Switch logic, Examples of Structural design (Combinational logic).

UNIT-V: SUB SYSTEM DESIGN PROCESS

Design of ALU subsystem, some commonly used storage elements, Aspects of design tools, Design for testability, Practical design for test guidelines, Built in self-test, CMOS project-an incrementer / decrementer, a comparator for two n-bit numbers. Ultra-fast systems, Technology development, MOSFET based design.

TEXT BOOKS:

1. Basic VLSI Design by Douglas A, Pucknell, Kamran Eshraghian, Prentice-Hall, l996, 3rd Edition.
2. Modern VLSI Design - Wayne Wolf, Pearson Education, 3rd Edition, 1997.
3. CMOS VLSI Design – A Circuits and Systems Perspective, Neil H. E Weste, David Harris, Ayan Banerjee, 3rd Ed, Pearson, 2009.

REFERENCES:

1. Mead, C.A and Conway, LA, "Introduction to VLSI Systems", Addison-Wesley, Reading, Massachusetts, l980.
2. Introduction to VLSI Systems: A Logic, Circuit and System Perspective – Ming-BO Lin, CRC Press, 2011

DIGITAL SIGNAL PROCESSING

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To understand the basic concepts and techniques for digital signal processing.
2. To familiarize with DSP concepts by studying the design of different digital filters and transform-domain processing.

COURSE OUTCOMES:

After successful completion of this course the student will be able to

CO1: Understand the representation of discrete time signals and systems.**(L2)**

CO2: Apply the Fourier transform for signal processing.**(L3)**

CO3: Design and implement IIR filters**.(L4)**

CO4: Design and implement FIR filters. **(L4)**

CO5: Study the applications of DSP**. (L1)**

SYLLABUS

UNIT-I: DISCRETE TIME SIGNALS and SYSTEMS, Applications of Z-Transforms

Discrete Time Signals Sequences, Linear Shift Invariant Systems, Stability and Causality, Linear Constants Coefficient Difference Equations, Frequency Domain Representation of Discrete Time Signals and Systems. System Functions H(z) of Digital Systems, Stability Analysis, Structure and Realization of Digital Filters.

UNIT-II: DISCRETE AND FAST FOURIER TRANSFORMS

Properties of the DFS, DFS Representation of Periodic Sequences, Properties of DFT, Convolution of Sequences. Radix 2 Decimation in Time (DIT) and Decimation in Frequency (DIF), FFT Algorithms, Inverse FFT.

UNIT-III: IIR FILTER DESIGN TECHNIQUES

Design of IIR Filters from Analog Filters, Analog Filters Approximations (Butterworth and Chebyshev Approximations), Frequency Transformations, General Considerations in Digital Filter Design, Bilinear Transformation Method, Step and Impulse Invariance Technique.

UNIT-IV: FIR FILTER DESIGN TECHNIQUES

Introduction to characteristics of linear phase FIR filters, Frequency response, Designing FIR filters using windowing methods: Rectangular window, Hanning window, Hamming window, Generalized Hamming window, Bartlett triangular window, Comparison of IIR and FIR filters

UNIT-V: APPLICATIONS

Applications of FFT in Spectrum Analysis and Filtering, Application of DSP in Speech Processing.

TEXT BOOKS:

1.Alan V. Oppenheim and Ronald W. Schafer: Digital Signal Processing, PHI.

2.John G.Proakis, Dimitris G.Manolakis, Digital Signal Processing, Principles, Algorithms and Applications , 4th Edition, Pearson Education PHI, 2013.

REFERENCES:

1. Sanjit K. Mitra, Digital Signal Processing "A – Computer Based Approach", Tata Mc Graw Hill.

2. Raddar and Rabiner, Application of Digital Signal Processing.

3. S. P. Eugene Xavier, Signals, Systems and Signal Processing, S. Chand and Co. Ltd.

4. Antonio, Analysis and Design of Digital Filters, Tata Mc Graw Hill.

WEB RESOURCES:

1. http://ww.nptel.iitm.ac.in
2. http://www.ece.cmu.edu/~ee791/
3. http://www.ee.umanitoba.ca/~moussavi/dsp815/LectureNotes/index.html
4. http://cobweb.ecn.purdue.edu/~ipollak/ee438/FALL04/notes/notes.html

MICROPROCESSORS & MICROCONTROLLERS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To provide an in-depth understanding of the operations of microprocessors, assembly language programming and interfacing.
2. To provide an in-depth understanding of the operations of microcontrollers and its applications.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Analyze the architecture of 8086 microprocessors. **(L4)**

CO2: Implement assembly language programs using instructions related to I/O, MEMORY and ISR. **(L3)**.

CO3: Illustrate how peripherals are interfaced with Microprocessor. **(L4)**

CO4: Differentiate 8086 processor and advanced processors. **(L4)**

CO5: Develop Small systems using Microcontrollers. **(L6)**

SYLLABUS

UNIT1-I: 8086/8088 MICROPROCESSORS

Register organization of 8086, Architecture, signal description of 8086, physical memory organization, general bus operation, I/O addressing capability, special purpose activities, Minimum mode, maximum mode of 8086 system and timings, the processor 8088, machine language instruction formats, addressing mode of 8086, instruction set off 8086,assembler directives and operators.

UNIT-II: PROGRAMMING WITH 8086 MICROPROCESSOR

Machine level programs, programming with an assembler, Assembly language programs, introduction to stack, stack structure of 8086/8088, interrupts and interrupt service routines, interrupt cycle of 8086, non-mask able interrupt and mask able interrupts, interrupt programming.

UNIT-III: BASIC AND SPECIAL PURPOSE PROGRAMMABLE PERIPHERALS AND THEIR INTERFACING WITH 8086/8088

Semiconductor memory interfacing, dynamic RAM interfacing, interfacing i/o ports, PIO 8255 modes of operation of 8255, interfacing to D/A and A/D converters, stepper motor interfacing, control of high power devices using 8255.Programmable interrupt controller 8259A, the keyboard /display controller8279, programmable communication interface 8251 USART, DMA Controller 8257.

UNIT-IV: ADVANCED MICRO PROCESSORS

Salient features of 80386DX, architecture and signal description of 80386, register organization of 80386 and addressing modes, data types of 80386, real address mode of 80386, protected mode of 80386, segmentation and Paging, virtual 8086 mode and enhanced mode. Instruction set of 80386. The coprocessor 80387.

UNIT-V: 8051 MICROCONTROLLER

Introduction to microcontrollers, 8051Microcontrollers, 8051pin description, connections, I/O ports and memory organization, MCS51addressing modes and instructions, assembly language programming tools.

PIC MICROCONTROLLERS AND ARM 32-BIT MICROCONTROLLER

Overview and features, PIC16Cx/7X instructions, interrupts in PIC 16C61/71, PIC 16F8XX Flash controllers, I/O ports and timers. Introduction to 16/32 Bit processors, ARM architecture and organization, ARM / Thumb programming model, ARM / Thumb instruction set.

TEXT BOOKS:

1. A.K.Ray, K.M.Bhurchandi ,"Advanced Microprocessors and Peripherals", Tata McGraw Hill Publications, 2000.
2. N.Sentil Kumar, M.Saravanan, S.Jeevananthan, "Microprocessors and Microcontrollers", Oxford University Press, 2010.

REFERENCES:

1. Douglas V Hall, "Microprocessors and Interfacing" Tata McGraw Hill Publications, 2005.
2. Ajay V Deshmukh," Microcontrollers", TATA McGraw Hill publications, 2012.
3. Krishna Kant, "Microprocessors and Microcontrollers", PHI Publications, 2010.
4. M. A. Mazidi, Sarmad Naimi "The AVR Microcontroller and Embedded Systems Using Assembly and C: Using Arduino Uno and Atmel Studio", 2nd Edition, Micro Digital Edition.

PROFESSIONAL ELECTIVE-II

DIGITAL IMAGE PROCESSING

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. Familiarize with basic concepts of digital image processing and different image transforms
2. Learn various image processing techniques like image enhancement, restoration, segmentation and compression
3. Understand color fundamentals and different color models
4. Understand morphological image processing and segmentation

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO 1: Analyze digital image capturing, basic relationships between pixels, mathematical tools and image transform of a binary /gray scale image. **(L4)**

CO 2: Analyze intensity transformation and filtering in spatial & frequency domain of grayscale image **(L4)**

CO 3: Explain restoration of a given noisy and/or degraded binary /gray scale image, and also its compression. **(L2)**

CO 4: Describe spatial filtering, segmentation and compression of color image belonging to models RGB/ CMY/ CMYK/ HSI. **(L2)**

CO 5: Analyze extraction and segmentation of image components in a given binary /gray scale image **(L4)**

SYLLABUS

UNIT-1: INTRODUCTION

Origins of digital image processing, uses digital image processing, fundamental steps in digital image processing, components of an image processing system, digital image fundamentals, Elements of visual percept ion, light and electromagnetic spectrum, imaging sensing and acquisition, image sampling and quantization. Some basic relationships between pixels, and introduction to the mathematical tools used in digital image processing. IMAGE RANSFORMS: Need for image transforms, Spatial Frequencies in image processing, introduction to Fourier transform, discrete Fourier transform, fast Fourier transform and its algorithm, properties of Fourier transform. Discrete sine transforms. Walsh Transform. Hadamard transform, Haar Transform. Slant transforms.

UNIT-2: INTENSITY TRANSFORMATIONS AND SPATIAL FILTERING

Background, Some basic intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, combining spatial enhancement methods, using fuzzy techniques for intensity transformations and spatial filtering.

FILTERING IN THE FREQUENCY DOMAIN: Preliminary concepts, Sampling and the Fourier transform of sampled functions, the discrete Fourier transform (DFT) of one variable, Extension to functions of two variables, some properties of the 2-D Discrete Fourier transform. The Basic of filtering in the frequency domain, image smoothing using frequency domain filters, Selective filtering, Implementation.

UNIT-3: IMAGE RESTORATION

A model of the image degradation /Restoration process, Noise models, restoration in the resence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Linear, Position–Invariant Degradations, Estimation the degradation function. Image Compression: Fundamentals, Some Basic Compression Methods: Huffman Coding, Golomb Coding, Arithmetic Coding, LZW Coding, Run-Length Coding and Symbol-Based Coding, LOSSY AND LOSSLESS predictive coding

UNIT-4: COLOUR IMAGE PROCESSING

Color fundamentals, color models, pseudo color image processing, basic of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression.

UNIT- 5: MORPHOLOGICAL IMAGE PROCESSING

Preliminaries Erosion and dilation, opening and closing, the Hit-or-miss transformation, some Basic Morphological algorithms, grey–scale morphology Image segmentation: Fundamentals, point, line, edge detection thresholding, region –based segmentation, segmentation using Morphological watersheds, basic knowledge of wavelet transformation

TEXT BOOKS:

1. R. C. Gonzalez and R. E. Woods, Digital Image Processing, 4th edition, Prentice Hall, 2018.
2. Anil K. Jain, “Fundamentals of Digital Image Processing”, Pearson Edit ion 1, 2015

REFERENCES:

1. R. C. Gonzalez, R. E. Woods and Steven L. Eddins, Digital Image Processing Using MATLAB, 2nd edit ion, Prentice Hall, 2009.
2. Jayaraman, S. Esakkirajan, and T. Veerakumar, Digital Image Processing, Tata McGraw- Hill. 2017.

INFORMATION THEORY AND CODING

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

The course is aimed at

1. Introducing the basics of information theory and channel capacity
2. Introduction to source and channel coding

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Compute information measure, channel capacity and perform source coding using different techniques **(L4)**

CO2: Calculate Shannon's limit by using orthogonal signals **(L4)**

CO3: Determine channel coding using different techniques **(L3)**

CO4: Determine channel coding using convolutional codes and also decoding **(L3)**

CO5: Investigate errors in codes and rectify them **(L6)**

SYLLABUS

UNIT-1:

Information measure and source coding, Entropy and Information rate, Coding for a discrete memory less source, Predictive coding for sources with memory, Information transmission on discrete channels, Mutual information, Discrete channel capacity, coding for the binary symmetric channel. Continuouschannels and system comparisons, continuous information, continuous channel capacity, ideal communication system, system comparisons.

UNIT-II:

Signal Space, Signals as Vectors, The Gram- Schmidt Procedure, Use of Orthogonal Signals to attain Shannon's limit, Rate Distortion Theory and Lossy Source Coding.

UNIT-III:

Rationale for coding, and types of codes, discrete memory less channels, linear block codes, Cyclic Codes.

UNIT-IV:

Convolution Codes, Maximum-likelihood Decoding of Convolution codes, Distance properties of convolution codes. Sequential Decoding of Convolution codes, Trellis codes. Applications of linear block codes, cyclic codes, convolution codes and Trellis Codes.

UNIT-V:

Algebraic codes, Burst error correcting, Parity check bit coding for error detection, Comparison of error rates in coded and uncoded transmission, Turbo Codes, Automatic repeat request.

TEXT BOOKS:

1) Communication Systems,3/e, by A.B. Carlson, Mc. Graw Hill Publishers(for topic1)
2) Digital Communications by Simon Haykin , John Wiley & Sons(for topic 2)
3) Principles of Communication Systems, Taub &Schilling, 2/e, TMH Publishers

REFERENCES:

1. Principles of Digital Communications, Signal representation, Detection, Estimation & Information
2. Coding by J Das, S.K. Mullick, P.K.Chatterjee, New Age Int. Ltd.

ELECTRONIC MEASUREMENTS AND INSTRUMENTATION

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To enable the student to select an Instrument that can be used based on the requirements. and to familiarize the students with the operation of AC, DC bridges.
2. To describe the usage and significance of Digital meters and instruments
3. To make the students to understand and use different signal generators and analyzers.
4. To impart the knowledge on various oscilloscopes to be used for different applications.
5. To enable the students to design various transducers for measurement of different physical quantities.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO 1: Explain the fundamental characteristics of different Instruments and Working of various AC, DC bridges. **(L2)**

CO2: Describe various digital meters and instruments to measure Electronic Parameters **(L2)**

CO 3: Understand the working of signal generators and analyzers **(L3).**

CO 4: Discuss the operation of various types of Transducers **(L3)**

CO 5: **Understand** measurement of various physical parameters **(L3)**

SYLLABUS

UNIT-I: BASIC MEASUREMENT CONCEPTS

Measurement systems, Static and dynamic characteristics, error analysis, moving coil meters, DC ammeters, DC voltmeters, Series type ohmmeter, Shunt type ohmmeter, multi meter , moving iron meters , Bridge measurements , Wheatstone, Kelvin, Guarded Wheatstone, Maxwell, Hay, Schering, Anderson and Wein bridge.

UNIT-II: BASIC ELECTRONIC MEASUREMENTS

AC voltmeters using rectifiers, True RMS responding voltmeter, Electronic multi meter, Comparison of analog and digital techniques , digital voltmeter, Ramp, Stair case ramp, Integrating, Continuous balance, Successive approximation.

UNIT-III: DIGITAL INSTRUMENTS

Frequency counters, measurement of frequency and time interval, extension of frequency range, measurement errors, Cathode ray oscilloscopes, block schematic,applications,special oscilloscopes, Storage and sampling oscilloscopes, wave analyzer, distortion analyzer, spectrum analyzer ,Q meters.

UNIT-IV: TRANSDUCERS

Introduction, Classification of transducers, Analog transducers, Resistive transducers, Potentiometers, Strain gauges, Types of strain gauges, Resistance strain gauges, Semiconductor strain gauges, Resistance thermometers, Thermometers, Application of Thermistors, Thermo-couple construction, Measurement of thermocouple output, Compensating circuits, Advantages and disadvantages of thermocouples, Variable inductance type transducer, Linear variable differential transformer, Rotary variable differential transformer, Capacitive transducers, Piezo-electric transducers, Digital transducers.

UNIT-V: MEASUREMENT OF PHYSICAL PARAMETERS

Flow Measurement, Displacement Meters, Liquid level Measurement, Measurement of Humidity and Moisture, Velocity, Pressure, High Pressure, Vacuum level, Temperature, Measurements

TEXT BOOKS:

1. Albert D. Helfrick and William D .Cooper – Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall of India, 2003.
2. A K Sawahney, Electrical And Electronics Measurement and Instrumentation, Dhanpat Rai, 2000

REFERENCES:

1. H S Kalsi, Electronic instrumentation, TMH, 1995.
2. Ernest O. Doebelin, Measurement Systems- Application and Design-Tata McGraw-Hill

EMI / EMC

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To provide information on various types EMI sources.
2. To study EMI on various test sites.
3. To study about various equipment to measure EMI
4. To study various types techniques for suppressing noise.
5. To study different standards of EMC designs.

COURSE OUTCOMES:

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

CO1: **Explain** about the history of EMI and their sources. (L2)

CO2: **Learn** about various types of Noise sources. (L1)

CO3: **Understand** various methods for suppression of EMI. (L2)

CO4: **Analyze** shielding Effectiveness and its determination. (L3)

CO5: **Design** simple circuits for EMC. (L3)

SYLLABUS

UNIT-I: Introduction, Natural and Nuclear sources of EMI / EMC

Electromagnetic environment, History, Concepts, Practical experiences and concerns, frequency spectrum conservations. An overview of EMI /EMC, Natural and Nuclear sources of EMI.

UNIT-II: EMI from apparatus, circuits and open area test sites

Electromagnetic emissions, noise from relays and switches, non-linearities in circuits, passive intermodulation, cross talk in transmission lines, transients in power supply lines, electromagnetic interference (EMI). Open area test sites and measurements.

UNIT-III: Radiated and conducted interference measurements and ESD

Anechoic chamber, TEM cell, GHTEM Cell, characterization of conduction currents/ voltages, conducted EM noise on power lines, conducted EMI from equipment, Immunity to conducted EMI detectors and measurements. ESD, Electrical fast transients / bursts, electrical surges.

UNIT-IV: Grounding, shielding, bonding and EMI filters

Principles and types of grounding, shielding and bonding, characterization of filters, power lines filter design.

UNIT-V: Cables, connectors, components and EMC standards

EMI suppression cables, EMC connectors, EMC gaskets, Isolation transformers, optoisolators, National / International EMC standards.

TEXT BOOKS:

1. Dr. V.P.Kodali - Engineering Electromagnetic Compatibility by IEEE Publication, Printed in India by S.Chand & Co. Ltd., New Delhi, 2000.
2. Electromagnetic Interference and Compatibility IMPACT series, IIT - Delhi, Modules 1-9.

REFERENCES:

1. C.R. Pal - Introduction to Electromagnetic Compatibility, John Wiley, 1992.

WEB RESOURCES:

1. www.measurement-testing.com/EMC-electromagnetic-compatibility
2. www.thefreedictionary.com/Electromagnetic+interference
3. wikipedia.org/wiki/Conducted_Electromagnetic_Interference

PROFESSIONAL ELECTIVE-III

CELLULAR AND MOBILE COMMUNICATIONS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To make students familiar with various generations of mobile communications
2. To understand the concept of cellular communication
3. To understand the basics of wireless communication
4. Knowledge of CDMA, TDMA, OFDMA mobile communication standard, its architecture, logical channels, advantages and limitations.
5. To under multicarrier communication systems and Hand off Technologies.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

CO1: Discuss the cellular system design and technical challenges **(L2)**.

CO2: Analyze the design parameters, Sectoring, cell splitting and Different type of Antennas used in Cellular system **(L4)**.

CO3: Summarize the principles of Interference, Co channel Interference **(L2)**.

CO4: Analyze the Mobile radio propagation, fading, diversity concepts and the channel modeling **(L4)**.

CO5: Analyze Multiuser Systems, CDMA, WCDMA network planning and OFDM Concepts and Handoff Technologies **(L4).**

SYLLABUS

UNIT-I: INTRODUCTION TO MOBILE AND CELLULAR COMMUNICATION SYSTEM

Introduction, cellular geometry, introduction to cellular concept, principles of operation of a cellular mobile system, multiple access schemes, analog and digital cellular mobile systems.

UNIT II: ELEMENTS OF CELLULAR RADIO SYSTEM DESIGN

Introduction, concept of frequency reuse channels, co-channel interference, Desired C/I from normal case in an omni directional antenna system, cell splitting, sectoring, consideration of the components of the cellular system.

UNIT-III: INTERFERENCE

Introduction, types of interference, Co-channel interference, Real time Co-channel interference measurement, Diversity Receiver, Non Co-channel interference.

UNIT-IV: MOBILE RADIO PROPAGATION AND MODELLING

Introduction, basics of mobile radio propagation, free space propagation model, link budget design, propagation models, types of small scale fading. Cell Coverage for Signal and Traffic Introduction, Point - to - Point model, Propagation over water or flat open area, Foliage loss, Cell site antenna heights and signal coverage cells, Mobile - to - Mobile Propagation.

UNIT-V: MULTIPLE ACCESS TECHNIQUES

Introduction, multiple access techniques, Frequency division multiple access, Time division multiple access, Code division multiple access, space division multiple access, Orthogonal frequency division multiplexing, capacity of TDMA and CDMA systems. Handoff Technologies Introduction, Handoff, classification based on nature of handoff, handoff initiation techniques.

TEXT BOOKS:

1. Gottapu Sasibhushana Rao, Mobile Cellular Communication, PEARSON International, 2012.

2. Lee, Cellular and Mobile Communications, Third Edition, McGraw Hill, 2006.

REFERENCES:

1. Theodore S Rappaport, Wireless Communications: Principles and Practice, Prentice Hall, 2002.

2. Kamilo Feher, Wireless Digital Communication: modulation and spread spectrum applications, PHI, 1995.

PROFESSIONAL ELECTIVE-III
SMART ANTENNA SYSTEMS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To provide the basic knowledge of smart antennas and their radiation characteristics.
2. To introduce the students various types of wire and aperture antennas.
3. To provide the knowledge of broad band antennas and their applications.
4. To develop the students understanding of various Microstrip antenna for smart antenna applications

COURSE OUTCOMES:

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

CO1: Understand the need of Smart antenna system. (L2)

CO2: Understand the direction of arrival estimation methods to combat fading in mobile communication. (L2)

CO3: Learn different adaptive algorithms for the smart antennas(L1)

CO4: Learn the Space–Time Processing of the antennas. (L1)

CO5: Design Mobile Stations Smart Antennas(L4)

SYLLABUS

UNIT-I: INTRODUCTION TO SMART ANTENNAS

Need for Smart Antennas, Smart Antenna Configurations, Switched-Beam Antennas, Adaptive Antenna Approach, Space Division Multiple Accesses (SDMA), Architecture of a Smart Antenna System, Receiver, Transmitter, Benefits and Drawbacks, Mutual Coupling Effects

UNIT-II: DOA ESTIMATION FUNDAMENTALS

Introduction The Array Response Vector, Received Signal Model, The Subspace-Based Data Model, Signal Auto covariance Matrices ,Conventional DOA Estimation Methods, Conventional Beamforming Method, Capon's Minimum Variance Method, Subspace Approach to DOA Estimation ,The MUSIC Algorithm, The ESPRIT Algorithm, Uniqueness of DOA Estimates

UNIT-III: BEAMFORMING FUNDAMENTALS

The Classical Beam former-Statistically Optimum Beam forming Weight Vectors, The Maximum SNR Beamformer, The Multiple Side lobe Canceller and the Maximum, SINR Beam former-

Minimum Mean Square Error (MMSE),Direct Matrix Inversion (DMI), Linearly Constrained Minimum Variance (LCMV) , Adaptive Algorithms for Beamforming ,The Least Mean-Square (LMS) Algorithm, The Recursive Least-Squares (RLS) Algorithm

UNIT-IV: SPACE–TIME PROCESSING

Introduction, Discrete Space–Time Channel and Signal Models, Space–Time Beamforming, Inter symbol and Co-Channel Suppression, ISI Suppression, CCI Suppression, Joint ISI and CCI Suppression, Space–Time Processing for DS-CDMA, Capacity and Data Rates in MIMO Systems, Single-User Data Rate Limits, Multiple-Users Data Rate Limits, Data Rate Limits Within a Cellular System, MIMO in Wireless Local Area Networks

UNIT-V: MOBILE STATIONS' SMART ANTENNAS

Introduction -Multiple-Antenna MS Design, Combining Techniques, Selection (Switched) Diversity, Maximal Ratio Combining, Adaptive Beamforming or Optimum Combining ,RAKE Receiver Size, Mutual Coupling Effects, Dual-Antenna Performance Improvements ,Downlink Capacity Gains

TEXT BOOKS:

1. Constantine A. Balanis, Panayiotis I. Ioannides, Introduction to Smart Antennas Morgan & Claypool Publishers
2. Ahmed El Zooghby, Smart Antenna Engineering, Artech House

REFERENCES:

1. M.J. Bronzel, Smart Antennas, John Wiley, 2004
2. T.S.Rappaport&J.C.Liberti, Smart Antennas for Wireless Communication, Prentice Hall (PTR) , 1999.
3. R.Janaswamy, Radio Wave Propagation and Smart Antennas for Wireless Communication, Kluwer, 2001

WEB RESOURCES:

1. http://nptel.iitm.ac.in/courses/117107035

PROFESSIONAL ELECTIVE-III

SATELLITE COMMUNICATIONS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

The main objectives of the course is to:

1: Learn the fundamentals of satellite communication.

2: Describe the concepts of satellite orbits and launchers.

3: Explain the satellite subsystems and space qualification.

4: Classify the various methods of satellite access.

5: Summarize the applications of satellites.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

CO1: **Understand** the concepts of basic Satellite System **(L2)**.

CO2: **Discuss** the orbital mechanics **(L2)**.

CO3: **Describe** the satellite subsystems **(L2)**.

CO4: **Design** the Satellite Link **(L4)**.

CO5: Implement various satellite applications **(L3)**.

SYLLABUS

UNIT-I: INTRODUCTION

Origin of Satellite Communications, Historical Back- ground, Basic Concepts of Satellite Communications, Frequency allocations for Satellite Services, Applications, and Future Trends of Satellite Communications.

UNIT-II: ORBITAL MECHANICS AND LAUNCHERS

Orbital Mechanics, Look Angle determination, Orbital perturbations, Orbit determination, launches and launch vehicles, Orbital effects in communication systems performance.

UNIT-III: SATELLITE SUBSYSTEMS

Attitude and orbit control system, telemetry, tracking, Command and monitoring, power systems, communication subsystems, Satellite antenna Equipment reliability and Space qualification.

UNIT IV: SATELLITE LINK DESIGN

Basic transmission theory, system noise temperature and G/T ratio, Design of down links, up link design, Design of satellite links for specified C/N, System design example.

MULTIPLE ACCESS: Frequency division multiple access (FDMA) Intermodulation, Calculation of C/N. Time division Multiple Access (TDMA) Frame structure, Examples. Satellite Switched TDMA Onboard processing, DAMA, Code Division Multiple access (CDMA), Spread spectrum transmission and reception.

UNIT-V: SATELLITE APPLICATIONS

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. GPS Position Location Principles, Differential GPS, Direct Broadcast satellites (DBS/DTH).

TEXT BOOKS:

1. Satellite Communications – Timothy Pratt, Charles Bostian and Jeremy Allnutt, WSE, Wiley Publications, 2nd Edition, 2003.
2. Satellite Communications – Dennis Roddy, McGraw Hill, 2nd Edition, 1996.
3. Satellite Communications Engineering – Wilbur L. Pritchard, Robert A Nelson and Henri G.Suyderhoud, 2nd Edition, Pearson Publications, 2003.

REFERENCES:

1. Satellite Communications: Design Principles – M. Richharia, BS Publications, 2nd Edition, 2003.
2. Satellite Communication – D.C Agarwal, Khanna Publications, 5th Ed.
3. Fundamentals of Satellite Communications – K.N. Raja Rao, PHI, 2004

WEB RESOURCES:

1. www.intelasat.com
2. http://www.isro.org/satellites/satelliteshome.aspx

PROFESSIONAL ELECTIVE-III

ARTIFICIAL NEURAL NETWORKS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To gain knowledge about the fundamentals of artificial neural networks.
2. To gain knowledge about single layer networks such as perceptron with supervised learning method.
3. To learn about the Back propagation which is mostly used supervised learning algorithm for multilayer networks.
4. To learn about unsupervised learning networks which are used to discover special features and patterns from available data without using external help.
5. To learn how to apply the Artificial Neural Networks for real world problems.

COURSE OUTCOMES:

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

CO1: Understand the fundamentals such as neural networks, learning laws and their applications. **(L2)**

CO2: Understand how to train the neural networks to solve linear separability with perceptions and also to understand support vector classification. **(L2)**

CO3: Understand how to train Back propagation algorithm and setting the parameter values. **(L2)**

CO4: Understand about the clustering process using neural networks such as counter propagation networks and Adaptive Resonance Theory**. (L2)**

CO5: Apply the principles of Artificial Neural Networks in the fields of image processing, pattern recognition. **(L3)**

SYLLABUS

UNIT-I: INTRODUCTION

History of Neural Networks, Structure and function of biological and artificial neuron, models of a neuron, neural network architectures, Neural learning, Learning laws Applications of neural networks to solve tasks such as clustering and pattern association, Evaluation of Networks.

UNIT-II: SUPERVISED LEARNING-I

Single layer networks: Supervised and unsupervised learning, Perceptrons, Linear separability, Perceptron training algorithm, Gaurenty of success, Modifications, Support vector classification.

UNIT-III: SUPERVISED LEARNING-II

Multi-layer networks: Multi level discrimination, Preliminaries, Back propagation algorithm, Classification using Back propagation, setting the parameter values, Radial basis functions, Support vector machines, Probabilistic neural network, Polynomial networks

UNIT-IV: UNSUPERVISED LEARNING

Winner - Take - all networks, learning vector quantizers, Counter propagation networks, Adaptive Resonance Theory, Topologically organized networks, Distance based learning, principal component analysis networks.

UNIT-V: ASSOCIATIVE MEMORIES

Non iterative procedures for association, Hopfield networks, Boltzmann Machines, Hetero-associators, Applications of Neural Networks: Optimization, Travelling salesperson, Applications in Pattern recognition and image processing.

TEXT BOOKS:

1. Kishan Mehrotra, Chelkuri K. Mohan, Sanjav Ranka - Elements of Artificial Neural Networks, Penram
International, 2001.
2. B. Yegnanarayana - Artificial Neural Networks, PHI, New Delhi, 1999.

REFERENCES:

1. J.M. Zurada - Introduction to Artificial Neural Systems, Jaico Publications, India,1994.
2. Rajasekharan and Pai - Neural Netwroks, Fuzzy Logic and Genetic algorithms: synthesis and applications, PHI Publication, 2003.

WEB RESOURCES:

1.http://nptel.ac.in/SYLLABUS/SYLLABUS.php?subjectId=117105084

OPEN ELECTIVE-I (EVEN SEMESTER)

Fundamentals of IoT

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To Understand the Characteristics of IoT and Applications of IoT.

2. To understand the Arduino IDE installation, Arduino programs and the prototypes using Arduino with external devices.

3. To understand the concepts of Sensors, Raspberry programming and python packages to interface Amazon web services.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Describe the concepts of IoT along with its applications. **(L2)**

CO2: Design a prototype using Arduino Uno. **(L4)**

CO3: Identify different types of sensors, actuators and communication Protocols. **(L2)**

CO4: Build a prototype using Raspberry pi. **(L4)**

CO5: Design an IoT application to interact with Django. **(L4)**

SYLLABUS

UNIT-I: INTRODUCTION TO IoT

Definition of IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, IoT Enabling Technologies, IoT levels & Deployment Templates, IoT Applications. (Text Book 1,3)

UNIT-II: IOT WITH ARDUINO

Introduction to the Arduino, creating an Arduino programming Environment, Using the Arduino IDE, creating an Arduino program, Using Libraries, working with Digital Interfaces, interfacing with Analog devices, communicating with devices, using sensors, working with Motors, Using an LCD. (Text Book -2)

UNIT-III: SENSORS AND ACTUATORS

Introduction, Sensor, Types of Sensors, Actuators, classification of Actuators. Technologies used in IoT: Bluetooth, Bluetooth Low Energy (BLE), Wi-Fi, Li-fi, Z-Wave, X-10, Sigfox, ZigBee, LoRa WAN, 5-G, LPWAN, RFID and NFC, WSN. (Text Book- 3)

UNIT-IV: IoT WITH RASPBERRY PI

Raspberry Pi, About the Board, Programming Raspberry Pi with Python, Controlling LED with Raspberry Pi, interfacing an LED and Switch with Raspberry Pi, Interfacing a Light Sensor (LDR) with Raspberry Pi. (Text Book -1)

UNIT-V: IoT PHYSICAL SERVERS & CLOUD OFFERINGS:

Python Packages for IoT, WAMP – Auto Bahn for IoT, Python Web Application Framework – Django, Amazon Web Services for IoT, Sky Net IoT messaging platform (Text book- 1)

TEXT BOOKS:

1. Vijay Madisetti and Arshdeep Bahga, Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2016.
2. Richard Blum, Arduino Programming in 24 Hours, Sams Teach Yourself, Pearson Education,2017.
3. Jain, Prof. Satish, Singh, Shashi, Internet of Things and its Applications, 1st Edition, BPB, 2020.

REFERENCES:

1. Donald Norris, Internet of things_ do-it-yourself projects with Arduino, Raspberry Pi, and Beagle Bone Black,1st Edition, McGraw-Hill,2015.
2. Adeal Javed Lake Zurich, Illinois, Building Arduino Projects for the Internet: Experiments with RealWorld Applications, 1st Edition, USA, A press,2016.
3. Yashavant Kanetkar, Shrirang Korde, 21 IOT Experiments, 1st Edition, BPB Publications, 2018.
4. Dr. Rajesh Singh, Dr. Anita Gehlot, Dr. Lovi Raj Gupta, Navjot Rathour, Mahendra Swain, Bhupendra Singh, IoT based Projects Realization with Raspberry Pi, Node MCU and Arduino, 1st Edition, BPB Publications, 2020.

WEB RESOURCES:

1. https://www.arduino.cc/reference/en
2. https://create.arduino.cc/projecthub
3. https://maker.pro/raspberry-pi/tutorial
4. https://projects.raspberrypi.org/en/projects
5. https://www.digikey.com/en/maker/blogs/2019/how-to-use-mqtt-with-the-raspberry-pi

OPEN ELECTIVE-II

FUNDAMENTALS OF ELECTRONIC COMMUNICATIONS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

The objective of this subject is to:

1. Introduce the students to modulation and various analog and digital modulationschemes.
2. They can have a broad understanding of satellite, optical, cellular, mobile and wireless concepts

COURSE OUTCOMES:

After the successful completion of course student should be able to

CO1: Explain necessity of modulation and multiplexing **(L2)**.

CO2: Understand the evolution of cellular systems **(L2)**.

CO3: Describe different types of networks and technologies **(L2)**.

CO4: Explain basic operation of a satellite and its navigation systems **(L2)**.

CO5: Understand basics of optical fiber communication **(L2)**.

SYLLABUS

UNIT-I: ANALOG AND DIGITAL MODULATION

Analog Signals, Digital Signals, Need for Modulation, Analog Modulation and its types, Sampling and Quantization, Advantage of Digital Signals over Analog Signals, Digital Modulation and its types, Time Division Multiplexing and Frequency Division Multiplexing.

UNIT-II: CELLULAR AND MOBILE COMMUNICATIONS

Cellular telephone systems, A Cellular Industry Overview, 2G and 3G Digital Cell Phone Systems, Long Term Evolution and 4G Cellular Systems

UNIT-III: FUNDAMENTALS OF NETWORKING AND WIRELESS TECHNOLOGIES

Network Fundamentals, Internet Applications, Internet Transmission Systems, Wireless LAN, PANs and Bluetooth, ZigBee and Mesh Wireless Networks, WiMAX and Wireless Metropolitan Area Networks

UNIT-IV: SATELLITE COMMUNICATION

Satellite Orbits, satellite communication systems, SatelliteSubsystems, Ground Stations, Satellite Applications, Global Navigation Satellite Systems

UNIT-V: FUNDAMENTALS OF OPTICAL COMMUNICATION

Optical Principles, Optical Communication Systems, Construction of Optic Fibers, Fiber–Optic Cables, Principles of Photo detection, types of light sources and detectors

.

TEXT BOOKS:

1. Principles of Electronic Communication Systems, Louis E. Frenzel, 3e, McGraw Hill publications, 2008.
2. Electronic Communications systems, Kennedy, Davis 4e, MC GRAW HILL EDUCATION, 1999

REFERENCES:

1. Theodore Rapp port, Wireless Communications - Principles and practice, PrenticeHall, 2002.
2. Roger L. Freeman, Fundamentals of Telecommunications, 2e, Wiley publications.
3. Introduction to data communications and networking, Wayne Tomasi, PearsonEducation, 2005.

WEB RESOURCES:

1. http://nptel.iitm.ac.in/courses/
2. http://web.engr.oregonstate.edu/~magana/ECE461-561/index.htm
3. http://www.ensc.sfu.ca/~jiel/courses/327/index.html
4. http://www.ece.utah.edu/~npatwari/ece5520/lectureAll.pdf

DIGITAL SIGNAL PROCESSING LABORATORY

Credits	*Periods*			*Exam Hrs.*	*Sessional Marks*	*Exam Marks*	*Total Marks*
	Theory	*Tutorial*	*Lab*				
1.5	-	-	3	3	50	50	100

COURSE OBJECTIVES:

1. To implement Linear and Circular Convolution
2. Implement FIR and IIR filters
3. Study the architecture of DSP processor

COURSE OUTCOMES:

CO1: **Understand** about the basic signal generation **(L2)**

CO2: **Describ**e Fourier Transform Concepts **(L2)**

CO3: **Design** FIR filters and IIR filters **(L4)**

CO4: **Demonstrate** their abilities towards DSP processor based implementation of DSP systems **(L2)**

LIST OF EXPERIMENTS

MAT LAB EXPERIMENTS

1. Generation of discrete –time sequences
2. Implementation of Discrete time systems
    a) Linear Convolution of two sequences
    b) Circular Convolution of two sequences
3. Frequency analysis of discrete time sequences
4. Frequency analysis of discrete time systems
5. Design of IIR digital filter
    a) Butterworth
    b) Chebyshev
6. Design of FIR digital filter
7. Design of FIR filter using
    a) Hamming window
    b) Rectangular window

HARDWARE EXPERMENTS

1. Verification of Linear Convolution using DSP Processor kit
2. Verification of Circular Convolution using DSP Processor kit
3. Implementation of IIR Filters on DSP Processor
4. Implementation of FIR Filters using Window Techniques on DSP Processor

MICROPROCESSORS & MICROCONTROLLERS LABORATORY

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
1.5	-	-	3	3	50	50	100

COURSE OBJECTIVES:

The main objectives of this course is to:

1. Understand programming for 8086 microprocessors using 8086 Kit
2. Learn 8086 programming using TASM Assembler.
3. Interface 8086 with I/O and other devices.
4. Study programming for Arduino UNO and its interfacing.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Write programs using Assembly language for small applications using 8086. **(L2)**

CO2: Write programs using Assembly language for small applications using 8051 in Keil Software. **(L2)**

CO3: Acquire skills in peripheral interfacing to both processor and Arduino UNO. **(L3)**

CO4: Implement mini projects for real time applications. **(L2)**

LIST OF PROGRAMS

8086 ESA-86/88 KIT PROGRAMMING

1. Write a program to add two 16 bit numbers stored in two memory locations 2000H and 2002H and store the result in another memory location 2004H.
2. Write a program to subtract two 16 bit numbers stored in two memory locations 2000H and 2002H and store the result in another memory location 2004H.
3. Write a program to multiply two 16 bit numbers stored in two memory locations 2000H and 2002H and store the result in another memory location 2004H.
4. Write a program to divide two 16 bit numbers stored in two memory locations 2000H and 2002H and store the result in another memory location 2004H.
5. Write a program to add two 32 bit numbers stored in two memory locations 2000H and 2004H and store the result in another memory location 2008H.
6. Write a program to find Factorial of a given number.
7. Write a program to find Fibonacci Series of a given number.

8086 PROGRAMMING USING TASM ASSEMBLER

8. Write a program to perform addition operation on two multi-byte numbers.
9. Write a program to perform subtraction operation on two multi-byte numbers.
10. Write a program to sort a given set of hexadecimal numbers.
11. Write a program to find whether the given string is Palindrome or not.
12. Write a program for inserting an element at a specified location in a given string.
13. Write a program to reverse a string.
14. Write a program to convert BCD numbers into equivalent binary value.

8086 INTERFACING

15. Interface Stepper Motor to 8086 and write a program to rotate the stepper motor both in clockwise and anti-clockwise direction.
16. Interface 8279 keyboard display controller to 8086 and write a program to display the message "Welcome to MP Lab".

8051 PROGRAMMING USING KEIL SIMULATOR

17. Write a program to generate a square wave of 50% duty cycle at pin P2.1 using timer 0 in mode1.Assume XTAL=11.0592 MHz.
18. Write a program to send a message "WELCOME" serially at 9600 baud rate Continuously through serial port of 8051.

INTERFACING USING ARDUINO UNO

19. Interface LEDs to Arduino UNO and write a program for blinking LED.
20. Write a program for measuring light intensity using LDR and Arduino UNO.
21. Interface LM35 temperature sensor to Arduino UNO and write a program to measure the room temperature.

MINI PROJECTS USING ARDUINO UNO

22. Write a program for Home automation using Arduino UNO.
23. Interface Ultrasonic sensors to Arduino UNO and write a program to measure distance.
24. Automatic Irrigation controller using Arduino UNO.

IV/IV BTECH 1st SEM (7th Semester)

B.TECH. (ECE) 4th YEAR 1st SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION									
CATEGORY	**CODE NUMBER**	**COURSE**	**HOURS PER WEEK**			**MAXIMUM MARKS**			**CREDITS**
			THEORY	**TUTORIAL**	**LAB**	**EXAM**	**SESSIONALS**	**TOTAL**	
HSC		Principles of Economics & Management	3	0	0	70	30	100	3
PCC		Microwave Engineering	3	0	0	70	30	100	3
PCC		Radar Engineering	3	0	0	70	30	100	3
PEC		Professional Elective- IV	3	0	0	70	30	100	3
PEC		Professional Elective- V	3	0	0	70	30	100	3
OEC		Open Elective-II	3	0	0	70	30	100	3
PCC		Industrial Internship	0	0	0	0	0	100	2
PCC		Microwave Engineering Lab	0	0	3	50	50	100	1.5
PCC		Skill based Lab	0	0	3	50	50	100	1.5
		Total	**18**	0	**6**	**520**	**280**	**900**	**23**

Professional Elective-IV:
1. Fiber Optic Communications
2. Internet of Things
3. DSP Processors & Architectures
4. Bio Medical Instrumentation

Professional Elective-V:
1. Global Positioning System
2. Embedded Systems
3. VLSI Testing and testability
4. Machine Learning

Open Elective-II:
1. Offered by Department of CSE
2. Offered by Department of Mechanical
3. Offered by Department of Civil Engineering
4. Offered by Department of MBA

IV/IV BTECH 2nd SEM (8th Semester)

B.TECH. (ECE) 4th YEAR 2nd SEMESTER SCHEME OF INSTRUCTION AND EXAMINATION									
CATEGORY	CODE NUMBER	COURSE	HOURS PER WEEK			MAXIMUM MARKS			CREDITS
			THEORY	TUTORIAL	LAB	EXAM	SESSIONALS	TOTAL	
PCC		Project	0	0	24	50	50	100	12
		MOOCs-II	0	0	3	100	0	100	1.5
		Total	**0**	**0**	27	150	50	200	13.5

LIST OF OPEN ELECTIVES OFFERED FOR OTHER DEPARTMENT STUDENTS

1. Fundamentals of IoT (Open Elective-1 offered during EVEN Semester)
2. Fundamentals of Electronic Communications (Open Elective-2 offered during ODD Semester)

PRINCIPLES OF ECONOMICS AND MANAGEMENT

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. Apply economic reasoning to the analysis of selected contemporary economic problems.
2. Understand how households (demand) and businesses (supply) interact in various market structures to determine price and quantity of goods and services produced and consumed.
3. Analyze the efficiency and equity implications of government interference in markets.
4. To unable student to understand various Management Principles
5. Understand the Entrepreneurship environment.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Understand the links between production costs and the economic models of supply.

CO2: Represent supply, in graphical form, including the upward slope of the supply curve and what shifts the supply curve.

CO3: Know the procedure of various forms of starting an organization

CO4: Relate the basics of Principles of Management in relation with functional areas like Financial Management and Human Resources Management and Production Management.

CO5: Acquire the knowledge on basics of entrepreneurship.

SYLLABUS

UNIT-I: INTRODUCTION TO MANAGERIAL ECONOMICS

Wealth, Welfare and Scarce Definitions of Economics; micro and Macro Economics; Demand- Law of Demand, factors determining price elasticity of demand.

UNIT-II: FORMS OF BUSINESS ORGANIZATIONS

Perfect Competition, Monopolistic Competition, Monopoly, Oligopoly and Duopoly. Forms of Business Organizations: Sole Proprietorship, Partnership, Joint Stock Company- Private Limited and Public Limited Companies.

UNIT-III: INTRODUCTION TO MANAGEMENT

Functions of Management- Taylors Scientific management; Henry Fayol's Principle of Management; Human Resource Management Basic Functions of HR Manager; Man Power Planning, Recruitment, Selection, Training, Development, Placement, Compensation and performance Appraisal (in brief).

UNIT-IV: PRODUCTION MANAGEMENT

Production Planning and Control, plant Location, Breakeven Analysis, assumptions and applications. Inventory Importance.

UNIT-V: FINANCIAL MANAGEMENT

Types of Capital: Fixed and Working Capital and Methods of Raining Finance; Marketing Management: Functions of marketing and Distribution Channels. Marketing Mix elements.

TEXT BOOKS:

1. K.K. DEWETT, Modern Economic Theory, S.Chand and Company, NewDelhi-55.
2. S.C. Sharma and Banga T. R., Industrial Organization & Engineering Economics, Khanna Publications, Delhi-6.

REFERENCE BOOKS:

1. A.R. AryaSri, Management Science, TMH publications, NewDelhi-20.
2. A.R. AryaSri, Managerial Economics and Financial Analysis, TMH Publication.

MICROWAVE ENGINEERING

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To impart knowledge on basics of microwave electron beam devices and their applications in X band frequency.
2. Understand Microwave sources and amplifiers.
3. To study Microwave semiconductor devices & applications
4. To become familiar with the concepts of Microwave Integrated Circuits.
5. To know the concepts of Microwave Measurements

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Describe the various waveguide components and s-parameter analysis of microwave component **(L2)**.

CO2: Perform **analysis** mathematically the operation and working of the various tubes **(L3)**.

CO3: Describe and explain working of solid state devices **(L2)**.

CO4: Design of MMICs and analysis of CMOS, NMOS Fabrication techniques **(L4)**.

CO5: Study about Microwave Measurement Techniques **(L2).**

SYLLABUS

UNIT-I: MICROWAVE COMPONENTS

Introduction to Microwave Engineering- microwave spectrum bands, advantages and applications of microwaves, Wave-guide Components, coupling mechanisms, Scattering Matrix and its Properties, Scattering Matrix of Isolator, circulator, directional coupler, E-Plane Tee, H plane Tee and Magic Tee. Cavity Resonators, Re-entrant Cavities, Attenuators, Ferrite Devices

UNIT-II: MICROWAVE TUBES

Limitations of conventional tubes at microwave frequencies, Resonant Cavities, Linear beam tubes, Reflex Klystron, applegate diagram and principle of working, Two – Cavity Klystron, Multi – Cavity Klystron, Traveling Wave Tube, Crossed Field Device- Magnetron, Hull cut-off voltage Equation.

UNIT-III: MICROWAVE SOLID STATE DEVICES

Negative resistance phenomenon, Gunn Diode, domain formation, RWH theory, Tunnel Diode principle of operation, IMPATT- principle of operation, TRAPATT, BARITT, PIN Diodes.

UNIT-IV: MICROWAVE INTEGRATED CIRCUITS

Introduction, advantages and disadvantages of MMICs, comparison of MMICs with HMICs, Applications of MICs, materials used for MMICs, Substrate, Conductor, Dielectric and Resistive Materials, Growth of MMIC, Fabrication Techniques, MOSFET Fabrication, - MOSFET formation, NMOS fabrication process.

UNIT-V: MICROWAVE MEASUREMENTS

VSWR, Frequency, Guided Wavelength, Coupling factor and Directivity measurements.

TEXT BOOKS:

1. Microwave and Radar Engineering, Gottapu Sasibhushana Rao, Pearson Education, New Delhi, 2014.
2. Microwave Engineering, Microwave Engineering, 4th Edition, David M. Pozar, November 2011.

REFERENCES:

1. Foundations for Microwave Engineering, R. R. Collin, McGraw Hill
2. Microwave Communications – Components and Circuits, E. Hund, McGraw Hill.
3. Microwave Devices, circuits and subsystems for communications engineering, Ian A Glover and Steve Pennock, Wiley Publishers, 2007.
4. Microwave Engineering, G.S.N. Raju, IK International Publishers

WEB RESOURCES:

1. https://nptel.ac.in/courses/108103141
2. https://www.coursera.org/learn/microwave-antenna

RADAR ENGINEERING

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To study the principles of operation of various blocks of Radar systems and Radar Range equation in detail.
2. To study the functions of various blocks of CW Radar, FM-CW Radar, MTI and Pulse Doppler Radars, Tracking radar and their limitations and applications
3. To study the functions of various blocks of Radar receivers and detection of Radar signals in noise in detail.
4. To study the principles and working of phased array antennas and their application to radar systems.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Explain the basic concepts of Radar **(L2)**.

CO2: Analyze the CW Radar and FMCW Radar system for the measurement of speed and distance **(L3)**.

CO3: Apply the techniques to remove the clutter using MTI Radar and Pulse Doppler Radar **(L3).**

CO4: Classify different techniques of tracking radars **(L2)**.

CO5: Explain various techniques employed in radar receivers for detection of signals in noise **(L2)**.

SYLLABUS

UNIT-I: INTRODUCTION TO RADARS

Introduction, History, Frequencies and applications of Radars, classification of Radars, Basic Radars, Radar Block Diagram, Pulse Radar characteristics.

UNIT-II: CW AND FMCW RADARS:

CW Radar, FMCW, Radar, and Pulse Radar: Introduction, CW Radar, Doppler Effect, FMCW Radar, FMCW altimeter, Pulse Radar.

UNIT-III: MTI AND PULSE DOPPLER RADAR

Introduction, Doppler Frequency, Doppler processing in CW, MTI and PDRs, MTI radars, Delay line Cancellers, Double Delay Line cancellers, types of MTI radars, Pulse Doppler Radar, Moving target Detector

UNIT-IV: TRACKING RADARS

Introduction, search and tracking radar system, various scanning and tracking techniques, range tracking, angle tracking, tracking accuracy, frequency agility, Track While Scan, phased array radars, radar displays.

UNIT-V: DETECTION OF SIGNALS IN NOISE AND RADAR RECEIVERS Introduction, matched filter receiver, correlation detection, detection criteria, automatic detection, CFAR receiver, Detectors, duplexer.

TEXT BOOKs:

1. Microwave and Radar Engineering, Gottapu Sasibhushana Rao, Pearson Education, New Delhi, 2014.
2. Introduction to Radar Systems, Skolnik, McGraw Hill, 3rd Edition, 2001.

REFERENCES:

1. Simon Kingsley, Shaun Quegan, Understanding Radar Systems, SciTech Publications, 1999.
2. Mark A Richards et.al, Principles of Modern Radar, SciTech Publications,2014.
3. Radar Engineering and Fundamentals of Navigational Aids, G S N Raju, IK International Publishers 2008.

WEB RESOURCES:

1. https://www.youtube.com/watch?v=toooafh-FJ4
2. https://www.youtube.com/watch?v=CDfLR8cXj_4&list=PLeQaX2aOLdF6ViCPbRRjOUFXlYZ7Ld9ME
3. https://www.youtube.com/watch?v=a1gRhIVCz7M&list=PLeQaX2aOLdF6ViCPbRRjOUFXlYZ7Ld9ME&index=4
4. https://www.youtube.com/watch?v=T3L20wl7an0&list=PLeQaX2aOLdF6ViCPbRRjOUFXlYZ7Ld9ME&index=2

PROFESSIONAL ELECTIVE-IV

FIBER OPTIC COMMUNICATIONS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To learn the basic concepts of fiber optics communications system with various components or process for various applications.
2. To clarify the student with fiber materials used in optical communication and losses involved
3. Students can learn about different optical sources and receivers
4. Graduate will demonstrate the ability to design a system, component or process as per need and specification.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Describe the types of transmission in OFC and the development of communication and Optical fibers, the Basics requirements of a system and uses of OFC **(L2)**.

CO2: Learn the different modes of optical fiber, the types of fibers, materials different Parameters of Fiber **(L3)**.

CO3: Discuss about the connectors and their constructions, different connector losses **(L2)**.

CO4: Study the construction of Optical sources, detectors, receiver operation, and the Parameters **(L3)**.

CO5: know the design process of Fiber link and WDM concepts **(L4)**.

SYLLABUS

UNIT- I: OVERVIEW OF OPTICAL FIBER COMMUNICATION

Introduction, The general system, advantages of optical fiber communications. Optical fiber wave guides- Introduction, Ray theory transmission, Total Internal Reflection, Acceptance angle, Numerical Aperture, Skew rays, Modes, V-number, Mode coupling, Step Index fibers, Graded Index fibers, cut off wavelength, Mode Field Diameter, Effective Refractive Index, Related problems.

UNIT- II: FIBER MATERIALS

Glass, Halide, Active glass, Chalgenide glass, Plastic optical fibers.

SIGNAL DISTORTION IN OPTICAL FIBERS: Attenuation, Absorption, Scattering and Bending losses, Core and Cladding losses, Information capacity determination, Group delay, Types of Dispersion: Material dispersion, Wave-guide dispersion, Intermodal dispersion.

UNIT -III: OPTICAL FIBER CONNECTORS AND POWER COUPLING

Connector types, Single mode fiber connectors, Connector return loss, Fiber Splicing- Splicing techniques, Splicing single mode fibers, Fiber alignment and joint loss- Multimode fiber joints, single mode fiber joints.

SOURCE TO FIBER POWER LAUNCHING - Output patterns, Power coupling and launching, Equilibrium Numerical Aperture, Laser diode to fiber coupling,

UNIT- IV: OPTICAL SOURCES AND RECEIVER

LEDs, Structures, Materials, Quantum efficiency, Power, Modulation, Power bandwidth product. Injection Laser Diodes- Modes, Threshold conditions, External quantum efficiency, Laser diode rate equations, Reliability of LED&ILD, Optical detectors-Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors

OPTICAL RECEIVER- Fundamental receiver operation, Receiver configuration, Quantum limit

UNIT -V: OPTICAL SYSTEM DESIGN

Point-to- point links- Component choice and considerations, Link power budget, Rise time budget with examples, WDM, Necessity, Principles, Measurement of Attenuation, Eye pattern.

TEXT BOOKS:

1. Optical Fiber Communications – Gerd Keiser, Mc Graw-Hill International edition, 3rd Edition, 2000.
2. Optical Fiber Communications – John M. Senior, PHI, 2nd Edition, 2002.

REFERENCES:

1. Fiber Optic Communications – D.K. Mynbaev , S.C. Gupta and Lowell L. Scheiner, Pearson Education,2005.
2. Text Book on Optical Fiber Communication and its Applications – S.C.Gupta, PHI, 2005.
3. Fiber Optic Communication Systems – Govind P. Agarwal , John Wiley, 3rd Ediition, 2004.
4. Fiber Optic Communications – Joseph C. Palais, 4th Edition, Pearson Education, 2004.

WEB RESOURCES:

1. https://youtu.be/ougKUUM3hJA
2. https://youtu.be/-ap00IUJm7k

PROFESSIONAL ELECTIVE-IV

INTERNET OF THINGS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To Understand the Characteristics of IoT and Applications of IoT.

2. To understand the Arduino IDE installation, Arduino programs and the prototypes using Arduino with external devices.

3. To understand the concepts of Sensors, Raspberry programming and python packages to interface Amazon web services.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Describe the concepts of IoT along with its applications. **(L2)**

CO2: Design a prototype using Arduino Uno. **(L4)**

CO3: Identify different types of sensors, actuators and communication Protocols. **(L2)**

CO4: Build a prototype using Raspberry pi. **(L4)**

CO5: Design an IoT application to interact with Django. **(L4)**

SYLLABUS

UNIT-I: INTRODUCTION TO IoT

Definition of IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, IoT Enabling Technologies, IoT levels & Deployment Templates, IoT Applications. (Text Book 1,3)

UNIT-II: IoT WITH ARDUINO

Introduction to the Arduino, creating an Arduino programming Environment, Using the Arduino IDE, creating an Arduino program, Using Libraries, working with Digital Interfaces, interfacing with Analog devices, communicating with devices, using sensors, working with Motors, Using an LCD. (Text Book -2)

UNIT-III: SENSORS AND ACTUATORS

Introduction, Sensor, Types of Sensors, Actuators, classification of Actuators. Technologies used in IoT: Bluetooth, Bluetooth Low Energy (BLE), Wi-Fi, Li-fi, Z-Wave, X-10, Sigfox, ZigBee, LoRa WAN, 5-G, LPWAN, RFID and NFC, WSN. (Text Book- 3)

UNIT-IV: IoT WITH RASPBERRY PI

Raspberry Pi, About the Board, Programming Raspberry Pi with Python, Controlling LED with Raspberry Pi, interfacing an LED and Switch with Raspberry Pi, Interfacing a Light Sensor (LDR) with Raspberry Pi. (Text Book -1)

UNIT-V: IoT PHYSICAL SERVERS & CLOUD OFFERINGS:

Python Packages for IoT, WAMP – Auto Bahn for IoT, Python Web Application Framework – Django, Amazon Web Services for IoT, Sky Net IoT messaging platform (Text book- 1)

TEXT BOOKS:

1. Vijay Madisetti and Arshdeep Bahga, Internet of Things (A Hands-on-Approach), 1st Edition, VPT, 2016.
2. Richard Blum, Arduino Programming in 24 Hours, Sams Teach Yourself, Pearson Education,2017. 3. Jain, Prof. Satish, Singh, Shashi, Internet of Things and its Applications, 1st Edition, BPB, 2020.

REFERENCES:

1. Donald Norris, Internet of things_ do-it-yourself projects with Arduino, Raspberry Pi, and Beagle Bone Black,1st Edition, McGraw-Hill,2015.
2. Adeal Javed Lake Zurich, Illinois, Building Arduino Projects for the Internet: Experiments with RealWorld Applications, 1st Edition, USA, A press,2016.
3. Yashavant Kanetkar, Shrirang Korde, 21 IOT Experiments, 1st Edition, BPB Publications, 2018.
4. Dr. Rajesh Singh, Dr. Anita Gehlot, Dr. Lovi Raj Gupta, Navjot Rathour, Mahendra Swain, Bhupendra Singh, IoT based Projects Realization with Raspberry Pi, Node MCU and Arduino, 1st Edition, BPB Publications, 2020.

WEB RESOURCES:

1. https://www.arduino.cc/reference/en
2. https://create.arduino.cc/projecthub
3. https://maker.pro/raspberry-pi/tutorial
4. https://projects.raspberrypi.org/en/projects
5. https://www.digikey.com/en/maker/blogs/2019/how-to-use-mqtt-with-the-raspberry-pi

PROFESSIONAL ELECTIVE-IV

DSP PROCESSORS AND ARCHITECTURES

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To familiarize with DSP concepts by studying the design of different digital filters and transforms.
2. To introduce the architectural features of programmable DSP Processors of Texas Instruments (TI) and Analog devices (AD).
3. To understanding the practical examples of DSP Processor architectures
4. To develop programming knowledge by using Instruction set of DSP Processors
5. To know the interfacing techniques to I/O devices and memory.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Analyze discrete time signals in frequency domain and Design digital filters. **(L4)**

CO2: Understand the basic concepts of Digital Signal Processing. **(L2)**

CO3: To distinguish the architectural features of General purpose processors and DSP processors. **(L4)**

CO4: Understand the architectures of TMS320C54xx devices and ADSP 2100 DSP devices **(L2)**

CO5: Develop small systems by programing of TMS320C54xx (**L3**).

SYLLABUS

UNIT-I: INTRODUCTION TO DIGITAL SIGNAL PROCESING

Introduction, A Digital signal-processing system, The sampling process, Discrete time sequences Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters, Decimation and interpolation, Analysis and Design tool for DSP Systems MATLAB, DSP using MATLAB.

UNIT-II: COMPUTATIONAL ACCURACY IN DSP IMPLEMENTATIONS

Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

UNIT-III: ARCHITECTURES FOR PROGRAMMABLE DSP DEVICES AND EXECUTION

Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities. Address Generation Unit, Programmability and Program Execution, Speed Issues, Features for External interfacing, Hardware looping, Interrupts, Stacks, Relative Branch support, Pipelining and Performance, Pipeline Depth, Interlocking, Branching effects, Interrupt effects, Pipeline Programming models

UNIT-IV: PROGRAMMABLE DIGITAL SIGNAL PROCESSORS

Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline Operation of TMS320C54XX Processors.

UNIT-V: INTERFACING MEMORY AND I/O PERIPHERALS TO PROGRAMMABLE DSP DEVICES

Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA). A Multichannel buffered serial port (McBSP), McBSP Programming, a CODEC interface circuit, CODEC programming, A CODEC-DSP interface example.

TEXT BOOKS:

1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.
2. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. S. Chand & Co, 2000.

REFERENCES:

1. Digital Signal Processors, Architecture, Programming and Applications – B. Venkata Ramani and M.Bhaskar, TMH, 2004.
2. Digital Signal Processing – Jonatham Stein, John Wiley, 2005.

WEB RESOURCES

1. http://nptel.iitm.ac.in
2. https://www.coursera.org/specializations/digital-signal-processing
3. https://www.youtube.com/watch?v=04UvJkki0Ig
4. https://training.ti.com/c55x-digital-signal-processors-dsp

PROFESSIONAL ELECTIVE-IV

BIO MEDICAL INSTRUMENTATION

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1.To introduce an fundamentals of transducers as applicable to physiology
2.To explore the human body parameter measurements setups
3.To make the students understand the basic concepts of forensic techniques.
4.To give basic ideas about how multimedia evidences are useful in crime investigation.

COURSE OUTCOMES:

At the end of the course the student will be able to

CO1: Understand the basic medical instrumentation system and bioelectric potentials. (**L2**)
CO2: Illustrate different types of electrodes to acquire bio-signals. (**L3**)
CO3: Demonstrate clinical laboratory measurements and assistive devices. (**L3**)
CO4: Discuss about the latest developments in medical imaging systems. (**L2**)
CO5: Outline patient care and safety while using biomedical equipment. (**L2**)

SYLLABUS

UNIT-I: COMPONENTS OF MEDICAL INSTRUMENTATION SYSTEMS

Basic Medical Instrumentation System, Static and dynamic characteristics of medical instruments, Bio-signals and characteristics. Problems encountered with measurements from human beings. Sources of Bioelectric Potentials, Resting and Action Potentials.

UNIT-II: BIO-POTENTIAL ELECTRODES AND PHYSIOLOGICAL TRANSDUCERS

Electrode potential and its equivalent circuit, Types of Electrodes-Surface Electrodes, Needle Electrodes, Micro Electrodes. Biochemical Transducers.

Bio-Signal Acquisition:

Electrical Conduction system of the heart, Electrocardiogram, ECG leads, Einthoven triangle, Plethysmography, EEG 10-20 lead system and EMG.

UNIT-III: CLINICAL LABORATORY MEASUREMENTS

Blood cell Counter, Blood flow meters- Electromagnetic blood flow meter, Ultrasonic Doppler blood flow meter, automated blood pressure measurements.

Physiological Assist Devices & Therapeutic Equipment:

Pacemakers -External & internal, Defibrillators- External & internal, Hemodialysis machine.

UNIT-IV: MONITORY AND IMAGING EQUIPMENT

Spirometry, Ventilators, Arrhythmia Monitor, Foetal Monitor and Incubator. X-ray machine, Computed Tomography (CT), Magnetic Resonance Imaging System, Ultrasound Imaging system

UNIT-V: PATIENT CARE AND SAFETY

The elements of Intensive Care Monitor, Diagnosis, Calibration and reparability of Patient Monitoring equipment, Shock Hazards and Prevention, Physiological Effects and Electrical Current, Shock Hazards from Electrical Equipment, Methods of Accident Prevention, Isolated Power Distribution System.

TEXT BOOKS:

1. Leslie Cromwell, F.J. Weibell, E.A. Pfeiffer, Biomedical Instrumentation and Measurements. 2nd Edition, PHI, 2004.
2. Dr. M. Arumugam, Biomedical Instrumentation. 2nd Edition, Anuradha publications, 2002.

REFERENCES:

1. R.S. Khandpur, Hand-book of Biomedical Instrumentation. 2nd Edition, TMH, 2003.John G. Webster, Medical Instrumentation, Application and Design. John Wiley, 3rd Edition, 2009.
2. Onkar N. Pandey, Rakesh Kumar, Bio-Medical Electronics and Instrumentation. 3rd Edition, Katson Books, 2002.

PROFESSIONAL ELECTIVE-V

GLOBAL POSITIONING SYSTEM

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

The main objectives of the course is to:

1. Learn the development of GPS.
2. Describe the working principle of GPS
3. Explain the various GNSS systems.
4. Describe GPS Constellation and Signal structure.
5. Summarize the coordinate systems.

COURSE OUTCOMES:

After successful completion of the course, the students will be able to:

CO1: **Understand** the History and evolution of Global Position System **(L2)**.
CO2: **Calculate** the user position using basic equations **(L2)**.
CO3: **Compare** GPS, GLONASS and GALILEO **(L2)**.
CO4: **Discuss** the GPS Signal Structure **(L4)**.
CO5: **Compare** various Coordinate systems **(L2)**.

SYLLABUS

UNIT-I: INTRODUCTION

Introduction to Global Position System, the History of GPS, the Evolution of GPS, Development of NAVSTAR GPS, Block I, Block II satellites, Block IIA, Block IIR and Block II R-M satellites.

UNIT-II: GPS WORKING PRINCIPLE

Trilateration method, Determination of where the satellites are, Determination of how far the satellites are, Determining the receiver position in 2D or X-Y Plane, Determining the receiver position in 3D or X-Y-Z Plane, basic equations for finding user position, user position determination with least squares estimator.

UNIT-III: OTHER GLOBAL SATELLITE CONSTELLATIONS

GLONASS, GALILEO, Comparison of 3GNSS (GPS, GALILEO, GLONASS) in terms of constellation and services provided.

UNIT-IV: GPS SATELLITE CONSTELLATION AND SIGNALS

GPS system segments, Space segment, Control segment, User segment, GPS Signals, Pseudorandom noise (PRN) code, C/A code, P code Navigation data, and Signal structure of GPS.

UNIT-V: COORDINATE SYSTEMS

Geoid, Ellipsoid, Coordinate Systems, Geodetic and Geo centric coordinate systems, ECEF coordinates, world geodetic 1984 system.

TEXT BOOKS:

1. G S RAO, Global Navigation Satellite Systems, McGraw-Hill Publications, New Delhi, 2010
2. Pratap Mishra, Global positioning system: signals, measurements, and performance, Ganga-Jamuna Press, 2006

REFERENCES:

1. Scott Gleason and Demoz Gebre-Egziabher, GNSS Applications and Methods, Artech House, 685 Canton Street, Norwood, MA 02062, 2009.
2. James Ba – Yen Tsui, 'Fundamentals of GPS receivers – A software approach', John Wiley & Sons (2001).
3. B.Hoffmann-Wellenhof, GPS theory and practice, 5th Edition, Springer 2001.

WEB RESOURCES:

1. https://nptel.ac.in/courses/105107062
2. https://www.gps.gov
3. https://www.udemy.com/topic/gps

PROFESSIONAL ELECTIVE-V

EMBEDDED SYSTEMS

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. The basic concepts of an embedded system are introduced.
2. The various elements of embedded hardware and their design principles are explained
3. Different steps involved in the design and development of firmware for embedded systems is elaborated.
4. Internals of Real-Time operating system and the fundamentals of RTOS based embedded Firmware design is discussed.
5. Familiarize with the different IDEs for firmware development for different family of Processors/controllers and embedded operating systems

COURSE OUTCOMES:

After successful completion of this course, the students will be able to:

CO1: Describe Understand the basic concepts of an embedded system and able to know an embedded system design approach to perform a specific function **(L2)**

CO2: Design the hardware components required for an embedded system and the design approach of an embedded hardware **(L4)**

CO3: Identify the various embedded firmware design approaches on embedded environment. **(L2)**

CO4: Build Understand how to integrate hardware and firmware of an embedded system using real time operating system. **(L4)**

CO5: Design an different IDEs for firmware development for different family of processors / controller**. (L4)**

SYLLABUS

UNIT-I: INTRODUCTION

Embedded system-Definition, history of embedded systems, classification of embedded systems, major application areas of embedded systems, purpose of embedded systems, the typical embedded system-core of the embedded system, Memory, Sensors and Actuators, Communication Interface, Embedded firmware, Characteristics of an embedded system, Quality attributes of embedded systems, Application-specific and Domain-Specific examples of an embedded system.

UNIT-II: EMBEDDED HARDWARE DESIGN

Analog and digital electronic components, I/O types and examples, Serial communication devices, Parallel device ports, Wireless devices, Timer and counting devices, Watchdog timer, Real time clock.

UNIT-III: EMBEDDE FIRMWARE DESIGN

Embedded Firmware design approaches, Embedded Firmware development languages, ISR concept, Interrupt sources, Interrupt servicing mechanism, Multiple interrupts, DMA, Device driver programming, Concepts of C versus Embedded C and Compiler versus Cross-compiler.

UNIT-IV: REAL TIME OPERATING SYSTEMS

Operating system basics, Types of operating systems, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling, Task communication, Task synchronization.

HARDWARE SOFTWARE CO-DESIGN

Fundamental Issues in Hardware Software Co- Design, Computational models in embedded design, Hardware software Trade-offs, Integration of Hardware and Firmware.

UNIT-V: EMBEDDED SYSTEM DEVELOPMENT, IMPLEMENTATION AND TESTING

The integrated development environment, Types of files generated on cross-compilation, Deassembler/ Decompiler, Simulators, Emulators and Debugging, Target hardware debugging, Embedded Software development process and tools, Interpreters, Compilers and Linkers, Debugging tools, Quality assurance and testing of the design, Testing on host machine, Simulators, Laboratory Tools.

TEXT BOOKS:

1. Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013.
2. Embedded Systems-By Shibu. K.V-Tata McGraw Hill Education Private Limited, 2013.

REFERENCES:

1. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013.
2. Embedded Systems-Lyla B.Das-Pearson Publications, 2013.

WEB RESOURCES:

1. https://www.tutorialspoint.com/what-is-an-embedded-operating-system
2. https://www.javatpoint.com/embedded-operating-system

PROFESSIONAL ELECTIVE-V

VLSI TESTING AND TESTABILITY

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. Understand the data types and test bench environment for Design under Test
2. Understand System Verilog assertions and the applications of randomization techniques.

COURSE OUTCOMES:

After successful completion of this course, the students will be able to

CO1: Outline the concepts of verification methodologies **(L2)**

CO2: Explain the concepts of various data types **(L2)**

CO3: Develop test bench environment for Design under Test **(L6)**

CO4: Summarize the System Verilog assertions **(L2)**

CO5: Describe the applications of randomization techniques **(L2)**

SYLLABUS

UNIT-I: VERIFICATION GUIDELINES

Verification Process, Basic Test bench functionality, directed testing, Methodology basics, Constrained-Random stimulus, Functional coverage, Test bench Components Layered test bench, Building layered test bench, Simulation environment phases, Maximum code reuse,Test bench performance.

UNIT-II: DATA TYPES

Built-in data types, Fixed-size arrays, Dynamic arrays, Queues, Associative Arrays, Linked lists, Array methods, choosing a storage type, creating new types with typedef, Creating user-defined structures, Type conversion, Enumerated types, Constants, strings, expression width.

UNIT-III: PROCEDURAL STATEMENTS AND ROUTINES

Procedural statements, tasks, functions and void Functions, Routine arguments, returning from a routine, local data storage, Time values Connecting the test bench and design: Separating the test bench and design, Interface constructs, Stimulus timing, Interface driving and sampling, connecting it all together, Top-level scope, Program – Module interactions.

UNIT-IV: SYSTEM VERILOG ASSERTIONS

Basic OOP: Introduction, first class, define a class, OOP terminology, Creating new objects, Object de-allocation, Using objects, Static variables vs. Global variables, Class routines, Defining routines, outside of the class, Scoping rules, Using one class inside another, Understanding dynamic objects, Copying objects, Public vs. private, Straying off course, building a test bench.

UNIT-V: RANDOMIZATION

Introduction, randomization, Randomization in System Verilog, Constraint details, solution probabilities, Controlling multiple constraint blocks, Valid constraints, In-line constraints, The pre_randomize and post_randomize functions, Constraints tips and techniques, common randomization problems.

TEXT BOOKS

1. Spear, Chris. System Verilog for verification: a guide to learning the test bench language features, 2nd Edition Springer Science & Business Media, 2008.

REFERENCES

1. IEEE 1800-2009 standard (IEEE Standard for System Verilog, Unified Hardware Design, Specification, and Verification Language).
2. System Verilog website: www.systemverilog.org
3. OVM, UVM (on top of SV)

WEB RESOURCES

1. www.verificationacademy.com

PROFESSIONAL ELECTIVE-V

MACHINE LEARNING

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	30	70	100

COURSE OBJECTIVES:

1. To introduce students to the basic concepts and techniques of Machine Learning.
2. To become familiar with regression methods, classification methods, clustering Methods and understand the basic problems using Hidden Markov Models.

COURSE OUTCOMES:

At the end of the course student will be able to

CO1: Perform regression analysis using the concepts of supervised machine learning algorithms. **(L3)**

CO2: Apply different classification algorithms for real time problem solving. **(L4)**

CO3: Apply different clustering algorithms for real time problem solving **(L4)**

CO4: Solve real time problems using decision trees and regression trees. **(L4)**

CO5: Understand the applications of Hidden Markov Models. **(L2)**

SYLLABUS

UNIT-I: INTRODUCTION TO MACHINE LEARNING

Applications of Machine learning, and Supervisory Learning: Learning classes from examples, Vapnik-Charvonenkis (VC) Dimension, Probably Approximately Correct(PAC) Learning, noise, learning multiple classes, regression, model selection and generalization, dimensions of supervised machine learning algorithms.

UNIT-II: BAYESIAN DECISION THEORY

Classification, losses and risks, discriminant functions, utility theory, value of information, Bayesian networks, Influence diagrams, Association rules, Parametric Methods: Maximum likelihood estimation, evaluating an estimator with bias and variance, Bayes' estimator, parametric classification, regression, tuning model complexity: bias vs variance dilemma, model selection procedures. Multivariate methods: Multivariate data, parameter estimation, missing value imputation, univariate normal distribution and classification, discrete features, regression, Dimensionality Reduction: Subset selection, PCA, Factor Analysis, multi-dimensional scaling, LDA.

UNIT-III: CLUSTERING

Mixture densities, K-means clustering, Expectation Maximization algorithm, mixtures of Latent Variable Models, Supervised learning after clustering, Hierarchical clustering, and choosing number of clusters. Non-parametric methods: Non-parametric methods density estimation, generalization to multivariate data, nonparametric classification, condensed nearest neighbors, non-parametric regression: smoothing models, choosing smoothing parameters.

UNIT-IV: DECISION TREES AND LINEAR DISCRIMINATION

Univariate classification and regression trees, rule extraction from trees, Multivariate trees, Generalizing linear model, two class and multi-class geometry of linear discriminant, pairwise separation, gradient descent, logistic discrimination for binary and multi-class problems, Support vector machines, optimal separating hyperplane, kernel functions for non-separable spaces, SVM for regression.

UNIT-V: HIDDEN MARKOV MODELS

Discrete Markov processes, Hidden Markov Models, three basic problems of HMM, Evaluation problem, finding the state sequence, Learning model parameters, continuous observations, Model selection in HMM Assessing and comparing classification Algorithms: Cross-validation and resampling methods, measuring error, interval estimation, hypothesis testing, assessing performance of a classifier, comparing two classification algorithms, comparing multiple classification algorithms based on variance.

TEXT BOOKS:

1. Introduction to Machine Learning by Ethem Alpaydin, Prentice-Hall of India, 2006
2. Machine Learning by Saikat Dutt and Subramanian Chandramouli

REFERENCES:

1. Machine Learning, Tom Mitchell , McGraw Hill,1997

FUNDAMENTALS OF ELECTRONIC COMMUNICATIONS

(OPEN ELECTIVE)

Course Objectives: The objective of this subject is to:

- Introduce the students to modulation and various analog and digital modulationschemes.
- They can have a broad understanding of satellite, optical, cellular, mobile and wireless concepts

Course Outcomes: By the end of course student should be able to

- **Explain** necessity of modulation, types of modulation and advantage of multiplexing (**L2**)
- **Understand** evolution of cellular systems their features and their future (**L2**)
- **Analyze** different types of networks and internet technology (**L4**)
- **Explain** basic operation of a satellite and it's navigation systems (**L2**)
- **Understand** optical fiber communication and basic wireless technologies (**L2**)

UNIT - I

Analog and Digital Modulation: Analog Signals, Digital Signals, Need for Modulation, Analog Modulation and it's types, Frequency Division Multiplexing, Sampling and Quantization, Advantage of Digital Signals over Analog Signals, Digital Modulation and it's types, Time Division Multiplexing.

UNIT - II

Cellular and Mobile Communications: Cellular telephone systems, A Cellular Industry Overview, 2G and 3G Digital Cell Phone Systems, Long Term Evolution and 4G Cellular Systems

UNIT - III

Fundamentals of Networking and Internet Technologies: Network Fundamentals, LAN Hardware, Internet Applications, Internet Transmission Systems

UNIT - IV

Satellite Communication: Satellite Orbits, Satellite Communication systems, Satellite Subsystems, Ground Stations, Satellite Applications, Global Navigation Satellite Systems

UNIT - V

Optical Communication and Wireless Technologies: Optical Principles, Optical Communication

Systems, Fiber –Optic Cables, Wavelength Division Multiplexing. Wireless LAN, PANs and Bluetooth, ZigBee and Mesh Wireless Networks, WiMAX and Wireless Metropolitan Area Networks

Text Books:

1. Principles of Electronic Communication Systems, Louis E. Frenzel, 3e, McGraw Hill Publications, 2008.
2. Electronic Communications systems, Kennedy, Davis 4e, McGraw Hill Education, 1999

Reference Books:

1. Theodore Rappport, Wireless Communications - Principles and Practice, PrenticeHall, 2002.
2. Roger L. Freeman, Fundamentals of Telecommunications, 2e, Wiley Publications.
3. Introduction to Data Communications and Networking, Wayne Tomasi, Pearson Education, 2005.

MICROWAVE ENGINEERING LAB

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	50	50	100

COURSE OBJECTIVES:

1. The lab course will give a practical exposure to students to learn the characteristics of Microwave components.
2. To gain the practical hands on experience by exposing the students to various microwave components.

COURSE OUTCOMES:

After successful completion of the Course students able to

CO1 **Demonstrate** the characteristics of Microwave sources.(L2)
CO2 **Test** the characteristics of microwave components(L4)
CO3 **Analyze** the radiation pattern of antenna (L3)
CO4 **Measure** Numerical Aperture and Losses in Optical Link.(L3)

LIST OF EXPERIMENTS

1. Reflex Klystron Characteristics
2. V-I Characteristics of GUNN Diode
3. Measurement of Coupling Factor and Directivity of a 4-Port Directional coupler
4. Measurement of Microwave frequency and wavelength
5. Radiation Pattern of Horn Antenna
6. Radiation Pattern of Parabolic Antenna
7. Attenuation measurement
8. Measurement of Scattering Parameters of Circulator
9. Measurement of Scattering Parameters of Magic Tee
10. Measurement of S-Parameters of E-Plane Tee
11. Measurement of S-Parameters of h-Plane Tee
12. Scattering parameters of Isolator.
13. Fiber Optic Analog Link design

SKILL BASED LAB

Credits	Periods			Exam Hrs.	Sessional Marks	Exam Marks	Total Marks
	Theory	Tutorial	Lab				
3	3	-	-	3	50	50	100

COURSE OBJECTIVES:

1. To Learn Basic Programming of Python
2. To understand the Arduino IDE installation, Arduino programs, Raspberry programming.
3. To introduce students to latest software relevant to communication engineering.
4. To introduce students to latest software relevant to VLSI Design.

COURSE OUTCOMES:

By the end of course student would be able to

CO1: Develop the python programs using operators, conditional and looping statements **(L4)**
CO2: Design a prototype using Arduino Uno and **Build** a prototype using Raspberry pi. **(L4)**
CO3: Perform basic analog and digital Modulation techniques using LabView Software. **(L2)**
CO4: Design and analysis performance of combinational circuits. **(L4)**

LIST OF EXPERIMENTS

MODULE 1: PYTHON

1. Write a python program to get factorial of a non-negative integer.
2. Write a python program to check whether a number is perfect or not.
3. Write a python program for Fibonacci series.
4. Given a number count the total number of digits in a number.
5. Write a python program to get largest number and smallest number in a list.

MODULE 2: IOT

1. Controlling of LED using Arduino.
2. Develop Traffic light controlling system using Arduino.
3. Working of Sensors with Arduino.
4. Controlling LED with Raspberry Pi.
5. Interfacing LED and Switch with Raspberry Pi.

Module 3: LabVIEW

1. Amplitude Modulation and Demodulation
2. Frequency Modulation and Demodulation
3. Binary Amplitude Shift Keying
4. Binary Phase Shift Keying
5. Binary Frequency Shift Keying

MODULE 4: TANNER TOOL

1. Inverter, NAND and NOR Gates
2. Multiplexer
3. Half Adder
4. Full Adder