Savitribai Phule Pune University
Faculty of Science & Technology

Curriculum

For
Bachelor of Engineering
(Electronics and Computer Engineering)
(Choice Based Credit System)

(With Effect from Academic Year 2020-21)

Savitribai Phule Pune University
Faculty of Science & Technology

Curriculum

For

First Engineering

BE(Electronics and Computer Engineering)

(Choice Based Credit System)

(2019 Course)

(With Effect from Academic Year 2020-21)

TABLE -1 First Engineering(Electronics and Computer)_structure
Semester-I

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credits			
		Theory	Practical	Tutorial	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
107001	Engineering Mathematics-I	03	--	01	30	70	25	--	--	125	03	--	01	04
107002/ 107009	Engineering Physics / Engineering Chemistry	04	02	--	30	70	--	25	--	125	04	01	--	05
102003	Systems in Mechanical Engineering	03	02	--	30	70	--	25	--	125	03	01	--	04
103004 / 104010	Basic Electrical Engineering / Basic Electronics Engineering	03	02	--	30	70	--	25	--	125	03	01	--	04
110005/ 101011	Programming and Problem Solving / Engineering Mechanics	03	02	--	30	70	--	25	--	125	03	01	--	04
111006	Workshop[@]	--	02	--	--	--	--	25	--	25	--	01	--	01
	Total	16	10	01	150	350	25	125	--	650	16	05	01	22
101007	Audit Course 1[&]	02	Environmental Studies-I											

Induction Program : 2 weeks at the beginning of semester-I and 1 week at the beginning of semester-II

TABLE 2 First Engineering (Electronics and Computer)_structure
Semester-II

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credits			
		Theory	Practical	Tutorial	ISE	ESE	TW	PR	OR	Total	TH	PR	TUT	Total
107008	Engineering Mathematics-II	04	--	01	30	70	25	--	--	125	04	--	01	05
107002/ 107009	Engineering Physics/ Engineering Chemistry	04	02	--	30	70	--	25	--	125	04	01	--	05
103004 / 104010	Basic Electrical Engineering / Basic Electronics Engineering	03	02	--	30	70	--	25	--	125	03	01	--	04
110005/ 101011	Programming and Problem Solving / Engineering Mechanics	03	02	--	30	70	--	25	--	125	03	01	--	04
102012	Engineering Graphics [Ω]	01	02	01	--	50	25		--	75	01	01		02
110013	Project Based Learning[§]	--	04	--	--	--	25	50	--	75	--	02	--	02
	Total	15	12	02	120	330	75	125	--	650	15	05	02	22
101014	Audit Course 2[&]	02	Environmental Studies-II											
107015		--	Physical Education-Exercise and Field Activities											

Instructions:

- PR/Tutorial must be conducted in three batches per division.
- Minimum number of required Experiments/Assignments in PR/ Tutorial shall be carried out as mentioned in the syllabi of respective subjects.
- Every Student should appear for Engineering Physics, Engineering Chemistry, Engineering Mechanics, Basic Electrical Engineering, Basic Electronics Engineering, Programming and Problem solving during the year.
- College is allowed to distribute Teaching workload of subjects Engineering Physics, Engineering Chemistry, Basic Electrical Engineering, Basic Electronics Engineering, Engineering Mechanics, Programming and Problem solving in semester I and II dividing number of FE divisions into two appropriate groups.
- Assessment of tutorial work has to be carried out as term-work examination. Term-work Examination and Practical Examination at first year of engineering course **shall be internal continuous assessment only.**

Ω 1 Credit for Engineering Graphics theory has to be awarded on the basis of End semester examination of 50 marks while 1 credit of tutorial and practical **shall be awarded on internal continuous assessment only**.

@ Credit for the course of workshop practical is to be awarded on the basis of continuous assessment / submission of job work.

§ Project based learning (PBL) requires continuous mentoring by faculty throughout the semester for successful completion of the tasks selected by the students per batch. While assigning the teaching workload a load of 2 Hrs/week/batch needs to be considered for the faculty involved. The Batch needs to be divided into sub-groups of 5 to 6 students. Assignments / activities / models/ projects etc. under project based learning is carried throughout semester and Credit for PBL has to be awarded on the basis of internal continuous assessment and evaluation at the end of semester.

& Audit course for Environmental Studies and II (As per D.O.No.F.13-1/2000 (EA/ENV/COS-I) dated 14 May, 2019) is mandatory but non-credit course. Examination has to be conducted at the end of Sem I & II respectively for award of grade at college level. Grade awarded for audit course shall not be calculated for grade point &CGPA.

Audit course for Physical education is mandatory non-credit course. Examination has to be conducted at the end of Semester for award of grade at college level. Grade awarded for audit course shall not be calculated for grade point &CGPA.

Guidelines for Induction Program

Induction programme for first year students is introduced to familiarize them to the new environment and encourage them to look beyond classrooms. Objective is to help new students adjust and feel comfort-able in the new environment, inculcate in them the ethos and culture of the institution, help them build bonds with other students and faculty members, and expose them to a sense of larger purpose and self exploration. Induction Program should be preferably of 3 weeks (**2 weeks at the beginning of semester-I and 1 week at the beginning of semester-II)**.

In order to implement the (SIP) in the College the following activities can be taken at College.

- Physical Activity-This would involve a daily routine of physical activity with games and sports.
- Creative Arts: - Every students would chose one skill related to the arts whether visual arts or performing arts.
- Mentoring and Universal Human values:-Mentoring and connecting the students with faculty members and other students is the most important part of student induction. This can be effectively done by forming a group of 20-22 students with a faculty mentor each. This can be implemented through group discussion and real life activities rather than lecturing.
- Familiarization with College, Department, Branch :-The incoming student should be told about the credit, grading system and scheme of the examination. They should be explained how the study in College differs from the study in school. They should be taken on College tour and shown important points such as library, canteen, gymkhana etc. They should be shown their department.
- Literary Activity :-Literary Activity would compass reading book, writing a summery, debating, checking play etc.
- Proficiency modules :- The modules can be designed to overcome some critical lacunas that students might have like English Speaking, Computer familiarity etc.
- Lectures by Eminent People:- The lectures of Eminent people to be organized to expose the student to social activity public life.
- Visit to local Area:-A couple of visits to the landmark of the city or a hospital are orphanage could be organized.
- Extracurricular activities in College:-The new students should be introduced to the extracurricular activities at the College.
- Feedback and Report on the program:-Students should be asked to give their mid program Feedback and a each group of 20-22 students should be asked to prepare a single report on their experience of the program.

To Summarize the above activity the sequence of activities can be planned as given below :

- Address by Principal, HOD's and other functionaries and welcome the new students along with their parents.
- The branch wise allocation of students to be done and a group of 20-22 students is to farmed along with one faculty as mentor.
- A detail time table of various activities is to be prepared and displayed for all students. The timetable should give details of location and details of faculty in charge of the activity.
- The visit to local areas can be arranged on Saturdays.

The various activities to be carried out can be divided into three phases :-

1. Initial phase:- Which may induce Address by Principal, HOD's and other functionaries College and Dept Visit, interaction with parents Forming of students group and assigning of mentor mentee.
2. Regular Phase:- This phase may include the activities such as creative arts / universal

Human values Games & Sports in the morning session and in the afternoon session. Literary activities, Proficiency module, Lectures & workshop, Extra curricular Activities can be scheduled.

3. Closing Phase:- This phase may include taking feed back of students, preparation of Report by each group, Test of creative Arts, Human Values can be taken.

These are summarized guidelines given to the student inducing induction programme (SIP) Please refer SIP Manual published by AICTE for detail guidelines [2].

Savitribai Phule Pune University

First Year Engineering (2019 Course)

107001 – Engineering Mathematics – I

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH : 3 Hrs./Week	**04**	**In-Semester Exam :30 Marks**
TUT : 1 Hr/Week		**End-Semester Exam :70 Marks**
		TW :25 Marks

Prerequisites:
Differentiation, Integration, Maxima and Minima, Determinants and Matrices.

Course Objectives:
To make the students familiarize with concepts and techniques in Calculus, Fourier series and Matrices. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance analytical thinking power, useful in their disciplines.

Course Outcomes (COs): The students will be able to learn

CO1: Mean value theorems and its generalizations leading to Taylors and Maclaurin's series useful in the analysis of engineering problems.

CO2: the Fourier series representation and harmonic analysis for design and analysis of periodic continuous and discrete systems.

CO3: to deal withderivative of functions of several variables that are essential in various branches of Engineering.

CO4: to apply the concept of Jacobian to find partial derivative of implicit function and functional dependence. Use of partial derivatives in estimating error and approximation and finding extreme values of the function.

CO5: the essential tool of matrices and linear algebra in a comprehensive manner for analysis of system of linear equations, finding linear and orthogonal transformations, Eigen values and Eigen vectors applicable to engineering problems

Course Contents

Unit I: Differential Calculus: (08 Hrs.)

Rolle's Theorem, Mean Value Theorems, Taylor's Series and Maclaurin's Series, Expansion of functions using standard expansions, Indeterminate Forms, L' Hospital's Rule, Evaluation of Limits and Applications.

Unit II: Fourier Series (08 Hrs.)

Definition, Dirichlet's conditions, Full range Fourier series, Half range Fourier series, Harmonic analysis, Parseval's identity and Applications to problems in Engineering.

Unit III: Partial Differentiation (08Hrs.)

Introduction to functions of several variables, Partial Derivatives, Euler's Theorem on Homogeneous functions, Partial derivative of Composite Function, Total Derivative, Change of Independent variables

Unit IV: Applications of Partial Differentiation (08 Hrs.)

Jacobian and its applications, Errors and Approximations, Maxima and Minima of functions of two variables, Lagrange's method of undetermined multipliers.

Unit V: Linear Algebra-Matrices, System of Linear Equations (08 Hrs.)

Rank of a Matrix, System of Linear Equations, Linear Dependence and Independence, Linear and Orthogonal Transformations, Application to problems in Engineering.

Unit VI: Linear Algebra-Eigen Values and Eigen Vectors, Diagonaliztion (08 Hrs.)

Eigen Values and Eigen Vectors, Cayley Hamilton theorem, Diagonaliztion of a matrix, Reduction of Quadratic forms to Canonical form by Linear and Orthogonal transformations.

Text Books:

1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill)
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi)

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.)
2. Advanced Engineering Mathematics by M. D. Greenberg (Pearson Education)
3. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning)
4. Thomas' Calculus by George B. Thomas, (Addison-Wesley, Pearson)
5. Applied Mathematics (Vol. I & Vol. II) by P.N.Wartikar and J.N.Wartikar Vidyarthi Griha Prakashan, Pune.
6. Linear Algebra –An Introduction, Ron Larson, David C. Falvo (Cenage Learning, Indian edition)

Tutorial and Term Work:

i) Tutorial for the subject shall be engaged in minimum three batches (batch size of 22 students maximum) per division.

ii) Term work shall consist of six assignments on each unit-I to unit-VI and is based on performance and continuous internal assessment.

107002: Engineering Physics

Teaching Scheme:	Credits	Examination Scheme:
TH: 04 Hr/week	**05**	**In-Semester :30 Marks**
PR: 02 Hr/Week		**End-Semester :70 Marks**
		PR :25 Marks

Prerequisite Courses, if any:
Fundamentals of: optics, interference, diffraction polarization, wave-particle duality, semiconductors and magnetism

Companion Course, if any: Laboratory Practical

Course Objectives:
To teach students basic concepts and principles of physics, relate them to laboratory experiments and their applications

Course Outcomes:
On completion of the course, learner will be able to–

CO1: Develop understanding of interference, diffraction and polarization; connect it to few engineering applications.

CO2: Learn basics of lasers and optical fibers and their use in some applications.

CO3: Understand concepts and principles in quantum mechanics. Relate them to some applications.

CO4: Understand theory of semiconductors and their applications in some semiconductor devices.

CO5: Summarize basics of magnetism and superconductivity. Explore few of their technological applications.

CO6: Comprehend use of concepts of physics for Non Destructive Testing. Learn some properties of nanomaterials and their application.

Course Contents

Unit I **Wave Optics** **(08 Hrs)**

Interference

- Introduction to electromagnetic waves and electromagnetic spectrum
- Interference in thin film of uniform thickness (with derivation)
- Interference in thin film wedge shape (qualitative)
- Applications of interference: testing optical flatness, anti-reflection coating

Diffraction

- Diffraction of light
- Diffraction at a single slit, conditions for principal maxima and minima, diffraction pattern
- Diffraction grating, conditions for principal maxima and minima starting from resultant amplitude equations, diffraction pattern
- Rayleigh's criterion for resolution, resolving power of telescope and grating

Polarization

- Polarization of light, Malus law
- Double refraction, Huygen's theory of double refraction

Applications of polarization: LCD

Unit II **Laser and Optic Fibre** **(08 Hrs)**

Laser

- Basics of laser and its mechanism, characteristics of laser
- Semiconductor laser: Single Hetro-junction laser
- Gas laser: CO_2 laser
- Applications of lasers: Holography, IT, industrial, medical

Optic Fiber

- Introduction, parameters: Acceptance Angle, Acceptance Cone, Numerical Aperture
- Types of optical fiber- step index and graded index
- Attenuation and reasons for losses in optic fibers (qualitative)
- Communication system: basic building blocks

Advantages of optical fiber communication over conventional methods.

Unit III **Quantum Mechanics** **(08 Hrs)**

- De-Broglie hypothesis
- Concept of phase velocity and group velocity (qualitative)
- Heisenberg Uncertainty Principle
- Wave-function and its physical significance
- Schrodinger's equations: time independent and time dependent
- Application of Schrodinger's time independent wave equation - Particle enclosed in infinitely deep potential well (Particle in RigidBox)
- Particle in Finite potential well (Particle in Non Rigid box) (qualitative)
- Tunneling effect, Tunneling effect examples (principle only): Alpha Decay, Scanning Tunneling Microscope, Tunnel diode
- Introduction to quantum computing

Unit IV **Semiconductor Physics** **(08 Hrs)**

- Free electron theory (Qualitative)
- Opening of band gap due to internal electron diffraction due to lattice Band theory of solids
- Effective mass of electron Density of states
- Fermi Dirac distribution function
- Conductivity of conductors and semiconductors
- Position of Fermi level in intrinsic and extrinsic semiconductors (with derivations based on carrier concentration)
- Working of PN junction on the basis of band diagram
- Expression for barrier potential (derivation)
- Ideal diode equation
- Applications of PN junction diode: Solar cell (basic principle with band diagram) IV Characteristics and Parameters, ways of improving efficiency of solar cell
- Hall effect: Derivation for Hall voltage, Hall coefficient, applications of Hall effect

Unit V **Magnetism and Superconductivity** **(8Hrs.)**

Magnetism

- Origin of magnetism
- Classification of magnetism on the basis of permeability (qualitative)
- Applications of magnetic devices: transformer cores, magnetic storage, magneto-optical recording

Superconductivity

- Introduction to superconductivity; Properties of superconductors: zero electrical
- resistance, critical magnetic field, persistent current, Meissner effect
- Type I and Type II superconductors
- Low and high temperature superconductors (introduction and qualitative)
- AC/DC Josephson effect; SQUID: basic construction and principle of working; Applications of SQUID
- Applications of superconductors

Unit VI **Non Destructive Testing and Nanotechnology** **(8 Hrs.)**

Non Destructive Testing

- Classification of Non-destructive testing methods
- Principles of physics in Non-destructive Testing
- Advantages of Non-destructive testing methods
- Acoustic Emission Testing
- Ultrasonic (thickness measurement, flaw detection)
- Radiography testing

Nanotechnology

- Introduction to nanotechnology
- Quantum confinement and surface to volume ratio
- Properties of nanoparticles: optical, electrical, mechanical

Applications of nanoparticles: Medical (targeted drug delivery), electronics, space and defense, automobile

Books & Other Resources:

Text Books:

1. Engineering Physics, Avadhanulu, Kshirsagar, S. Chand Publications
2. A textbook of optics – N Subrahmanyam and BriLal , S. Chand Publications
3. Engineering Physics, Gaur, Gupta, Dhanpat Rai and Sons Publications

Reference Books:

1. Fundamentals of Physics, Resnick and Halliday (John Wiley and Sons)
2. Optics, Jenkins and White (Tata Mcgraw Hill)
3. Principles of Physics, Serway and Jewett (Saunders college publishing)
4. Introduction to Solid State Physics, C. Kittel (Wiley and Sons)
5. Principles of Solid State Physics, H. V. Keer, New Age International
6. Laser and Non-Linear Optics, B. B. Laud (Oscar publication)
7. Nanotechnology: Principles and Practices, Dr. S. K. Kulkarni (Capital Publishing Company

Guidelines for Instructor's Manual

Lab manual is expected to cover following points:

1. Engineering Program Outcome (Graduate Attribute) and which attributes will be covered during practical
2. List of experiments to be performed with mention of objectives and outcome of the experiment

Guidelines for Student's Lab Journal

Student's lab journal is expected to cover:

1. List of experiments to be performed with mention of objectives and outcome of the experiment.
2. Instructions to students for performing the experiments
3. Precautions for each experiment
4. Write up of experiment (Preferably mentioning significance of experiment).

Guidelines for Lab /TW Assessment

1. The distribution of weightage of term work marks should be informed to students before start of the semester.
2. Term work assessment should be on continuous basis. At frequent intervals students are expected to inform about their progress/lagging.

Guidelines for Laboratory Conduction

1. DO's and DONT'S, along with precautions, are need to be displayed at prominent location in laboratory
2. Students should be informed about DO'S and DON'T and precautions before performing the experiment

Suggested List of Laboratory Experiments (<u>Any eight</u>)

Sr.	Experiment
1	Experiment based on Newton's rings (determination of wavelength of monochromatic light, determine radius of curvature of plano-convex lens)
2	To determine position of diffraction minima by studying diffraction at a single slit
3	To determine unknown wavelength by using plane diffraction grating
4	To find out Resolving power of Diffraction Grating/Telescope
5	To verify Malus Law
6	Any experiment based on Double Refraction (Determination of refractive indices, identification of types of crystal)
7	Any Experiment based on Laser (Thickness of wire, determination of number of lines on grating surface)
8	An experiment based on optic fibers
9	To study IV characteristics of Solar Cell and determine parameters (fill factor and efficiency)
10	To determine band gap of given semiconductor
11	To determine Hall coefficient and charge carrier density
12	Temperature dependence characteristics of semiconductor laser
13	To find out Magnetic susceptibility of given material
14	Ultrasonic Interferometer: Determination of velocity of ultrasonic waves in given liquid and find its compressibility
	Suggested Demonstration Experiments
1	Michelson interferometer
2	Half shade Polarimeter
3	Determination of absorption coefficient of sound of given material
4	Temperature dependence
5	Brewster's law
6	Measurement of sound pressure level

102003 - Systems in Mechanical Engineering		
Teaching Scheme: **TH : 3 Hrs./week** **PR : 2 Hrs./Week**	**Credits** **04**	**Examination Scheme:** **In-Semester :30 Marks** **End-Semester :70 Marks** **PR :25 Marks**

Course Objectives:

1. To identify the sources of energy and their conversions
2. To explain the basic concept of engineering thermodynamics and its application
3. To understanding the specifications of vehicles
4. To get acquainted with vehicle systems
5. To introduce manufacturing processes applying proper method to produce components
6. To be able to select and compare domestic appliances

Course Outcomes

On completion of the course, learner will be able to

CO1: Describe and compare the conversion of energy from renewable and non-renewable energy sources

CO2: Explain basic laws of thermodynamics, heat transfer and their applications

CO3: List down the types of road vehicles and their specifications

CO4: Illustrate various basic parts and transmission system of a road vehicle

CO5: Discuss several manufacturing processes and identify the suitable process

CO6: Explain various types of mechanism and its application

Course Contents

Unit I Introduction of energy sources & its conversion (06 Hrs)

Energy sources: Thermal energy, Hydropower energy, Nuclear energy, Solar energy, Geothermal energy, Wind energy, Hydrogen energy, Biomass energy and Tidal energy. Grades of Energy. (*Numerical on efficiency calculation of thermal power plant*)

Energy conversion devices: Introduction of pump, compressor, turbines, wind mills etc (*Simple numerical on power and efficiency calculations)*

Unit II Introduction to Thermal Engineering (06Hrs)

Laws of thermodynamics, heat engine, heat pump, refrigerator *(simple numerical)*

Modes of heat transfer: conduction, convection and radiation, Fourier's law, Newton's law of cooling, Stefan Boltzmann's law. *(Simple numerical)*

Two stroke and Four stroke engines (Petrol, Diesel and CNG engines). Steam generators.

Unit III Vehicles and their Specifications (04 Hrs)

Classification of automobile. Vehicle specifications of two/three wheeler, light motor vehicles, trucks, buses and multi-axle vehicles. Engine components (Introduction). Study of engine specifications, comparison of specifications of vehicles. Introduction of Electric and Hybrid Vehicles. Cost analysis of the Vehicle.

Unit IV Vehicle systems (08 Hrs)

Introduction of chassis layouts, steering system, suspension system, braking system, cooling system and fuel injection system and fuel supply system. Study of Electric and Hybrid Vehicle systems. Study of power transmission system, clutch, gear box (Simple Numerical), propeller shaft, universal joint, differential gearbox and axles. Vehicle active and passive safety arrangements: seat, seat belts, airbags and antilock brake system.

Unit V **Introduction to Manufacturing** **(06 Hrs)**

Conventional Manufacturing Processes: Casting, Forging, Metal forming (Drawing, Extrusion, etc.), Sheet metal working, Metal joining, etc. Metal cutting processes and machining operations- Turning, Milling and Drilling, etc.

Micromachining. Additive manufacturing and 3D Printing. Reconfigurable manufacturing system and IOT, Basic CNC programming**:** Concept of Computer Numerical Controlled machines.

Unit VI Engineering Mechanisms and their application in Domestic Appliances (6Hrs.)

Introduction to Basic mechanisms and equipment: Pumps, blowers, compressors, springs, gears, Belt-Pulley, Chain-Sprocket, valves, levers, etc. Introduction to terms: Specifications, Input, output, efficiency, etc.

Applications of: Compressors - Refrigerator, Water cooler, Split AC unit; Pumps - Water pump for overhead tanks, Water filter/Purifier units; Blower - Vacuum cleaner, Kitchen Chimney; Motor - Fans, Exhaust fans, Washing machines; Springs - Door closure, door locks, etc.; Gears - Wall clocks, watches, Printers, etc.; Application of Belt-Pulley/Chain-Sprocket - Photocopier, bicycle, etc.; Valves - Water tap, etc.; Application of levers - Door latch, Brake pedals, etc.; Electric/Solar energy - Geyser, Water heater, Electric iron, etc. (simple numerical on efficiency calculation)

Books & Other Resources

Text Books

1. Nag, P. K., "Engineering Thermodynamics," Tata McGraw-Hill Publisher Co. Ltd.
2. Chaudhari and Hajra, "Elements of Workshop Technology", Volume I and II, Media Promoters and Publishers, Mumbai
3. Agrawal,Basant and Agrawal, C. M., (2008), "Basics of Mechanical Engineering", John Wiley and Sons, USA
4. Rajput, R.K., (2007), "Basic Mechanical Engineering", Laxmi Publications Pvt. Ltd.
5. Pravin Kumar, (2018), " Basic Mechanical Engineering, 2nd Ed.", Pearson (India) Ltd.
6. Moran, M. J., Shapiro, H. N., Boettner, D. D., and Bailey, M. "Fundamentals of Engineering Thermodynamics", Wiley
7. Surinder Kumar, (2011), "Basic of Mechanical Engineering", Ane Books Pvt. Ltd. New Delhi

Reference Books

1. Khan, B. H., "Non Conventional Energy Sources, Tata McGraw-Hill Publisher Co. Ltd.
2. Boyle, Godfrey, "Renewable Energy",2nd Ed., Oxford University Press
3. Khurmi, R.S. ,and Gupta, J. K.,"A Textbook of Thermal Engineering", S. Chand & Sons
4. Incropera, F. P. and Dewitt, D.P., (2007), "Fundamentals of Heat and Mass Transfer, 6th Ed., John Wiley and Sons, USA
5. Groover,Mikell P., (1996), "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems", Prentice Hall, USA
6. Norton, Robert L., (2009), "Kinematics and Dynamics of Machinery", Tata McGrawHill
7. Cleghorn, W. L., (2005), "Mechanisms of Machines", Oxford University Press
8. Juvinal, R. C., (1994), "Fundamentals of Machine Component Design", John Wiley and Sons, USA
9. Ganeshan, V., (2018), "Internal Combustion Engines", McGraw Hill
10. Anderson, Curtis Darrel and Anderson,Judy, (2010), "Electric and Hybrid Cars: A History", 2nd Ed., McFarland

Guidelines for Instructor's Manual

The Instructor's Manual should contain following related to every experiment:

- Brief theory related to the experiment.
- Apparatus with their detailed specifications.

- Schematic, Layout /diagram.
- Observation table/ simulation plots/graphs.
- Sample calculations for one/two reading.
- Result table.
- Graph and Conclusions.
- Few questions related to the experiment.
- Relevance of practical in real life /industry

Guidelines for Student's Lab Journal

The Student's Lab Journal should contain following related to every experiment:

- Theory related to the experiment.
- Apparatus with their detailed specifications.
- Schematic, Layout /diagram.
- Observation table/ simulation plots/graphs.
- Sample calculations for one/two reading.
- Result table.
- Graph and Conclusions.
- Few short questions related to the experiment.

Guidelines for Lab /TW Assessment

- There should be continuous assessment for the TW.
- Assessment must be based on understanding of theory, attentiveness during practical, and understanding.
- Session, how efficiently the student is able to do connections and get the results.
- Timely submission of journal.

The student shall complete the following activity as a term work.

Sr. No.	Activity
1.	**Group A: Industry / Workshop / Showroom Visit:** The visit of students is mandatory, to provide awareness and understanding of the course.
2.	**Group B: Assignments:** The student shall complete the following assignments on: i. Energy sources (Minimum one assignment on Conventional and one on Non-conventional sources) ii. Vehicle specifications and systems in passenger car iii. Electric vehicle specifications and its systems iv. Domestic appliances viz. refrigerator, air-conditioner, washing machine, cold storage
3.	**Group C: Experiments:** The student shall complete the following (**any four)** experiments: i. Demonstration of power train system in the vehicle ii. Demonstration of vehicle systems (automobile chassis, steering system, suspension system, braking system - Any Two) iii. Demonstration of energy conversion devices iv. Demonstration of additive manufacturing / rapid prototyping techniques v. Demonstration of CNC

103004: Basic Electrical Engineering		
Teaching Scheme: **TH : 03 Hr/week** **PR : 02 Hr/Week**	**Credits** **04**	**Examination Scheme:** **In-Semester : 30 Marks** **End-Semester : 70 Marks** **PR : 25 Marks**

Prerequisite Courses, if any: Engineering physics**,** electron theory, electricity, potential and kinetic energy

Course Overview: This course aims at enabling students of all Engineering Branches to understand the basic concepts of electrical engineering. This course is designed to provide knowledge of fundamentals and various laws in electromagnetic and magnetic circuits, electrostatics. The steady state analysis of AC and DC circuits, and its applications transformer, batteries and different energy conversion techniques are also included in this course.

Course Objectives:

1. To introduce fundamental concepts, various laws-principles and theorems associated with electrical systems.
2. To impart basic knowledge of all electrical quantities such as current, voltage, power, energy, frequency along with different types of fields.
3. To provide knowledge about fundamental parameters such as resistance, inductance and capacitance and magnetic circuits, AC and DC circuits.
4. To provide knowledge of the concepts of transformer, different energy conversions techniques.

Course Outcomes:

At the end of course students will be able to

CO1: Differentiate between electrical and magnetic circuits and derive mathematical relation for self and mutual inductance along with coupling effect.

CO2: Calculate series, parallel and composite capacitor as well as characteristics parameters of alternating quantity and phasor arithmetic

CO3: Derive expression for impedance, current, power in series and parallel RLC circuit with AC supply along with phasor diagram.

CO4: Relate phase and line electrical quantities in polyphase networks, demonstrate the operation of single phase transformer and calculate efficiency and regulation at different loading conditions

CO5: Apply and analyze the resistive circuits using star-delta conversion KVL, KCL and different network theorems under DC supply.

CO6: Evaluate work, power, energy relations and suggest various batteries for different applications, concept of charging and discharging and depth of charge.

Course Contents

Unit I **Electromagnetism**: (**6Hrs**)

Review: resistance, emf, current, potential, potential difference and Ohm's law

Electromagnetism: Magnetic effect of an electric current, cross and dot conventions, right hand thumb rule, nature of magnetic field of long straight conductor, solenoid and toroid. Concept of mmf, flux, flux density, reluctance, permeability and field strength, their units and relationships. Simple series magnetic circuit, Introduction to parallel magnetic circuit(Only theoretical treatment), comparison of electric and magnetic circuit, force on current carrying conductor placed in magnetic field, Fleming's left hand rule. Faradays laws of electromagnetic induction, Fleming's right hand rule, statically and dynamically induced e.m.f., self and mutual inductance, coefficient of couplings. Energy stored in magnetic field.

Unit II **Electrostatics and AC Fundamentals** **(6 Hrs)**

A) Electrostatics: Electrostatic field, electric flux density, electric field strength, absolute permittivity, relative permittivity and capacitance. Capacitor, capacitors in series and parallel, energy stored in capacitors, charging and discharging of capacitors (no derivation) and time constant. **(2Hrs)**

B) AC Fundamentals: Sinusoidal voltages and currents, their mathematical and graphical representation, Concept of cycle, Period, frequency, instantaneous, peak(maximum), average and r.m.s. values, peak factor and form factor. Phase difference, lagging, leading and in phase quantities and phasor representation. Rectangular and polar representation of phasor. **(4Hrs)**

Unit III **Single Phase AC Circuits** **(06 Hrs)**

Study of AC circuits consisting of pure resistance, pure inductance, pure capacitance, series R-L, R-C and R-L-C circuits, phasor diagrams, voltage, current and power waveforms, resonance in series RLC circuits, concept of impedance, concept of active, reactive, apparent, complex power and power factor, Parallel AC circuits (No numericals), concept of admittance

Unit IV **Polyphase A.C. Circuits and Single phase Transformers** **(06 Hrs)**

A) Polyphase A.C. Circuits: Concept of three-phase supply and phase sequence. Balanced and unbalanced load, Voltages, currents and power relations in three phase balanced star-connected loads and delta-connected loads along with phasor diagrams. **(3Hrs)**

B) Single phase transformers: principle of working, construction and types, emf equation, voltage and current ratios. Losses, definition of regulation and efficiency, determination of these by direct loading method. Descriptive treatment of autotransformers. **(3Hrs)**

Unit V **DC Circuits:** **(06 Hrs)**

Classification of electrical networks, Energy sources – ideal and practical voltage and current sources, Simplifications of networks using series and parallel combinations and star-delta conversions, Kirchhoff's laws and their applications for network solutions using loop analysis, Superposition theorem, Thevenin's theorem.

Unit VI **Work, Power, Energy and Batteries** **(06 Hrs)**

A) Work, Power, Energy: Effect of temperature on resistance, resistance temperature coefficient, insulation resistance, conversion of energy from one form to another in electrical, mechanical and thermal systems. (**4Hrs**)

B) Batteries : Different types of batteries (Lead Acid and Lithium Ion), construction, working principle, applications, ratings, charging and discharging, concept of depth of charging, maintenance of batteries, series -parallel connection of batteries **(2Hrs)**

Books & Other Resources:

Text Books:

1. V.D. Toro, Principles of Electrical Engineering, Prentice Hall India, 1989
2. D. P. Kothari, I.J. Nagrath, Theory and Problems of Basic Electrical Engineering, PHI Publication
3. V.K. Mehta, RohitMehata Basic Electrical Engineering, S Chand Publications
4. B.L. Theraja, A text book on electrical technology Vol-I

Reference Books:

1. H Cotton, Electrical technology, CBS Publications
2. L. S. Bobrow, ―Fundamentals of Electrical Engineering‖, Oxford University Press, 2011.
3. E. Hughes, ―Electrical and Electronics Technology‖, Pearson, 2010.
4. D. C. Kulshreshtha, ―Basic Electrical Engineering‖, McGraw Hill, 2009.

Guidelines for Instructor's Manual

The Instructor's Manual should contain following related to every experiment –

- Brief theory related to the experiment.
- Apparatus with their detailed specifications.

- Connection diagram /circuit diagram.
- Observation table/ simulation waveforms.
- Sample calculations for one/two reading.
- Result table.
- Graph and Conclusions.
- Few questions related to the experiment.
- Relevance of practical in real life /industry

Guidelines for Student's Lab Journal

The Student's Lab Journal should contain following related to every experiment –

- Theory related to the experiment.
- Apparatus with their detailed specifications.
- Connection diagram /circuit diagram.
- Observation table/ simulation waveforms.
- Sample calculations for one/two reading.
- Result table.
- Graph and Conclusions.
- Few short questions related to the experiment.

Guidelines for Lab /TW Assessment

- There should be continuous assessment for the TW.
- Assessment must be based on understanding of theory, attentiveness during practical, understanding .
- Session, how efficiently the student is able to do connections and get the results.
- Timely submission of journal.

Suggested List of Laboratory Experiments/Assignments

Group A

Following **eight** practical are compulsory

1. To study safety precautions while working on electrical systems, handling of various equipment's such as multimeter, ammeters, voltmeters, wattmeter's, real life resistors, inductors and capacitors
2. To calculate and measure of charging and discharging of capacitor and observe the response on storage oscilloscope.
3. To measure steady state response of series RL and RC circuits on AC supply and observations of voltage and current waveforms on storage oscilloscope.
4. To derive resonance frequency and analyze resonance in series RLC circuit.
5. To verify the relation between phase and line quantities in three phase balanced star delta connections of load.
6. To determine efficiency and regulation of transformer by direct loading test of a single phase transformer.
7. To verify KVL and Superposition theorem.
8. To verify Thevenin's theorem in a DC network

Group B

From following **minimum two** practical are compulsory

1. To measure insulation resistance of electrical equipment's/cable using Megger
2. To demonstrate different types of electrical protection equipments such as fuses, MCB, MCCB, ELCB.
3. To measure of earth resistance at substation earthing using fall of potential method with IS 3043 standard.
4. To study of LT and HT electricity bills.

110005: Programming and Problem Solving		
Teaching Scheme: **TH: 03 Hrs/Week** **PR : 02 Hrs/Week**	**Credits** **04**	**Examination Scheme:** **In-Semester : 30 Marks** **End-Semester : 70 Marks** **PR : 25 Marks**

Prerequisite Courses, if any: students are expected to have a good understanding of basic computer principles.

Companion Course, if any: Programming and Problem Solving Laboratory (110005)

Course Objectives:

Prime objective is to give students a basic introduction to programming and problem solving with computer language Python. And to introduce students not merely to the coding of computer programs, but to computational thinking, the methodology of computer programming, and the principles of good program design including modularity and encapsulation.

1. To understand problem solving, problem solving aspects, programming and to know about various program design tools.
2. To learn problem solving with computers
3. To learn basics, features and future of Python programming.
4. To acquaint with data types, input output statements, decision making, looping and functions in Python
5. To learn features of Object Oriented Programming using Python
6. To acquaint with the use and benefits of files handling in Python

Following Fields are applicable for courses with companion Laboratory course

Course Outcomes: On completion of the course, learner will be able to–

CO1: Inculcate and apply various skills in problem solving.

CO2: Choose most appropriate programming constructs and features to solve the problems in diversified domains.

CO3: Exhibit the programming skills for the problems those require the writing of well-documented programs including use of the logical constructs of language, Python.

CO4: Demonstrate significant experience with the Python program development environment.

Course Contents

Unit I Problem Solving, Programming and Python Programming (07 Hrs)

General Problem Solving Concepts- Problem solving in everyday life, types of problems, problem solving with computers, difficulties with problem solving, problem solving aspects, top down design. Problem Solving Strategies,

Program Design Tools: Algorithms, Flowcharts and Pseudo-codes, implementation of algorithms.

Basics of Python Programming: Features of Python, History and Future of Python, Writing and executing Python program, Literal constants, variables and identifiers, Data Types, Input operation, Comments, Reserved words, Indentation, Operators and expressions, Expressions in Python.

Unit II Decision Control Statements (08 Hrs)

Decision Control Statements: Decision control statements, **Selection/conditional** branching Statements: if, if-else, nested if, if-elif-else statements. **Basic loop** Structures/Iterative statements: while loop, for loop, selecting appropriate loop. Nested loops, The *break, continue, pass, else* statement used with loops. Other data types- Tuples, Lists and Dictionary.

Unit III **Functions and Modules** **(08 Hrs)**

Need for functions, **Function**: definition, call, variable scope and lifetime, the return statement. Defining functions, Lambda or anonymous function, documentation string, good programming practices. Introduction to modules, Introduction to packages in Python, Introduction to standard library modules.

Unit IV **Strings** **(07 Hrs)**

Strings and Operations- concatenation, appending, multiplication and slicing. Strings are immutable, strings formatting operator, built in string methods and functions. Slice operation, ord() and chr() functions, in and not in operators, comparing strings, Iterating strings, the string module.

Unit V **Object Oriented Programming** **(08 Hrs)**

Programming Paradigms-monolithic, procedural, structured and object oriented, **Features of Object oriented programming-**classes, objects, methods and message passing, inheritance, polymorphism, containership, reusability, delegation, data abstraction and encapsulation.

Classes and Objects: classes and objects, class method and self object, class variables and object variables, public and private members, class methods.

Unit VI **File Handling and Dictionaries** **(07 Hrs)**

Files: Introduction, File path, Types of files, Opening and Closing files, Reading and Writing files. Dictionary method. **Dictionaries-** creating, assessing, adding and updating values.

Case Study: Study design, features, and use of any recent, popular and efficient system developed using Python. (This topic is to be excluded for theory examination).

Text Books:

1. Reema Thareja, "Python Programming Using Problem Solving Approach", Oxford University Press, ISBN 13: 978-0-19-948017-6
2. R. Nageswara Rao, "Core Python Programming", Dreamtech Press; Second edition ISBN-10: 938605230X, ISBN-13: 978-9386052308 ASIN: B07BFSR3LL

Reference Books:

1. R. G. Dromey, "How to Solve it by Computer", Pearson Education India; 1st edition, ISBN-10: 8131705625, ISBN-13: 978-8131705629 Maureen Spankle, "Problem Solving and Programming Concepts", Pearson; 9th edition, ISBN-10: 9780132492645, ISBN-13: 978-0132492645
2. Romano Fabrizio, "Learning Python", Packt Publishing Limited, ISBN: 9781783551712, 1783551712
3. Paul Barry, "Head First Python- A Brain Friendly Guide", SPD O'Reilly, 2nd Edition, ISBN:978-93-5213-482-3
4. Martin C. Brown, "Python: The Complete Reference", McGraw Hill Education, ISBN-10: 9789387572942, ISBN-13: 978-9387572942, ASIN: 9387572943
5. Jeeva Jose, P. Sojan Lal, "Introduction to Computing & Problem Solving with Python", Khanna Computer Book Store; First edition, ISBN-10: 9789382609810, ISBN-13: 978-9382609810

Programming and Problem Solving Laboratory

Guidelines for Instructor's Manual

The instructor's manual is to be developed as a hands-on resource and reference. The instructor's manual need to include prologue (about University/program/ institute/ department/foreword/ preface etc), copy of curriculum, conduction & Assessment guidelines, topics under consideration-concept, objectives, outcomes, set of typical applications/assignments/ guidelines, and references.

Guidelines for Student's Lab Journal

The laboratory assignments are to be submitted by student in the form of journal. Journal consists of prologue, Certificate, table of contents, and handwritten write-up of each assignment (Title, Objectives, Problem Statement, Outcomes, software & Hardware requirements, Date of Completion, Assessment grade/marks and assessor's sign, Theory-Concept in brief, features of

tool/framework/language used, Design, test cases, conclusion. Program codes with sample output of all performed assignments are to be submitted as softcopy.

As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of write-ups and program listing to journal may be avoided. Use of DVD containing students programs maintained by lab In-charge is highly encouraged. For reference one or two journals may be maintained with program prints at Laboratory.

Guidelines for Lab /TW Assessment

Continuous assessment of laboratory work is done based on overall performance and lab assignments performance of student. Each lab assignment assessment will assign grade/marks based on parameters with appropriate weightage. Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, innovation, efficient codes, punctuality and neatness.

Guidelines for Laboratory Conduction

List of laboratory assignments is provided below for reference. The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. The assignment framing policy need to address the average students and inclusive of an element to attract and promote the intelligent students. The instructor may set multiple sets of assignments and distribute among batches of students. It is appreciated if the assignments are based on real world problems/applications. Encourage students for appropriate use of coding style, proper indentation and comments.

Use of open source software and recent version is to be encouraged.

In addition to these, instructor may assign one real life application in the form of a mini-project based on the concepts learned. Instructor may also set one assignment or mini-project that is suitable to respective branch beyond the scope of syllabus.

Suggested List of Laboratory Experiments/Assignments
(Any 6 to 8 laboratory assignments)

Sr. No.	Problem Statement Write Program in Python (with function/class/file, as applicable)
1.	To calculate salary of an employee given his basic pay (take as input from user). Calculate gross salary of employee. Let HRA be 10 % of basic pay and TA be 5% of basic pay. Let employee pay professional tax as 2% of total salary. Calculate net salary payable after deductions.
2.	To accept an object mass in kilograms and velocity in meters per second and display its momentum. Momentum is calculated as $e=mc^2$ where m is the mass of the object and c is its velocity.
3.	To accept N numbers from user. Compute and display maximum in list, minimum in list, sum and average of numbers.
4.	To accept student's five courses marks and compute his/her result. Student is passing if he/she scores marks equal to and above 40 in each course. If student scores aggregate greater than 75%, then the grade is distinction. If aggregate is 60>= and <75 then the grade if first division. If aggregate is 50>= and <60, then the grade is second division. If aggregate is 40>= and <50, then the grade is third division.
5.	To check whether input number is Armstrong number or not. An Armstrong number is an integer with three digits such that the sum of the cubes of its digits is equal to the number itself. Ex. 371.
6.	To simulate simple calculator that performs basic tasks such as addition, subtraction, multiplication and division with special operations like computing x^y and x!.

7.	To accept the number and Compute a) square root of number, b) Square of number, c) Cube of number d) check for prime, d) factorial of number e) prime factors
8.	To accept two numbers from user and compute smallest divisor and Greatest Common Divisor of these two numbers.
9.	To accept a number from user and print digits of number in a reverse order.
10.	To input binary number from user and convert it into decimal number.
11.	To generate pseudo random numbers.
12.	To accept list of N integers and partition list into two sub lists even and odd numbers.
13.	To accept the number of terms a finds the sum of *sine* series.
14.	To accept from user the number of Fibonacci numbers to be generated and print the Fibonacci series.
15.	Write a python program that accepts a string from user and perform following string operations- i. Calculate length of string ii. String reversal iii. Equality check of two strings iii. Check palindrome ii. Check substring
16.	To copy contents of one file to other. While copying a) all full stops are to be replaced with commas b) lower case are to be replaced with upper case c) upper case are to be replaced with lower case.
17.	To count total characters in file, total words in file, total lines in file and frequency of given word in file.
18.	Create class EMPLOYEE for storing details (Name, Designation, gender, Date of Joining and Salary). Define function members to compute a)total number of employees in an organization b) count of male and female employee c) Employee with salary more than 10,000 d) Employee with designation "Asst Manager"
19.	Create class STORE to keep track of Products (Product Code, Name and price). Display menu of all products to user. Generate bill as per order.
Mini-Projects	
20.	Calculator with basic functions. Add more functionality such as graphic user interface and complex calculations.
21.	Program that simulates rolling dice. When the program runs, it will randomly choose a number between 1 and 6 (Or other integer you prefer). Print that number. Request user to roll again. Set the min and max number that dice can show. For the average die, that means a minimum of 1 and a maximum of 6.
22.	Use raspberry pi/or similar kit and python for- • Room Temperature Monitoring System • Motion Detection System • Soil Moisture Sensor • Home Automation System • A robot • Smart mirror or a smart clock. • Smile Detection using Raspberry Pi Camera
23.	Guess Number: Randomly generate a number unknown to the user. The user needs to guess what that number is. If the user's guess is wrong, the program should return some sort of indication as to how wrong (e.g. the number is too high or too low). If the user guesses correctly, a positive indication should appear. Write functions to check if the user input is an actual number, to see the difference between the inputted number and the randomly generated numbers, and to then compare the numbers.

111006 -Workshop Practice

Teaching Scheme:	Credits	Examination Scheme:
PR : 2 Hrs/Week	01	PR : 25 Marks

Course Objectives:

1. To understand the construction and working of machine tools and functions of its parts.
2. To develop the skill through hands-on practices using hand tools, power tools, machine tools in manufacturing and assembly shop leading to understanding of a production processes.
3. To understand workshop layout and safety norms.

Course Outcomes:

CO1: Familiar with safety norms to prevent any mishap in workshop.
CO2: Able to handle appropriate hand tool, cutting tool and machine tools to manufacture a job.
CO3: Able to understand the construction, working and functions of machine tools and their parts.
CO4: Able to know simple operations (Turning and Facing) on a centre lathe.

Note

1. The demonstration of machine tools to be conducted by **teaching** faculty.
2. Minimum eight experiments to be conducted out of 10.

Guidelines for Instructor's Manual

Instructor manual shall contain:

- The production drawing of a job with all linear and geometric dimensions, Raw material, size and shape, allowances provided.
- List of tooling required.
- Process plan to complete the job.
- General safety instructions.

Guidelines for Student's Lab Journal

i. Student has to maintain a workshop diary consisting of drawing / sketches of the jobs and a brief description of tools, equipment, and procedure used for doing the job and time schedule.
ii. Student has to maintain one file for write ups based on demonstration of machine tools and safety norms

Guidelines for LAB/TW Assessment

Term work assessment shall be based on the timely completion of jobs, quality of job, skill acquired, and maintain of workshop diary and brief write-ups on illustrations/sketches of demonstrated parts/mechanisms/machine tools etc.

Guidelines for Laboratory Conduction

i. 1st on importance of workshop practical and shop floor safety norms
ii. 2nd to 6th Sessions are about demonstration of machine tools (Any 4)
iii. 7th to 9th on making utility job (Any 2)
iv. 10th& 11th session on preparation of workshop layout and safety norms.

Suggested List of Laboratory Experiments/Assignments

Sr. No.	List of Experiments
1.	Mandatory briefing on shop-floor safety
2.	**Demonstration and working of centre lathe** Demonstration on various functions of lathe parts: Headstock, Tailstock, Carriage, Lead screw, All geared Mechanism, Apron mechanism etc.
3.	**Demonstration of Lathe operations:** Step turning and facing, drilling operation on a Mild Steel cylindrical job on centre lathe. Understanding the concept of speed, feed and depth of cut.

4.	**Demonstration of Drilling machine** Demonstration on construction of Radial drilling machine, Tool holding devices, Concept of speed, feed and depth of cut.
5.	**Demonstration on Milling machine** Demonstration on construction, table movements, indexing and tooling of milling machine.
6.	**Demonstration of Shaper/Grinding machine (Any one)** Shaper: Crank and slotted link mechanism, Work feed mechanism Grinding: Surface grinder/Cylindrical grinding machine, Mounting of grinding wheel
7.	**Term work includes one job of Carpentry** Introduction to wood working, kinds of woods, hand tools & machines, Types of joints, wood turning. Pattern making, types of patterns and its allowances.
8.	**Term work to include one job involving fitting** to size, male-female fitting with drilling and tapping operation on Mild Steel plate; Introduction to marking, cutting and sawing, sizing of metal, shearing, Concept of fits and interchangeability, selection of datum and measurements.
9.	**Term work to include one utility job preferably using sheet metal** (e.g. Tray, Funnel etc.) with riveting/welding/brazing/soldering (at least one temporary and one Permanent joint either using resistance welding/Arc welding); Introduction to sheet metal operations: punching, blanking, bending, drawing.
10.	**Prepare a Layout of Workshop** To prepare a work shop layout.
11.	**Collection of information about safety norms** in any one of the following type of industry:Metalworking/Chemical/Cement/Pharmaceuticals/Defense/Atomic energy/Aerospace /Marine/Construction/Railway etc.

Reference/Text Books

1. John, K. C., (2010),"Mechanical Workshop Practice, Prentice Hall Publication, New Delhi
2. Hazra and Chaudhary, Workshop Technology-I & II, Media promoters & Publisher Pvt. Ltd.

101007: Environmental Studies-I

TH:02 Hrs./week **(Mandatory Non-Credit Course)**

Course Objectives:

1. To explain the concepts and strategies related to sustainable development and various components of environment.
2. To examine biotic and abiotic factors within an ecosystem, to identify food chains, webs, as well as energy flow and relationships.
3. To identify and analyze various conservation methods and their effectiveness in relation to renewable and nonrenewable natural resources.
4. To gain an understanding of the value of biodiversity and current efforts to conserve biodiversity on national and local scale.

Course Outcomes: On completion of the course, learner will be able to–

CO1:Demonstrate an integrative approach to environmental issues with a focus on sustainability.

CO2: Explain and identify the role of the organism in energy transfers in different ecosystems.

CO3: Distinguish between and provide examples of renewable and nonrenewable resources & analyze personal consumption of resources.

CO4: Identify key threats to biodiversity and develop appropriate policy options for conserving biodiversity in different settings.

Course Contents

Unit I **Introduction to environmental studies** **(02 Hrs)**

Multidisciplinary nature of environmental studies; components of environment – atmosphere, hydrosphere, lithosphere and biosphere. Scope and importance; Concept of sustainability and sustainable development.

Unit II **Ecosystems** **(06 Hrs)**

What is an ecosystem? Structure and function of ecosystem; Energy flow in an ecosystem: food chain, food web and ecological succession. Case studies of the following ecosystems:

a) Forest ecosystem
b) Grassland ecosystem
c) Desert ecosystem
d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit III **Natural Resources: Renewable and Non-renewable Resources** **(08 Hrs)**

Land Resources and land use change; Land degradation, soil erosion and desertification.

Deforestation: Causes and impacts due to mining, dam building on environment, forests, biodiversity and tribal populations.

Water: Use and over-exploitation of surface and ground water, floods droughts, conflicts over water (international & inter-state).

Heating of earth and circulation of air; air mass formation and precipitation.

Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs, case studies.

Unit IV **Biodiversity and Conservation** **(08 Hrs)**

Levels of biological diversity: genetic, species and ecosystem diversity; Biogeography zones of India; Biodiversity patterns and global biodiversity hot spots. India as a mega-biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity; In-situ and Ex-situ conservation of biodiversity. Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic and Informational value.

Suggested Readings:

1. Carson, R. 2002. Silent spring. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R.1993. This Fissured Land: An Ecological History of India. Univ. of California Press.
3. Gleeson,B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
4. Gleick, P.H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J. Gary K. Meffe, and Carl Ronald carroll. Principals of Conservation Biology.
   Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339:36-37.
7. McCully, P.1996. Rivers no more: the environmental effects of dams (pp.29-64). Zed Books.
8. McNeil, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.

107008 – Engineering Mathematics – II

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH : 4 Hrs./Week	**05**	**In-Semester : 30 Marks**
TUT : 1 Hr./Week		**End-Semester : 70 Marks**
		TW : 25 Marks

Prerequisites:

Integration, Differential Equation, Three-dimensional coordinate systems

Course Objectives:

To make the students familiarize with Mathematical Modeling of physical systems using differential equations advanced techniques of integration, tracing of curve, multiple integrals and their applications. The aim is to equip them with the techniques to understand advanced level mathematics and its applications that would enhance thinking power, useful in their disciplines.

Course Outcomes (COs): The students will be able to learn

CO1: the effective mathematical tools for solutions of first order differential equations that model physical processes such as Newton's law of cooling, electrical circuit, rectilinear motion, mass spring systems, heat transfer etc.

CO2: advanced integration techniques such as Reduction formulae, Beta functions, Gamma functions, Differentiation under integral sign and Error functions needed in evaluating multiple integrals and their applications.

CO3: to trace the curve for a given equation and measure arc length of various curves.

CO4: the concepts of solid geometry using equations of sphere, cone and cylinder in a comprehensive manner.

CO5: evaluation of multiple integrals and its application to find area bounded by curves, volume bounded by surfaces, Centre of gravity and Moment of inertia.

Course Contents

Unit I: First Order Ordinary differential Equations (09 Hrs.)

Exact differential equations, Equations reducible to exact form. Linear differential equations, Equations reducible to linear form, Bernoulli's equation.

Unit II: Applications of Differential Equations (09 Hrs.)

Applications of Differential Equations to Orthogonal Trajectories, Newton's Law of Cooling, Kirchhoff's Law of Electrical Circuits, Rectilinear Motion, Simple Harmonic Motion, One dimensional Conduction of Heat.

Unit III: Integral Calculus (09 Hrs.)

Reduction Formulae, Beta and Gamma functions, Differentiation Under Integral Sign and Error functions.

Unit IV: Curve Tracing (09 Hrs.)

Tracing of Curves – Cartesian, Polar and Parametric curves, Rectification of curves.

Unit V: Solid Geometry (09 Hrs.)

Cartesian, Spherical polar and Cylindrical coordinate systems, Sphere, Cone and Cylinder.

Unit VI: Multiple Integrals and their Applications (09 Hrs.)

Double and Triple integrations, Change of order of integration, Applications to find Area, Volume, Mass, Centre of Gravity and Moment of Inertia.

Text Books:

1. Higher Engineering Mathematics by B. V. Ramana (Tata McGraw Hill)
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi)

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.)
2. Advanced Engineering Mathematics by M. D. Greenberg (Pearson Education)
3. Advanced Engineering Mathematics by Peter V. O'Neil (Thomson Learning)
4. Thomas' Calculus by George B. Thomas, (Addison-Wesley, Pearson)
5. Applied Mathematics (Vol. I and II) by P.N. Wartikar and J.N.Wartikar Vidyarthi Griha Prakashan, Pune.
6. Differential Equations by S. L. Ross (John Wiley and Sons)

Tutorial and Term Work:

i) Tutorial for the subject shall be engaged in minimum three batches (batch size of 22 students) per division.

ii) Term work shall consist of six assignments on each unit-I to unit-VI and is based on

performance and continuous internal assessment.

107009: Engineering Chemistry

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH : 04 Hrs/week	**05**	**In Semester : 30 Marks**
PR : 02 Hrs/Week		**End Semester: 70 Marks**
		PR : 25 Marks

Prerequisite Courses, if any:
Types of titrations, volumetric analysis, structure property relationship, types of crystals, periodic table, classification and properties of polymers, electromagnetic radiation, electrochemical series

Companion Course, if any: Laboratory Practical

Course Objectives:

1. To understand technology involved in analysis and improving quality of water as commodity.
2. To acquire the knowledge of electro-analytical techniques that facilitates rapid and precise understanding of materials.
3. To understand structure, properties and applications of speciality polymers and nano material.
4. To study conventional and alternative fuels with respect to their properties and applications.
5. To study spectroscopic techniques for chemical analysis.
6. To understand corrosion mechanisms and preventive methods for corrosion control.

Course Outcomes:
On completion of the course, learner will be able to–

CO1: Apply the different methodologies for analysis of water and techniques involved in softening of water as commodity.

CO2: Select appropriate electro-technique and method of material analysis.

CO3: Demonstrate the knowledge of advanced engineering materials for various engineering applications.

CO4: Analyze fuel and suggest use of alternative fuels.

CO5: Identify chemical compounds based on their structure.

CO6: Explain causes of corrosion and methods for minimizing corrosion.

Course Contents

Unit I Water Technology (08Hrs)

Impurities in water, hardness of water: Types, Units and Numericals. Determination of hardness (by EDTA method using molarity concept) and alkalinity, numericals. Ill effects of hard water in boiler - priming and foaming, boiler corrosion, caustic embrittlement, scale and sludge.

Water treatment: i) Zeolite method and numericalsii) Demineralization method. Purification of water: Reverse osmosis and Electrodialysis.

Unit II Instrumental Methods of Analysis (08Hrs)

Introduction: Types of reference electrode (calomel electrode), indicator electrode (glass electrode), ion selective electrode: ion selective membranes such as solid membrane, enzyme based membrane and gas sensing membrane.

[A] Conductometry: Introduction, conductivity cell, conductometric titrations of acid versus base with titration curve.

[B] pHmetry: Introduction, standardization of pH meter, pH metric titration of strong acid versus strong base with titration curve.

Unit III **Engineering Materials** **(08Hrs)**

A] Speciality polymers: Introduction, preparation, properties and applications of the following polymers:

1. Engineering Thermoplastic: Polycarbonate,
2. Bio-degradable polymers: Poly (hydroxybutyrate-hydroxyvalanate),
3. Conducting Polymer: Polyacetylene,
4. Electroluminescent polymer: Polyphenylenevinylene,
5. Polymer composites: Fiber reinforced plastic (FRP)- Glass reinforced and Carbon reinforced polymer composite

[B] Nanomaterials: Introduction, classification of nanomaterials based on dimensions (zero dimensional, one-dimensional, two-dimensional and three-dimensional), structure, properties and applications of graphene and carbon nanotubes, quantum dots (semiconductor nanoparticles).

Unit IV **Fuels** **(08Hrs)**

Introduction (definition, classification of fuel based on chemical reactions and characteristics of an ideal fuel),

Calorific value (CV): Higher calorific value (HCV) and Lower calorific value (LCV), Determination of Calorific value: Principle, construction and working of Bomb calorimeter and Boy's gas calorimeter and numericals,

Solid fuel: Coal: Analysis of Coal-Proximate and Ultimate analysis, numericals,

Liquid fuel: Petroleum: Refining of petroleum /crude oil and composition, boiling range and uses of various fractions,

Gaseous fuel: Composition, properties and applications of CNG. Hydrogen gas as a future fuel

Alternative fuels: Power alcohol and biodiesel.

Unit V **Spectroscopic Techniques** **(08Hrs)**

[A]UV-Visible Spectroscopy:

Introduction, interaction of electromagnetic radiation with matter, statement of Beer's law and Lambert's law, absorption of UV radiation by organic molecule leading to different electronic transitions, terms involved in UV-visible Spectroscopy- chromophore, auxochrome, bathochromic shift, hypsochromic shift, hyperchromic shift and hypochromic shift, Instrumentation and basic principle of single beam spectrophotometer, applications of UV-visible spectroscopy.

[B] Infra red Spectroscopy:

Introduction, Principle of IR Spectroscopy, types of vibrations: Stretching (symmetric and asymmetric) and bending (scissoring, rocking, wagging and twisting), conditions of absorption of IR radiations, vibration of diatomic and polyatomic molecules. Instrumentation with block diagram. Parts of IR spectrum, fundamental group region, fingerprint region, applications of IR spectroscopy.

Unit VI **Corrosion Science** **(08Hrs)**

Introduction, Types of corrosion – Dry and Wet corrosion, mechanism of dry corrosion, nature of oxide films and Pilling-Bedworth's rule, wet corrosion – mechanism: hydrogen evolution and oxygen absorption, galvanic cell corrosion, concentration cell corrosion, Factors influencing rate of corrosion. Methods of corrosion control and prevention: cathodic and anodic protection, metallic coatings and its types, surface preparation, methods to apply metallic coatings-hot dipping, cladding, electroplating, cementation.

Books & Other Resources:

Text Books:

1. Engineering Chemistry by O .G. Palanna, Tata Magraw Hill Education Pvt. Ltd.
2. Textbook of Engineering Chemistry by Dr. S. S. Dara, Dr. S. S. Umare, S. Chand & Company Ltd.
3. Textbook of Engineering Chemistry by Dr. Sunita Rattan, S. K. Kataria& Sons Publisher

Reference Books:

1. Engineering Chemistry, Wiley India Pvt. Ltd.
2. Inorganic Chemistry, 5 ed by Shriver and Atkins, Oxford University Press
3. Basic Concept of Analytical Chemistry, 2ed , S. M. Khopkar, New Age-International Publisher
4. Instrumental Methods of Chemical Analysis, G. R. Chatwal& S. K. Anand, Himalaya Publishing House
5. Spectroscopy of organic compounds, 2 ed, P. S. Kalsi, New Age-International Ltd., Publisher
6. Polymer Science, V. R. Gowarikar, N. V. Viswanathan, jayadevSreedhar, Wiley Eastern Limited

1. To determine hardness of water by EDTA method
2. To determine alkalinity of water
3. To determine strength of strong acid using pH meter
4. To determine maximum wavelength of absorption of $CuSO_4$/$FeSO_4$/ $KMnO_4$, verify Beer's law and find unknown concentration of given sample.
5. Titration of a mixture of weak acid and strong acid with strong base using conductometer
6. Preparation of polystyrene/phenol-formaldehyde/urea-formaldehyde resin
7. To determine molecular weight/radius of macromolecule polystyrene/ polyvinyl alcohol by viscosity measurement.
8. Proximate analysis of coal.
9. To coat copper and zinc on iron plate using electroplating.
10. Preparation of biodiesel from oil.
11. Colloidal synthesis of 2-6 or 3-5 semiconductor quantum dots nanoparticles

104010:Basic Electronics Engineering

Teaching Scheme:	**Credits**	**Examination Scheme**
TH : 03 Hrs./week	**04**	**In - Semester : 30 Marks**
PR : 02 Hrs./week		**End - Semester : 70 Marks**
		PR : 25 Marks

Course Objectives:

1. The principle of electronics and working principle of PN junction diode and special purpose diodes.
2. The functioning of transistors like BJT, MOSFETs and OPAMP.
3. Basics of various logic gates, digital circuits and their applications.
4. Working and functions of various electronic instruments.
5. The operating principles and applications of various active and passive sensors.
6. Basic principles of communication systems.

Course Outcomes: On completion of the course, learner will be able to–

CO1: Explain the working of P-N junction diode and its circuits.

CO2: Identify types of diodes and plot their characteristics and also can compare BJT with MOSFET.

CO3: Build and test analog circuits using OPAMP and digital circuits using universal/basic gates and flip flops.

CO4: Use different electronics measuring instruments to measure various electrical parameters.

CO5: Select sensors for specific applications.

CO6: Describe basic principles of communication systems.

Course Contents

Unit I **Introduction to Electronics** **(08Hrs)**

Evolution of Electronics, Impact of Electronics in industry and in society.

Introduction to active and passive components, P-type Semiconductor, N-type Semiconductor. Current in semiconductors(Diffusion and Drift Current)

P-N Junction Diode: P-N Junction diode construction and its working in forward and reverse bias condition, V-I characteristics of P-N junction Diode, Diode as a switch, Half Wave Rectifier, Full wave and Bridge Rectifier.

Special purpose diodes: Zener diode, Light Emitting Diode (LED) and photo diode along with V-I characteristics and their applications.

Unit II **Transistor and OPAMP** **(07Hrs)**

Bipolar Junction Transistor : Construction, type, Operation, V-I Characteristics, region of operation, BJT as switch and CE amplifier

Metal Oxide Semiconductor Field Effect Transistors (MOSFET): Construction, Types, Operation, V-I characteristics, Regions of operation, MOSFET as switch & amplifier.

Operational amplifier: Functional block diagram of operational amplifier, ideal operational amplifier, Op-amp as Inverting and Non inverting amplifier

Unit III **Number System and Logic Gates** **(07Hrs)**

Number System:- Binary, BCD, Octal, Decimal, Hexadecimal their conversion and arithmetic, De-Morgan's theorem.

Basic Gates:- AND, OR, NOT, Universal Gate- XOR, XNOR, Half adder, Full adder

Flip Flop's SR, JK, T and D

Introduction to Microprocessor and Microcontroller (Only block diagram and explanation)

Unit IV **Electronic Instrumentation** **(06Hrs)**

Electronic Instruments: Principles and block diagram of digital multimeter, Function Generator, Digital Storage Oscilloscope (DSO) Power scope, AC/DC power supply, Auto transformer, Analog ammeter and voltmeter.

Unit V **Sensors** **(07Hrs)**

Classification of a sensors, Active /Passive Sensors, Analog/Digital Sensors, Motion Sensors (LVDT, Accelerometer), Temperature Sensors (Thermocouple, Thermistor, RTD), Semiconductor Sensors(Gas Sensors), Optical Sensors (LDR), Mechanical Sensors (Strain Guage, Load Cell, Pressure sensors), Biosensors. (Working Principle and one application).

Unit VI **Communication Systems** **(07Hrs)**

Basic Communication System: Block Diagram, Modes of Transmission, Communication Media: Wired and Wireless, Electromagnetic Spectrum, Allotment of frequency band for different applications, Block Diagram of AM and FM Transmitter and receiver,

Mobile Communication System: Cellular concept, Simple block diagram of GSM system.

Books & Other Resources:

Text Books:

1. "Electronics Devices" by Thomas. L. Floyd, 9th Edition, Pearson (Unit I, II)
2. "Modern Digital Electronics" by R.P. Jain, 4th Edition, Tata McGraw Hill (Unit III)
3. "Electronic Instrumentation" by H.S. Kalsi, 3rd Edition, Tata McGraw Hill (Unit IV)
4. "Sensors and Transducers" by D. Patrnabis, 2nd Edition, PHI (Unit V)
5. "Electronic Communication Systems" by Kennedy & Davis, 4th Edition, Tata McGraw Hill (Unit VI)
6. "Mobile Wireless communication" by M. Schwartz, Cambridge University Press (Unit VI)

Reference Books:

1. "Digital Fundamentals" by Thomas. L. Floyd, 11th Edition, Pearson

2. "Mobile Communication" by J. Schiller, 2nd Edition, Pearson
3. "Sensors Handbook", by S. Soloman, 2nd Edition.

List of Laboratory Experiments/Assignments

1.	**Electronic Components:** Study of Active and Passive components a) Resistors (Fixed & Variable), Calculation of resistor value using color code. b) Capacitors (Fixed & Variable) c) Inductors, Calculation of inductor value using color code. d) Devices such Diode, BJT, MOSFETs, various IC packages e) Switches & Relays
2.	**Measurements using various measuring equipments:** a) Set up CRO and function generator for measurement of voltage, frequency b) Obtain the phase shift between to signals using CRO with the help of Lissagous pattern. c) Measure voltage, resistance using digital multimeter. Also use multimeter to check diode, BJT
3.	**V-I characteristics of:** a) P-N Junction Diode **(Study the datasheet of typical PN junction diode 1N 400X)** b) Zener Diode **(Study the datasheet of typical Zener diode 1N 4148)**
4.	**Rectifier circuits:** a) Implement half wave, full wave and bridge rectifier using diodes b) Observe the effect of capacitor filter on rectifier output
5.	**Frequency response of MOSFET:** a) To plot frequency response of BJT amplifier.**(Simulation)** b) To plot frequency response of MOSFET amplifier.**(Simulation)**
6.	**Linear applications of Op-amp:** Build inverting and non-inverting amplifier using op-amp **(Study the datasheet of typical Op-Amp 741)**
7.	**Test and verify the truth tables of:** a) Basic and Universal Gates **(Study the data sheet of respective IC's)** b) Half / Full Adder c) RS/JK/T/D flip flop
8.	**Study of transducers : (Any 3)**
9.	Build and test any circuit using BJT/MOSFET/Op-Amp/Logic Gates using any one sensor.
10.	Case Study of any one electronics appliances with block diagram, specification etc.

Guidelines for Instructor's Manual

- The instructor's manual is to be developed as a hands-on resource and reference.
- Copy of Curriculum, Conduction & Assessment guidelines, List of Experiments to be attached.

Guidelines for Student's Lab Journal

- The laboratory assignments/experiments are to be submitted by student in the form of journal.
- Journal consists of Certificate, table of contents, and handwritten write-up for each experiment.
- Each experiment should consist of :
  - ✓ Title.
  - ✓ Objectives.
  - ✓ Problem Statement, Outcomes
  - ✓ Hardware / Software (If any) requirements.
  - ✓ Concept.
  - ✓ Experimental procedure / Setup.

- ✓ Observation table
- ✓ Conclusion.

Guidelines for Laboratory Conduction

- All the experiments mentioned in the syllabus are compulsory.
- Use of open source software and recent version is to be encouraged.

Guidelines for Lab /TW Assessment

- Continuous assessment of laboratory work is done based on overall performance.
- Each lab assignment/ experiment assessment will assign grade / marks based on parameters with appropriate weightage.
- Suggested parameters for overall assessment as well as each lab assignment / experiment assessment include:
  - ✓ Timely completion.
  - ✓ Performance.
  - ✓ Punctuality and neatness.
- The parameters for assessment is to be known to the students at the beginning of the course.

101011: Engineering Mechanics

Teaching Scheme:	**Credits**	**Examination Scheme:**
TH : 3 Hrs./week	**04**	**In-Semester : 30 Marks**
PR : 2 Hrs./Week		**End-Semester : 70 Marks**
		PR : 25 Marks

Prerequisite Courses, if any: 12th Physics, Maths

Course Objectives:

1. To impart knowledge about force systems and methods to determine resultant centroid and moment of inertia
2. To teach methods to calculate force of friction
3. To impart knowledge to determine reaction of beams, calculate member forces in trusses, cables and frames using principles of equilibrium
4. To teach space force systems
5. To train students to solve problems related to particle mechanics using principles of kinematics, kinetics and work power energy

Course Outcomes:

On completion of the course, learner will be able to–

CO1: Determine resultant of various force systems

CO2: Determine centroid, moment of inertia and solve problems related to friction

CO3: Determine reactions of beams, calculate forces in cables using principles of equilibrium

CO4: Solve trusses, frames for finding member forces and apply principles of equilibrium to forces in space

CO5: Calculate position, velocity and acceleration of particle using principles of kinematics

CO6: Calculate position, velocity and acceleration of particle using principles of kinetics and Work, Power, Energy

Course Contents

Unit I Resolution and Composition of Forces (07Hrs)

Principle of statics, Force system, Resolution and composition of forces, Resultant of concurrent forces. Moment of a force, Varignon's theorem, resultant of parallel force system, Couple, Equivalent force couple system, Resultant of parallel general force system

Unit II Distributed Forces and Friction (06Hrs)

Moment of area, Centroid of plane lamina and wire bends, Moment of Inertia.

Friction- Laws of friction, application of friction on inclined planes Wedges and ladders friction Application to flat belt

Unit III **Equilibrium** **(06Hrs)**

Free body diagram Equilibrium of concurrent, parallel forces in a plane Equilibrium of general forces in a plane Equilibrium of three forces in a plane, Types of beams, simple and compound beams, Type of supports and reaction,

Forces in space, Resultant of concurrent and parallel forces in a space, Equilibrium of concurrent and parallel forces in a space.

Unit IV **Analysis of Structures** **(06 Hrs)**

Two force member, Analysis of plane trusses by Method of joints Analysis of plane trusses by method of section, Analysis of plane frames, Cables subjected to point load multi force member.

Unit V **Kinematics of Particle** **(06 Hrs)**

Kinematics of linear motion- Basic concepts Equation of motion for constant acceleration Motion under gravity, Variable acceleration motion curves.

Kinematics of curvilinear motion- Basic Concepts Equation of motion in Cartesian coordinates Equation of motion in path coordinates Equation of motion in polar coordinates Motion of projectile.

Unit VI **Kinetics of Particle** **(06Hrs)**

Kinetics- Newton's Second Law of motion Application of Newton's Second Law.

Work, power, energy, conservative and non-conservative forces Conservation of energy for motion of particle, Impulse, Momentum, Direct central impact. Coefficient of restitution, Impulse Momentum principle of particle.

Books & Other Resources:

Text Books:

1. Vector Mechanics for Engineers, by F. P. Beer and E. R. Johnson, McGraw-Hill Publication
2. Engineering Mechanics by R. C. Hibbeler, Pearson Education

Reference Books:

1. Engineering Mechanics by S. P. Timoshenko and D. H. Young, McGraw- Hill publication
2. Engineering Mechanics by J. L. Meriam and Craige, John Willey
3. Engineering Mechanics by F L Singer, Harper and Rowe publication
4. Engineering Mechanics by A. P. Boresi and R. J. Schmidt, Brooks/Cole Publication

Laboratory Course

Guidelines for Instructor's Manual

An instruction manual with aim, objective, apparatus, procedure and calculations to be performed for each experiment to be provided for students called as Lab Manual. Every year problems for assignment should be changed. It is advisable to give different data to different batches

Guidelines for Student's Lab Journal

Journal should be hand written

Guidelines for Lab /TW Assessment

Each and every experiment should be assessed and given mark out of 10. Finally the marks can be converted as per given in the structure.

Guidelines for Laboratory Conduction

Divide the students of a batch in groups of not more than 4 students and ask each group to take readings separately followed by calculations for each experiment. After every experiment faculty should sign the lab manual of readings of every student in the batch

Suggested List of Laboratory Experiments/Assignments

Sr. No.	Group A
	1. Verification of law of parallelogram of forces/polygon of forces. 2. To determine support reaction of simple/compound beams. 3. Determination of coefficient friction of belt/inclined plane. 4. To determine forces in the members of space force system. 5. To study the curvilinear motion. 6. Determination of coefficient of restitution.
	Group B
	Assignment of five problems on every unit to be solved during practical
	Group C
	Any two assignments of the following by graphical method using any drawing software. a) To determine the resultant of general force system. b) To determine unknown forces of concurrent force system c) To determine the forces in the member of the plane truss d) To determine velocity and acceleration of particle from given s-t diagram.

102012: Engineering Graphics		
Teaching Scheme: **TH : 01 Hr/week** **PR : 02 Hrs/Week** **TUT : 01 Hr/Week**	**Credits** **02**	**Examination Scheme:** **End-Semester : 50 Marks** **TW : 25 Marks**

Course Objectives

1. To acquire basic knowledge about engineering drawing language, line types, dimension methods, and simple geometrical construction.
2. To draw conic sections by various methods, involutes, cycloid and spiral.
3. To acquire basic knowledge about physical realization of engineering objects and shall be able to draw its different views.
4. To visualize three dimensional engineering objects and shall be able to draw their isometric views.
5. To imagine visualization of lateral development of solids.
6. To acquire basic knowledge about the various CAD drafting software's and its basic commands required to construct the simple engineering objects.

Course Outcomes

On completion of the course, learner will be able to

CO1: Draw the fundamental engineering objects using basic rules and able to construct the simple geometries.

CO2: Construct the various engineering curves using the drawing instruments.

CO3: Apply the concept of orthographic projection of an object to draw several 2D views and its sectional views for visualizing the physical state of the object.

CO4: Apply the visualization skill to draw a simple isometric projection from given orthographic views precisely using drawing equipment.

CO5: Draw the development of lateral surfaces for cut section of geometrical solids.

CO6: Draw fully-dimensioned 2D, 3D drawings using computer aided drafting tools.

Course Contents

Unit I Fundamentals of Engineering Drawing (01 Hrs)

Need of Engineering Drawing and design, Sheet layout, Line types and dimensioning and simple geometrical constructions

Unit II Introduction to 2D and 3D computer aided drafting packages (02 Hrs)

Evolution of CAD, Importance of CAD, Basic Commands - Edit, View, Insert, Modify, Dimensioning Commands, setting and tools etc. and its applications to construct the 2D and 3D drawings

Unit III Engineering Curves (01 Hr)

Introduction to conic sections and its significance, various methods to construct the conic sections. Helix for cone and cylinder , rolling curves (Involutes , Cycloid) and Spiral

Unit IV Orthographic Projection (02 Hrs)

Principle of projections, Introduction to First and Third angle Projection methods, Orthographic projection of point, line, plane, solid and machine elements/parts

Unit V Isometric Projection (03 Hrs)

Introduction to isometric projection, oblique projection and perspective projection. Draw the isometric projection from the given orthographic views

Unit VI Development of Lateral Surfaces (03 Hrs)

Introduction to development of lateral surfaces and its industrial applications. Draw the development of lateral surfaces for cut section of cone, pyramid, prism etc.

Books & Other Resources

Text Books

1. Bhatt, N. D. and Panchal, V. M., (2016), "Engineering Drawing", Charotar Publication, Anand, India
2. K. Venugopal, K, (2015), "Engineering and Graphics", New Age International, New Delhi
3. Jolhe, D. A., (2015), "Engineering Drawing with introduction to AutoCAD", Tata McGraw Hill, New Delhi
4. Rathnam, K., (2018), " A First Course in Engineering Drawing", Springer Nature Singapore Pte. Ltd., Singapore

Reference Books

1. Madsen, D. P. and Madsen, D. A., (2016), "Engineering Drawing and design", Delmar Publishers Inc., USA
2. Bhatt, N. D., (2018), "Machine Drawing", Chartor Publishing house, Anand, India
3. Dhawan, R. K., (2000), "A Textbook Of Engineering Drawing", S. Chand, New Delhi
4. Luzadder, W. J. and Duff, J. M., (1992), "The Fundamentals of Engineering Drawing: With an Introduction to Interactive Computer Graphics for Design and Production", Peachpit Press, USA
5. Giesecke, F. E., Mitchell, A., Spencer, H. C., Hill, I. L., Loving, R. O., Dygon, J. T., (1990), "Principles of engineering graphics", McMillan Publishing, USA

6. Jensen, C., Helsel, J. D., Short, D. R., (2008), "Engineering Drawing and Design", McGraw-Hill International, Singapore

Guidelines for Laboratory Conduction

Tutorial Session

Can be utilized to teach the basic commands of any drafting package, by using this knowledge students shall be able to complete the five assignments on the CAD software. (Minimum 2 problems in each assignment)

Assignment 1: Construct any Engineering Curve using any method

Assignment 2: Orthographic view of any machine element along with sectional view.

Assignment 3: Draw Isometric view for given orthographic views.

Assignment4 :Draw the isometric or Orthographic view of a product/object (For example Workshop Job prepared during the workshop practice or any product developed during the first year session).

Assignment 5: Draw the development of lateral surface of a solid/ truncated solid.

Practical Session

Draw minimum two problems on each assignment on the A3 size drawing sheet.

Suggested List of Laboratory Experiments/Assignments

Assignment 1: Construct any Engineering Curve by any method

Assignment 2: Orthographic view of any machine element along with sectional view.

Assignment 3: Draw Isometric view for given orthographic views.

Assignment 4: Draw the development of lateral surface of a solid/ truncated solid

Assignment 5: Draw the isometric or Orthographic view of a product/object (For example Workshop Job prepared during the workshop practice or any product developed during the first year session.)

110013: Project Based Learning

Teaching Scheme:	**Credits**	**Examination Scheme:**
PR: 04 Hrs/Week	**02**	**PR : 50 Marks**

Preamble:

For better learning experience, along with traditional classroom teaching and laboratory learning; project based learning has been introduced with an objective to motivate students to learn by working in group cooperatively to solve a problem.

Project-based learning (PBL) is a student-centric pedagogy that involves a dynamic classroom approach in which it is believed that students acquire a deeper knowledge through active exploration of real-world challenges and problems. Students learn about a subject by working for an extended period of time to investigate and respond to a complex question, challenge, or problem. It is a style of active learning and inquiry-based learning. (Reference: Wikipedia). Problem based learning will also redefine the role of teacher as mentor in learning process. Along with communicating knowledge to students, often in a lecture setting, the teacher will also to act as an initiator and facilitator in the collaborative process of knowledge transfer and development.

Course Objectives:

1. To emphasizes learning activities that are long-term, interdisciplinary and student-centric.
2. To inculcate independent learning by problem solving with social context.
3. To engages students in rich and authentic learning experiences.
4. To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.

Course Outcomes:

CO1: Project based learning will increase their capacity and learning through shared cognition.
CO2: Students able to draw on lessons from several disciplines and apply them in practical way.
CO3: Learning by doing approach in PBL will promote long-term retention of material and replicable skill, as well as improve teachers' and students' attitudes towards learning.

Group Structure:

Working in supervisor/mentor –monitored groups. The students plan, manage and complete a task/project/activity which addresses the stated problem.

- There should be team/group of 5 -6 students
- A supervisor/mentor teacher assigned to individual groups

Selection of Project/Problem:

The problem-based project oriented model for learning is recommended. The model begins with the identifying of a problem, often growing out of a question or "wondering". This formulated problem then stands as the starting point for learning. Students design and analyze the problem within an articulated interdisciplinary or subject frame.

A problem can be theoretical, practical, social, technical, symbolic, cultural and/or scientific and grows out of students' wondering within different disciplines and professional environments. A chosen problem has to be **exemplary**. The problem may involve an interdisciplinary approach in both the analysis and solving phases.

By exemplarity, a problem needs to refer back to a particular practical, scientific, social and/or technical domain. The problem should stand as one specific example or manifestation of more general learning outcomes related to knowledge and/or modes of inquiry.

There are no commonly shared criteria for what constitutes an acceptable project. Projects vary greatly in the depth of the questions explored, the clarity of the learning goals, the content and structure of the activity.

- A few hands-on activities that may or may not be multidisciplinary
- Use of technology in meaningful ways to help them investigate, collaborate, analyze, synthesize and present their learning.
- Activities may include- Solving real life problem, investigation /study and Writing reports of in depth study, field work.

Assessment:

The institution/head/mentor is committed to assessing and evaluating both student performance and program effectiveness.

Progress of PBL is monitored regularly on weekly basis. Weekly review of the work is necessary. During process of monitoring and continuous assessment AND evaluation the individual and team performance is to be measured. PBL is monitored and continuous assessment is done by supervisor /mentor and authorities.

Students must maintain an institutional culture of authentic collaboration, self-motivation, peer-learning and personal responsibility. The institution/department should support students in this regard through guidance/orientation programs and the provision of appropriate resources and services. Supervisor/mentor and Students must actively participate in assessment and evaluation processes.

Group may demonstrate their knowledge and skills by developing a public product and/or report and/or presentation.

- Individual assessment for each student (Understanding individual capacity, role and involvement in the project)
- Group assessment (roles defined, distribution of work, intra-team communication and togetherness)
- Documentation and presentation

Evaluation and Continuous Assessment:

It is recommended that the all activities are to be record and regularly, regular assessment of work to be done and proper documents are to be maintained at college end by both students as well as mentor (you may call it PBL work book).

Continuous Assessment Sheet (CAS) is to be maintained by all mentors/department and institutes.

Recommended parameters for assessment, evaluation and weightage:

- Idea Inception **(5%)**
- Outcomes of PBL/ Problem Solving Skills/ Solution provided/ Final product **(50%)** (Individual assessment and team assessment)
- Documentation (Gathering requirements, design & modeling, implementation/execution, use of technology and final report, other documents) **(25%)**
- Demonstration (Presentation, User Interface, Usability etc) **(10%)**
- Contest Participation/ publication **(5%)**
- Awareness /Consideration of -Environment/ Social /Ethics/ Safety measures/Legal aspects **(5%)**

PBL workbook will serve the purpose and facilitate the job of students, mentorand project coordinator. This workbook will reflect accountability, punctuality, technical writing ability and work flow of the work undertaken.

References:

- Project-Based Learning, Edutopia, March 14, 2016.
- What is PBL? Buck Institute for Education.
- www.schoology.com
- www.wikipedia.org
- www.howstuffworks.com

101014: Environmental Studies-II

TH: 02 Hr/week **Mandatory Non-Credit Course**

Course Objectives:

1. To provide a comprehensive overview of environmental pollution and the science and technology associated with the monitoring and control.
2. To understand the evolution of environmental policies and laws.
3. To explain the concepts behind the interrelations between environment and the development.
4. To examine a range of environmental issues in the field, and relate these to scientific theory.

Course Outcomes: On completion of the course, learner will be able to–

CO1: Have an understanding of environmental pollution and the science behind those problems and potential solutions.

CO2: Have knowledge of various acts and laws and will be able to identify the industries that are violating these rules.

CO3: Assess the impact of ever increasing human population on the biosphere: social, economic issues and role of humans in conservation of natural resources.

CO4: Learn skills required to research and analyze environmental issues scientifically and learn how to use those skills in applied situations such as careers that may involve environmental problems and/or issues.

Course Contents

Unit V **Environmental Pollution** **(08 Hrs)**

Environmental pollution : types, causes, effects and controls; Air, water, soil, chemical and noise pollution

Nuclear hazards and human health risks

Solid waste management: Control measures of urban and industrial waste

Pollution case studies.

Unit VI **Environmental Pollution** **(07 Hrs)**

Climate change, global warming, ozone layer depletion, acid rain and impacts on human communities& agriculture.Environment Laws : Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and control of Pollution) Act; Wildlife protection Act; Forest Conservation Act; International agreements; Montreal and Kyoto Protocols and conservation on Biological Diversity (CBD). The Chemical Weapons Convention (CWC).Nature reserves, tribal population and rights, and human, wildlife conflicts in Indian context

Unit VII **Human Communities and the Environment** **(06 Hrs)**

Human population and growth; Impacts on environment, human health and welfares.

Carbon foot-print. Resettlement and rehabilitation of project affected persons; case studies. Disaster management: floods earthquakes, cyclones and landslides. Environmental movements: Chipko, Silent valley, Bishnios of Rajasthan. Environmental ethics: Role of Indian and other religions and cultures in environmental conservation.

Environmental communication and public awareness, case studies (e.g., CNG vehicles in Delhi).

Unit VIII **Field work** **(05 Hrs)**

- Visit to an area to document environmental assets; river/forest/flora/fauna, etc.
- Visit to a local polluted site – Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, birds and basic principles of identification.
- Study of simple ecosystems-pond, river Delhi Ridge, etc

Suggested Readings:

1. Carson, R. 2002. Silent spring. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R.1993. This Fissured Land: An Ecological History of India. Univ. of California Press.
3. Gleeson,B. and Low, N. (eds.) 1999. Global Ethics and Environment, London, Routledge.
4. Gleick, P.H. 1993. Water in Crisis. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J. Gary K. Meffe, and Carl Ronald carroll. Principals of Conservation Biology, Sunderland: Sinauer Associates, 2006
6. Grumbine, R. Edward, and Pandit, M.K. 2013. Threats from India's Himalaya dams. Science, 339:36-37.
7. McCully, P.1996. Rivers no more: the environmental effects of dams (pp.29-64). Zed Books.
8. McNeil, John R. 2000. Something New Under the Sun: An Environmental History of the Twentieth Century.

Savitribai Phule Pune University
Faculty of Science & Technology

Proposed Curriculum

For

SE (Electronics & Computer Engineering)
(Choice Based Credit System)

(With Effect from Academic Year 2021-22)

Savitribai Phule Pune University, Pune
S.E. (Electronics & Computer Engineering) 2020 Course
(With effect from Academic Year 2021-22)

Semester-III

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit			
		Theory	Practical	Tutorial	In-Sem	End-Sem	TW	PR	OR	Total	TH	PR	TUT	Total
	Engineering Mathematics III	04	-	01	30	70	25	-	-	125	04	--	01	05
	Electronic Circuits	03	-	-	30	70	-	-	-	100	03	-	-	03
	Digital Circuits	03	-	-	30	70	-	-	-	100	03	-	-	03
	Data structures & Algorithms	03	-	-	30	70	-	-	-	100	03	-	-	03
	Computer Organization	03	-	-	30	70	-	-	-	100	03	-	-	03
	Electronic Circuit Lab	-	02	-	-	-	-	50	-	50	-	01	-	01
	Digital circuits Lab		02					50		50		01		01
	Data Structure and Algorithm Lab	-	02	-	-	-	-	-	25	25	-	01	-	01
	Computer Organization Lab	-	02	-	-	-	25	-	-	25	-	01	-	01
	Electronic Skill Development	-	02	-	-	-	25	-	-	25	-	01	-	01
	Mandatory Audit Course 3 [&]	-	-	-					-	-	-	-	-	-
	Total	**16**	**10**	**01**	**150**	**350**	**75**	**100**	25	**700**	**-**		**-**	
										Total Credit	**16**	**05**	**01**	**22**

Savitribai Phule Pune University, Pune
S.E. (Electronics & Computer Engineering) 2020 Course
(With effect from Academic Year 2021-22)

Semester-IV

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit			
		Theory	Practical	Tutorial	In-Sem	End-Sem	TW	PR	OR	Total	TH	PR	TUT	Total
	Signals & Systems	03	-	01	30	70	25	-	-	125	03	--	01	04
	Principles of Programming Language	03	-		30	70		-	-	100	03	-	-	03
	Principles of Communication System	03	-	-	30	70	-	-	-	100	03	-	-	03
	Object Oriented Programming	03	-	-	30	70	-	-	-	100	03	-	-	03
	System Programming & Operating Systems	03	-	-	30	70	-	-	-	100	03	-	-	03
	Signals & System Lab	-	02	-	-	-	25	-	-	50	-	01	-	01
	Communication Lab	-	02	-	-	-	-	50	-	50	-	01	-	01
	Object Oriented Programming Lab	-	02	-	-	-	-	-	25	25	-	01	-	01
	Employability Skill Development	-	02	-	-	-	25	-	-	25	-	01	-	01
	Project Based Learning [η]	-	04	-	-	-	50	-	-	50	-	02	-	02
	Mandatory Audit Course 4[&]	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	15	14	01	150	350	125	50	25	700	-	-	-	-
										Total Credit	**15**	**06**	**01**	**22**

Abbreviations:

In-Sem: In semester End-sem: End semester TH : Theory TW : Term Work

PR : Practical OR : Oral TUT : Tutorial

Note: Interested students of S.E. (Electronics/E&TC) can opt any one of the audit course from the list of audit courses prescribed by BoS (Electronics & Telecommunications Engineering)

Instructions:

- PR/Tutorial must be conducted in three batches per division.

- Minimum number of required Experiments/Assignments in PR/ Tutorial shall be carried out as mentioned in the syllabi of respective subjects.
- Assessment of tutorial work has to be carried out as term-work examination. Term-work Examination at second year of engineering course **shall be internal continuous assessment only.**

- **η:** Project based learning (PBL) requires continuous mentoring by faculty throughout the semester for successful completion of the tasks selected by the students per batch. While assigning the teaching workload of 2 Hrs/week/batch needs to be considered for the faculty involved. The Batch needs to be divided into sub-groups of 5 to 6 students. Assignments / activities / models/ projects etc. under project based learning is carried throughout semester and Credit for PBL has to be awarded on the basis of internal continuous assessment and evaluation at the end of semester.

- **&:** Audit course is mandatory but non-credit course. Assessment has to be conducted at the end of Sem III & IV respectively for award of grade at college level. Grade awarded for audit course shall not be calculated for grade point & CGPA.

Guidelines for Instructor's Manual

- The instructor's manual is to be developed as a hands-on resource and reference.
- Copy of Curriculum, Conduction & Assessment guidelines, List of Experiments to be attached.

Guidelines for Laboratory Conduction

- Students are not allowed to touch any equipment or other materials in the laboratory until they are instructed by Teacher or Technician.
- All the experiments mentioned in the syllabus are compulsory.
- Use of open source software and recent version is to be encouraged.
- In addition to these, faculty member has to get it done a mini-project based on the concepts learned.

Guidelines for Student's Lab Journal

- The laboratory assignments/experiments are to be submitted by student in the form of journal.
- Journal consists of Certificate, table of contents, and handwritten write-up for each experiment.
- Each experiment should consist of:
  - ✓ Title.
  - ✓ Objectives.
  - ✓ Problem Statement, Outcomes
  - ✓ Hardware / Software (If any) requirements.
  - ✓ Concept.
  - ✓ Experimental procedure / Setup.
  - ✓ Observation table
  - ✓ Conclusion.

Guidelines for Lab Assessment

- Continuous assessment of laboratory work is done based on overall performance.
- Each lab assignment/ experiment assessment will assign grade / marks based on parameters with appropriate weightage.
- Suggested parameters for overall assessment as well as each lab assignment / experiment assessment include:
  - ✓ Timely completion.
  - ✓ Performance.
  - ✓ Punctuality and neatness.
- The parameters for assessment are to be known to the students at the beginning of the course.

Engineering Mathematics -III
Credits: Th – 04 ,Tut-01

Teaching Scheme:
Theory : 04 hr/week
Tutorial: 01 hr/week

Examination Scheme:
In-Sem : 30 Marks
End-Sem : 70 Marks
Term Work : 25 Marks

Prerequisites: - Differential and Integral Calculus, Taylor series and Infinite series, Differential equations of first order and first degree, Fourier series, Vector algebra, Algebra of complex numbers.

Course Objectives:
After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

- Linear differential equations of higher order using analytical methods and numerical methods applicable to Control systems and Network analysis.
- Transforms such as Fourier transform, Z-transform and applications to Communication systems and Signal processing.
- Vector differentiation and integration required in Electro-Magnetics and Wave theory.
- Complex functions, conformal mappings, contour integration applicable to Electrostatics, Digital filters, Signal and Image processing.

Course Outcomes:
On completion of the course, student will be able to:

1. Solve higher order linear differential equation using appropriate techniques for modeling and analyzing electrical circuits.
2. Solve problems related to Fourier transform, Z-transform and applications to Communication systems and Signal processing.
3. Obtain Interpolating polynomials, numerically differentiate and integrate functions, numerical solutions of differential equations using single step and multi-step iterative methods used in modern scientific computing.
4. Perform vector differentiation and integration, analyze the vector fields and apply to Electro-Magnetic fields.
5. Analyze conformal mappings, transformations and perform contour integration of complex functions in the study of electrostatics and signal processing.

Course Contents

Unit I: Linear Differential Equations (LDE) and Applications (09 Hours)

LDE of n^{th} order with constant coefficients, Method of variation of parameters, Cauchy's & Legendre's DE, Simultaneous & Symmetric simultaneous DE. Modeling of Electrical circuits.

Unit II: Transforms **(09 Hours)**

Fourier Transform (**FT**): Complex exponential form of Fourier series, Fourier integral theorem, Fourier Sine & Cosine integrals, Fourier transform, Fourier Sine and Cosine transforms and their inverses.

Z - Transform **(ZT):** Introduction, Definition, Standard properties, ZT of standard sequences and their inverses. Solution of difference equations.

Unit III: Numerical Methods **(09 Hours)**

Interpolation: Finite Differences, Newton's and Lagrange's Interpolation formulae, Numerical Differentiation.

Numerical Integration: Trapezoidal and Simpson's rules, Bound of truncation error,

Solution of Ordinary differential equations: Euler's, Modified Euler's, Runge-Kutta 4^{th} order methods.

Unit IV: Vector Differential Calculus **(09 Hours)**

Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities.

Unit V: Vector Integral Calculus and Applications **(09 Hours)**

Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stoke's theorem. Applications to problems in Electro-magnetic fields.

Unit VI : Complex Variables **(09 Hours)**

Functions of Complex variables, Analytic functions, Cauchy-Riemann equations, Conformal mapping, Bilinear transformation, Cauchy's integral theorem, Cauchy's integral formula, Laurent's series, Residue theorem.

Text Books:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 9e, Wiley India.
2. Peter V. O'Neil, "Advanced Engineering Mathematics", 7e, Cengage Learning.

Reference Books:

1. M. D. Greenberg, “Advanced Engineering Mathematics”, 2e, Pearson Education.
2. Wylie C.R. & Barrett L.C. , “Advanced Engineering Mathematics”, McGraw-Hill, Inc.
3. B. S. Grewal, “Higher Engineering Mathematics” Khanna Publication, Delhi.
4. P. N. Wartikar & J. N. Wartikar, “Applied Mathematics”, Volumes I and II, Pune VidyarthiGrihaPrakashan,.
5. B.V. Ramana, “Higher Engineering Mathematics”, Tata McGraw-Hill.
6. Thomas L. Harman, James
7. Dabney and Norman Richert, “Advanced Engineering Mathematics with MATLAB”, 2e, Brooks/Cole, Thomson Learning.

Guidelines for Tutorial and Term Work:

i) Tutorial shall be engaged in four batches (batch size of 20 students maximum) per division.

ii) Term work shall be based on continuous assessment of six assignments (one per each unit) and performance in internal tests.

Savitribai Phule Pune University **Second Year of Electronics & Computer Engineering (2020 Course)** **XXXXXX: Electronic Circuits**		
Teaching Scheme:	**Credit**	**Examination Scheme:**
TH: 03 hrs. / week	**03**	**In-Sem (Theory): 30 Marks** **End Sem (Theory): 70 Marks**
Prerequisite Courses, if any: 104010 - Basic Electronics Engineering		
Companion Course, if any: XXXXXX - Electronic Circuits Laboratory		
Course Objectives: To make the students understand • Semiconductor device MOSFET, its characteristics, parameters & applications. • Concepts of feedbacks in amplifiers & oscillators. • Operational amplifier, concept, parameters & applications. • ADC, DAC as an interface between analog & digital domains. • Concepts, characteristics & applications of PLL.		

Course Outcomes: On completion of the course, learner will be able to –

CO1: Assimilate the physics, characteristics and parameters of MOSFET towards its application as amplifier.

CO2: Design MOSFET amplifiers, with and without feedback, & MOSFET oscillators, for given specifications.

CO3: Analyze and assess the performance of linear and switching regulators, with their variants, towards applications in regulated power supplies.

CO4: Explore and deploy basic configurations of Op-amp with negative feedback, with focus on relevant parameters.

CO5: Design, Build and test Op-amp based analog signal processing and conditioning circuits towards various real time applications.

CO6: Understand and compare the principles of various data conversion techniques and PLL with their applications.

Course Contents

Unit I	MOSFET & its Analysis	(08 Hrs)

Enhancement MOSFET: Construction, Characteristics, AC equivalent ckt, Parameters, Parasitics, Body effect, Sub-threshold conduction, W/L ratio. Common source amplifier & analysis, Load line, Source follower.

Mapping of Course Outcomes for Unit I	CO1: Assimilate the physics, characteristics and parameters of MOSFET towards its application as amplifier.

Unit II	MOSFET Circuits	(06 Hrs)

MOSFET as switch, resistor/diode. Current sink & source, Current mirror. Four types of feedback amplifiers, Effects of feedback, Voltage series & current series feedback amplifiers. Barkhausen criterion, Wein bridge & phase shift oscillator.

Mapping of Course Outcomes for Unit II	CO2: Design MOSFET amplifiers, with and without feedback, & MOSFET oscillators, for given specifications.

Unit III	Voltage Regulators	(06 Hrs)

Three terminal voltage regulator (317): Block diagram, typical ckts, Current boosting. Low Dropout Regulator (LDO).

SMPS: Block diagram, Types, typical ckts.

Mapping of Course Outcomes for Unit III	CO3: Analyze and assess the performance of linear and switching regulators, with their variants, towards applications in regulated power supplies.

Unit IV	Operational Amplifier	(08 Hrs)

Block diagram, Differential amplifier analysis for dual i/p balanced o/p mode (using r parameters), Level shifter, Op amp parameters, Current mirror, Op-amp characteristics (AC & DC).		
Mapping of Course Outcomes for Unit IV	**CO4: Explore and deploy basic configurations of Op-amp with negative feedback, with focus on relevant parameters.**	
Unit V	**Op-Amp Applications**	**(10 Hrs)**
Inverting amplifier, Non inverting amplifier **[Study the effect on R_i, R_o, gain & bandwidth]**, Voltage follower, Summing amplifier, Differential amplifier, Practical integrator, Practical differentiator, Instrumentation amplifier, Comparator, Schmitt trigger, Square & triangular wave generator, Precision rectifiers. **[More emphasis on applications]**		
Mapping of Course Outcomes for Unit V	**CO5: Design, Build and test Op-amp based analog signal processing and conditioning circuits towards various real time applications.**	
Unit VI	**Converters & PLL**	**(06 Hrs)**
DAC & ADC: Types / Techniques, Characteristics, block diagrams, Ckts, Specifications, Merits, Demerits, Comparisons. **PLL:** Block Diagram, Characteristics, phase detectors, Details of PLL IC 565 Applications, Typical circuits.		
Mapping of Course Outcomes for Unit VI	**CO6: Understand and compare the principles of various data conversion techniques and PLL with their applications.**	

Learning Resources

Text Books:

1. Donald Neaman, "Electronic Circuits – Analysis and Design" Third edition, Mc Graw Hill.
2. Ramakant Gaikwad, "Op amps & Linear Integrated Circuits", Pearson Education.

Reference Books:

1. Millman Halkias, " Integrated Electronics".
2. Phillip E. Allen, Douglas R. Holberg, "CMOS Analog Circuit Design", Second Edition, Oxford.
3. Salivahan and Kanchana Bhaskaran, "Linear Integrated Circuits", Tata McGraw Hill.

MOOC / NPTEL Courses:

1. NPTEL Course **"Analog Electronic Circuits"** by Prof. Pradip Kumar Mandal (IIT Kharakpur) https://nptel.ac.in/courses/108/105/108105158/
2. NPTEL Course on **"Analog Circuits"** by Prof. Jayanta Mukherjee (IIT Bombay) https://nptel.ac.in/courses/108/101/108101094/

Savitribai Phule Pune University

Second Year of Electronics & Computer Engineering (2020 Course)

XXXXXX: Digital Circuits

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 hrs. / week	03	In-Sem (Theory): 30 Marks End Sem (Theory): 70 Marks

Prerequisite Courses, if any:

Companion Course, if any: XXXXXX - Digital Circuits Laboratory

Course Objectives: To make the students understand

- The fundamental principles of two-valued logic and various devices used to implement logical operations on variables.
- Boolean algebra, Karnaugh maps and its application to the design and characterization of digital circuits.
- To analyze logic processes and implement logical operations using combinational logic circuits.
- The principles of logic design and use of simple memory devices, flip-flops, and sequential circuits.
- Concepts of sequential circuits and to analyze sequential systems in terms of state machines.
- System design approach using programmable logic devices.

Course Outcomes: On completion of the course, learner will be able to –

CO1: Identify and prevent various hazards and timing problems in a digital design.

CO2: Use the basic logic gates and various reduction techniques of digital logic circuit.

CO3: Analyze, design and implement combinational logic circuits.

CO4: Analyze, design and implement sequential circuits

CO5: Differentiate between Mealy and Moore machines.

CO6: Analyze digital system design using PLD

Course Contents

Unit I	Digital Logic Families	(04 Hrs)

Classification and Characteristics of digital Logic Families: -Speed, power dissipation, figure of merit, fan in, fan out, current, voltage, noise immunity, operating temperatures and power supply requirements. TTL logic. Operation of TTL NAND gate, active pull up, wired AND, open collector output, unconnected inputs. Tri-State logic. CMOS logic: CMOS inverter, NAND, NOR gates, unconnected inputs, wired logic, open drain output. Interfacing CMOS and TTL.

Mapping of Course Outcomes for Unit I	CO1: Identify and prevent various hazards and timing problems in a digital design.

Unit II	**Combinational Logic Design**	**(08 Hrs)**
Definition of combinational logic, canonical forms, Standard representations for logic functions, k-map representation of logic functions (SOP and POS forms), minimization of logical functions for min-terms and max-terms (upto 4 variables), don't care conditions, Design Examples: Arithmetic Circuits, BCD - to – 7 segment decoder, Code converters. Introduction to Quine- McCluskey method, Quine McCluskey using don't care terms, Reduced prime implicants Tables.		
Mapping of Course Outcomes for Unit II	**CO2: Use the basic logic gates and various reduction techniques of digital logic circuit.**	
Unit III	**Combinational Circuits**	**(06 Hrs)**
Adders and their use as subtractor, look ahead carry, ALU, Digital Comparator, Parity generators/checkers, Multiplexers and their use in combinational logic designs, multiplexer trees, De-multiplexers and their use in combinational logic designs, Decoders, Demultiplexer trees.		
Mapping of Course Outcomes for Unit III	**CO3: Analyze, design and implement combinational logic circuits.**	
Unit IV	**Sequential Logic Design**	**(08 Hrs)**
1 Bit Memory Cell, Clocked SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear terminals, hold and setup time and metastability. Excitation Table for flip flops. Conversion of flip flops. Application of Flip flops: Registers, Shift registers, Counters (ring counters, twisted ring counters), Sequence Generators, ripple counters, up/down counters, synchronous counters, lock out, Clock Skew, Clock jitter. Effect on synchronous designs.		
Mapping of Course Outcomes for Unit IV	**CO4: Analyze, design and implement sequential circuits**	
Unit V	**State Machines**	**(07 Hrs)**
Basic design steps- State diagram, State table, State reduction, State assignment, Mealy and Moore machines representation, Implementation, finite state machine implementation, Sequence detector. Introduction to Algorithmic state machines- construction of ASM chart and realization for sequential circuits		
Mapping of Course Outcomes for Unit V	**CO5: Differentiate between Mealy and Moore machines.**	
Unit VI	**Programmable Logic Devices**	**(08 Hrs)**

Programmable logic devices: Detail architecture, Study of PROM, PAL, PLA, General Architecture of FPGA and CPLD. Semiconductor memories: memory organization and operation, expanding memory size, Classification and characteristics of memories, RAM ROM, EPROM, EEPROM, NVRAM, SRAM, and DRAM. Designing combinational circuits using PLDs.

Mapping of Course Outcomes for Unit VI	**CO6: Analyze digital system design using PLD**

Learning Resources

Text Books:

1. R.P. Jain, "Modern digital electronics" , 3rd edition , 12th reprint Tata McGraw Hill Publication,2007**.**
2. Thomas Floyd, "Digital Electronics", 11th Edition.
3. M. Morris Mano, "Digital Logic and Computer Design" 4the dition,Prentice Hall of India, 2013.
4. Taub and Schilling, "Digital Principles and Applications," TMH.

Reference Books:

1. Anand Kumar, "Fundamentals of Digital Circuits" 1st edition, Prentice Hall of India, 2001
2. J. F. Wakerly, "Digital Design- Principles and Practices," 3rd Edition, Pearson
3. M. M. Mano, "Digital Design," Prentice Hall India.

MOOC / NPTEL Courses:

1. NPTEL Course **"Digital Circuits"** by Prof. Santanu Chattopadhay (IIT Kharakpur) https://nptel.ac.in/courses/108/105/ 108105113/
2. NPTEL Course **"Digital Circuits & Systems"** https://nptel.ac.in/courses/117/106/117106086/
3. NPTEL Course **"Digital Circuits"** by Prof. Goutam Saha (IIT Kharakpur) https://nptel.ac.in/courses/108/105/108105132/

Savitribai Phule Pune University

Second Year of Electronics & Computer Engineering (2020 Course)

XXXXXX: Data Structure and Algorithm

Teaching Scheme:	**Credit**	**Examination Scheme:**
TH: 03 hrs. / week	**03**	**In-Sem (Theory): 30 Marks** **End Sem (Theory): 70 Marks**

Prerequisite Courses, if any:

Companion Course, if any: XXXXXX - Data Structure Laboratory

Course Objectives:

- To learn basic concepts of C Programming language
- To learn different sorting and searching algorithms and its analysis
- To learn linear data structures : Stack and Queue, Link List and applications.
- To learn Non linear data structures : Tree , Graph and applications.
- To study the systematic way of solving problems, various methods of organizing large amounts of data.
- To solve problems using data structures such as binary trees, binary search trees, and graphs and writing programs

Course Outcomes: On completion of the course, learner will be able to –

CO1: Develop programs using C programming language.

CO2: Implement sorting and searching algorithms and calculates it complexity.

CO3: Develop applications of stacks and queues using array.

CO4: Demonstrate applicability of linear data structures.

CO5: Design height balanced Binary Tree and analyze its time complexity.

CO6: Demonstrate applicability of Non linear data structures with real time application.

CO7: Design height balanced Binary Tree and analyze its time complexity.

CO8: Apply the knowledge of graph for solving the problems of spanning tree and shortest path algorithm.

Course Contents

Unit I	Introduction to C Programming	(08 Hrs)

C Fundamentals: Constants, Variables and Keywords in C, Operators, Bitwise Operations, Decision Control and Looping Statements.

Arrays & Pointers: Arrays, Functions, Recursive Functions, Pointers, String Manipulations, Structures, Union, Enumeration, MACROS.

File Handling: File Operations- Open, Close, Read, Write And Append

Mapping of Course Outcomes for Unit I	CO1: Develop programs using C programming language.	
Unit II	**Searching and Sorting Algorithms**	**(06 Hrs)**

Algorithms: Analysis of Iterative and Recursive algorithms, Space & Time complexity, Asymptotic notation- Big-O, Theta and Omega notations. **Searching methods:** Linear, Binary and Fibonacci Search. **Sorting methods:** Bubble, Insertion, Selection, Merge, and Quick Sort.		
Mapping of Course Outcomes for Unit II	**CO2: Implement sorting and searching algorithms and calculates it complexity.**	
Unit III	**Stack and Queues**	**(06 Hrs)**
Stacks: Concept, Basic Stack operations, Array representation of stacks, Stack as ADT, Stack Applications: Reversing data, Arithmetic expressions conversion and evaluation. **Queues:** Concept, Queue operations, Array representation of queues, Queue as ADT, Circular queue, Priory Queue, Application of queues: Categorizing data, Simulation of queues.		
Mapping of Course Outcomes for Unit III	**CO3: Develop applications of stacks and queues using array**	
Unit IV	**Linked List**	**(06 Hrs)**
Concept of linked organization, Singly Linked List, Stack using linked list, Queue using linked list, Doubly Linked List, Circular Linked List, Linked list as ADT. Representation and manipulations of polynomials using linked list, comparison of sequential and linked organization.		
Mapping of Course Outcomes for Unit IV	**CO4: Demonstrate applicability of linear data structures.**	
Unit V	**Trees**	**(06 Hrs)**
Introduction to trees: Basic Tree Concepts. **Binary Trees:** Concept & Terminologies, Representation of Binary Tree in memory, Traversing a binary tree. Binary Search Trees (BST): Basic Concepts, BST operations, Concept of Threaded Binary Search Tree **AVL Tree:** Basic concepts and rotations of a Tree.		
Mapping of Course Outcomes for Unit V	**CO5: Design height balanced Binary Tree and analyze its time complexity.** **CO6: Demonstrate applicability of Non linear data structures with real time application.** **CO7: Design height balanced Binary Tree and analyze its time complexity.**	
Unit VI	**Graphs**	**(06 Hrs)**

Graph: Basic Concepts & terminology.

Representation of graphs: Adjacency matrix, Adjacency list.

Operations on graph: Traversing a graph.

Spanning trees: Minimum Spanning tree- Kruskal's Algorithm, Prim's Algorithm. Dijkstra's Shortest Path Algorithm

Mapping of Course Outcomes for Unit VI	**CO8: Apply the knowledge of graph for solving the problems of spanning tree and shortest path algorithm.**

Learning Resources

Text Books:

1. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", Galgotia Books Source.

2. Richard. F. Gilberg& Behrouz A. Forouzan, Data Structures A Pseudocode Approach with C, Cengage Learning, second edition.

Reference Books:

1. Seymour Lipschutz, Data Structure with C, Schaum's Outlines, Tata McGrawHill.

2. E Balgurusamy – Programming in ANSI C, Tata McGraw-Hill, Third Edition.

3. Yedidyah Langsam, Moshe J Augenstein, Aaron M Tenenbaum – Data structures using C and C++ - PHI Publications, 2nd Edition.

4. Reema Thareja, "Data Structures using C", Second Edition, Oxford University Press, 2014

MOOC / NPTEL:

1. NPTEL Course **"Programming & Data Structure"**

https://nptel.ac.in/courses/106/105/106105085/

2. NPTEL Course "Data Structure & Algorithms"

https://nptel.ac.in/courses/106/102/106102064/

Savitribai Phule Pune University

Second Year of Electronics & Computer Engineering (2020 Course)

XXXXXX: Computer Organization

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 hrs. / week	03	In-Sem (Theory): 30 Marks End Sem (Theory): 70 Marks

Prerequisite Courses, if any: Fundamentals of Programming Languages-I & II
Basics of Electronics Engineering

Companion Course, if any: XXXXXX - Computer Organization Lab

Course Objectives:

- To understand the structure, function and characteristics of computer systems.
- To understand the design of the various functional units and components of digital computers.
- To identify the elements of modern instructions sets and explain their impact on processor design.
- To explain the function of each element of a memory hierarchy, identify and compare different methods for computer I/O.
- To compare simple computer architectures and organizations based on established performance metrics.

Course Outcomes: On completion of the course, learner will be able to –

CO1: Demonstrate computer architecture concepts related to design of modern processors, memories and I/Os.

CO2: Analyze the principles of computer architecture using examples drawn from commercially available computers.

CO3: Evaluate various design alternatives in processor organization.

Course Contents		
Unit I	**Computer Evolution & Performance**	**(07 Hrs)**
Computer Organization and Architecture, Structure and Function, Evolution (a brief history) of computers, Designing for Performance, Evolution of Intel processor architecture- 4 bit to 64 bit, performance assessment. **A top level view of Computer function and interconnection:** Computer Components, Computer Function, Interconnection structure, bus interconnection. **Computer Arithmetic:** The Arithmetic and Logic Unit, addition and subtraction of signed numbers, design of adder and fast adder, carry look ahead addition, multiplication of positive numbers, signed operand multiplication, booths algorithm, fast multiplication, integer division. **Floating point representation and operations :** IEEE standard, arithmetic operations, guard bits and truncation.		
Mapping of Course Outcomes for Unit I	**CO1: Demonstrate computer architecture concepts related to design of modern processors, memories and I/Os.**	
Unit II	**Computer Memory System**	**(07 Hrs)**
Characteristics of memory system, The memory hierarchy. **Cache Memory:** Cache memory principles, Elements of cache design- cache address, size, mapping functions, replacement algorithms, write policy, line size, number of cache, one level and two level cache, performance characteristics of two level cache- locality & operations. **Internal Memory:** Semiconductor main memory, advanced DRAM organization. **External Memory:** Hard Disk organization, RAID- level 1 to level 6. **Case Study-** Pentium IV cache organization.		
Mapping of Course Outcomes for Unit II	**CO1: Demonstrate computer architecture concepts related to design of modern processors, memories and I/Os.**	
Unit III	**Input Output System**	**(07 Hrs)**
External devices, **I/O modules** - Module function and I/O module structure. **Programmed I/O:** overview, I/O commands, I/O instructions, Interrupt driven I/O- interrupt processing, design issues. **Direct Memory Access:** Drawbacks of programmed and interrupt driven I/O, DMA functions, **Case Study: DMA Controller** Intel 8237A-study in brief, I/O channels and processors- evolution and characteristics. **Case Study:** Study of Programmable Interrupt Controller Intel 82C59A in brief.		

Mapping of Course Outcomes for Unit III	**CO2: Analyze the principles of computer architecture using examples drawn from commercially available computers.**	
Unit IV	**Instruction sets**	**(07 Hrs)**
Characteristics and Functions: Machine instruction characteristics, types of operands. **Types of operations:** Data transfer, arithmetic, logical, conversion, input-output, system control, and transfer of control. **Addressing modes and Formats:** Addressing modes- immediate, direct, indirect, register, register indirect, displacement and stack **Instruction Formats:** instruction length, allocation of bits, variable length instructions. **Case Study:** Study above mention functionalities in 8086.		
Mapping of Course Outcomes for Unit IV	**CO2: Analyze the principles of computer architecture using examples drawn from commercially available computers.**	
Unit V	**Processor Organization**	**(07 Hrs)**
Processor organization, Register organization- user visible registers, control and status registers, **Instruction Cycle-** The machine cycle and Data flow. **Instruction Pipelining-** Pipelining Strategy, pipeline performance, pipeline hazards, dealing with branches. **Instruction level parallelism and superscalar processors -** Super scalar verses super pipelined, constraints. **Design Issues-** instruction level and machine parallelism, Instruction issue policy, register renaming, machine parallelism, branch prediction, superscalar execution and implementation. **Case studies-** Register organization of microprocessor 8086, Pipelining in Pentium, Pentium IV.		
Mapping of Course Outcomes for Unit V	**CO3: Evaluate various design alternatives in processor organization.**	
Unit VI	**Basic Processing Unit**	**(07 Hrs)**
Fundamental Concepts: Register transfer, performing arithmetic or logic operations, fetching a word from memory, storing a word in memory, Execution of a complete instruction- branch instructions. **Hardwired control**, M**icro-programmed control:** Micro instructions, micro program sequencing, wide branch addressing, microinstruction with next address field, pre-fetching microinstructions and emulation.		
Mapping of Course Outcomes for Unit VI	**CO3: Evaluate various design alternatives in processor organization.**	

Learning Resources

Text Books:

1. W. Stallings, "Computer Organization and Architecture: Designing for performance", Pearson Education/ Prentice Hall of India, 2003 7th Edition.
2. Zaky S, Hamacher, "Computer Organization", McGraw-Hill Publications, 2001, 5th Edition.

Reference Books:

1. John P Hays, "Computer Architecture and Organization", McGraw-Hill Publication, 1998, , 3rd Edition.
2. Miles Murdocca and Vincent Heuring, "Computer Architecture and Organization- an integrated approach", Wiley India Pvt. Ltd, 2nd Edition.
3. A. Tanenbaum, "Structured Computer Organization", Prentice Hall of India, 1991, 4th Edition
4. Patterson and Hennessy, "Computer Organization and Design", Morgan Kaufmann Publishers In, 4th Edition.

MOOC / NPTEL Courses:

1. NPTEL Course **"Computer Organization"**

https://nptel.ac.in/courses/106/106/106106092/

2. NPTEL Course **"Computer Architecture & Organization"**

https://nptel.ac.in/courses/106/105/106105163/

Savitribai Phule Pune University

Second Year of Electronics & Computer Engineering (2020 Course)

XXXXXX: Electronic Circuits Lab

Teaching Scheme:	Credit	Examination Scheme:
PR: 02 hrs. / week	01	PRACTICAL: 50 Marks

Prerequisite Courses, if any:

Companion Course, if any: XXXXXX - Electronic Circuits

List of Laboratory Experiments

Group A [Any 4 to be performed]

1.	To design, build single stage CS amplifier & verify dc operating point.
2.	To build & test single stage CS amplifier, plot frequency response. Calculate A_v, R_i, R_o & bandwidth.
3.	To implement current series feedback amplifier & measure R_{if}, R_{of}, A_{vf} & bandwidth.
4.	To implement MOSFET amplifier based Wein bridge oscillator.

5.	To design & implement an adjustable voltage regulator using three terminal voltage regulator IC.
Group B [Any 8 to be performed]	
6.	To measure following Op- amp parameters & compare with specifications given in data sheet. **[Any two Practical Op-Amp can be used for comparison. eg.LM741, OP07, LF351, LF356]** a) Input bias current b) Input offset current c) Input offset voltage d) Slew rate e) CMRR
7.	To design, build & test integrator using Op-amp for given frequency f_a.
8.	To design, build & test three Op amp Instrumentation amplifier for typical application.
9.	To design, build & test Square and triangular waveform generator using Op-Amp (LF351/6)
10.	To build & test Op amp precision half & full wave rectifiers.
11.	To design, build & test Schmitt trigger using Op-Amp (LF356)
12.	To design, build & test 2 or 3 bit R-2R ladder DAC.
13.	To design & implement 4 bit R-2R ladder DAC.
14.	To build & test PLL ckt.

Note: Min. of 1 practical from Group A and min. of 2 practicals from Group B are to be performed as Simulation practical in addition to above mentioned practicals and compare the results of simulated practicals with the corresponding hardware practical.

Savitribai Phule Pune University **Second Year of Electronics & Computer Engineering (2020 Course)** **XXXXXX: Digital Circuits Lab**		
Teaching Scheme:	**Credit**	**Examination Scheme:**
PR: 02 hrs. / week	**01**	**PRACTICAL: 50 Marks**
Prerequisite Courses, if any:		
Companion Course, if any: XXXXXX - Digital Circuits		

List of Laboratory Experiments	
1.	**Study of IC-74LS153 as a Multiplexer:** (Refer Data-Sheet). a. Design and Implement 8:1 MUX using IC-74LS153 & Verify its Truth Table. b. Design & Implement the given 4 variable function using IC74LS153. Verify its Truth- Table
2.	**Study of IC-74LS138 as a Demultiplexer / Decoder:** (Refer Data-Sheet) a. Design and Implement full adder and subtractor function using IC-74LS138. b. Design & Implement 3-bit code converter using IC-74LS138.(Gray to Binary/Binary to Gray)
3.	**Study of IC-74LS83 as a BCD adder:** (Refer Data-Sheet). a. Design and Implement 1 digit BCD adder usingIC-74LS83 b. Design and Implement 4-bit Binary sub tractor using IC-74LS83.
4.	**Study of IC-74LS85 as a magnitude comparator:** (Refer Data-Sheet) a. Design and Implement 4-bitComparator. b. Design and Implement 8-bit Comparator
5.	Study of Counters: a. Design and Implement 4-bit counter using JK- Flip flop
6.	**Study of Counter ICs (74LS90/74LS93):** (Refer Data-Sheet) a. Design and Implement MOD-N and MOD-NN using IC-74LS90 and draw Timing diagram. b. Design and Implement MOD-N and MOD-NN using IC-74LS93 and draw Timing diagram.
7.	Study of synchronous counter: a. Design & Implement 4-bit Up/down Counter and MOD-N Up/down Counter using IC74HC191/ IC74HC193. Draw Timing Diagram.
8.	Verify four voltage and current parameters for TTL and CMOS (IC 74LSXX, 74HCXX), (Refer Data-Sheet).
9.	**Study of Shift Register:** Design and Implement 4-bit right shift and left shift register using D-flip flop.
10.	**Study of Shift Register (74HC194/74LS95):** a. Design and Implement Pulse train generator using IC-74HC194/IC74LS95 (Use right shift/ left shift). b. Design and Implement 4-bit Ring Counter/ Twisted ring Counter using shift registers IC 74HC194/IC74LS95.
11.	**Study of Counter ICs (74LS90/74LS93):** (ReferData-Sheet) a. Design and Implement MOD-N and MOD-NN using IC-74LS90 and draw Timing diagram. b. Design and Implement MOD-N and MOD-NN using IC-74LS93 and draw Timing diagram.

Savitribai Phule Pune University Second Year of Electronics & Computer Engineering (2020 Course) XXXXXX: Data Structure and Algorithm Lab		
Teaching Scheme:	**Credit**	**Examination Scheme:**
PR: 02 hrs. / week	**01**	**ORAL: 25 Marks**
Prerequisite Courses, if any:		
Companion Course, if any: XXXXXX - Data Structure and Algorithm		

List of Laboratory Experiments

Group A: Compulsory

Write a C program to:

1.	Perform following String operations with and without pointers to arrays (without using the library functions): a. substring b. palindrome c. compare d. copy e. reverse
2.	Implement Database Management using array of structures with operations Create, Display, Modify, Append, Search and Sort. (For any database like Employee or Bank database with and without pointers to structures)
3.	Implement Stack and Queue using arrays.
4.	Create a singly linked list with options: a. Insert (at front, at end, in the middle), b. Delete (at front, at end, in the middle), c. Display, d. Display Reverse, e. Revert the SLL
5.	Implement Binary search tree with operations Create, search, and recursive traversals.
6.	Implement Graph using adjacency Matrix with BFS & DFS traversals.

Group B: Perform (Any 4)

Write a C program to:

7.	Implement stack and Queue using Linked Lists.

8.	Implement assignment 2 using files
9.	Add two polynomials using linked lists.
10.	Reverse a doubly linked list
11.	Evaluate postfix expression (input will be postfix expression)
12.	Reverse and Sort stack using recursion.
13.	Implement In order tree traversal without recursion
14.	To find in order predecessor and successor of a given key in BST.
15.	Implement Quicksort

Group C: Perform (Any 2)

Write a C program to:

16.	Implement merge sort for doubly linked list.
17.	Construct a tree from given inorder and preorder traversal
18.	Implement Dijkstra's Algorithm
19.	Implement Circular Linked List with various operations
20.	Represent graph using adjacency list or matrix and generate minimum spanning tree using Prism's algorithm

Group assignment

- Make Group of **4 students** in a batch (Batch of 20)
- Group will select any one topic as group assignment
- After completing the mini-project the respective group will present it during the practical slot.
  - Distribution of work in a group during presentation may contain:
    - Algorithm / Flowchart
    - Program Explanation
    - Application

Savitribai Phule Pune University

Second Year of Electronics & Computer Engineering (2020 Course)

XXXXX: Computer Organization Lab

Teaching Scheme:	Credit	Examination Scheme:
PR: 02 hrs. / week	01	Term Work: 25 Marks

Prerequisite Courses, if any:

Companion Course, if any:

List of Laboratory Experiments	
1.	Study of basic architecture of 8086.
2.	Study the complete instruction set of 8086 and write the instructions of 8086 along with examples.
3.	Write an assembly language code using 8086 to implement data transfer instruction.
4.	Write an assembly language code using 8086 to store numbers in reverse order in memory location.
5.	Write an assembly language code using 8086 to implement arithmetic instruction.
6.	Write an assembly language code using 8086 to add two numbers using lxi instruction.
7.	Write an assembly language code using 8086 to add two 8 bit numbers stored in memory and also storing the carry.
8.	Write an assembly language code using 8086 to find the factorial of a number.
9.	Write an assembly language code using 8086 to implement logical instructions.

Savitribai Phule Pune University

Second Year of Electronics & Computer Engineering (2020 Course)

XXXXXX: Electronic Skill Development Lab

Teaching Scheme:	Credit	Examination Scheme:
PR: 02 hrs. / week	**01**	**TERM WORK: 25 Marks**

Prerequisite Courses, if any: Basic Electronics Engineering, Fundamentals of Programming, Open-source electronics platform based on easy-to-use hardware and software (preferably Arduino)

Companion Course, if any: Any one of the following:

1. Jeremy Blum PCB tutorials
2. OrCAD basic Tutorials

List of Assignments (Min. 10 has to be completed)	
Group A: Application of Electronics Principles in Practice	
1.	Electronic Components and Connections (Bread boarding)
2.	Introduction and applications using Arduino and micro python
3.	Using Sensors & Actuators and their interfacing with Arduino (Motor Driver with relays , Reversible motor, SSR)
4.	Wireless Connectivity to Arduino
Group B: Hardware Design, Fault Finding, Testing, Repair and Measuring	

5.	Drawing layout of PCB using PCB design software
6.	Single layer PCB design for a simple electronic Circuit
7.	Using test equipment for testing, fault finding & repair etc.
8.	Use of measuring equipment for measurement of signals.
9.	Using Simulation software for design & testing of electronic circuits.
Group C: Assembly, SMD Overview, Power Budgeting, Batteries (Lead Acid , LiPo), Solar	
10.	Assemble and utilize mechanical parts such as DC Motor, AC Motor, Stepper motor Solenoid, sensors etc., Connect assemble mechanical parts to form a working unit , Wire and form cables. industry standards
11.	Assemble and use various types of parts and surface mounted devise parts, Assemble parts to standard determined by IPC-A-610, Work to correct sequences and tolerances, Accurately solder components using lead free solder to comply with
12.	Calculation of Power budget for an electronic circuit.
13.	Study & Use of various types of Batteries.
14.	Study of various solar power generation systems.

Learning Resources

Reference Books:

1. R S Khandpur, “Printed Circuit Boards: Design – Fabrication and Assembly”, Tata McGrawHill
2. Simon Monk “Hacking Electronics”, McGrawHill

Web resources:

1. https://github.com/arduino/Arduino
2. https://spoken-tutorial.org/tutorialsearch/?search_foss=Arduino&search_language=English
3. https://worldskillsindia.co.in/worldskill/file/2019/Electronics.pdf
4. https://worldskills.org/what/projects/wsss/

Savitribai Phule Pune University

Second Year of Electronics & Computer Engineering (2020 Course)

XXXXXX: Mandatory Audit Course - 3

Teaching Scheme:	Credit	Examination Scheme:
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GUIDELINES FOR CONDUCTION OF AUDIT COURSE

In addition to credits courses, it is manadatory that there should be audit course (non-credit course) from second year of Engineering. The student will be awarded grade as AP on successful completion of audit course. The student may opt for two of the audit courses (One in each semester). Such audit courses can help the student to get awareness of different issues which make impact on human lives and enhance their skill sets to improve their employability. List of audit courses offered in each semester is provided in curriculum. Student can choose the audit course either from courses available on SWAYAM or NPTEL Portal. Evaluation of audit course will be done at institute level. Method of conduction and method of assessment for audit courses is suggested.

The student registered for audit course shall be awarded the grade AP and shall be included such grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at institute level itself.

Selecting an Audit Course:

A) Using Swayam Platform:

With a view to providing access to the best quality learning resources across the country, the project **'Study Webs of Active Learning for Young Aspiring Minds' (SWAYAM)** has been started. SWAYAM provides an integrated platform and portal for online courses, using information and communication technology (ICT) and covering High School till all higher education subjects and skill sector courses to ensure that every student benefits from learning material through ICT.

- Student can select any of the course mentioned in the syllabus and has to register for the corresponding MOOC course available on the SWAYAM Platform as a Audit course.
- The duration of the course should not be more than 8 Weeks.
- Once the course is completed the student has to appear for the examination as per the guidelines on the SWAYAM portal.
- After clearing the examination successfully; student will be awarded with passing certificate a copy which he/she has to submit to concerned authority for getting the clearance of completing the Audit course.

B) Using NPTEL Platform:

NPTEL is an initiative by MHRD to enhance learning effectiveness in the field of technical education by developing curriculum based video courses and web based e-courses. The details of NPTEL courses are available on its official website https://swayam.gov.in/nc details/NPTEL.

- Student can select any of the course mentioned in the syllabus and has to register for the corresponding online course available on the NPTEL Platform as an Audit course.
- The duration of the course should not be more than 8 Weeks.
- Once the course is completed the student has to appear for the examination as per the guidelines on the NPTEL portal.
- After clearing the examination successfully; student will be awarded with passing certificate a copy which he/she has to submit to concerned authority for getting the clearance of completing the Audit course.

Assessment of an Audit Course:

- The assessment of the course will be done at the institute level. The institute has to maintain the record of the various audit courses opted by the students. The audit course opted by the students could be interdisciplinary.
- After the completion of the course the students must undergo the examination as per the schedule on SWAYAM and NPTEL platforms.
- During the course students will be submitting the online assignments. A copy of same students can submit as a part of term work for the corresponding Audit course.
- On the satisfactory submission of assignments and course completion certificate; the institute can mark as “Present” and the student will be awarded the grade AP on the marksheet.
- Every student must compel that student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory in-semester performance.

Savitribai Phule Pune University

Second Year of Electronics & Computer Engineering (2020 Course)

XXXXXX: Signals & Systems

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 hrs. / week **TUTORIAL: 01hr. / week**	**03**	**In-Sem (Theory): 30 Marks** **End Sem (Theory): 70 Marks**

Prerequisite Courses, if any:

Companion Course, if any: XXXXX - Signal & Systems Lab

Course Objectives:

- To understand the mathematical representation of continuous and discrete time signals and systems.
- To classify signals and systems into different categories.
- To analyze Linear Time Invariant (LTI) systems in time and transform domains.
- To build basics for understanding of courses such as signal processing, control system and communication.
- To develop basis of probability and random variables.

Course Outcomes: On completion of the course, learner will be able to –

CO1: Identify, classify basic signals and perform operations on signals.

CO2: Identify, Classify the systems based on their properties in terms of input output relation and in terms of impulse response and will be able to determine the convolution between to signals.

CO3: Analyze and resolve the signals in frequency domain using Fourier series and Fourier Transform.

CO4: Resolve the signals in complex frequency domain using Laplace Transform, and will be able to apply and analyze the LTI systems using Laplace Transforms.

CO5: Define and Describe the probability, random variables and random signals. Compute the probability of a given event, model, compute the CDF and PDF.

CO6: Compute the mean, mean square, variance and standard deviation for given random variables using PDF.

Course Contents		
Unit I	**Introduction to Signals & Systems**	**(07 Hrs)**
Signals: Introduction,Graphical, Functional, Tabular and Sequence representation of Continuous and Discrete time signals. Basics of Elementary signals: Unit step, Unit ramp, Unit parabolic, Impulse, Sinusoidal, Real exponential, Complex exponential, Rectangular pulse, Triangular, Signum, Sinc and Gaussian function. **Operations on signals**: time shifting, time reversal, time scaling, amplitude scaling, signal addition, subtraction, signal multiplication. Communication, control system and Signal processing examples. **Classification of signals:** Deterministic, Random, periodic , Non periodic, Energy , Power, Causal , Non- Causal, Even and odd signal. **Systems**: Introduction, Classification of Systems: Lumped Parameter and Distributed Parameter System, static and dynamic systems, Causal-non causal systems, Linear and Non- linear systems, time variant and time invariant systems, stable and unstable systems, invertible and non- invertible systems.		
Mapping of Course Outcomes for Unit I	**CO1: Identify, classify basic signals and perform operations on signals.**	
Unit II	**Time domain representation of LTI System**	**(07 Hrs)**
Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral using graphical method for unit step to unit step, unit step to exponential, exponential to exponential, unit step to rectangular and rectangular to rectangular only. Computation of convolution sum. Properties of convolution. System interconnection, system properties in terms of impulse response, step response in terms of impulse response.		
Mapping of Course Outcomes for Unit II	**CO2: Identify, Classify the systems based on their properties in terms of input output relation and in terms of impulse response and will be able to determine the convolution between to signals.**	
Unit III	**Fourier Series**	**(07 Hrs)**
Fourier series (FS) representation of periodic Continuous Time (CT) signals, Dirichlet condition for existence of Fourier series, orthogonality, basis functions, Amplitude and phase response, FS representation of CT signals using trigonometric and exponential Fourier series. Applications of Fourier series, properties of Fourier series and their physical significance, Gibbs phenomenon.		
Mapping of Course Outcomes for Unit III	**CO3: Analyze and resolve the signals in frequency domain using Fourier series and Fourier Transform.**	

Unit IV	Fourier Transform	(07 Hrs)
Fourier Transform (FT) representation of aperiodic CT signals, Dirichlet condition for existence of Fourier transform, evaluation of magnitude and phase response, FT of standard CT signals, Properties and their significance, Interplay between time and frequency domain using sinc and rectangular signals, Fourier Transform for periodic signals.		
Mapping of Course Outcomes for Unit IV	**CO3: Analyze and resolve the signals in frequency domain using Fourier series and Fourier Transform.**	
Unit V	**Laplace Transform**	**(07 Hrs)**
Definition of Laplace Transform (LT), Limitations of Fourier transform and need of Laplace transform, ROC, Properties of ROC, Laplace transform of standard periodic and aperiodic functions, properties of Laplace transform and their significance, Laplace transform evaluation using properties, Inverse Laplace transform based on partial fraction expansion, stability considerations in S domain, Application of Laplace transforms to the LTI system analysis.		
Mapping of Course Outcomes for Unit V	**CO4: Resolve the signals in complex frequency domain using Laplace Transform, and will be able to apply and analyze the LTI systems using Laplace Transforms.**	
Unit VI	**Probability and Random Variables**	**(07 Hrs)**
Probability: Experiment, sample space, event, probability, conditional probability and statistical independence, Bayes theorem, Uniform and Gaussian probability models. **Random variables:** Continuous and Discrete random variables, cumulative distributive function, Probability density function, properties of CDF and PDF. Statistical averages, mean, moments and expectations, standard deviation and variance.		
Mapping of Course Outcomes for Unit VI	**CO5: Define and Describe the probability, random variables and random signals. Compute the probability of a given event, model, compute the CDF and PDF.** **CO6: Compute the mean, mean square, variance and standard deviation for given random variables using PDF.**	

Learning Resources

Text Books:

1. Simon Haykins and Barry Van Veen, “Signals and Systems”, 2nd Edition, Wiley India.
2. M.J. Roberts “Signal and Systems”, Tata McGraw Hill 2007.

Reference Books:

1. Charles Phillips, "Signals, Systems and Transforms", 3rd Edition, Pearson Education.
2. Peyton Peebles, "Probability, Random Variable, Random Processes", 4th Edition, Tata Mc Graw Hill.
3. A. Nagoor Kanni "Signals and Systems", 2nd edition, Mc Graw Hill.

MOOC / NPTEL Courses:

1. NPTEL Course **"Principles of Signals & System"**, by Prof. Aditya.K. Jagannath (IIT Kanpur)

https://nptel.ac.in/courses/108/104/108104100/

2. Lecture Series on, **"Signals & Systems"**, by Prof. K.S. Venkatesh (IIT Kanpur)

http://www.nptelvideos.in/2012/12/signals-and-system.html

Savitribai Phule Pune University

Second Year of Electronics & Computer Engineering (2020 Course)

XXXXX: Principles of Programming Language

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 hrs. / week	03	In-Sem (Theory): 30 Marks End Sem (Theory): 70 Marks

Prerequisite Courses, if any:

Companion Course, if any: XXXXX – Principles of Programming Language Lab

Course Objectives:

- To learn principles of programming language
- To understand structural, computational and logical implications regarding programming languages
- To explore main programming paradigms.
- To understand and apply Object Oriented Programming (OOP) principles using C++ and Java

Course Outcomes: On completion of the course, learner will be able to –

CO1: To analyze the strengths and weaknesses of programming languages for effective and efficient program development.

CO2: To inculcate the principles underlying the programming languages enabling to learn new programming languages.

CO3: To grasp different programming paradigms

CO4: To use the programming paradigms effectively in application development.

Course Contents		
Unit I	**Programming Language Syntax & semantics**	**(07 Hrs)**
Software development process, language and software development environments, language and software design methods, languages and computer architecture, programming language qualities, languages and reliability, languages and maintainability, languages and efficiency, a brief historical perspective and early high level languages, a bird's eye view of programming language concepts. **Syntax and semantics:** Language definition, syntax, abstract syntax, concrete syntax, and pragmatics, semantics, an introduction to formal semantics, languages, language processing, interpretation, translation, the concept of binding, variables, name and scope, Type, l-value, r-value, reference and unnamed variables, routines, generic routines, aliasing and overloading, an abstract semantic processor, run time structure.		
Mapping of Course Outcomes for Unit I	**CO1: To analyze the strengths and weaknesses of programming languages for effective and efficient program development.** **CO2: To inculcate the principles underlying the programming languages enabling to learn new programming languages.**	
Unit II	**Structuring Data, Computations and Programming**	**(07 Hrs)**
Structuring of Data- Built in and primitive types, Data aggregates and type constructors, Cartesian product, Finite mapping User -defined types and abstract data types, Type systems, Static versus dynamic program checking, Strong typing and type checking, Type compatibility, Type conversions, Types and subtypes, Generic types, monomorphic versus polymorphic type systems, **Structuring of Computations:** Structuring the computation, Expressions and statements, Conditional execution and iteration, Routines, Style issues: side effects and aliasing, Exceptions,		
Mapping of Course Outcomes for Unit II	**CO1: To analyze the strengths and weaknesses of programming languages for effective and efficient program development.** **CO2: To inculcate the principles underlying the programming languages enabling to learn new programming languages.**	
Unit III	**Structuring of a Program**	**(07 Hrs)**

Software design method, Concepts in support of modularity, Encapsulation, Interface and implementation, Separate and independent compilation, Libraries of modules, Language features for programming in the large, Program organization, Grouping of units, Encapsulation, Interface and implementation, Abstract data types, classes, and modules, Generic units, Generic data structures, Generic algorithms, Generic modules, Higher levels of genericity.

Programming paradigms: Introduction to programming paradigms, Introduction to four main Programming paradigms- procedural, object oriented, functional, and logic & rule based.

Mapping of Course Outcomes for Unit III	**CO1: To analyze the strengths and weaknesses of programming languages for effective and efficient program development.** **CO2: To inculcate the principles underlying the programming languages enabling to learn new programming languages.**

Unit IV	**Java as Object Oriented Programming Language**	**(07 Hrs)**

Java History, Java Features, Java and Internet, Java and Word Wide Web, Web Browsers, Java Virtual Machine.

Data Types and Size: (Signed vs. Unsigned, User Defined vs. Primitive Data Types, Explicit Pointer type).

Arrays: One dimensional array, multi-dimensional array, alternative array declaration statements.

Control Statements Revision of identical selection Statements in brief (if, else if, Nested if, Switch, Nested Switch), Iterative Statements For Each version of For Loop, Declaring Loop Control Variables Inside the for loop, Using comma in for loop), Jump Statements (Labeled Break and Labeled Continue).

String Handling: String class methods.

Mapping of Course Outcomes for Unit IV	**CO2: To inculcate the principles underlying the programming languages enabling to learn new programming languages.** **CO3: To grasp different programming paradigms**

Unit V	**Inheritance, Polymorphism and Encapsulation in Java**	**(07 Hrs)**

Classes and Methods: class fundamentals, declaring objects, assigning object reference variables, adding methods to a class, returning a value, constructors, this keyword, garbage collection, finalize() method, overloading methods, argument passing, object as parameter, returning objects, access control, static, final, nested and inner classes, command line arguments, variable -length arguments.

Inheritances: member access and inheritance, super class references, Using super, multilevel hierarchy, constructor call sequence, method overriding, dynamic method dispatch, abstract classes, Object class.

Packages and Interfaces: defining a package, finding packages and CLASSPATH, access protection, importing packages, interfaces (defining, implementation, nesting, applying), variables in interfaces, extending interfaces, instance of operator.

Mapping of Course Outcomes for Unit V	**CO3: To grasp different programming paradigms**

Unit VI	**Exception handling in Java**	**(07 Hrs)**

Fundamental, exception types, uncaught exceptions, try, catch, throw, throws, finally, multiple catch clauses, nested try statements, built-in exceptions, custom exceptions (creating your own exception sub classes).

Managing I/O: Streams, Byte Streams and Character Streams, Predefined Streams, Reading console Input, Writing Console Output, Print Writer class,

Applet: Applet Fundamental, Applet Architecture, Applet Skeleton, Requesting Repainting, status window, HTML Applet tag, passing parameters to Applets, Difference between Applet and Application Program.

Mapping of Course Outcomes for Unit VI	**CO3: To grasp different programming paradigms.** **CO4: To use the programming paradigms effectively in application development.**

Learning Resources

Text Books:

1. Carlo Ghezzi, Mehdi Jazayeri, “Programming Language Concepts”,3rd Ed, Wiley Publication.
2. Herbert Schildt, "The Complete Reference Java", 9th Ed, TMH,

Reference Books:

1. Sebesta R., "Concepts of Programming Languages", 4th Edition, Pearson Education.
2. Deugo, “Java Gems”, Cambridge University Press.
3. T. W. Pratt, M. V. Zelkowitz, "Programming Languages Design and Implementation‖, 4th Ed, PHI

MOOC / NPTEL Courses:

1. NPTEL Course **"Principles of Programming Language"**

https://nptel.ac.in/courses/106/102/106102067/

2. NPTEL Course **"Programming in Java"**

https://nptel.ac.in/courses/106/105/106105191/

Savitribai Phule Pune University

Second Year of Electronics & Computer Engineering (2020 Course)

XXXXXX: Object Oriented Programming

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 hrs. / week	03	In-Sem (Theory): 30 Marks End Sem (Theory): 70 Marks

Prerequisite Courses, if any:

Companion Course, if any: XXXXXX - OOP Lab

Course Objectives:

- Make the students familiar with basic concepts and techniques of object oriented programming in C++ To acquaint the students with the fundamental principles of modulation process and different amplitude and angle modulation systems.
- Develop an ability to write programs in C++ for problem solving.

Course Outcomes: On completion of the course, learner will be able to –

CO1: Describe the principles of object oriented programming.

CO2: Apply the concepts of data encapsulation, inheritance in C++.

CO3: Understand Operator overloading and friend functions in C++.

CO4: Apply the concepts of classes, methods inheritance and polymorphism to write programs C++.

CO5: Apply Templates, Namespaces and Exception Handling concepts to write programs in C++.

CO6: Describe and use of File handling in C++.

Course Contents

Unit I	Foundation of Object Oriented Programming	(08 Hrs)

Introduction to procedural, modular, object-oriented and generic programming techniques, Limitations of procedural programming, Need of object-oriented programming, fundamentals of object-oriented programming: objects, classes, data members, methods, messages, data encapsulation, data abstraction and information hiding, inheritance, polymorphism. Inline functions, Function overloading, call by value and call by reference, return by reference, functions with default arguments, this pointer, illustrative Simple C++ Programs. Dynamic initialization of variables, memory management operators, Member dereferencing operators, operator precedence, typecast operators, Scope resolution operators, arrays.		
Mapping of Course Outcomes for Unit I	**CO1: Describe the principles of object oriented programming.**	
Unit II	**Classes & Objects**	**(06 Hrs)**
Defining class, Defining member functions, static data members, static member functions, private data members, public member functions, arrays of objects, objects as function arguments. Constructors and Destructors: types of constructors, handling of multiple constructors, destructors. (**Complex Class & String Class**)		
Mapping of Course Outcomes for Unit II	**CO2: Apply the concepts of data encapsulation, inheritance in C++.**	
Unit III	**Operator Overloading**	**(06 Hrs)**
Fundamentals of Operator Overloading, Restrictions on Operators Overloading, Operator Functions as Class Members vs. as Friend Functions, Overloading Unary Operators, Overloading Binary Operators, Overloading of operators using friend functions.		
Mapping of Course Outcomes for Unit III	**CO3: Understand Operator overloading and friend functions in C++.**	
Unit IV	**Inheritance & Polymorphism**	**(06 Hrs)**
Introduction to inheritance, base and derived classes, friend classes, types of inheritance, hybrid inheritance, member access control, static class, multiple inheritance, ambiguity, virtual base class, Introduction to polymorphism, pointers to objects, virtual functions, pure virtual functions, abstract base class, Polymorphic class, virtual destructors, early and late binding, container classes, Contained classes, Singleton class.		
Mapping of Course Outcomes for Unit IV	**CO4: Apply the concepts of classes, methods inheritance and polymorphism to write programs C++.**	
Unit V	**Templates, Namespaces and Exception handling**	**(06 Hrs)**

Templates: Introduction, Function template and class template, function overloading vs. function templates

Namespaces: Introduction, Rules of namespaces

Exception handling: Introduction, basics of exception handling, exception handling mechanism, throwing and catching mechanism, specifying exceptions, Multiple Exceptions, Exceptions with arguments C++ streams, stream classes, unformatted I/O, formatted I/O and I/O manipulators.

Mapping of Course Outcomes for Unit V	**CO5: Apply Templates, Namespaces and Exception Handling concepts to write programs in C++.**

Unit VI	**Working with files**	**(06 Hrs)**

Introduction, classes for file Stream Operations, opening and closing files, detecting End_Of_File (EOF), modes f File Opening, file pointers and manipulators, updating file, error handling during file operations.

Mapping of Course Outcomes for Unit VI	**CO6: Describe and use of File handling in C++.**

Learning Resources

Text Books:

1. E Balagurusamy, "Programming with C++", Tata McGraw Hill, 3rd Edition.

2. Herbert Schildt , "The Complete Reference C++", 4th Edition.

Reference Books:

1. Robert Lafore, "Object Oriented Programming in C++", Sams Publishing, 4th Edition.

2. Matt Weisfeld, "The Object-Oriented Thought Process", Pearson Education.

MOOC / NPTEL Courses:

1. NPTEL Course **"Prgramming in Java",** by Prof. Debasis Samanta (IIT Kharakpur)

https://nptel.ac.in/courses/106/105/106105191/

2. NPTEL Course **"Prgramming in C++",** by Prof. Pratha Pritam (IIT Kharakpur)

https://nptel.ac.in/courses/106/105/106105151/

Other Resources:

1. Bjarne Stroustrup, "A Tour of C++"

Savitribai Phule Pune University

Second Year of Electronics & Computer Engineering (2020 Course)

XXXXXX: Principles of Communication Systems

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 hrs. / week	03	In-Sem (Theory): 30 Marks End Sem (Theory): 70 Marks

Prerequisite Courses, if any:

Companion Course, if any: XXXXXX - Signals & Systems
XXXXXX- Communications Lab

Course Objectives:

- To equip/ familiarize students with basic mathematical tools for time and frequency domain analysis of communication signal and systems.
- To acquaint the students with the fundamental principles of modulation process and different amplitude and angle modulation systems.
- To introduce the students with the concept of Sampling theorem and pulse modulation techniques PAM, PWM, PPM.
- To impart pre-requisites of digital communication systems and explore digital representation techniques like PCM, DPCM, DM and ADM.
- To highlight the issues in baseband digital transmission such as data representation, synchronization, multiplexing and ISI.

Course Outcomes: On completion of the course, learner will be able to –

CO1: To compute & compare the bandwidth and transmission power requirements by analyzing time and frequency domain spectra of signal required for modulation schemes under study.

CO2: Describe and analyze the techniques of generation, transmission and reception of Amplitude Modulation Systems.

CO3: Explain generation and detection of FM systems and compare with AM systems.

CO4: Exhibit the importance of Sampling Theorem and correlate with Pulse Modulation technique (PAM, PWM, and PPM).

CO5: Characterize the quantization process and elaborate digital representation techniques (PCM, DPCM, DM and ADM).

CO6: Illustrate waveform coding, multiplexing and synchronization techniques and articulate their importance in baseband digital transmission.

Course Contents		
Unit I	**Signals & spectra**	**(08 Hrs)**
Introduction to Communication System, Analog and Digital messages, regenerative repeaters, Signal Bandwidth & Power. Size & classification of signal, exponential fourier series, concept of negative frequencies. Fourier transform and properties, Frequency shifting, Concept of baseband and bandpass signals, Signal transmission through LTI system. Signal energy & Energy Spectral density. Signal power & Power Spectral Density, Input and output PSD, PSD of modulated signal.		
Mapping of Course Outcomes for Unit I	**CO1: To compute & compare the bandwidth and transmission power requirements by analyzing time and frequency domain spectra of signal required for modulation schemes under study.**	
Unit II	**AM transmission & reception for signal tone**	**(08 Hrs)**
Need for frequency translation, Amplitude modulation (DSB-C), Double sideband Suppressed carrier (DSB-SC) modulation, Single sideband modulation (SSB), Vestigial Sideband modulation (VSB),Spectrum and Bandwidth of AM, DSB-SC, SSB & VSB, Calculation of modulation index for AM wave, Modulation index for more than one modulating signals, Power and power efficiency, AM reception		
Mapping of Course Outcomes for Unit II	**CO2: Describe and analyze the techniques of generation, transmission and reception of Amplitude Modulation Systems.**	
Unit III	**FM transmission & reception for signal tone**	**(08 Hrs)**
Phase Modulation (PM) and Frequency Modulation (FM), Relationship between Phase and Frequency Modulation, Modulation Index, Spectrum of FM (single tone): Feature of Bessel Coefficient, Power of FM signal, Bandwidth of tone modulated FM signal, modulation index : AM vs. FM, Spectrum of constant Bandwidth' FM, Narrowband and Wideband FM. **FM modulators and demodulators:** FM generation by Armstrong's Indirect method, frequency multiplication and application to FM, FM demodulator.		
Mapping of Course Outcomes for Unit III	**CO3: Explain generation and detection of FM systems and compare with AM systems.**	

Unit IV	Pulse Modulation	(06 Hrs)
Need of analog to digital conversion, sampling theorem for low pass signal in time domain, and Nyquist criteria, Types of sampling- natural and flat top. Pulse amplitude modulation & concept of TDM: Channel bandwidth for PAM, equalization, Signal Recovery through holding. Pulse Width Modulation (PWM) and Pulse Position Modulation (PPM): Generation & Detection.		
Mapping of Course Outcomes for Unit IV	**CO4: Exhibit the importance of Sampling Theorem and correlate with Pulse Modulation techniques (PAM, PWM, and PPM)**	
Unit V	**Digital Representation of Analog Signals**	**(06 Hrs)**
Quantization of Signals: Quantization error, Uniform & Non-Uniform types of Quantization, Mid-rise & Mid-tread Quantizer, Companding, A-law & μ-law, Pulse Code Modulation system– Generation & Reconstruction, Differential Pulse code modulation, Delta Modulation, Adaptive Delta Modulation.		
Mapping of Course Outcomes for Unit V	**CO5: Characterize the quantization process and elaborate digital representation techniques (PCM, DPCM, DM and ADM).**	
Unit VI	**Baseband Digital Transmission**	**(06 Hrs)**
Line codes: Properties and spectrum **Digital Multiplexing and hierarchies:** T1, AT&T, E1, CCITT, Scrambling & Unscrambling. **Synchronization:** Carrier Synchronization, Bit Synchronization and Frame Synchronization. Intersymbol Interference, Equalization.		
Mapping of Course Outcomes for Unit VI	**CO6: Illustrate waveform coding, multiplexing and synchronization techniques and articulate their importance in baseband digital transmission.**	

Learning Resources

Text Books:

1. Taub , Schilling and Saha, “Principles of Communication Systems”, 4th Edition, McGraw-Hill.
2. B P Lathi, Zhi Ding, “Modern Analog and Digital Communication System”, Oxford University Press, 4th Edition.

Reference Books:

1. Bernard Sklar, Prabitra Kumar Ray, "Digital Communications Fundamentals and Applications", 2nd Edition, Pearson Education
2. Wayne Tomasi, " Electronic Communications System", 5th Edition , Pearson Education
3. A.B Carlson, P B Crully, J C Rutledge, ―Communication Systems‖, 5th Edition, Tata McGraw Hill Publication.
4. Simon Haykin, "Communication Systems", 4th Edition, John Wiley & Sons.

MOOC / NPTEL Courses:

1. NPTEL Course **"Principles of Communication Systems-I",** by Prof. Aditya.K. Jagannath

https://nptel.ac.in/courses/108/104/108104091/

Savitribai Phule Pune University

Second Year of Electronics & Computer Engineering (2020 Course)

XXXXXX: System Programming & Operating Systems

Teaching Scheme:	Credit	Examination Scheme:
TH: 03 hrs. / week	03	In-Sem (Theory): 30 Marks End Sem (Theory): 70 Marks

Prerequisite Courses, if any:

Companion Course, if any:

Course Objectives: To make the students understand

- To understand system software concepts, like the use and implementation of assembler, macros, linker, loaders and compiler.
- To get acquainted with software tools for program development.
- To explore memory allocation methods, input output devices and file system w. r. t. various operating system.
- To study and implement various processes scheduling techniques and dead lock avoidance schemes in operating system.

Course Outcomes: On completion of the course, learner will be able to –

CO1: Demonstrate the knowledge of Systems Programming and Operating Systems.

CO2: Formulate the Problem and develop the solution for same.

CO3: Compare and analyse the different implementation approach of system programming operating system abstractions.

CO4: Interpret various OS functions used in Linux / Ubuntu

Course Contents

Unit I	Introduction to System Programming	(07 Hrs)

Introduction: Components of System Software, Language Processing Activities, Fundamentals of Language Processing.

Assemblers: Elements of Assembly language programming. Simple assembler scheme, Structure of an assembler, Design of single and two pass assembler.

Macro Processors: Macro Definition and call, Macro expansion, Nested Macro Calls, Advanced Macro Facilities, Design of a two-pass macro-processor.

Mapping of Course Outcomes for Unit I	CO1: Demonstrate the knowledge of Systems Programming and Operating Systems.

Unit II	Compilers, Loaders and Linkers	(07 Hrs)

Compilers: Basic compilers function, Phases of compilation, memory allocation, compilation of expression, Compilation of expressions, compilation of control structures, Code of optimization.

Loaders: Loader Schemes: Compile and go, General Loader Scheme, Absolute loaders, subroutine linkages, relocating loaders, direct linking loaders, Design of an absolute loader.

Linkers: Relocation and linking concepts, Design of linker, self relocating programs, Static and dynamic linker.

Mapping of Course Outcomes for Unit II	CO1: Demonstrate the knowledge of Systems Programming and Operating Systems.

Unit III	Introduction to Operating System & Process Management	(07 Hrs)

Introduction to OS : Architecture, Goals & Structures of O.S, Basic functions, Interaction of O. S. & hardware architecture, System calls, Batch, multiprogramming. Multitasking, time sharing, parallel, distributed & real -time O.S.

Process Management: Concept, Process states, Process control, Threads.

Scheduling: Types of scheduling, Scheduling algorithms.

Mapping of Course Outcomes for Unit III	CO1: Demonstrate the knowledge of Systems Programming and Operating Systems. CO2: Formulate the Problem and develop the solution for same.

Unit IV	**Concurrency Control**	**(07 Hrs)**
Concurrency: Interprocess communication, Mutual Exclusion, Semaphores, Classical Problems of Synchronization: Readers-Writers, Producer Consumer, and Dining Philosopher problem. **Deadlock:**Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection.		
Mapping of Course Outcomes for Unit IV	**CO1: Demonstrate the knowledge of Systems Programming and Operating Systems.** **CO3: Compare and analyse the different implementation approach of system programming operating system abstractions.**	
Unit V	**Memory Management**	**(07 Hrs)**
Basics of memory management, Swapping, Memory Allocation, Paging, Segmentation ,Virtual memory, Demand Paging, Page replacement, Page replacement algorithms – Optimal FIFO, LRU, LRU approximation, Allocation of frames		
Mapping of Course Outcomes for Unit V	**CO3: Compare and analyse the different implementation approach of system programming operating system abstractions.**	
Unit VI	**Input Output File system**	**(07 Hrs)**
I/O management & Disk scheduling: I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, Disk Scheduling (FCFS), RAID, Disk Cache. **File Management:** Concepts, File Organization, File Directories, File Sharing, Record Blocking, Allocation methods, Free Space management		
Mapping of Course Outcomes for Unit VI	**CO6: Understand and compare the principles of various data conversion techniques and PLL with their applications.**	

Learning Resources

Text Books:

1. Dhamdhere D., "Systems Programming and Operating Systems", 2nd Edition, 'TMH
2. Siberschatz A, Galvin P.B, Gagne G, “Operating System Concepts”, John Wiley.
3. J. J. Donovan, ―Systems Programming‖, McGraw Hill

Reference Books:

1. Stalling William, "Operating Systems", Pearson Education, fifth edition.

2. Adam Hoover, “System Programming with C and UNIX”, Pearson Education

3. Leland L. Beck, “System Software,” Pearson Editions.

4. Andrew S. Tanenbaum, “Modern Operating Systems”, Second Edition, PHI.

MOOC / NPTEL Courses:

1. NPTEL course on, "Operating Systems"

https://nptel.ac.in/courses/106/108/106108101/

Savitribai Phule Pune University **Second Year of Electronics & Computer Engineering (2020 Course)** **XXXXXX: Signals & System Lab**		
Teaching Scheme:	**Credit**	**Examination Scheme:**
PR: 02 hrs. / week	**01**	**Term Work: 25 Marks**
Prerequisite Courses, if any:		
Companion Course, if any: XXXXXX - Signals & Systems		

LIST OF ASSIGNMENTS / TUTORIALS

Group A	
1.	Generate and plot the following signals in time domain and also sketch its amplitude and phase spectrum. Verify the result: • Impulse • Unit Step • Exponential • Unit ramp • Sinc • Rectangular
2 (a)	Write the codes to plot the following signals also simulate the signals: (a) $\sin(200\pi t)$ (b) $\sin(200\pi t + \frac{\pi}{6})$ (c) $\sin(200\pi t - \frac{\pi}{6})$ (d) $\cos(200\pi t)$ (e) $\cos(200\pi t + \frac{\pi}{4})$ (f) $\cos(200\pi t - \frac{\pi}{6})$
2 (b)	Develop codes to simulate, and plot the results for an exponential signal: $x(t) = k\,e^{-at}u(t)$ for the cases: (a) $k = 1$, and $a = 0.35$ (b) $k = 1.2$ and $a = -0.45$
3.	**Sampling & Aliasing** Consider various human voice / speech (probably your voice both male and female) or music signals. Try different sampling rates and observe the effect of aliasing.

4.	**Real time speech signal and Spectral analysis** The speech signal has frequency components in the audio frequency range 300 Hz to 3400 Hz of the electromagnetic spectrum. Record the male and female voice speech Signal. Write a programme to record the speech signals and sketch it in time domain, its amplitude spectrum and phase spectrum.
5.	The music signal has frequency components in the audio frequency range 20 Hz to 20000 Hz of the electromagnetic spectrum. Record or use the recorded music samples of different instruments (at least four) and Write a programme to record the music signal and sketch it in time domain, its amplitude spectrum and phase spectrum. Also comment on the result.
6.	Find the convolution integral of Unit step and exponential signals and write a program to sketch the out response of the system. Also verify the commutative property of convolution integral.
7.	Take any one periodic signal and find its fourier series coefficients using exponential or trigonometric FS method. Write a program to find its Fourier series coefficients. Also using FS coefficients, reconstruct the signal. Observe the effect of Gibb's phenomenon.
Group B	
8.	Software / Hardware implementation of step response for First order and Second Order Systems for under damped and Critically Damped system.
9.	Stability analysis for any given system with Characteristic Equation given (Software Simulation).
10.	Hardware/Software / Simulation of root locus for given G(s)H(s). Comment on time domain specifications and stability of the system.
11.	Software implementation/Simulation frequency response analysis using Bode Plot for given G(s) H(s). Comment on Gain Margin, Phase Margin and Stability of the system.
12.	Software implementation/Simulation frequency response analysis using Nyquist Plot for given G(s) H(s). Comment on Gain Margin, Phase Margin and Stability of the system.

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Second Year of Electronics & Computer Engineering (2020 Course)

XXXXXX: Communication Lab

Teaching Scheme:	Credit	Examination Scheme:
PR: 02 hrs. / week	**01**	**PRACTICAL: 50 Marks**

Prerequisite Courses, if any:
Companion Course, if any: XXXXXX – Principles of Communication system

List of Laboratory Experiments	
Group A	
1.	AM Generation (DSB-FC): Calculation of modulation index by graphical method, Power of AM Wave for different modulating signal and Observe Spectrum.
2.	Frequency modulator & demodulator using Varicap/Varactor Diode and NE 566 VCO, IC 565 (PLL based detection), calculation of modulation index & BW of FM.
3.	Verification of Sampling Theorem, PAM Techniques, (Flat top & Natural sampling), reconstruction of original signal, Observe Aliasing Effect in frequency domain.
4.	Generation and Detection of PWM using IC 555
5.	Study of PCM
6.	Study of Companded PCM
7.	**Study of DM:** Generation and detection
8.	**Study of ADM:** Generation and detection
9.	Study of line codes (NRZ, RZ, POLAR RZ, BIPOLAR (AMI), MANCHESTER) & their spectral analysis.
Group B - Simulation Practicals	
10.	Simulation of T1/E1 system using suitable software.
11.	Simulation program to study effect of ISI and noise in baseband communication system.
12.	Simulation program to calculate Signal to noise ratio for PCM system & DM system.
13.	Verify Sampling Theorem using simulation.
14.	Demonstrate Scrambling and descrambling operation either using hardware or any simulation tool.

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Second Year of Electronics & Computer Engineering (2020 Course)XXXXXX:

Object Oriented Programming Lab

Teaching Scheme:	**Credit**	**Examination Scheme:**
PR: 02 hrs. / week	**01**	**ORAL: 25 Marks**

Prerequisite Courses, if any:
Companion Course, if any: XXXXXX - Object Oriented Programming

List of Laboratory Experiments	
Group A (Any Four)	
1.	Write a program in C++ to sort the numbers in an array using separate functions for read, display, sort and swap. The objective of this assignment is to learn the concepts of input, output, functions, call by reference in C++.
2.	Write a C++ program that illustrates the concept of Function over loading.
3.	Write a program in C++ to perform following operations on complex numbers Add, Subtract, Multiply, Divide, Complex conjugate. Design the class for complex number representation and the operations to be performed. The objective of this assignment is to learn the concepts classes and objects.
4.	Write a program in C++ to implement Stack. Design the class for stack and the operations to be performed on stack. Use Constructors and destructors. The objective of this assignment is to learn the concepts classes and objects, constructors and destructors.
5.	Write a program in C++ to overload unary operators for complex class.
Group B (Any Seven)	
6.	Write a program in C++ to perform following operations on complex numbers Add, Subtract, Multiply, Divide. Use operator overloading for these operations. The objective of this assignment is to learn the concepts operator overloading.
7.	Write a program in C++ to implement string class. Write constructors, destructor, Accepts function and Display function.
8.	Write a program in C++ to implement string class. Write constructors, destructor, Accepts function and Display function. To overload = operator so as call copy constructor.
9.	Write a program in C++ to implement containment concept using Employee, B Date, & String Classes.
10.	Write a program in C++ to Read and Display the information of Employee Using Multiple Inheritance. Use Basic Info and Department Info as a base classes of Employee class.
11.	Write a C++ program that illustrates run time polymorphism by using virtual functions.
12.	Write a C++ program which use try and catch for exception handling.
13.	Write a C++ program which to implement class and function template.
14.	Write a C++ program which to demonstrate use of namespace in the program.
15.	Write a C++ program which copies the contents of one file to another.

Savitribai Phule Pune University Second Year of Electronics & Computer Engineering (2020 Course) XXXXXX: Employbility Skills Development		
Teaching Scheme:	**Credit**	**Examination Scheme:**
PR: 02 hrs. / week	**01**	**TERM WORK: 25 Marks**

uidelines for Conduction of Employability Skills Development Lab

- The teacher may design specific assignments that can highlight the learning outcomes of each unit.
- Each activity conducted in the lab should begin with a brief introduction of the topic, purpose of the activity from a professional point of view and end with the learning outcomes as feedback from students.
- Most of the lab sessions can be designed to be inclusive; allowing students to learn skills experientially; which will benefit them in the professional environment.
- Every student must be given sufficient opportunity to participate in each activity and constructive feedback from the instructor / facilitator at the end of the activity should learn towards encouraging students to work on improving their skills.
- Activities should be designed to respect cultural, emotional and social standing of students. Some of the activities can be designed to cater to enhancement of multiple skills – For eg – Team Building Activity can highlight ‘open communication’, ‘group discussion’, ‘respecting perspectives’, ‘leadership skills’, ‘focus on goals’ which can help students improve their inherent interpersonal skills.

Guidelines for Student’s Lab Journal and TW Assessment

- Each student should have a Lab Workbook (sample can be provided if required) which outlines each lab activity conducted.
- The student must respond by writing out their learning outcomes and laborating the activities performed in the lab.
- Continuous assessment of laboratory work is to be done based on overall performance and lab assignments and performance of student.

- Each lab assignment assessment will be assigned grade/marks based on parameters with appropriate weightage.
- Suggested parameters for overall assessment as well as each lab assignment assessment include- timely completion, performance, punctuality, neatness, enthusiasm, participation and contribution in various activities-SWOC analysis, presentations, team activity, event management, group discussion, group exercises and interpersonal skills and similar other activities/assignments

List of Laboratory Sessions

1.	**Introduction of Self / SWOC Analysis:** a. Explain how to introduce oneself in a professional manner and presenting oneself positively Name | Academic Profile | Achievements | Career Aspirations | Personal Information (hobbies, family, social) b. Focus on introspection and become aware of one's Strengths, Weakness, Opportunities and Challenges Students can write down their SWOC in a matrix and the teacher can discuss the gist personally
2.	**Career Goals and Planning:** • Make students understand the difference between a job and a career. Elaborate steps on how to plan a career. ➢ Students can choose a career and they should write down what skills, knowledge, steps are need to be successful in that particular career and how they can get the right opportunity • Explain to students how to plan short term and long term goals. ➢ Think and write down their short term goals and long terms goals. Teacher can read and discuss (provide basic counselling) about the choices written
3.	**Group Discussion:** • The class can be divided into groups of 8 – 10 students in each group for a discussion lasting 10 minutes ➢ Topics can be topical and non-controversial. After each group finishes its discussion, the teacher can give critical feedback including areas of

	improvement. The teacher should act as a moderator / observer only
4.	**Team Building Activities:** • The class can be divided into groups of 4-5 students in each group and an activity can be given to each group ➢ The activities chosen for each team should be competitive and should involve every student in the team. The activities can be conducted indoors or outdoors depending on infrastructure.
5.	**Public Speaking - (Choose any 2):** • **Prepared Speech** ➢ Topics are shared with students and they will be given 10 minutes to prepare and 3 minutes to deliver followed by Q&A from audience. Teacher can evaluate each student based on content, communication skills, logical and cohesive presentation of topic, perspective of student, ability to handle questions and respond positively • **Extempore Speech** ➢ Various topics are laid out in front of the audience and each student is to pick one topic and speak about the topic for 5 minutes followed by Q&A from audience. Teacher can evaluate each student based on ability to think on his/her feet, content, communication skills, logical and cohesive presentation of topic, perspective of student, ability to handle questions and respond positively • **Reviewing an Editorial article** ➢ Either using e-paper / printed copy, students have to select a recent editorial (that is non-controversial), read it and explain to the audience what the editor's perspective is and what the student's perspective is • **Book Review** Each student will orally present to the audience his/her review of a book that he/she has recently read
6.	**Mock Interviews:** • Every student has to undergo this session and the teacher should seek the

	assistance of another faculty member / TPO Officer to act as interview panel. Students will be informed beforehand about the job profile that they are appearing the interview for and they have to come prepared with a printed copy of their resume, formally dressed. Questions will include technical as well as HR. Faculty can choose to give problems that students have to solve using their technical skills. Students will be graded on the basis of their technical knowledge, ability to answer questions well, presentation of self, body language and verbal skills
7.	**Listening and Reading Skills:** • Listening Worksheets to be distributed among students ➢ Each student can be given specifically designed worksheets that contain blanks / matching / MCQs that are designed to an audio (chosen by the faculty). Students have to listen to the audio (only once) and complete the worksheet as the audio plays. This will help reiterate active listening as well as deriving information (listening to information between the lines)Reading Comprehension Worksheets to be distributed among students • Teacher can choose reading passages from non-technical domains, design worksheets with questions for students to answer. This will enhance students' reading skills by learning how to skim and scan for information.
8.	**Writing Skills (Choose any 2):** • **Letter / Email Writing** ➢ After explaining to the students the highlights of effective writing, students can be asked to write (using digital platforms / paper-based) letter to an organization with the following subject matter i. requesting opportunity to present his/her product ii. complaining about a faulty product / service iii. apologizing on behalf of one's team for the error that occurred iv. providing explanation for a false accusation by a client • **Report Writing** ➢ After describing various formats to write report and explaining how to write a report, each student should be asked to write a report (digital / paper-based) on any of the following topics ▪ Industrial visit ▪ Project participated in ▪ Business / Research Proposal • **Resume Writing**

	➢ The teacher should conduct a brief session outlining the importance of a CV / Resume and students can write / type out their own resumes ▪ Share various professional formats ▪ Focus on highlighting individual strengths ▪ Develop personalized professional goals / statement at the beginning of the resume
9.	**Lateral and Creative Thinking:** • Every student needs to step out of the linear thinking and develop lateral and creative thinking. Teacher can develop creative activities in the classroom / lab that will help students enhance their creative thinking. Some of the suggested activities ➢ Each group (3-4 students) can be given random unrelated items and they will be given 20 mins to come up with creative ideas on how the objects can be used for activities / purposes other than its intended one ➢ Each student is given a random line and he/she has to spin a fictional story and tell it to the class (3 minutes). Each story should have a beginning, middle and end ➢ Each group (3-4 students) can be given a fictional / hypothetical dangerous situation and they have to find a solution to that problem. They can present it to the other teams who will then get the opportunity to pick flaws in the ideas
10.	**Presentation Skills:** Every student will have to choose a topic of his/her choice and make a 5-minute presentation using audio-video aids / PPT. The topic can either be technical or non-technical. Focus and evaluation of each presentation should be the depth of knowledge about the topic, originality of perspective on the topic, well-researched or not, verbal and non-verbal skills and ability to answer questions effectively. Plagiarism should be discredit and students should be warned about it.
11.	**Expert Lecture :** Highlighting the need to manage stress and time, experts from the fields of health and fitness, counselling, training, medical or corporate HR can be invited to deliver a participatory session that focus on helping students to cope with parental, social, peer and career pressures

Savitribai Phule Pune University

Second Year of Electronics & Computer Engineering (2020 Course)

XXXXXX: Project Based Learning

Teaching Scheme:	Credit	Examination Scheme:
TH: 04 hrs. / week	02	TERM WORK: 50 Marks

Preamble:

The main stream engineering education follows traditional classroom teaching, in which the major focus is mainly on the lecturer and the student has very little (if any) choice on the learning process. This traditional approach no doubt has been effective for years; however rapid development in engineering and technology requires adopting a teaching approach that would assist students not only in developing a core set of industry relevant skills, but also enable them to adapt to changes in their professional career. Today the employers' demands are: Communication skills, Ability to work in Interdisciplinary teams, Analytical skills, Management skills. This consideration concludes that Project-Based Learning (PBL) is the best way to fulfill industry needs.

Course Objectives:

- To emphasize project based learning activities that are long-term, interdisciplinary and student-centric.
- To inculcate independent and group learning by solving real world problem with the help of available resources.
- To be able to develop application based on the fundamentals of electronics and communication engineering by possibly the integration of previously acquired knowledge.
- To get practical experience in all steps in the life cycle of the development of electronic systems: specification, design, implementation, and testing
- To be able to select and utilize appropriate hardware and software tools to design and analyze the proposed system.
- To provide every student the opportunity to get involved either individually or as a group so as to develop team skills and learn professionalism.

Course Outcomes: On completion of the course, learner will be able to –

CO1: Identify the real world problem (possibly of interdisciplinary nature) through a rigorous literature survey and formulate/set relevant aim and objectives.

CO2: Contribute to society through proposed solution by strictly following professional ethics and safety measures.

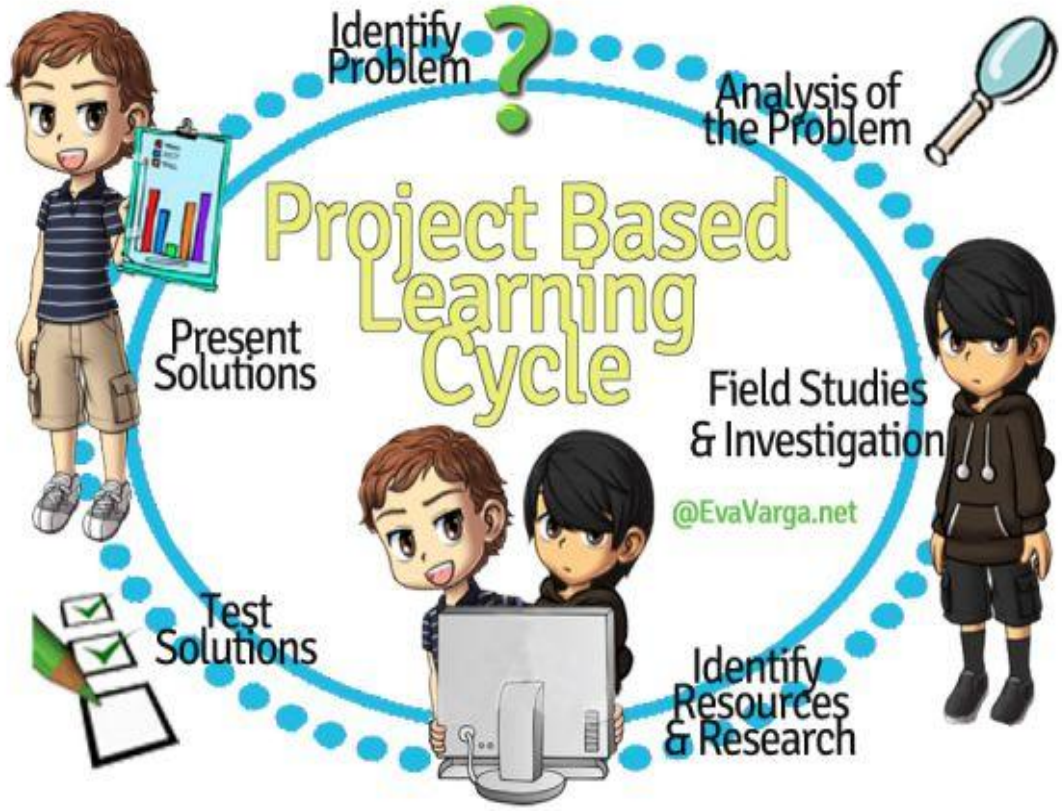
CO3: Propose a suitable solution based on the fundamentals of electronics and communication engineering by possibly the integration of previously acquired knowledge.

CO4: Analyze the results and arrive at valid conclusion.

CO5: Use of technology in proposed work and demonstrate learning in oral and written form.

CO6: Develop ability to work as an individual and as a team member.

Working Cycle:



Group Structure:

Working in supervisor/mentor –monitored groups. The students plan, manage and complete a task/project/activity which addresses the stated problem.

1. Create groups of 4 (four) to 5 (Five) students in each class
2. A supervisor/mentor teacher assigned to individual groups

Project Selection:

Survey through journals, patents or field visit (A problem can be theoretical, practical, social, technical, symbolic, cultural and/or scientific), check the physibility of solution, analyze the problem, design and find the values of components.

There are no commonly shared criteria for what constitutes an acceptable project. Projects vary greatly in the depth of the questions explored, the clarity of the learning goals, the content and structure of the activity.

The problem-based project oriented model for learning is recommended. The model begins with the identifying of a problem, often growing out of a question or "wondering". This formulated problem then stands as the starting point for learning. A problem can be theoretical, practical, social, technical, symbolic, cultural and/or scientific and grows out of students' wondering within different disciplines and professional environments. As stated in the preamble as electronics is an important grounding for other disciplines (computer science, signal processing, and communications), the project topic can be Interdisciplinary in nature. However the chosen problem must involve the application of electronics and communication engineering fundamentals. Out of the total developed system setup, the project must involve minimum 40% electronic components. Although in a genuine case 100% software based project topic may be allowed.

Tools for testing:

Recommended to use tools like DSO, PCB Manufacturing Equipment's, Scilab / Matlab, Multisim, Eagle etc.

Ethical Practices, team work and project management:

Use IEEE standards for project manufacturing, respect the time of others, attend the reviews, poster presentation and model exhibitions, strictly follow the deadline of project completion, comply with all legislation requirements that govern workplace health and safety practices.

Effective Documentation:

In order to make our engineering graduates capable to prepare effective documentation, it is required for the students to learn the effective writing skills. The PBL final report is expected to consist of the Literature Survey, Problem Statement, Aim and Objectives, System Block Diagram, System Implementation Details, Discussion and Analysis of Results, Conclusion, System Limitations and Future Scope. Many freely available software tools (for instance Medley (Elsevier), Grammerly) are expected to be used during the preparation of PBL synopsis and final report. It is expected that the PBL guides/mentors shall teach students about utilizing valid sources of information (such as reference papers, books, magazines, etc) related to their PBL topic.

Evaluation & Continuous Assessment:

The institution/head/mentor is committed to assessing and evaluating both student performance and program effectiveness. Progress of PBL is monitored regularly on weekly basis. Weekly review of the work is necessary. During process of monitoring and continuous assessment and evaluation the individual and team performance is to be measured. PBL is monitored and continuous assessment is done by supervisor /mentor and authorities. Students must maintain an institutional culture of authentic collaboration, self-motivation, peer-learning and personal responsibility. The institution/department should support students in this regard through guidance/orientation programs and the provision of appropriate resources and services. Supervisor/mentor and Students must actively participate in assessment and evaluation processes.

It is recommended that the all activities are required to be recorded and regularly. A regular assessment of PBL work is required to be maintained at the department in PBL log book by students. It is expected that the PBL log book must include following:

1. Weekly monitoring by the PBL guide,
2. Assessment sheet for PBL work review by PBL guide and PBL Evaluation Committee (PEC).

The PEC structure shall consist of Head of the department, 1/2 senior faculties of the department and one industry expert (optional).

Continuous Assessment Sheet (CAS) is to be maintained by the department. Recommended parameters for assessment, evaluation and weightage:

1. Idea Inception (kind of survey). (10%)
2. Outcome (Participation/ publication, copyright, patent, product in market). (50%)
3. Documentation (Gathering requirements, design & modeling, implementation/execution, use of technology and final report, other documents). (15%)
4. Attended reviews, poster presentation and model exhibition. (10%)
5. Demonstration (Poster Presentation, Model Exhibition etc). (10%).
6. Awareness /Consideration of - Environment/ Social /Ethics/ Safety measures/Legal aspects. (5%)

Learning Resources

Reference Books / Research Arcticles:

1. Setting the Standard for Project Based Learning, Book by John Larmer, John R. Mergendoller, and Suzie Boss
2. Project Based Teaching: How to Create Rigorous and Engaging Learning Experiences, Book by John Larmer and Suzie Boss
3. Hacking Project Based Learning: 10 Easy Steps to PBL and Inquiry in the, Book by Erin M. Murphy and Ross Cooper.
4. M. Krašna, "Project based learning (PBL) in the teachers' education," 2016 39th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), Opatija, 2016, pp. 852-856, doi: 10.1109/MIPRO.2016.7522258.

Web resources:

- Project-Based Learning, Edutopia, March 14, 2016.
- What is PBL? Buck Institute for Education.
- www.schoology.com
- www.howstuffworks.com
- www.wikipedia.org

Savitribai Phule Pune University

Second Year of Electronics & Computer Engineering (2020 Course)

XXXXXX: Mandatory Audit Course - 4

Teaching Scheme:	Credit	Examination Scheme:
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GUIDELINES FOR CONDUCTION OF AUDIT COURSE

In addition to credits courses, it is manadatory that there should be audit course (non-credit course) from second year of Engineering. The student will be awarded grade as AP on successful completion of audit course. The student may opt for two of the audit courses (One in each semester). Such audit courses can help the student to get awareness of different issues which make impact on human lives and enhance their skill sets to improve their employability. List of audit courses offered in each semester is provided in curriculum. Student can choose the audit course either from courses available on SWAYAM or NPTEL Portal. Evaluation of audit course will be done at institute level. Method of conduction and method of assessment for audit courses is suggested.

The student registered for audit course shall be awarded the grade AP and shall be included such grade in the Semester grade report for that course, provided student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory in-semester performance and secured a passing grade in that audit course. No grade points are associated with this 'AP' grade and performance in these courses is not accounted in the calculation of the performance indices SGPA and CGPA. Evaluation of audit course will be done at institute level itself.

Selecting an Audit Course:

C) Using Swayam Platform:

With a view to providing access to the best quality learning resources across the country, the project **'Study Webs of Active Learning for Young Aspiring Minds' (SWAYAM)** has been started. SWAYAM provides an integrated platform and portal for online courses, using information and communication technology (ICT) and covering High School till all higher education subjects and skill sector courses to ensure that every student benefits from learning material through ICT.

- Student can select any of the course mentioned in the syllabus and has to register for the corresponding MOOC course available on the SWAYAM Platform as a Audit course.
- The duration of the course should not be more than 8 Weeks.
- Once the course is completed the student has to appear for the examination as per the guidelines on the SWAYAM portal.
- After clearing the examination successfully; student will be awarded with

passing certificate a copy which he/she has to submit to concerned authority for getting the clearance of completing the Audit course.

D) Using NPTEL Platform:

NPTEL is an initiative by MHRD to enhance learning effectiveness in the field of technical education by developing curriculum based video courses and web based e-courses. The details of NPTEL courses are available on its official website https://swayam.gov.in/nc details/NPTEL.

- Student can select any of the course mentioned in the syllabus and has to register for the corresponding online course available on the NPTEL Platform as an Audit course.
- The duration of the course should not be more than 8 Weeks.
- Once the course is completed the student has to appear for the examination as per the guidelines on the NPTEL portal.
- After clearing the examination successfully; student will be awarded with passing certificate a copy which he/she has to submit to concerned authority for getting the clearance of completing the Audit course.

Assessment of an Audit Course:

- The assessment of the course will be done at the institute level. The institute has to maintain the record of the various audit courses opted by the students. The audit course opted by the students could be interdisciplinary.
- After the completion of the course the students must undergo the examination as per the schedule on SWAYAM and NPTEL platforms.
- During the course students will be submitting the online assignments. A copy of same students can submit as a part of term work for the corresponding Audit course.
- On the satisfactory submission of assignments and course completion certificate; the institute can mark as “Present” and the student will be awarded the grade AP on the marksheet.
- Every student must compel that student has the minimum attendance as prescribed by the Savitribai Phule Pune University and satisfactory in-semester performance.

Savitribai Phule Pune University
Faculty of Science & Technology

Proposed Curriculum

For

TE (Electronics & Computer Engineering)
(Choice Based Credit System)

(With Effect from Academic Year 2022-23)

Savitribai Phule Pune University, Pune
TE (Electronics & Computer Engineering) 2019 Course
(With effect from Academic Year 2022-23)

Semester-V

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit			
		Theory	Practical	Tutorial	IN-Sem	End-Sem	TW	PR	OR	Total	TH	PR	TUT	Total
1	Microcontroller and Applications	03	-	-	30	70	-	-	-	100	03	-	-	**03**
2	Power Electronics and Applications	03	-	-	30	70	-	-	-	100	03	-	-	**03**
3	Digital Signal Processing and Applications	03	-	-	30	70	-	-	-	100	03	-	-	**03**
4	*Elective – I	03	-	-	30	70	-	-	-	100	03	-	-	**03**
5	Advanced Data Structures	03	-	-	30	70	-	-	-	100	03	-	-	**03**
6	Microcontroller and Power Lab	-	04	-	-	-	25	50	-	75	-	02	-	**02**
7	DSP and Elective-I Lab	-	04	-	-	-	-	50	-	50	-	02	-	**02**
8	Advanced Data Structures Lab	-	02	-	-	-	25	-	-	25	-	01	-	**01**
9	Seminar	-	01	-	-	-	50	-	-	50	-	-	-	**01**
10	Audit Course 5 (Mandatory)	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	**15**	**11**	**-**	**150**	**350**	**100**	**100**	**-**	**700**	**15**	**05**	**-**	**21**

Abbreviations:

TH : Theory TW : Term Work PR : Practical
OR : Oral TUT : Tutorial

Note: Interested students of T.E. (Electronics/E&TC/Electronics & Computer) can opt any one of the audit course from the list of audit courses prescribed by BoS (Electronics & Telecommunications Engineering)

***Elective-I**
1 Computer Graphics
2. Advanced JAVA and Mobile Application Development
3. Mechatronics
4. Fundamentals of HDL

Savitribai Phule Pune University, Pune
TE (Electronics & Computer Engineering) 2019 Course
(With effect from Academic Year 2022-23)

Semester-VI

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit			
		Theory	Practical	Tutorial	IN-Sem	End-Sem	TW	PR	OR	Total	TH	PR	TUT	Total
1	Advanced Processor	03	-	-	30	70	-	-	-	100	03	-	-	**03**
2	Database Management System	03	-	-	30	70	-	-	-	100	03	-	-	**03**
3	Data Communication	03	-	-	30	70	-	-	-	100	03	-	-	**03**
4	**Elective-II	03	-	-	30	70	-	-	-	100	03	-	-	**03**
5	Advanced Processor and Data Communication Lab	-	04	-	-	-	25	50	-	75	-	02	-	**02**
6	DBMS and Elective-II Lab	-	04	-	-	-	25	50	-	75	-	02	-	**02**
7	Project Based Seminar	-	02	-	-	-	50	-	-	50	-	01	-	**01**
8	Internship	-	04	-	-	-	100	-	-	100	-		-	**04**
9	Audit Course 6 (Mandatory)	-	-	-	-	-	-	-	-	-	-	-	-	**-**
	Total	**12**	**14**		**120**	**280**	**200**	**100**	-	**700**	**12**	**05**	-	**21**

Abbreviations:

TH : Theory TW : Term Work PR : Practical
OR : Oral TUT : Tutorial

Note: Interested students of T.E. (Electronics/E&TC/Electronics & Computer) can opt any one of the audit course from the list of audit courses prescribed by BoS (Electronics & Telecommunications Engineering)

**Elective-II
1. Web Technology
2. Multimedia Techniques
3. Programmable Logic Controller and Application
4. Network Analysis and Synthesis

Semester I

Microcontroller and Applications

Credits: TH-03

Teaching Scheme:

Lectures: 3 Hrs/ Week

Examination Scheme:

In Semester Assessment:
Phase I : 30
End Semester Examination:
Phase II: 70

Course Objectives:

- To understand the applications of Microprocessors & Microcontrollers.
- To understand need of microcontrollers in embedded system.
- To understand architecture and features of typical Microcontroller.
- To learn interfacing of real world input and output devices
- To study various hardware & software tools for developing applications
- To learn MSP430 Microcontroller and low power features.

Course Outcomes:

- After successfully completing the course students will be able to
- Learn importance of microcontroller in designing embedded application
- Describe the 8051 & PIC18FXX microcontroller architectures and its feature.
- Develop interfacing to real world devices
- Learn use of hardware & software tools
- Design simple applications using MSP430

UNIT I: Introduction to microcontroller Architecture 7L

Microprocessor and microcontroller comparison, advantages & applications, Harvard & Von Neumann architecture, RISC & CISC processors. Role of microcontroller in embedded system. Selection criteria of microcontroller. Overview of MCS-51 architecture, Block diagram and explanation of 8051, Port structure, memory organization, Interrupt structure, timers and its modes, serial communication modes. Overview of Instruction set, Sample programs (assembly): Delay using Timer and interrupt, Programming Timer 0&1, Data transmission and reception using Serial port.

Unit II: Interfacing-I 6L

Software and Hardware tools for development of microcontroller based systems such as assemblers, compliers, IDE, Emulators, debuggers, programmers, development board, DSO, Logic Analyzer. Interfacing LED with and without interrupt, Keypads, Seven Segment multiplexed Display, LCD, ADC Interfacing. All Programs in embedded c language.

Unit III: Interfacing-II 5L

Interfacing of DAC, Temperature sensors, Stepper motor, Motion detectors, Relay, Buzzer, Opto- isolators. All programs are in embedded C- language.

Unit IV: MSP430 Microcontroller Architecture and Low Power Features 7L

Low Power 16-bit MSP430x5xx microcontroller architecture, address space, on-chip peripherals (analog and digital), and Register sets. Instruction set, instruction formats, and various addressing modes of MSP430 devices; Variants of the MSP430 family viz. MSP430x2x, MSP430x4x, MSP430x5x and their targeted applications, System clocks. Low Power aspects of MSP430: low power modes, Active vs Standby current consumption, FRAM vs Flash for low power; reliability.

Unit V: Real World Interfacing 5L

GPIO programming and I/O multiplexing; Interrupts and interrupt programming. Watchdog timer. Timers & Real Time Clock (RTC), PWM control. Analog interfacing and data acquisition: ADC and Comparator in MSP430, data transfer using DMA. Serial communication basics, Synchronous/Asynchronous interfaces (like UART, USB, SPI, and I2C). UART protocol, I2C protocol, SPI protocol. Implementing and programming UART, I2C, SPI interface using MSP430, Interfacing external devices.

Unit VI: Applications using 8051 and MSP430 Microcontrollers 4L

Design of DAS, Design of frequency counter with display on LCD, Design of Digital Multimeter, Home protection System, Design of environment monitoring system, Design of water level monitoring and control. All programs are in embedded C.

Text Books:

1. Mazidi, 8051 microcontroller & embedded system 3rd Edition ,Pearson
2. Mazidi, PIC microcontroller & embedded system 3rd Edition ,Pearson
3. MSP430 microcontroller basics 1st Edition by John H. Davies (Author), Newnes Publication ISBN- 13: 978-0750682763

Reference Books:

1. Getting Started with the MSP430 Launch pad by Adrian Fernandez, Dung Dang, Newness publication ISBN-13: 978-0124115880 1
2. I2C, RTC data sheets from www.ti.com

Power Electronics and Applications

Credits: TH-03

Teaching Scheme:

Lectures: 3 Hrs/ Week

Examination Scheme:

In Semester Assessment:
Phase I : 30
End Semester Examination:
Phase II: 70

Course Objectives:

- To equip the students with the basic knowledge of Power semi conductor Devices
- To study the controlled Rectifiers, Inverters and DC to DC converters.
- To understand the working AC and DC Drives.
- To study the application of Power Electronics.

Course Outcomes:

Students will be able to

- Understand the working of Power Electronics Devices.
- Understand working of Controlled Rectifiers, Inverters and DC to DC converters.
- Understand the Working of AC/DC Drives.

Unit 1:- Power Semiconductor Devices 7 L

Introduction to construction, characteristics, ratings & applications of power diodes, power BJT, power MOSFET & IGBT. Study of Thyristors: construction, characteristics, ratings of SCR, TRIAC, DAIC. Switching/ triggering methods: switching methods/types of triggering devices like DIAC, UJT & PUT Thyristor commutation Tech. (basic concepts) ,protection scheme against over-current, over voltage, dv/dt cooling technique

Unit 2:- Thyristor Application 7 L

Controlled rectifiers: Principles of operations of phase controlled converters, single phase half bridge, semi converter & bridge converters, effect of source inductance on fully controlled bridge converter, performance parameters Design of SCR based DC power circuits including UJT as triggering device AC power control using SCR-UJT & TRIAC-DIAC like universal speed controller fan regulator Design of SCR/TRIAC based AC power control circuits including UJT/DIAC as a triggering device.

Unit 3:- Inverter 6 L

Principles of operation of inverters, PWM inverter, bridge inverter, basic circuit scheme of IGBT/ power MOSFET based inverter circuits harmonic reduction in inverter output. Inverter circuits using H-Bridge for 3-phase output (180 and 120 degree conduction)

Unit 4:- DC to DC Converters 6 L

Basic operation of choppers, study of diff. types of chopper circuits like step up, step down chopper, four quadrant operation of chopper, Basic concept of SMPS and Analysis of various conduction modes of Buck, Boost, Buck-Boost, Cuk converter; design and selection of inductor and capacitor for converters.

Unit 5:- Drives AC Motor Drives **5 L**

Concept & requirement of drives, Current fed & Voltage fed drives, rotor resistance control & v/f control of AC motors DC Motor Drives : DC Drives for brushed/brushless motors

Unit 6:- Industrial Applications **5 L**

Induction & dielectric heating process, block diagram, merits/demerits Applications of power electronics in traction. HVDC transmission system. UPS: ON-line and OFF line UPS with battery AH, back up time, battery charger rating. Power Electronics in Battery Charging Applications, Power Electronics in Induction heating, Electronic lamp ballast.

Text Books:

1. P.S. Bhimbra, Power Electronics, Khanna publishers, 2004
2. M. H. Rashid, Power Electronics, 2nd Edition, PHI, 2005
3. Power Electronics & its applications, by Alok Jain, PENRAM International Publishing (India) Pvt. Ltd.
4. T. J. E.Miller.' Brushless magnet & Reluctance motor drives' Claredon Press London Power Electronics &Variable frequency drives- Technology & Application , Bimal Bose

Reference Books:

1. P.C. Sen, Power Electronics, Tata McGraw Hill, 2005
2. Mohan Undeland Robbins, Power Electronics- Converters application & Design, Wiley Eastern,1996
3. Dubey, Dorald, Thyristorised Power Controller, Wiley Eastern Ltd.1993
4. G.K. Dubey, Power Electronics & control, PHI 1986
5. S.K. Bhattacharya, Industrial Electronics & Control, TATA McGraw Hill, 2007
6. P.C. Sen Modern Power Electronics, Wheeler Publication
7. Modern Electric Traction by Pratab , Dhanpat Rai and sons ,Delhi
8. Power Electronics by Cyril W. Lander, Mc Graw Hill Europe
9. Fundamentals of power Electronics with MATLAB, by Randall Shaffer, Book News, INC, Portland(E-book Available)
10. Advanced Electric Drives-Analysis, control & modeling using SIMULINK, Ned Mohan, MNPER-2001

Digital Signal Processing And Applications

Credits: TH-03

Teaching Scheme:

Lectures: 3 Hrs/ Week

Examination Scheme:

In Semester Assessment:
Phase I : 30
End Semester Examination:
Phase II: 70

Course Objectives:

- To understand DTFT and DFT.
- To understand, analyze and design FIR and IIR filters.
- To understand realization of FIR and IIR Filters.
- To understand its hardware implementation using DSP Processor

Course Outcomes:

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

- Apply DFT as an analytical tool.
- Analyze LTI Systems using FFT algorithms.
- Design FIR and IIR systems.
- Implement FIR and IIR Systems.
- Implement various DSP Systems on DSP Processor

Unit 1: Z-transform and its application to the analysis of LTI systems: 6L

Need for transform, relation between Laplace transform and Z transform, between Fourier transform and Z transform, Properties of ROC and properties of Z transform, Relation between pole locations and time domain behavior, causality and stability considerations for LTI systems, Inverse Z transform, Power series method, partial fraction expansion method, Solution of difference equations.

Unit 2: Discrete Fourier Transform: 7L

Frequency domain sampling and reconstruction of discrete time signals – DFT, properties of the DFT, use of DFT in linear filtering, filtering of long data sequences, DFT as linear transformation, Efficient computation of the DFT- FFT Algorithms, Radix 2 DITFFT and DIFFFT, Goertzel Algorithm.

Unit 3: Design of IIR filters & FIR Filter: 7L

IIR:- Classical design by impulse invariance, bilinear transformation and matched Z transform, characteristics and design of commonly used filters – butter worth, Chebyshev and elliptic filters, Spectral transformations, Direct design of IIR filters.

FIR:- General considerations, Linear phase FIR Filters, Symmetric and anti-symmetric impulse response, Design using windows, frequency sampling design, Optimum design.

Unit 4: Implementation of Discrete time Systems: **6L**

Structures for FIR systems – Direct form, cascade form, Frequency sampling and lattice structures. Structures for IIR systems – Direct form, cascade and parallel form, lattice ladder structures. Finite word length effects.

Unit 5: Multi rate Signal Processing: **5L**

Multi rate Signal Processing:-Sampling rate reduction: decimation by integer factors, Sampling rate increase: interpolation by integer factors, sampling rate conversion by non integer factors.

Unit 6, DSP Processors and Application of DSP: **5L**

DSP Processors: -Need for Special architecture of DSP processor, Difference between DSP processor & microprocessor, A general DSP processor TMS320C54XX series,

Application of DSP: Case study of Real Time DSP applications to Speech Signal Processing and Biomedical Signal Processing

References:

1. Proakis J.G and.Manolakis D.G. Mimitris D. (2003) ―Introduction to Digital Signal Processing, Prentice Hall, India
2. Oppenheim A.V.and Schafer R.W. (2003) ―Discrete Time Signal Processing‖, Pearson education.
3. Ifeachar and Jervis (2003) ―Digital Signal Processing: A Practical approach‖ Pearson education, Asia
4. Rabiner L.R and Gold D.J (1988) ―Theory and applications of digital signal processing‖ Prentice Hall, India
5. Sanjit Mitra K (2001) ―Digital Signal Processing: A computer based approach‖, TMH
6. Johnson J.R,(1994) ―Introduction to Digital Signal Processing‖ Prentice Hall, India

ELECTIVE I

Credits: TH-03

Teaching Scheme:

Lectures: 3 Hrs/ Week

Examination Scheme:

In Semester Assessment:
Phase I : 30
End Semester Examination:
Phase II: 70

Computer Graphics

Course Objectives:

- To acquaint the learner with the basic concepts of Computer Graphics
- To learn the various algorithms for generating and rendering graphical figures
- To get familiar with mathematics behind the graphical transformations
- To understand and apply various methods and techniques regarding projections, animation, shading, illumination and lighting

Course Outcomes:

After successfully completing the course students will be able to

- Apply mathematics and logic to develop Computer programs for elementary graphic operations
- Develop scientific and strategic approach to solve complex problems in the domain of Computer Graphics
- Develop the competency to understand the concepts related to Computer Vision and Virtual reality
- Apply the logic to develop animation and gaming programs

Unit I: Basic Concepts 8L

Introduction to Computer Graphics, Basics of graphics systems, Raster scan & Random scan displays, basic display processor Display Files: display file structure, algorithms and display file interpreter. Primitive operations on display file Plotting Primitives: Scan conversions, lines, line segments, vectors, pixels and frame buffers, vector generation Line drawing Algorithms: DDA, Bresenham Circle drawing Algorithms: - DDA, Bresenham Character Generation: Stroke Principle, Starburst Principle, Bit map method, Introduction to aliasing and anti-aliasing

Unit II: Polygons and Graphical Transformations 6L

Polygon and its types, inside test, polygon filling methods: Seed fill, Scan Line, Flood fill and Boundary fill 2D Geometric Transformations - translation, scaling, rotation, other

transformations such as reflection, shearing, matrix representation and homogeneous coordinate system, Composite transformations

Unit III: 3-D Transformations and Projections **6L**

Translation, scaling, rotation, rotation about X, Y, Z and arbitrary axis reflection about XY, YZ, XZ and arbitrary plane. Projections: Types Parallel - Oblique: Cavalier, Cabinet and orthographic :Isometric, Dimetric, Trimetric and Perspective - Vanishing Points as 1 point, 2 point and 3 point.

Unit IV: Segments, Windowing and Clipping **6L**

Segment: Introduction, Segment table, Segment creation, closing, deleting and renaming, Visibility Windowing: Concept of window and viewport, viewing transformations Line Clipping: Cohen Sutherland Method, Midpoint subdivision method Polygon Clipping: Sutherland Hodgman method for clipping convex and concave polygons

Unit V: Shading, Animation and Gaming **6L**

Shading: Halftoning, Gouraud and Phong Shading Computer Animation: Animation sequences, functions & Languages, Key-frame Systems, Motion Specifications. Gaming platforms: Graphics Memory Pipeline, Block diagram of NVIDIA workstation and i860 Introduction to OpenGL ES

Unit VI: Curves and Fractals **6L**

Introduction, Curve generation, Interpolation, interpolating algorithms, interpolating polygons, B-Splines and corners, Bezier curves, Fractals, fractal lines and surfaces Interactive Graphics & usage of the tools of computer graphics – 3D Studio and Maya

Text Books

1. S. Harrington, “Computer Graphics”, 2nd Edition, McGraw-Hill Publications, 1987.
2. D. Rogers, “Procedural Elements for Computer Graphics”, 2nd Edition, Tata McGraw-Hill Publication, 2001.

Reference Books

1. J. Foley, V. Dam, S. Feiner, J. Hughes, “Computer Graphics Principles and Practice”, 2nd Edition, Pearson Education, 2003.
2. D. Hearn, M. Baker, “Computer Graphics – C Version”, 2nd Edition, Pearson Education, 2002,
3. D. Rogers, J. Adams, “Mathematical Elements for Computer Graphics”, 2nd Edition, Tata McGraw-Hill Publication, 2002.
4. Zhigang Xiang, Roy Plastock, “Computer Graphics”, Schaum’s Series outlines
5. Shirley, Marschner, “Fundamentals of Computer Graphics”, Third Ed, A K Peters SPD
6. F.S. Hill JR, “Computer Graphics Using Open GL”, Pearson Education
7. D.P. Mukharjee, Debasish Jana, “Computer Graphics Algorithms and implementation”, PHI Learning
8. Samuel R. Buss, “3D Computer Graphics”, Cambridge University Press

Advanced JAVA and Mobile Application Development

Credits: TH-03

Teaching Scheme:

Lectures: 3 Hrs/ Week

Examination Scheme:

In Semester Assessment:
Phase I : 30
End Semester Examination:
Phase II: 70

Course Objectives:

1. To adapt the usage of modern tools and recent software.
2. To evaluate problems and analyze data using current technologies
3. To learn the process of creation of data-driven web applications using current technologies
4. To understand how to incorporate best practices for building enterprise applications
5. To learn how to employ Integrated Development Environment(IDE) for implementing and testing of software solution
6. To construct software solutions by evaluating alternate architectural patterns.

Course Outcomes:

1. On completion of the course, student will be able to–
2. Evaluate problems and analyze data using current technologies in a wide variety of business and organizational contexts.
3. Create data-driven web applications
4. Incorporate best practices for building applications
5. Employ Integrated Development Environment(IDE) for implementing and testing of software solution
6. Construct software solutions by evaluating alternate architectural patterns.

Unit I : Advanced Java-1 8L

Data Structures in Java: Enumeration, BitSet, Vector, Stack, Dictionary, Hash table, Properties. Generics and Collection Framework: Generic Methods and Generic Classes. Interfaces (Set, List, Queue, and Dequeue) and classes (ArrayList, Vector, LinkedList, PriorityQueue, HashSet, LinkedHashSet, and TreeSet)

Unit II : Advanced Java-2 6L

Serialization and Networking: Serializing an Object and Deserializing an Object, Socket Programming. Database Connectivity and Multithreading: SQL, JDBC, Thread life cycle, Thread methods, Thread Pools, Executor Service. GUI in JAVA: AWT, Applet, Swing.

Unit III: Mobile Application Development **7L**

Introduction to Android: Android Platform Architecture, Basic components of android, Features of ART and Delvik Virtual Machine, Activity Life Cycle, Intents and Intent Filters, Resources, System Permissions, Android Application Structure, Device screen size compatibility, Android Emulator.

Unit IV: User Interface components **6L**

User Interface components: Layouts, Recycler View, List View, Grid View and Web view, Input Controls: Buttons, Checkboxes, Radio Buttons, Toggle Buttons, Spinners, Input Events, Menus, Toast, Dialogs, Styles and Themes.

Unit V: Multimedia, Animation and Graphics **7L**

Multimedia, Animation and Graphics: Playing Audio, Playing Video, Rotate Animation, FadeIn/FadeOut Animation, Zoom Animation, Scale Animation, 2D and 3D Graphics. Data Storage: Shared Preferences, Internal Storage, External Storage, SQLite Databases, Content provider. and Remote Databases.

Unit VI: Advanced Components of Android **6L**

Advanced Components of Android: Web App, JSON Parsing, Google Map, GPS, Sensors, Bluetooth/Wi-Fi Connectivity

Text Books

1. Herbert Schildt, "Java: The Complete Reference", TMG Publication, ISBN 9780070636774
2. Thomas Powell, "Java generics and collections", O'Reilly Media, ISBN: 0596527756
3. Neil Smyth, "Android Studio 2 Development Essentials", Payload Media, ISBN: 1532853319
4. John Horton, "Android Programming for Beginners", ISBN 10:1785883267

Reference Books

1. Sharanam Shah and Vaishali Shah , "JAVA EE 7 for Beginners", SPD, ISBN: 13:978-93-5110- 349-3
2. Reto Meier, "Professional Android 4 Application Development", Wrox, ISBN-10: 1118102274; ISBN-13: 978-1118102275
3. Greg Nudelman, "Android Design Patterns :Interaction Design Solutions for Developers", ISBN-10: 1118394151; ISBN-13: 978-1118394151
4. Sharanam Shah, Vaishali Shah," Core Java 8 for beginners", THE TEAM, ISBN: 13:978-93- 5213-080-1

Mechatronics

Credits: TH-03

Teaching Scheme:

Lectures: 3 Hrs/ Week

Examination Scheme:

In Semester Assessment:
Phase I : 30
End Semester Examination:
Phase II: 70

Course Objectives:

- To understand the concept and key elements of Mechatronics system, representation into block diagram
- To understand principles of sensors their characteristics
- To Understand of various data presentation and data logging systems
- To Understand concept of actuator
- To Understand various case studies of Mechatronics systems

Course Outcomes:

On completion of the course, student will be able to–

- Identification of key elements of mechatronics system and its representation in terms of block diagram
- Understanding basic principal of Sensors and Transducer.
- Able to prepare case study of the system given.

Unit I: Introduction to Mechatronics 6L

Basics of Mechatronics Systems: Definition of Mechatronics, Key elements of Mechatronics Systems, Levels of mechatronics systems, Measurement Characteristics, Examples of Mechatronics systems in daily life as , Washing Machines, Digital Cameras, CD Players, camcorders, Mechatronics design process, phases of mechatronics design process, integrated design approach. Mechanical Components and Servo mechanism: Mechanical System and Motion, Mass Inertia and Dashpot, Gears, types of Gears, Servomechanism (Concepts and Theory, Problems).Case study Mechatronics Design of Coin Counter/Coin Separator

Unit II: Overview of Sensors, Transducers and their Characteristics Specifications 6L

Specifications related to selection criterion for force, pressure, temperature and motion (Rotary and Linear). Classification and selection of transducers: Force: Load Cell, Cantilever Beam (Design aspect example) Pressure: Strain Gauge, Piezoelectric Motion: Rotary and Linear motions, Proximity sensors Inductive, Capacitive and Magnetic, sources detectors in optical proximity sensors. Comparison of Various proximity sensors Temperature: Optical Fibre and its use in temperature measurement, Fibre Optic Temperature sensors, Ultrasonic Transducers for applications as position, level, flow measurement. Gas sensors, Wind sensors: Gyroscope, Accelerometer, Magnetometer (As used in smart phones) Smart Sensors: Concept, Radiation

Sensors - Smart Sensors - Film sensor, IR- temperature sensors Introduction to MEMS& Nano Sensors . Rotary Optical Encoder

Unit III: Hydraulic Systems 6L

Introduction to Hydraulic Actuators Fluid Power systems: Concept of Actuators, Classification of Actuators: Pneumatic, Hydraulic and Electrical Actuators, Fluid Power systems Hydraulic Systems: Physical Components of a Hydraulic systems, Hydraulic Pumps (e.g. Gear Pumps, Vane Pumps, Piston Pumps and Axial Piston Pumps) , Filters and Pressure Regulation, Relief Valve, Accumulator.

Unit IV: Pneumatic Systems 6L

Introduction to Pneumatic a Actuators Physical Components of a Pneumatic Systems, Pneumatic Cylinders, Pneumatic Actuators (e.g. Spring Actuator and Spring Actuator with positioner), Air compressor, Air Receiver, Air Dryer, Air Service Treatment: Air Filter, air regulator and Gauge, Air Lubricator and Pressure regulation Intake and Air Filter. Case study of Robotic Pick and Place robot

Unit V: Electrical Actuators, Electron-Mechanical Actuators 6L

Electrical-Actuation system: Selection criteria and specifications of stepper motors, solenoid valves, relays (Solid State relays and Electromechanical relays). Election Criterion of control valve, Single acting and Double acting Cylinders. Electro-Pneumatic: Pneumatic Motors, Valves: Electro Hydraulic: 3/2 Valves, 4/2 Valves, 5/3 Valves Cables: Power cable and Signal cables

Unit VI: Mechatronics Systems in Automobile 6L

(Treatment with Block Diagram Approach) Boat Autopilot, High Speed tilting trains, Automatic car parking systems, Engine Management systems, Antilock Brake systems (ABS) ,CNC Machines(Only Black Diagram and explanation)

Text Books:

1. W. Boltan-Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering‖ 6th Edition, Pearson Education, 2016
2. David Alciatore and MaichaelB Histand, -Introduction to Mechatronics and Measurement Systems‖,4th Edition, Tata McGraw Hill 2013.
3. K.P.Ramachandran, G.K.Vijayaraghavan and M.S. Balasundaram, -Mechatronics-Integrated
4. Mechanical Electronic Systems‖, Willey Publication 2008

Reference Books:

1. Nitaigour P. Mahalik ,Mechatronics-Principles, Concepts and Applications, Tata McGraw Hill, Eleventh reprint 2011.
2. Devdas Shetty and Richard A.Kolk, -Mechatronics System Design, Thomson India Edition 2007.
3. HMT Limited, -Mechatronics, Tata McGraw-Hill Publishing House

Fundamentals of HDL

Credits: TH-03

Teaching Scheme:

Lectures: 3 Hrs/ Week

Examination Scheme:

In Semester Assessment:
Phase I : 30
End Semester Examination:
Phase II: 70

Course Objectives:

- To study basic programming in VHDL
- To learn Concepts of Verilog HDL

Course Outcomes:

After successfully completing the course students will be able to

1. Learn the role of HDL in digital system design using latest tools like VHDL and Verilog.
2. Describe and test digital logic circuits in data flow description, structural description, behavioral description and advanced constructs (procedures, tasks, functions) usingboth VHDL and Verilog.
3. Develop VHDL code to model and simulate basic combinational networks and sequential machines

Unit I: Introduction to HDL 6L

Introduction: Why HDL? A Brief History of HDL, Structure of HDL Module, Operators, Data types, Types of Descriptions, simulation and synthesis, Brief comparison of VHDL and Verilog

Unit II: Modelling styles in VHDL 6L

Data-Flow Descriptions: Highlights of Data-Flow Descriptions, Structure of Data-Flow Description, Data Type – Vectors. Behavioral Descriptions: Behavioral Description highlights, structure of HDL behavioral Description, The VHDL variable –Assignment Statement, sequential statements. Structural Descriptions: Highlights of structural Description, Organization of the structural Descriptions, state Machines

Unit III: Programmable Logic Devices 6L

Complex Programmable Logic Devices – Architecture of CPLD, Organization of FPGAs, FPGA Programming Technologies (SRAM, Antifuse), Programmable Logic Block Architectures, Programmable Interconnects, and Programmable I/O blocks in FPGAs

Unit IV: Procedures and Functions 6L

Procedures and Functions: Procedures, Tasks, and Functions: Highlights of Procedures, tasks,

and Functions, Procedures and tasks, Functions.

Unit V: Introduction to Verilog HDL **6L**

Program structure, Logic System, Nets, Variables, and Constants, Vectors and Operators, Arays, Logical Operators and Expressions.

Unit VI: Design Elements in Verilog **6L**

Compiler directives, structural design elements, Dataflow design elements, Behavioral design elements (Procedural Code)

Text Books:

1. HDL Programming (VHDL and Verilog)- Nazeih M.Botros- Dreamtech Press (Available through John Wiley – India and Thomson Learning), 2006 Edition
2. John F Wakerly, Digital Design- Principles and Practices, Pearson education, 4 Edition

Reference Books:

1. VHDL -Douglas Perry, TMH
2. Stephen Brown & ZvonkoVranesic, Fundamentals of Digital Logic Design with VHDL, Tata McGrw-Hill, New Delhi, 2nd Ed., 2007
3. Verilog HDL –Samir Palnitkar, Pearson Education

Fundamentals of Digital Logic with Verilog Design-Stephen Brown, TMH

Advance Data Structures

Credits: TH-03

Teaching Scheme:

Lectures: 3 Hrs/ Week

Examination Scheme:

In Semester Assessment:
Phase I : 30
End Semester Examination:
Phase II: 70

Course Objectives:

- To develop a logic for graphical modeling of the real life problems.
- To suggest appropriate data structure and algorithm for graphical solutions of the problems.
- To understand advanced data structures to solve complex problems in various domains.
- To operate on the various structured data
- To build the logic to use appropriate data structure in logical and computational solutions.
- To understand various algorithmic strategies to approach the problem solution.

Course Outcomes:

On completion of the course, student will be able to–

- To apply appropriate advanced data structure and efficient algorithms to approach the problems of various domain.
- To design the algorithms to solve the programming problems.
- To use effective and efficient data structures in solving various Computer Engineering domain problems.
- To analyze the algorithmic solutions for resource requirements and optimization
- To use appropriate modern tools to understand and analyze the functionalities confined to the data structure usage.

Unit I Trees 6 L

Tree- basic terminology, General tree and its representation, representation using sequential and linked organization, Binary tree- properties, converting tree to binary tree, binary tree traversals- in order, preorder, post order, level wise -depth first and breadth first, Operations on binary tree. Binary Search Tree (BST), BST operations, Threaded binary tree- concepts, threading, insertion and deletion of nodes in in-order threaded binary tree, in order traversal of in-order threaded binary tree. Case Study- Use of binary tree in expression tree-evaluation and Huffman's coding

Unit II Graphs 6 L

Hours Basic Concepts, Storage representation, Adjacency matrix, adjacency list, adjacency multi list, inverse adjacency list. Traversals-depth first and breadth first, Introduction to Greedy Strategy, Minimum spanning Tree, Greedy algorithms for computing minimum spanning tree- Prims and Kruskal Algorithms, Dikjtra's Single source shortest path, Topological ordering. Case study- Data structure used in Web graph and Google map.

Unit III Hashing **6 L**

Hash Table- Concepts-hash table, hash function, bucket, collision, probe, synonym, overflow, open hashing, closed hashing, perfect hash function, load density, full table, load factor, rehashing, issues in hashing, hash functions- properties of good hash function, division, multiplication, extraction, mid-square, folding and universal, Collision resolution strategies- open addressing and chaining, Hash table overflow- open addressing and chaining, extendible hashing. Dictionary- Dictionary as ADT, ordered dictionaries. Skip List- representation, searching and operations- insertion, removal.

Unit IV Search Trees **6 L**

Symbol Table-Representation of Symbol Tables- Static tree table and Dynamic tree table, Introduction to Dynamic Programming, Weight balanced tree, Optimal Binary Search Tree (OBST), OBST as an example of Dynamic Programming, Height Balanced Tree- AVL tree.

Unit V Indexing and Multiway Trees **6 L**

Indexing and Multiway Trees- Indexing, indexing techniques, Types of search tree- Multiway search tree, B-Tree, B+Tree, Trie Tree, Splay Tree, Red-Black Tree, K-dimensional tree, AA tree. Set- Set ADT, realization of Set and operations. Heap-Basic concepts, realization of heap and operations, Heap as a priority queue, heap sort

Unit VI File Organization **6 L**

Sequential file organization- concept and primitive operations, Direct Access File- Concepts and Primitive operations, Indexed sequential file organization-concept, types of indices, structure of index sequential file, Linked Organization- multi list files, coral rings, inverted files and cellular partitions. External Sort- Consequential processing and merging two lists, multiday merging- a k way merge algorithm.

Text Books:

1. Horowitz, Sahani, Dinesh Mehata, Fundamentals of Data Structures in C++‖, Galgotia Publisher, ISBN: 8175152788, 9788175152786.
2. M Folk, B Zoellick, G. Riccardi, File Structures, Pearson Education, ISBN:81-7758-37-5 3. Peter Brass, Advanced Data Structures‖, Cambridge University Press, ISBN: 978-1-107-43982-5

References Books:

1. A. Aho, J. Hopcroft, J. Ulman, Data Structures and Algorithms, Pearson Education, 1998, ISBN-0-201-43578-0.
2. Michael J Folk, File Structures an Object Oriented Approach with C++, Pearson Education, ISBN: 81-7758-373-5.
3. Sartaj Sahani, Data Structures, Algorithms and Applications in C++, Second Edition, University Press, ISBN:81-7371522 X.
4. G A V Pai, Data Structures and Algorithms, The McGraw-Hill Companies, ISBN - 9780070667266.
5. Goodrich, Tamassia, Goldwasser, Data Structures and Algorithms in Java‖, Wiley Publication, ISBN: 9788126551903.

Microcontroller and Power Lab

Credits: PR-02

Teaching Scheme:
Practical: 4 Hrs/ Week

Examination Scheme:
Practical: 50 Marks
Term work: 25 Marks

Microcontroller and Application Experiments:

List of Experiments:
(4 from each group (8051 & MSP430)

1) Interfacing LED bank to 8051 microcontroller using timer with interrupt.
2) Interfacing Seven Segment Display to 8051 microcontroller
3) Interfacing DAC to 8051 microcontroller for generating various waveforms
4) Interfacing stepper motor to 8051 microcontroller.
5) Interfacing of LCD to 8051 microcontroller.
6) Learn and understand how to configure MSP-EXP430G2 digital I/O pins. Write a C program for configuration of GPIO ports for MSP430 (blinking LEDs, push buttons interface).
   Exercises:
   a) Modify the code to make the green and red LEDs blink.
   b) Modify the delay with which the LED blinks.
7) Learn and understand GPIO based Interrupt programming. Write a C program and associated GPIO ISR using interrupt programming technique.
   Exercises:
   a) Write the code to enable a Timer interrupt for the pin P1.1.
   b) Write the code to turn on interrupts globally.
8) Implement Pulse Width Modulation to control the brightness of the on-board, green LED. This experiment will help you to learn and understand the configuration of PWM and Timer peripherals of the MSP430G2553.
   Exercises: a) Observe the PWM waveform on a particular pin using CRO.
9) Learn and understand how to configure the PWM and ADC modules of the MSP-EXP430G2 to control the DC motor using external analog input.
   Exercises: a) Create a PWM signal of 75% duty cycle on particular PWM pin.
10) Configure of Universal Serial Communication Interface (USCI) module of MSP430G2553 for UART based serial communication. The main objective of this experiment is to use UART of the MSP430G2553 to communicate with the computer.
    Exercise: Modify the above code to transmit the set of strings to the serial terminal via UART as shown below:
    char str1[ ]=”MSP430G2553 MCU”
    char str2[ ]= “ Ultra low power mixed signal processing applications”

Power Electronics and Application Experiments

List of Experiments: Any -8

1. Study of V-I Characteristics of MOSFET / SCR.
2. Study of TRIAC & DIAC characteristics.
3. Study of UJT based triggering circuits
4. Study of Half wave & full wave controlled rectifier
5. Study of IGBT/ MOSFET based inverter
6. Study of SCR/TRIAC based AC power control circuit
7. Study of DC motor speed control using chopper
8. Study of PWM drive for Induction motor using IGBT
9. Simulation of Three phase Semi/Full converter for R and RL load.
10. Simulation of Three phase PWM inverters for R and RL load
11. Simulation of chopper circuit for R and RL load .

DSP and Elective -I Lab

Credits: PR-02

Teaching Scheme:
Practical: 4 Hrs/ Week

Examination Scheme:
Practical: 50 Marks

Digital Signal Processing and Applications.

Note: Experiments 1 to 8 can be performed in any appropriate software like C /MATLAB / Scilab etc. Minimum six experiments to be performed. Experiment No. 9 & 10 are mandatory.

1. To find Z and inverse Z transform and pole zero plot of Z-transfer function.
2. To solve the difference equation and find the system response using Z-transform.
3. To study the properties of DFT. Write programs to confirm all DFT properties.
4. Implementation of FFT algorithms
5. Program for finding linear convolution & circular convolution.
6. Program for finding linear convolution using circular convolution
7. To study the effect of different windows on FIR filter response.
8. Design and implement two stage sampling rate converter.
9. To plot the mapping function used in bilinear transformation method of IIR filter design.(assignment may be given)
10. Effect of coefficient quantization on the impulse response of the filter using direct form I and II realization and cascade realization.(theory assignment)

ELECTIVE I

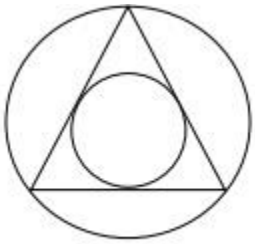
Computer Graphics

List of Practical's :- Any -8

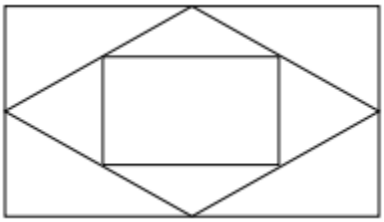
Implement any 4 Practicals from group A and any 4 assignments from group B

List of Practicals: Group A

1. A Mandelbrot Set is a set of complex number z that does not diverge under the transformation $xn+1 = xn\ 2 + z$with $x0 = 0$. Where, both x and z represent the complex numbers.
   a)Plot the Mandelbrot set for the threshold |x|= 2.
   b) Plot Julia set choosing $z \neq 0$. Use 254 colors for plotting in both cases. Change the threshold to observe different patterns.
2. Draw the polygons by using the mouse. Choose colors by clicking on the designed color pane. Use window port to draw. (Use DDA algorithm for line drawing)
3. Draw inscribed and Circumscribed circles in the triangle as shown as an example below (Use any Circle drawing and Line drawing algorithms)



4. Draw the following pattern using any Line drawing algorithms.



5. Draw a 4X4 chessboard rotated 45˚ with the horizontal axis. Use Bresenham algorithm to draw all the lines. Use seed fill algorithm to fill black squares of the rotated chessboard

Group B

1. Implement Cohen Sutherland Hodgman algorithm to clip any given polygon. Provide the vertices of the polygon to be clipped and pattern of clipping interactively.
2. Implement translation, sheer, rotation and scaling transformations on equilateral triangle and rhombus.
3. Implement Cube rotation about vertical axis passing through its centroid.
4. Generate fractal patterns by using Koch curves.
5. Animation : Implement any one of the following animation assignments,
   i) Clock with pendulum
   ii)National Flag hoisting
   iii)Vehicle/boat locomotion
   iv)Falling Water drop into the water and generated waves after impact
   v) Kaleidoscope views generation (at least 3 colorful patterns)

Reference Books

1. S. Harrington, "Computer Graphics", 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 – 07 – 100472 – 6.
2. D. Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill Publication, 2001, ISBN 0 – 07 – 047371 – 4.

Advance Java and Mobile Application Development

List of Practical's:- Any -8

Assignments for Advanced JAVA

1. Design a system with the help of advance data structures in Java and enhance the system using collections and generics.
2. Enhance the above system with the help of socket programming use client server architecture.
3. Enhance above system by using JDBC, Multithreading, concurrency, synchronous and asynchronous callbacks, ThreadPools using ExecutorService.
4. Transform the above system from command line system to GUI based application Suggested

Mobile Application Development

1. Download Install and Configure Android Studio on Linux/windows platform.
2. Design a mobile app for media player.
3. Design a mobile app to store data using internal or external storage.
4. Design a mobile app using Google Map and GPS to trace the location.

Suggested Mini Project on Advanced JAVA and Mobile Application Development

Design and develop a mobile app for novice trekkers by recording the paths from regular trekkers by using, Material Design Pattern for UI, Storage [SQLite database/File/Shared Preference/cloud], Internet connection /Wi-Fi/Bluetooth, GPS and Google Map

Mechatronics

List of Practical's :- Any -8

1. Servomotor position control using photo electric pickup
2. Position and velocity measurement using encoders
3. Study of liquid flow measurement.
4. Study on the application of data acquisition systems for industrial purposes.
5. Interfacing of any 2- sensors with data acquisition systems.
6. Study of Hydraulic Trainer.
7. Study of Pneumatic Trainer.
8. Study of Electro-Pneumatic Trainer.
9. Study of Electro-Hydraulic Trainer.
10. Demonstration of any one case study

Fundamental of HDL

1. List of Experiments:

1. Simulate Half adder and Full Adder using VHDL
2. Simulate 4:1 Mux using VHDL
3. Simulate all types of FlipFlops using VHDL
4. Simulate Shift Register(Left and Right shift) using VHDL
5. Simulate Half adder and Full Adder using Verilog
6. Simulate 3:8 Decoder using Verilog
7. Simulate Counter using Verilog
8. Simulate ALU using Verilog

Advance Data Structures

Each student must perform at least 13 Practicals as at least 02 from group A, 02 from group B, 2 from group C, 2 from group D, 01 from group E, 01 from group F and 3 from group G.

Operating System recommended : 64-bit Open source Linux or its derivative Programming tools recommended:

Open Source: C++ Programming tool like G++/GCC Suggested List of Laboratory Assignments Write C++/Java program for following-

Group A

1. A book consists of chapters, chapters consist of sections and sections consist of subsections. Construct a tree and print the nodes. Find the time and space requirements of your method.
2. Beginning with an empty binary search tree, Construct binary search tree by inserting the values in the order given. After constructing a binary tree - i. Insert new node ii. Find number of nodes in longest path iii. Minimum data value found in the tree iv. Change a tree so that the roles of the left and right pointers are swapped at every node v. Search a value
3. For given expression eg. a-b*c-d/e+f construct inorder sequence and traverse it using postorder traversal(non recursive).
4. Read for the formulas in propositional calculus. Write a function that reads such a formula and creates its binary tree representation. What is the complexity of your function?
   Given binary tree with n nodes, assign this tree to another [operator=] and then erase all nodes in a binary tree.
5. Convert given binary tree into threaded binary tree. Analyze time and space complexity of the algorithm.
6. Consider threading a binary tree using preorder threads rather than inorder threads. Design an algorithm for traversal without using stack and analyze its complexity.
7. A Dictionary stores keywords & its meanings. Provide facility for adding new keywords, deleting keywords, updating values of any entry. Provide facility to display whole data sorted in ascending/ Descending order. Also find how many maximum comparisons may require for finding any keyword. Use Binary Search Tree for implementation.

Group B

8. Write a function to get the number of vertices in an undirected graph and its edges. You may assume that no edge is input twice. i. Use adjacency list representation of the graph and find runtime of the function ii. Use adjacency matrix representation of the graph and find runtime of the function
9. There are flight paths between cities. If there is a flight between city A and city B then there is an edge between the cities. The cost of the edge can be the time that flight takes to reach city B from A, or the amount of fuel used for the journey. Represent this as a graph. The node can be represented by airport name or name of the city. Use adjacency list

representation of the graph or use adjacency matrix representation of the graph. Justify the storage representation used.

10. You have a business with several offices; you want to lease phone lines to connect them up with each other; and the phone company charges different amounts of money to connect different pairs of cities. You want a set of lines that connects all your offices with a minimum total cost. Solve the problem by suggesting appropriate data structures.
11. Tour operator organizes guided bus trips across the Maharashtra. Tourists may have different preferences. Tour operator offers a choice from many different routes. Every day the bus moves from starting city S to another city F as chosen by client. On this way, the tourists can see the sights alongside the route travelled from S to F. Client may have preference to choose route. There is a restriction on the routes that the tourists may choose from, the bus has to take a short route from S to F or a route having one distance unit longer than the minimal distance. Two routes from S to F are considered different if there is at least one road from a city A to a city B which is part of one route, but not of the other route.
12. Consider the scheduling problem. n tasks to be scheduled on single processor. Let t1, ..., tn be durations required to execute on single processor is known. The tasks can be executed in any order but one task at a time. Design a greedy algorithm for this problem and find a schedule that minimizes the total time spent by all the tasks in the system. (The time spent by one is the sum of the waiting time of task and the time spent on its execution.)

Group C

13. Consider telephone book database of N clients. Make use of a hash table implementation to quickly look up client‘s telephone number.
14. Implement all the functions of a dictionary (ADT) using hashing. Data: Set of (key, value) pairs, Keys are mapped to values, Keys must be comparable, Keys must be unique Standard Operations: Insert(key, value), Find(key), Delete(key)
15. For given set of elements create skip list. Find the element in the set that is closest to some given value.
16. The symbol table is generated by compiler. From this perspective, the symbol table is a set of name-attribute pairs. In a symbol table for a compiler, the name is an identifier, and the attributes might include an initial value and a list of lines that use the identifier. Perform the following operations on symbol table: (1) Determine if a particular name is in the table (2) Retrieve the attributes of that name (3) Modify the attributes of that name (4) Insert a new name and its attributes (5) Delete a name and its attributes

Group D

17. Given sequence k = k1 <k2 < … < kn of n sorted keys, with a search probability pi for each key ki . Build the Binary search tree that has the least search cost given the access probability for each key.
18. A Dictionary stores keywords & its meanings. Provide facility for adding new keywords, deleting keywords, updating values of any entry. Provide facility to display whole data sorted in ascending/ Descending order. Also find how many maximum comparisons may require for finding any keyword. Use Height balance tree and find the complexity for finding a keyword

Group E

19. To create ADT that implements the SET concept. a. Add (newElement) -Place a value into the set b. Remove (element) Remove the value c. Contains (element) Return true if element is in collection d. Size () Return number of values in collection Iterator () Return an iterator used to loop over collection e. Intersection of two sets, f. Union of two sets, g. Difference between two sets, h. Subset
20. Read the marks obtained by students of second year in an online examination of particular subject. Find out maximum and minimum marks obtained in that subject. Use heap data structure. Analyze the algorithm.

Group F

21. Assume we have two input and two output tapes to perform the sorting. The internal memory can hold and sort m records at a time. Write a program in java for external sorting. Find out time complexity. 23 Department maintains a student information. The file contains roll number, name, division and address. Allow user to add, delete information of student. Display information of particular employee. If record of student does not exist an appropriate message is displayed. If it is, then the system displays the student details. Use sequential file to main the data.
22. Company maintains employee information as employee ID, name, designation and salary. Allow user to add, delete information of employee. Display information of particular employee. If employee does not exist an appropriate message is displayed. If it is, then the system displays the employee details. Use index sequential file to maintain the data.

Group G

23. Implement the Heap/Shell sort algorithm implemented in Java demonstrating heap/shell data structure with modularity of programming language.
24. Any application defining scope of Formal parameter, Global parameter, Local parameter accessing mechanism and also relevance to private, public and protected access. Write a Java program which demonstrates the scope rules of the programming mechanism.
25. Write a Java program which will demonstrate a concept of Interfaces and packages: In this assignment design and use of customized interfaces and packages for a specific application are expected.
26. Write a Java program which will demonstrate a concept of cohesion and coupling of the various modules in the program.
27. Write a program on template and exception handling in Java: in this assignment multiple templates are to be designed as a pattern and these patterns to be used to take decisions.
28. Write a Java program for the implementation of different data structures using JAVA collection libraries (Standard toolkit library): at least 5 data structures are used to design a suitable application.
29. Design a mini project using JAVA which will use the different data structure with or without Java collection library and show the use of specific data structure on the efficiency (performance) of the code.

SEMINAR

Credits: PR-01

Teaching Scheme:
Practical: 1 Hr. / Week

Examination Scheme:
Term work: 50 Marks

Course Objectives:

- To explore the basic principles of communication (verbal and non-verbal) and active,
- empathetic listening, speaking and writing techniques.
- To expose the student to new technologies, researches, products, algorithms, services

Course Outcomes:

On completion of the course, student will–

- be able to be familiar with basic technical writing concepts and terms, such as audience
- analysis, jargon, format, visuals, and presentation.
- be able to improve skills to read, understand, and interpret material on technology.
- improve communication and writing skills

Guidelines:

1. Each student will select a topic in the area of Computer Engineering and Technology
2. preferably keeping track with recent technological trends and development beyond scope of syllabus.
3. The topic must be selected in consultation with the institute guide.
4. Each student will make a seminar presentation in the term making use of audio/visual aids for a duration of 20-25 minutes and submit the seminar report prepared in latex
5. Active participation at classmate seminars is essential.
6. A panel of staff members from the institute will assess the seminar internally during the Presentation.

Guidelines for Assessment:

As a panel of staff members along with a guide would be assessing the seminar work based on these parameters-Contents and Presentation, Punctuality and Timely Completion, Question and Answers, Seminar Report, Paper presentation/Publication, Attendance and Active Participation.

Recommended Format of the Seminar Report:

- Title Page with Title of the topic, Name of the candidate with Exam Seat Number, Roll Number, Name of the Guide, Name of the Department, Institution and Year
- Seminar Approval Sheet/Certificate
- Abstract and Keywords
- Acknowledgement
- Table of Contents, List of Figures, List of Tables and Nomenclature
- Chapters Covering topic of discussion- Introduction with section including organization of the report, Literature Survey/Details of design/technology/Analytical and/or experimental work, if any/ …..,Discussions and Conclusions ,Bibliography/References

- Plagiarism Check report
- Report Documentation page

References:

1. Rebecca Stott, Cordelia Bryan, Tory Young, “Speaking Your Mind: Oral Presentation and Seminar Skills (Speak-Write Series)”, Longman, ISBN-13: 978-0582382435
2. Johnson-Sheehan, Richard, “Technical Communication”, Longman. ISBN 0-321-11764-6.

Semester II

Advanced Processors

Credits: TH-03

Teaching Scheme:

Lectures: 3 Hrs/ Week

Examination Scheme:

In Semester Assessment:
Phase I : 30
End Semester Examination:
Phase II: 70

Course Objectives:

1. To understand need and application of ARM Microprocessors in embedded system.
2. To study the architecture of ARM series microprocessor
3. To understand architecture and features of typical ARM7& DSP Processors.
4. To learn interfacing of real world input and output devices
5. To learn embedded communication systems.

Course Outcomes:

On completion of the course, student will be able to

1. Describe the ARM microprocessor architectures and its feature.
2. Interface the advanced peripherals to ARM based microcontroller
3. Design embedded system with available resources.
4. Use of DSP Processors and resources for signal processing applications.

Course Contents

Unit I : ARM7, ARM9, ARM11 Processors 6L

Introduction to ARM processors and its versions, ARM7, ARM9 & ARM11 features, advantages & suitability in embedded application, registers, CPSR, SPSR, ARM and RISC design philosophy, ARM7 data flow model, programmers model, modes of operations

Unit II :ARM7 Based Microcontroller 6L

ARM7 Based Microcontroller LPC2148: Features, Architecture (Block Diagram and Its Description), System Control Block (PLL and VPB divider) , Memory Map, GPIO, Pin Connect Block, timer, Instruction set, programming in assembly language.

Unit III : Real World Interfacing with ARM7 Based Microcontroller-1 6L

Interrupt structure of LPC2148, Interfacing with LED, LCD, GLCD, KEYPAD, simple LPC2148 GPIO Programming examples Using timers of LPC2148 to generate delay, serial communication programming for transmission and reception from computer, programming for UART.

Unit IV : Real World Interfacing with ARM7 Based Microcontroller -2 **6L**

GSM and GPS module interfacing, on-chip ADC using interrupt (VIC) and without using interrupt (VIC), EEPROM using I2C, SDCARD using SPI, on-chip DAC for waveform generation.

Unit V : Digital signal Processors –I **6L**

Introduction, Computer Architectures for signal processing, General purpose Digital signal Processors, selecting digital signal processors, Special purpose DSP Hardware, Architecture of TMS320C67X, Features of C67X processors, CPU, General purpose register files, Functional units and operation, Data paths, Control register file.

Unit VI : Digital signal Processors-II **6L**

TMS320C67X Functional units, Internal memory, External memory, on chip peripherals, Interrupts, Instruction set and addressing modes, Fixed point instructions, Floating point instructions, Conditional operations, Parallel operations, Pipeline operations, Code Composer studio, Application programs in C67X

Text Books:

1. Andrew Sloss, Dominic Symes, Chris Wright,-ARM System Developer‘s Guide – Designing and Optimizing System Software‖, ELSEVIER
2. Digital Signal Processors: Architecture, Programming and Applications By B. Venkatramani, M Bhaskar McGraw Hill Second Edition

Reference Books:

1. LPC 214x User manual (UM10139) :- www.nxp.com
2. ARM architecture reference manual : - www.arm.com
3. Trevor Martin, An Engineer‘s Introduction to the LPC2100 series, Hitex (UK)
4. TMS320C67XX User manual: www.ti.com
5. Digital Signal Processing A Practical Approach by Emmanuel Ifeachor, Barrie W. Jervis Pearson Second edition
6. Joseph Yiu, -The Definitive Guide to the ARM Cortex-M, Newness, ELSEVIER.

Database Management System

Credits: TH-03

Teaching Scheme:

Lectures: 3 Hrs/ Week

Examination Scheme:

In Semester Assessment:
Phase I : 30
End Semester Examination:
Phase II: 70

Course Objectives :

1. To understand the fundamental concepts of database management. These concepts include aspects of database design, database languages, and database-system implementation
2. To provide a strong formal foundation in database concepts, technology and practice
3. To give systematic database design approaches covering conceptual design, logical design and an overview of physical design
4. Be familiar with the basic issues of transaction processing and concurrency control
5. To learn and understand various Database Architectures and Applications
6. To learn a powerful, flexible and scalable general purpose database to handle big data

Course Outcomes :

On completion of the course, student will be able to–

1. Design E-R Model for given requirements and convert the same into database tables.
2. Use database techniques such as SQL & PL/SQL.
3. Use modern database techniques such as NOSQL.
4. Explain transaction Management in relational database System.
5. Describe different database architecture and analyses the use of appropriate architecture in real time environment.
6. Use advanced database Programming concepts Course Contents

Unit I Introduction 7L

Introduction to Database Management Systems, Purpose of Database Systems, Database-System Applications, View of Data, Database Languages, Database System Structure, Data Models, Database Design and ER Model: Entity, Attributes, Relationships, Constraints, Keys, Design Process, Entity Relationship Model, ER Diagram, Design Issues, Extended E-R Features, converting E-R & EER diagram into tables.

Unit II SQL AND PL/SQL 7L

SQL: Characteristics and advantages, SQL Data Types and Literals, DDL, DML, DCL, TCL, SQL Operators, Tables: Creating, Modifying, Deleting, Views: Creating, Dropping, Updating using Views, Indexes, SQL DML Queries: SELECT Query and clauses, Set Operations, Predicates and Joins, Set membership, Tuple Variables, Set comparison, Ordering of Tuples, Aggregate Functions, Nested Queries, Database Modification using SQL Insert, Update and Delete Queries. PL/SQL: concept of Stored Procedures & Functions, Cursors, Triggers, Assertions, roles and privileges , Embedded SQL, Dynamic SQL.

Unit III Relational Database Design **8L**

Relational Model: Basic concepts, Attributes and Domains, CODD's Rules, Relational Integrity: Domain, Referential Integrities, Enterprise Constraints, Database Design: Features of Good Relational Designs, Normalization, Atomic Domains and First Normal Form, Decomposition using Functional Dependencies, Algorithms for Decomposition, 2NF, 3NF, BCNF, Modeling Temporal Data.

Unit IV Database Transactions and Query Processing **8L**

Basic concept of a Transaction, Transaction Management, Properties of Transactions, Concept of Schedule, Serial Schedule, Serializability: Conflict and View, Cascaded Aborts, Recoverable and Non-recoverable Schedules, Concurrency Control: Need, Locking Methods, Deadlocks, Time-stamping Methods, Recovery methods : Shadow-Paging and Log-Based Recovery, Checkpoints, Query Processing, Query Optimization, Performance Tuning.

Unit V Parallel and Distributed Databases **7L**

Introduction to Database Architectures: Multi-user DBMS Architectures, Case study- Oracle Architecture. Parallel Databases: Speedup and Scale up, Architectures of Parallel Databases. Distributed Databases: Architecture of Distributed Databases, Distributed Database Design, Distributed Data Storage, Distributed Transaction: Basics, Failure modes, Commit Protocols, Concurrency Control in Distributed Database.

Unit VI NoSQL Database **8L**

Introduction to NoSQL Database, Types and examples of NoSQL Database- Key value store, document store, graph, Performance, Structured verses unstructured data, Distributed Database Model, CAP theorem and BASE Properties, Comparative study of SQL and NoSQL, NoSQL Data Models, Case Study-unstructured data from social media. Introduction to Big Data, HADOOP: HDFS, MapReduce.

Text Book :

1. Silberschatz A., Korth H., Sudarshan S., "Database System Concepts", McGraw Hill Publishers, ISBN 0-07-120413-X, 6th edition
2. Connally T, Begg C., "Database Systems", Pearson Education, ISBN 81-7808-861-4
3. Pramod J. Sadalage and Martin Fowler, “NoSQL Distilled”, Addison Wesley, ISBN- 10: 0321826620, ISBN-13: 978-0321826626 References: 1. C J Date, “An Introduction to Database Systems”, Addison-Wesley, ISBN: 0201144719 2. S.K.Singh, “Database Systems : Concepts, Design and Application”, Pearson, Education, ISBN 978-81-317-6092-5 3. Kristina Chodorow, Michael Dirolf, “MangoDB: The Definitive Guide” ,O’Reilly Publications, ISBN: 978-1-449-34468-9.
4. Adam Fowler, “NoSQL For Dummies”, John Wiley & Sons, ISBN-1118905628
5. Kevin Roebuck, “Storing and Managing Big Data - NoSQL, HADOOP and More”, Emereopty Limited, ISBN: 1743045743, 9781743045749

6. Joy A. Kreibich, “Using SQLite”, O'REILLY, ISBN: 13:978-93-5110-934-1
7. Garrett Grolemund, “Hands-on Programming with R”, O'REILLY, ISBN : 13:978-93- 5110-728-6

Data Communication

Teaching Scheme:

Lectures: 3 Hrs/ Week

Examination Scheme:

In Semester Assessment:
Phase I : 30
End Semester Examination:
Phase II: 70

Course Objectives:

- To provide an in-depth introduction to all aspects of data communication system.
- To define different data formats for better data transmission.
- To introduce various digital baseband and bandpass modulation schemes.
- To identify the need of data coding and error detection/correction mechanism.
- To provide knowledge of various multiplexing schemes.

Course Outcomes:

After successfully completing the course, students will be able to

- Define and explain terminology of data communications
- Understand the impact and limitations of various modulation techniques.
- Get exposure to entropy and other coding techniques.
- Identify and explain error detection and correction using appropriate techniques.
- Design of data communication system.
- To acknowledge the need of spread spectrum schemes.

Unit I: Data Transmission Fundamentals (8L)

Data transmission concepts and terminology, analog and digital data transmission, Transmission modes (simplex, half duplex, full duplex), Transmission Impairments and Channel Capacity, transmission media : Guided (UTP, STP, Optical, coaxial) & wireless(Radio wave, Microwave, Infrared), Data Transmission(parallel and serial- synchronous and asynchronous transmission), analog and digital signal properties, Bandwidth, bit rate, baud rate data rate limits, Connecting devices: Hubs/Repeaters, Switches, Bridges, Routers, Layered Architecture (OSI Model), ISDN

Unit II: Baseband Signal Encoding (6L)

Block Diagram of Digital Communication System, Digital Versus Analog Sampling Process, PCM Generation and Reconstruction, Quantization Noise, Non-uniform Quantization and Companding, DM, ADM, DPCM and applications, **Basic line codes**: RZ, NRZ, Unipolar, Polar, Bipolar, AMI, Manchester: properties and comparison; Multilevel line codes: MLT3, 2B1Q.

Unit III: Bandpass Digital Signalling (8L)

Bandpass Digital Signalling Generation, detection, signal space diagram ASK, FSK, PSK, QPSK, OQPSK, QAM schemes, comparison. **M-arysignalling**: MPSK, MFSK signalling, OFDM.

Unit IV: Multiple Access Techniques (6L)

Introduction to Multiple Access Techniques – TDMA, FDMA, CDMA Spread spectrum techniques DSSS and FHSS, introduction to orthogonal codes and their properties; suitable example of orthogonal code and its autocorrelation, random access, Pure and slotted ALOHA, Media access control protocol (CSMA)

Unit V: Error Control Coding (6L)

Linear block codes, Hamming code, Hamming distance, CRC, syndrome detection, convolution code, trellis diagram, coding gain, Veterbi algorithm for detection Error control systems: FEC, ARQ Stop and Wait, Hybrid ARQ, go back N, selective repeat

Unit VI: Information Theory (6L)

The concept of Information, Information rate, entropy, mutual information, channel capacity, Bandwidth-SNR tradeoffs, use of orthogonal signals to achieve Shannon‟s limit. **Entropy coding:** overview of BSC, Huffman coding, Shannon-Fano coding, code efficiency, channel through put.

Text Books :

1. Bernard Sklar, Digital Communication,2/E, Pearson Education India, 2009

2. Willam Stallings, Data and Computer

Reference Books:

1. Behrouz A. Forouzan, Data Communications and Networking, 4/E, McGraw-Hill, 2006

2.Leon W. Couch II, Digital and Analog Communication Systems, 6/E, Pearson Education Asia, 2002 3.Taub Schilling, Principals of Communication Systems, 2/E, Tata McGraw Hill, 2004

4.John J Proakis, Digital Communications, 3/E, McGraw-Hill Higher Education, 2001

5. Simon Haykin, Digital Communication, 4/E, Wiley,1988

Elective II

Teaching Scheme:

Lectures: 3 Hrs/ Week

Examination Scheme:

In Semester Assessment:
Phase I : 30
End Semester Examination:
Phase II: 70

Web Technology

Course Objectives:

1. To understand the principles and methodologies of web based applications development process.
2. To understand current client side and server side web technologies.
3. To understand current client side and server side frameworks.
4. To understand web services and content management.

Course Outcomes:

On completion of the course, student will be able to–

1. Analyze given assignment to select sustainable web development design methodology.
2. Develop web based application using suitable client side and server side web technologies.
3. Develop solution to complex problems using appropriate method, technologies, frameworks, web services and content management.

Unit I Web Development Process, Front End Tools 7L

Introduction to web technology, internet and www, Web site planning and design issues, HTML: structure of html document , HTML elements: headings, paragraphs, line break, colors & fonts, links, frames, lists, tables, images and forms, Difference between HTML and HTML5. CSS: Introduction to Style Sheet, Inserting CSS in an HTML page, CSS selectors, XML: Introduction to XML, XML key component, Transforming XML into XSLT, DTD: Schema, elements, attributes, Introduction to JSON.

Unit II Client Side Technologies 8L

JavaScript: Overview of JavaScript, using JS in an HTML (Embedded, External), Data types, Control Structures, Arrays, Functions and Scopes, Objects in JS, DOM: DOM levels, DOM Objects and their properties and methods, Manipulating DOM, JQuery: Introduction to JQuery, Loading JQuery, Selecting elements, changing styles, creating elements, appending elements, removing elements, handling events.

Unit III Server Side Technologies 8L

Introduction to Server Side technology and TOMCAT, Servlet: Introduction to Servlet, need and advantages, Servlet Lifecycle, Creating and testing of sample Servlet, session management. JSP: Introduction to JSP, advantages of JSP over Servlet, elements of JSP page: directives, comments, scripting elements, actions and templates, JDBC Connectivity with JSP.

Unit IV Server Side Technologies **7L**

PHP: Introduction to PHP, Features, sample code, PHP script working, PHP syntax, conditions & Loops, Functions, String manipulation, Arrays & Functions, Form handling, Cookies & Sessions, using MySQL with PHP, WAP & WML, AJAX: Introduction, Working of AJAX, AJAX processing steps, coding AJAX script.

Unit V Client and Server Side Frameworks **7L**

Angular JS : Overview, MVC architecture, directives, expression, controllers, filters, tables, modules, forms, includes, views, scopes, services, dependency injection, custom directives, Internationalization, Introduction to NodeJS. Struts: Overview, architecture, configuration, actions, interceptors, result types, validations, localization, exception handling, annotations.

Unit VI Web Services **8L**

Web Services: Overview, types of WS, difference between SOAP and REST, EJB: types of EJB, benefits, Architecture, EJB technology, JNDI lookup, Introduction to Content Management System(CMS) ,Wordpress / Joomala, Advanced Technology: Bootstrap, JSF, Spring.

Text Book:

1. Achyut Godbole & Atul Kahate, "Web Technologies: TCP/IP to Internet Application Architectures", McGraw Hill Education publications, ISBN, 007047298X, 9780070472983
2. Ralph Moseley & M. T. Savaliya, "Developing Web Applications", Wiley publications, ISBN 13 : 9788126538676

References:

1. Adam Bretz & Colin J Ihrig, "Full Stack Javascript Development with MEAN", SPD, ISBN-13: 978-0992461256
2. Giulio Zambon, "Beginning JSP, JSF and Tomcat", Apress Publication, ISBN-10: 1430246235; ISBN-13: 978- 1430246237
3. Jeremy McPeak& Paul Wilton," Beginning JavaScript", Wrox Publication, ISBN-13: 978-0470525937
4. Black Book, "Struts 2", Dreamtech Press, ISBN 13, : 9788177228700
5. Black Book, "JDBC 4.2, Servlet 3.1 & JSP 2.3", Dreamtech Press, ISBN-13: 978-8177228700
6. Sandeep Panda, "Angular JS: Novice To Ninja", SPD, First Edition 2014, ISBN-13: 978-0992279455

7. B. V. Kumar, S. Sangeetha, S. V. Subrahmanya,, "J2EE Architecture, an illustrative gateway to enterprise solutions", Tata McGraw Hill Publishing Company. ISBN: 9780070621633

Multimedia Technologies

Teaching Scheme:

Lectures: 3 Hrs/ Week

Examination Scheme:

In Semester Assessment:
Phase I : 30
End Semester Examination:
Phase II: 70

Course Objectives:

1. To learn 5 basic components of multimedia (text, image, audio, video and animation)
2. To learn the advance graphics
3. To learn compression techniques for various multimedia components
4. To learn Gaming and animation

Course Outcomes:

At the end of this course students will be able to
1. To create their own file formats for specific application
2. To do some projects based on current trends in multimedia
3. To use of open sources for authoring tool for animation and presentations
4. To develop simple games and animation

Unit I Introduction to Multimedia 6 L

Goals, objectives, and characteristics of multimedia, Multimedia building blocks, Multimedia architecture, hardware support Distributed multimedia applications, streaming technologies, multimedia database systems Multimedia authoring tools, overview of multimedia software tools, Multimedia Applications Media Entertainment, Media consumption, web-based applications, e-learning and education Text: Types of text, Text compression: Huffman coding, LZ & LZW Text file formats: TXT, DOC; RTF, PDF, PS

Unit II Digital Image 6 L

Basic Image fundamentals, image File formats - (BMP, TIFF, JPEG, GIF) Image acquisition, storage processing, Communication, and display Image Enhancement: Enhancement by point processing, Spatial filtering Image Compression: Types of Compression: Lossy & Lossless, Symmetrical & Asymmetrical, Intra-frame &Inter-frame Hybrid JPEG, Lossless: RLE, Shannon

- Fano algorithm, Arithmetic coding. Lossy: Vector quantization, Fractal Compression Technique, Transform Coding, Psycho-analysis, and inter-frame Correlation. Hybrid: JPEG-DCT

Unit III Audio And Audio Compression **6 L**

Nature of sound waves, characteristics of sound waves, psycho-acoustic, MIDI, digital audio, CD formats. Audio file formats: WAV, AIFF, VOC, AVI, MPEG Audio File formats, RMF, WMA Audio compression techniques : DM, ADPCM and MPEG Audio file conversions Multimedia Supported audio formats in Android, Media Playback

Unit IV Video **6 L**

Video signal formats, Video transmission standards: EDTV, CCIR, CIF, SIF, HDTV, digitization of video Video file formats: MOV, Real Video, H-261, H-263, Cinepack, Nerodigtal,Video editing, DVD formats, MPEG, Video streaming Multimedia Supported video formats in Android, Media Playback.

Unit V Animation And Opengl **6 L**

Animation: Basics of animation, types of animation, principles of animation, techniques of animation, Creating animation OpenGL: Open GL over windows/Linux, Extension, programming languages, SDK, shadowing techniques, rendering,

Unit VI Advances In Multimedia **6 L**

Virtual Reality : Concept, Forms of VR, VR applications, VR devices: Hand Gloves, Head mounted tracking system, VR chair, CCD, VCR, 3D Sound system, Head mounted display Synchronization: Multimedia Communication and applications, Study of Multimedia networking, Quality of data transmission, Multimedia over IP, Media on Demand Multimedia in Android: Android Multimedia Framework Architecture, G Streamer :Introduction, G Streamer Based Multimedia Framework, Open Core Multimedia Engine

Text Books

1. Ralf Steinmetz and Klara Nahrstedt "Multimedia Computing, Communication and Applications", Pearson Education.
2. K.R. Rao, “Multimedia Communication Systems: Techniques, Standards, and Networks”, TMH.
3. Ranjan Parekh, "Principles of Multimedia", 2/E, Tata McGraw-Hill, ISBN: 1259006506

Reference Books

1. Ashok Banerji, Ananda Ghosh, “Multimedia Technologies”, ISBN: 9780070669239 2. Gonzalez, Woods, "Digital Image Processing" Addison Wesley
2. Ze-Nian Li, Marks S. Drew, "Fundamentals of Multimedia", Pearson Education.
   Edward Angel, “OpenGL: A Primer”, Addison-Wesley.
3. Parag Havaldar, Gerard Medioni, “Multimedia Systems”, Cengage Learning.

PLC & Applications

Teaching Scheme:

Lectures: 3 Hrs/ Week

Examination Scheme:

In Semester Assessment:
Phase I : 30
End Semester Examination:
Phase II: 70

Course Objectives:

1. Ability to recognize industrial control problems suitable for PLC control.
2. Overview of Ladder Logic Programming to Program PLC.
3. The ability to select the essential elements and practices needed to develop and implement the Engineering Automation using PLC approach.

Course Outcomes:

After successfully completing the course students will be able to

1. Understand concepts of PLC, its uses & applications.
2. Develop PLC ladder programs for simple industrial applications.
3. Use knowledge of Installation, troubleshooting & maintenance of PLC to provide solution for industrial automation problems.

Unit I : PLC Overview 8L

Definition & History of PLC, Basic structure & Components of PLC, Principle of Operation, Selection of PLC, Why Use PLC, PLC I/O Modules, Memory & How it is used, PLC advantages & Disadvantages, PLC vs Computers, , Overview of Micro PLCs. Conventional ladders vs PLC Ladder logic, What is Logic? Overview of Logic functions, Number systems & Codes, Hardwired Logic vs Programmed logic, Programming word level logic instructions, Relation of digital gate logic to contact/coil logic, Relay logic, Relay Sequencers

Unit II : Basics of PLC Programming -I 6L

Processor memory organization, PLC Programming languages, Ladder diagrams, Relays, contactors, switches, sensors, output control devices, latching relays, ladder diagram elements. Instructions: Relay type instructions, Instruction addressing, Branch Instructions, Internal Relay Instructions, Programming. Write ladder logic for a) two switches labelled as A & B are wired in parallel controlling a lamp, where two switches are separate inputs. b) That will cause output, pilot light PL, to be on when selector switch SS is closed, push button PB is closed and limit switch LS is open.

Unit III: Basics of PLC Programming -II **6L**

Basic Functions : PLC Timer & Counter functions, Timer & Counter Industrial applications, Arithmetic functions, Comparison functions, Jump functions, Data handling functions, Digital Bit functions, PLC matrix Functions, Advanced PLC Functions: Analog PLC operation, PID control of Continuous processes. Write a PLC program for a) controlling lubricating oil being dispensed from a tank, b) Automatic water sprinkler system of a garden

Unit IV: PLC Installation, Troubleshooting & Maintenance **6L**

Installation : Consideration of operating environment, Receiving test, check & assembly, Electrical Noise, Leaky inputs & outputs, Grounding, voltage variations & surges, Circuit protections & wiring, Program Editing & Commissioning. Troubleshooting: Processor module, Input & Output malfunctions, Ladder logic program. PLC Maintenance.

Unit V: Process control, HMI & SCADA **6L**

Types of processes, structure of control systems, on/off control, PID Control, Motion control, SCADA (Supervisory control and data acquisition): Block diagram, RTU (Remote terminal unit), Functions of RTU, MTU (Main terminal unit), functions of MTU, operating interfaces & applications, HMI (Human Machine Interface, Interfacing technique of PLC with HMI

Unit VI: PLC Networking & Applications **6L**

Types of communication interface, Types of networking channels, Advantages of standard industrial network, Serial communication, Industrial network : CAN (Controller area network), Devicenet, Controlnet, Ethernet/IP, Modbus, Fieldbus, Profibus-PA/DP, SCADA (Supervisory control & data acquisition), HMI (Human Machine Interface), Two-axis, three axis robot control with PLC

Text Books

1. "Programmable Logic Controllers" Frank D. Petruzella, Fourth Edition, McGraw-Hill Education
2. "Programmable logic controllers & Industrial Automation" Madhuchandra Mitra, Samarjeet Sen Gupta, Fourth reprint 2012. Penram International Pvt.Ltd.

Reference Books

1. "Programmable Logic Controllers, Principles & Applications" John W. Wobb, Ronald A. Rais, Fifth Edition, PHI publishing.
2. "Introduction to Programmable Logic Controllers "Garry Dunning, 3rd Edition, Thomson, Delmar Learning.
3. Curtis Johnson, "Process Control Instrumentation Technology"; 8th Edition, Pearson Education.

Network Analysis and Synthesis

Teaching Scheme:

Lectures: 3 Hrs/ Week

Examination Scheme:

In Semester Assessment:
Phase I : 30
End Semester Examination:
Phase II: 70

Course Objectives:

1. Understand, Analyze the basic AC and DC circuits using KCL,KVL and network Theorems
2. Determine the voltages, currents, power and impedances at various nodes and loops using all the simplification techniques.
3. Understand and apply graph theory to solve network equations
4. Understand, identify and analyze the series, parallel resonance circuits, calculate the bandwidth, selectivity, Q-factor also.
5. To synthesize passive network by various methods

Course Outcomes:

After successfully completing the course, students will be able to

1. Apply the time and frequency method of analysis.
2. Find the various parameters of two port network.
3. Apply network topology for analyzing the circuit
4. Synthesize the network using passive elements.

Unit I: Basic Circuit Analysis and Simplification Techniques (6L)

Kirchoff's Current and Voltage Laws, Independent and dependent sources and their interconnection, and power calculations.

Network Analysis: Mesh, Super mesh, Node and Super Node analysis. Source transformation and source shifting.

Network Theorems: Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems.

Unit II: Graph Theory and Network Equations (6L)

Network graph, tree, co-tree, and loops. Incidence matrix, tie-set, cut-set matrix. Formulation of equilibrium equations in matrix form, solution of resistive networks and principle of duality.

Unit III: Frequency Selective Networks (6L)

Series Resonance: Impedance, Phase angle variations with frequency, Voltage and current variation with frequency, Bandwidth, Selectivity. Effect of Rgon BW & selectivity. Magnification factor.

Parallel resonance: Resonant frequency and admittance variation with frequency, Bandwidth and selectivity. General case: Resistance present in both branches.Comparison and applications of series and parallel resonant circuits.

Unit IV: Network Functions & Fundamentals of Network Synthesis (6L)

Network functions, properties of all types of network functions, Effect of poles and zeros on the system function, network synthesis problems, elements of reliability, causality and stability, Hurwitz's polynomial, Positive real function testing, elementary synthesis procedures.

Unit V: Synthesis of One Port Networks (6L)

Properties of RC, RL and LC driving point functions and their synthesis in Foster and Cauer forms. Synthesis of RLC driving point functions in terms of partial fraction and continued fractions for simple driving point functions.

Unit V: Passive Filter Design (6L)

Introduction to various approximation techniques, Butterworth and Chebyshev approximation, derivation of normalized low pass filter transfer function upto 3rd order by Butterworth approximation from basic principles. Evaluation of transfer function for Chebyshev filters from pole zero plots. Synthesis of above mentioned filters with 1ohm termination. Frequency transformation to high pass,band pass and band stop forms. Normalized low pass filters, frequency scaling and Impedance scaling.

Text Books :

1. Franklin Kuo, "Network Analysis and Synthesis", Wiley international.
2. GobindDaryanani, "Principles of Active Network Synthesis and Design", Wiley International.

Reference Books:

1. M.E. Van Valkenberg, "Analog Filter Design", Harcourt Brace Jovanovich College Publishers.
2. Wai-Kai Chen , "Passive and Active Filters, theory and implementations", Wiley international
3. Lawrence Huelsman, "Active and Passive Analog Filter Design", McGraw-Hill Inc

Advanced Processors and Data Communication Lab

Credits: PR-02

Teaching Scheme:
Practical: 4 Hrs/ Week

Examination Scheme:
Practical: 50 Marks
Term work: 25 Marks

Advanced Processors

List of Practical's

Group A: LPC2148 Based Experiments (Any 6)

1. 1 Interfacing LPC2148 with LCD display
2. GPIO configuration and control with simple LED example
3. Interfacing of ultrasonic sensor with LPC 2148
4. Using UART of LPC2148 for serial reception and transmission from/to computer
5. Interfacing GSM with LPC2148 for sending and receiving message
6. Interfacing GPS with LPC2148 for finding current location latitude and longitude values
7. Using built-in ADC of LPC2148 for displaying its values (Programming built-in ADC with
8. interrupt and without interrupt) OR
9. Interfacing SD card to LPC2148 using SPI
10. Interfacing EEPROM to LPC2148 using I2C protocol

Group B: DSP Based Experiments (Any 2) The programs may be written in assembly language, C language and combination of both

1. Convolution
2. Discrete Fourier Transform Using FFT Algorithm
3. Discrete Fourier Transform Using DFT FFT Radix 2 Algorithm
4. FIR filter
5. Real time audio signal capture

TMS320C6748 DSP Development kit(LCDK) with XDS100 V2 JTAG Emulator may found useful.

Data Communication

List of Practical's (Any six from 1 to 9)

1. Experimental Study of PCM and Companded PCM.

2. Experimental study delta modulation and signal reconstruction

3. Experimental study of basic line codes and Multi level line codes

4. Experimental study of ASK modulation and demodulation

5. Experimental study of PSK modulation and demodulation

6. Experimental study of FSK modulation and demodulation

7. Experimental study of QPSK and OQPSK modulation and demodulation

8. Design of PN sequence generator.

9. Experimental study of generation and detection of Spread Spectrum System (DSSS)

Software Assignments: (Any two from 10 to 12):

10. Implementation of linear block code

11. Implementation of Convolution code and Viterbi algorithm

12. Implementation of Shannon Fano and Huffman codes

DBMS and Elective-II Lab

Credits: PR-02

Teaching Scheme:

Practical: 4 Hrs/ Week

Examination Scheme:

Practical: 50 Marks

Term work: 25 Marks

Database Management System

Each student must perform at least 13 assignments (8-Mandotory plus 4 from remaining 8 assignments) from group A , 5 from group B and 2 mini projects from Group C Operating System recommended

Suggested List of Practicals:

Group A- Database Programming Languages – SQL, PL/SQL

1. Study of Open Source Relational Databases : MySQL
2. Design and Develop SQL DDL statements which demonstrate the use of SQL objects such as Table, View, Index, Sequence, Synonym
3. Design at least 10 SQL queries for suitable database application using SQL DML statements: Insert, Select, Update, Delete with operators, functions, and set operator.
4. Design at least 10 SQL queries for suitable database application using SQL DML statements: all types of Join, Sub-Query and View.
5. Cursors: (All types: Implicit, Explicit, Cursor FOR Loop, Parameterized Cursor) Write a PL/SQL block of code using parameterized Cursor, that will merge the data available in the newly created table N_RollCall with the data available in the table O_RollCall. If the data in the first table already exist in the second table then that data should be skipped. Frame the separate problem statement for writing PL/SQL block to implement all types of Cursors inline with above statement. The problem statement should clearly state the requirements.
6. PL/SQL Stored Procedure and Stored Function. Write a Stored Procedure namely proc_Grade for the categorization of student. If marks scored by students in examination is <=1500 and marks>=990 then student will be placed in distinction category if marks scored are between 989 and900 category is first class, if marks 899 and 825 category is Higher Second Class Write a PL/SQL block for using procedure created with above requirement. Stud_Marks(name, total_marks) Result(Roll,Name, Class) Frame the separate problem statement for writing PL/SQL Stored Procedure and function, inline with above statement. The problem statement should clearly state the requirements.
7. Database Trigger (All Types: Row level and Statement level triggers, Before and After Triggers). Write a database trigger on Library table. The System should keep track of the records that are being updated or deleted. The old value of updated or deleted records should

be added in Library_Audit table. Frame the problem statement for writing Database Triggers of all types, in-line with above statement. The problem statement should clearly state the requirements.

Group B Large Scale Databases

1. Study of Open Source NOSQL Database: MongoDB (Installation, Basic CRUD operations, Execution)
2. Design and Develop MongoDB Queries using CRUD operations. (Use CRUD operations, SAVE method, logical operators)
3. Implement aggregation and indexing with suitable example using MongoDB.
4. Implement Map reduces operation with suitable example using MongoDB.
5. Design and Implement any 5 query using MongoDB
6. Create simple objects and array objects using JSON
7. Encode and Decode JSON Objects using Java/Perl/PHP/Python/Ruby

Group C Mini Project : Database Project Life Cycle

1. Write a program to implement MogoDB database connectivity with PHP/ python/Java Implement Database navigation operations (add, delete, edit etc.) using ODBC/JDBC.
2. Implement MYSQL/Oracle database connectivity with PHP/ python/Java Implement Database navigation operations (add, delete, edit,) using ODBC/JDBC.
3. Using the database concepts covered in Part-I & Part-II & connectivity concepts covered in Part C, students in group are expected to design and develop database application with following details: Requirement Gathering and Scope finalization Database Analysis and Design:

   a. Design Entity Relationship Model, Relational Model, Database Normalization Implementation :

   b. Front End : Java/Perl/PHP/Python/Ruby/.net

   c. Backend : Mongo DB/MYSQL/Oracle

   d. Database Connectivity : ODBC/JDBC Testing : Data Validation Group of students should submit the Project Report which will be consist of documentation related to different phases of Software Development Life Cycle: Title of the Project, Abstract, Introduction, scope, Requirements, Data Modeling features, Data Dictionary, Relational Database Design, Database Normalization, Graphical User Interface, Source Code, Testing document, Conclusion. Instructor should maintain progress report of mini project throughout the semester from project group and assign marks as a part of the term work

Web Technology

List of experiments

a) Installation and Configuration of Web Application Servers Tomcat, Apache, WebSphere, JBoss, GlassFish.

b) Design and develop any suitable web application using HTML, CSS and XML in consultation of course instructor.

1. Perform validation of all fields in assignment no.1 by using Java script/JQuery.
2. Add dynamic web application essence in assignment no. 2 using Servlet, JSP and backend.
3. Add dynamic web application essence in assignment no. 2 using PHP, MySQL database connectivity and AJAX controls.
   a) Re-Design, develop and deploy assignment no. 3 of unit –III using Strut
   b) Re-Design, develop and deploy assignment no. 4 of unit –IV using Angular JS
4. Design, Develop and Deploy separate web application using EJB/CMS/JSF/Spring/Bootstrap.

Multimedia Technologies

List of experiments

1. Create a new file format to store a multimedia data.
2. Implement a compression technique and check the efficiency on different inputs.
3. To develop a theme based multimedia presentation
4. To add a digital signature onto a document
5. To perform steganography of text onto an image and check the efficiency with different inputs.

Programmable Logic Controller and Application

List of Experiments (Any 8)

Design & Simulate using any PLC simulation software

1. Simple Start/Stop Ladder Logic Relay
2. Single Push Button On/Off Ladder Logic
3. PLC Program Example with On Delay Timer
4. PLC Program Example with Off Delay Timer

5. PLC Program Example with Retentive Timer
6. Star Delta PLC Ladder Diagram
7. Ladder Diagram for DOL Motor Starter
8. Industrial Visit to Nearest Process Control Plant for study of PLC, SCADA, HMI.
9. Traffic Light Ladder Logic Diagram
10. Ladder Diagram for Bottle Filling Plant
11. PLC Ladder Diagram for Elevator Control
12. 13, 14. Implement experiments 9, 10, and 11 using PLC hardware

Network Analysis and Synthesis

List of Experiments :-

1. Determine the current through the various branches and voltages across the various branches using Thevnins Theorems
2. Determine the current voltages across the various branches using Norons Theorems
3. Determine the current voltages across the various branches using Superposition Theorems
4. For two port LC network, find all network functions and sketch plot poles and zeros.
5. To carry out synthesis of one port LC network into any of the Canonical forms and verify practically.
6. Design a Butterworth low/high pass filter Sallen Key circuit and verify (at least 2^{nd} order).
7. Design a Chebyshev low/high pass filter Sallen Key circuit and verify (at least 2^{nd} order).
8. Design build and test a simple audio equalizer using filter concepts.

Project Based Seminar

Credits: PR-01

Teaching Scheme:
Practical: 2 Hrs/ Week

Examination Scheme:
Term work: 50 Marks

Introduction:

Graduates of final year IT program are supposed to design and implement projects through knowledge and skills acquired in previous semesters. Students should identify complex engineering problems and find effective, efficient and innovative ways of solving them through their projects. In a technical seminar, students should aim to review literature in a focused way for identifying a complex problem to be attempted in their final year project. Seminar should make the student attain skills like

(a) Gathering of literature in specific area in a focused manner
(b) Effectively summarizing the literature to find state-of-the-art in proposed area
(c) Identifying scope for future work
(d) Presenting (arguing) the case for the intended work to be done as project
(e) Reporting literature review and proposed work in scientific way using good English.

Course Objectives:

1. To perform focused study of technical and research literature relevant to a specific topic.
2. To study, interpret and summarize literature scientifically.
3. To build independent thinking on complex problems.
4. To build collaborative work practices.
5. To communicate scientific information to a larger audience in oral and written form.
6. To use presentation standards and guidelines effectively.

Course Outcomes :

1. To gather, organize, summarize and interpret technical literature with the purpose of formulating a project proposal.
2. To write a technical report summarizing state-of-the-art on an identified topic.
3. Present the study using graphics and multimedia presentations.
4. Define intended future work based on the technical review.
5. To explore and enhance the use of various presentation tools and techniques.
6. To understand scientific approach for literature survey and paper writing.

Guidelines for Project Based Seminars

1. A project group consisting of 3 to 4 students shall identify problem(s) in Computer Engineering /Information Technology/Electronics Engineering referring to recent trends and developments in consultation with institute guide.
2. The group must review sufficient literature (reference books, journal articles, conference papers, white papers, magazines, web resources etc.) in relevant area on their project topic as decided by the guide.

3. Internal guide shall define a project statement based on the study by student group.
4. Students should identify individual seminar topic based on the project undertaken in consultation with guide.
5. Seminar topics should be based on project undertaken. Guide should thoughtfully allocate seminar topics on different techniques to solve the given problem (project statement), comparative analysis of the earlier algorithms used or specific tools used by various researchers.
6. Research articles could be referred from IEEE, ACM, Science direct, Springer, Elsevier, IETE,CSI or freely available digital libraries like Digital Library of India (dli.ernet.in), National Science Digital Library, JRD Tata Memorial Library, citeseerx.ist.psu.edu, getcited.org, arizona.openrepository.com, Open J-Gate, Research Gate, worldwidescience.org etc.
7. The group shall present the study as individual seminars in 20 – 25 minutes.

Guidelines for Seminar Report Format:

1. Each student shall submit two copies of the seminar report in a prescribed format duly signed by the guide and Head of the department/Principal.
2. First chapter of a project group may talk about the project topic. At the end of the first chapter individual students should begin with introduction of seminar topic and its objectives.
3. Broad contents of review report (20-25 pages) shall be
   i. Introduction of Project Topic
   ii. Motivation, purpose and scope of project and seminar
   iii. Related work (of the seminar title) with citations
   iv. Discussion (your own reflections and analysis)
   v. Conclusions
   vi. Project definition. (Short version of RUP's vision document if possible).
   vii. References in IEEE Format
4. Students are expected to use open source tools for writing seminar report, citing the references and plagiarism detection. (Latex for report writing; Mendeley, Zatero for collecting, organizing and citing the resources; Dupli Checker , Paper Rater, Plagiarism Checker and Viper for plagiarism detection)

Guidelines for Seminar Evaluation

1. A panel of examiners appointed by University will assess the seminar externally during the presentation.
2. Attendance for all seminars for all students is compulsory.
3. Criteria for evaluation
   i. Relevance of topic - 05 Marks
   ii. Relevance + depth of literature reviewed- 10 Marks
   iii. Seminar report (Technical Content) - 10 Marks
   iv. Seminar report (Language) - 05 Marks

v. Presentation Slides - 05 Marks
vi. Communication Skills - 05 Marks
vii. Question and Answers - 10 Marks

Guidelines for Seminar Presentation

1) A panel of examiner will evaluate the viability of project scope and seminar delivery.
2) Oral examination in the form of presentation will be based on the project and seminar work completed by the candidates.
3) Seminar report must be presented during the oral examination.

References

1. Sharon J. Gerson, Steven M. Gerson, Technical Writing: Process and Product, Pearson Education Asia, ISBN: 130981745, 4th Edition.
2. Andrea J. Rutherfoord, Basic Communication Skills for Technology, Pearson Education Asia, 2nd Edition.
3. Lesikar, Lesikar's Basic Business Communication, Tata McGraw, ISBN: 256083274, 1st Edition.

Internship

Credits: PR-01

Examination Scheme:
Term work: 100 Marks

The students are required to undergo exhaustive Industrial Training of minimum three to four weeks immediately after the completion of sixth semester and before the commencement of seventh semester in an industry of repute in the field of Electronics or Computer engineering. The relevant industry is to be finalized in consultation with the head of concerned department before the end of sixth semester.

During the training period the students are expected to undergo rigorous exposure of the industry, its working style, various departments and their working, hands on experience on the various equipment's available with the industry. Student should maintain a log book mentioning day to day activity he / she has carried out during the training period.

Students are required to submit neatly typed and bound training report after joining the college. The report should include information about working of the industry as also specific information of the work done by the student in the industry. The students are also required to attach the Original Certificate issued by the competent authority from the industry where he / she has undergone training mentioning the successful completion of the training.

The industrial report is to be submitted within first 15 days of commencement of the seventh term in bound format and soft copy. The department will conduct industrial report presentation session for every student under the head 'Term work' under Industrial training evaluation by the internal examiner. Evaluation of Industrial training by students will carried out after Semester VI based on -

i) Knowledge acquired by him during the industrial training

ii) His/her performance in presentation

iii) Report

iv) Discussions

Savitribai Phule Pune University
Faculty of Science & Technology

Proposed curriculum

For

BE (Electronics & Computer Engineering)
(Choice Based Credit System)

(With Effect from Academic Year 2023-24)

Savitribai Phule Pune University, Pune
BE (Electronics & Computer Engineering) 2019 Course
(With effect from Academic Year 2023-24)

Semester-VII

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit			
		Theory	Practical	Tutorial	IN-Sem	End-Sem	TW	PR	OR	Total	TH	PR	TUT	Total
1	Advanced Techniques for Electrical Vehicle	03	-	-	30	70	-	-	-	100	03	-	-	**03**
2	Internet of Things	03	-	-	30	70	-	-	-	100	03	-	-	**03**
3	*Elective – I	03	-	-	30	70	-	-	-	100	03	-	-	**03**
4	**Elective – II	03	-	-	30	70	-	-	-	100	03	-	-	**03**
5	Lab Practice-I (Advanced Techniques for Electrical Vehicle + IoT)	-	04	-	-	-	25	50	-	75	-	02	-	**02**
6	Lab Practice-II (Elective – I)	-	04	-	-	-	25	50	-	75	-	02		**02**
7	MOOC	-		-	-	-	50	-	-	50	-	-	-	**02**
8	Project Stage I	-	04	-	-	-	50	-	50	100	-	-	-	**02**
9	Audit Course 7 (Mandatory)	-		-	-	-	-	-	-	-	-	-	-	-
	Total	**12**	**12**	**-**	**120**	**280**	**150**	**100**	**50**	**700**	**12**	**04**	**-**	**20**

Abbreviations:

TH : Theory TW : Term Work PR : Practical
OR : Oral TUT : Tutorial

Note: Interested students of B.E. (Electronics/E&TC/Electronics & Computer) can opt any one of the audit course from the list of audit courses prescribed by BoS (E &T Engineering)

*Elective-I	**Elective-II
1.Embedded System and RTOS	1.Mobile Communication
2.VLSI Design	2.Robotics and Automation
3. Information and Cyber Security	3.Software Testing and Quality Assurance
4. Digital Image Processing	4.Artificial Intelligence and Machine Learning

Savitribai Phule Pune University, Pune
BE (Electronics & Computer Engineering) 2019 Course
(With effect from Academic Year 2023-24)

Semester-VIII

Course Code	Course Name	Teaching Scheme (Hours/Week)			Examination Scheme and Marks						Credit			
		Theory	Practical	Tutorial	IN-Sem	End-Sem	TW	PR	OR	Total	TH	PR	TUT	Total
1	Computer Network	03	-	-	30	70	-	-	-	100	03	-	-	**03**
2	Cloud Computing	03	-	-	30	70	-	-	-	100	03	-	-	**03**
3	#Elective – III	03	-	-	30	70	-	-	-	100	03	-	-	**03**
4	##Elective – IV	03	-	-	30	70	-	-	-	100	03	-	-	**03**
5	Lab Practice-III (Computer Network)	-	02	-	-	-	25	50	-	75	-	01	-	**01**
6	Lab Practice-IV (Elective – III)	-	02	-	-	-	25	50	-	75	-	01	-	**01**
7	Project Stage II	-	12	-	-	-	100		50	150	-	-	-	**06**
8	Audit Course 8 (Mandatory)	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	**12**	**16**	-	**120**	**280**	**150**	**100**	**50**	**700**	**12**	**02**	-	**20**

Abbreviations:

TH : Theory TW : Term Work PR : Practical
OR : Oral TUT : Tutorial

Note: Interested students of B.E. (Electronics/E&TC/Electronics & Computer) can opt any one of the audit course from the list of audit courses prescribed by BoS (Electronics & Telecommunications Engineering)

#Elective-III	**##Elective-IV**
1.Electronics System Design	1.Software Defined Radio
2.Optical Fiber Communication	2.Wireless Sensor Network
3.Data Mining and Ware Housing	3.Design and Analysis of Algorithm
4.Human Computer Interface	4.Software Engineering
	5.Open Elective

SEMESTER – I

Advanced Techniques for Electrical Vehicle

Teaching Scheme:
Lectures: 3 Hrs/ Week

Examination Scheme:
In Semester Examination: Phase I: **30**
End Semester Examination: Phase II: **70**

Course Contents:

Unit I: Basics of EV — 6L

History of EV, Types of EVs, Block diagram and working Principle of EV, Major Components of EV, Advantages of EV over other vehicles, Limitations of EV.

Unit II: Components and their functions of EV — 6L

Major Electric/Electronic Components and their function, Major Mechanical (Mechatronics) Components and their function, Parameters consideration before design EV, Selection criteria of the component while designing the EV, Standards required as per AIS norms

Unit III: Drive train system — 6L

Types of Motors and its working principles of EV, Function of Controllers and their use EV drives, Types of Sensors and their functions, Functional block diagram of each stage in brief, Scope of Development of EV drive system

Unit IV: Battery Technologies — 6L

Traditional battery system, Current battery and their function, Function of batteries in EV, Battery parameter, Battery Management System (BMS), Comparison of Batteries and scope of development, Upcoming technologies in battery.

Unit V: Charging Infrastructure — 6L

Basics of charging and Infrastructure, Types of charging and its function, Points to be considered in design of charger, Types of chargers and working principles, Sources and utilization of renewable, energy for charging.

Unit VI: Challenges in EV and Solutions — 6L

Charging and Infrastructure issues, Troubles shootings in drive trains, troubleshooting in batteries, Maintenances of EVs, Safety and precaution for EVs

Books:

1. Basic Electric Vehicle Technology Explained John lawry- Wiley publications.
2. Electric & Hybrid vehicles -Tom Denton- Institute of the Motor Industry.
3. Modern Electric, Hybrid Ele. & fuel Cell vehicles - Mehrdad Ehsani, Yimin Gao -CRC Press.

Internet of Things

Teaching Scheme:
Lectures: 3 Hrs/ Week

Examination Scheme:
In Semester Examination: Phase I: **30**
End Semester Examination: Phase II: **70**

Course Objectives:

- Introduction to different aspects of the IoT, including end devices, networks, programming, and security and privacy implications.
- Understand what constitutes an IoT design solution.
- To learn real world application scenarios of IoT along with its societal and economic impact using case studies.

Course Outcomes:

After successfully completing the course students will be able to

1. Discover key IoT concepts including identification, sensors, localization, wireless protocols, data storage and security.
2. Explore IoT technologies, architectures, standards, and regulation.
3. Realize the value created by collecting, communicating, coordinating, and leveraging the data from connected devices.
4. Examine technological developments that will likely shape the industrial landscape in the future.
5. Develop and implement IoT solutions and applications.

Course Contents:

Unit I: Fundamentals of IOT 6L

Introduction to Internet of Things, Emerging Trends, Economic Significance, Technical Building Blocks, Physical design of IoT, Logical design of IoT, Sensors and actuators, Classification of sensors, types of Sensors and actuators and comparison of sensors and actuators, Introduction to IOT networking: Gateways and routing, IoT Protocols, IoT enabling technologies, IoT Issues and Challenges, IoT Security and privacy, Applications.

Unit II: IoT Protocols and Security 6L

SCADA and RFID Protocols, IEEE 802.15.4, BACNet Protocol, Modbus, HART, Zigbee, MQTT, IoT Security: Security Requirements, Challenges for Secure IoT, Key elements of IoT Security: Identity establishment, Access control, Data and message security, Security model for IoT.

Unit III: WSN & Cloud Computing 6L

WSN: introduction to WSN technology, Basic components of WSN, Characteristic features of WSNs, challenges, Application of WSN in: smart homes, healthcare, intelligent transportation, agriculture, etc. Cloud Computing: Cloud architecture standards and interoperability, Business concerns in the cloud, characteristics, Cloud types; IaaS, PaaS, SaaS, Public cloud, Private cloud, Benefits and challenges of

cloud computing, Development environments for service development: Amazon, Azure, Thingspeak, Google App-cloud platform in industry.

Unit IV: Implementation of IoT 6L

Implementation of IoT with Arduino: Introduction to arduino, arduino board overview, Programming environment, Simple assignments using arduino, Sending data to Cloud, analysis using any IoT platform Introduction to Raspberry Pi, Raspberry Pi board overview, Programming environment, introduction to python programming, Simple assignments using Raspberry Pi, Sending data to cloud, analysis of data using any IoT platform.

Unit V: Big Data - Data Storage and Analytics 6L

What is Big Data (BD), Modern Corporate need of BD Strategy, Main components of Big Data Solution, Basic Architecture of BD Solution, Introduction to Hadoop, Prototyping with any development board Data Analytics: Types of data analytics, Using Cloud Services to visualize live Data Streams. Data analytics using any platform like Amazon, Azure, Thingspeak or any other open source platform

Unit VI: Technological Aggregation & Case Studies 6L

Modern trends in IOT: Wearable, industrial standards, Open Data Management & API. Case studies, connected use cases in Real-life/Thematic areas – Smart Homes/Buildings, Smart Cities, Smart Industry, Smart Medical care, Smart Automation etc.

Text Book:

1. Arshdeep Bahga, Vijay Madisetti,, Internet of Things, A hands-on approach, Universities Press
2. Honbo Zhou, The Internet of Things in the Cloud: A Middleware Perspective, CRC Press, 2012

Reference Book:

1. David Easley and Jon Kleinberg, Networks, Crowds, and Markets: Reasoning About a Highly Connected World, Cambridge University Press, 2010.
2. Lyla B. Das, Embedded Systems: An Integrated Approach, Pearson.
3. Dieter Uckelmann, Mark Harrison, Florian Michahelles, Architecting the Internet of Things, Springer, 2011.
4. Olivier Hersent, Omar Elloumi and David Boswarthick, The Internet of Things: Applications to the Smart Grid and Building Automation, Wiley, 2012.
5. Olivier Hersent, David Boswarthick, Omar Elloumi , The Internet of Things – Key applications and Protocols, Wiley, 2012.
6. Barrie Sosinsky, Cloud Computing Bible, Wiley-India, 2010.
7. Adrian McEwen, Hakim Cassimally, Designing the Internet of Things, Wiley, 2014

ELECTIVE-I

Teaching Scheme:
Lectures: 3 Hrs/ Week

Examination Scheme:
In Semester Examination: Phase I: 30
End Semester Examination: Phase II: 70

Embedded System and RTOS

Course Objectives:

- To understand the embedded system design issues.
- To learn real time operating system concepts.
- To understand the Embedded Linux environment.
- To learn embedded software development and testing process.

Course Outcomes:

After successfully completing the course students will be able to

1. Get insight of design metrics of embedded systems to design real time applications to match recent trends in technology.
2. Understand Real time system concepts.
3. Understand Linux operating system and device drivers.
4. Get to know the hardware – software co-design issues and testing methodology for embedded system.

Course Contents:

Unit I: Introduction to Embedded Systems 6L

Introduction to Embedded Systems, Architecture, Classification and Characteristics of Embedded System, Design Process, Design Metrics and optimization of various parameters of embedded system. ARM9 architecture.ARM-CM3 Based Microcontroller LPC1768: Features, Architecture (Block Diagram & Its Description), System Control, Clock & Power Control, GPIO, Pin Connect Block.

Unit II: Real Time Systems Concepts 6L

Foreground/ Background systems, Critical section of code, Resource, Shared resource, multitasking, Task, Context switch, Kernel, Scheduler, Non-Preemptive Kernel, Preemptive Kernel, Reentrancy, Round robin scheduling, Task Priorities, Static & Dynamic Priority, Priority Inversion, Assigning task priorities, Mutual Exclusion, Deadlock, Clock Tick, Memory requirements, Advantages & disadvantages of real time kernels.

Unit III: µCOS II 6L

Features of µCOS II. Kernel structure. µCOS II RTOS services: Task management, Time management, Intertask Communication and Synchronization.

Unit IV: Embedded Linux Development Environment 6L

Need of Linux, Embedded Linux Today, Open Source and the GPL, BIOS Versus Boot loader, Anatomy of an Embedded System, Storage Considerations, Embedded Linux Distributions. Embedded

Development Environment, Cross-Development Environment, Host System Requirements, Hosting Target Boards. Development Tools, GNU Debugger, Tracing and Profiling Tools, Binary Utilities.

Unit V: Linux Kernel Construction 6L

Linux Kernel Background, Linux Kernel Construction, Kernel Build System, Kernel Configuration. Role of a Bootloader, Bootloader Challenges. A Universal Bootloader: Das UBoot. Porting U-Boot. Device Driver Concepts, Module Utilities, Driver Methods. Linux File System & Concepts.

Unit VI: Embedded Software Development, Testing Process and Tools 6L

Embedded Software development process and tools, Host and Target Machines, linking and Locating Software, Getting Embedded Software into the Target System, Issues in Harware- Software Design and Co-design. Testing on Host Machine, Simulators, Laboratory Tools. Case study of Embedded system like Automatic Chocolate Vending Machine, Mobile Phone, digital camera.

Text Books:

1. Jean J.Labrosse, "MicroC OS II, The Real-Time Kernel", 2nd edition, CMP Books.
2. Christopher Hallinan, "Embedded Linux Primer –A Practical, Real-World Approach "2nd edition, Prentice Hall.

Reference Books:

1. Raj Kamal, "Embedded Systems – Architecture, Programming and Design" 2nd edition, McGraw Hill.
2. Frank Vahid and Tony Givargis, "Embedded System Design – A Unified hardware/ Software introduction" 3rd edition, Wiley.

List of Experiments:

Group A: ARM7/ ARM Cortex- M3 & µCOS - II Based Experiments (any four)

1. Multitasking in µCOS II RTOS using minimum 3 tasks on ARM7/ ARM Cortex- M3.
2. Semaphore as signaling & Synchronizing on ARM7/ ARM Cortex- M3.
3. Mailbox implementation for message passing on ARM7/ ARM Cortex- M3.
4. Queue implementation for message passing on ARM7/ ARM Cortex- M3.
5. Implementation of MUTEX using minimum 3 tasks on ARM7/ ARM Cortex- M3.

Group B: ARM9 & LINUX Based Experiments (any four)

6. Download pre-configured Kernel Image, File System, boot loader to target device- ARM9.
7. Writing simple application using embedded Linux on ARM9.
8. Writing "Hello World" device Driver. Loading into & removing from Kernel on ARM9 board.
9. Write a program for I2C based RTC using embedded Linux on ARM9.
10. Using Device driver for GPIO, write a program to blink LED onARM9.

11. Write a program for external interrupt on ARM9.

VLSI Design

Course Objectives:

To understand CMOS technology and its application in VLSI Circuits.

- To design digital circuits using HDL.
- To implement digital circuits using FPGA.
- To design using CAD tools.

Course Outcomes:

After successfully completing the course students will be able to

1. Understand VLSI Design Flow.
2. Design advance digital circuit using HDL.
3. Understand the importance of CAD tools.

Course Contents:

Unit I: Introduction to VLSI Circuits **6L**

MOS Inverter: MOS Transistors, MOS Transistor Switches, CMOS Logic, Circuit and System Representations, Design Equations, Transistor Sizing, Voltage Transfer Characteristics, Power Dissipation, Noise Margin, Power Delay Product, Energy dissipation. Combinational MOS Logic Circuits: Pass Transistors/Transmission Gates; Designing with transmission gates.

Unit II: Digital Circuit Design and testing using HDL **6L**

Module, Entity, Architecture, Modelling styles, Design of sequential circuits, asynchronous and synchronous design issues, state machine modelling (Moore and Mealy machines), attributes, Generics, Basic test benches, Test bench structure, constrained random stimulus generation.

Unit III: CMOS Subsystem Design **6L**

Semiconductor memories, memory chip organization, Random Access Memories (RAM), Static RAM (SRAM), standard architecture, 6T cell, sense amplifier, address decoders, timings. Dynamic RAM (DRAM), different DRAM cells, refresh circuits, timings.

Unit IV: Floor Planning and Placement **6L**

Clock skew, Clock distribution techniques, clock jitter. Supply and ground bounce, power distribution techniques. Power optimization. Interconnect routing techniques; wire parasitic, Signal integrity issues. I/O architecture, pad design.

Unit V: Design and Verification with PLD's **6L**

Implementing Functions in FPGAs, Implementing Functions Using Shannon's Decomposition, Carry Chains in FPGAs, Cascade Chains in FPGAs, Examples of Logic Blocks in Commercial FPGAs, Dedicated Memory in FPGAs, Dedicated Multipliers in FPGAs, JTAG, Boundary scan, TAP Controller.

Unit VI: CAD Tools 6L

MOS Layers Stick/Layout Diagrams: Layout Design Rules, Issues of Scaling, Scaling factor for device parameters. Layout editors, Design rule checkers, circuit extractors – Hierarchical circuit extractors – Automatic layout tools, silicon compilers, modelling and extraction of circuit parameters from physical layout.

Text Book:

1. Neil H. Weste and Kamran, Principles of CMOS VLSI Design, Pearson Publication.

2. John F. Wakerly, Digital Design, Principles and Practices, Prentice Hall Publication.

Reference Book:

3. Douglas Perry, VHDL, McGraw Hill Publication.

4. Samir Palnitkar, Verilog HDL 2/e, Pearson Education.

5. Charles Roth, Digital System Design using VHDL, McGraw Hill Publication.

6. Preas, M. Lorenzatti, "Physical Design and Automation of VLSI Systems", The Benjamin Cummins Publishers, 1998.

7. R. Jacob Baker; Harry W.Li., David E. Boyce, CMOS Circuit Design, Layout and Simulation, IEEE Press, Prentice Hall of India.

8. M.Ciletti, Advanced Digital Design with Verilog HDL,Second Edition Pearson Education.

9. Sung-Mo (Steve) Kang, Yusuf Leblebici, CMOS Digital Integrated Circuits, Tata McGraw Hill Publication.

10. Computer Aided Logical Design with Emphasis on VLSI – Hill & Peterson, Wiley, 1993.

List of Experiments:

PART-A (Perform any four)

Modelling and Functional Simulation, synthesis and implementation on PLDs of the following digital circuits (with Xilinx/ ModelSim tools/Pyxis) using VHDL/Verilog Hardware Description Languages. (Two experiments are to be performed using VHDL and two using Verilog.)

1. Parity generator

2. Cyclic Encoder / Decoder

3. Read Only Memory (ROM)/ Random Access Memory (RAM) implementation

4. Mealy State Machine/Moore State Machine-examples

5. Arithmetic Multipliers using FSMs

6. Digital calculator

PART-B (Perform any four) Experiments shall be carried out using Mentor Graphics/Cadence Tools/Microwind

Schematic Entry/ Simulation / Layout/ DRC/PEX/Post Layout Simulation of:

1. CMOS Inverter
2. NAND Gate/ OR Gate
3. Flip Flops (T & D)
4. Register Cell
5. Adder Circuits

PART- C (Optional)

VLSI system design using IP generator-Vivado software

Information and Cyber Security

Course Objectives:

- To offer an understanding of principle concepts, central topics and basic approaches in information and cyber security.
- To know the basics of cryptography.
- To acquire knowledge of standard algorithms and protocols employed to provide confidentiality, integrity and authenticity.
- To enhance awareness about Personally Identifiable Information (PII), Information Management, cyber forensics.

Course Outcomes:

1. Gauge the security protections and limitations provided by today's technology.
2. Identify information security and cyber security threats.
3. Analyze threats in order to protect or defend it in cyberspace from cyber-attacks.
4. Build appropriate security solutions against cyber-attacks.

Course Contents:

Unit I: Security Basics **6L**

Introduction, Elements of Information Security, Security Policy, Techniques, Steps, Categories, Operational Model of Network Security, Basic Terminologies in Network Security. Threats and Vulnerability, Difference between Security and Privacy.

Unit II: Data Encryption Techniques And Standards **6L**

Introduction, Encryption Methods: Symmetric, Asymmetric, Cryptography, Substitution Ciphers. Transposition Ciphers, Stenography applications and limitations, Block Ciphers and methods of operations, Feistal Cipher, Data Encryption Standard (DES), Triple DES, DES Design Criteria, Weak Keys in DES Algorithms, Advance Encryption Standard (AES).

Unit III: Public Key And Management 6L

Public Key Cryptography, RSA Algorithm: Working, Key length, Security, Key Distribution, Deffie-Hellman Key Exchange, Elliptic Curve: Arithmetic, Cryptography, Security, Authentication methods, Message Digest, Kerberos, X.509 Authentication service. Digital Signatures: Implementation, Algorithms, Standards (DSS), Authentication Protocol.

Unit IV: Security Requirements 6L

IP Security: Introduction, Architecture, IPV6, IPv4, IPSec protocols, and Operations, AH Protocol, ESP Protocol, ISAKMP Protocol, Oakkey determination Protocol, VPN. WEB Security: Introduction, Secure Socket Layer (SSL), SSL Session and Connection, SSL Record Protocol, Change Cipher Spec Protocol, Alert Protocol, Handshake Protocol. Electronic Mail Security: Introduction, Pretty Good Privacy, MIME, S/MIME, Comparison. Secure Electronic Transaction (SET).

Unit V: Firewall And Intrusion 6L

Introduction, Computer Intrusions. Firewall Introduction, Characteristics and types, Benefits and limitations. Firewall architecture, Trusted Systems, Access Control. Intrusion detection, IDS: Need, Methods, Types of IDS, Password Management, Limitations and Challenges.

Unit V: Confidentiality And Cyber Forensic 6L

Introduction to Personally Identifiable Information (PII), Cyber Stalking, PII impact levels with examples Cyber Stalking, Cybercrime, PII Confidentiality Safeguards, Information Protection Law: Indian Perspective.

Text Books:

1. Bernard Menezes, “Network Security and Cryptography”, Cengage Learning India, 2014, ISBN No.: 8131513491
2. Nina Godbole, Sunit Belapure, “Cyber Security”, Wiley India, 2014, ISBN No.:978-81-345-2179-1

Reference Books:

1. Eoghan Casey, “Digital Evidence and Computer Crime Forensic Science, Computers and the Internet”, ELSEVIER, 2011, ISBN 978-0-12-374268-1
2. Atul Kahate, “Cryptography and Network Security”, Mc Graw Hill Publication, 2nd Edition, 2008, ISBN : 978-0-07-064823-4
3. William Stallings, “Cryptography and network security principles and practices”, Pearson, 6th Edition, ISBN : 978-93-325-1877-3
4. Forouzan, “Cryptography and Network Security (SIE)”, Mc Graw Hill, ISBN, 007070208X, 9780070702080
5. Dr. Nilakshi Jain-Digital Forensic: The Fascinating World of Digital Evidences-Wiley India-ISBN: 9788126565740

List of Experiments:

1. Implementation of S-DES
2. Implementation of S-AES
3. Implementation of Diffie-Hellman key exchange

4. Implementation of RSA.
5. Implementation of ECC algorithm.
6. **Mini Project 1:** SQL Injection attacks and Cross -Site Scripting attacks are the two most common attacks on web application. Develop a new policy based Proxy Agent, which classifies the request as a scripted request or query based request, and then, detects the respective type of attack, if any in the request. It should detect both SQL injection attack as well as the Cross-Site Scripting attacks.
7. **Mini Project 2:** This task is to demonstrate insecure and secured website. Develop a web site and demonstrate how the contents of the site can be changed by the attackers if it is http based and not secured. You can also add payment gateway and demonstrate how money transactions can be hacked by the hackers. Then support your website having https with SSL and demonstrate how secured website is.

Digital Image Processing

Course Objectives:

- To learn the fundamental concepts of Digital Image and video Processing.
- To study basic image and video processing operations.
- To understand image and video analysis algorithms.
- To expose students to current applications in the field of digital image and video processing.

Course Outcomes:

On completion of the course, student will be able to–

1. Develop and implement various mathematical operations on image.
2. Develop and implement algorithms for image enhancement and restoration.
3. Apply compression techniques for image and video processing.
4. Use segmentation and morphological operations for image processing applications.
5. Apply video processing algorithms for motion detection applications.

Course Contents:

Unit I: Digital Image Fundamentals **6L**

Steps in image processing, Human visual system, Sampling & quantization, Representing digital images, Spatial & gray-level resolution, Image file formats, Basic relationships between pixels, Distance Measures. Basic operations on images-image addition, subtraction, logical operations, scaling, translation, rotation. Image Histogram. Color fundamentals & models – RGB, HSI YIQ.

Unit II: Image Enhancement and Restoration **6L**

Spatial domain enhancement: Point operations-Log transformation, Power-law transformation, Piecewise linear transformations, Histogram equalization. Filtering operations- Image smoothing, Image sharpening. Frequency domain enhancement: 2D DFT, Smoothing and Sharpening in frequency

domain. Homomorphic filtering. Restoration: Noise models, Restoration using inverse filtering and Wiener filtering.

Unit III: Image Compression **6L**

Types of redundancy, Fidelity criteria, Lossless compression – Run length coding, Huffman coding, Bit-plane coding, Arithmetic coding. Introduction to DCT, Wavelet transform. Lossy compression – DCT based compression, Wavelet based compression. Image and Video Compression Standards – JPEG, MPEG.

Unit IV: Image Segmentation and Morphological Operations **6L**

Image Segmentation: Point Detections, Line detection, Edge Detection-First order derivative Prewitt and Sobel. Second order derivative – LoG, DoG, Canny. Edge linking, Hough Transform, Thresholding – Global, Adaptive. Otsu‟s Method. Region Growing, Region Splitting and Merging. Morphological Operations: Dilation, Erosion, Opening, Closing, Hit-or-Miss transform, Boundary Detection, Thinning, Thickening, Skeleton.

Unit V: Basics of Video Processing **6L**

Video formation, perception and representation: Principle of color video, video cameras, video display, pinhole model, CAHV model, Camera motion, Shape model, motion model, Scene model, two dimensional motion models. Three Dimensional Rigid Motion, Approximation of projective mapping

Unit VI: Motion estimation Techniques **6L**

Optical flow, motion representation, motion estimation criteria, optimization methods, pixel based motion estimation, Block matching algorithm, gradient based, Intensity matching, feature matching, frequency domain motion estimation, Depth from motion. Motion analysis applications: Video Summarization, video surveillance.

Text Book:

1. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Third Edition, - Pearson Education.
2. Digital Video processing, A Murat Tekalp, Prentice Hall.

References:

1. S Sridhar, “Digital Image Processing”, Oxford University Press.
2. Video Processing and Communications, Yao Wang, J. Osternann and Qin Zhang, Pearson Education.
3. Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins, “Digital Image Processing
4. Using MATLAB”, Second Edition, - Tata McGraw Hill Publication.
5. S Jayaraman, S Esakkirajan, T Veerakumar, “Digital Image Processing”, Tata McGraw Hill Publication.
6. “Handbook of Image and Video processing”, Al Bovik, Academic press, second Edition.

List of Experiments:

1. Conversion of 24 bit color image to 8 bit , 4 bit, 1 bit image.
2. Apply image negation and power-law correction operations on image.

3. Enhance image using histogram equalization and stretching.
4. Perform image smoothing and sharpening operations.
5. Detect image edges using Sobel, Prewitt and Roberts‟s operator.
6. Perform Morphological operations on binary images.
7. Compress image using DCT / Wavelet transform.
8. Apply Global and adaptive thresholding to an image.
9. Using frequency domain technique estimates the motion in video.
10. Implement algorithm for video boundary detection.

Note: Experiments are to be performed preferably using open source software.

ELECTIVE-II

Teaching Scheme:
Lectures: 3 Hrs/ Week

Examination Scheme:
In Semester Examination: Phase I: 30
End Semester Examination: Phase II: 70

Mobile Communication

Course Objectives:

- To understand switching techniques for voice and data traffic.
- To nurture students with knowledge of traffic engineering to design networks.
- To realize importance of cellular concepts and its propagation mechanism.
- To understand architecture of GSM system.
- To overview 4G LTE and 5G technologies.

Course Outcomes:

On completion of the course, students will be able to

1. Apply the concepts of switching technique and traffic engineering to design multistage networks.
2. Explore the architecture of GSM.
3. Differentiate thoroughly the generations of mobile technologies.

Course Contents:

Unit I - Switching techniques for Voice and Data **6L**

Switching techniques for Voice: Manual Switching System, Electronic Switching System and Time Division Switching. Single Stage networks, Gradings, Two stage and Three stage networks. Synchronization, Control of switching systems: Call processing Functions, Common Control, Reliability, Availability and Security. Switching techniques for Data: Circuit switching, Message Switching and packet switching in perceptive with mobile communication.

Unit II - Traffic Engineering and Signaling **6L**

Telecommunication Traffic: Unit of Traffic, Traffic measurement, A mathematical model, Lost- call systems: Theory, traffic performance, loss systems in tandem, traffic tables. Queuing systems: Erlang Distribution, probability of delay, Finite queue capacity, Systems with a single server, Queues in tandem, delay tables and application of delay formulae. Signaling: Customer line signaling. FDM carrier systems, PCM signaling, Inter-register signaling, Common channel signaling, CCITT signaling system and Digital customer line signaling.

Unit III: Cellular Concept **8L**

Introduction to cellular telephone system, Cellular concept : Expansion of mobile system capacity through frequency reuse, Cell geometry, Selection of cluster size, Cell splitting and sectoring, Coverage and capacity in cellular system and Handoff strategies. Propagation Mechanism: Free space and two ray propagation model, Basic propagation mechanism. Hata outdoor propagation model. Small Scale Fading and Multipath: Types of Small scale fading, Small scale multipath propagation, Impulse response model of multipath channel and Small scale multipath measurements.

Unit IV: GSM Fundamentals **8L**

Introduction, Architecture of GSM, characteristics of GSM standards, services, Radio transmission parameters in GSM System, Applications.

Unit V: GSM Channels and Services **8L**

Traffic and Logical Channels in GSM, GSM time hierarchy, GSM burst structure, Description of call setup procedure, Handover mechanism in GSM, Security in GSM. Data transmission in GSM: Data Services, SMS, HSCSD, GPRS, EDGE. Multiple Access Techniques-TDMA, CDMA and OFDMA.

Unit VI: Evolution of Mobile Technologies **6L**

Evolution of Mobile Generation and its comparison (GSM & CDMA), Overview of LTE: LTE basics, LTE frame structure, LTE Design parameters with Standardization and Architecture of LTE. Overview of 5 G Networks : Comparison of 4G and 5G technology, Opportunities and requirements in 5G network, Open Wireless Architecture of 5G network and Disruptive technologies for 5G.

Text Books

1. Thiagarajan Vishwanathan, ―Telecommunication Switching Systems and Networks‖; PHI Publications
2. Theodore Rappaport, ―Wireless Communications Principles and Practice‖ Second Edition, Pearson Education

Reference Books

1. Fei Hu, ―Opportunities in 5G Networks : A research& development perspective‖, CRC Press
2. J. E. Flood , ―Telecommunications Switching, Traffic and Networks‖, Pearson Education
3. Krzysztof Wesolowski, ―Mobile Communication Systems‖, Wiley Student Edition
4. John C. Bellamy, ―Digital Telephony‖, Third Edition; Wiley Publications
5. Mischa Schwartz, Mobile Wireless Communications‖, Cambridge University Press
6. Aditya Jagannatham, Principles of Modern Wireless Communication Systems

Robotics and Automation

Course Objectives:

The objective of this course is to impart knowledge about basic mathematics related to industrial robots for their control, design and application in robotics & automation Industries.

Course Outcomes:

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

1. Perform kinematic and dynamic analyses with simulation.
2. Design control laws for a simple robot.
3. Integrate mechanical and electrical hardware for a real prototype of robotic device.
4. Select a robotic system for given industrial application.

Course Contents:

Unit 1: Introduction to Robotics: 6L

Types and components of a robot, Classification of robots, Kinematics systems; Definition of mechanisms and manipulators, Degrees of Freedom

Unit 2: Robot Kinematics and Dynamics: 6L

Kinematic Modelling: Translation and Rotation Representation, Coordinate transformation, DH parameters, Forward and inverse kinematics, Jacobian, Singularity, and Statics.
Dynamic Modelling: Forward and inverse dynamics, Equations of motion using Euler-Lagrange formulation, Newton Euler formulation

Unit 3: Sensors 6L

Sensor: Contact and Proximity, Position, Velocity, Force, Tactile etc., Introduction to Cameras, Camera calibration, Geometry of Image formation, Euclidean/Similarity/Affine/Projective transformations, Vision applications in robotics.

Unit 4: Robot Actuation Systems: 6L

Actuators: Electric, Hydraulic and Pneumatic; Transmission: Gears, Timing Belts and Bearings, Parameters for selection of actuators.

Unit 5: Robot Control: 6L

Basics of control: open loop- closed loop, Transfer functions, Control laws: P, PD, PID Linear and Non-linear controls

Unit 6: Control Hardware and Interfacing: 6L

1) Embedded systems: Microcontroller Architecture and integration with sensors, actuators, components, Programming, Applications for Industrial robot - programming in – VAL II
2) AI in Robotics: Applications in unmanned systems, defense, medical, industries, etc.
3) Robotics and Automation for Industry 4.0
4) Robot safety and social robotics.

Text Books

1) Introduction to Robotics : J. Craig , Pearson
2) Robot Dynamics and Control, Spong & Vidyasagar, Mc Graw Hill
3) Robotics Engineering : R. Klafter, PHI
4) Robotics : Subir K Saha , Mc Graw Hill
5) Industrial Robotics : M. P. Groover, Ashish Dutta , McGraw Hill

Software Testing and Quality Assurance

Course Objectives:

- Introduce basic concepts of software testing
- Understand white box, block box, object oriented, web based and cloud testing
- Know in details automation testing and tools used for automation testing
- Understand the importance of software quality and assurance software systems development.

Course Outcomes:

On completion of the course, student will be able to–

1. Describe fundamental concepts in software testing such as manual testing, automation testing and software quality assurance.
2. Design and develop project test plan, design test cases, test data, and conduct test operations
3. Apply recent automation tool for various software testing for testing software
4. Apply different approaches of quality management, assurance, and quality standard to software system
5. Apply and analyze effectiveness Software Quality Tools Course Contents

Course contents:

Unit I: Introduction 6L

Introduction, historical perspective, Definition, Core Components, Quality View, Financial Aspect, Customers suppliers and process, Total Quality Management(TQM), Quality practices of TQM, Quality Management through- Statistical process Control, Cultural Changes, Continual Improvement cycle, quality in different areas, Benchmarking and metrics, Problem Solving Techniques, Problem Solving Software Tools. Software Quality- Introduction, Constraints of Software product Quality assessment, Customer is a King, Quality and Productivity Relationship, Requirements of Product, Organization Culture, Characteristics of Software, Software Development Process, Types of Product, Criticality Definitions, Problematic areas of SDLC, Software Quality Management, Why Software has defects, Processes related to Software Quality, Quality Management System‟s Structure, Pillars of Quality Management System, Important aspects of quality management.

Unit II: Test Planning and Management 6L

Review of Fundamentals of Software Testing, Testing during development life cycle, Requirement Traceability matrix, essentials, Work bench, Important Features of Testing Process, Misconceptions, Principles, salient and policy of Software testing, Test Strategy, Test Planning, Testing Process and number of defects found, Test teem efficiency, Mutation testing, challenges, test team approach,

Process problem faced, Cost aspect, establishing testing policy, methods, structured approach, categories of defect, Defect/ error/ mistake in software, Developing Test Strategy and Plan, Testing process, Attitude towards testing, approaches, challenges, Raising management awareness for testing, skills required by tester.

Unit III: Software Test Automation **6L**

What is Test Automation, Terms used in automation, Skills needed for automation, What to automate, scope of automation, Design and Architecture of automation, Generic requirement for Test Tool, Process Model for Automation, Selecting Test Tool, Automation for XP/Agile model, Challenges in Automation, Data-driven Testing. Automation Tools like JUnit, Jmeter

Unit IV: Selenium Tool **6L**

Introducing Selenium, Brief History of The Selenium Project, Selenium‟s Tool Suite, Selenium- IDE, Selenium RC, Selenium Webdriver, Selenium Grid, Test Design Considerations

Unit V: Quality Management **6L**

Software Quality, Software Quality Dilemma, Achieving Software Quality, Software Quality Assurance. Elements of SQA, SQA Tasks, Goals, and Metrics, Formal Approaches to SQA, Statistical Software Quality Assurance, Six Sigma for Software Engineering, ISO 9000 Quality Standards, SQA Plan.

Unit VI: Software Quality Tools **6L**

Total Quality Management, Product Quality Metrics, In process Quality Metrics, Software maintenance, Ishikawa's 7 basic tools, Checklists, Pareto diagrams, Histogram, Run Charts, Scatter diagrams, Control chart, Cause Effect diagram. Defect Removal Effectiveness and Process Maturity Level.

Text Books:

1. M G Limaye, “Software Testing Principles, Techniques and Tools”, Tata McGraw Hill, ISBN: 9780070139909 0070139903.
2. Srinivasan Desikan, Gopalswamy Ramesh, “Software Testing Principles and Practices”, Pearson, ISBN-10: 817758121X

Reference Books:

1. Naresh Chauhan, “Software Testing Principles and Practices ", OXFORD, ISBN-10: 0198061846. ISBN-13: 9780198061847.
2. Stephen Kan, “Metrics and Models in Software Quality Engineering”, Pearson, ISBN-10: 0133988082; ISBN-13: 978-0133988086.

Artificial Intelligence and Machine Learning

Course Objectives:

- To understand human learning aspects and relate it with machine learning concepts.
- To understand nature of the problem and apply machine learning algorithm.
- To find optimized solution for given problem.

Course Outcomes:

On completion of the course, student will be able to,

1. Distinguish different learning based applications
2. Apply different preprocessing methods to prepare training data set for machine learning.
3. Design and implement supervised and unsupervised machine learning algorithm.
4. Implement different learning models
5. Learn Meta classifiers and deep learning concepts Course Contents

Course contents:

Unit I Introduction to Machine learning 6L

Classic and adaptive machines, Machine learning matters, Beyond machine learning-deep learning and bio inspired adaptive systems, Machine learning and Big data. Important Elements of Machine Learning- Data formats, Learnability, Statistical learning approaches, Elements of information theory.

Unit II Feature Selection 6L

Scikit- learn Dataset, Creating training and test sets, managing categorical data, Managing missing features, Data scaling and normalization, Feature selection and Filtering, Principle Component Analysis(PCA)-non negative matrix factorization, Sparse PCA, Kernel PCA. Atom Extraction and Dictionary Learning.

Unit III Regression 6L

Linear regression- Linear models, A bi-dimensional example, Linear Regression and higher dimensionality, Ridge, Lasso and ElasticNet, Robust regression with random sample consensus, Polynomial regression, Isotonic regression, Logistic regression-Linear classification, Logistic regression, Implementation and Optimizations, Stochastic gradient descendent algorithms, Finding the optimal hyper-parameters through grid search, Classification metric, ROC Curve.

Unit IV Naïve Bayes and Support Vector Machine 6L

Bayes‟ Theorom, Naïve Bayes‟ Classifiers, Naïve Bayes in Scikit- learn- Bernoulli Naïve Bayes, Multinomial Naïve Bayes, and Gaussian Naïve Bayes. Support Vector Machine(SVM)- Linear Support Vector Machines, Scikit- learn implementation- Linear Classification, Kernel based classification, Non- linear Examples. Controlled Support Vector Machines, Support Vector Regression.

Unit V Decision Trees and Ensemble Learning 6L

Decision Trees- Impurity measures, Feature Importance. Decision Tree Classification with Scikit-learn, Ensemble Learning-Random Forest, AdaBoost, Gradient Tree Boosting, Voting Classifier. Clustering Fundamentals- Basics, K-means: Finding optimal number of clusters, DBSCAN, Spectral Clustering. Evaluation methods based on Ground Truth- Homogeneity, Completeness, Adjusted Rand Index. Introduction to Meta Classifier: Concepts of Weak and eager learner, Ensemble methods, Bagging, Boosting, Random Forests.

Unit VI Clustering Techniques 6L

Hierarchical Clustering, Expectation maximization clustering, Agglomerative Clustering-Dendrograms, Agglomerative clustering in Scikit- learn, Connectivity Constraints. Introduction to Recommendation Systems- Naïve User based systems, Content based Systems, Model free

collaborative filtering-singular value decomposition, alternating least squares. Fundamentals of Deep Networks-Defining Deep learning, common architectural principles of deep networks, building blocks of deep networks.

Text Books

1. Giuseppe Bonaccorso, "Machine Learning Algorithms", Packt Publishing Limited, ISBN- 10: 1785889621, ISBN-13: 978-1785889622
2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioners Approach", O"REILLY, SPD, ISBN: 978-93-5213-604-9, 2017 Edition 1st.

Reference Books

1. Ethem Alpaydin, " Introduction to Machine Learning", PHI 2nd Edition-2013, ISBN 978-0- 262-01243-0
2. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", Cambridge University Press, Edition 2012, ISBN-10: 1107422221; ISBN-13: 978- 1107422223
3. Tom Mitchell "Machine Learning" McGraw Hill Publication, ISBN: 0070428077 9780070428072
4. Nikhil Buduma, "Fundamentals of Deep Learning", O"REILLY publication, second edition 2017, ISBN: 1491925612

LAB PRACTICE –I

Teaching Scheme:
Practical: 4 Hrs./ Week

Examination Scheme:
Termwork (TW): 25
Practical (PR): 50

Advanced Techniques for Electrical Vehicle

List of Experiments:

1. Study of major components of Electric vehicles.
2. Study and test function of Mechatronics component of Electric vehicle.
3. Function of Motor and Controller of Electrical Vehicles.
4. Study the function of accelerator and impact on motor speed and torque.
5. Study of load variations on various motors of Electrical Vehicles on different gradient/load.
6. Study of battery and its parameter at loading and unloading of motor.
7. Study of chargers and effect on charging time by change in voltage, current and battery type.
8. Study the trouble shooting and testing waveforms of different drive trains of Electrical Vehicles and Battery parameter.
9. Visit to any Electrical Vehicles manufacturing plant.

Internet of Things

List of Experiments:

Perform any 4 experiments from group A and Any 4 from Group B, Any 1 from Group C

Group A

1. Study of Connectivity and configuration of Arduino board circuit with basic peripherals, LEDs. Understanding GPIO and its use in program.
2. Interfacing touch sensor, LDR, with Arduino board.
3. Interfacing of DC motor and servo motor with Arduino Board.
4. Interfacing temperature and humidity sensor using I2C protocol with Arduino board.
5. Interfacing of ultrasonic sensor with Arduino
6. Wireless communication between Arduino and PC using Bluetooth protocol.
7. Interfacing Wifi module with Arduino.
8. Interfacing Xbee module with Arduino.

Group B

9. Study of different operating systems for Raspberry-Pi /Beagle board. Understanding the process of OS installation on Raspberry-Pi /Beagle board.
10. Study of Connectivity and configuration of Raspberry-Pi /Beagle board circuit with basic peripherals, LEDS. Understanding GPIO and its use in program.
11. Understanding the connectivity of Raspberry-Pi /Beagle board circuit with temperature sensor. Write an application to read the environment temperature. If temperature crosses a threshold value, the application indicated user using LEDs.
12. Understanding the connectivity of Raspberry-Pi /Beagle board circuit with IR sensor. Write an application to detect obstacle and notify user using LEDs.
13. Understanding and connectivity of Raspberry-Pi /Beagle board with IR sensor. Write an application to for obstacle detection.
14. Understanding and connectivity of Raspberry-Pi /Beagle board with a Zigbee module. Write a network application for communication between two devices using Zigbee.
15. Write a server application to be deployed on Raspberry-Pi /Beagle board. Write client applications to get services from the server application.
16. Create a simple web interface for Raspberry-pi/Beagle board to control the connected LEDs remotely through the interface.

Group C

17. Develop a Real time application like smart home with following requirements: When user enters into house the required appliances like fan, light should be switched ON. Appliances should also get controlled remotely by a suitable web interface. The objective of this application is student should construct complete Smart application in group.
18. Develop a Real time application like a smart home with following requirements: If anyone comes at door the camera module automatically captures his image send it to the email account of user or send notification to the user. Door will open only after user's approval.

LAB PRACTICE –II

Teaching Scheme: **Examination Scheme:**

Practical: 4 Hrs./ Week

Termwork (TW): 25
Practical (PR): 50

Elective-I

Experiments to be chosen based on Elective I

MOOC

Teaching Scheme:
Practical: Hours/ Week

Examination Scheme:
Termwork (TW): 50

Course Objectives:

- To promote interactive user forums to support community interactions among students, professors, and experts
- To promote learn additional skills anytime and anywhere
- To enhance teaching and learning on campus and online

Course Outcomes:

On completion of the course, learner will acquire additional knowledge and skill.

MOOCs (Massive Open Online Courses) provide affordable and flexible way to learn new skills, pursue lifelong interests and deliver quality educational experiences at scale. Whether you're interested in learning for yourself, advancing your career or leveraging online courses to educate your workforce, SWYAM, NPTEL, edx or similar ones can help.

World's largest SWAYAM MOOCs, a new paradigm of education for anyone, anywhere, anytime, as per your convenience, aimed to provide digital education free of cost and to facilitate hosting of all the interactive courses prepared by the best more than 1000 specially chosen faculty and teachers in the country. SWAYAM MOOCs enhances active learning for improving lifelong learning skills by providing easy access to global resources.

SWAYAM is a programme initiated by Government of India and designed to achieve the three cardinal principles of Education Policy viz., access, equity and quality. The objective of this effort is to take the best teaching learning resources to all, including the most disadvantaged. SWAYAM seeks to bridge the digital divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy.

This is done through an indigenous developed IT platform that facilitates hosting of all the courses, taught in classrooms from 9th class till post-graduation to be accessed by anyone, anywhere at any time. All the courses are interactive, prepared by the best teachers in the country and are available, free of cost to the residents in India. More than 1,000 specially chosen faculty and teachers from across the Country have participated in preparing these courses.

The courses hosted on SWAYAM is generally in 4 quadrants – (1) video lecture, (2) specially prepared reading material that can be downloaded/printed (3) self-assessment tests through tests and quizzes and (4) an online discussion forum for clearing the doubts. Steps have been taken to enrich the learning experience by using audio-video and multi-media and state of the art pedagogy / technology. In order to ensure best quality content are produced and delivered, seven National Coordinators have been appointed: They are NPTEL for engineering and UGC for post-graduation education.

Guidelines:

Instructors are requested to promote students to opt for courses (not opted earlier) with proper mentoring. The departments will take care of providing necessary infrastructural and facilities for the learners.

References:

1. https://swayam.gov.in/
2. https://onlinecourses.nptel.ac.in/
3. https://www.edx.org

Project Stage I

Teaching Scheme:
Practical: 4 Hrs./ Week

Examination Scheme:
Termwork (TW): 50
ORAL (OR): 50

Course Objectives:

- To Apply the knowledge for solving realistic problem
- To develop problem solving ability
- To Organize, sustain and report on a substantial piece of team work over a period of several months
- To Evaluate alternative approaches, and justify the use of selected tools and methods
- To Reflect upon the experience gained and lessons learned,
- To Consider relevant social, ethical and legal issues,
- To find information for yourself from appropriate sources such as manuals, books, research journals and from other sources, and in turn increase analytical skills.
- To Work in TEAM and learn professionalism.

Course Outcomes:

On completion of the course, student will be able to–

1. Solve real life problems by applying knowledge.
2. Analyze alternative approaches, apply and use most appropriate one for feasible solution.
3. Write precise reports and technical documents in a nutshell.

4. Participate effectively in multi-disciplinary and heterogeneous teams exhibiting team work, Inter-personal relationships, conflict management and leadership quality.

Guidelines

Project work Stage – I is an integral part of the Project work. In this, the student shall complete the partial work of the Project which will consist of problem statement, literature review, SRS, Model and Design. The student is expected to complete the project at least up to the design phase. As a part of the progress report of project work Stage-I, the candidate shall deliver a presentation on the advancement in Technology pertaining to the selected project topic. The student shall submit the duly certified progress report of Project work Stage-I in standard format for satisfactory completion of the work by the concerned guide and head of the Department/Institute.

The examinee will be assessed by a panel of examiners of which one is necessarily an external examiner. The assessment will be broadly based on work undergone, content delivery, presentation skills, documentation, question-answers and report.

AUDIT COURSE 7

SEMESTER – II

Computer Network

Teaching Scheme:
Lectures: 3 Hrs/ Week

Examination Scheme:
In Semester Examination: Phase I: 30
End Semester Examination: Phase II: 70

Course Objectives:

- To understand the fundamental concepts of networking standards, protocols and technologies.
- To learn different techniques for framing, error control, flow control and routing.
- To learn role of protocols at various layers in the protocol stacks.
- To learn network programming.
- To develop an understanding of modern network architectures from a design and performance perspective

Course Outcomes:

On completion of the course, student will be able to–

1. Analyze the requirements for a given organizational structure to select the most appropriate networking architecture and technologies
2. Demonstrate LAN and WAN protocol behavior using Modern Tools.
3. Analyze data flow between peer to peer in an IP network using Application, Transport and Network Layer Protocols.
4. Illustrate applications of Computer Network capabilities, selection and usage for various sectors of user community.
5. Develop Client-Server architectures and prototypes by the means of correct standards and technology.

Course Contents

Unit I: Physical Layer 7L

Introduction of LAN; MAN; WAN; PAN, Ad-hoc Network, Network Architectures: Client-Server; Peer To Peer; Distributed and SDN, OSI Model, TCP/IP Model, Topologies: Star and Hierarchical; Design issues for Layers, Transmission Mediums: CAT5, 5e, 6, OFC and Radio Spectrum, Network Devices: Bridge, Switch, Router, Brouter and Access Point, Manchester and Differential Manchester Encodings; IEEE802.11: Frequency Hopping (FHSS) and Direct Sequence (DSSS)

Unit II : Logical Link Control 7L

Design Issues: Services to Network Layer, Framing, Error Control and Flow Control. Error Control: Parity Bits, Hamming Codes (11/12-bits) and CRC. Flow Control Protocols: Unrestricted Simplex, Stop and Wait, Sliding Window Protocol, WAN Connectivity: PPP and HDLC

Unit III: Medium Access Control 6L

Channel allocation: Static and Dynamic, Multiple Access Protocols: Pure and Slotted ALOHA, CSMA, WDMA, IEEE 802.3 Standards and Frame Formats, CSMA/CD, Binary Exponential Back -off algorithm, Fast Ethernet, Gigabit Ethernet, IEEE 802.11a/b/g/n and IEEE 802.15 and IEEE 802.16 Standards, Frame formats, CSMA/CA.

Unit IV: Network Layer **7L**

Switching techniques, IP Protocol, IPv4 and IPv6 addressing schemes, Subnetting, NAT, CIDR, ICMP, Routing Protocols: Distance Vector, Link State, Path Vector, Routing in Internet: RIP ,OSPF, BGP, Congestion control and QoS, , MPLS, Mobile IP, Routing in MANET : AODV, DSR

Unit V: Transport Layer **7L**

Services, Berkley Sockets, Addressing, Connection establishment, Connection release, Flow control and buffering, Multiplexing, TCP, TCP Timer management, TCP Congestion Control, Real Time Transport protocol(RTP), Stream Control Transmission Protocol (SCTP), Quality of Service (QoS), Differentiated services, TCP and UDP for Wireless.

Unit VI: Application Layer **6L**

Domain Name System (DNS), Hyper Text Transfer Protocol (HTTP), Email: SMTP, MIME, POP3, Webmail, FTP, TELNET, Dynamic Host Control Protocol (DHCP), Simple Network Management Protocol (SNMP).

Text Books:

1. Andrew S. Tenenbaum, “Computer Networks”,5th Edition, PHI, ISBN 81-203-2175-8.
2. Fourauzan B., "Data Communications and Networking", 5th Edition, Tata McGraw- Hill, Publications, 2006

References:

1. Kurose, Ross “Computer Networking a Top Down Approach Featuring the Internet”, Pearson; 6th edition (March 5, 2012), ISBN-10: 0132856204
2. Matthew S. Gast “802.11 Wireless Networks”, O’Reilly publications; 2nd Edition.
3. C. Siva Ram Murthy and B. S. Manoj, “Ad Hoc Wireless Networks: Architectures and Protocols” Prentice Hall, 2004
4. Holger Karl and Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks”, Wiley, ISBN: 0-470-09510-5

Cloud Computing

Teaching Scheme:
Lectures: 3 Hrs/ Week

Examination Scheme:
In Semester Examination: Phase I: 30
End Semester Examination: Phase II: 70

Course Objectives:

- To become familiar with Cloud Computing and its ecosystem.
- To learn basics of virtualization and its importance.
- To evaluate in-depth analysis of Cloud Computing capabilities.

- To give technical overview of Cloud Programming and Services.
- To understand security issues in cloud computing.
- To be exposed to Ubiquitous Cloud and Internet of Things.

Course Outcomes:

1. To understand the need of Cloud based solutions.
2. To understand Security Mechanisms and issues in various Cloud Applications
3. To explore effective techniques to program Cloud Systems.
4. To understand current challenges and trade-offs in Cloud Computing.
5. To find challenges in cloud computing and delve into it to effective solutions.
6. To understand emerging trends in cloud computing.

Course Contents

UNIT I: FUNDAMENTALS OF CLOUD COMPUTING 6L

Origins and Influences, Basic Concepts and Terminology, Goals and Benefits, Risks and Challenges, Roles and Boundaries, Cloud Characteristics, Cloud Delivery Models, Cloud Deployment Models, Federated Cloud/Inter cloud, Types of Clouds.

Cloud-Enabling Technology: Broadband Networks and Internet Architecture, Data Center Technology, Virtualization Technology, Web Technology, Multitenant Technology, Service Technology.

UNIT II: Virtualization and Common Standards in Cloud Computing 6L

Implementation Levels of Virtualization, Virtualization Structures/Tools and Mechanisms, Types of Hypervisors, Virtualization of CPU, Memory, and I/O Devices, Virtual Clusters and Resource Management Virtualization for Data-Center Automation.

Common Standards: The Open Cloud Consortium, Open Virtualization Format, Standards for Application Developers: Browsers (Ajax), Data (XML, JSON), Solution Stacks (LAMP and LAPP), Syndication (Atom, Atom Publishing Protocol, and RSS), Standards for Security.

UNIT III: CLOUD PROGRAMMING, ENVIRONMENTS AND APPLICATIONS 6L

Features of Cloud and Grid Platforms, Programming Support of Google App Engine, Programming on Amazon AWS and Microsoft Azure, Emerging Cloud Software Environments, Understanding Core Open Stack Ecosystem.

Applications: Moving application to cloud, Microsoft Cloud Services, Google Cloud Applications, Amazon Cloud Services, Cloud Applications (Social Networking, E-mail, Office Services, Google Apps, and Customer Relationship Management).

UNIT IV: CLOUD SECURITY AND ISSUES 6L

Cloud Security Mechanisms: Encryption, Hashing, Digital Signature, Public Key Infrastructure (PKI), Identity and Access Management (IAM), Single Sign-On (SSO), Hardened Virtual Server Images.

Cloud Issues: Stability, Partner Quality, Longevity, Business Continuity, Service-Level Agreements, Agreeing on the Service of Clouds, Solving Problems, Quality of Service, Regulatory Issues and Accountability.

UNIT V: UBIQUITOUS CLOUDS AND THE INTERNET OF THINGS 6L

Cloud Trends in Supporting Ubiquitous Computing, Performance of Distributed Systems and the Cloud, Enabling Technologies for the Internet of Things (RFID, Sensor Networks and ZigBee Technology, GPS), Innovative Applications of the Internet of Things (Smart Buildings and Smart Power Grid, Retailing and Supply-Chain Management, Cyber-Physical System), Online Social and Professional Networking.

UNIT VI: FUTURE OF CLOUD COMPUTING 6L

How the Cloud Will Change Operating Systems, Location-Aware Applications, Intelligent Fabrics, Paints, and More, The Future of Cloud TV, Future of Cloud-Based Smart Devices, Faster Time to Market for Software Applications, Home-Based Cloud Computing, Mobile Cloud, Autonomic Cloud Engine, Multimedia Cloud, Energy Aware Cloud Computing, Jungle Computing.

Docker at a Glance: Process Simplification, Broad Support and Adoption, Architecture, Getting the Most from Docker, The Docker Workflow.

Text Books

1. Jack J. Dongarra, Kai Hwang, Geoffrey C. Fox, Distributed and Cloud Computing: From Parallel
2. Processing to the Internet of Things, Elsevier, ISBN :9789381269237, 9381269238, 1st Edition.
3. Thomas Erl, Zaigham Mahmood and Ricardo Puttini, Cloud Computing: Concepts, Technology &
4. Architecture, Pearson, ISBN :978 9332535923, 9332535922, 1st Edition.

Reference Books

1. Srinivasan, J. Suresh, Cloud Computing: A practical approach for learning and implementation, Pearson, ISBN :9788131776513.
2. Brian J.S. Chee and Curtis Franklin, Jr., Cloud Computing: Technologies and Strategies of the Ubiquitous Data Center, CRC Press, ISBN :9781439806128.
3. Kris Jamsa, Cloud Computing: Saas, Paas, Iaas, Virtualization, Business Models, Mobile, Security,and More, Jones and Bartlett, ISBN :9789380853772.
4. John W. Ritting house, James F. Ransome, Cloud Computing Implementation, Management, andSecurity, CRC Press, ISBN : 978 1439806807, 1439806802.
5. Karl Matthias, Sean P. Kane, Docker: Up and Running, OReilly, ISBN:9781491917572, 1491917571.
6. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, Mastering Cloud Computing: Foundations and Applications Programming, McGraw Hill, ISBN: 978 1259029950, 1259029956.
7. Barrie Sosinsky, Cloud Computing Bible, Wiley, ISBN: 978 8126529803.
8. Gautham Shroff, Enterprise Cloud Computing, Cambridge, ISBN: 9781107648890.

ELECTIVE-III

Teaching Scheme:
Lectures: 3 Hrs/ Week

Examination Scheme:
In Semester Examination: Phase I: 30
End Semester Examination: Phase II: 70

Electronics System Design

Course Objectives:

- To understand the stages of system (hardware/ software) design and development.
- To learn the different considerations of analog, digital and mixed circuit design.
- To be acquainted with methods of PCB design and different tools used for PCB Design.
- To understand the importance of testing in product design cycle.
- To understand the processes and importance of documentation.

Course Outcomes:

After successfully completing the course students will be able to

1. Understand various stages of hardware, software and PCB design.
2. Analyze reliability of product design.
3. Design and test various electronic products/modules.
4. Suggest special design considerations and understand need of documentation.

Course contents:

Unit I: Introduction 6L

Stages in product design- Market survey, Product Specifications (Electrical, Mechanical, Environmental), R&D and Engineering Prototypes, Pilot Production Batch, Environmental testing, Documentation, Manufacturing. Electronic Products Classification: Consumer, Industrial and Military, their peculiarities in terms of Cost/performance ratio and Reliability. Case study of a typical Industrial Product. Reliability: Bath tub curve, Measures taken (at Component and Product level and various soldering techniques including Surface Mount Technology) to improve reliability.

Unit II: Hardware Design- Analog Circuits 6L

Analog signal conditioning: Factors affecting choice of Op-Amps in signal conditioning, applications, Need for Instrumentation Amplifiers- Case study of an Instrumentation amplifier circuit designed using discrete components and special purpose IC. Error budget analysis with case study. Interpretation of ADC and DAC specifications from design view point, considerations in selecting references (Vref for ADC).

Unit III: Hardware Design- Digital Circuits 6L

Interfacing of LED, HB LED, LCD, Keyboard, Relays (Electromagnetic and Solid State) with Microcontrollers. Comparative study of different Microcontroller architectures, Factors affecting choice of Microcontroller for particular application with case study of one application. Comparison of buses and protocols used in electronic products- I2C, SPI, CAN, LIN, Flexray.

Unit IV: Software Design and Testing for Electronic Product 6L

Different approaches for development of application software for Electronic Product. Assemblers, Factors affecting choice between Assembly language and High level languages like C and C++. Documentation

practices and templates for above software. Debugging tools and techniques for software- Features of Simulators, ICE, IDE.

Unit V: PCB Design and EMI/EMC 6L

PCB Design practices for Analog and Mixed signal circuits: Ground Loops, Precision circuits, shielding and guarding. PCB Design Practices for High speed digital circuits, Signal integrity and EMC, EMI/EMC testing standards and compliance for PCB design.

Unit VI: Fault Finding and Testing 6L

Analyses- DC/ Operating Point Analysis, AC (Frequency Response), Transient, Sensitivity, Monte Carlo. Debugging/ Fault finding- Features and limitations of Analog CRO, DSO, Spectrum analyzer, Logic Analyzer and Mixed Signal Oscilloscopes in finding hardware/software faults. Environmental Testing: Need for Environmental Testing. Temperature, Humidity, Vibration and Shock tests. Introduction to EMI/EMC testing standards and compliance.

Text Books:

1. Bernhard E. Bürdek, History, Theory and Practice of Product Design, Springer Science, 2005.
2. Paul Horowitz, Art of Electronics, Cambridge University Press.

Reference Books:

1. Howard Johnson, Martin Graham, High-speed Digital design- A Handbook of Black Magic, Prentice Hall Publication.
2. G. Pahl and W. Beitz J. Feldhusen and K.-H. Grote, Engineering Design – A Systematic Approach_, Springer, 2007.
3. Tim Williams, EMC for Product Designers, Elsevier, Fourth edition 2007.
4. Jerry C Whitaker, The Electronics Handbook, CRC Press, IEEE Press, ISBN 0- 8493-8345-5.
5. David Bailey, Practical Radio Engineering and Telemetry for Industry, Elsevier, ISBN 07506 58037.
6. Pressman, Software Engineering - A Practitioner's Approach.
7. David Bailey, Practical Radio Engineering & Telemetry for Industry, Elsevier, ISBN 07506 58037.
8. Domine Lenders, Johan van der Tang, Cicero S. Vaucher , Circuit Design for RF Transceivers, Kluwer Academic Publishers, 2003.

List of Experiments:

1. Design and implement low dropout regulated power supply (Estimation of current requirement)
2. Design of SPAN ZERO circuit.
3. Design and implement Transducer interface using Wheatstone bridge.
4. Study of Error budget analysis of instrumentation amplifier or any other complicated circuit using ADC/ DAC.
5. Design Data Acquisition System (DAS) using appropriate Microcontroller.
6. PCB Design for Mixed Signal Circuit (Involving ADC and Signal Conditioning). Test the circuit using MSO.
7. DC and AC analysis of given circuit.
8. Sensitivity analysis for given circuit.
9. Reliability calculations from given data.

10. Visit to product based industry to study various processes.

Optical Fiber Communication

Course Objectives:

- To understand the about the various optical fiber modes, configuration and transmission characteristics of optical fibers.
- To learn about the various optical sources, detectors and transmission techniques.
- To explore various idea about optical fiber measurements and various coupling techniques.
- To enrich the knowledge about optical communication systems and networks.

Course Outcomes:

After successfully completing the course, students will be able to

- Understand advantages and applications of optical communication.
- Identify different optical devices with their operating principle.
- Formulate optical communication problem for synthesis.

Course Contents:

Unit I: Fundamentals of FOC **6L**

Basic block diagram of Optical Fiber Communication system, Principles of light propagation through a fiber, Different types of fibers and their characteristics, Attenuation, Distortion, Pulse broadening in GI fibers, Mode coupling, Coupling losses, Material dispersion, Dispersion in single-mode and multimode fibers, Connectors & splicers.

Unit II: Optical Sources **6L**

Working principle and characteristics of sources (LED, LASER),Tunable lasers, Quantum well lasers , Charge capture in Quantum well lasers, Multi Quantum well Laser diodes, Surface Emitting Lasers: Vertical cavity Surface Emitting Lasers

Unit III: Optical Detectors **6L**

Working principle and characteristics of detectors (PIN, APD),Material requirement for RCEPD, Resonant cavity enhancement (RCE) Photo Detector ,Noise analysis in detectors, coherent and noncoherent detection, receiver structure, bit error rate of optical receivers, and receiver performance

Unit IV: Fiber Optic Components **6L**

Fiber fabrication (VAD,MCVD), fiber joints, fiber connectors, splices Couplers, multiplexers, filters, fiber gratings, Fabry Perot filters, switches and wavelength converters, Optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA.

Unit V: Optical Link **6L**

Introduction, Point to point links, system considerations, link power budget, and rise time budget. RF over fiber, key link parameters, Radio over fiber links, microwave photonics.

Unit VI: Optical Communication Systems and Networks 6L

System design consideration: Point to Point link design,Link power budget, rise time budget, WDM, Passive DWDM Components, Elements of optical networks, SONET/SDH ,Optical Interfaces-SONET/SDH Rings and Networks-High speed light wave Links, OADM configuration, Optical ETHERNET Soliton

Text Books:

1. Optical Fiber Communication -Gerd Keiser, 4th Ed., MGH, 2008.
2. Optical Fiber Communications--John M. Senior, Pearson Education. 3rd Impression, 2007.

Reference Books:

1. Fiber optics communications-Harold Kolimbiris
2. Introduction to optical fibers, Cheri, McGraw Hill.
3. An introduction to fiber optics, A. Ghatak and K.Thyagrajan, Cambridge Univ, press 10
4. Optical fiber communication and sensors-M. Arumugam Agencies, 20002 optic sensors.
5. Fiber optic communication-Joseph C Palais: 4th Edition, Pearson Education.

List of Experiments:

1. DC Characteristics of LED and PIN Photo diode
2. Mode Characteristics of Fibers.
3. Characteristics of light detector.
4. Measurement of Numerical Aperture.
5. Measurement of attenuation of optical Fiber Cable of Various lengths.
6. Measurement of connector and bending losses.
7. Study of any two optical instruments: Optical Power Meter, OTDR, OSA etc.
8. Fiber optic Analog and Digital Link- frequency response(analog) and eye diagram (digital) .

Data Mining and Ware Housing

Course Objectives:

- To understand the fundamentals of Data Mining
- To identify the appropriateness and need of mining the data
- To learn the preprocessing, mining and post processing of the data
- To understand various methods, techniques and algorithms in data mining

Course Outcomes:

On completion of the course the student should be able to-

1. Apply basic, intermediate and advanced techniques to mine the data
2. Analyze the output generated by the process of data mining
3. Explore the hidden patterns in the data

4. Optimize the mining process by choosing best data mining technique

Course Contents

Unit I: Introduction 7L

Data Mining, Data Mining Task Primitives, Data: Data, Information and Knowledge; Attribute Types: Nominal, Binary, Ordinal and Numeric attributes, Discrete versus Continuous Attributes; Introduction to Data Preprocessing, Data Cleaning: Missing values, Noisy data; Data integration: Correlation analysis; transformation: Min-max normalization, z-score normalization and decimal scaling; data reduction: Data Cube Aggregation, Attribute Subset Selection, sampling; and Data Discretization: Binning, Histogram Analysis

Unit II: Data Warehouse 7L

Data Warehouse, Operational Database Systems and Data Warehouses(OLTP Vs OLAP), A Multidimensional Data Model: Data Cubes, Stars, Snowflakes, and Fact Constellations Schemas; OLAP Operations in the Multidimensional Data Model, Concept Hierarchies, Data Warehouse Architecture, The Process of Data Warehouse Design, A three-tier data warehousing architecture, Types of OLAP Servers: ROLAP versus MOLAP versus HOLAP.

Unit III: Measuring Data Similarity and Dissimilarity 6L

Measuring Data Similarity and Dissimilarity, Proximity Measures for Nominal Attributes and Binary Attributes, interval scaled; Dissimilarity of Numeric Data: Minskowski Distance, Euclidean distance and Manhattan distance; Proximity Measures for Categorical, Ordinal Attributes, Ratio scaled variables; Dissimilarity for Attributes of Mixed Types, Cosine Similarity.

Unit IV: Association Rules Mining 7L

Market basket Analysis, Frequent item set, Closed item set, Association Rules, a-priori Algorithm, Generating Association Rules from Frequent Item sets, Improving the Efficiency of a-priori, Mining Frequent Item sets without Candidate Generation: FP Growth Algorithm; Mining Various Kinds of Association Rules: Mining multilevel association rules, constraint based association rule mining, Meta rule-Guided Mining of Association Rules.

Unit V: Classification 7L

Introduction to: Classification and Regression for Predictive Analysis, Decision Tree Induction, Rule-Based Classification: using IF-THEN Rules for Classification, Rule Induction Using a Sequential Covering Algorithm. Bayesian Belief Networks, Training Bayesian Belief Networks, Classification Using Frequent Patterns, Associative Classification, Lazy Learners-k-Nearest-Neighbor Classifiers, Case-Based Reasoning.

Unit VI: Multiclass Classification 6L

Multiclass Classification, Semi-Supervised Classification, Reinforcement learning, Systematic Learning, Wholistic learning and multi-perspective learning. Metrics for Evaluating Classifier Performance: Accuracy, Error Rate, precision, Recall, Sensitivity, Specificity; Evaluating the Accuracy of a Classifier: Holdout Method, Random Sub sampling and Cross-Validation

Text Books:

1. Han, Jiawei Kamber, Micheline Pei and Jian, “Data Mining: Concepts and Techniques”, Elsevier Publishers, ISBN:9780123814791, 9780123814807.
2. Parag Kulkarni, “Reinforcement and Systemic Machine Learning for Decision Making” by Wiley-IEEE Press, ISBN: 978-0-470-91999-6

References Books:

1. Matthew A. Russell, "Mining the Social Web: Data Mining Facebook, Twitter, LinkedIn, Google+, GitHub, and More" , Shroff Publishers, 2nd Edition, ISBN: 9780596006068
2. Maksim Tsvetovat, Alexander Kouznetsov, "Social Network Analysis for Startups:Finding connections on the social web", Shroff Publishers , ISBN: 10: 1449306462

Human Computer Interface

Course Objectives:

- To design, implement and evaluate effective and usable Human Computer Interfaces.
- To describe and apply core theories, models and methodologies from the field of HCI.
- Learn a variety of methods for evaluating the quality of a user interface
- To implement simple graphical user interfaces based on principles of HCI.

Course Outcomes:

On completion of the course, student will be able to–

1. Evaluate the basics of human and computational abilities and limitations.
2. Inculcate basic theory, tools and techniques in HCI.
3. Apply the fundamental aspects of designing and evaluating interfaces.
4. Apply appropriate HCI techniques to design systems that are usable by people

Course Contents

Unit I Foundations of Human–Computer Interaction 7L

What is HCI – design, models, evaluation, Need to understand people, computers and methods. Basic human abilities - vision, hearing, touch, memory.

Computers – speed, interfaces, widgets, and effects on interaction. Humans – Memory, Attention Span, Visual Perception, psychology, ergonomics. Understanding Users.

Methods for evaluation of interfaces with users: goals of evaluation, approaches, ethics, introspection, extracting the conceptual model, direct observation, constructive interaction, interviews and questionnaires, continuous evaluation via user feedback and field studies, choosing an evaluation method.

Unit II: The Design Process 7L

Interaction Design Basics, Interaction Styles. HCI in the Software Process. HCI design principles and rules: design principles, principles to support usability, golden rules and heuristics, HCI patterns,

design rules, HCI design standards. Direct Manipulation - Overview, Scope, Applications. Universal Design, User-centered design, task analysis/GOMS, Graphic Design

Unit III: Implementation **6L**

Implementation Tools, Technology and change designing for the Web, designing for portable devices. Handling errors and Designing Help. Prototyping and UI Software.

Unit IV: Evaluation and User Support **7L**

Evaluation of User Interfaces. Web Browsers - Fonts, Color Palette, Color Depth, Resolution, Layout, Size, Orientation. Mobile devices issues – design, limitations, what next. User Support.

Unit V: Users Models **7L**

Predictive Models, Cognitive Models. Interaction with Natural Languages, Next Generation Interface. Socio-organizational Issues and Stakeholder Requirements. Heuristic Evaluation, Evaluation with Cognitive Models, Evaluation with Users.

Unit VI: Task Models and Dialogs **7L**

Task Analysis, DOET (Design of Everyday Things). Design Dialogs Notations, Warnings, and Error messages. Model-based Evaluation. User Testing, Usability Testing, User Acceptance Testing.

Text Books:

1. Alan J, Dix. Janet Finlay, Rusell Beale, "Human Computer Interaction", Pearson Education, 3rd Edition, 2004, ISBN 81-297-0409-9
2. Jenny Preece, Rogers, Sharp, “Interaction Design-beyond human-computer interaction”, WILEY-INDIA, ISBN 81-265-0393-9

Reference Books:

1. Jonathan Lazar, Jinjuan Feng, Harry Hochheiser, “Research Methods in Human-Computer Interaction", Third Edition, Morgan Kaufmann, 2017, ISBN: 9780128053904.
2. Mary Beth Rosson and John M. Carroll, “Usability Engineering: Scenario-Based Development of Human-Computer Interaction”, Morgan Kaufmann, 2001, ISBN-13: 978-1558607125

ELECTIVE-IV

Teaching Scheme:
Lectures: 3 Hrs/ Week

Examination Scheme:
In Semester Examination: Phase I: 30
End Semester Examination: Phase II: 70

Software Defined Radio

Course Objectives:

- To understand ―Modern Radio Communication System ― that can be reconfigured To understand GNU Radio
- To understand how SDR platform provides easy access to wireless network system

- To understand how unlike simulation in Communication Projects, SDR allows easy access to both PHY and MAC layer
- To understand the concept of Cognitive Radio and Spectrum sharing

Course Outcomes:

On completion of the course, student will be able to

1. Compare SDR with traditional Hardware Radio HDR.
2. Implement modern wireless system based on OFDM, MIMO & Smart Antenna.
3. Build experiment with real wireless waveform and applications, accessing both PHY and
4. MAC, Compare SDR versus MATLAB and Hardware Radio Work on open projects and explore their capability to build their own communication System.

Course Contents:

Unit I: Introduction to SDR and RF Implementation 6L

Introduction to SDR, Need of SDR, Principles of SDR , Basic Principle and difference in Analog radio and SDR, SDR characteristics, required hardware specifications, Software/Hardware platform, GNU radio -What is GNU radio, GNU Radio Architecture, Hardware Block of GNU,GNU software , MATLAB in SDR , Radio Frequency Implementation issues, Purpose of RF front End, Dynamic Range ,RF receiver Front End topologies, Flexibility of RF chain with software radio, Duplexer ,Diplexer ,RF filter ,LNA ,Image reject filters , IF filters , RF Mixers Local Oscillator , AGC, Transmitter Architecture and their issues, Sampling theorem in ADC, Noise and distortion in RF chain, Pre-distortion

Unit II: SDR Architecture 7L

Architecture of SDR-Open Architecture, Software Communication Architecture, Transmitter Receiver Homodyne/heterodyne architecture, RF front End, ADC, DAC, DAC/ADC Noise Budget, ADC and DAC Distortion, Role of FPGA/CPU/GPU in SDR, Applications of FPGA in SDR, Design Principles using FPGA, Trade –offs in using DSP, FPGA and ASIC, Power Management Issues in DSP, ASIC, FPGA

Unit III: Multi Rate Signal Processing 6L

Sample timing algorithms, Frequency offset estimation and correction, Channel Estimation, Basics of Multi Rate, Multi Rate DSP, Multi Rate Algorithm, DSP techniques in SDR, OFDM in SDR

Unit IV: Smart/MIMO Antennas using Software Radio 6L

Smart Antenna Architecture, Vector Channel Modeling , Benefits of Smart Antenna Phased Antenna Array Theory, Adaptive Arrays, DOA Arrays, Applying Software Radio Principles to Antenna Systems, Beam forming for systems-Multiple Fixed Beam Antenna Array, Fully Adaptive Array , Relative Benefits and Trade-offs OF Switched Beam and Adaptive Array, Smart Antenna Algorithms , Hardware Implementation of Smart Antennas, MIMO -frequency, time, sample Synchronization, Space time block coding-Space Time Filtering, Space Time Trellis Coding.

Case Study: Principles of MIMO-OFDM

Unit V: Cognitive Radio 6L

Cognitive Radio Architecture, Dynamic Access Spectrum, Spectrum Efficiency, Spectrum Efficiency gain in SDR and CR ,Spectrum Usage, SDR as a platform for CR, OFDM as PHY layer ,OFDM Modulator, OFDM Demodulator, OFDM Bandwidth, Benefits of OFDM in CR, Spectrum Sensing in CR, CR Network

Unit VI: Applications of SDR 7L

Application of SDR in Advance Communication System-Case Study, Challenges and Issues, Implementation, Parameter Estimation –Environment, Location, other factors, Vertical Handoff, Network Interoperability.

Case Study:

1) CR for Public Safety –PSCR , Modes of PSCR, Architecture of PSCR

2) Beagle board based SDR 3) Embedded PCSR using GNU radio

Text Books:

1. Jeffrey. H. Reed ,Software Radio : A Modern Approach to Radio Engineering, Pearson LPE
2. Markus Dillinge, KambizMadani, Nancy Alonistioti, Software Defined Radio :Architectures ,Systems and Functions ,Wiley

Reference Books:

1. Tony .J. Rouphael, RF and DSP for SDR, Elsevier Newness Press ,2008
2. Dr.TajStruman,Evaluation of SDR –Main Document
3. SDR –Handbook, 8th Edition , PENTEK
4. Bruce a. Fette, Cognitive Radio Technology, Newness, Elsevier

Wireless Sensor Network

Course Objectives:

- To learn basic concepts of wireless sensor networks.
- To be familiar with architecture and protocols used in wireless sensor networks.
- To provide knowledge of deployment and security issues of wireless sensor networks.

Course Outcomes:

On completion of the course, students will be able to

- Explain various concepts and terminologies used in WSN.
- Describe importance and use of radio communication and link management in WSN.
- Explain various wireless standards and protocols associated with WSN.
- Recognize importance of localization and routing techniques used in WSN.
- Understand techniques of data aggregation and importance of security in WSN.
- Examine the issues involved in design and deployment of WSN.

Course Contents:

Unit I: Introduction 6L

What are Wireless Sensor Networks, Wireless Sensor Node, Anatomy of a Sensor Node, Architecture of WSN, Performance metrics in WSN, types of WSN.

Unit II: Radio Communication & Link Management 6L

Radio Waves and Modulation/ Demodulation, Properties of Wireless Communications, Medium Access Protocols, Wireless Links Introduction, Properties of Wireless Links, Error Control, Naming and Addressing, Topology Control.

Unit III: Wireless Standards & Protocol Stack 6L

WSN Standards- IEEE802.15.4 low rate WPAN, Zigbee, Wireless HART, ISA 100.11a, 6LoWPAN, IEEE802.15.3, Wibree, BLE, Zwave, ANT, Insteon, Wavenis, Protocol stack of WSNs, Cross Layer Protocol Stack.

Unit IV: Localization & Routing 6L

Localization: Localization Challenges and Properties, Deployment Schemes, Proximity Schemes, Ranging Schemes, Range-Based Localization, Range-Free Localization, Routing Basics, Routing Metrics, Routing Protocols, Full-Network Broadcast, Location-Based Routing, Directed Diffusion, Collection Tree Protocol, Zigbee, Multi-Hop Communications.

Unit V: Data Aggregation & Security 6L

Clustering Techniques, In-Network Processing and Data Aggregation, Compressive Sampling, Security Issues in Wireless Sensor Networks, Attacks, Defensive Measures, Security requirements and threat model.

Unit VI: Designing & Deploying WSN Applications 6L

Designing and Deploying WSN Applications, Early WSN Deployments, General Problems, General Testing and Validation, Requirements Analysis, Top-Down Design Process, Bottom-Up Implementation Process.

Text Books:

1. Dargie W. and Poellabauer C., "Fundamentals of Wireless Sensor Networks: Theory and Practice," John Wiley and Sons.
2. Anna Hac, "Wireless Sensor Network Designs," John Wiley and Sons.
3. Holger Karl and Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks,” John Wiley and Sons.

Reference Books:

1. Edgar H. Callaway Jr. and Edgar H. Callaway, "Wireless Sensor Networks: Architectures and Protocols," CRC Press.
2. Sohraby K., Minoli D. and Znati T., "Wireless Sensor Networks: Technology, Protocols and Applications,” John Wiley and Sons.

Design and Analysis of Algorithm

Course Objectives:

- To develop problem solving abilities using mathematical theories
- To analyze the performance of algorithms
- To study algorithmic design strategies

Course Outcomes:

On completion of the course, student will be able to–

1. Formulate the problem
2. Analyze the asymptotic performance of algorithms
3. Decide and apply algorithmic strategies to solve given problem
4. Find optimal solution by applying various methods

Course Contents

Unit I: Fundamentals 7L

The Role of Algorithms in Computing - What are algorithms, Algorithms as technology, Evolution of Algorithms, Design of Algorithm, Need of Correctness of Algorithm, Confirming correctness of Algorithm – sample examples, Iterative algorithm design issues

Unit II: Models and Design 7L

Functional Model – Features, Recursive processes, Scope rules, Tail recursion, Checking correctness of Iterative process. Imperative Model – Basics, Specifications and Prototyping, Stepwise Refinement, Proof Rules – Basics, For loops, Goto and Exit loops, Functions and Procedures, Problem Solving using Greedy strategy - Knapsack problem, Huffman code generation algorithm

Unit III: Abstract Algorithms 7L

Dynamic Programming, Divide and Conquer, Greedy strategy, Branch-n-Bound, Natural Algorithms – Evolutionary Algorithms and Evolutionary Computing, Introduction to Genetic Algorithm, Simulated Annealing, Artificial Neural Network and Tabu Search.

Unit IV: Complexity Theory 7L

Complexity theory – Counting Dominant operators, Growth rate, upper bounds, asymptotic growth, O, Ω, Θ, o and ω notations, polynomial and non-polynomial problems, deterministic and non-deterministic algorithms, P-class problems, NP-class of problems, Polynomial problem reduction NP complete problems- vertex cover and 3-SAT and NP hard problem - Hamiltonian cycle

Unit V: Amortized Analysis 7L

Amortized Analysis – Binary, binomial and Fibonacci heaps, Dijkstra's Shortest path algorithm, Splay Trees, Time-Space tradeoff, Introduction to Tractable and Non-tractable Problems, Introduction to Randomized and Approximate algorithms, Embedded Algorithms: Embedded system scheduling (power optimized scheduling algorithm), sorting algorithm for embedded systems.

Unit VI: Multithreaded and Distributed Algorithms 7L

Multithreaded Algorithms - Introduction, Performance measures, Analyzing multithreaded algorithms, Parallel loops, Race conditions. Problem Solving using Multithreaded Algorithms - Multithreaded matrix multiplication, Multithreaded merge sort. Distributed algorithms - Introduction, Distributed breadth first search, Distributed Minimum Spanning Tree. String Matching- Introduction, The naive string matching algorithm, The Rabin-Karp algorithm Books:

Text Books:

1. Parag Himanshu Dave, Himanshu Bhalchandra Dave, " Design And Analysis Of Algorithms", PEARSON Education, ISBN 81-7758-595-9
2. Gilles Brassard, Paul Bratley, Fundamentals of Algorithmics, PHI, ISBN 978-81-203-1131-2

Reference Books:

1. Michael T. Goodrich, Roberto Tamassia , Algorithm Design: Foundations, Analysis and Internet Examples, Wiley, ISBN 978-81-265-0986-7
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, Introduction to Algorithms, MIT Press; ISBN 978-0-262-03384-8
3. Horowitz and Sahani, "Fundamentals of Computer Algorithms", 2ND Edition. University Press, ISBN: 978 81 7371 6126, 81 7371 61262
4. Rajeev Motwani and Prabhakar Raghavan, "Randomized Algorithns", Cambridge University Press, ISBN: 978-0-521-61390-3
5. Dan Gusfield, "Algorithms on Strings, Trees and Sequences", Cambridge University Press,ISBN:0-521-67035-7

Software Engineering

Course Objectives:

- To learn and understand the principles of Software Engineering
- To be acquainted with methods of capturing, specifying, visualizing and analyzing software requirements.
- To apply Design and Testing principles to S/W project development.
- To understand project management through life cycle of the project.
- To understand software quality attributes.

Course Outcomes:

On completion of the course, student will be able to–

- Decide on a process model for a developing a software project
- Classify software applications and Identify unique features of various domains
- Design test cases of a software system.
- Understand basics of IT Project management.
- Plan, schedule and execute a project considering the risk management.
- Apply quality attributes in software development life cycle. Course Contents

Course Contents:

Unit I Introduction to Software Engineering, Software Process Models 7L

Software Engineering Fundamentals: Nature of Software, Software Engineering Principles, The Software Process, Software Myths. Process Models :A Generic Process Model, Prescriptive Process Models: The Waterfall, Incremental Process(RAD), Evolutionary Process, Unified Process, Concurrent. Advanced Process Models & Tools: Agile software development: Agile methods, Plan-driven and agile development, Extreme programming Practices, Testing in XP, Pair programming. Introduction to agile tools: JIRA, Kanban, Case Studies: An information system (mental health-care system), wilderness weather system.

Unit II Software Requirements Engineering& Analysis 7L

Requirements Engineering: User and system requirements, Functional and non-functional requirements, Types & Metrics, A spiral view of the requirements engineering process. Software Requirements Specification (SRS): The software requirements Specification document, The structure of SRS, Ways of writing a SRS, structured & tabular SRS for an insulin pump case study, Requirements elicitation & Analysis: Process, Requirements validation, Requirements management. Case Studies: The information system.

Case study - Mental health care patient management system (MHC-PMS).

Unit III: Design Engineering 6L

Design Process & quality, Design Concepts, The design Model, Pattern-based Software Design. Architectural Design :Design Decisions, Views, Patterns, Application Architectures, Modeling Component level Design: component, Designing class based components, conducting component-level design, User Interface Design: The golden rules, Interface Design steps & Analysis, Design Evaluation, Case Study: Web App Interface Design.

Unit IV Project Management: Process, Metrics, Estimations & Risks 7L

Project Management Concepts: The Management Spectrum, People, Product, Process, Project, The W5HH Principle, Metrics in the Process and Project Domains, Software Measurement : size & function oriented metrics(FP & LOC), Metrics for Project and Software Quality, Project Estimation :Observations on Estimation, Project Planning Process, Software Scope and feasibility, Resources: Human Resources, Reusable software, Environmental Resources. Software Project Estimation, Decomposition Techniques, Empirical Estimation Models: Structure, COCOMO II, Estimation of Object-oriented Projects, Specialized Estimation Case Study: Software Tools for Estimation, Project Scheduling: Basic Concepts, Defining a Task Set for the Software Project, Defining Task Network, Scheduling with time-line charts, Schedule tracking Tools:- Microsoft Project, Daily Activity Reporting & Tracking (DART)

Unit V: Project management: risk management, configuration management, maintenance & reengineering 6L

Project Risk Management : Risk Analysis & Management: Reactive versus Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection, Risk Refinement, Risk Mitigation, Risks Monitoring and Management, The RMMM plan for case study project Software Configuration Management : The SCM repository, SCM process, Configuration management for WebApps, Case study: CVS and Subversion Tools, Visual Source Safe from Microsoft & Clear Case. Maintenance &

Reengineering: Software Maintenance, Software Supportability, Reengineering, Business Process Reengineering, Software Reengineering, Reverse Engineering, Restructuring, Forward Engineering

Unit VI: Software Testing 7L

Introduction to Software Testing, Principles of Testing, Testing Life Cycle, Phases of Testing, Types of Testing, Verification & Validation, Defect Management, Defect Life Cycle, Bug Reporting, GUI Testing, Test Management and Automation

Text Books:

1. Roger Pressman, "Software Engineering: A Practitioner's Approach", McGraw Hill, ISBN 0–07–337597–7
2. Ian Sommerville, " Software Engineering", Addison and Wesley, ISBN 0-13-703515-2

Reference Books:

1. Carlo Ghezzi, "Fundamentals of Software Engineering", Prentice Hall India, ISBN-10: 0133056996
2. Rajib Mall, "Fundamentals of Software Engineering", Prentice Hall India, ISBN-13: 978-8120348981
3. Pankaj Jalote, "An Integrated Approach to Software Engineering", Springer, ISBN 13: 9788173192715.
4. S K Chang, "Handbook of Software Engineering and Knowledge Engineering", World Scientific, Vol I, II, ISBN: 978-981-02-4973-1
5. Tom Halt, "Handbook of Software Engineering", Clanye International, ISBN- 10: 1632402939

Open Elective

Lab Practice III

Teaching Scheme:
Practical: 2 Hrs./ Week

Examination Scheme:
Termwork (TW): 25
Practical (PR): 50

Computer Network

List of Experiments:

(Perform any 8 experiments)

1. Study of network commands & IP address configurations.
2. Study of Cable tester for fault detection of UTP-CAT5 Cross / Straight LAN cable.

3. Implementation of LAN using star topology and connectivity between two computers using cross over UTP CAT5 cable. (Cisco Packet Tracer)
4. Installation and configuration of Web Server and hosting web page using HTML programming. (Cisco Packet Tracer)
5. Installation and configuration of Proxy Server.
6. Installation and configuration of FTP server for FTP communication.
7. Installation and configuration of Telnet server for Telnet Communication. (Teamviewer)
8. Write a program in „C" for Encryption and Decryption (RSA Algorithm).
9. Write a program in „C" for Shortest Path algorithm.
10. Connectivity of LAN computers to Internet using Dial-Up modem/leased line Modem /Mobile Handset. (Installation and configuration).
11. Installation of Suitable Protocol Analyzing software and Analysis of Intranet activities. (Wireshark)
12. Configure RIP using packet Tracer.
13. Study of any network simulation tools-To create a network with three nodes & establish a TCP connection between node 0 & node 1 such that node 0 will send TCP packet to node 2 via node 1.

Lab Practice IV

Teaching Scheme:
Practical: 2 Hrs./ Week

Examination Scheme:
Termwork (TW): 25
Practical (PR): 50

Elective-III

Experiments to be chosen based on Elective III.

Project Stage II

Teaching Scheme:
Practical: 12 Hrs./ Week

Examination Scheme:
Termwork (TW): 100
ORAL (OR): 50

Course Objectives:

- To follow SDLC meticulously and meet the objectives of proposed work
- To test rigorously before deployment of system
- To validate the work undertaken
- To consolidate the work as furnished report.

Course Outcomes:

On completion of the course, student will be able to–

1. Show evidence of independent investigation
2. Critically analyze the results and their interpretation.
3. Report and present the original results in an orderly way and placing the open questions in the right perspective.
4. Link techniques and results from literature as well as actual research and future research lines with the research.
5. Appreciate practical implications and constraints of the specialist subject

Guidelines

In Project Work Stage–II, the student shall complete the remaining project work which consists of Selection of Technology and Tools, Installations, UML implementations, testing, Results, performance discussions using data tables per parameter considered for the improvement with existing/known algorithms/systems and comparative analysis and validation of results and conclusions. The student shall prepare and submit the report of Project work in standard format for satisfactory completion of the work that is the duly certified by the concerned guide and head of the Department/Institute.

AUDIT COURSE 8