Faculty of Science & Technology
Savitribai Phule Pune University, Pune
Maharashtra, India

Curriculum
for
Second Year of Information Technology
(2019 Course)
(With effect from AY 2020-21)

I N D E X

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Savitribai Phule Pune University
Second Year of Information Technology Engineering(2019 Course)
(With effect from Academic Year 2020-21)

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
214441	Discrete Mathematics	03	-	01	30	70	25	-	-	125	03	--	01	04
214442	Logic Design and Computer Organization	03	-	-	30	70	-	-	-	100	03	-	-	03
214443	Data Structures and Algorithms	03	-	-	30	70	-	-	-	100	03	-	-	03
214444	Object Oriented Programming	03	-	-	30	70	-	-	-	100	03	-	-	03
214445	Basics of Computer Network	03	-	-	30	70	-	-	-	100	03	-	-	03
214446	Logic Design Computer Organization Lab	-	02	-	-	-	25	25	-	50	-	01	-	01
214447	Data Structures and Algorithms Lab	-	04	-	-	-	25	25	-	50	-	02	-	02
214448	Object Oriented Programming Lab	-	04	-	-	-	25	25	-	50	-	02	-	02
214449	Soft Skill Lab	-	02	-	-	-	25	-	-	25	-	01	-	01
214450	Mandatory Audit Course 3	-	-	-	-	-	-	-	-	-	Non Credit			-
Total		15	12	01	150	350	125	75	--	700	15	06	01	22

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

Note: Students of S.E. (Information Technology) can opt any one of the audit course from the list of audit courses prescribed by BoS (Information Technology)

#Mandatory Audit Course 3:

214450A- Ethics and values in IT
214450B - Quantitative Aptitude and Logical Reasoning
214450C- Language Study- Japanese- Module
214450D-Cyber Security and Law

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Savitribai Phule Pune University, Pune
Second Year of Information Technology Engineering (2019 Course)
(With effect from Academic Year 2020-21)

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
207003	Engineering Mathematics- III	03	-	01	30	70	25	-	-	125	03	--	01	04
214451	Processor Architecture	03	-	-	30	70	-	-	-	100	03	-	-	03
214452	Database Management System	03	-	-	30	70	-	-	-	100	03	-	-	03
214453	Computer Graphics	03	-	-	30	70	-	-	-	100	03	-	-	03
214454	Software Engineering	03	-	-	30	70	-	-	-	100	03	-	-	03
214455	Programming Skill Development Lab	-	02	-	-	-	25	25	-	50	-	01	-	01
214456	Database Management System Lab	-	04	-	-	-	25	25		50	-	02	-	02
214457	Computer Graphics Lab	-	02	-	-	-	-	25	-	25	-	01	-	01
214458	Project Based Learning	-	04	-	-	-	50	-	-	50	-	02	-	02
214459	Mandatory Audit Course 4	-	-	-	-	-	-	-	-	-	Non Credit			-
Total		15	12	01	150	350	125	75	-	700	15	06	01	22

Abbreviations:

TH: Theory TW: Term Work PR: Practical

OR: Oral TUT: Tutorial

Note: Students of S.E. (Information Technology) can opt any one of the audit course from the list of audit courses prescribed by BoS (Information Technology)

#Mandatory Audit Course 4:

- **214459A - Water Supply and Treatment**
- **214459B - Language Study- Japanese- Module II**
- **214459C - Waste Management and Pollution Control**
- **214459D - Intellectual Property Rights**

SEMESTER – IV

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Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
207003: Engineering Mathematics III

Teaching Scheme:	Credit Scheme:	Examination Scheme:	
Theory (TH) : 03 hrs/week	03	Mid_Semester:	30 Marks
Tutorial (TUT) :01 hrs/ week	01	End_Semester:	70 Marks
		TW :	25 Marks

Prerequisites: Differential & Integral calculus, Taylor series, Differential equations of first order and first degree, Fourier series, Collection, Classification and Representation of data.

Course Objectives:

1. To make the students familiarize with concepts and techniques in Linear differential equations, Fourier transform& Z-transform, Statistical methods, Probability theory and Numerical methods.2. 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:

On completion of this course student will be able to –

- **CO1:** Solve Linear differential equations, essential in modelling and design of computer-based systems.
- **CO2:** Apply concept of Fourier transform and Z-transform and its applications to continuous and discrete systems and image processing.
- **CO3:** Apply Statistical methods like correlation& regression analysis and probability theory for data analysis and predictions in machine learning.
- **CO4:** Solve Algebraic &Transcendental equations and System of linear equations using numerical techniques.
- **CO5:** Obtain Interpolating polynomials, numerical differentiation and integration, numerical solutions of ordinary differential equations used in modern scientific computing.

COURSE CONTENTS

Unit I	Linear Differential Equations	06 hrs

LDE of n^{th} order with constant coefficients, Complementary function, Particular integral, General method, Short methods, Method of variation of parameters, Cauchy's & Legendre's DE, Simultaneous & Symmetric simultaneous DE.

Unit II	Transforms	06 hrs

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

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

Unit III	Statistics	06 hrs

Measures of central tendency, Measures of dispersion, Coefficient of variation, Moments, Skewness and Kurtosis, Curve fitting: fitting of straight line, parabola and related curves,

Correlation and Regression, Reliability of Regression Estimates.		
Unit IV	**Probability and Probability Distributions**	**06 hrs**
Probability, Theorems on Probability, Bayes theorem, Random variables, Mathematical Expectation, Probability density function, Probability distributions: Binomial, Poisson, Normal and Hyper geometric, Sampling distributions, Test of Hypothesis: Chi-Square test, t-test.		
Unit V	**Numerical Methods**	**06 hrs**
Numerical Solution of Algebraic and Transcendental equations: Bisection, Secant, Regula-Falsi, Newton–Raphson and Successive Approximation Methods, Convergence and Stability. Numerical Solutions of System of linear equations: Gauss elimination, LU Decomposition, Cholesky, Jacobi and Gauss-Seidel Methods.		
Unit VI	**Numerical Methods**	**06hrs**
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 and Predictor-Corrector methods		
Text Books:		
1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill 2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publication, Delhi		
Reference Books:		
1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10ed, Wiley India 2. M. D. Greenberg, "Advanced Engineering Mathematics", 2edPearson Education 3. Peter V. O'Neil , "Advanced Engineering Mathematics", 7ed,Cengage Learning 4. S. L. Ross , "Differential Equations", 3e, Wiley India 5. Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 5e, Elsevier Academic Press 6. M. K. Jain, S. R. K. Iyengar And R. K. Jain1, "Numerical Methods for Scientific and Engineering Computation", 5e,New Age International Publication		
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.		

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Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214451: Processor Architecture

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory(TH): 03hrs/week	03	Mid_Semester: 30 Marks End_Semester: 70 Marks

Prerequisites: Logic Design & Computer Organization

Course Objectives :

1. To study architectural details of PIC 18 microcontroller.
2. To study applications of PIC through various interfacing devices.

Course Outcomes :

On completion of this course student will be able to –

CO1: Apprehend architecture and memory organization of PIC 18 microcontroller.
CO2: Implement embedded C programming for PIC 18.
CO3: Use concepts of timers and interrupts of PIC 18.
CO4: Demonstrate real life applications using PIC 18.
CO5: Analyze architectural details of ARM processor.

COURSE CONTENTS

Unit I	PIC Microcontroller Architecture	06 hrs
Introduction: introduction to microcontroller, Brief history of microcontrollers, Difference between microprocessor and microcontroller, Criteria for selection of microcontroller, **PIC18FXXX:** Features and architecture, comparison of PIC 18 series microcontrollers; PIC18F458/452 Pin out connection, Registers of PIC18F, **Program and data memory organization**: The Program Counter and Programmable ROM space in the PIC, File register and Access bank, Bank switching in PIC18; **Addressing modes:** Addressing modes with instruction example, Oscillator configurations, Reset operations, Brownout reset, Watchdog timer, Power down modes & Configuration registers.		
Mapping of Course Outcomes for Unit I	**CO1,CO2**	

Unit II	PIC I/O Ports and Timer	06 hrs
I/O Port: I/O Port structure with programming: I/O Port structure, I/O Port programming, I/O Bit manipulation Programming. **Timer/Counter:** Registers used for Timer/Counter operation, Delay calculations, Programming of Timers using Embedded C.		
Case Study	**Traffic light signal controller using Timer/Counter**	
Mapping of Course Outcomes for Unit II	**CO2, CO3**	

Unit III	PIC Interrupts & Interfacing-I	06 hrs

PIC Interrupts: Interrupt Vs Polling, IVT, Steps in executing interrupt, Sources of interrupts; Enabling and disabling interrupts, Interrupt registers, Priority of interrupts, Programming of: Timer using interrupts, External hardware interrupts, Serial communication interrupt; Interfacing of LED, Interfacing 16X2 LCD (8 bits) and Key board (4 x 4 Matrix), Interfacing Relay & Buzzer.		
Mapping of Course Outcomes for Unit III	**CO2, CO3, CO4**	
Unit IV	**PIC Interfacing-II**	**06 hrs**
CCP modes: Capture, Compare and PWM generation; DC Motor speed control with CCP, Stepper motor interfacing with PIC, **Basics of Serial communication protocols:** Study of RS232, I2C, SPI, UART, Serial communication programming using Embedded C.		
Mapping of Course Outcomes for Unit IV	**CO2, CO4**	
Unit V	**PIC Interfacing-III**	**06 hrs**
Interfacing : Interfacing of ADC and DAC 0808 with PIC, Temperature sensor interfacing using ADC and I2C with PIC, Interfacing of RTC (DS1306) using I2C with PIC, Interfacing of EEPROM using SPI with PIC,		
Case Study	**Home protection system, All programs in Embedded C**	
Mapping of Course Outcomes for Unit V	**CO2, CO4**	
Unit VI	**Current Trends in Processor Architecture**	**06 hrs**
ARM & RISC :ARM and RISC design philosophy, Introduction to ARM processor & its versions ARM 7, ARM 9, ARM 11, Features& advantages of ARM processor, Suitability of ARM processor in embedded applications, ARM 7 dataflow model, Programmers model. CPSR & SPSR registers, Modes of operation, Difference between PIC and ARM.		
Mapping of for Unit VI	**CO5**	

Text Books:

1. Muhammad Ali Mazidi , Danny Causey, RolinMcKinlay, "PIC Microcontroller and Embedded Systems: Using Assembly and C for PIC18", 4th Edition by,Pearson international edition
2. Andrew N. Sloss, Dominic Symes, Chris Wright, Morgan, "ARM System Developer's Guide Designing and Optimizing System Software", Kaufmann Publishers

Reference Books:

1. Peatman, John B, "Design with PIC Microcontroller", Pearson Education PTE
2. Ramesh Gaonkar, "Fundamentals of Microcontrollers and Applications In Embedded Systems(with the PIC18 Microcontroller Family)"Thomson/Delmar Learning; 1 edition (January 8, 2007), ISBN:978-1401879143
3. Microchip's PIC18FXXX Data Sheet
4. Muhammad Ali Mazidi, SarmadNaimi,"ARM Assembly Language Programming & Architecture"

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Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214452: Database Management System

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory(TH):03hrs/week	03	Mid_Semester: 30 Marks End_Semester: 70 Marks

Prerequisite Courses, if any: Discrete Mathematics

Course Objectives:

1. The objective of the course is to present an introduction to database management system as a subject in its own right.
2. To understand the fundamental concepts of Relational Database management system.
3. To present SQL and procedural interfaces to SQL comprehensively.
4. To provide a strong formal foundation in Relational Database Concepts, database concepts, technology and practice &to introduce the concepts of Query Processing.
5. To introduce the concepts of Transaction Processing and to present the issues and techniques relating to concurrency and recovery in multi-user database environments.
6. To introduce the recent trends in database technology.

Course Outcomes:

On completion of this course student will be able to --

CO1: Apply fundamental elements of database management systems.
CO2: Design ER-models to represent simple database application scenarios.
CO3: Formulate SQL queries on data for relational databases.
CO4: Improve the database design by normalization & to incorporate query processing.
CO5: Apply ACID properties for transaction management and concurrency control.
CO6: Analyze various database architectures and technologies.

COURSE CONTENTS

Unit I	Introduction to DBMS	06 hrs

Introduction : Basic concepts, Advantages of DBMS over file processing systems, Data abstraction, Database languages, Data models, Data independence, Components of a DBMS, Overall structure of DBMS, Multi-user DBMS architecture, System catalogs, Data Modeling: Basic concepts, Entity, attributes, relationships, constraints, keys.

Case Study	**MySQL Database**
Mapping of Course Outcomes for Unit I	**CO1**

Unit II	Relational Model	06 hrs

ER and EER diagrams: Components of ER model, Conventions, Converting ER diagrams into tables Relational Model: Basic concepts, Attributes and Domains, Codd's rules.

Relational Integrity: Nulls, Entity, Referential integrities, Enterprise constraints, Views, Schema diagram		
Case Study	**Student / Timetable / Reservation / any data Management System**	
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Introduction to SQL - PL/SQL**	**06 hrs**
Introduction to SQL: Characteristics and advantages SQL Data Types, Literals, DDL, DML, SQL Operators Tables: Creating, Modifying, Deleting, Views: Creating, Dropping, Updation using Views, Indexes, Nulls. **SQL DML Queries**: SELECT query and clauses, Set operations, Tuple Variables, Set comparison, Ordering of Tuples , Aggregate Functions, Nested Queries, Database Modification using SQL Insert, Update, Delete Queries, Stored Procedure, Triggers, Programmatic **SQL** : Embedded SQL, Dynamic SQL, ODBC		
Case Study	**Employee database system**	
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Database Design & Query Processing**	**06 hrs**
Relational Databases Design: Purpose of Normalization, Data Redundancy and Update Anomalies, Functional Dependencies. The process of Normalization: 1NF, 2NF, 3NF, BCNF. Introduction to **Query Processing:** Overview, Measures of Query cost, Selection and Join operations, Evaluation of Expressions **Introduction to Query optimization:** Estimation, Transformation of Relational Expression		
Case Study	**Employee Database design**	
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Transaction & Concurrency Control**	**06 hrs**
Transaction Management: Basic concept of a Transaction, Properties of Transactions, Database Architecture, Concept of Schedule, Serial Schedule. **Serializability:** Conflict and View, Cascaded aborts Recoverable and Non-recoverable Schedules. **Concurrency Control:** Need Locking methods Dead locks, Time stamping Methods. Optimistic Techniques, Multi-version Concurrency Control. **Different crash recovery methods:** Shadow-Paging, Log-based Recovery: Deferred and Immediate, Check Points		
Case Study	**Banking Transaction**	
Mapping of Course Outcomes for Unit V	**CO5**	

Unit VI	Advanced Databases	06 hrs
Database Architectures: Centralized and Client-Server Architectures, 2 Tier and 3 Tier Architecture, Introduction to Parallel Databases, Key elements of Parallel Database Processing, Architecture of Parallel Databases, Introduction to Distributed Databases, Architecture of Distributed Databases, Distributed Database Design. **Emerging Database Technologies:** Introduction, No SQL Databases- Internet Databases, Cloud databases, Mobile Databases, SQLite database, XML databases		
Case Study	**RealmDB, ORMLite, Couchbase Lite**	
Mapping of Course Outcomes for Unit VI	**CO6**	

Text Books:

1. Silberschatz A., Korth H., Sudarshan S. "Database System Concepts", 6th edition, Tata McGraw Hill Publishers
2. G. K. Gupta "Database Management Systems" , Tata McGraw Hill

Reference Books:

1. Rab P., Coronel C. "Database Systems Design, Implementation and Management", 5th edition, Thomson Course Technology, 2002
2. Elmasri R., Navathe S. " Fundamentals of Database Systems", 4th edition, Pearson Education, 2003
3. Date C. " An Introduction to Database Systems", 7th edition, Pearson Education, 2002
4. Ramkrishna R., Gehrke J. " Database Management Systems", 3rd edition, McGraw Hill

Web Resources:

https://nptel.ac.in/courses/106/105/106105175/

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Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214453: Computer Graphics

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory (TH): 03 hrs/week	03	Mid_Semester: 30 Marks End_Semester: 70 Marks

Prerequisite Courses, if any: Basic Geometry, Trigonometry, Vectors and Matrices, Data Structures and Algorithms

Course Objectives:

1. Understand the foundations of computer graphics: hardware systems, math basis, light and color.
2. Understand the complexities of modeling realistic objects through modeling complex scenes using a high-level scene description language.
3. Become acquainted with some advanced topics in computer graphics. The student should gain an expanded vocabulary for discussing issues relevant to computer graphics (including both the underlying mathematics and the actual programming).
4. The student should gain an appreciation and understanding of the hardware and software utilized in constructing computer graphics applications.
5. The student should gain a comprehension of windows, clipping and view-ports in relation to images displayed on screen.
6. The student should gain an understanding of geometric, mathematical and algorithmic concepts necessary for programming computer graphics.

Course Outcomes:

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

CO1: Apply mathematical and logical aspects for developing elementary graphics operations like scan conversion of points, lines, circle, and apply it for problem solving.

CO2: Employ techniques of geometrical transforms to produce, position and manipulate Objects in 2 dimensional and 3-dimensional space respectively.

CO3: Describe mapping from a world coordinates to device coordinates, clipping, and projections in order to produce 3D images on 2D output device.

CO4: Apply concepts of rendering, shading, animation, curves and fractals using computer graphics tools in design, development and testing of 2D, 3D modeling applications.

CO5: Perceive the concepts of virtual reality.

COURSE CONTENTS

Unit – I	Computer Graphics Basic, OpenGL and Line, Circle Drawing	06 hrs

Introduction CG :Introduction to computer graphics, basics of graphics systems, raster and random scan, basic display processor

OpenGL – Introduction – Graphics function, OpenGL Interface, primitives and attributes, Control functions, programming events.

Line Drawing: DDA Line drawing algorithm, Bresenham Line drawing algorithm **Circle Drawing:** Bresenham circle drawing algorithm. **Character Generation:** Stroke principle, starburst principle, bitmap method. Introduction to aliasing and anti-aliasing.		
Case Study	**Computer-generated imagery (CGI)**	
Mapping of Course Outcomes for Unit I	**CO1**	
Unit – II	**Polygons, 2D Transformations**	**06 hrs**
Polygons: Polygons and its types, inside test, Polygon filling methods: Seed Fill – Flood fill and Boundary Fill, Scan-line Fill algorithms, **2D Transformations:** Translation, Scaling, Rotation, Reflection and Shearing, Matrix representation and homogeneous coordinate system, composite transformations.		
Case Study	**Transformation of an Object in Computer Graphics: Mathematical Matrix Theory**	
Mapping of Course Outcomes for Unit II	**CO2**	
Unit – III	**Windowing, Clipping,3D Transformation, Projections**	**06 hrs**
Windowing: Concept of window and viewport, viewing transformations **Line Clipping:** Cohen Sutherland method of line clipping **Polygon Clipping:** Sutherland Hodgeman method for convex and concave polygon clipping. **3D Transformation:** Translation, scaling, rotation about X, Y, Z & arbitrary axis, and reflection about XY, YZ, XZ & arbitrary plane. **Projections:** Types of projections- Parallel, Perspective **Parallel:** oblique – Cavalier, Cabinet, Orthographic – isometric, diametric, trimetric **Perspective:** vanishing points as 1 point, 2 point and 3 point.		
Case Study	**3D Rendering and Modeling**	
Mapping of Course Outcomes for Unit III	**CO2 & CO3**	
Unit – IV	**Segments, Illumination models, colour models and shading**	**06 hrs**
Segments: Introduction, Segment table, segment creation, closing, deleting, renaming, and visibility. **Illumination models**: Light sources, ambient light, diffuse light, specular reflection, the Phong model, combined diffuse and specular reflections with multiple light sources. **Color Models:** CIE Chromaticity Diagram, Color Gamut, RGB, CMY, YCbCr,HSVcolor models. **Shading Algorithms:** Constant intensity shading, Halftone, Gourand and Phong Shading.		
Case Study	**Best practices in Day lighting& Passive Systems for Smaller Commercial Buildings**	
Mapping of Course Outcomes for Unit IV	**CO4**	

Unit – V	Curves, fractals and Animation	06 hrs
Curves: Introduction, interpolation and approximation, Spline Interpolation Methods – hermite interpolation, Bezier curves, B-Splines. **Fractals:** Introduction, Classification, fractal Dimension, Fractal dimension and surfaces, Hilbert curve, Koch Curve. **Animation:** Basics of animation, types of animation, principles of animation, design of animation sequences, animation languages, key frame, morphing, motion specification. Methods of controlling animation, frame-by-frame animation techniques, real-time animation techniques.		
Case Study	**3D Animation services for character expressions.**	
Mapping of Course Outcomes for Unit V	**CO4**	
Unit – VI	**Virtual Reality**	**06 hrs**
Introduction of Virtual Reality: Fundamental Concept, Three I's of virtual reality and Classic Components of VR systems, Applications of VR systems. **Multiple Modals of Input and Output Interface in Virtual Reality:** Input – 3D position Trackers and its types, Navigation and Manipulation Interfaces, Gesture Interfaces, Graphics Displays – HMD and CAVE, Sound Displays, Haptic Feedback **Rendering Pipeline:** Graphics rendering Pipeline, Haptics Rendering Pipeline Modeling in Virtual Reality: Concepts of Geometric Modeling, Kinematic Modeling, Physical modeling and Behavior modeling.		
Case Study	**Virtual reality in aviation and Space travel Training**	
Mapping of Course Outcomes for Unit VI	**CO5**	

Test Books

1. D. Hearn, M. Baker, "Computer Graphics – C Version", 2nd Edition, Pearson Education, 2002, ISBN81 – 7808 – 794 – 4
2. S. Harrington, "Computer Graphics", 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 – 07 –100472 – 6
3. Grigore C. Burdea, Philippe Coiffet, "Virtual Reality Technology", second edition, Wiley India Edition, ISBN 81-265-0789-6

Reference books

1. D. Rogers, "Procedural Elements for Computer Graphics", 2nd Edition, Tata McGraw-HillPublication, 2001, ISBN 0 – 07 – 047371 – 4.
2. J. Foley, V. Dam, S. Feiner, J. Hughes, "Computer Graphics Principles and Practice", 2nd Edition, Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9.
3. Foley, "Computer Graphics: Principles & Practice in C", 2e, ISBN 9788131705056, Pearson Edu.
4. F.S. Hill JR, "Computer Graphics Using Open GL", Pearson Education

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Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214454: Software Engineering

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory(TH) : 03 hrs/week	03	Mid_Semester: 30 Marks End_Semester: 70 Marks

Prerequisite Courses, if any: Fundamentals of Programming Languages

Course Objectives:

1. To learn the principles of Software Engineering.
2. To learn and understand methods of capturing, specifying, visualizing and analyzing software requirements.
3. To know design principles to software project development.
4. To learn basics of IT project management.
5. To understand software quality attributes and testing principles.
6. To introduce formal methods and recent trends in Software Engineering.

Course Outcomes:

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

CO1: Classify various software application domains.
CO2: Analyze software requirements by using various modeling techniques.
CO3: Translate the requirement models into design models.
CO4: Apply planning and estimation to any project.
CO5: Use quality attributes and testing principles in software development life cycle.
CO6: Discuss recent trends in Software engineering by using CASE and agile tools.

COURSE CONTENTS

Unit I	Introduction To Software Engineering	06 hrs

Software Engineering Fundamentals: Nature of Software, Software Engineering Practice, Software Process, Software Myths.
Process Models : A Generic Process Model, Linear Sequential Development Model, Iterative Development Model, The incremental Development Model
Agile software development: Agile manifesto, agility principles, Agile methods, myth of planned development, Introduction to Extreme programming and Scrum.
Agile Practices: test driven development, pair programming, continuous integration in DevOps , Refactoring

Case Study	An information system – Library Management system
Mapping of Course Outcomes for Unit I	CO1

Unit II	Requirements Engineering & Analysis	06 hrs

Requirements Engineering: User and system requirements, Functional and non-functional requirements, requirements engineering (elicitation, specification, validation, negotiation) prioritizing requirements (Kano diagram), requirement traceability matrix(RTM)
Software Requirements Specification (SRS): software requirements Specification document,

structure of SRS, writing a SRS, structured SRS for online shopping, **Requirements Analysis:** Analysis Model, data modeling, scenario based modeling, class based modeling, Flow oriented modeling, behavioral modeling-Introduction to UML diagrams		
Case Study : Library Management system		
Mapping of Course Outcomes for Unit II	**CO2**	
Unit III	**Design Engineering**	**06 hrs**
Design Engineering : Design Process & quality, Design Concepts, design Model, Pattern-based Software Design. Architectural Design :Design Decisions, Views, Patterns, Application Architectures, **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 Design / Library Management System		
Mapping of Course Outcomes for Unit III	**CO3**	
Unit IV	**Project Planning, Management And Estimation**	**6 hrs**
Project Planning: Project initiation, Planning Scope Management, Creating the Work Breakdown Structure, scheduling: Importance of Project Schedules, Developing the Schedule using Gantt Charts, PERT/ CPM **Project Management:** 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 **Project Estimation:** Software Project Estimation, Decomposition Techniques, Cost Estimation Tools and Techniques, Typical Problems with IT Cost Estimates.		
Case Study: Project Management tool like OpenProj or MS Project		
Mapping of Course Outcomes for Unit IV	**CO4**	
Unit V	**Software Quality And Testing**	**06 hrs**
Quality Concepts: Quality, software quality, Quality Metrics, software quality dilemma, achieving software quality **Software Testing:** Introduction to Software Testing, Principles of Testing, Test plan, Test case, Types of Testing, Verification & Validation, Testing strategies, Defect Management, Defect Life Cycle, Bug Reporting, debugging.		
Case Study : Software testing tool like selenium		
Mapping of Course Outcomes for Unit V	**CO5**	
Unit VI	**Formal Methods Recent Trends In Software Engineering**	**06 hrs**
Recent Trends in SE : SCM, Risk Management, Technology evolution, process trends, collaborative development, software reuse, test-driven development, global software development challenges, CASE – taxonomy, tool-kits, workbenches, environments, components of CASE, categories (upper, lower and integrated CASE tools), Introduction to agile tools Jira, Kanban		
Case Study : CASE software/ HP Quality Center (QC) / Jira		

Mapping of Course Outcomes for Unit VI	CO6

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. Joseph Phillips, “IT Project Management-On Track From start to Finish”, Tata Mc Graw-Hill,ISBN13:978-0-07106727-0,ISBN-10:0-07-106727-2
2. Pankaj Jalote, “Software Engineering: A Precise Approach”,Wiley India, ISBN: 9788-1265-2311-5
3. Marchewka, “Information Technology Project Management”,Willey India, ISBN: 9788-1265-4394-6
4. Rajib Mall, “Fundamentals of Software Engineering”,Prentice Hall India, ISBN-13:9788-1203-4898-1

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214455: Programming Skill Development Lab

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Theory(TH) :02hrs/week	01	PR: 25Marks TW: 25Marks

Prerequisites: Computer Organization and Architecture

Course Objectives:

1. To learn embedded C programming and PIC18FXXXmicrocontrollers.
2. To learn interfacing of real-world input and output devices to PIC18FXXX microcontroller

Course Outcomes:

On completion of this course student will be able to --

CO1: Apply concepts related to embedded C programming.

CO2: Develop and Execute embedded C program to perform array addition, block transfer, sorting operations

CO3: Perform interfacing of real-world input and output devices to PIC18FXXX microcontroller.

CO4: Use source prototype platform like Raspberry-Pi/Beagle board/Arduino.

Guidelines for Instructor's Manual

The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant. The instructor's manual should include prologue, university syllabus, conduction & Assessment guidelines, topics under consideration- concept, objectives, outcomes, algorithm, sample test cases etc.

Guidelines for Student's Lab Journal

1. The laboratory assignments should be submitted by students in the form of journal. The Journal consists of Certificate, table of contents, and 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, circuit diagram, pin configuration, conclusion/analysis).
2. As a conscious effort and little contribution towards Green IT and environment awareness, attaching printed papers as part of program listing to journal may be avoided.
3. Use of Digital media like shared drive containing students' programs maintained by lab In-charge is highly encouraged.
4. Practical Examination will be based on the term work submitted by the student in the form of journal.
5. Candidate is expected to know the theory involved in the experiment.
6. The practical examination should be conducted if the journal of the candidate is completed in all respects and certified by concerned faculty and head of the department.
7. All the assignment mentioned in the syllabus must be conducted.

Guidelines for Lab /TW Assessment

1. Examiners will assess the term work based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for

implementation of practical assignment, timely submission of assignment in the form of write-up along with results of implemented assignment, attendance etc.

2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Necessary knowledge of usage of software and hardware of PIC18FXXX microcontrollers and its interfacing kits should be checked by the concerned faculty members.

Guidelines for Laboratory Conduction

The instructor is expected to frame the assignments by understanding the prerequisites, technological aspects, utility and recent trends related to the topic. 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.

Guidelines for Practical Examination

Both internal and external examiners should jointly set problem statements for practical examination. During practical assessment, the expert evaluator should give the maximum weightage to the satisfactory implementation of the problem statement. The supplementary and relevant questions may be asked at the time of evaluation to judge the student's understanding of the fundamentals, effective and efficient implementation. The evaluation should be done by both external and internal examiners.

Suggested List of Laboratory Assignments

Suggested List of Laboratory Assignments Group A (Any Three):

Mapping of Course Outcomes for Group A -- CO1 , CO2

1. Study of Embedded C programming language (Overview, syntax, One simple program like addition of two numbers).
2. Write an Embedded C program to add array of n numbers.
3. Write an Embedded C program to transfer elements from one location to another for following:
i) Internal to internal memory transfer
ii) Internal to external memory transfer
4. Write an Embedded C menu driven program for :
i) Multiply 8 bit number by 8 bit number
ii) Divide 8 bit number by 8 bit number
5. Write an Embedded C program for sorting the numbers in ascending and descending order.

Group B (Any Three):

Mapping of Course Outcomes for Group B -- CO3

6. Write an Embedded C program to interface PIC 18FXXX with LED & blinking it using specified delay.
7. Write an Embedded C program for Timer programming ISR based buzzer on/off.
8. Write an Embedded C program for External interrupt input switch press, output at relay.
9. Write an Embedded C program for LCD interfacing with PIC 18FXXX.

Group C (Any two):

Mapping of Course Outcomes for Group C -- CO3

10. Write an Embedded C program for Generating PWM signal for servo motor/DC motor.
11. Write an Embedded C program for PC to PC serial communication using UART.
12. Write an Embedded C program for Temperature sensor interfacing using ADC & display on LCD.

Group D:

Mapping of Course Outcomes for Group D -- CO4

13. Study of Arduino board and understand the OS installation process on Raspberry-pi.
14. Write simple program using Open source prototype platform like Raspberry-Pi/Beagle board/Arduino for digital read/write using LED and switch Analog read/write using sensor and actuators.

Reference Books :

1. Mazidi, Rolin McKinlay and Danny Causey, 'PIC Microcontroller and Embedded Systems using Assembly and C for PIC18", Pearson Education
2. "Raspberry Pi for Beginners", 2nd Edition book" e-book.
3. Peatman, John B, "Design with PIC Microcontroller", Pearson Education PTE,
4. Ramesh Gaonkar, "Fundamentals of Microcontrollers and Applications In Embedded Systems (with the PIC18 Microcontroller Family)"Thomson/Delmar Learning; 1 edition (January 8, 2007), ISBN:978-1401879143.

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214456: Database Management System Lab

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR):04hrs/week	02	PR: 25 Marks TW: 25 Marks

Prerequisites: Data structures and Software engineering principles and practices.

Course Objectives :

1. 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, recent technologies and best industry practices.
3. To give systematic database design approaches covering conceptual design, logical design and an overview of physical design.
4. To learn the SQL database system.
5. To learn and understand various Database Architectures and its use for application development.
6. To program PL/SQL including stored procedures, stored functions, cursors and packages.

Course Outcomes :

On completion of this course student will be able to --

CO1: Install and configure database systems.
CO2: Analyze database models & entity relationship models.
CO3 : Design and implement a database schema for a given problem-domain
CO4: Implement relational database systems.
CO5: Populate and query a database using SQL DDL / DML / DCL commands.
CO6 : Design a backend database of any one organization: CASE STUDY

Guidelines for Instructor's Manual

The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

Guidelines for Student's Lab Journal

1. Student should submit term work in the form of journal with write-ups based on specified list of assignments.
2. Practical and Oral Examination will be based on all the assignments in the lab manual
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted only if the journal of the candidate is complete in all respects.

Guidelines for Oral /Practical Assessment

1. Examiners will assess the student based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of

handwritten write-up along with results of implemented assignment, attendance etc.

2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried out.
3. Appropriate knowledge of usage of software and hardware related to respective laboratory should be checked by the concerned faculty member.

Suggested List of Laboratory Assignments

Group A: Study of Databases

Mapping of Course Outcomes Group A -- CO1

1. Study of MySQL Open source software. Discuss the characteristics like efficiency, scalability, performance and transactional properties
2. Install and configure client and server of MySQL.(Show all commands and necessary steps for installation and configuration)
3. Study of SQLite: What is SQLite? Uses of Sqlite. Building and installing SQLite.

Group B: MySQL

Mapping of Course Outcomes Group B -- CO2, CO3, CO4, CO5

1. Design any database with at least 3 entities and relationships between them. Draw suitable ER/EER diagram for the system.
2. Design and implement a database (for assignment no 1) using DDL statements and apply normalization on them
3. Create Table with primary key and foreign key constraints.
   a. Alter table with add n modify b. Drop table
4. Perform following SQL queries on the database created in assignment 1.
   - Implementation of relational operators in SQL
   - Boolean operators and pattern matching
   - Arithmetic operations and built in functions
   - Group functions
   - Processing Date and Time functions
   - Complex queries and set operators
5. Execute DDL/DML statements which demonstrate the use of views. Update the base table using its corresponding view. Also consider restrictions on updatable views and perform view creation from multiple tables.

Group C: PL/SQL

Mapping of Course Outcomes Group C -- CO6

1. Write and execute PL/SQL stored procedure and function to perform a suitable task on the database. Demonstrate its use.
2. Write and execute suitable database triggers .Consider row level and statement level triggers.
3. Write a PL/SQL block to implement all types of cursor.

Group D: Relational Database Design

Mapping of Course Outcomes Group D -- CO5, CO6

Design and case study of any organization (back end only), Project Proposal and High Level SRS

To prepare for project, do the following:

1. Form teams of around 3 to 4 people
2. Create requirements document with the following information:-
   a. Give one or two paragraph description of your goals for the topic(s).
   b. List what all types of users will be accessing your application
   c. List the various functionalities that your application will support. Explain each in about a paragraph worth of detail.
   d. List the hardware and software requirements at the backend and at the front end.
   e. Give an estimate of the number of users of each type, the expected load (transactions per day), and the expected database size.

Project ER Diagram and Database Design

For ER diagram and Database design following guidelines can be used:

1. Draw an ER diagram of your project.
2. Reduce this ER diagram into the tables and complete database design.
3. Subsequently, list all the functional dependencies on each table that you expect will hold.
4. Check that the database schema is in 3NF/BCNF. If it is not, apply normalization. Use non-loss decomposition and bring the database schema in 3NF/BCNF.

Give the ER diagram and the data dictionary as part of the requirement specifications file which you created for the project proposal.

Reference Books:

1. Dr. P. S. Deshpande, “SQL and PL/SQL for Oracle 10g Black Book”, DreamTech
2. Ivan Bayross, “SQL, PL/SQL: The Programming Language of Oracle”, BPB Publication
3. Reese G., Yarger R., King T., Williums H, “Managing and Using MySQL”, Shroff Publishers and Distributors Pvt. Ltd., ISBN: 81 - 7366 - 465 – X, 2nd Edition
4. Eric Redmond, Jim Wilson, “Seven databases in seven weeks”, SPD, ISBN: 978-93-5023-91
5. Jay Kreibich, Using SQLite, SPD, ISBN: 978-93-5110-934-1, 1st edition

Home

Savitribai Phule Pune University, Pune
Second Year Information Technology (2019 Course)
214457: Computer Graphics Lab

Teaching Scheme:	Credit Scheme:	Examination Scheme:
Practical (PR) :02hrs/week	02	PR : 25 Marks TW: 25 Marks

Prerequisites: Basic Geometry, Trigonometry, Vectors and Matrices, Data Structures and Algorithms

Course Objectives :

1. To acquaint the learners with the concepts of OpenGL.
2. To acquaint the learners with the basic concepts of Computer Graphics.
3. To implement the various algorithms for generating and rendering the objects.
4. To get familiar with mathematics behind the transformations.
5. To understand and apply various methods and techniques regarding animation.

Course Outcomes :

On completion of this course student will be able to --

CO1: Apply line& circle drawing algorithms to draw the objects.

CO2: Apply polygon filling methods for the object.

CO3: Apply polygon clipping algorithms for the object.

CO4: Apply the 2D transformations on the object.

CO5: Implement the curve generation algorithms.

CO6: Demonstrate the animation of any object using animation principles.

Guidelines for Instructor's Manual

The faculty member should prepare the laboratory manual for all the experiments and it should be made available to students and laboratory instructor/Assistant.

Guidelines for Student's Lab Journal

1. Student should submit term work in the form of journal with write-ups based on specified list of assignments.
2. Practical and Oral Examination will be based on all the assignments in the lab manual
3. Candidate is expected to know the theory involved in the experiment.
4. The practical examination should be conducted if and only if the journal of the candidate is complete in all respects.

Guidelines for Lab /TW Assessment

1. Examiners will assess the student based on performance of students considering the parameters such as timely conduction of practical assignment, methodology adopted for implementation of practical assignment, timely submission of assignment in the form of write-ups along with results of implemented assignment, attendance etc.
2. Examiners will judge the understanding of the practical performed in the examination by asking some questions related to theory & implementation of experiments he/she has carried

out.

3. Appropriate knowledge of usage of software related to respective laboratory should be checked by the concerned faculty member.

Guidelines for Laboratory Conduction

1. All the assignments should be implemented in C++ with OpenGL libraries.
2. Assignment 1 (week 1) should cover all the basic functions of openGL to get students familiar with Graphics Environment. Hence, this assignment is not included in Practical Exam.
3. The different objects/shapes/patterns should be drawn for implementation of drawing algorithm.
4. All the assignments should explore the conceptual understanding of students.
5. The keyboard/Mouse interfaces should be used wherever possible.

Guidelines for PRACTICAL EXAM conduction

1. There will be 2 problem statements options and student will have to perform any one.
2. All the problem statements carry equal weightage.

Virtual Laboratory

- https://cse18-iiith.vlabs.ac.in/
- http://vlabs.iitb.ac.in/vlabs-dev/labs/cglab/index.php

Suggested List of Laboratory Assignments

1. Install and explore the OpenGL -- **CO1**

2. Implement DDA and Bresenham line drawing algorithm to draw: i) Simple Line ii) Dotted Line iii) Dashed Line iv) Solid line ;using mouse interface Divide the screen in four quadrants with center as (0, 0). The line should work for all the slopes positive as well as negative.

3. Implement Bresenham circle drawing algorithm to draw any object. The object should be displayed in all the quadrants with respect to center and radius- **C02**

4. Implement the following polygon filling methods : i) Flood fill / Seed fill ii) Boundary fill ; using mouse click, keyboard interface and menu driven programming**- CO4**

5. Implement Cohen Sutherland polygon clipping method to clip the polygon with respect the viewport and window. Use mouse click, keyboard interface - **CO4**

6.Implement following 2D transformations on the object with respect to axis : – **CO5**

i) Scaling ii) Rotation about arbitrary point iii) Reflection

7. Generate fractal patterns using i) Bezier ii) Koch Curve - **CO5**

8. Implement animation principles for any object - **CO6**

Text 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, McGraw-Hill Publications, 1987, ISBN 0-07-047371-4

3. F.S. Hill JR, "Computer Graphics Using OpenGL", Pearson Education

Reference Books

1. Graphics Principles and Practice", 2nd Edition, Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9

2. D.Hearn, M. Baker, "Computer Graphics – C Version", 2nd Edition, Pearson Education, 2002, ISBN81 – 7808 – 794 – 4

3. D. Rogers, J. Adams, "Mathematical Elements for Computer Graphics", 2nd Edition, Tata McGraw-Hill Publication, 2002, ISBN 0 – 07 – 048677 – 8

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. D.P. Mukharjee, Debasish Jana, "Computer Graphics Algorithms and implementation", PHI Learning

7. Samuel R. Buss, "3D Computer Graphics", Cambridge University Press

8. Mario Zechner, Robert Green, "Beginning Android 4 Games Development", Apress, ISBN: 978-81-322-0575-3

9. Maurya, "Computer Graphics with Virtual Reality Systems, 2ed.", Wiley, ISBN-9788126550883

10. Foley, "Computer Graphics: Principles & Practice in C", 2e, ISBN 9788131705056, Pearson