Autonomous Program Structure of
Second Year B. Tech. Fourth Semester
(Information Technology)
Academic Year: 2021-2022 Onwards

Course Code	Course Title	Teaching Scheme Hours/ Week			Examination Scheme				Total Marks	Credit
		Lecture	Tutorial	Practical	In Sem	End Sem	Oral	Practical		
BSIT 401	Calculus and Statistics	3	1	0	50	50	0	0	100	4
20IT 401	Computer Network	3	0	0	50	50	0	0	100	3
20IT 402	Operating Systems	3	0	0	50	50	0	0	100	3
20IT403	Database Management System	3	0	0	50	50	0	0	100	3
20IT 404	Human Computer Interaction	3	1	0	50	50	0	0	100	4
20IT 401L	Computer Network Lab	0	0	2	25	0	0	25	50	1
20IT 402L	Operating Systems Lab	0	0	4	25	0	0	25	50	2
20IT 403L	Database Management System Lab	0	0	4	25	0	25	0	50	2
20AC 401	Audit Course	0	0	2	0	0	0	0	0	No Credit
	Total	**15**	**2**	**12**	**325**	**250**	**25**	**50**	**650**	**22**
	Grand Total	**29**			**650**					

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Secretary Governing Body
MKSSS's Cummins College of Engineering
For Women, Pune-411052

MKSSS's Cummins College of Engineering for Women Karvenagar, Pune-411052

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Chairman Governing Body
MKSSS's Cummins College of Engineering
For Women, Pune-411052

BSIT 401 Calculus and Statistics

Teaching Scheme:
Lectures : 3 hours/week
Tutorial : 1 hours/week

Examination Scheme:
In-Semester : 50 Marks
End-Semester : 50 Marks
Credit : 4

Prerequisites: Permutation and Combination, Complex numbers - Properties, Argand Diagram, Basic properties of integration, Partial Fractions, Basic properties of integration, Beta and Gamma Functions, First order linear ordinary differential equations.

Course Objectives:
Mathematics is a necessary path to scientific knowledge which opens new perspective of mental activity. Our aim is to provide sound knowledge of Engineering Mathematics to make the students think mathematically and strengthen their thinking power to analyze and solve engineering problems in their respective areas.

Course Outcomes:
Students should be able to

1. Apply concepts of descriptive and inferential Statistics to interpret the data.
2. Calculate probabilities of random events using probability distributions.
3. Apply basic concepts of complex analysis to differentiate and integrate functions of complex variables.
4. Obtain Fourier transform and Z transform of simple functions and discrete sequences.
5. Obtain the solution of higher order Linear Differential Equations, simple electrical circuits.

Unit – I Statistics 7 Hours

Measures of central tendency, Standard deviation, Coefficient of Variation, Moments, Skewness & Kurtosis, Testing a statistical hypothesis, Type-I and Type-II error

Unit – II Probability Distributions 8 Hours

Random Variables – Discrete & continuous, Mathematical expectations, Probability density functions, Standard Distributions – Binomial, Poisson, Normal, Lognormal.

Unit – III Complex Analysis 8 Hours

Functions of Complex variables, Analytic Functions, Cauchy Riemann-Equations, Cauchy's Integral Theorem, Cauchy's Integral Formula, Laurent's series, Residue theorem, Conformal mapping, Bilinear Transformation

Unit – IV Z-Transforms 5 Hours

Definition, standard properties, Z- Transform of standard sequences and their inverses, solution of difference equation

Unit – V Fourier Transforms 6 Hours

Complex exponential form of Fourier series, Fourier integral theorem, sine and cosine integrals, Fourier transform, Fourier Sine and Cosine transform and their inverses

Unit – VI Higher Order Linear Differential equation and application 8 Hours

Higher order Linear differential equation with constant coefficients, Method of Variation of parameters, Cauchy's and Legendre's DE, Simultaneous DE, Modelling of electrical circuits.

Text Books

1. B.S. Grewal, 'Higher engineering Mathematics', Khanna publishers, Delhi (40th edition),(2008)
2. B. V. Ramana, 'Higher Engineering Mathematics', Tata McGraw Hill Publications (2007)
3. S.C. Gupta, V. K. Kapoor, 'Fundamental of Mathematical Statistics' , S. Chand & Sons (10th revised edition). 2002

Reference Books

1. Peter V. O'neil,'Advanced Engineering Mathematics', Thomson Brooks / Cole, Singapore (5th edition) (2007).
2. Erwin Kreyszig,'Advanced Engineering Mathematics' Wiley Eastern Ltd.(8th Student Edition), (2004).
3. C.R.Wylie, L.C. Barrette, 'Advanced Engineering Mathematics', McGraw Hill Publications, New Delhi.(6th edition)(2003)

20IT 401 Computer Networks

Teaching Scheme:
Lectures: 3 hours/week
Tutorial: --

Examination Scheme:
In-Semester: 50 Marks
End-Semester:50 Marks
Credits: 3

Prerequisite: Network Fundamentals

Course Objectives:

Familiarize students with

1. Routing at the network layer.
2. TCP and UDP key functions at transport layer.
3. Congestion control, fairness and stability of the Internet.
4. Wireless Technologies.

Course Outcomes:

Students will be able to

1. Analyze with different routing protocols.
2. Analyze the usage of various protocols at transport layer
3. Recognize usage of various protocols at application layer
4. Design a LAN with a switch and router.

Unit – I: Internetworking **7 Hours**

Internetworking Basics, OSI Model, Data Encapsulation, Introduction to TCP/IP, the process/Application layer Protocols, The Host-to Host Layer Protocols. The Internet Layer Protocols, Internet Protocol.

Unit – II: Introduction to Routing and Packet Forwarding **7 Hours**

Inside the Router, CPU, NVRAM, Router Interfaces, Routers and the Network Layer, Command Line Interface Configuration and Addressing, Basic Router Configuration, Building the Routing Table, IP Routing, Path Determination and Switching Functions Protocols.

Unit – III: IP Routing **7 Hours**

Routing Basics, Distance vector routing Protocols, Link state routing protocols. Routing Information protocol, Enhanced Interior Gateway Routing Protocol, Open Shortest Path First. Virtual Local area Networks, Network address translation.

Unit – IV: Transport Layer **7 Hours**

Transport layer duties and functionalities, application expectations and IP delivery semantics.
UDP: UDP functionality, UDP Header.
TCP: TCP Features, byte-stream, Connection-oriented, TCP Header Format, 2-way, 3-way Handshake, TCP State Diagram, TCP Sliding Window, Congestion Control Algorithms: Leaky Bucket, Token Bucket, Congestion Avoidance. UNIX Sockets, M/M/1 queue analysis.

Unit – V: Application Layer **7 Hours**

Client/Server Model, Telnet, Domain Name System, File Transfer protocol: FTP, TFTP, HyperText Transfer Protocol, POP3, IMAP, SMTP, E-mail, MIME, Simple Network Management Protocol.

Unit – VI: Wireless Technologies **7 Hours**

Introduction to wireless internetwork, IEEE 802.11, Cellular Technology, WLAN, Internet of Things, Bring Your Own Device. Introduction to android OS.

Text Books:

1. Andrew S. Tennabaum, David J. Weatherall Computer Networks", Pearson (5th edition), (2011)
2. Behrouz Forouzan ,"TCP/IP Protocol Suite", Mc-Graw Hill, (4th Edition) (2010)

Reference Books:

1. Theodore S. Rappaport, "Wireless Communications", Prentice Hall (2nd Edition) (2002)
2. Rick Graziani, Allan Johnson, Routing Protocols and Concepts , Cisco Press (2011)

20IT 402 Operating Systems

Teaching Scheme:
Lectures: 3 hours/week
Tutorial: --

Examination Scheme:
In-Semester: 50 marks
End-Semester: 50 marks
Credits: 3

Prerequisites: Data Structures

Course Objectives:

Familiarize students with

1. Basic functions and concepts of operating systems.
2. Mechanisms to handle processes and threads.
3. Principles of concurrency and deadlock.
4. Systems Programming Concepts

Course Outcomes:

Students should be able to

1. Explain concepts of operating system and basic shell scripting.
2. Apply concepts of memory management and file management techniques to solve different Operating Systems problems.
3. Apply appropriate process management and Inter Process Communication techniques to resolve various problems.
4. Explain basic concepts of Systems Programming.

Unit – I Introduction to Operating Systems **7 Hours**

Evolution of Operating Systems, Operating Systems Overview, OS structure, Functions of an OS: Program management, resource management, Protection and Security, PC Hardware and Booting, Shell Scripting, AWK, Sed

Unit – II Memory Management **7 Hours**

Logical Versus Physical Address Space, Swapping, Contiguous memory allocation, Non-contiguous memory allocation, Internal and external fragmentation, Segmentation, Paging, Structure of the Page Table

Virtual Memory: Demand paging, Prepaging, Thrashing, Page replacement algorithms, Translation look-aside buffer (TLB)

Unit – III Process Management **7 Hours**

Process concept, forking and exec, zombies, orphans, demons, context switching, wait, exit system calls, Scheduling: threads and scheduling algorithms, scheduling algorithms (FCFS, SJF, SRTF, Round robin, multilevel queues, feedback queues)

Linux schedulers – CFS

Unit – IV Inter Process Communication and Synchronization **7 Hours**

IPC, Critical Section, Race Condition, context switching, process related system calls, Critical Sections, Peterson's Solution, Bakery Algorithm, Test & Set, Spinlocks, Mutex, semaphores, producer consumer, dining philosophers. Deadlocks: Ostrich algorithm, banker's algorithm, deadlock prevention, deadlock detection and recovery

Unit – V Input/output and File Management **7 Hours**

I/O Devices, Organization of the I/O Function, polling, Disk structure, Disk scheduling and Disk management, files, protection, access methods, directory and disk structure, File-system mounting, File-system structure and File-system implementation, allocation methods

Unit – VI System Software and its importance **7 Hours**

Need of System Software, Assemblers: Pass structure of Assemblers, Macro Processor: Macro. Definition and call, Macro Expansion. Loaders: Loader Schemes, Compile and Go, General Loader Scheme, Subroutine Linkages, Relocation and linking

Text Books

1. Abraham Silberschatz, Pert B. Galvin, and Greg Gagne, "Operating System Concepts", 9th edition, by Wiley-India edition
2. "Modern Operating Systems", 4th edition, by Andrew S. Tanenbaum, PHI Learning Private limited, New Delhi

Reference Books:

1. "Operating Systems: Internals and Design Principles", 8th edition, William Stallings, Pearson Education Limited.
2. "The Design of the UNIX Operating System", Maurice J. Bach, Pearson.
3. "UNIX, concepts and applications", 4th edition, Sumitabha Das, Tata McGraw-Hill Education.
4. "Operating Systems Security", Trent Jaeger, Morgan and Claypool Publishers.
5. "Linux System Programming", 2nd Edition, Robert Love, O"Reilly
6. "Systems Programming and Operating Systems", 2nd Edition, D. M. Dhamdhere, Tata McGraw Hill.
7. "Systems Programming", Indian Edition, J. J. Donovan, McGraw-Hill

20IT 403 Database Management Systems

Teaching Scheme:
Lectures: 3 hours/week
Tutorial: -

Examination Scheme:
In-Semester: 50 marks
End-Semester: 50 marks
Credits: 3

Prerequisites: Data structures

Course Objectives:
Familiarize students with
1. Concepts and applications of database management.
2. Different models and normalization used for database design.
3. Query languages in databases.
4. Basic issues of database design and utilization.

Course Outcomes:
Students should be able to
1. Build appropriate database schema for the given application.
2. Apply normalization to database design.
3. Make use of query commands and concurrency control protocols.
4. Analyze business decisions related to Database information systems.

Unit – I: Introduction to DBMS **7 Hours**
Database Concepts, Database System Architecture, Data Models, entity, attributes, relationships, constraints, keys, E-R Model, conventions, EER Model, converting ER/EER diagram into tables. Relational Model, Attributes and Domains, Referential Integrities. Relational Algebra: Basic Operations

Unit – II: Relational Algebra and Calculus **7 Hours**
Relational algebra: introduction, Selection and projection, set operations, renaming, Joins, Division, syntax, semantics. Operators, grouping and ungrouping, relational comparison

Unit – III: Database Design and SQL **7 Hours**
Database Design, Functional Dependency, Purpose of Normalization, Data Redundancy, Anomalies. Normal forms 1NF, 2NF, 3NF, BCNF, 4NF and 5NF. Introduction to SQL, SQL Data Types, DDL, DML and DCL queries, Views, Indexes, Null handling, Nested Queries. PLSQL. Query optimization

Unit – IV: Database Transactions **7 Hours**
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.

Unit – V: Advanced Database Architectures and Concurrency Control **7 Hours**
Database Architectures, Centralized and Client-Server Architectures, 2 Tier and 3 Tier Architecture, Indexing and hashing, Parallel Databases, and Distributed Databases. Concurrency Control, Locking Methods, Deadlocks, Protocols, Recovery Methods

Unit – VI: Data Warehousing and Data Mining **7 Hours**

Data Warehousing, Architecture and features of Data Warehouse, ETL Process, OLAP. Data Mining, Knowledge Discovery, Data Mining techniques, Applications of data mining.

Text Books:

1. Silberschatz A., Korth H., Sudarshan S, Database System Concepts, McGraw Hill Publication, ISBN- 0-07-120413-X, Sixth Edition.
2. Ramez Elmasri, Shamkant B. Navathe**,** Fundamentals of Database Systems, Pearson Publication, ISBN-13: 978-0-136-08620-8

Reference Books:

1. S. K. Singh, Database Systems: Concepts, Design and Application, Pearson Publication, ISBN-978-81- 317-6092-5.
2. C J Date, An introduction to Database Systems, Addition-Wesley.
3. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill, 3rd Edition, 2003.
4. Reema Thareja, Data warehousing, Oxford University Press. ISBN 0195699610.

20IT 404 Human Computer Interaction

Teaching Scheme:
Lectures: 3 hours/week
Tutorial: 1 hours/week

Examination Scheme:
In-Semester: 50 marks
End-Semester: 50 marks
Credits: 4

Prerequisites: Object Oriented Technology.

Course Objectives:

Familiarize students with

1. Basic field of human-computer-interaction study
2. The concept of User centric approach.
3. Applications of human-computer-interaction to real life use cases.
4. Design of effective human-computer-interactions.

Course Outcomes:

Students should be able to

1. Identify the importance of HCI study and principles of User-Centered Design (UCD) approach.
2. Apply interaction design guidelines to a given application.
3. Analyze user interfaces for suggesting improvements.
4. Design prototypes for effective user-interfaces.

Unit – I Introduction 7 Hours

What is HCI? A discipline involved in HCI, Why is HCI study important? The psychology of everyday things, Principles of HCI, User-centered Design and Conceptual Models, Usability, Examples of good and bad HCI.

Unit – II Users and the Interaction 7 Hours

Human perception and memory, Thinking: Reasoning and Problem Solving, Human emotions and Psychology, Individual differences, Stages of action, Models of interaction, Ergonomics, Interaction styles, WIMP Interface, Interactivity, Context of interaction, Paradigms of Interactions.

Unit –III HCI Models 7 Hours

Cognitive models: GOMS Model, Hierarchical task analysis (HTA) model, Linguistic model, Physical and device models, Communication and collaboration models, Knowledge-based analysis.

Unit –IV HCI - Design Rules, Guidelines And Evaluation Techniques 7 Hours

Principles that support usability, Design standards, Design Guidelines, Golden rules, Using toolkits, User interface management System (UIMS), Goals of evaluation, Evaluation Criteria, Evaluation through expert analysis, Heuristics Evaluation through user participation, Choosing an Evaluation Method.

Unit – V HCI - Design Process 7 Hours

The process of design, Goal Directed Design Process, User focus, Scenarios, Navigation Design, Screen Design and Layout, Prototyping techniques, Wire-Framing, Model-View-Controller (MVC) Framework, Visual Interface Design.

Unit – VI Design of Applications 7 Hours

Multi-modal interaction, Website designing, Navigation design for websites, Evaluating a website, Designing for Mobiles, Evaluation for mobile computing, Socio-organizational issues and stakeholder requirements, Ubiquitous Computing with a case study like smart home.

Text Books

1. David Benyon "Designing Interactive Systems: A comprehensive guide to HCI, UX and interaction design", Pearson Education Limited, Third Edition.
2. Alan Dix, "Human Computer Interaction", Pearson Education. ISBN 978-81-317-1703-5.

Reference Books

1. Ben Shneiderman; Catherine Plaisant; Maxine Cohen; Steven Jacobs, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", Pearson Education Limited, ISBN 978-1-292-03701-1.
2. Donald A. Norman, "The Design of Everyday Things Basic Books", ISBN 978-0-465-07299-6.
3. Jeff Johnson, "Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Guidelines" Elsevier. ISBN 978-0-12-411556-9.
4. Alan Cooper, Robert Reimann, and Dave Cronin, " About Face 3: The Essentials of Interaction Design", Wiley Publishing, Inc.
5. Gerard Jounghyun Kim, "Human–Computer Interaction: Fundamentals and Practice" CRC Press. ISBN 978-1-4822-3390-2.
6. Helen Sharp, Jenny Preece, and Yvonne Rogers, "Interaction Design: Beyond Human-Computer Interaction".

20IT 401L Computer Network Laboratory

Teaching Scheme:
Practical: 2 hours/week

Examination Scheme:
In Semester : 25 marks
Practical : 25 marks
Credit : 1

Prerequisites: Network Fundamentals.

Course Objectives:
Familiarize students with
1. Routing at the network layer and VLANS.
2. TCP and UDP key functions at transport layer.
3. Congestion control, fairness and stability of the Internet.
4. Wireless Technologies.

Course Outcomes:
Students will be able to
1. Configure router with different routing protocols (static and dynamic).
2. Implement a LAN with a switch and router.
3. Implement a VLAN.
4. Build a network.

Group A: Suggested List of Laboratory Assignments (any 5)
1. Build a small network and verify connectivity.
    a. Configure router.
    b. Configure Switch
2. Install Wireshark and view live network traffic with different filters.
3. Configure VLANs and Trunking
4. Configure DHCPv4
5. Socket program
6. Implement a wireless network.

Group B: Implement a mini project on any one of the following topics
1. Implement router-on-a-stick inter VLAN routing
2. Implement Ether channel
3. Implement DHCPv6 or IPv6 on a small network
4. Implement switch security configurations in VLANS.
5. Configure network devices with SSH.
6. Evaluate QoS of a network using NS2 simulation

Text Books
1. Rick Graziani, Allan Johnson, Routing Protocols and Concepts**,** Cisco Press (2011)

Reference Books
1. Andrew S. Tennabaum, David J. Weatherall**,** "Computer Networks**",** Pearson (5^{th}edition), (2011)
2. Behrouz Forouzan , "TCP/IP Protocol Suite", Mc-Graw Hill, (4^{th} Edition) (2010)

20IT 402L Operating Systems Laboratory

Teaching Scheme:
Practical: 4 hours/week

Examination Scheme:
In-Semester: 25 marks
Practical: 25 marks
Credits: 2

Prerequisites: Data Structures

Course Objectives:

Familiarize students with

1. Shell scripting and its importance.
2. Concepts of processes and threads.
3. Concurrency, Synchronization and deadlocks.
4. Basics of Unix commands.

Course Outcomes:

Students should be able to

1. Implement shell program.
2. Implement synchronized processes using multithreading concepts.
3. Apply the concept of deadlock in operating systems in implementation of multiprocessing environment.
4. Design solutions using IPC and synchronization.

Suggested List of Laboratory Assignments

1. Create two virtual machines using Type-2 hypervisor to understand basic virtualization concept.
2. Shell programming.
3. Write C programs to simulate UNIX commands like ls, grep, etc.
4. Write programs using the following system calls of UNIX operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
5. Write a C program to implement multithreading.
6. Implement producer-consumer problem using semaphores.
7. Write a C program to simulate the concept of Deadlock using Dining-Philosophers/ Banker's algorithm.
8. Write a C program to implement Inter Process Communication (shared memory or pipes or message queues).

Reference Books:

1. Neil Matthew, Richard Stones,"Beginning Linux Programming", 4th Edition, by Wrox Publication
2. Sumitabha Das, "UNIX, concepts and applications", 4th Edition, Tata McGraw-Hill Education
3. Robert Love, "Linux System Programming", 2nd Edition, O"Reilly
4. Robert Love, "Linux Kernel Development", 3rd Edition, Pearson
5. Abraham Silberschatz, Pert B. Galvin, and Greg Gagne, "Operating System Concepts", 9th edition, Wiley-India edition
6. Andrew S. Tanenbaum, "Modern Operating Systems", 4th edition, PHI Learning Private Limited, New Delhi
7. William Stallings, "Operating Systems: Internals and Design Principles", 8th edition, Pearson Education Limited

Other Resources:

1. https://www.vmware.com/support/ace/doc/setpol_vmconfig_ace.html
2. https://www.virtualbox.org/manual/ch01.html
3. https://homepages.uc.edu/~thomam/Intro_Unix_Text/Shell_Prog.html

20IT 403L Database Management Systems Laboratory

Teaching Scheme:
Laboratory: 4 hours/week

Examination Scheme:
In-Semester: 25 marks
Oral: 25 marks
Credits: 2

Prerequisites: Data structures

Course Objectives:

Familiarize students with

1. Implementation of fundamental concepts of database management
2. Use of database management systems.
3. SQL database system and PL/SQL
4. Accessing database using web application..

Course Outcomes:

Students should be able to

1. Make use of database language commands to create a database
2. Manipulate information using sql queries to retrieve useful information.
3. Apply PL/SQL for processing database
4. Use front end tools to design forms, reports and menus

Group A: Introduction to Databases (Study assignment)

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

Group B: SQL and PL/SQL (Minimum 6)

1. Design any database with at least 3 entities and relationships between them. Apply DCL and DDL commands. Draw suitable ER/EER diagrams for the system.
2. Execute DDL statements which demonstrate the use of views. Try to update the base table using its corresponding view. Also consider restrictions on updatable views and perform view creation from multiple tables.
3. Design and implement a database and apply at least 10 different DML queries for the following task. For a given input string display only those records which match the given pattern or a phrase in the search string.
4. Execute the aggregate functions like count, sum, avg etc. on the suitable database. Use group by and having clauses. Retrieve the data from the database based on time and date functions.
5. Implement nested sub queries. Perform a test for set membership (in, not in), set comparison (=some, >=some, <all etc.) and set cardinality (unique, not unique).
6. Write and execute suitable database triggers.
7. Write and execute PL/SQL stored procedure and cursor to perform a suitable task on the database.

Group C: Mini Project / Database Application Development

Student group preferably of size 4 students should decide the statement and scope of the project which will be refined and validated by the faculty. Choose database as per the requirement of the mini project. Draw and normalize the design up to an ER Diagram with normalization in case of back end as RDBMS. Design front end using any open source technology and perform connectivity to the database. Implement suitable database operations along with business logic, validations, reports etc.