M. Tech. Computer Science and Engineering

(CBCS)

Syllabus Effective From 2018-19

FIRST YEAR COMPUTER SCIENCE AND ENGINELNERING (M.TECH-I) – CBCS PATTERN

	SEMESTER - I																								
Sr. No	Course (Subject Title)	TEACHING SCHEM									EXAMINATION SCHEME														
		THEORY			TUTORIAL			PRACTICAL			THEORY						PRACTICAL			TERM WORK					
		Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Hours	Mode	Marks	Total Marks	Min	Hours	Mode	Max	Min	Hours	Max	Min			
1	PCC-CSE-101	3	3	3	1	1	1	-	-	-		CIE	30	100	12	As per BOS Guidelines	-	-	-	-	25	10			
												ESE	70		28										
2	PCC-CSE-102	3	3	3	-	-	-	1	2	2		CIE	30	100	12		-	-	-	-	25	10			
												ESE	70		28										
3	PCC-CSE-103	3	3	3	-	-	-	1	2	2		CIE	30	100	12		-	-	-	-	25	10			
												ESE	70		28										
4	PCE-CSE-101	3	3	3	-	-	-	-	-	-		CIE	30	100	12		-	-	-	-	25	10			
												ESE	70		28										
5	PCE-CSE-102	3	3	3	1	1	1	-	-	-		CIE	30	100	12		-	-	-	-	25	10			
												ESE	70		28										
6	PW-CSE-101	-	-	-	-	-	-	1	2	2		-	-	-	-		-	-	-	-	25	10			
	TOTAL	**15**	**15**	**15**	**2**	2	2	**3**	**6**	**6**				**500**							**150**				

CIE- Continuous Internal Evaluation, ESE – End Semester Examination

SEMESTER - II																										
Sr. No	Course (Subject Title)	TEACHING SCHEM :									EXAMINATION SCHEME															
		THEORY			TUTORIAL			PRACTICAL			THEORY						PRACTICAL				TERM WORK					
		Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Hours	Mode	Marks	Total Marks	Min	Hours	Mode	Max	Min		Hours	Max	Min			
1	PCC-CSE-201	3	3	3	1	1	1	-	-	-		CIE	30	100	12	As per BOS Guidelines	-	-	-		-	25	10			
												ESE	70		28											
2	PCC-CSE-202	3	3	3	-	-	-	1	2	2		CIE	30	100	12		-	-	-		-	25	10			
												ESE	70		28											
3	PCE-CSE-201	3	3	3	-	-	-	1	2	2		CIE	30	100	12		-	-	-		-	25	10			
												ESE	70		28											
4	PCE-CSE-202	3	3	3	1	1	1	-	-	-		CIE	30	100	12		-	-	-		-	25	10			
												ESE	70		28											
5	PCE-CSE-203	3	3	3				-	-	-		CIE	30	100	12		-	-	-		-	25	10			
												ESE	70		28											
6	PW-CSE-201	-	-	-	-	-	-	1	2	2							-	-	-		-	25	10			
	TOTAL	**15**	**15**	**15**	**2**	2	2	**3**	**6**	**6**				**500**								**150**				

CIE- Continuous Internal Evaluation, ESE – End Semester Examination

• Candidate contact hours per week : 30 Hours (Minimum)	• Total Marks SEM I & II: **1300**
• Theory/Tutorial Duration : 60 Minutes and Practical Duration : 120 Minutes	• Total Credits. SEM I & II: **40**
• In theory examination there will be a passing based on separate head of passing for examination of CIE and ESE.	
• There shall be separate passing for theory and practical (term work) courses.	

COURSE CODE AND DEFINITION

Semester I

Sr. No	Code No.	Subject	Credits
1.	PCC-CSE-101	Mathematical Foundations of Computer Science (MFCS)	4
2.	PCC-CSE-102	Design of Database Systems	4
3.	PCC-CSE-103	Advanced Algorithms	4
4.	PCE-CSE-101	Elective – I	3
5.	PCE-CSE-102	Elective-II	4
6.	PW-CSE-101	Research Methodology	1
		TOTAL	**20**

Sr. No	Elective-I	Elective-II
1	Advanced Network Protocol	Cloud and Virtualization
2	Ad-hoc Wireless Network	High Performance Computing Architectures
3	Pervasive Computing	Advanced Operating Systems

Semester II

Sr. No	Code No.	Subject	Credits
1.	PCC-CSE-201	Systems and Information Security	4
2.	PCC-CSE-202	Machine Learning	4
3.	PCE-CSE-201	Elective – III	4
4.	PCE-CSE-202	Elective-IV	4
5.	PCE-CSE-303	Elective-V	3
6.	PW-CSE-201	Seminar – I	1
		TOTAL	**20**

Sr. No	Elective-III	Elective-IV	**Elective V (open)
1	Data Analytics	Deep Learning	Parallel and Distributed Computing
2	Data Warehousing and Data Mining	Computer Vision	Information Retrieval
3	Business Analytics	Pattern Recognition	Natural Language Processing

SECOND YEAR COMPUTER SCIENCE AND ENGINELNERING (M.TECH-II)– CBCS PATTERN

Sr. No	Course (Subject Title)	TEACHING SCHEME									EXAMINATION SCHEME												
		THEORY			TUTORIAL			PRACTICAL			THEORY						PRACTICAL			TERM WORK			
		Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Credits	No. of Lecture	Hours	Hours	Mode	Marks	Total Marks	Min	Hours	Modes	Max	Min	Hours	Max	Min	
SEMESTER –III																							
1	PW-CSE-301	-	-	-	-	-	-	2	4	4	-	-	-	-	-	As per BOS Guidelines		-	-	-	50	20	
2	PW-CSE-302	-	-	-	-	-	-	2	4	4	-	-	-	-	-						50	20	
3	PW-CSE-303							8	16	16											100	40	
	TOTAL	-	-	-	-	-	-	**12**	**24**	**24**											**200**		
SEMESTER –IV																							
1	PW-CSE-401	-	-	-	-	-	-	16	32	32	-	-	-	-	-		OE	100	40		100	40	
	TOTAL	-	-	-	-	-	-	**16**	**32**	**32**								**100**			**100**		
	TOTAL	-	-	-	-	-	-	**28**	**56**	**56**								**100**			**300**		

- Total Marks for Sem III & IV :**400**
- Total Credits for Sem III & IV : **28**
- In theory examination there will be a passing based on separate head of passing for examination of CIE and ESE.
- There shall be separate passing for theory and practical (term work) courses.

Semester III

Sr. No	Code No.	Subject	Credits
1.	PW-CSE-301	*e-learning Course	2
2.	PW-CSE-302	# Seminar II	2
3.	PW-CSE-302	##Dissertation Phase-I	8
		TOTAL	**12**

Semester IV

Sr. No	Code No.	Subject	Credits
1.	PW-CSE-401	#Dissertation Phase-II	16
		TOTAL	**28**

Note :

* e-learning course :- Students are supposed to complete e-learning course from MOOCS/NPTEL/Swayam related to Dissertation work and not covered in M. Tech Sem I and Sem II and as per suggestions from respective guide.

*For seminar I, Seminar II work load will be for two students

** Open elective: - Students can take any subject from other PG discipline being conducted in the same Institute and with the consent of their Guide/PG Faculty from program of study.

Seminar II should be on advanced technology related to Dissertation topic.

Dissertation Phase I , Dissertation phase II work load will be for one student.

PCC-CSE-101 Mathematical Foundations of Computer Science

Theory : 3 Hr/Week
Tutorial: 1 Hr/Week
Marks : 100
Term Work : 25

Course Objectives

1. To enhance the problem solving skills in the areas of theoretical computer science.
2. To use the mathematical concepts in the development of computer applications.
3. To make the student aware of mathematical tools, formal methods & automata techniques to computing.
4. To strengthen the students' ability to carry out formal and higher studies in computer science.

Course Outcomes

At the end of the course students will be able to

1. Use mathematical concepts in the development of language design.
2. Design regular expressions and automata for different language classes.
3. Design context free grammar and push down automata for different applications.
4. Describe different types of Turing Machine their use, capability, and limitations.
5. Determine decidability and reducibility of computational problems.
6. Determine Computability and Computational Complexity.

Course Contents

Unit 1. Introduction **5 Hrs.**

Mathematical notions and terminology of sets, sequences and tuples, functions and relations graphs, strings and languages. Boolean logic properties and representation. Definitions, Theorems and types of proofs, formal proofs, deductive, reduction to definition, proof by construction, contradiction, induction, indirect, automatic, counter-examples

Unit 2. State Machines and Grammars **8 Hrs.**

Types of Languages, Types of grammar, recurrence relations, Regular expressions, Finite State Machines, DFA, NFA, Equivalence of DFA & NFA., Kleen's Theorem, pumping Lemma, Applications 5 Push down automata and CFG PDA, N-PDA, CFG, ambiguous grammar, non ambiguous grammar, CNF, Parsers: Top-down, Bottom-up, applications

Unit 3. Turing Machines **6 Hrs.**

Turing machines, variations of TMs, Combining TM's, programming techniques for TMs, Universal Turing Machines, recursive and recursively enumerable languages

Unit 4. Decidability and Reducibility **7 Hrs.**

Decidable languages, decidable problems concerning context-free languages, FA, PDA, Turing Machines, Undecidable problems from language theory,A simple undecidable problem (PCP), The halting problem- Diagonalization method, Reduction problems, mapping reducibility

Unit 5. Computability **5 Hrs.**

Primitive recursive functions, computable functions, primitive recursive functions. Computability examples, the recursion theorem

Unit 6. Computational Complexity **5 Hrs**

Tractable and intractable problems, growth rates of functions. Time complexity of TM. Tractable decision problems. Theory of Optimization

Reference Books

1 "Introduction to Theory of Computation", Michael Sipser, Thomson Brools Cole.

2 "Introduction to Automata Theory, Language and Computations", J.E. Hoperoft, Rajeev Motwani & J. D. Ullman, Pearson Education Asia, 2nd Edition.

3 "Introduction to Languages and Theory of Computation", John. Martin MGH.3rd Edition

4 "Discrete Mathematical Structures with Applications to Computer Science", J. P. Trembley and R. Manohar.

5 "Theory of Computer Science", E. V. Krishamoorthy.

PCC-CSE-102 Design of Database Systems

Theory : 3 Hr/Week
Practical: 2 Hr/Week
Marks : 100
Term Work : 25

Course Objectives

1. To make students aware of phases of database design, database system development life cycle and design methodology.
2. To acquire knowledge on parallel and distributed databases and its applications.
3. To expose to the students the design issues in specialized databases.
4. To address designing of graph and cloud databases for scalable performance

Course Outcomes

At the end of the course students will be able to

1. Describe basic concepts of database types
2. Explain security issues of database
3. Explain special and temporal databases
4. Describe cloud database activities
5. Explain graph databases

Course Contents

Unit 1. Database Planning, Design and Administration **6 Hrs.**

The information system lifecycle, the database system development lifecycle, database planning, system definitions, requirement collection and analysis, database design, DBMS selection, application design, prototyping, implementation, data conversion and loading, testing, operational maintenance, CASE tools, data and database administration.

Unit 2. Parallel and Distributed Databases **7 Hrs.**

Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems- Distributed Systems – Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Design of Parallel Systems- Distributed Database Concepts - Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Case Studies.

Unit 3. Security and Authorization **6 Hrs.**

Introduction to database security, access control, discretionary access control, mandatory access control, security for internet applications, additional issues related to security. Case study : Security and authorization in Oracle / IBM DB2.

Unit 4. Spatial, Temporal & Multimedia Databases **6 Hrs.**

Motivation, Time in databases, Spatial and Geographic data, Multimedia databases. Design issues of spatial, temporal and multimedia databases.

Unit 5. Cloud Databases **7 Hrs.**

Introduction, Architecture, Data Models, NoSQL databases : Apache Cassandra, CouchDB and MongoDB, Comparison of Relational databases and Cloud databases, Challenges to develop Cloud Databases.

Unit 6. Graph Databases **6 Hrs**

Introduction, options for storing connected data, data modeling with graphs, building graph database application, graphs in the real world, graph database internals.

Reference Books

1 Thomas Connolly, Carolyn Begg "Database Systems: A Practical Approach to Design, Implementation and Management", Pearson, 4th Edition. 2012

2 Silberschatz, Korth & Sudarshan, "Database System Concepts", MGH. 6th Edition 2011

3 Fundamentals of Database Systems - Elmasri and Navathe [4e], Pearson Education3. Database Systems, Design, Implementation and Management - Coronel-Morris- Rob)

4 Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design Implementation and Management", Third Edition, Pearson Education, 2007.

5 Ramakrishnan & Gehrke, "Database Management System.", MGH. 3rd Edition 2003

6 Jeffrey A. Hoffer, Mary B. Prescott, Fred R. McFadden, "Modern Database Management.", Pearson, 6th Edition 2002

7 Rob & Coronel, "Database Systems – Design, Implementation & Management.", Thomson, 5th Edition 2003

8 Oracle 11g / IBM DB2 9.7 manuals

PCC-CSE-103 Advanced Algorithm

Theory : 3 Hr/Week
Practical: 2 Hr/Week
Marks : 100
Term Work : 25

Course Objectives

1. To provide solution to problems using different algorithm design paradigms.
2. To analyze performance of algorithms and find lower bound.
3. To synthesize algorithms for different parallel architectures.

Course Outcomes

At the end of the course students will be able to

1. Discover solution to problems using different algorithm design paradigms like Divide and Conquer and Greedy Approach.
2. Apply dynamic programming approach to tackle problems.
3. Analyze performance of algorithms using asymptotic analysis.
4. Find lower bound of complexity to solve different problems.
5. Synthesize efficient algorithms for different parallel architectures.

Course Contents

Unit 1. **Introduction** **8 Hrs.**

Algorithm definition and specification, Performance analysis randomized algorithms, Divide and Conquer method, Binary search, Merge sort Quick sort and convex hull. Greedy method and Dynamic Programming General methods, Job sequencing with deadlines, Minimum cost spanning trees, Optimal merge patterns, All pairs shortest paths, Optimal binary search trees, Reliability design, Traveling salesman problem and flow shop scheduling.

Unit 2. **Lower bound Theory** **4 Hrs.**

Comparison trees, Oracles and adversary arguments, lower bounds through reductions.

Unit 3. **NP-Hard and NP- complete problems** **6 Hrs.**

Basic concepts, cook's theorem. NP –hard graph problems, NP-hard scheduling problems. NP-Hard code generation's problems.

Unit 4. **PARAM Algorithms** **6 Hrs.**

Introduction, computational model, Fundamental techniques and algorithms, Merging, lower bounds.

Unit 5. **Mesh Algorithms** **6 Hrs.**

Computational model, Packet routing fundamental algorithms, merging, computing the convex hull.

Unit 6. **Hypercube Algorithms** **6 Hrs**

Computational model, PPR routing fundamental algorithms, merging, computing the convex hull.

Reference Books

1 "Fundamentals Of Computer Algorithms", Ellis Horowitz, Sartaj Sahni and Sanguthewar Rajasekaran (Galgotia Publications)

2 “Design And Analysis Of Algorithms”, Aho, Hopcraft & Ulman (Addison Wesley)

3 “Introduction to Algorithms”, Thomas H. Cormen, Charles S. Leiserson, Ronald L.Rivest and Clifford Stein (PHI), 2nd Edition.

4 “Randomized Algorithms”, Rajeev Motwani and Prabhakar Raghavan (CambridgeUniversity Press)

PCE-CSE-101 Advanced Network Protocol

Theory : 3 Hr/Week **Marks :** 100
Practical: -- Hr/Week **Term Work :** 25

Course Objectives

1. To understand network protocols, architectures and applications
2. To study the functionality of various layers of the OSI model / TCP/IP model and understand the interactions between them
3. To Study the various Routing protocols in the Internet and the working of ATM.
4. To understand the networking management principals

Course Outcomes

At the end of the course students will be able to

1. Describe the functionality of various layers of the OSI model, TCP/IP protocol suite and ATM network.
2. Describe various Routing protocols in the Internet and networking management principals.
3. Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.
4. Implement, evaluate, and improve networking concepts, techniques, and algorithms through projects.

Course Contents

Unit 1. **Advanced Networks Concepts**: **6 Hrs.**

VPN-Remote-Access VPN, site-to-site VPN, Tunneling to PPP, Security in VPN. MPLS operation, Routing, Tunneling and use of FEC, Traffic Engineering, and MPLS based VPN, overlay networksP2P connections.-IPv4 and IPV6 addressing

Unit 2. **The WAN Protocol** **6 Hrs.**

Introducing ATM Technology, basic concepts of ATM Networking, Exploring the B-ISDN reference model, ATM Physical Layer, ATM Layer, ATM Adaptation Layer, Frame Relay, X.25, LAPB, HDLC, SDLC, PPP.

Unit 3. **Routing Protocols** **7 Hrs.**

Intra and interdomain routing; Unicast Routing Protocols: RIP, OSPF, BGP; Multicast Routing Protocols: MOSPF, DVMRP. Drawbacks of traditional routing methods, Idea of TE, TE and Different Traffic classes. IP over ATM, Multi protocol Label switching (MPLS)

Unit 4. **Transport Layer Protocols** **7 Hrs.**

The Transport service primitives
UDP: Process to Process communication, User Datagram Format, Operation and uses of UDP.
TCP: TCP Services and Features, TCP segment format, TCP Connections, Flow and error control in TCP, TCP Timers.
Berkeley Sockets: Socket Addresses, Elementary Socket system calls byte ordering and address conversion routines, connectionless iterative server,

Connection Oriented concurrent server, TCP and UDP Client server Programs

Unit 5. **Network Management Tools and Systems** **6 Hrs.**

Network Management Tools, Network Statistics Measurement Systems, History of Enterprise Management, Network Management systems, Commercial Network management Systems, System Management and Enterprise Management Solutions SNMP: Concept, Management components, SMI, MIB, SNMP format, Messages.

Unit 6. **Traffic Engineering and Capacity Planning** **6 Hrs**

Traffic Engineering Basics: Requirement, Traffic sizing, characteristics, Protocols, Time Delay considerations, Connectivity, Reliability, Availability and Maintainability, Throughput calculations.

Text Books

1 TCP/IP Protocol Suite, (B. A. Forouzan), Tata McGraw Hill

2 Advanced Computer Network- Dayanand Ambawade, Dr.Deven shah, Prof.MahendraMehra-Wiley India

3 Computer Networks, 5e (5th Edition) by Andrew Tanenbaum.

Reference Books

1 CCNA Intro – Study Guide – Todd Lammle, Sybex

2 Computer Networks: Principles, Technologies and Protocols for Network design, (N. Olifer, V. Olifer), Wiley India.

3 TCP/IP Volume 1, 2, 3, (W. Richard Stevens), Addison Wesley

4 TCP/IP Volume I and II, (D. E. Comer), Pearson Education.

5 High Performance Communication Networks, (J. Walrand, P. Varaiya), Morgan Kaufmann.

6 Computer Networks, (A. S. Tanenbaum), Pearson Education, Fourth Edition.

7 High-Speed Networks and Internets, Performance and Quality of Service, - William Stallings, Pearson Education

8 Larry L. Peterson, Bruce S ,"Computer Networks: A Systems Approach", 4th edition, Davie Publisher

9 Network Management: Principles and Practice; by Mani Subramanian; Addison Wesley; 2000; ISBN 0-201-35742-

10 The Cuckoo's Egg : Tracking a Spy Through the Maze of Computer Espionage;by Clifford Stoll;Pocket Books;ISBN 0671726889

11 A. Clemm, "Network Management Fundamentals", Cisco Press, ISBN-13 978-1-58720-137-0

PCE-CSE-101 Adhoc Wireless Networks

Theory : 3 Hr/Week **Marks :** 100
Practical: -- Hr/Week **Term Work :** 25

Course Objectives

1. To introduce Cellular and Ad Hoc wireless networks
2. To introduce routing protocol in Ad Hoc wireless networks
3. To introduce security in Ad Hoc wireless networks
4. To introduce QoS in Ad Hoc wireless networks

Course Outcomes

At the end of the course students will be able to

1. Identify issues in Ad Hoc wireless networks
2. Identify design issues and Classify MAC protocols in Ad Hoc wireless networks
3. Identify design issues and Classify routing protocols in Ad Hoc wireless networks
4. Identify design issues and explain operation of multicast routing protocols in Ad Hoc wireless networks
5. Explain security aspects in Ad Hoc wireless networks
6. Classify QoS solutions and Energy Management techniques in Ad Hoc wireless networks

Course Contents

Unit 1. **Introduction** **7 Hrs.**
Cellular and Ad Hoc wireless networks, Applications, Issues in Ad Hoc wireless networks.
MAC Protocols for ad hoc wireless networks – Introduction, Issues in designing MAC protocol, Design goals of MAC protocol, Classification of MAC protocols, Contention based protocols.

Unit 2. **Routing protocols for ad hoc wireless networks** **5 Hrs.**
Introduction, Issues in designing a routing protocol for ad hoc wireless networks, Classification of routing protocols, Table driven, on-demand Hybrid routing protocols.

Unit 3. **Multicast Routing in Ad hoc wireless networks** **6 Hrs.**
Introduction, Issues in designing a multicast routing protocol, Operation of multicast routing protocols, An architecture reference model for multicast routing protocols, Classification of multicast routing protocols, Tree-based, Mesh-based multicast routing protocols

Unit 4. **Transport layer and security protocols for ad hoc wireless networks** **8 Hrs.**
Introduction, Design issues and goals, Classification of transport layer solutions, TCP over ad hoc wireless networks, Security in ad hoc wireless networks, Network security requirements, Issues and challenges in security provisioning, Network security attacks, Key management, Secure routing.

Unit 5. **Quality of service** – Introduction, Issues and challenges, Classification of QoS solutions, MAC layer solutions, Network layer solutions, QoS framework. **5 Hrs**

Unit 6. **Energy management** – Introduction, Need, Classification of energy management schemes, Battery Management, Transmission Power Management, **5 Hrs**

System Power Management schemes.

Reference Books

1. Ad Hoc wireless Networks – Architecture and Protocols by C.S.R.Murthy& B.S. Manoj, Pearson Education
2. Ad Hoc Wireless Networks – A communication Theoretic perspective by O.K.Tonguz&G.Ferrari, Wiley India.
3. Ad Hoc Mobile Wireless Networks – Protocols and Systems by C. K. Toh (Pearson Education)
4. Ad Hoc Networking by Charles E. Perkins (Pearson Education)
5. Introduction to Wireless and Mobile Systems, 2nd Edition, by Dharma Prakash Agrawal & Qing-An Zeng (CENGAGE Learning)

PCE-CSE-101 Pervasive Computing

Theory : 3 Hr/Week
Practical: -- Hr/Week
Marks : 100
Term Work : 25

Course Objectives

1. To introduce pervasive computing abilities.
2. To introduce smart devices and environment required for pervasive computing.
3. To introduce Human Computer Interaction in context of Pervasive Computing.
4. To introduce handling of smart devices in context of Pervasive Computing.

Course Outcomes:

1. To model Key Ubiquitous/Pervasive Computing Properties
2. To understand working of smart environment and smart devices.
3. To understand working of Human Computer Interaction in context of Pervasive Computing.
4. To understand management of smart devices in context of Pervasive Computing.

Course Contents

Unit 1. **Introduction to Pervasive Computing** **5 Hrs.**
Concept of Pervasive Computing, Modeling the Key Ubiquitous/Pervasive Computing Properties, Mobile Adaptive Computing, Mobility Management and Caching

Unit 2. **Pervasive Computing Devices** **6 Hrs.**
Smart Environment : CPI and CCI ,Smart Devices : Application and Requirements , Ubiquitous Networks of Devices: CCI, Human to Human Interaction (HHI) Applications

Unit 3. **Human Computer Interaction** **6Hrs.**
Explicit HCI, Implicit HCI, User Interface and Interaction for four hand-held widely used devices, Hidden UI via basic smart devices, Hidden UI via wearable and Implanted devices, Human centered design, user models

Unit 4. **Management of Smart Devices** **8Hrs.**
Managing Smart Devices in Virtual Environments, Process and Application Management, Network Oriented Management, Monitoring and Accounting, Configuration Management, Fault Management, Performance Management, Service Oriented Computer Management, Managing Smart Devices in Physical Environments

Unit 5. **Middleware for Pervasive** **5 Hrs**
Adaptive middleware, Context aware middleware, Mobile middleware, Service Discovery, Mobile Agents.

Unit 6. **Challenges and Outlook** **6 Hrs**
Overview of challenges, smart devices, Smart Interaction, Smart physical environment device interaction, Smart human-device interaction, Human Intelligence versus machine intelligence, social issues.

Reference Books

1. Stefan Poslad, Ubiquitous Computing, Smart devices, environment and interaction, Wiley.

2. Frank Adelstein, Sandeep Gupta, Golden Richard III, Loren Schwiebert, Fundamentals of Mobile and Pervasive Computing, Tata McGraw Hills

3. Jochen Burkhardt, Horst Henn, Stefan Hepper, Klaus Rindtorff, Thomas Schaeck, Pervasive Computing, Pearson, Eighteenth Impression, 2014.

4. BoS Content: Books, Course Notes, Digital contents, Blogs developed by the BoS for bridging the gaps in the syllabus, problem solving approaches and advances in the course

PCE-CSE-102 Cloud and Virtualization

Theory : 3 Hr/Week **Marks :** 100
Practical: 2 Hr/Week **Term Work :** 25

Course Objectives

1. To understand the need of Cloud and virtualization
2. To understand the concepts of cloud computing
3. To understand the security issues in cloud computing.
4. To understand the concepts of virtualization, its types and virtual machines.
5. To understand the practical aspects of virtualization solutions.

Course Outcomes : At the end of the course student will be able to

1. Explain basic concepts of cloud computing
2. Describe virtualization concepts related with cloud
3. Describe security related aspects of cloud computing
4. Explain virtualization in different scenarios

Course Contents

Unit 1. **Introduction to Cloud** **4 Hrs.**

Getting to know the Cloud, Cloud and other similar configurations, Components of Cloud Computing, Cloud Types and Models: Private Cloud**,** Community Cloud, Public Cloud, Hybrid Clouds.

Unit 2. **Virtualization** **5 Hrs.**

Introduction and benefits, Implementation Levels of Virtualization, Virtualization at the OS Level, Virtualization Structure, Virtualization Mechanism, Open Source Virtualization Technology, Xen Virtualization Architecture, Binary Translation with Full Virtualization, Paravirtualization, Virtualization of CPU, Memory and I/O Devices.

Unit 3. **Cloud Computing Services and Data Security in Cloud** **6 Hrs.**

Explicit HCI, Implicit HCI, User Interface and Interaction for four hand-held widely used devices, Hidden UI via basic smart devices, Hidden UI via wearable and Implanted devices, Human centered design, user models

Unit 4. **Overview of Virtualization** **7 Hrs.**

Basics of Virtualization – Types of Virtualization Techniques – Merits and demerits of Virtualization –Full Vs Para-virtualization – Virtual Machine Monitor/Hypervisor - Virtual Machine Basics – Taxonomyof Virtual machines – Process Vs System Virtual Machines – Emulation: Interpretation and Binary Translation - HLL Virtual Machines

Unit 5. **Server and Network Virtualization** **7 Hrs**

Server Virtualization: Virtual Hardware Overview - Server Consolidation – Partitioning Techniques -Uses of Virtual server Consolidation – Server Virtualization Platforms, Network Virtualization: Design of Scalable Enterprise Networks – Layer2 Virtualization – VLAN - VFI - Layer 3 Virtualization –VRF - Virtual Firewall Contexts - Network Device Virtualization - Data- Path Virtualization – Routing Protocols.

Unit 6. **Storage, Desktop and Application Virtualization** **7 Hrs**

Storage Virtualization: Hardware Devices – SAN backup and recovery techniques – RAID –
Classical Storage Model – SNIA Shared Storage Model – Virtual Storage: File System Level and
Block Level, Desktop Virtualization: Concepts - Desktop Management Issues - Potential Desktop Virtualization Scenarios - Desktop Virtualization Infrastructures, Application Virtualization: Concepts- Application Management Issues - Redesign Application Management – Application Migration

Reference Books

1. Cloud Computing Black Book- Jayaswal, Kallakurchi, Houde, Shah, Dreamtech Press.
2. Cloud Computing: Principles and Paradigms – Buyya, Broburg, Goscinski.
3. Cloud Computing for Dummies – Judith Hurwitz.
4. James E. Smith, Ravi Nair, - Virtual Machines: Versatile Platforms for Systems and Processes, Elsevier/Morgan Kaufmann, 2005.
5. David Marshall, Wade A. Reynolds, - Advanced Server Virtualization: VMware and Microsoft Platform in the Virtual Data Center, Auerbach Publications, 2006.
6. Kumar Reddy, Victor Moreno, - Network virtualization, Cisco Press, July, 2006.
7. Chris Wolf, Erick M. Halter, - Virtualization: From the Desktop to the Enterprise, APress 2005.
8. Danielle Ruest, Nelson Ruest - Virtualization: A Beginner's Guide, TMH, 2009
9. Kenneth Hess , Amy Newman: Practical Virtualization Solutions: Virtualization from the Trenches Prentice Hall 2010

Guidelines for Tutorials:

(Minimum 4 Tutorials from unit 1 to 3 and 4 from Unit 4 to 6.)

PCE-CSE-102 High Performance Computer Architectures

Theory : 3 Hr/Week
Practical: 2 Hr/Week

Marks : 100
Term Work : 25

Course Objectives

1. Introduce types of computer architectures.
2. Introduce concepts of Memory Hierarchy and latency.
3. Instruction Level Parallelism.
4. Study of Data-Level Parallelism in Vector, SIMD, and GPU Architectures
5. Study of Warehouse-Scale Computers.

Course Outcomes:

At the end of the course students will be able to

1. Describe different design techniques with its analysis
2. Explain different memory hierarchy design
3. Describe instruction level and thread level parallelism
4. Explain data level parallelism with different architectures

Course Contents

Unit 1. **Fundamentals of Quantitative Design and Analysis** **5 Hrs**

Introduction, Classes of Computers, Defining Computer Architecture, Trends in Technology, Trends in Power and Energy in Integrated Circuits, Trends in Cost, Dependability Measuring, Reporting, and Summarizing Performance Quantitative Principles of Computer Design Putting It All Together: Performance, Price, and Power, Fallacies and Pitfalls.

Unit 2. **Memory Hierarchy Design** **6 Hrs.**

Introduction, Ten Advanced Optimizations of Cache Performance, Memory Technology and Optimizations, Protection: Virtual Memory and Virtua Machines, Crosscutting Issues: The Design of Memory Hierarchies, Putting I All Together: Memory Hierarchies in the ARM Cortex-A8 and Intel Core I7 Fallacies and Pitfalls.

Unit 3. **Instruction-Level Parallelism and Its Exploitation** **10 Hrs.**

Instruction-Level Parallelism: Concepts and Challenges, Basic Compiler Techniques for Exposing ILP , Reducing Branch Costs with Advanced Branch Prediction, Overcoming Data Hazards with Dynamic Scheduling ,Dynamic Scheduling: Examples and the Algorithm , Hardware-Based Speculation, Exploiting ILP Using Multiple Issue and Static Scheduling , Exploiting ILP Using Dynamic Scheduling, Multiple Issue, and Speculation , Advanced Techniques for Instruction Delivery and Speculation ,Studies of the Limitations of ILP Cross-Cutting Issues: ILP Approaches and the Memory System, Multithreading: Exploiting Thread-Level Parallelism to Improve Uniprocessor Throughput , Putting It All Together: The Intel Core i7 and ARM Cortex-A8 233 Fallacies and Pitfalls.

Unit 4. **Data-Level Parallelism in Vector, SIMD, and GPU Architecture** **7 Hrs.**

Introduction, Vector Architecture , SIMD Instruction Set Extensions for Multimedia , Graphics Processing Units Detecting and Enhancing Loop-Level Parallelism , Crosscutting Issues , Putting It All Together: Mobile versus Server GPUs and Tesla versus Core i7, Fallacies and Pitfalls.

Unit 5. **Thread-Level Parallelism** **7 Hrs.**

Introduction, Centralized Shared-Memory Architectures, Performance of Symmetric Shared-Memory Multiprocessors, Distributed Shared-Memory and Directory-Based Coherence, Synchronization, Models of Memory Consistency, Crosscutting Issues, Putting It All Together: Multicore Processors and Their Performance, Fallacies and Pitfalls

Unit 6. **Warehouse-Scale Computers to Exploit Request-Level and Data-Level Parallelism** **8 Hrs**

Introduction, Programming Models and Workloads for
Warehouse-Scale Computers, Computer Architecture of Warehouse-Scale Computers, Physical Infrastructure and Costs of Warehouse-Scale Computers, Cloud Computing: The Return of Utility Computing, Crosscutting Issues, Putting It All Together: A Google Warehouse-Scale Computer Fallacies and Pitfalls.

Text Books

1 Computer Architecture -A Quantitative Approach,FifthEdition by John L. Hennessy and David A. Patterson published by Elsevier.

Reference Books

1 M.R. Bhujade, “Parallel Computing”, 2nd edition, New Age International Publishers 2009

PCE-CSE-102 Advanced Operating Systems

Theory : 3 Hr/Week
Practical: 2 Hr/Week

Marks : 100
Term Work : 25

Course Objectives

6. To deliver different components of advanced and distribute operating system.
7. To provide knowledge of issues involved in virtualization, cloud and security aspects of OS.
8. To induce steps involved in designing operating systems and distributed systems.

Course Outcomes:

At the end of the course students will be able to

1. Explain the advances in operating systems and characteristics of environment in which they are used.
2. Apply the communication techniques in distributed operating systems and implement and analyze techniques such as remote procedures, scheduling in distributed systems.
3. Design and implement different control algorithms in distributed mutual exclusion, distributed deadlocks, election algorithms etc.

Course Contents

Unit 1. **Multiple E Processor Systems** **7 Hrs**

MULTIPROCESSORS- Multiprocessor Hardware, Multiprocessor Operating System Types, Multiprocessor Synchronization, Multiprocessor Scheduling, MULTICOMPUTER S - Multicomputer Hardware, Low-Level Communication Software, User-Level Communication Software, Remote Procedure Call, Distributed Shared Memory, Multicomputer Scheduling, Load Balancing

Unit 2. **Distributed Operating Systems** **7 Hrs.**

Features, Nodes of Distributed systems, Integrating Operation of Nodes of Distributed system, Reliable Interprocess Communication, Distributed Computation Paradigms, Networking, Models of Distributed System, Design Issues.

Theoretical Issues in Distributed Systems – Notions of Time and State, States and Events, Time, Clocks and Event Precedences, Recording the state of a distributed System.

Unit 3. **Distributed Control Algorithms** **6 Hrs.**

Operation of Distributed Control Algorithms, Correctness, Distributed Mutual Exclusion, Distributed Deadlock Handling, Distributed Scheduling Algorithms, Distributed Termination Detection, Election Algorithms, Practical Issues in using Distributed Control Algorithms

Recovery and Fault Tolerance – Faults, failures and recovery, Byzantine Faults and Agreement Protocols, Recovery, Fault Tolerance Techniques, Resiliency.

Unit 4. **Distributed File Systems** **7 Hrs.**

Design issues, Transparency, Semantics of file sharing, fault tolerance, DFS performance, Case studies – Sun Network File System, Andrew and Coda File System, GPFS, Windows.

Distributed System Security – Issues in Distributed system security, Message security, Authentication of Data and Messages, Third party authentication.

Unit 5. **Virtualization** **6 Hrs.**

Introduction, Characteristics of virtualized environments, Taxonomy of virtualization techniques, Virtualization and cloud computing, Pros and cons of virtualization, Technology examples

Unit 6. Cloud Computing Architecture **7 Hrs**

Introduction, The cloud reference model – Architecture, Infrastructure- and hardware-as-a-service, Platform as a service, Software as a service, Types of cloud, Economics of the cloud, Open challenges

Aneka - Framework overview, Anatomy of the Aneka container, Building Aneka clouds, Cloud programming and management - Aneka SDK, Management tools.

Text Books

1 Chapter 1 from Modern Operating Systems by Andrew S Tanenbaum, Pearson, 4th Edition

2 Chapter 2 to 4 from Operating Systems -A concept based approach 3rd Edition by D. M. Dhamdhere, McGraw Hill publication.

3 Chapter 5 to 6 from Rajkumar Buyya, Christian Vecchieola, S. Thamarai Selvi, "Mastering Cloud Computing", (McGrawHill)

Reference Books

1 Operating System Concepts, written by Peter B. Galvin, Greg Gagne and Abraham Silberschatz, John Wiley, 8th Edition.2011.

2 P. K. Sinha, "Distributed Operating Systems Concepts and Design", PHI.

PW-CSE-101 Research Methodology

Practical: 2 Hr/Week **Term Work :** 25

Course Objectives

1. To familiarise students with the dimensions and methods of research.
2. To familiarise students with different methods of data collection.
3. Give students an insight into the steps to be followed in doing a research.

Course Outcomes: At the end of the course student will be able to

1. Explain different dimensions and methods of research
2. Use appropriate method of data collection.

Course Contents

Unit 1 **Fundamentals of Research** **4 Hrs**

Introduction, Concepts of Research, Research Process, Creativity in Research, Ethics in Research, Managers and Research

Unit 2. **Research Problem** **4 Hrs.**

Research Problem Introduction, Concept of Research Problem, Conditions and Components of Research Problem

4 Hrs.

Unit 3. **Research Design**

Research Design Introduction, Concept of Research Design, Need and Features of Research Design, Components of Research Design, Types of Research Design

5 Hrs.

Unit 4. **Methods of Data Collection**

Methods of Data Collection Concepts of Data Collection, Types of Data, Methods of Primary Data Collection, Some other Methods of Primary Data Collection, Methods of Secondary Data Collection, Selecting an Appropriate Method of Data Collection

5 Hrs

Unit 5. **Data Processing and Analysis**

Data Processing and Analysis Introduction, Concepts of Data Processing, Concept of Data Analysis, Measures of Central Tendency, Measures of Dispersion, Measures of Skewness, Measures of Relationship, Other Statistical Measures used in Research

4 Hrs

Unit 6. **Computer Application in Research Methodology**

Computer Application in Research Methodology Introduction, Computer Application in Research Methodology, SPSS Software, Descriptive Statistics, Bivariate Statistics, Regression Analysis

Reference Books

1. Research Methodology by G.C.Ramamurthy & Kogent Learning Solutions Inc. (dreamtech press)