Uttarakhand Technical University, Dehradun

Scheme of Examination as per AICTE Flexible Curricula

Evaluation Schemes for B. Tech 2nd to 4th Year

W.E.F. Academic Session 2020-21

III to VIII SEMESTER

Bachelor of Technology (B. Tech.)

[Computer Science and Engineering]

VIII Semester

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per Week			Total Credit
				Theory			Practical						
				End Sem	Mid Sem	Quiz / Assignment	End Sem	Term Work /Lab Work & Sessional		L	T	P	
1.	BCST-801 BCSP-801	DC	Advanced Operating Systems	100	30	20	30	20	200	3	1	2	5
2.	BCST -802 BCSP-802	DC	Cryptography & Network Security	100	30	20	30	20	200	3	1	2	5
3.	BCST -803	DE	Departmental Elective	100	30	20	-	-	150	3	1	0	4
4.	BOCS-804	OE	Open Elective	100	30	20	-	-	150	3	1	0	4
5	BCSP -805	P	Major Project	-	-	-	100	100	200	0	0	8	4
Total				400	120	80	120	130	900	12	4	12	22
NSS/NCC													

Departmental Electives		**Open Electives**	
BCST 803 (A)	Speech and Natural Language Processing	BOCS -804(A)	Fault Tolerant Computing
BCST 803 (B)	Embedded Systems	BOCS -804 (B)	Artificial Intelligence
BCST 803 (C)	Queuing Theory and Modeling	BOCS 804 (C)	Cognitive Radio Networks
BCST 803 (D)	Cloud Security	BOCS 804 (D)	Service Oriented Architecture
BCST 803 (E)	Blockchain	BOCS 804 (E)	Subject from SWAYAM etc

Note: 20% of subjects can be allowed to be taken online through SWAYAM or any other international Institute.

Specialisation:

- A separate list of additional credits will be released for Minor/Specialisation degree
- Additional 18 credits are to be earned for degree with specialisation.
- In final semester of degree students may be allowed for two subjects online and other subjects can be completed in 6-8 weeks.

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New Scheme of Examination as per AICTE Flexible Curricula

Computer Science and Engineering, VIII-Semester

CS 801 Advanced Operating Systems

Course Objectives:

- Have an understanding of high-level OS kernel structure.
- Gained insight into hardware-software interactions for compute and I/O.
- Have practical skills in system tracing and performance analysis.
- Have been exposed to research ideas in system structure and behaviour.
- Have learned how to write systems-style performance evaluations.

- **Learning Outcomes:**
  1. Outline the potential benefits of distributed systems.
  2. Summarize the major security issues associated with distributed systems along with the range of techniques available for increasing system security.
  3. Apply standard design principles in the construction of these systems.
  4. Select appropriate approaches for building a range of distributed systems, including some that employ middleware

Course Content:

UNIT I:

Overview of UNIX system calls. The anatomy of a system call and x86 mechanisms for system call implementation. How the MMU/memory translation, segmentation, and hardware traps interact to create kernel–user context separation. What makes virtualization work? The kernel execution and programming context. Live debugging and tracing. Hardware and software support for debugging.

UNIT II:

DTrace: programming, implementation/design, internals. Kprobes and SysTrace: Linux catching up. Linking and loading. Executable and Linkable Format (ELF). Internals of linking and dynamic linking. Internals of effective spinlock implementations on x86. OpenSolaris adaptive mutexes: rationale and implementation optimization. Pre-emptive kernels. Effects of modern memory hierarchies and related optimizations.

UNIT III:

Process and thread kernel data structures, process table traversal, lookup, allocation and management of new structures, /proc internals, optimizations. Virtual File System and the layering of a file system call from API to driver. Object-orientation patterns in kernel code; a review of OO implementation generics (C++ vtables, etc).

UNIT IV:

OpenSolaris and Linux virtual memory and address space structures. Tying top-down and bottom-up object and memory page lookups with the actual x86 page translation and segmentation. How file operations, I/O buffering, and swapping all converged to using the same mechanism. Kmem and Vmem allocators. OO approach to memory allocation. Challenges of multiple CPUs and memory hierarchy. Security: integrity, isolation, mediation, auditing. From MULTICS and MLS to modern UNIX. SELinux type enforcement: design,

implementation, and pragmatics. Kernel hook systems and policies they enable. Trap systems and policies they enable. Tagged architectures and multi-level UNIX.

UNIT V:

ZFS overview. OpenSolaris boot environments and snapshots. OpenSolaris and UNIX System V system administration pragmatics: service startup, dependencies, management, system updates. Overview of the kernel network stack implementation. Path of a packet through a kernel. Berkeley Packet Filter architecture. Linux Netfilter architecture.

Topics for Programs:

1. Getting Started with Kernel Tracing - I/O
2. Kernel Implications of IPC
3. Micro-Architectural Implications of IPC
4. The TCP State Machine
5. TCP Latency and Bandwidth

Text Books:

1. Jean Bacon, Concurrent Systems, Addison – Wesley, 1998.
2. William Stallings, Operating Systems, Prentice Hall, 1995.
3. Andrew S. Tanenbaum and Maarten van Steen. “Distributed Systems: Principles and Paradigms”, Prentice Hall, 2nd Edition, 2007.
4. Silberschatz, Galvin, and Gagne, Operating System Concepts Essentials, 9th Edition.

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New Scheme of Examination as per AICTE Flexible Curricula

Computer Science and Engineering, VIII-Semester

CS 802 Cryptography & Network Security

Course Objectives:

The objective of the course is to provide a basic understanding of the various issues related to information systems security (esecurity). The course will present an overview of the risks encountered in information systems security, and the tools used for resolving these risks.

Course Learning Outcomes:

1. Provide security of the data over the network.
2. Do research in the emerging areas of cryptography and network security.
3. Implement various networking protocols.
4. Protect any network from the threats in the world.

Course Content:

UNIT I: INTRODUCTION & NUMBER THEORY

Services, Mechanisms and attacks-the OSI security architecture-Network security model-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography).FINITE FIELDS AND NUMBER THEORY: Groups, Rings, Fields-Modular arithmetic-Euclid‟s algorithm-Finite fields- Polynomial Arithmetic –Prime numbers-Fermat‟s and Euler‟s theorem-Testing for primality -The Chinese remainder theorem- Discrete logarithms.

UNIT II: BLOCK CIPHERS & PUBLIC KEY CRYPTOGRAPHY

Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management – Diffie Hellman Key exchange-Elliptic curve arithmetic-Elliptic curve cryptography.

UNIT III: HASH FUNCTIONS AND DIGITAL SIGNATURES

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 – SHA – HMAC – CMAC – Digital signature and authentication protocols – DSS – EI Gamal – Schnorr.

UNIT IV: SECURITY PRACTICE & SYSTEM SECURITY

Authentication applications – Kerberos – X.509 Authentication services – Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls – Firewall designs – SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security.

UNIT V: E-MAIL, IP & WEB SECURITY

E-mail Security: Security Services for E-mail-attacks possible through E-mail – establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. IPSecurity: Overview of IPSec – IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). Web Security: SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSLAttacks fixed in v3- Exportability-Encoding-Secure Electronic Transaction (SET)

List of Programs:-

1. Implement the following SUBSTITUTION & TRANSPOSITION TECHNIQUES concepts:
    - Caesar Cipher
    - Playfair Cipher
    - Hill Cipher
    - Vigenere Cipher
    - Rail fence – row & Column Transformation
2. Implement the following algorithms
    - DES
    - RSA Algorithm
    - Diffiee-Hellman
    - MD5
    - SHA-1
3. Implement the Signature Scheme - Digital Signature Standard.
4. Demonstrate how to provide secure data storage, secure data transmission and for creating digital signatures (GnuPG).
5. Setup a honey pot and monitor the honeypot on network (KF Sensor).
6. Installation of rootkits and study about the variety of options.
7. Perform wireless audit on an access point or a router and decrypt WEP and WPA. (Net Stumbler).
8. Demonstrate intrusion detection system (ids) using any tool (snort or any other s/w).

Books:

1. William Stallings, Cryptography and network security, Pearson Education.
2. Alfred J. Menezes, Paul C. van Oorschot and Scott A. Vanstone , Handbook of Applied Cryptography, CRC Press.
3. Margaret Cozzens, Steven J Miller, The mathematics of encryption, American Mathematical Society

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New Scheme of Examination as per AICTE Flexible Curricula

Computer Science and Engineering, VIII-Semester

Dept Elective CS 803(D) Cloud Security

Course Objectives:

- To provide introduction to the fundamental principles of cloud computing.
- Students should able to identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud.
- Students should learn and investigate the hardware and software architecture of Cloud Computing and understand how virtualization is key to a successful Cloud Computing solution.

Course Learning Outcomes:

1. Understand Cloud Computing Architectural Framework with Service Models.
2. Demonstrate with different levels of Virtualization by creating Virtual Machine for different applications.
3. Analyze cloud computing security challenges to design the security model.
4. Appraise the cloud management with migration techniques.
5. Develop the applications on Microsoft Azure, Google App Engine, Web 2.0 platforms.

Course Content:

Unit-1

Fundamentals of Cloud Computing: Fundamental concepts of Distributed Systems, IT Challenges, Technology Foundations of Cloud Computing, What is Cloud Computing? NIST Definition and Overview of Cloud Computing, Journey of the Cloud, Essential Characteristics of Cloud Computing, Cloud Components, Cloud Challenges, Economics of the Cloud

Understanding Cloud Architecture and Services: Cloud Architecture, Service Model and Deployment Model, Stack, Management Layers, Standards, Interoperability, Cloud Maturity, Introducing SOA, Relating SOA and Cloud Computing, Architectural Influences, Services: Storage-as-a-Service, Database-as-a-Service, Information-as-a-Service, Identity-as-a-Service, Process-as-a-Service, Integration-as-a-Service, Compliance-as-a-Service, Security-as-a-Service, Management/Governance-as-a-Service, Testing-as-a-Service

Unit-2

Infrastructure-As-A-Service (Iaas): Virtualization Overview, Virtualized Data Center (VDC) – Compute: Why Virtualize, How to Virtualize, Types of Virtualization, Understanding Hypervisors, Virtual Machine and its Components, Resource Management, Share, Limit and Reservation, Optimizing Memory Resource, Memory Ballooning, Virtual Machine Affinity, Physical to Virtual Conversion: Hot and Cold Conversion Process , Virtualized Data Center (VDC) – Storage: Benefits, Storage Virtualization at different Layers, Virtual Machine Storage Options and Considerations, Virtual Provisioning, Storage Tiering, Virtualized Data Center (VDC) – Networking: BenefitsComponents of VDC network infrastructure, Virtual Network Components, Virtual LAN, VLAN, Trunking, VLAN Tagging, Network Traffic Management, Virtualized Data Center (VDC) - Desktop and Application, VMware vSphere.

Unit-3

Platform-As-A-Service (Paas): PaaS: Overview, Web Application Frameworks, Web Hosting Services- 1: Google App Engine, Web Hosting Services- 2: Microsoft Azure Service.

Software-As-A-Service (Saas): SaaS: Overview, Web Services 2.0, REST API, SOAP API, User Authentication, Case Study: Healthcare or Banking

Unit-4

Cloud Security: Cloud Security: Information Security, Basic Terminology, Security Domains, Security Concerns and Threats, Access Control and Identity Management in Cloud, Governance, Risk and Compliance, Virtualization Security Management, Cloud Security Risk, Incident Response, Retirement, Cloud Computing Security Architecture, Architectural Consideration, Trusted Cloud Computing, Data Privacy, Testing from SOA to the Clouds.
Business Continuity In Cloud: Business Continuity in Cloud: Fault Tolerance Mechanisms in VDC, Backup in VDC, Replication and Migration in VDC, Capacity Planning, Vertical Scaling, Private Cloud Planning, Business Continuity Plan, Availability.
Cloud Infrastructure, Management and Migration: Cloud Infrastructure and Service Creation, Cloud Service Management, Cloud Administration, Cloud Monitoring, Cloud Migration Consideration: Migration Considerations, Phases to Adopt the Cloud

Unit-5

Hadoop in Cloud Computing: Overview of Big Data Analytics, Overview of Hadoop and Map Reduce, Example of Map Reduce, Hadoop as a Service in Public Cloud, Hadoop in Private Cloud, HDInsight.

Text Books:

1. RajkumarBuyya (Editor), James Broberg, Andrzej M. Goscinski, Cloud Computing: Principles and Paradigms, Wiley India Pvt Ltd, 2013.
2. RajkumarBuyya, Christian Vecchiola , TamaraiSelvi, Mastering Cloud Computing, First edition, McGraw Hill Education, 2013.
3. John Rhoton, Cloud Computing Explained, 2nd Edition , Recursive Press, , 2010.
4. Barrie Sosinsky, Cloud Computing: Bible, Wiley India, 2011
5. John W. Rittinghouse and James F. Ransome, Cloud Computing, Implementation, Management and Security, CRC Press, 2010
6. David S. Linthicum, Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide, Addison Wesley, 2009
7. Andrew S. Tanenbaum, Modern Operating Systems, 3rd Edition, Prentice Hall, 2007
8. George Reese, Cloud Application Architectures, O'Reilly, 2009
9. Mark C. Chu-Carroll, Code in the Cloud: Programming Google App Engine, Pragmatic Programmers, LLC, 2011
10. Roger Jennings, Cloud Computing with the Windows Azure Platform, Wrox, Wiley India, 2010

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Computer Science and Engineering, VIII-Semester

Open Elective CS 804(B) Artificial Intelligence

Course Objectives:

- The adoption of Artificial Intelligence (AI) technologies is widely expanding in our society. Applications of AI include: self-driving cars, personal assistants, surveillance systems, robotic manufacturing, machine translation, financial services, cyber security, web search, video games, and code analysis and product recommendations. Such applications use AI techniques to interpret information from a wide variety of sources and use it to enable intelligent, goal-directed behaviour.

Course Learning Outcomes:

1. Acquire advanced Data Analysis skills.
2. Stay Industry relevant and grow in your career.
3. Create AI/ML solutions for various business problems. Ÿ Build and deploy production grade AI/ML applications.
4. Apply AI/ML methods, techniques and tools immediately

Course Content:

Unit-1 (Introduction to AI): Definitions, Goals of AI, AI Approaches, AI Techniques, Branches of AI, Applications of AI. Introduction of Intelligent Systems: Agents and Environments, Good Behavior: the concept of Rationality, The Nature of Environments, The structure of Agents, How the components of agent programs work.

Unit-2 (Problems Solving, Search and Control Strategies)

Solving Problems by Searching, Study and analysis of various searching algorithms. Implementation of Depth-first search, Problem-Solving Agents, Searching for Solutions, Uninformed Search Strategies: Breadth-first search, Uniform-cost search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bi-directional search Informed (Heuristic) Search Strategies: Greedy best-first search A* search: Minimizing the total estimated solution cost, Conditions for optimality: Admissibility and consistency, Optimality of A*, Memory-bounded heuristic search, Heuristic Functions, Generating admissible heuristics from sub problems: Pattern databases, Learning heuristics from experience.

Beyond Classical Search: Local Search Algorithms and Optimization Problems: Hill-climbing search Simulated annealing, Local beam search, Genetic algorithms, Local Search in Continuous Spaces, Searching with Non-deterministic Actions: AND-OR search trees, Searching with Partial Observations.

Unit- 3 (Knowledge Representations Issues, Predicate Logic, Rules)

Knowledge representation, KR using predicate logic, KR using rules. Reasoning System - Symbolic, Statistical: Reasoning, Symbolic reasoning, Statistical reasoning.

Unit-4 (Quantifying Uncertainty, Learning Systems)

Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Bayes' Rule and Its Use, Representing Knowledge in an Uncertain Domain, Other Approaches to Uncertain Reasoning, Rule-based methods for uncertain reasoning, Representing vagueness: Fuzzy

sets and fuzzy logic, Study of fuzzy logic and Decision trees, Implementation aspects of Decision trees.
Learning from Examples: Forms of Learning, Supervised Learning, Learning Decision Trees, The decision tree representation, Expressiveness of decision trees, inducing decision trees from examples.

Unit-5 (Expert Systems)

Introduction, Knowledge acquisition, Knowledge base, Working memory, Inference engine, Expert system shells, Explanation, Application of expert systems.
Fundamentals of Neural Networks: Introduction and research history, Model of artificial neuron, Characteristics of neural networks, learning methods in neural networks, Single-layer neural network system, Applications of neural networks.
Fundamentals of Genetic Algorithms: Introduction, Encoding, Operators of genetic algorithm, Basic genetic algorithm.

Text/Reference Books:

1. Rich, Elaine Knight, Kevin, Artificial Intelligence, Tata McGraw Hill.
2. Luger, George F, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education.
3. Nilsson, Nils J, Artificial Intelligence, Morgan Kaufmann
4. Russell, Stuart J. Norvig, Peter, AI: A Modern Approach, Pearson Education