ADVANCED COMPUTER ARCHITECTURE		Semester	05
Course Code	**BCM701**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8 slots	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory/practical		

Course objectives:

CLO 1. Describe computer architecture.
CLO 2. Measure the performance of architectures in terms of right parameters.
CLO 3. Summarize parallel architecture and the software used for them

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) need not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same program

Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

MODULE-1

Theory of Parallelism: Parallel Computer Models, The State of Computing, Multiprocessors and Multicomputer, Multivector and SIMD Computers.
Program and Network Properties: Conditions of Parallelism, Program Partitioning and Scheduling, Program Flow Mechanisms.
Textbook- Chapter 1 (1.1to 1.3), Chapter 2 (2.1 to 2.3)

MODULE-2

Principles of Scalable Performance: Performance Metrics and Measures, Parallel Processing Applications, Speedup Performance Laws. For all Algorithm or mechanism any one example is sufficient.
Hardware Technologies-1: Processors and Memory Hierarchy, Advanced Processor Technology, Superscalar and Vector Processors, Virtual Memory Technology.
Textbook-Chapter 3 (3.1 to 3.3), Chapter 4 (4.1 to 4.4)

MODULE-3
Hardware Technologies 2: Cache Memory Organizations, Shared Memory Organizations, Pipelining and Superscalar Techniques, Linear & Nonlinear Pipeline Processors. **Parallel and Scalable Architectures:** Multiprocessors and Multicomputer, Multiprocessor System Interconnects, Cache Coherence, Synchronization Mechanisms & Message-Passing Mechanisms, **Textbook- Chapter 5,6 (5.1 to 5.4 and 6.1 to 6.2)**
MODULE-4
Multivector and SIMD Computers: Vector Processing Principles, Multivector Multiprocessors, Compound Vector Processing, Scalable. **Multithreaded and Dataflow Architectures:** Latency-Hiding Techniques, Principles of Multithreading, Fine- Grain Multicomputers. **Textbook-Chapter 8 (8.1 to 8.3) Chapter 9(9.1 to 9.3)**
MODULE-5
Software for parallel programming: Parallel Models, Languages, and Compilers, Parallel Programming Models, Parallel Languages and Compilers, Dependence Analysis of Data Arrays. **Instruction and System Level Parallelism**: Instruction Level Parallelism, Computer Architecture, Contents, Basic Design Issues, Problem Definition, Model of a Typical Processor, Compiler-detected Instruction Level Parallelism. **Chapter 10(10.1 to 10.3) Chapter 12(12.1 to 12.5)**

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Write a OpenMP program to sort an array on n elements using both sequential and parallel merge sort (using Section). Record the difference in execution time.
2	Write an OpenMP program that divides the Iterations into chunks containing 2 iterations, respectively (OMP_SCHEDULE=static,2). Its input should be the number of iterations, and its output should be which iterations of a parallelized for loop are executed by which thread. For example, if there are two threads and four iterations, the output might be the following: a. Thread 0 : Iterations 0 –– 1 b. Thread 1 : Iterations 2 –– 3
3	Write a program for implementing a Simple Thread.
4	Illustrate how the matrix multiplication is implemented With Shared Memory.
5	Cache Simulation with Simics
6	Write a program for data movement in CUDA
7	Implement a parallel program using CUDA
8	Implement Asynchronous Concurrent Execution using streams

Course outcome (Course Skill Set)

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

- Interpret the performance of a processor based on metrics such as execution time, cycles per instruction (CPI), Instruction count etc.
- Identify the challenges of realizing different kinds of parallelism (such as instruction, data, thread, core level) and leverage them for performance advancement.
- Apply the concept of memory hierarchy for efficient memory design and virtual memory to overcome the memory wall.
- Examine emerging computing trends, computing platforms, and design trade-offs.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper has to be designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks scored will be proportionately reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module.

Suggested Learning Resources:

Books

Textbook

1. Kai Hwang and Naresh Jotwani, Advanced Computer Architecture (SIE): Parallelism, Scalability, Programmability, McGraw Hill Education 3/e. 2015

Reference Books:

1. J.P. Shen and M.H. Lipasti, Modern Processor Design, MC Graw Hill, Crowfordsville, 2005.

Weblinks and Video Lectures (e-Resources):

https://onlinecourses.nptel.ac.in/noc23_cs07/preview
https://archive.nptel.ac.in/courses/106/103/106103206/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Conduct performance evaluation of a CPU using any generic program - 5 Marks
2. Conduct performance comparison of sequential and parallel programming - 5 Marks

Network Management		Semester	7
Course Code	**BCM702**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	3:0:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03
Examination nature (SEE)	Theory/practical		

Course objectives:

- Understand the basics of network management and protocols.
- Learn network management organization, information models and functional models.
- Demonstrate network management tools and systems.

Teaching-Learning Process (General Instructions)

These are sample Strategies; that teachers can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) need not be only a traditional lecture method; alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain the functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher Order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based-Learning (PBL), which fosters students' Analytical skills, and develops design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than recall it.

MODULE-1

Data Communications and Network Management Overview: Analogy of Telephone Network Management, Data (Computer) and Telecommunication Network, Distributed Computing Environment, Challenges of IT Managers, Network Management: Goals, Organization, and Functions, Network Management Architecture and Organization, Network Management Perspectives, NMS Platform, Current Status and Future of Network Management.
Basic Foundations: Standards, Models, and Language.

Chapter-1 (1.1-1.3, 1.8-1.13), Chapter 3

MODULE-2

SNMPv1 Network Management: Organization and Information Models.

Chapter 4.

MODULE-3

SNMPv1 Network Management: Communication and Functional Models.
SNMP Management: SNMPv2: Major Changes in SNMPv2, SNMPv2 System Architecture, SNMPv2 Structure of Management Information, SNMPv2 Protocol.

Chapter 5, 6 (6.1 -6.3, 6.5)

MODULE-4

SNMP Management: SNMPv3.
SNMP Management: RMON.

Chapter 7, 8

MODULE-5

Network Management Tools, Systems, and Engineering.

Chapter 9

PRACTICAL COMPONENT OF IPCC *(May cover all / major modules)*

Sl.NO	Experiments
1	Use the basic network tool commands for the follows: a. Choose any IP address in your subnet or outside and find the name of the host. b. Ping at least two public institutions' addresses inside and outside India. Analyse your results and note the significant points. c. Execute traceroute to the following IP addresses and analyze: www.gatech.edu and ns1.bangla.net
2	Use tools available on public domain and Exercise the following test tools: snmptest snmpget snmpgetnext snmpset
3	Use tools available on public domain and Exercise the following test tools: snmptrap snmpwalk snmpnetstat
4	Apply the SNMP tools to the following applications: Application 1: Choose any three hosts and determine which of the hosts has been running the longest. Application 2: Use SNMP system MIB and find all the information about the hosts that you used in Application 1.
5	Apply the SNMP tools to the following applications: Application 1: Acquire the routing table of a router using IP MIB and find out the approximate size of the table. Application 2: Your instructor has set the snmpd.conf table in a host with different community users accessing different profiles of information from the database. Inspect the configuration file (/etc/snmpd.conf) for the SNMP daemon running on the host. Attempt an snmpwalk using each of the community names it defines. Compare the amount of information available with each.
6	Apply the SNMP tools to the following application: Your instructor will give you MIB views for different groups of users. Modify the snmpd.conf table to implement those views.
7	Open NMAP (a) find few live machines (b) discover open ports (TCP Connect Scan, SYN Stealth Scan, UDP Scan, Idle Scan.
8	Using NMAP identify the vulnerabilities associated with the open ports. For example, vulnerabilities associated with the open ports of Simple Network Management Protocol (SNMP) and Server Message Block (SMB) protocols.

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

- Explain the need and role of network management in communication networks.
- Describe network organization and information models.
- Demonstrate network communication and functional models.
- Outline network management protocol:v3 and remote monitoring of network.
- Demonstrate network management tools and systems.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

CIE for the theory component of the IPCC (maximum marks 50)

- IPCC means practical portion integrated with the theory of the course.
- CIE marks for the theory component are **25 marks** and that for the practical component is **25 marks**.
- 25 marks for the theory component are split into **15 marks** for two Internal Assessment Tests (Two Tests, each of 15 Marks with 01-hour duration, are to be conducted) and **10 marks** for other assessment methods mentioned in 22OB4.2. The first test at the end of 40-50% coverage of the syllabus and the second test after covering 85-90% of the syllabus.
- Scaled-down marks of the sum of two tests and other assessment methods will be CIE marks for the theory component of IPCC (that is for **25 marks)**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the theory component of IPCC.

CIE for the practical component of the IPCC

- **15 marks** for the conduction of the experiment and preparation of laboratory record, and **10 marks** for the test to be conducted after the completion of all the laboratory sessions.
- On completion of every experiment/program in the laboratory, the students shall be evaluated including viva-voce and marks shall be awarded on the same day.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to **15 marks**.
- The laboratory test **(duration 02/03 hours)** after completion of all the experiments shall be conducted for 50 marks and scaled down to **10 marks.**
- Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **25 marks**.
- The student has to secure 40% of 25 marks to qualify in the CIE of the practical component of the IPCC.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours**)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored by the student shall be proportionally scaled down to 50 Marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper may include questions from the practical component.

Suggested Learning Resources:

Textbook:

1. Mani Subramanian, Network Management - Principles and Practice, Second Edition, Pearson, 2010.

Reference Books:

1. Richmond S. Adebiaye, Theophilus D. Owusu, Network Systems Management, Second Edition, Createspace Independent Pub, 2013.
2. Alexander Clemm, Network Management Fundamentals, Cisco Press, 2007.
3. Benoit Claise, Ralf Wolter, Network Management, 1st Edition, Cisco Systems, 2007.

Web links and Video Lectures (e-Resources):

- INTRODUCTION TO NMAP : https://www.nitttrchd.ac.in/imee/Labmanuals/A%20Practical%20Approach%20to%20Network%20Monitoring.pdf
- https://www.cisco.com/c/en/us/solutions/enterprise-networks/what-is-network-management.html
- https://www.cs.bu.edu/fac/matta/Teaching/ITL/lab2-556S05.pdf

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

Course mini-project for a batch of TWO students – Refer Appendix B Project Suggestions of Textbook **[10 Marks]**

	CRYPTOGRAPHY & NETWORK SECURITY		Semester	7
	Course Code	**BCS703**	CIE Marks	50
	Teaching Hours/Week (L:T:P: S)	4:0:0:0	SEE Marks	50
	Total Hours of Pedagogy	50	Total Marks	100
	Credits	04	Exam Hours	3
	Examination type (SEE)	Theory		

Course objectives:

1. Understand the basics of Cryptography concepts, Security and its principle
2. To analyse different Cryptographic Algorithms
3. To illustrate public and private key cryptography
4. To understand the key distribution scenario and certification
5. To understand approaches and techniques to build protection mechanism in order to secure computer networks

Teaching-Learning Process

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) needs not to be only a traditional lecture method, but alternative effective teaching methods could be adopted to attain the outcomes.
2. Use of Video/Animation to explain functioning of various concepts.
3. Encourage collaborative (Group Learning) Learning in the class.
4. Ask at least three HOT (Higher order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop design thinking skills such as the ability to design, evaluate, generalize, and analyze information rather than simply recall it.
6. Introduce Topics in manifold representations.
7. Show the different ways to solve the same problem with different circuits/logic and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding
9. Use any of these methods: Chalk and board, Active Learning, Case Studies

Module-1 10 hours

A model for Network Security, Classical encryption techniques: Symmetric cipher model, Substitution ciphers-Caesar Cipher, Monoalphabetic Cipher, Playfair Cipher, Hill Cipher, Polyalphabetic Ciphers, One time pad, Steganography.

Block Ciphers and Data Encryption Standards: Traditional Block Cipher structures, data Encryption Standard (DES), A DES Example, The strength of DES, Block cipher design principles.

Chapter 1: 1.8 Chapter 3: 3.1, 3.2, 3.5 Chapter 4: 4.1, 4.2, 4.3, 4.4, 4.5

Module-2 10 hours

	Pseudorandom number Generators: Linear Congruential Generators, Blum Blum Shub Generator. Public key cryptography and RSA: Principles of public key cryptosystems-Public key cryptosystems, Applications for public key cryptosystems, Requirements for public key cryptography, Public key Cryptanalysis, The RSA algorithm: Description of the Algorithm, Computational aspects, The Security of RSA. Diffie-Hellman key exchange: The Algorithm, Key exchange Protocols, Man-in-the-middle Attack, Elliptic Curve Cryptography: Analog of Diffie-Hellman key Exchange, Elliptic Curve Encryption/Decryption, Security of Elliptic Curve Cryptography. Chapter 8: 8.2 Chapter 9: 9.1, 9.2 Chapter 10: 10.1, 10.4
	Module-3 10 hours
	Applications of Cryptographic Hash functions, Two simple Hash functions, Key management and distribution: Symmetric key distribution using symmetric encryption, Symmetric key distribution using asymmetric encryption, Distribution of public keys, X.509 Certificates, Public Key Infrastructures Chapter 11: 11.1, 11.2 Chapter 14: 14.1, 14.2, 14.3, 14.4, 14.5
	Module-4 10 hours
	User Authentication: Remote user authentication principles**,** Kerberos**,** Remote user authentication using asymmetric encryption. Web security consideration, Transport layer security. Email Threats and comprehensive email security, S/MIME, Pretty Good Privacy. Chapter 15: 15.1, 15.3, 15.4 Chapter 17: 17.1, 17.2 Chapter 19: 19.3, 19.4, 19.5
	Module-5 10 hours
	Domainkeys Identified Mail. IP Security: IP Security overview, IP Security Policy, Encapsulating Security Payload, Combining security associations, Internet key exchange. Chapter 19: 19.9 Chapter 20: 20.1, 20.2, 20.3, 20.4, 20.5

Course outcome

At the end of the course, the student will be able to :

CO1: Explain the basic concepts of Cryptography and Security aspects

CO2: Apply different Cryptographic Algorithms for different applications

CO**3:** Analyze different methods for authentication and access control.

CO4: Describe key management, key distribution and Certificates.

CO5: Explain about Electronic mail and IP Security.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Books

Text Books:

William stallings, "Cryptography and Network Security", Pearson Publication, Seventh Edition.

References:

1. Keith M Martin, "Everyday Cryptography", Oxford University Press
2. V.K Pachghare,"Cryptography and Network Security", PHI, 2nd Edition

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Group assignment (TWO) to implement Cryptographic Algorithms (15 + 10 marks)