20MCA102	ADVANCED DATABASE MANAGEMENT YSTEMS	CATEGORY	L	T	P	CREDIT
		GENERAL	3	1	0	4

Preamble: This course provides the basic concepts and terminology related to relational and non-relational database management systems. The concept of advanced DBMS techniques and new generation databases like MongoDB, HBase and Cassandra are also introduced. This course serves as a prerequisite for many advanced courses in Data Science and Machine Learning areas.

Prerequisite: Basic knowledge in Database Management Systems.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand the fundamentals of relational database systems including: data models, database architectures and ER features.
CO 2	Analyze and apply the different normalization techniques.
CO 3	Assess the basic issues of transaction processing and concurrency control.
CO 4	Understand the roles that databases play in organizations and familiarize with basic database storage, file organization, database accessing techniques.
CO 5	Understand the basics of query processing, object-oriented, distributed databases.
CO 6	Analyze non-relational database systems and structures and XML.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1				1			1					
CO 2	3	3	3	2			2	2			2	2
CO 3	1	2	2	2		2					2	2
CO 4					1		1					
CO 5	1			1								
CO 6	1											

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember(K1)	10	10	10
Understand(K2)	20	20	20
Apply(K3)	20	20	30
Analyse(K4)			
Evaluate(K5)			
Create(K6)			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	40	60	3 hours

Continuous Internal Evaluation Pattern:

Attendance   : 8 marks

Continuous Assessment Test (2 numbers)   : 20 marks

Assignment/Quiz/Course project   : 12 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 compulsory short answer questions, 2 from each module. Each question carries 3 marks. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 6 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Examine why databases are important. (K3)

2. Describe the basic features of the relational data model and discuss their importance to the end user and the designer. (K2)

3. Analyze the graphic depiction of relationships among the entities and examine how these depictions help in the database design process. (K3 & K4)

Course Outcome 2 (CO2):

1. Evaluate and design good table structures to control data redundancies and anomalies.
    (K5 & K6)

Course Outcome 3(CO3):

1. Explain the database transaction and its properties. (K2)
2. Describe concurrency control and analyze the role it plays in maintaining the database integrity. (K2 & K4)
3. Assess the common algorithms for concurrency control. (K5)
4. Define deadlock and discuss the strategies for managing deadlocks. (K1 & K2)
5. Examine how database recovery management is used to maintain database integrity. (K3)

Course Outcome 4 (CO4):

1. Discuss the various disk-organization techniques. (K2)
2. Describe the various data structures that allow fast access to data. (K2)
3. Analyze and examine the different indexing techniques. (K3 & K4)

Course Outcome 5 (CO5):

1. Describe the basics of query processing and evaluate the query processing cost. (K2 & K5)
2. Analyze the concept of object oriented databases and distributed databases. (K4)

Course Outcome 6 (CO6):

1. Explain the concept of XML. (K2)
2. Describe the various NoSQL databases. (K2)

Model Question Paper

Reg No.:_____		Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

MODEL QUESTION PAPER M.C.A.DEGREE EXAMINATION

Course Code: 20MCA102

Course Name: ADVANCED DATABASE MANAGEMENT SYSTEMS

Max. Marks: 60	Duration: 3 Hours

PART A

		Answer all questions, each carries3 marks.	Marks
1		Define weak entity set with an example.	(3)
2		With the help of a diagram explain the different levels of data abstraction?	(3)
3		Differentiate between BCNF and 3NF with an example.	(3)
4		Explain functional dependency with suitable example.	(3)
5		Discuss the ACID properties of transaction.	(3)
6		Define deadlock and discuss the strategies for managing deadlocks.	(3)
7		Diagrammatically represent the basic steps in query processing.	(3)
8		Differentiate static and dynamic hashing.	(3)
9		Illustrate the different types of Distributed Databases.	(3)
10		Define collection and document in MongoDB.	(3)

PART B

Answer any one question from each module. Each question carries 6 marks.

Module I

11		Draw an E-R diagram of a college database with entities student, staff, course, teacher, clerk, department & hostel? Relationship names must be meaningful	(6)

		and there should be an ISA relationship also in diagram.	
		OR	
12		Explain the relational model concept and discuss the different relational model constraints.	(6)
		Module II	
13		Analyse the common anomalies found in databases? How can we eliminate it through normalization?	(6)
		OR	
14		Define Normalization. Explain 1NF, 2NF and 3NF in detail.	(6)
		Module III	
15		Define deadlock. How can we deal with deadlocks?	(6)
		OR	
16		Explain concurrency control with locking methods.	(6)
		Module IV	
17		Explain the various RAID levels with appropriate diagrams.	(6)
		OR	
18		Differentiate between Dense index and Sparse index with example.	(6)
		Module V	
19		Explain HBase and Cassandra.	(6)
		OR	
20		Explain XML and its applications.	(6)
		****	

SYLLABUS

Module I:

Relational Databases:- Introduction - Purpose of Database System – Database System Applications - View of data: Data Abstraction, Instances and Schemas, Data Models – Database Architecture - Database Users and Administrators: Database Users and Interfaces, DBA – Introduction to the Relational Model: Structure of Relational Database, database Schema, Keys, Relational Query language – The Relational Algebra: Fundamental Operations, Formal definition of the relational algebra, additional relational algebra operations – The Entity-Relationship model: Entity Set, Relationship Set, Attributes – Constraints: Mapping cardinalities, Key Constraints, Participation Constraints - E-R Diagrams: Basic structure, Complex attributes, Roles, Non binary relationship sets, Weak Entity Set, Relational Database Design using ER- to Relational Mapping – Extended ER Features: Specialization, Generalization, Attribute inheritance, Constraints on generalization, Aggregation.

Module II:

Database Design:- Database Tables and Normalization – The Need for Normalization – The Normalization Process: Inference Rules for Functional Dependencies (proof not needed) - Minimal set of Functional Dependencies - Conversion to First Normal Form, Conversion to Second Normal Form, Conversion to Third Normal Form - Improving the Design - Surrogate Key Considerations - Higher Level Normal Forms: Boyce/Codd Normal Form, Fourth Normal Form, Join dependencies and Fifth Normal Form – Normalization and Database Design.

Module III:

Transaction Management and Concurrency Control:- Transaction: Evaluating Transaction Results, Transaction Properties, Transaction Management with SQL, The Transaction Log – Concurrency Control: Lost Updates, Uncommitted Data, Inconsistent Retrievals, The Scheduler – Concurrency Control with Locking Methods: Lock Granularity, Lock Types, Two Phase Locking to Ensure Serializability, Deadlocks – Concurrency Control with Timestamping Methods: Wait/Die and Wait/Wound Schemes – Concurrency Control with Optimistic Methods - Database Recovery Management: Transaction Recovery.

Module IV:

Data Storage and Querying:- RAID – File Organization – Organization of Records in Files – Indexing and Hashing: Basic concept, Ordered Indices, B+ tree Index Files: Structure of a B+- Tree (structure only, algorithms not needed) - B tree index files – Static Hashing – Dynamic Hashing – Query Processing: Overview - Selection Operation.

Module V:

System Architecture, Object Oriented Databases, XML and NoSQL:- Distributed Databases: Homogeneous and Heterogeneous Databases, Distributed Data Storage,

Distributed Transactions - Object Based Databases: Overview, Complex Data types, Structured types and inheritance in SQL, Table Inheritance, Array and Multiset types in SQL, Object identity and reference types in SQL - XML: DTD and XML Schema, XML presentation, XML Applications - Next Generation Databases: Distributed Relational Databases - Nonrelational Distributed Databases - MongoDB Sharding and Replication - Hbase - Cassandra - CAP Theorem.

Text Books

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan," ***Database System Concepts***", McGraw Hill Education, 6th Edition, 2011. *(for Module 1 Refer Chapter 1 [1.1 to 1.3, 1.9,1.12], Chapter 2 [2.1-2.3,2.5], Chapter 6 [6.1], Chapter 7 [7.2, 7.3, 7.8(7.81. To 7.8.5)], for Module 4 Refer Chapter 10 [10.3, 10.5, 10.6], Chapter 11 [11.1, 11.2, 11.3(11.3.1), 11.4.5 and module 5 Refer Chapter 19 [19.1,19.2, 19.3 - Distributed Databases], Refer Chapter 22 [22.1 to 22.6 - Object Based Databases]).*

2. Ramez Elmasri, Shamkant B.Navathe, " ***Fundamentals of Database Systems*** ", Pearson Education, 5th Edition, 2007. *(for Module 1 - Refer Chapter 7 [7.1] - 7.1.1 - Relational Database Design using ER- to Relational Mapping]) and for Module 2 - Refer Chapter 10 [10.2.2 and 10.2.4], Refer Chapter 11 [11.4 - Join dependencies and Fifth Normal Form).*

3. Guy Harrison, "***Next Generation Databases: NoSQL, NewSQL, and Big Data***", Apress, 1st Edition, 14 December 2015. *Refer Chapters 8 and 3 (for Module 5 - Next Generation Databases and CAP Theorem).*

4. Rob, Peter and Carlos Coronel, "*Database Principles: Fundamentals of Design, Implementation and Management*", 9th Edition, 2011. *(for Module 2, refer chapter 6) and (for module 3, refer chapter 10) and (for Module 5, refer Chapter 14 -XML).*

Reference Books

1. Ashutosh Kumar Dubay, "*Database Management Concepts*", S.K. Kataria & Sons, 1st Edition (2012).

2. Raghu Ramakrishnan and Johannes Gehrke, "*Database Management Systems*", McGraw Hill, 3rd Edition (2014).

3. Thomas M Connolly and Carolyn E Begg, "*Database systems- A Practical Approach to Design, Implementation and Management*", Pearson Education, 4th Edition (2014).

Web Resources

1. Introduction to Databases (nptel) https://nptel.ac.in/courses/106/106/106106220/
2. Database Design (nptel) https://nptel.ac.in/courses/106/106/106106093/
3. Introduction to Database Systems and Design
   https://nptel.ac.in/courses/106/106/106106095/
4. Fundamentals of Database Systems
   https://nptel.ac.in/courses/106/104/106104135/#
5. Database Management Essentials (Coursera)
   https://www.coursera.org/learn/database-management
6. Database Systems Concepts & Design
   https://www.udacity.com/course/database-systems-concepts-design--ud150

Course Contents and Lecture Schedule

No.	Topic	No. of Lectures
1	*Module I: Relational Databases*	*15 hrs*
1.1	Introduction - Purpose of Database System - Database System Applications	1 hr
1.2	View of data: Data Abstraction, Instances and Schemas, Data Models	1 hr
1.3	Database Architecture	1 hr
1.4	Database Users and Administrators: Database Users and Interfaces, DBA	1 hr
1.5	Introduction to the Relational Model: Structure of Relational Database, database Schema, Keys, Relational Query language	1 hr
1.6	The Relational Algebra: Fundamental Operations, Formal definition of the relational algebra, additional relational algebra operations	2 hr
1.7	The Entity-Relationship model: Entity Set, Relationship Set, Attributes	1 hr
1.8	Constraints: Mapping cardinalities, Key Constraints, Participation Constraints	2 hr
1.9	E-R Diagrams: Basic structure, Complex attributes, Roles, Non binary relationship sets, Weak Entity Set	1 hr
1.10	Relational Database Design using ER- to Relational Mapping	2 hr
1.11	Extended ER Features: Specialization, Generalization, Attribute inheritance, Constraints on generalization, Aggregation.	2 hr
2	*Module II: Database Design*	*9 hrs*
2.1	Database Tables and Normalization - The Need for Normalization	1 hr
2.2	The Normalization Process: Inference Rules for Functional Dependencies (proof not needed) - Minimal set of Functional Dependencies - Conversion to First Normal Form, Conversion to Second Normal Form	2 hr
2.3	Conversion to Third Normal Form	1 hr
2.4	Improving the Design - Surrogate Key Considerations	1 hr

No	Topic	No. of Lectures
2.5	Higher Level Normal Forms: Boyce/Codd Normal Form	1 hr
2.6	Fourth Normal Form	1 hr
2.7	Join dependencies and Fifth Normal Form	1 hr
2.8	Normalization and Database Design	1 hr
3	*Module III: Transaction Management and Concurrency Control*	*9 hrs*
3.1	Transaction: Evaluating Transaction Results, Transaction Properties	1 hr
3.2	Transaction Management with SQL, The Transaction Log	1 hr
3.3	Concurrency Control: Lost Updates, Uncommitted Data, Inconsistent Retrievals, The Scheduler	2 hr
3.4	Concurrency Control with Locking Methods: Lock Granularity	1 hr
3.5	Lock Types, Two Phase Locking to Ensure Serializability	1 hr
3.6	Deadlocks	1 hr
3.7	Concurrency Control with Timestamping Methods: Wait/Die and Wait/Wound Schemes, Concurrency Control with Optimistic Methods, Database Recovery Management: Transaction Recovery	2 hr
4	*Module IV: Data Storage and Querying*	*10 hrs*
4.1	RAID	1 hr
4.2	File Organization	1 hr
4.3	Organization of Records in Files	1 hr
4.4	Indexing and Hashing: Basic concept, Ordered Indices	1 hr
4.5	B+ tree Index Files: Structure of a B+-Tree, B tree Index Files	2 hr
4.6	Static Hashing, Dynamic Hashing	2 hr
4.7	Query Processing: Overview, Selection Operation	2 hr

No	Topic	No. of Lectures
5	*Module V: System Architecture, Object Oriented Databases, XML and NoSQL*	*13 hrs*
5.1	Distributed Databases: Homogeneous and Heterogeneous Databases, Distributed Data Storage, Distributed Transactions	2 hr
5.2	Object Based Databases: Overview, Complex Data types	1 hr
5.3	Structured types and inheritance in SQL	1 hr
5.4	Table Inheritance	1 hr
5.5	Array and Multiset types in SQL	1 hr
5.6	Object identity and reference types in SQL	1 hr
5.7	XML: DTD and XML Schema	1 hr
5.8	XML presentation, XML Applications	1 hr
5.9	Next Generation Databases: Distributed Relational Databases - CAP Theorem	1 hr
5.10	Norelational Databases – MongoDB Sharding and Replication	1 hr
5.11	Hbase	1 hr
5.12	Cassandra	1 hr

20MCA104	ADVANCED COMPUTER NETWORKS	CATEGORY	L	T	P	CREDIT
		GENERAL	3	1	0	4

Preamble: This course intends to provide insight into Advanced Computer Networks. A software professional should have an understanding of layered network architecture. Various kinds of network architectures, issues in integrating networks to modern application development are to be addressed. It is also intended to expose the student to modern technologies such as IPV6 and software defined networks. More detailed treatment can be done through seminars, assignments and talks by eminent external experts.

Prerequisite: Basic concepts of computer operating systems.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Comprehend the terminology and concepts of basic communication model, analyse the protocol layers and design application layer protocols.
CO 2	Understand and analyse the various transport layer protocols.
CO 3	Compare and contrast various routing algorithms in the network layer.
CO 4	Understand and analyse the concepts of link layer and physical layer.
CO 5	Understand how modern cellular and wireless networks work

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	2		2	2	2		3		2	
CO 2	3	3	2		2	2			3		2	
CO 3	3	3			2	2	2		3		2	
CO 4	3	3				2			3		2	
CO 5	3	3				2			3			

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	30
Analyze			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	40	60	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 8 marks
Continuous Assessment Test (2 numbers) : 20 marks
Assignment/Quiz/Course project : 12 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 compulsory short answer questions, 2 from each module. Each question carries 3 marks. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 6 marks

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Explain HTTP request-response behavior with a neat diagram.
2. Compare and contrast OSI and TCP/IP network reference models.

3. Explain the importance of layering in data communication.

Course Outcome 2 (CO2)

1. Explain the process of three-way handshaking in TCP.
2. Compare and contrast Multiplexing and De-multiplexing process in transport layer.

3. Explain How TCP is controlling congestion during data transmission.

Course Outcome 3(CO3):

1. Explain how multicast routing is used in routing protocols.
2. Compare and contrast IPV4 and IPV6.
3. Differentiate virtual circuits and datagram networks.

Course Outcome 4 (CO4):

1. Explain how parity is used to achieve error detection in data communication.
2. Illustrate IEEE 802.3 frame structure.

3. Write short notes on routers, switches and bridges.

Course Outcome 5 (CO5):

1. List out and explain the various IEEE 802.11 WLAN Components.
2. Explain the architecture of Bluetooth in personal area networks.

3. Explain any six network attacks and their counter measures.

Model Question paper

Part A

1. Differentiate HTTP persistent and non-persistent communication.
2. List out and explain the functionalities of different DNS records.
3. Compare TCP and UDP at transport layer.
4. Demonstrate how stop-and-wait protocol is used for reliable data transfer.
5. Explain how IPv6 solve the problem of IPv4 exhaustion?
6. Explain how ARP is working in data link layer?
7. A series of 8-bit message blocks to be transmitted across a data link using CRC for error detection. A generator polynomial of $x^3 + x^2 + 1$.is to be used. Message transmitted as 110010. Explain how CRC check is implemented?
8. Classify various wired media used in short and long distance communication.
9. Explain Network Address Translation (NAT).
10. Explain piconet topology of Bluetooth?   [3x10=30 Marks]

Part B

Module 1

11. List and explain ISO/OSI layers and their functions.   [6 Marks]

OR

12. Describe various service models in Quality of Service (QOS).   [6 Marks]

Module 2

13. Write a short note on:
    a. Stop-and-wait   [3 Marks]
    b. Go-back-N   [3 Marks]

OR

14. Explain the principles of congestion control with its fairness and efficiency. [6 Marks]

Module 3

15. Define routing? Explain the process of link state routing with OSPF protocol.

OR   [6 Marks]

16. What is Virtual circuit? Explain the connection management in Virtual circuit with suitable diagrams.

[6 Marks]

Module 4

17. Write a short note on:

    a. Collision based multiple access protocol   [3 Marks]
    b. Token based multiple access protocol   [3 Marks]

OR

18. Explain IEEE 802.3 Ethernet frame format with its access protocol.

[6 Marks]

Module 5

19. What is Bluetooth? Explain the various layers of Bluetooth with a neat diagram.

[6 Marks]

OR

20. Write a short note on:
    a. Traffic analysis tools   [3 Marks]
    b. Troubleshooting   [3 Marks]

Syllabus

Module	Contents	Hours
I	Overview of Computer Networks and the Internet. History. Protocols, Review of last mile technologies used for internet access. Packet switching. Basic ideas about delay queuing throughput. Concept of Quality of Service, Protocol layering . OSI model and TCP model Application layer protocols - Client-server architecture Network layer 7 application architecture, Web, HTTP, FTP, SMTP, POP3, and DNS, Peer-to-peer file sharing networks	10

Module	Contents	Hours
II	Transport Layer Protocols: Introduction to transport layer, Multiplexing and de-multiplexing, Principles of Reliable data transfer - Stop-and-wait and Go-back- N design and evaluation, Connection oriented transport TCP, Connectionless transport UDP, Principles of congestion control -efficiency and fairness	10
III	Network Layer Protocols: Virtual circuits and datagrams, Principles of routing, internet protocol Ipv4 CIDR Routing algorithms: Link-state and distance vector routing, Routing on the internet RIP OSPF and BGP, Multicast routing. Introduction to IPV6 and software defined networks, Open flow	10
IV	Link layer and Physical Layer: Introduction to link layer - Error detection (parity, checksum, and CRC), Multiple access protocols (collision and token based), IEEE 802.3 Ethernet, Switching and bridging, Media, Signal strength and interference. Data encoding. Ethernet switches , Routers MAC, ARP, FIB	8
V	IEEE 802.11 Wi-Fi, Bluetooth, and cellular networks,Threats and attacks, Network Address Translation , Firewalls, VPNs, Introduction to network management, SNMP, Overview of tools and troubleshooting, Traffic analysis tools and Configuration management.	10

Textbooks:

1. Behrouz A Forouzan, Firouz Mosharraf, "*Computer Networks: A top down Approach*", McGraw Hill Education, 1 st Edition (2011).
2. James F Kurose and Keith W Ross, "*Computer Networking: A Top - Down Approach*", Pearson Education; 6 th Edition (2017).

Reference Books:

1. Kevin R. Fall, W. Richard Stevens, "*TCP/IP Illustrated, Volume 1 -The Protocols*", Pearson Education, 2 nd Edition (2014).

2. Larry Peterson, Bruce Davie, "*Computer Networks, A systems Approach*", Morgan Kaufmann   Publishers, 5th Edition (2011).

3. Uyless Black, "*Computer Networks: Protocols, Standards and Interface*", Prentice HallIndia   Learning Private Limited, 8 th Edition (2015).

4. William Stallings, "*Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud*", Pearson Education, 1 st Edition (2016)

5. *The Illustrated Network: How TCP/IP Works in a Modern Network* 2nd edition Walter Goralski   Morgan Kaufmann Publications

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1		
1.1	Overview of Computer Networks and the Internet. History. Protocols , Review of last mile technologies used for internet access. Packet switching.	2
1.2	Basic ideas about delay queuing through put. Concept of Quality of Service Protocol layering . OSI model and TCP model	4
1.3	Application layer protocols - Client-server architecture Network application architecture, Web, HTTP, FTP, SMTPPOP3 and DNS, Peer-to-peer file sharing networks	4
2		
2.1	Transport Layer Protocols: Introduction to transport layer	2
2.2	Multiplexing and demultiplexing, Principles of Reliable data transfer - Stop-and-wait and Go-back- N design and evaluation	3
2.3	Connection oriented transport TCP, Connection less transport UDP	3
2.4	Principles of congestion control -efficiency and fairness	2
3		
3.1	Network Layer Protocols: Virtual circuits and datagrams	2
3.2	Principles of routing, internet protocol Ipv4 NAT , Routing algorithms: Link-state and distance vector routing,	3
3.3	Routing on the internet RIP OSPF and BGP, Multicastrouting.	2
3.4	Introduction to IPV6 and software defined networks	2
4		
4.1	Link layer and Physical Layer: Introduction to link layer - Error detection (parity, checksum, and CRC)	2
4.2	Multiple access protocols (collision and token based), IEEE 802.3	2
4.3	Ethernet, Switching and bridging, Media, Signal strength and interference. Data encoding. Ethernet switches , Routers MAC, ARP, FIB	4

No	Topic	No. of Lectures
5		
5.1	**I**EEE 802.11 Wi-Fi, Bluetooth, and cellular networks,	3
5.2	Threats and attacks, Firewalls, NAT,VPNs, Introduction to network management, SNMP,	4
5.3	Overview of tools and troubleshooting, Traffic analysis tools and Configuration management**.**	3
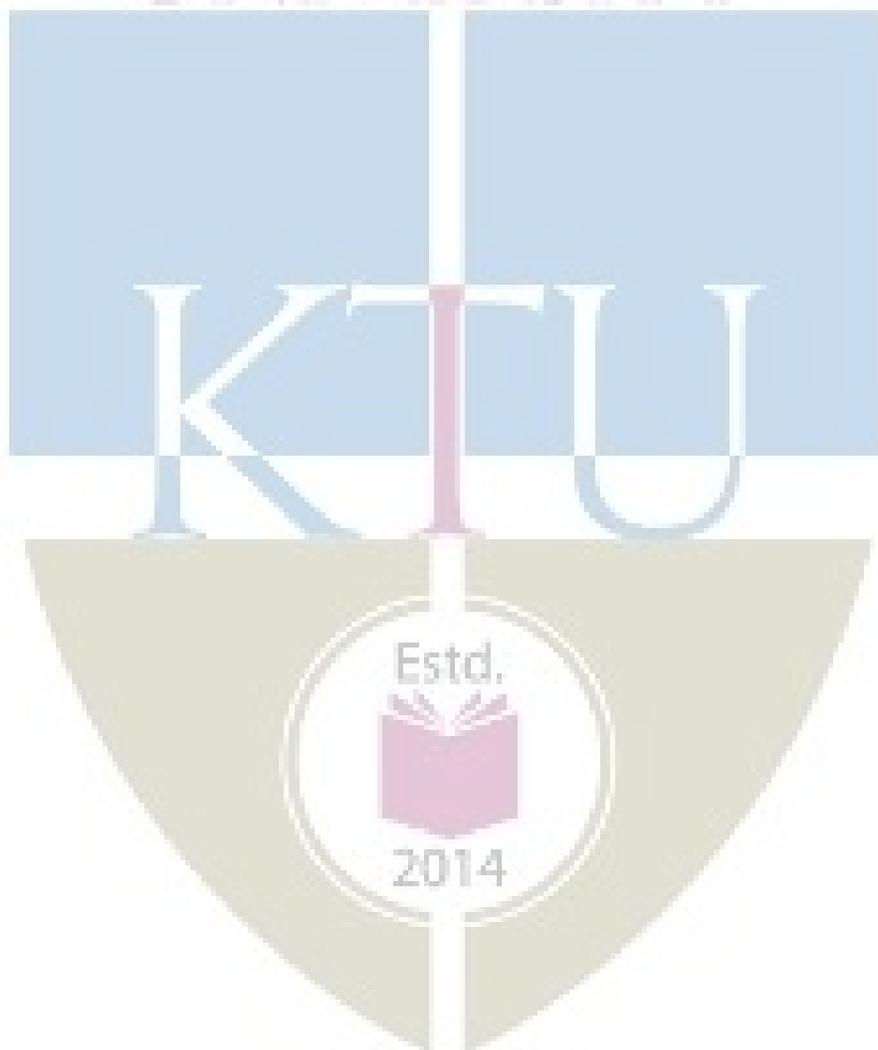
20MCA162	**APPLIED STATISTICS**	**CATEGORY**	**L**	**T**	**P**	**CREDIT**
		ELECTIVE	**3**	**1**	**0**	**4**

Preamble: This course introduces the concepts and application of probability distribution, Correlation, Regression and testing of hypothesis. The topics treated in this course have applications in Computer Science.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Apply the concept of discrete probability distributions in determining the parameters of the distribution and hence to solve different problems
CO 2	Apply the concept of continuous probability distribution in solving different problems
CO 3	Apply the principles of correlation and regression in practical problems.
CO 4	Develop confidence intervals for various problems.
CO 5	Test the given hypothesis on the basis of known criteria.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3										
CO 2	3	3										
CO 3	3	3										
CO 4	3	3										
CO 5	3	3										

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	**2**	
Remember(K1)	10	10	10
Understand(K2)	20	20	20
Apply(K3)	20	20	30
Analyse(K4)			
Evaluate(K5)			
Create(K6)			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	40	60	3 hours

Continuous Internal Evaluation Pattern:

Attendance   : 8 marks
Continuous Assessment Test (2 numbers)   : 20 marks
Assignment/Quiz/Course project   : 12 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 compulsory short answer questions, 2 from each module. Each question caries 3 marks. Part B contains 2 questions from each module of which student should answer any one.Each question can have maximum 2 sub-divisions and carry 6 marks

Course Level Assessment Questions

 Course Outcome 1 (CO1):

1. With the usual notation find p for the binomial random variable X, if n = 6 and

 9 p[x =4] = p[x =2] (K3)

2. Define Poisson distribution. Derive it's Mean. (K1)

3. A die is tossed twice. Getting 'a number greater than 4' is considered as success. Find the mean and   variance of the probability distribution of the number of success. (K3)

Course Outcome 2 (CO2)

1. Define distribution function of a continuous random variable. Also state it's important properties. (K1)
2. Derive the mean and variance of a continuous uniform distribution. (K4)
3. In a normal distribution 31% of the items are under 45 and 8% are over 64. Find the mean and standard deviation of the distribution. (K3)

Course Outcome 3(CO3):

1. State the principle of least squares. (K1)
2. Fit a parabola by the method of least squares, to the following data. (K3)

x:	1	2	3	4	5
y:	5	12	26	60	97

3. Compute the correlation coefficient from the following data. (K3)

x:	77	54	27	52	14	35	90	25	96	60
y:	35	58	60	40	50	40	35	56	34	42

Course Outcome 4 (CO4):

1. Differentiate parameter and statistic. (K1)
2. A random sample of 700 units from a large consignment showed that 200 were damaged. Find i) 95% and ii) 99% confidence limits for proportion of damaged limits in the consignment. (K3)
3. Explain different types of sampling. (K2)

Course Outcome 5 (CO5):

1. State Type I and Type II error. (K1)
2. Explain the different steps in testing of hypothesis. (K2)
3. In a big city 325 men out of 600 men were found to be smokers. Does this information support the conclusion that the majority of men in this city are smokers? (K5)

Syllabus

Module 1

Introduction – Random Experiment, Random Variables, Discrete Random Variables, Probability Distributions and Probability Mass Functions, Mean and Variance of a Discrete Random Variable, Discrete Uniform Distribution - Mean and Variance, Binomial Distribution - Mean and Variance, Geometric Distribution - Mean and Variance, Poisson Distribution - Mean and Variance

Module 2

Continuous Random Variables, Probability Density Functions, Mean and Variance of a Continuous Random Variable, Continuous Uniform Distribution- Mean and Variance, Normal Distribution-Mean and Variance (Proof not required), Standard Normal Distribution, Exponential Distribution.

Module 3

Curve fitting – Principle of least squares – fitting a straight line – fitting a parabola – linear correlation and regression – Karl's Pearson's Coefficient of Correlation.

Joint and marginal probability distribution - Conditional probability distribution - independent random variable (discrete case only).

Module 4

Sampling distribution – Introduction to sampling – random sampling – sampling distribution – standard error – estimation – interval estimates and confidence interval – estimation of population mean and proportions (small and large samples).

Module 5

Testing of hypothesis – introduction – basic concepts – Hypothesis concerning a mean – equality of means – Hypothesis concerning one proportion – difference of two proportions.

Text Books

1. Veerarajan T, "***Probability and Random Process***", 3rd Edition, Tata McGraw-Hill(2002)

2. Gupta S.C and Kapoor V .K, "***Fundamentals of Mathematical Statistics***", Sultan Chand and Sons (2014).

Reference Books

1. David S. Moore and George P. McCabe, "***Introduction to practice of statistics***", W.H. Freeman & Company, 5th Edition (2005).

2. G. Jay Kerns, "*Introduction to Probability and Statistics Using R*", Chapman & Hall (2010)
3. Douglas C. Montgomery and George C. Runger, "*Applied Statistics and Probability for Engineers*", Wiley India, 5th Edition (2012).

Web Resources

1. Probability and statistics EBook
http://wiki.stat.ucla.edu/socr/index.php/EBook
2. https://www.openintro.org/stat/textbook.php
3. http://www.math.uah.edu/stat/index.html
4. Statistics Online Computational Resource
http://www.socr.ucla.edu/

Course Contents and Lecture Schedule

Topic	No. of lectures
Module 1	**9 hrs**
Introduction – Random Experiment, Random Variables, Discrete Random Variables, Probability Distributions and Probability Mass Functions, Mean and Variance of a Discrete Random Variable	3
Discrete Uniform Distribution - Mean and Variance	1
Binomial Distribution - Mean and Variance	2
Geometric Distribution - Mean and Variance, Poisson Distribution - Mean and Variance	3
Module 2	**9 hrs**
Continuous Random Variables, Probability Density Functions, Mean and Variance of a Continuous Random Variable	3
Continuous Uniform Distribution, Mean and Variance	2
Normal Distribution, Mean and Variance (Proof not required), Standard Normal Distribution	3
Exponential Distribution	1

Topic	No. of lectures
Module 3	**9 hrs**
Curve fitting – Principle of least squares – fitting a straight line – fitting a parabola	3
linear correlation and regression – Karl's Pearson's Coefficient of Correlation	2
Joint and marginal probability distribution	2
Conditional probability distribution - independent random variable (discrete case only)	2
Module 4	**9 hrs**
Sampling distribution – Introduction to sampling – random sampling	3
sampling distribution – standard error	2
estimation – interval estimates and confidence interval – estimation of population mean and proportions (small and large samples)	4
Module 5	**9 hrs**
Testing of hypothesis – introduction – basic concepts	3
Hypothesis concerning a mean – equality of means	3
Hypothesis concerning one proportion – difference of two proportions	3

20MCA172	ADVANCED OPERATING SYSTEMS	CATEGORY	L	T	P	CREDIT
		ELECTIVE	3	1	0	4

Preamble: This course intends to provide insight into more Advanced Operating Systems. Detailed discussion on various concepts like process synchronization, mutual exclusion, resource sharing, concurrency control and security are discussed at algorithm level. Various kinds of advanced operating systems like Distributed Systems, Multiprocessor systems, and Database Systems are included to the level possible within the scope of a single course. More detailed treatment can be done through seminars , assignments and talks by eminent external experts .

Prerequisite: Basic concepts of desktop computer operating systems.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Identify synchronization problems in operating systems and issues in distributed systems.
CO 2	Explain classification of mutual exclusion algorithms and security violations.
CO 3	Explain the design of distributed shared memory and issues in load distribution.
CO 4	Explain design issues and synchronization in multiprocessor systems.
CO 5	Explain synchronization and concurrency control in database systems.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2			2				1			
CO 2	2	1							1			
CO 3	2	1							1			
CO 4	2	1							1			
CO 5	2	2			1		1		1			

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10		10
Understand	20	20	20
Apply	20	20	20
Analyse		10	10
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	40	60	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 8 marks
Continuous Assessment Test (2 numbers) : 20 marks
Assignment/Quiz/Course project : 12 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 compulsory short answer questions, 2 from each module. Each question carries 3 marks. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 6 marks

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Explain synchronization using semaphore.
2. Classify Advanced operating systems.
3. Illustrate limitation of Lamports clocks.

Course Outcome 2 (CO2)

1. Explain some of the algorithms for mutual exclusion.
2. Explain potential security violations.
3. Compare the Lamport's algorithm and Rickart-Agarwala algorithm.

Course Outcome 3(CO3):

1. Explain major design issues and building mechanisms in Distributed file systems.
2. Explain important algorithms for implementing DSM.
3. Explain issues in load distribution.

Course Outcome 4 (CO4):

1. Explain system architecture of Multiprocessor systems.
2. Explain design issues in Database Multiprocessor Systems.
3. Explain how virtualization is implemented.

Course Outcome 5 (CO5):

1. Explain Lock based algorithms for concurrency control in Database Systems.
2. Illustrate Timestamp based algorithms for concurrency control in Database Systems.
3. Explain design issues in Database Systems.

Model Question paper

Part A

1. Categorize various advanced operating systems.
2. Illustrate synchronization using semaphore.
3. Explain potential security violations.
4. Explain requirements of mutual exclusion.
5. What is the difference between load balancing and load sharing?
6. Which are the major components of a load distributing algorithm?
7. Explain the interconnection network in multiprocessors?
8. Explain the structure of Multiprocessor of Operating Systems.
9. Explain what is meant by serializability.
10. What is meant by Log equivalence?   (3 x 10 = 30 Marks)

Part B

Module 1

11. Identify any six issues that are common with Distributed systems.   [6 Marks]

OR

12. Write a note on the following
    a. mutex   [3 marks]
    b. semaphore   [3 marks]

Module 2

13. Write short notes on
    a. Rickart-Agarwala Algorithm   [3 Marks]
    b. Lamport's algorithm.   [3 Marks]

OR

14. Explain any six Design Principles for Secure Systems.   [6 Marks]

Module 3

15. Identify major design issues in Distributed File systems.

[6 Marks]

OR

16. Write any two algorithms for implementing DSM

[6 Marks]

Module 4

17. Explain Multiprocessor System Architectures and Interconnection Networks.

[6 Marks]

OR

18. Discuss the synchronization of processes in Multiprocessors.
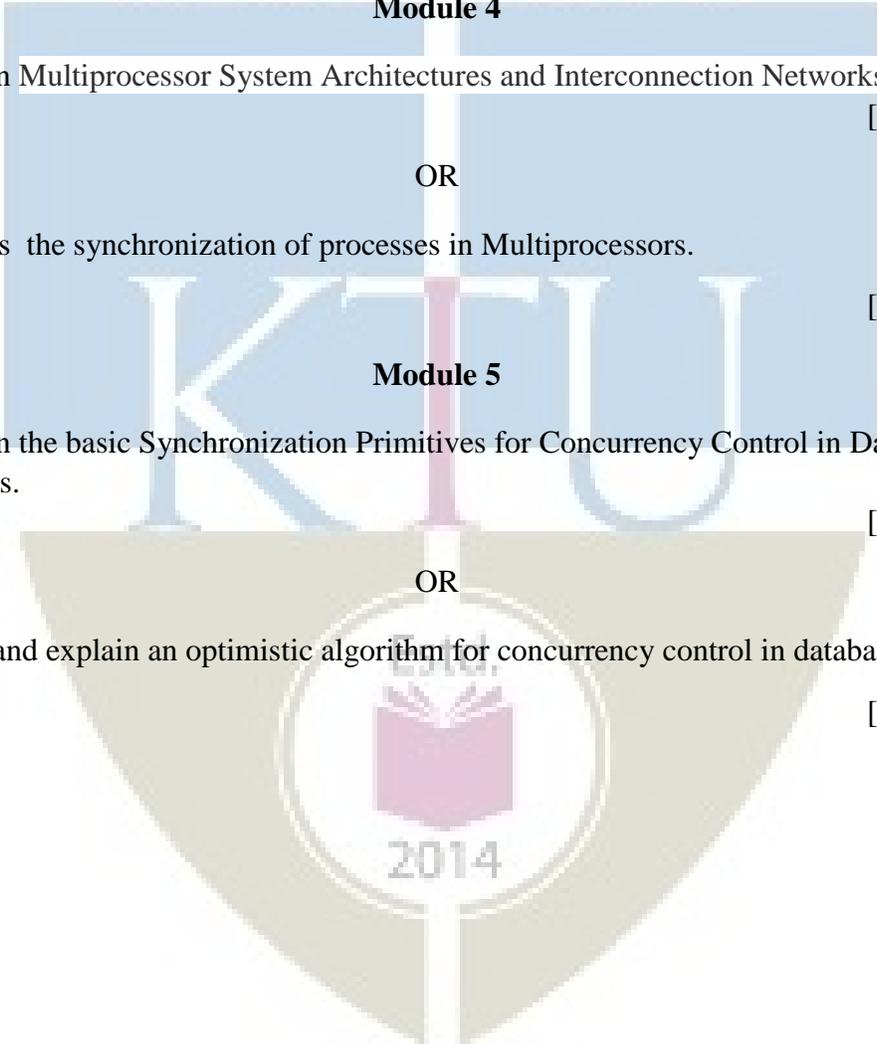
[6 Marks]

Module 5

19. Explain the basic Synchronization Primitives for Concurrency Control in Database systems.

[6 Marks]

OR

20. Write and explain an optimistic algorithm for concurrency control in database systems.

[6 Marks]

Syllabus

Module	Contents	Hours
I	**Overview**: Functions of Operating System –Design Approaches –Types of Advanced Operating Systems. **Synchronization Mechanisms**: Concept of Processes and Threads –The Critical Section Problem – Other Synchronization Problems:– Monitor –Serializer – Path Expressions. **Distributed Operating Systems**:- Issues in Distributed Operating System – Communication Networks And Primitives –Lamport's Logical clocks – Causal Ordering of Messages.	10
II	**Distributed Mutual Exclusion**:- Classification - Requirements – Measuring Performance – Lamport's Algorithm – Rickart-Agarwala Algorithm – Suzuki-Kasami's Broadcast Algorithm. : **Security** Potential Security Violations – Design Principles for Secure Systems –The Access Matrix Model and Implementation- The Access Control list Method.	10
III	**Distributed Resource Management**: Mechanisms for building Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory – Issues in Load Distributing – Components of Load Distributing Algorithm – Sender-Initiated Algorithm – Receiver- Initiated Algorithm.	10
IV	**Multiprocessor Operating Systems**: Basic Multiprocessor System Architectures – Interconnection Networks – Structures – Design Issues – Threads – Process - Synchronization – Processor Scheduling – Memory Management – Virtualization – Types of Hypervisors – Paravirtualization – Memory Virtualization – I/O Virtualization.	8
V	**Database Systems**: Problem of Concurrency Control – Serializability – Basic Synchronization Primitives for Concurrency Control – Lock-Based Algorithms – Time-Stamp Based Algorithms – Optimistic Algorithms.	10

Textbooks:

1. Mukesh Singhal and Niranjan G. Shivaratri, "***Advanced Concepts in Operating Systems***
   – Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.
2. Andrew S. Tanenbaum, "***Modern Operating Systems***", 3rd Edition, Prentice Hall, 2012.

Reference Books:

1. Pradeep K Sinha, "***Distributed Operating Systems: Concepts and Design***", Prentice Hall of India, 2007.
2. George Coulouris, Jean Dollimore,Tim Kindberg, Gordon Blair, ***"Distributed Systems,Concepts and Design"***, 5th Edtn,Pearson, 2019
3. https://www.classcentral.com/course/udacity-advanced-operating-systems-1016
4. https://www.my-mooc.com/en/mooc/advanced-operating-systems--ud189/

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction**	
1.1	**Overview**: Functions of Operating System –Design Approaches –Types of Advanced Operating Systems.	2
1.2	**Synchronization Mechanisms**: Concept of Processes and Threads – The Critical Section Problem – Other Synchronization Problems:– Monitor –Serializer – Path Expressions.	4
1.3	**Distributed Operating Systems**:- Issues in Distributed Operating System – Communication Networks And Primitives –Lamport's Logical clocks – Causal Ordering of Messages	4
2		
2.1	**Distributed Mutual Exclusion**:- Classification - Requirements – Measuring Performance – Lamport's Algorithm –	2
2.2	. Rickart-Agarwala Algorithm – Suzuki- Kasami's Broadcast Algorithm.	3
2.3	**Security :**Potential Security Violations – Design Principles for Secure Systems –The Access Matrix Model and Implementation- The Access Control list Method	5

No	Topic	No. of Lectures
3		
3.1	**Distributed Resource Management**: Mechanisms for building Distributed File Systems – Design Issues.	3
3.2	**Distributed Shared Memory** – Algorithms for Implementing Distributed Shared memory	3
3.3	**Load Distribution** : Issues in Load Distributing – Components of Load Distributing Algorithm – Sender- Initiated Algorithm – Receiver-Initiated Algorithm.	4
4		
4.1	**Multiprocessor Operating Systems**: Basic Multiprocessor System Architectures – Interconnection Networks – Structures – —.	3
4.2	Design Issues – Threads – Process Synchronization - Processor Scheduling – Memory Management	3
4.3	Virtualization – Types of Hypervisors – Paravirtualization – Memory Virtualization – I/O Virtualization.	2
5		
5.1	**Database Systems**: Problem of Concurrency Control – Serializability – Basic Synchronization Primitives for Concurrency Control – Lock-Based Algorithms-	5
5.2	Time-Stamp Based Algorithms	3
5.3	Optimistic Algorithms	2

20MCA188	ARTIFICIAL INTELLIGENCE	CATEGORY	L	T	P	CREDIT
		ELECTIVE	3	1	0	4

Preamble: This course introduces the techniques of Artificial Intelligence and analyzes various methods of solving problems using it. The concept of expert system architecture & fuzzy operations are introduced. This course serves as a prerequisite for many advanced courses in Data Science areas.

Prerequisite: Mathematical Foundations for Computing, Advanced Data structures

Course Outcomes: After the completion of the course the student will be able to

CO 1	Apply the steps needed to provide a formal specification for solving the problem.
CO 2	Apply and analyze the different types of control and heuristic search methods to solve problems
CO 3	Understand various Game theory problems & Knowledge structures
CO 4	Formulate knowledge representation and examine resolution in predicate and propositional logic
CO 5	Apply feasible planning and learning techniques to solve non-trial problems
CO 6	Analyze expert systems & fuzzy operations to solve real life problems.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3							2			
CO 2	3	3							2			
CO 3	3	3							2			
CO 4	3	3							2			
CO 5	3	3							2			
CO 6	3	3	3				3		2		2	2

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	**2**	
Remember(K1)	10	10	10
Understand(K2)	20	20	20
Apply(K3)	20	20	30
Analyse(K4)			
Evaluate(K5)			
Create(K6)			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	40	60	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 8 marks
Continuous Assessment Test (2 numbers) : 20 marks
Assignment/Quiz/Course project : 12 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 compulsory short answer questions, 2 from each module. Each question caries 3 marks. Part B contains 2 questions from each module of which student should answer any one.Each question can have maximum 2 sub-divisions and carry 6 marks

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Describe the areas of Artificial intelligence. (K1)

2. List the problem formulations & production characteristics. (K1 & K2)

3. Solve the various problems such as 8 puzzle, Crypt arithmeticetc(K3)

Course Outcome 2 (CO2):

1. Describe search strategies in solving problems. (K1 & K2)

2. List the disadvantages of hill climbing algorithm (K1& K2)

3. Illustrate A* algorithm for the graph (K3)

Course Outcome 3 (CO3):

1. Demonstrate two player Zero sum game (K3)

2. List and explain the knowledge representation methods in AI.   (K1&K2)

3. Explain how alpha-beta algorithm works in pruning of branches with an example.(K3)

Course Outcome 4 (CO4):

1. Translate the following sentence to predicate logic   (K3)

   a) 'All pompeians were Roman'

   b)'All Romans were either loyal to Caesar or hated him'.

2. Explain the algorithm to convert WFF to clause.(K1 & K2)

3.Describe about resolution graph in predicate and propositional logic.(K1 & K2)

Course Outcome 5 (CO5):

1. Differentiate between Goal stack and Hierarchical planning in AI. (K1 & K2)

2. Discuss about neural net learning(K1 & K2)

3. List out the steps in genetic learning. (K1 & K2)

Course Outcome 6 (CO6):

1. Specify the components in expert system. (K1 & K2)

2. Solve various fuzzy operations   (K3)

3. List out & explain various tools and languages in AI. (K1 & K2)

Model question paper

Part A

1. List the applications areas in AI
2. Solve the following cryptarithmetic problem

       SEND +
       MORE
       MONEY

3. Explain iterative deepening search
4. List the disadvantages of hill climbing
5. Solve a simple two player Zero sum game
6. Explain about conceptual dependency
7. Explain inference rules in FOPL
8. List components of a planning system
9. Give a short note on role of an expert system
10. List various fuzzy operations

(10X3=30 marks)

Part B

11. Consider a water jug problem .You are given two jugs, a 4 gallon and 3 gallons. Neither has any measuring markers on it. There is a pump that can be used to fill the jugs with water. How can you get exactly 2 gallons of water into 4-gallon jug.State the production rule for waterjug problem

(6)

OR

12. Solve missionaries and cannibals problem (6)
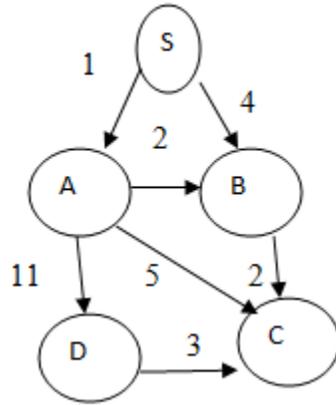
13. Explain blind search strategies in detail (6)

OR

14. Explain A* Algorithm for the given graph (6)

Heuristic Value:

S	6
A	2
B	3
C	0
D	5

15. List and explain the knowledge representation methods in AI. (6)

OR

16. Explain how alpha-beta algorithm works in pruning of branches with an example. (6)

17. Explain the algorithm to convert WFF to clause with an example. (6)

OR

18. Explain Neural net and Genetic learning methods in AI (6)

19. Illustrate architecture of an expert system and mention its features. (6)

OR

20. Solve the following using various Fuzzy set operations (6)
    A= {0.1/1,0.3/2,0.45/3}

    B={0.15/1,0.34/2}

(5X6=30 Marks)

SYLLABUS

Module 1

Introduction to AI and Production Systems:- AI-Problem formulation, Problem Definition - Production systems, Problem characteristics, Production system characteristics , Example AI Problems (8 Puzzle problem, Missionary Cannibals Problem, Crypt arithmetic Problems, block world Problem)

Module 2

Search Strategies : - Blind search strategies -Depth First Search, Breadth First Search, Best First Search, Iterative Deepening Search, Heuristic Search strategies- Admissible Heuristics and examples - Simple Hill Climbing and Steepest Ascending Hill Climbing, Simulated Annealing , A* algorithm.

Module 3

Game playing : Two Player Zero Sum Games, Modelling Two Player Zero Sum Games as search problems, Min-Max Algorithm, Optimizing Min Max Algorithm using $\alpha - \beta$ cut off, *Knowledge Representation Structures :* Frames, Sematic Networks and Conceptual Dependencies.

Module 4

Knowledge representation using Logic : - First Order Predicate Logic (FOPL), Well Formed Formula(WFF) in FOPL, Inference rules for FOPL, The Clause Form and conversion of WFFs to Clause Form, Resolution- Refutation .*Planning :-* Overview, components of a planning system, Goal stack planning, Hierarchical planning, *Learning :-*Forms of learning, neural net learning & genetic learning

Module 5

Expert systems:–Architecture of expert systems, Roles of expertsystems,Languages and tools – Typical expert system examples.*Fuzzy Logic: -* Fuzzy Variables ,Fuzzy Sets and Fuzzy Set Operations, Typical Examples using FuzzySets.

Text Books

1. Kevin Night and Elaine Rich, "*Artificial Intelligence (SIE)*", McGrawHill-2008.
2. StuartRussel and Peter Norvig "*AI – A Modern Approach*", 2nd Edition, Pearson Education2007.

Reference Books

1. Peter Jackson, "*Introduction to Expert Systems*", 3rd Edition, Pearson Education,2007.
2. Dan W. Patterson, "*Introduction to AI and ES*", Pearson Education,2007.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	*Module I: Introduction to AI*	*9 hrs*
1.1	AI-Problem formulation, Problem Definition -Production systems	
1.2	Production system characteristics	
1.3	AI Problems	
2	*Module II: Search Strategies*	*9 hrs*
2.1	Blind search strategies	
2.2	Heuristics search strategies	
2.3	Simple Hill Climbing and Steepest Ascending Hill Climbing,	
2.4	Simulated anneling	
2.5	A* algorithm	
3	*Module III: Game playing*	*9 hrs*
3.1	Zero sum game	
3.2	Minimax algorithm	
3.3	Alpha beta pruning	
3.4	Knowledge representation structure	
4	*Module IV: Knowledge representation using Logic*	*12 hrs*
4.1	First Order Predicate Logic (FOPL)	
4.2	Well Formed Formula(WFF) in FOPL, Inference rules for FOPL	
4.3	The Clause Form and conversion of WFFs to Clause Form	
4.4	Resolution	
4.5	Planning	
4.6	Learning	
5	*Module V: APPLICATIONS*	*6 hrs*
5.1	Expert system Architecture	
5.2	Fuzzy logic operations	
5.3	Languages and tools	

20MCA192	IPR AND CYBER LAWS	CATEGORY	L	T	P	CREDIT
		ELECTIVE	3	1	0	4

Preamble: This course intends to provide insight into Intellectual Property Rights and Cyber Laws. It includes detailed discussion on various intellectual property rights, procedures to apply for copyrights &patents, legalities of intellectual property to avoid plagiarism and other IPR related crimes. Effectiveness of cyber-laws and other countermeasures against cybercrime and cyber warfare are discussed in detail. Various kinds of Intellectual Property issues in cyberspace and the growth and development of the law in this regard are included to the level possible within the scope of a single course. More detailed treatment can be done through seminars, assignments and talks by eminent external experts including industry.

Prerequisite: General awareness on internet essentials, web technologies, e-commerce.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Explain the fundamentals of IPR and patents.
CO 2	Apply intellectual property related tools such as trademark and copyright to real problems.
CO 3	Discuss Industrial designs, trade secret and geographic Indications.
CO 4	Describe laws governing cyberspace and analyze the role of Internet Governance in framing policies for Internet security.
CO 5	Discuss different types of cybercrimes and penalties under IT Act.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	1		1						
CO 2	3	3	2	1		1						
CO 3	3	2	1	1								
CO 4	2	2	1			1						
CO 5	2	2	1	1		1						

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	30	25
Apply	20	10	25
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	40	60	3 hours

Continuous Internal Evaluation Pattern:

Attendance   : 8 marks
Continuous Assessment Test (2 numbers)   : 20 marks
Assignment/Quiz/Course project   : 12 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 compulsory short answer questions, 2 from each module. Each question carries 3 marks. Part B contains 2 questions from each module of which student should answer any one. Each question can have maximum 2 sub-divisions and carry 6 marks

Course Level Assessment Questions

Course Outcome 1 (CO1):

4. Discuss the need for protection of intellectual property.
5. Explain TRIPS Agreement.
6. Illustrate types of patent applications.

Course Outcome 2 (CO2)

4. Explain Trademark Infringement and Protection of trademarks.
5. Explain the rights conferred by copyright, registration and ownerships of copyrights.
6. Discuss about software copyright.

Course Outcome 3(CO3):

4. Discuss the need for protection of design and explain Design Act, 2000.
5. Explain basic concepts of Geographic Indications such as filing, granting and Protection of geographic indications.
6. Describe the procedure of discovering and protecting of trade secret.

Course Outcome 4 (CO4):

4. Explain the need for cyber laws.
5. Discuss protection of copyright on cyberspace.
6. Explain ISP in cyberspace.

Course Outcome 5 (CO5):

4. Explain different amendments on IT Act 2000.
5. Discuss Terrorism on cyberspace.
6. Explain offences of misrepresentation.

Model Question paper

Part A

21. Categorize various patent applications.
22. Explain the criteria for categorizing an invention as patentable or non-patentable.
23. What are the requirements for filing trademarks?
24. Explain copyright and the rights conferred by copyrights.
25. Explain the term geographical indications by giving suitable examples.
26. What is meant by design under the Design Act,2000?
27. Describe the risks associated with cyber space.
28. What is meant by the term cyber laws.
29. Explain cyber stalking and phishing.
30. Define the term hacking and explain its essentials.   [3 x 10 =30 Marks]

Part B

Module 1

31. Describe the procedure for registration of patents.   [6 Marks]

OR

32. Write short notes on
    c. Intellectual property and the need for its protection.   [3 marks]
    d. Importance and features of WIPO.   [3 marks]

Module 2

33. Explain the methods for transferring copyrights.   [6 Marks]

OR

34. Describe software copyright and how can software be classified according to copyrights.
[6 Marks]

Module 3

35. What is industrial design? Describe the salient features of Design act, 2000.   [6 Marks]

OR

36. How are the trade secrets dealt with under the Indian law? Discuss.

[6 Marks]

Module 4

37. Explain the essential requirements of cyber squatting.

[6 Marks]

OR

38. Discuss about cyber space and the protection of copyrights on cyberspace.

[6 Marks]

Module 5

39. Explain the objectives and features of Information Technology Act 2000.

[6 Marks]

OR

40. What do you mean by cyber crimes? Discuss the nature and types of cyber crimes.

[6 Marks]

Syllabus

Module	Contents	Hours
I	Fundamentals of IPR- Introduction – Intellectual property – Need for protection of intellectual property – WIPO – Intellectual property rights and development – Rationale of protection – TRIPS Agreement - **Patents :** – Introduction – Patentable and Non-patentable Invention – Types of patent applications – Guidelines for registration of patent – patent filing – grant of patent – types of patent documents.	10

Module	Contents	Hours
II	**Trademarks**– Introduction – Guidelines for registration- Requirements for filing trademarks – Trademark Infringement – Protection of trademarks – **Copyright –** Introduction – Rights conferred by copyright – registration – ownerships – terms – transfer of copyrights – copyright infringement – databases and copyright- **Software Copyright**–Introduction – Need of software copyright – classification of software according to copyright – software auditing –copyright notice – transfer of copyright.	10
III	**Industrial Designs**– Introduction – Need for protection of design – requirements for registration of designs – Design Act,2000 – Duration of registration of design – application procedure – **GeographicIndications –**Introduction **–** Filing – **Granting** – Protection of geographic indications**.** **Trade Secret –** definition – discovering and protecting of trade secret.	10
IV	**Cyber law** - Need for cyber laws - Historical perspective - cyberspace - deception by squatting in cyberspace - protection of copyright on cyberspace - infringement of copyright on cyberspace - linking,hyperlinking and framing - ISP in cyberspace - cyberspace and protection of patents in India.	8
V	**Information Technology Act and Punishments**- Introduction to IT Act 2000- Amendments on IT Act - Violation of the right of privacy in cyberspace/internet-punishment for violation of privacy, breach of confidentiality and privacy under IT act-Terrorism on cyberspace Overview of cybercrimes-offences by intermediaries- offences related to protected system- offences of misrepresentation- punishment for Abetment and Attempt to commit offences under the IT act.	10

Textbooks:

1.Dr. R. Radhakrishnan and Dr. S. Balasubramanian, "**Intellectual Property Rights: Text and Cases**", Excel Books
2.Harish Chander, "**Cyber Law and IT Protection**", PHI Learning Pvt.Ltd.
Reference Books:

5. D.Bainbridge, "**Introduction to Computer Law**", Pearson Education
6. RohasNagpal, "**Cyber Crime & Corporate Liability**", CCH, 2008
7. https://www.udemy.com/course/cyber-security-law/
8. https://www.coursera.org/specializations/introduction-intellectual-property

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction**	
1.1	**Fundamentals of IPR-** Introduction – Intellectual property – Need for protection of intellectual property	2
1.2	WIPO – Intellectual property rights and development – Rationale of protection – TRIPS Agreement	3
1.3	**Patents : –** Introduction **–** Patentable and Non-patentable Invention – Types of patent applications – Guidelines for registration of patent – patent filing – grant of patent – types of patent documents	5
2		
2.1	**Trademarks**– Introduction – Guidelines for registration – Requirements for filing trademarks – Trademark Infringement – Protection of trademarks	3
2.2	**Copyright –** Introduction – Rights conferred by copyright – registration – ownerships – terms – transfer of copyrights – copyright infringement – databases and copyright	3
2.3	**Software Copyright**– Introduction – Need of software copyright – classification of software according to copyright – software auditing – copyright notice – transfer of copyright.	4
3		
3.1	**Industrial Designs**– Introduction – Need for protection of design – requirements for registration of designs – Design Act,2000 – Duration of registration of design – application procedure	4

No.	Topic	No. of Lectures
3.2	**Geographic Indications –** Introduction **–** Filing **Granting** – Protection of geographic indications**.**	4
3.3	**Trade Secret –** definition – discovering and protecting of trade secret.	2
4		
4.1	**Cyber law** - Need for cyber laws - Historical perspective - cyberspace - deception by squatting in cyberspace.	3
4.2	Protection of copyright on cyberspace - infringement of copyright on cyberspace - linking, hyper linking and framing -	3
4.3	ISP in cyberspace - cyberspace and protection of patents in India.	2
5		
5.1	**Information Technology Act and Punishments**- Introduction to IT Act2000- Amendments on IT Act	2
5.2	Violation of the right of privacy in cyberspace/internet-punishment for violation of privacy, breach of confidentiality and privacy under IT act-Terrorism on cyberspace overview of cybercrimes	4
5.3	Offences by intermediaries- offences related to protected system- offences of misrepresentation-punishment for Abetment and Attempt to commit offences under the IT act.	4
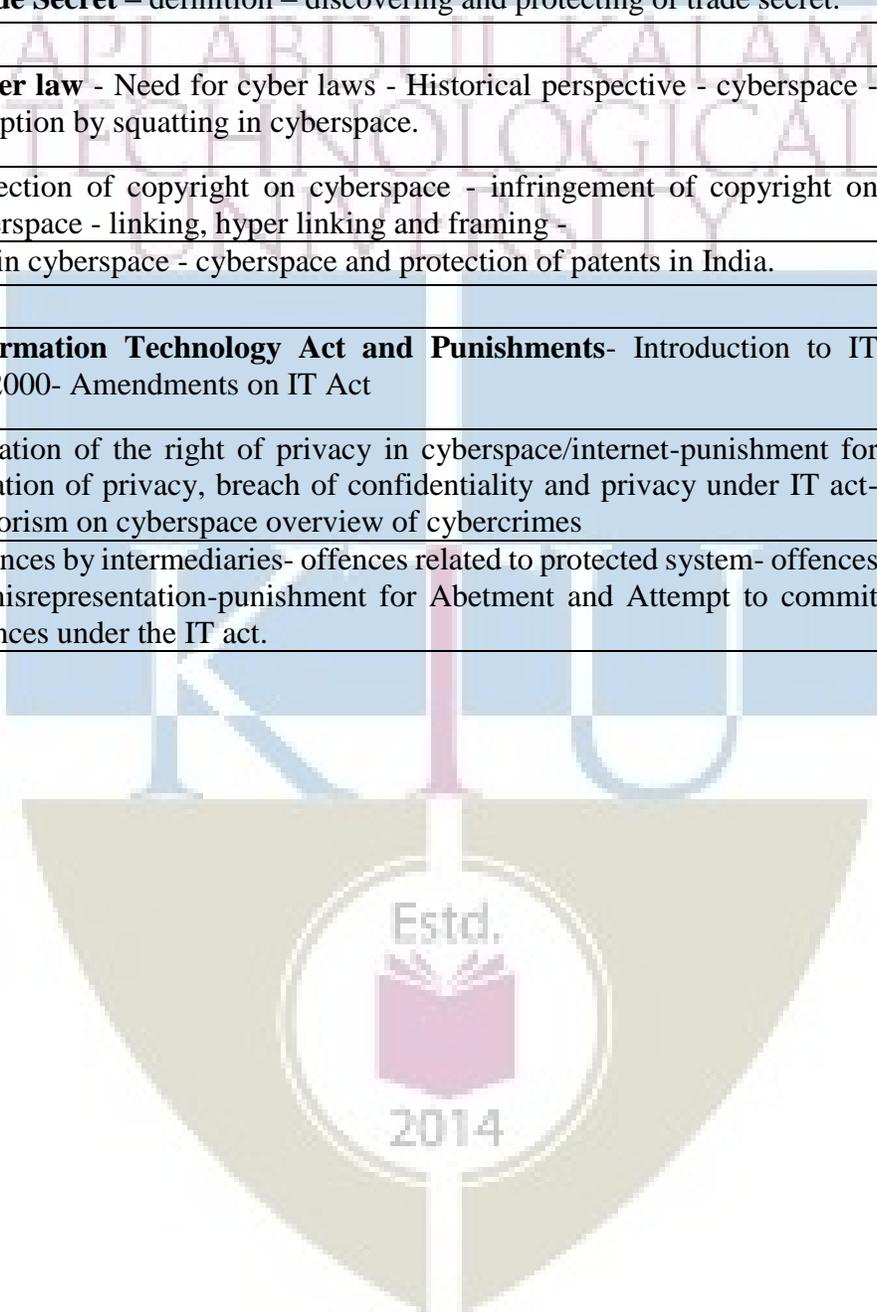
20MCA132	OBJECT ORIENTED PROGRAMMING LAB	CATEGORY	L	T	P	CREDIT
		PRACTICAL	0	1	3	2

Preamble: This course enables the students to understand the concepts of object-oriented programming and to develop skills using these paradigms using Java.

Prerequisite: Knowledge of any programming language preferred.

Course Outcomes: After the completion of the course the student will be able to

CO 1	Understand object-oriented concepts and design classes and objects to solve problems
CO 2	Implement arrays and strings.
CO 3	Implement object-oriented concepts like inheritance, overloading and interfaces
CO 4	Implement packages, exception handling, multithreading and generic programming. Use java.util package and Collection framework
CO 5	Develop applications to handle events using applets
CO 6	Develop applications using files and networking concepts

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	2	2	3							
CO 2	3	2	2		3							
CO 3	3	2	2		3							
CO 4	3	2	2		3							
CO 5	3	3	3		3	2			3		3	
CO 6	3	3	3		3	2			3		3	

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember(K1)			
Understand(K2)			
Apply(K3)	10	10	10
Analyse(K4)	10	10	10
Evaluate(K5)	10	10	10
Create(K6)	20	20	20

Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	50	50	3 hours

Continuous Internal Evaluation Pattern:

Maximum Marks: 50	
Attendance	15%
Maintenance of daily lab record and GitHub management	20%
Regular class viva	15%
Timely completion of day to day tasks	20%
Tests/Evaluation	30%

End Semester Examination Pattern:

Maximum Marks: 50			
Verification of Daily program record and Git Repository			5 marks
Viva			10 marks
Problem solving (Based on difficulty level, one or more questions may be given)	Flowchart / Algorithm / Structured description of problem to explain how the problem can be solved / Interface Design	15%	35 marks
	Program correctness	50%	
	Code efficiency	15%	
	Formatted output and Pushing to remote Git repository	20%	
Total Marks			50 marks

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Define a class 'product' with data members pcode, pname and price. Create 3 objects of the class and find the product having the lowest price.
2. Read 2 matrices from the console and perform matrix addition.

3. Add complex numbers

4. Read a matrix from the console and check whether it is symmetric or not.

5. Create CPU with attribute price. Create inner class Processor (no. of cores, manufacturer) and static nested class RAM (memory, manufacturer). Create an object of CPU and print information of Processor and RAM.

Course Outcome 2 (CO2)

1. Program to Sort strings

2. Search an element in an array.

3. Perform string manipulations

4. Program to create a class for Employee having attributes eNo, eName eSalary. Read n employ information and Search for an employee given eNo, using the concept of Array of Objects.

Course Outcome 3(CO3):

1. Area of different shapes using overloaded functions

2. Create a class 'Employee' with data members Empid, Name, Salary, Address and constructors to initialize the data members. Create another class 'Teacher' that inherit the properties of class employee and contain its own data members department, Subjects taught and constructors to initialize these data members and also include display function to display all the data members. Use array of objects to display details of N teachers.

3. Create a class 'Person' with data members Name, Gender, Address, Age and a constructor to initialize the data members and another class 'Employee' that inherits the properties of class Person and also contains its own data members like Empid, Company_name, Qualification, Salary and its own constructor. Create another class 'Teacher' that inherits the properties of class Employee and contains its own data members like Subject, Department, Teacherid and also contain constructors and methods to display the data members. Use array of objects to display details of N teachers.

4. Write a program has class Publisher, Book, Literature and Fiction. Read the information and print the details of books from either the category, using inheritance.

5. Create classes Student and Sports. Create another class Result inherited from Student and Sports. Display the academic and sports score of a student.

6. Create an interface having prototypes of functions area() and perimeter(). Create two classes Circle and Rectangle which implements the above interface. Create a menu driven program to find area and perimeter of objects.

7. Prepare bill with the given format using calculate method from interface.

Order No.

Date :

Product Id	Name	Quantity	unit price	Total
101	A	2	25	50
102	B	1	100	100

Net. Amount   150

Course Outcome 4 (CO4):

1. Create a Graphics package that has classes and interfaces for figures Rectangle, Triangle, Square and Circle. Test the package by finding the area of these figures.
2. Create an Arithmetic package that has classes and interfaces for the 4 basic arithmetic operations. Test the package by implementing all operations on two given numbers
3. Write a user defined exception class to authenticate the user name and password.
4. Find the average of N positive integers, raising a user defined exception for each negative input.
5. Define 2 classes; one for generating multiplication table of 5 and other for displaying first N prime numbers. Implement using threads. (Thread class)
6. Define 2 classes; one for generating Fibonacci numbers and other for displaying even numbers in a given range. Implement using threads. (Runnable Interface)
7. Producer/Consumer using ITC
8. Program to create a generic stack and do the Push and Pop operations.
9. Using generic method perform Bubble sort.
10. Maintain a list of Strings using ArrayList from collection framework, perform built-in operations.
11. Program to remove all the elements from a linked list
12. Program to remove an object from the Stack when the position is passed as parameter
13. Program to demonstrate the creation of queue object using the PriorityQueue class
14. Program to demonstrate the addition and deletion of elements in deque
15. Program to demonstrate the creation of Set object using the LinkedHashset class
16. Write a Java program to compare two hash set

17. Program to demonstrate the working of Map interface by adding, changing and removing elements.
18. Program to Convert HashMap to TreeMap

Course Outcome 5 (CO5):

1. Program to draw Circle, Rectangle, Line in Applet.
2. Program to find maximum of three numbers using AWT.
3. Find the percentage of marks obtained by a student in 5 subjects. Display a happy face if he secures above 50% or a sad face if otherwise.
4. Using 2D graphics commands in an Applet, construct a house. On mouse click event, change the color of the door from blue to red.
5. Implement a simple calculator using AWT components.
6. Develop a program that has a Choice component which contains the names of shapes such as rectangle, triangle, square and circle. Draw the corresponding shapes for given parameters as per user's choice.
7. Develop a program to handle all mouse events and window events
8. Develop a program to handle Key events.

Course Outcome 6 (CO6):

1. Program to list the sub directories and files in a given directory and also search for a file name.
2. Write a program to write to a file, then read from the file and display the contents on the console.
3. Write a program to copy one file to another.
4. Write a program that reads from a file having integers. Copy even numbers and odd numbers to separate files.
5. Client server communication using Socket – TCP/IP
6. Client Server communication using DatagramSocket - UDP

Syllabus:

Classes and Objects, Constructors, Method Overloading, Access Modifiers, Arrays and Strings, Inheritance, Interfaces, Abstract classes, Dynamic Method Dispatch, String, Packages, Introduction to java.util, Collection framework, User defined packages, Exceptions, Multithreading, Applets, Graphics, File, Generic programming, Socket Programming

Reference Books

1. Herbert Schildt, "*Java The Complete Reference*", Seventh Edition, Tata McGraw-Hill Edition

2. C. Thomas Wu, "*An introduction to Object-oriented programming with Java*", Fourth Edition, Tata McGraw-Hill Publishing company Ltd.

3. Cay S. Horstmann and Gary Cornell, "*Core Java: Volume I – Fundamentals*", Eighth Edition, Sun Microsystems Press.

4. K. Arnold and J. Gosling, "*The JAVA programming language*", Third edition, Pearson Education.

5. Paul Deitel and Harvey Deitel, "*Java, How to Program*", Tenth Edition, Pearson Education

6. Rohit Khurana, "*Programming with Java*", Vikas Publishing, 2014.

7. Timothy Budd, "*Understanding Object-oriented programming with Java*", Updated Edition, Pearson Education.

8. Y. Daniel Liang, "*Introduction to Java programming*", Seventh Edition, Pearson Education.

Web Reference

- https://www.hackerrank.com/domains/java
- https://www.geeksforgeeks.org/java-tutorial/
- https://www.w3resource.com/java-tutorial/
- https://www.w3resource.com/java-exercises/
- https://nptel.ac.in/courses/106/105/106105191/
- https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-cs08/
- https://www.coursera.org/learn/object-oriented-java
- https://www.edx.org/course/object-oriented-programming-in-java-2

Course Contents and Lab Schedule

Topic	No. of hours
1. Classes and Objects.	3
2. Constructors, Method Overloading, Access Modifiers	2
3. Arrays and Strings.	4
4. Inner class – static and non-static	2
5. Inheritance, Multiple inheritance - implementation using interfaces	3
6. Method overriding, Abstract classes, Dynamic Method Dispatch	3
7. Interfaces and Packages, StringBuffer class	3
8. Introduction to java.util package – Vector, Scanner, StringTokenizer	2
9. Collection framework – ArrayList, LinkedList, Stack, Queue, Set, Map	3
10. User defined packages	2
11. Exceptions – User defines exceptions	2
12. Multithreading – Thread class	2
13. Inter Thread Communication	2
14. Generic programming	2
15. Applets, Graphics – 2D	3
16. Event handling in Applet	3
17. File	3
18. Socket Programming	3

20MCA134	ADVANCED DBMS LAB	CATEGORY	L	T	P	CREDIT
		PRACTICAL	0	1	3	2

Preamble: This course is to provide understanding on relational and non-relational database systems and its design. The course covers SQL, PL/SQL and NoSQL programs which are essential for the development and deployment of web based applications. Also this course serves as a prerequisite for many advanced courses in Data Science areas.

Prerequisite: Database Management Systems

Course Outcomes: After the completion of the course the student will be able to

CO 1	Design and build a simple relational database system and demonstrate competence with the fundamentals tasks involved with modelling, designing and implementing a database.
CO 2	Apply PL/SQL for processing databases.
CO 3	Comparison between relational and non-relational (NoSQL) databases and the configuration of NoSQL Databases.
CO 4	Apply CRUD operations and retrieve data in a NoSQL environment.
CO 5	Understand the basic storage architecture of distributed file systems.
CO 6	Design and deployment of NoSQL databases with real time requirements.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	3	2	2					1	1	
CO 2	2	2	2		1							
CO 3	2	2	2	2						1	1	
CO 4	2	2	3	1	2		1			1	1	1
CO 5	3	2	2				1				1	1
CO 6	2	2	3	1	1			1		1	1	2

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember(K1)			
Understand(K2)			
Apply(K3)	10	10	10
Analyse(K4)	10	10	10
Evaluate(K5)	10	10	10
Create(K6)	20	20	20

Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	50	50	3 hours

Continuous Internal Evaluation Pattern:

Maximum Marks: 50	
Attendance	15%
Maintenance of daily lab record and GitHub management	20%
Regular class viva	15%
Timely completion of day to day tasks	20%
Tests/Evaluation	30%

End Semester Examination Pattern:

Maximum Marks: 50			
Verification of Daily program record and Git Repository			5 marks
Viva			10 marks
Problem solving (Based on difficulty level, one or more questions may be given)	Flowchart / Algorithm / Structured description of problem to explain how the problem can be solved / Interface Design	15%	35 marks
	Program correctness	50%	
	Code efficiency	15%	
	Formatted output and Pushing to remote Git repository	20%	
Total Marks			50 marks

Course Level Assessment

Questions Course Outcome 1 (CO1):

1. Creation of a database using DDL commands including integrity constraints. (K6)
2. Create an application to apply Data Manipulation Language (DML) commands to modify the database. (K6)
3. Apply DCL and TCL commands to impose restrictions on databases. (K3)
4. Create an application to retrieve data from databases using select, views. (K6)
5. Create an application to use joins for query optimization. (K6)

Course Outcome 2 (CO2):

1. Construct PL/SQL code for sample databases. (K6)

Course Outcome 3(CO3):

1. Compare relational and non-relational databases. (K5)
2. Understand the installation and configuration of NoSQL Databases. (K2)

Course Outcome 4 (CO4):

1. Build sample collections/documents to perform query operations. (K6)

Course Outcome 5 (CO5):

1. Build sample collections/documents to perform the shell commands like replica set, indexing etc. (K6)

Course Outcome 6 (CO6):

1. Develop sample applications using any of the front end tools and NoSQL. (K6)
2. Usage of concerned Online/Cloud Storage Management Systems like MongoDB Atlas, Cassandra DataStax etc. (K6)
3. Deployment of NoSQL in Cloud: Google Bigtable/ Amazon DynamoDB/ Azure Cosmos DB. (K6)

Syllabus

1. An overview of relational database design using MySQL/ MariaDB/ PostgreSQL etc. (Apply the following basic queries on an Employee/ Student database etc.)
   a. DDL Commands
   b. DML Commands
   c. Imposing restrictions on database (DCL & TCL Commands)
   d. Accessing database (SELECT, Filtering using WHERE, HAVING, GROUP BY, ORDER BY Clauses, Subquery and View)
   e. Optimizing databases (Join, Aggregate & Set operations, Other operators like arithmetic, logical, special etc.)
2. PL/SQL Programs (Trigger, Cursor, Stored Procedures and Functions)
3. Introduction to NoSQL Databases.
   a. Installation and configuration of any one of the NoSQL databases - MongoDB/ Cassandra/ HBase/ CouchDB/ Amazon DynamoDB/ Redis/ Neo4j etc.
4. Designing Databases using NoSQL
5. Query Processing
   a. Performing CRUD operations
   b. Retrieving Data from a NoSQL database
   c. Usage of aggregate functions, regular expressions etc.
6. NoSQL Administration
   a. Security, Monitoring & Backup
   b. Create Users and Roles
7. NoSQL shell commands
   a. Perform Sharding, Replication (Master-Slave/ Master-Less/ Peer-to-Peer Architectures), Clustering, Partitioning, Indexing (Corresponding to the selected NoSQL Database)

8. Deployment
   a. Local Deployment
      i. NoSQL and Front-End: PHP/Java/Python (MongoDB/ Cassandra etc.)
   b. Cloud Deployment
      i. NoSQL and Cloud: Amazon DynamoDB/ Google Bigtable/ Azure Cosmos DB
      ii. Familiarization of Atlas/ DataStax corresponding to the selected NoSQL Database

9. *Micro project: Students can be given a group micro project, so that they learn to work in a team environment.*

Text Books

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan," ***Database System Concepts***", McGraw Hill Education, 6th Edition (2011)
2. Guy Harrison, "***Next Generation Databases: NoSQL, NewSQL, and Big Data***", Apress, 1st Edition (14 December 2015)

Reference Books

1. Raghu Ramakrishnan and Johannes Gehrke, "***Database Management Systems***", McGraw Hill, 3rd Edition (2014).
2. HBase: The Definitive Guide. Lars George O'Reilly Media; August 2011, ISBN: 9781449315771
3. Shashank Tiwari. Professional NoSQL. John Wiley and Sons. ISBN: 978-0-470-94224-6.
4. MongoDB Administrator's Guide, Cyrus Dasadia, October 2017, Packet Publishing ISBN: 9781787126480
5. Cassandra: The Definitive Guide Distributed Data at Web Scale, 1st Edition, Eben Hewitt, Jeff Carpenter, O'Reilly Media; November 2010

Web Resources

1. Database Management System https://nptel.ac.in/courses/106/105/106105175/

2. Databases: SQL https://www.edx.org/course/databases-5-sql

3. Introduction to MongoDB https://www.coursera.org/learn/introduction-mongodb

4. Apache Cassandra https://www.edureka.co/cassandra

5. NoSQL systems https://www.coursera.org/learn/nosql-databases

6. https://hbase.apache.org/

7. https://couchdb.apache.org/ https://aws.amazon.com/dynamodb/

8. https://aws.amazon.com/dynamodb/

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	*An overview of relational database design using MySQL/ MariaDB/ PostgreSQL etc. (Apply the following basic queries on an Employee/ Student database etc.)*	*6 hrs*
1.1	- DDL Commands - DML Commands - Imposing restrictions on database (DCL & TCL Commands)	3
1.2	- Accessing database (SELECT, Filtering using WHERE, HAVING, GROUP BY, ORDER BY Clauses, Subquery and View) - Optimizing databases (Join, Aggregate & Set operations, Other operators like arithmetic, logical, special etc.)	3

No	Topic	No. of Lectures
2	*PL/SQL Programs*	*4 hrs*
2.1	• Trigger, Cursor, Stored Procedures and Functions	4
3	*Introduction to NoSQL Databases*	*2 hrs*
3.1	• Installation and configuration of any one of the NoSQL databases - MongoDB/ Cassandra/ HBase/ CouchDB/ Amazon DynamoDB/ Redis/ Neo4j etc.	2
4	*Designing Databases using NoSQL*	*2 hrs*
5	*Query Processing*	*8 hrs*
5.1	• Performing CRUD operations • Retrieving Data from a NoSQL database • Usage of aggregate functions, regular expressions etc.	8
6	*NoSQL Administration*	*2 hrs*
6.1	• Security, Monitoring & Backup • Create Users and Roles	2
7	*NoSQL shell commands*	*6 hrs*
7.1	• Perform Sharding, Replication (Master-Slave/ Master-Less/ Peer-to-Peer Architectures), Clustering, Partitioning, Indexing (Corresponding to the selected NoSQL Database)	6
8	*Deployment*	*16 hrs*
8.1	• Local Deployment NoSQL and Front-End: PHP/Java/Python (MongoDB/ Cassandra etc.)	4
8.2	• Cloud Deployment NoSQL and Cloud: Amazon DynamoDB/ Google Bigtable/ Azure Cosmos DB	8
8.3	• Familiarization of Atlas/ DataStax corresponding to the selected NoSQL Database	4
9	*Micro project*	*10 hrs*

20MCA136	NETWORKING & SYSTEM ADMINISTRATION LAB	CATEGORY	L	T	P	CREDIT
		PRACTICAL	0	1	3	2

Preamble: This laboratory course is intended to provide the background knowledge required for a software professional in the fields of networking and system administration. Students will acquire necessary knowledge to deploy and administer systems.

Prerequisite: Basic understanding of computer programming, Internet and operating systems

Course Outcomes: After the completion of the course the student will be able to

CO 1	Install and configure common operating systems.
CO 2	Perform system administration tasks.
CO 3	Install and manage servers for web applications.
CO 4	Write shell scripts required for system administration.
CO 5	Acquire skill sets required for a DevOps.

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	1		2		2							
CO 2	1		2									
CO 3			2		2							
CO 4					2							
CO 5	2				2							

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember(K1)			
Understand(K2)			
Apply(K3)	10	10	10
Analyse(K4)	10	10	10
Evaluate(K5)	10	10	10
Create(K6)	20	20	20

Mark distribution

Total Marks	CIE	ESE	ESE Duration
100	50	50	3 hours

Continuous Internal Evaluation Pattern:

Maximum Marks: 50	
Attendance	15%
Maintenance of daily lab record and GitHub management	20%
Regular class viva	15%
Timely completion of day to day tasks	20%
Tests/Evaluation	30%

End Semester Examination Pattern:

Maximum Marks: 50			
Verification of Daily program record and Git Repository			5 marks
Viva			10 marks
Problem solving (Based on difficulty level, one or more questions may be given)	Flowchart / Algorithm / Structured description of problem to explain how the problem can be solved / Interface Design	15%	35 marks
	Program correctness	50%	
	Code efficiency	15%	
	Formatted output and Pushing to remote Git repository	20%	
Total Marks			50 marks

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Install latest version of Ubuntu on a virtual box, set up a static ip address to it and install drupal environment.
2. You are given a computer with very low hardware resources. It is to be used as a kiosk. Identify and install a suitable Linux distribution. You can simulate it in a virtual environment.

Course Outcome 2 (CO2)

1. You are given a system which is connected to internet. However, users logging on to the system are unable to access internet from their browser. Trouble shoot the issue,clearly documenting the steps you have taken (Possible issues to look for are browser configuration, network connectivity, routing, ip address configuration,DNS resolution)

2. You are given a system which boots to a non graphical environment. You are also given a shell script which is designed for a specific task. Your task is to make sure that the script runs every time the system boots up. Write/modify necessary scripts for this.

3. You are required to add 100 users to a Linux system. Details of the users to be added were collected from a web form to a csv file. The csv may contain errors such as wrong case or missing fields. Write a script to add users using the data provided in the csv file with proper error checking.

Course Outcome 3(CO3):

1. You are given a bare bone installation of latest version Ubuntu. Assume that the system is accessible from internet. Your task is to successfully install word press (or any other web application) on this server. Clearly indicate the steps taken and software installed for this task.

2. Assume that you have an installation of old version Ubuntu. However, it does not have the latest version of virtual box (or some other application). The new version is available as a binary on a website. Upgrade to this version.

Course Outcome 4 (CO4):

1.Look at the system log files. Write a shell script to extract the last login details of a particular user and list out all failed logins. Store the results to a file. The user name should be given as a command line argument.

2.Write a shell script to display the details of a particular process currently running. Assume that you have necessary permissions. The process name/id is to be given as a command line argument

Course Outcome 5 (CO5):

1.Capture network traffic on your system. Using wireshark find out all http and https traffic to a specific host.

2.Write an Ansible playbook to deploy a new Linux VM on a remote server.

Syllabus:

Introduction to Computer hardware. Study of various peripherals. Study of common operating systems. File system organization in common operating systems.

Study of command line environment in common operating systems. Study of command line tools for system administration.

Shell scripting: bash shell, shell scripts for system management.

Study of startup scripts.

Study of server software for common applications such as http, ftp, dns, dhcp.

Practical study of Ipv4 and Ipv6 networking protocols. Setting up firewalls.

Virtual machines and containers. Configuration and deployment.

List of Lab Experiments/Exercises

To gain proficiency in command line tools and operations, it is highly recommended to use a terminal window instead of GUI tools. This will later help the student with latest approaches in maintaining cloud based infrastructure. virtualbox/quemu. may be used for this.

1. Introduction to Computer hardware: Physical identification of major components of a computer system such as mother board, RAM modules, daughter cards, bus slots, SMPS, internal storage devices,i nterfacing ports. Specifications of desktop and server class computers. Installation of common operating systems for desktop and server use. (Students may be asked to formulate specification for computer to be used as Desktop, Web server)

2. Study of a terminal based text editor such as Vim or Emacs. (By the end of the course, students are expected to acquire following skills in using the editor: cursor operations, manipulate text, search for patterns, global search and replace)
   Basic Linux commands, familiarity with following commands/operations expected
   1. man
   2. ls, echo, read
   3. more, less, cat,
   4. cd, mkdir, pwd, find
   5. mv, cp, rm ,tar
   6. wc, cut, paste
   7. head, tail, grep, expr
   8 chmod, chown
   9. Redirections & Piping
   10. useradd, usermod, userdel, passwd
   11. df,top, ps
   12 ssh, scp, ssh-keygen, ssh-copy-id
   .
3. File system hierarchy in a common Linux distribution, file and device permissions, study of system configuration files in /etc, familiarizing log files for system events, user activity, network events.

4. Shell scripting: study bash syntax, environment variables, variables, control constructs such as if, for and while, aliases and functions, accessing command line arguments passed to shell

scripts. Study of startup scripts, login and logout scripts, familiarity with systemd and system 5 init scripts is expected.

5. Installation and configuration of LAMP stack. Deploy an open source application such as phpmyadmin and Wordpress.

6. Installation and configuration of common software frame works such as Laravel. (Student should acquire the capability to install and configure a modern framework)

7. Build and install software from source code, familiarity with make and cmake utilities expected.

8. Introduction to command line tools for networking
   IPv4 networking, network commands: ping route traceroute, nslookup, ip. Setting up static and dynamic IP addresses. Concept of Subnets, CIDR address schemes, Subnet masks, iptables, setting up a firewall for LAN, Application layer (L7) proxies.

9. Analyzing network packet stream using tcpdump and wireshark. Perform basic network service tests using nc.

10. Introduction to Hypervisors and VMs, Xen or KVM , Introduction to Containers: Docker, installation and deployment.

11. Automation using Ansible: Spin up a new Linux VM using Ansible playbook