SEMESTER V

SLOT	COURSE NO.	COURSES	L-T-P	HOURS	CREDIT
A	CST 301	FORMAL LANGUAGES AND AUTOMATA THEORY	3-1-0	4	4
B	CST 303	COMPUTER NETWORKS	3-1-0	4	4
C	CDT 305	DATA ANALYTICS	3-1-0	4	4
D	CDT 307	BIG DATA PROCESSING	3-1-0	4	4
E	CST 309	MANAGEMENT O F SOFTWARE SYSTEMS	3-0-0	3	3
F	MCN 301	DISASTER MANAGEMENT	2-0-0	2	--
S	CDL 331	DATA ANALYTICS LAB	0-0-3	3	2
T	CSL 333	DATABASE MANAGEMENT SYSTEMS LAB	0-0-3	3	2
R/M/H	VAC	Remedial/Minor/Honourscourse*	2-0-0	4	4
		TOTAL		**29***	**23/27**
* Excluding Hours to be engaged for Remedial/Minor/Honours course.					

NOTE:

1. *All Institutions should keep 4 hours exclusively for Remedial class/Minor/ Honours course (Tuesdays from 3 to 5 PM and Wednesdays from 3 to 5 PM). If a student does not opt for minor/honours programme, he/she can be given remedial class.

CST 301	FORMAL LANGUAGES AND AUTOMATA THEORY	Category	L	T	P	Credit	Year of Introduction
		PCC	3	1	0	4	2019

Preamble: This is a core course in theoretical computer science. It covers automata and grammar representations for languages in Chomsky Hierarchy. For regular languages, it also covers representations using regular expression and Myhill-Nerode Relation. The topics covered in this course have applications in various domains including compiler design, decidability and complexity theory, software testing, formal modelling and verification of hardware and software.

Prerequisite: Basic knowledge about the following topic is assumed: sets, relations - equivalence relations, functions, proof by Principle of Mathematical Induction.

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

CO1	Classify a given formal language into Regular, Context-Free, Context Sensitive, Recursive or Recursively Enumerable. **[Cognitive knowledge level: Understand]**
CO2	Explain a formal representation of a given regular language as a finite state automaton, regular grammar, regular expression and Myhill-Nerode relation. [**Cognitive knowledge level: Understand**]
CO3	Design a Pushdown Automaton and a Context-Free Grammar for a given context-free language. [**Cognitive knowledge level** : **Apply**]
CO4	Design Turing machines as language acceptors or transducers. [**Cognitive knowledge level: Apply**]
CO5	Explain the notion of decidability. [**Cognitive knowledge level: Understand**]

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	⊘	⊘	⊘									⊘

CO2	⊘	⊘	⊘	⊘								⊘
CO3	⊘	⊘	⊘	⊘								⊘
CO4	⊘	⊘	⊘	⊘								⊘
CO5	⊘	⊘	⊘	⊘								⊘

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Life long learning

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test 1 (Marks)	**Test 2 (Marks)**	
Remember	**30**	**30**	**30**
Understand	**30**	**30**	**30**
Apply	**40**	**40**	**40**
Analyze			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:
Attendance : **10 marks**
Continuous Assessment - Test : **25 marks**
Continuous Assessment - Assignment : **15 marks**

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks. The first series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing the remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 2 sub-divisions and carries 14 marks.

Syllabus

CST 301 Formal Languages and Automata Theory

Module - 1 (Introduction to Formal Language Theory and Regular Languages)

Introduction to formal language theory– Alphabets, Strings, Concatenation of strings, Languages.

Regular Languages - Deterministic Finite State Automata (DFA) (Proof of correctness of construction not required), Nondeterministic Finite State Automata (NFA), Equivalence of DFA and NFA, Regular Grammar (RG), Equivalence of RGs and DFA.

Module - 2 (More on Regular Languages)

Regular Expression (RE), Equivalence of REs and DFA, Homomorphisms, Necessary conditions for regular languages, Closure Properties of Regular Languages, DFA state minimization (No proof required).

Module - 3 (Myhill-Nerode Relations and Context Free Grammars)

Myhill-Nerode Relations (MNR)- MNR for regular languages, Myhill-Nerode Theorem (MNT) (No proof required), Applications of MNT.

Context Free Grammar (CFG)- CFG representation of Context Free Languages (proof of correctness is required), derivation trees and ambiguity, Normal forms for CFGs.

Module - 4 (More on Context-Free Languages)

Nondeterministic Pushdown Automata (PDA), Deterministic Pushdown Automata (DPDA), Equivalence of PDAs and CFGs (Proof not required), Pumping Lemma for Context-Free Languages (Proof not required), Closure Properties of Context Free Languages.

Module - 5 (Context Sensitive Languages, Turing Machines)

Context Sensitive Languages **-** Context Sensitive Grammar (CSG), Linear Bounded Automata.

Turing Machines - Standard Turing Machine, Robustness of Turing Machine, Universal Turing Machine, Halting Problem, Recursive and Recursively Enumerable Languages.

Chomsky classification of formal languages.

Text Book

1. Dexter C. Kozen, Automata and Computability, Springer (1999)

Reference Materials

1. John E Hopcroft, Rajeev Motwani and Jeffrey D Ullman, Introduction to Automata Theory, Languages, and Computation, 3/e, Pearson Education, 2007
2. Michael Sipser, Introduction To Theory of Computation, Cengage Publishers, 2013.

Sample Course Level Assessment Questions

Course Outcome 1 (CO1): Identify the class of the following languages in Chomsky Hierarchy:

- $L_1 = \{a^p | p \text{ is a prime number}\}$
- $L_2 =$
$\{x\{0,1\}^* | x \text{ is the binary representation of a decimal number which is a multiple of } 5\}$
- $L_3 = \{a^n b^n c^n | n \geq 0\}$
- $L_4 = \{a^m b^n c^{m+n} | m > 0, n \geq 0\}$
- $L_5 = \{M\#x | M \text{ halts on } x\}$. Here, M is a binary encoding of a Turing Machine and x is a binary input to the Turing Machine.

Course Outcome 2 (CO2):
(i) Design a DFA for the language $L = \{axb | x \in \{a, b\}^*\}$
(ii) Write a Regular Expression for the language:$L = \{x \in \{a, b\}^* | third \ last \ symbol \ in \ x \ is \ b\}$
(iii) Write a Regular Grammar for the language:$L = \{x \in \{0,1\}^* | there \ are \ no \ consecutive \ zeros \ in x\}$
(iv) Show the equivalence classes of the canonical Myhill-Nerode relation induced by the language: $L = \{x \in \{a, b\}^* | x contains \ even \ number \ of a's \ and \ odd \ number \ of b's\}$.

Course Outcome 3 (CO3):
(i) Design a PDA for the language$L = \{ww^R | w \in \{a, b\}^*\}$. Here, the notation w^R represents the reverse of the string w.
(ii) Write a Context-Free Grammar for the language $L = \{a^n b^{2n} | n \geq 0\}$.

Course Outcome 4 (CO4):
(i) Design a Turing Machine for the language $L = \{a^n b^n c^n | n \geq 0\}$
(ii) Design a Turing Machine to compute the square of a natural number. Assume that the input is provided in unary representation.

Course Outcome 5 (CO5): Argue that it is undecidable to check whether a Turing Machine M enters a given state during the computation of a given input x.

Model Question paper

QP CODE: **PAGES:3**

Reg No:_____   **Name :_____**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: CST301

Course Name: Formal Languages and Automata Theory

Max.Marks:100   **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. Design a DFA for the language $L = \{x \in \{a, b\}^* | aba \text{ is not a substring in } x\}$.

2. Write a Regular Grammar for the language: $L = \{axb | x \in \{a, b\}^*\}$

3. Write a Regular Expression for the language:
    $L = \{x \in \{0,1\}^* | \text{there are no consecutive } 1's \text{ in } x\}$

4. Prove that the language $L_1 = \{a^{n!} | n \in N\}$ is not regular.

5. List out the applications of Myhill-Nerode Theorem.

6. Write a Context-Free Grammar for the language: $L = \{x \in \{a, b\}^* | \#_a(x) = \#_b(x)\}$. Here, the notation $\#_1(w)$ represents the number of occurrences of the symbol 1 in the string w.

7. Design a PDA for the language of odd length binary palindromes (no explanation is required, just list the transitions in the PDA).

8. Prove that Context Free Languages are closed under set union.

9. Write a Context Sensitive Grammar for the language $L = \{a^n b^n c^n | n \geq 0\}$ (no explanation is required, just write the set of productions in the grammar).

10. Differentiate between Recursive and Recursively Enumerable Languages.

(10x3=30)

Part B
(Answer any one question from each module. Each question carries 14 Marks)

11. (a) Draw the state-transition diagram showing an NFA N for the following language L. Obtain the DFA D equivalent to N by applying the subset construction algorithm. **(7)**

$$L = \{x \in \{a, b\}^* | the\ second\ last\ symbol\ in\ x\ is\ b\}$$

(b) Draw the state-transition diagram showing a DFA for recognizing the following language: **(7)**

$$L = \{x \in \{0,1\}^* | x\ is\ a\ binary\ representation\ of\ a\ natural$$

$number\ which\ is\ a$multiple of 5}

OR

12. (a) Write a Regular grammar G for the following language Ldefined as: $L = \{x \in \{a, b\}^* | x does\ not\ conatin\ consecutive b's\}$. **(7)**

(b) Obtain the DFA A_G over the alphabet set $\Sigma = \{a, b\}$, equivalent to the regular grammar G with start symbol S and productions: $S \to aA$ and $A \to aA|bA|b$. **(7)**

13. (a) Using Kleen's construction, obtain the regular expression for the language represented by the   following NFA
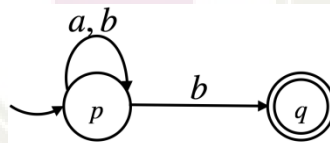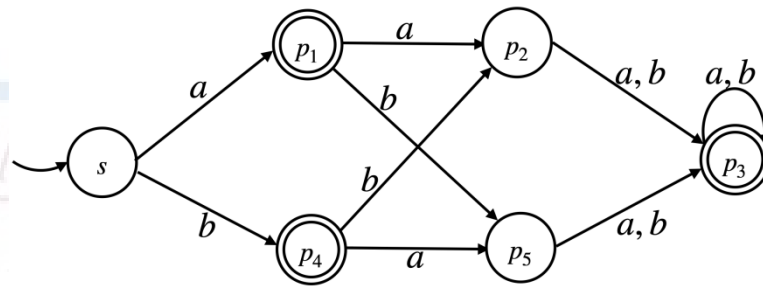

(8)

(b) Using pumping lemma for regular languages, prove that the language $L = \{a^n b^n | n \geq 0\}$ is not regular. **(7)**

OR

14. (a) <!-- figure --> Obtain the minimum-state DFA from the following DFA. **(8)**

(b) Using ultimate periodicity for regular languages, prove that the language   **(6)**
     $L = \{a^{n^2} | n \geq 0\}$ is not regular.

15. (a) Show the equivalence classes of the canonical Myhill-Nerode relation for the   **(7)**
     language of binary strings with odd number of $1's$ and even number of 0s.

(b) With an example, explain ambiguity in Context Free Grammar   **(7)**

OR

16. (a) Convert the Context-Free Grammar with productions: $\{S \rightarrow aSb|\epsilon\}$ into
     Greibach Normal form.   **(8)**

(b) Convert the Context-Free Grammar with productions: $\{S \rightarrow aSa|bSb|SS|\epsilon\}$ **(6)**
     into Chomsky Normal form.

17. (a) Design a PDA for the language $L = \{a^m b^n c^{m+n} | n \geq 0, m \geq 0\}$. Also   **(7)**
     illustrate the computation of the PDA on a string in the language

(b) With an example illustrate how a multi-state PDA can be transformed into an   **(7)**
     equivalent single-state PDA.

OR

18. (a) Using pumping lemma for context-free languages, prove that the language: **(6)**
    $L = \{ww \mid w \in \{a, b\}^*\}$ is not a context-free language.

    (b) With an example illustrate how a CFG can be converted to a single-state PDA **(8)**

19. (a) Design a Turing machine to obtain the sum of two natural numbers a and b, **(7)**
    both represented in unary on the alphabet set $\{1\}$. Assume that initially the
    tape contains $\vdash 1^a 0 1^b \, \flat^\omega$. The Turing Machine should halt with $\vdash 1^{a+b} \, \flat^\omega$
    as the tape content. Also, illustrate the computation of your Turing Machine
    on the input $a = 3$ and $b = 2$.

    (b) With an example illustrate how a CFG can be converted to a single-state **(7)**
    PDA.

OR

20. (a) Design a Turing machine to obtain the sum of two natural numbers a and b, **(7)**
    both represented in unary on the alphabet set $\{1\}$. Assume that initially the
    tape contains $\vdash 1^a 0 1^b \, \flat^\omega$. The Turing Machine should halt with $\vdash 1^{a+b} \, \flat^\omega$
    as the tape content. Also, illustrate the computation of your Turing Machine
    on the input $a = 3$ and $b = 2$.

    (b) Write a context sensitive grammar for the language $L = \{a^n b^n c^n \mid n \geq 0\}$. **(7)**
    Also illustrate how the the string $a^2 b^2 c^2$ can be derived from the start symbol
   of the proposed grammar.

Teaching Plan

Sl. No	Topic	No. of Hours (45 hrs)
Module - 1 (Introduction to Formal Language Theory and Regular Languages)		**9 Hours**
1.1	Introduction to formal language theory – Alphabets, strings, concatenation of strings, Languages	1 Hour
1.2	Deterministic Finite State Automata (DFA) – Example DFA (Proof of correctness of construction not required)	1 Hour
1.3	Formal definition of DFA, Language accepted by the class of DFA	1 Hour
1.4	Nondeterministic Finite State Automata (NFA) – Example NFA	1 Hour
1.5	Formal definition of NFA, NFA with $\square$ transitions - examples, formal definition	1 Hour
1.6	Equivalence of DFA and NFA with and without $\square$ transitions - Subset construction	1 Hour
1.7	Regular Grammar (RG) – Example RGs, derivation of sentences	1 Hour
1.8	Formal definition of RG, Language represented by a RG	1 Hour
1.9	Equivalence of RG and DFA	1 Hour
Module - 2 (More on Regular Languages)		**9 Hours**
2.1	Regular Expression (RE) - Example REs and formal definition	1 Hour
2.2	Conversion of RE to NFA with $\square$ transition	1 Hour
2.3	Conversion of NFA with $\square$ transition to RE (Kleen's construction)	1 Hour
2.4	Homomorphisms	1 Hour
2.5	Pumping Lemma for regular languages	1 Hour
2.6	Ultimate periodicity	1 Hour
2.7	Closure Properties of Regular Languages (proof not required)	1 Hour

2.8	DFA state minimization - Quotient construction	1 Hour
2.9	State Minimization Algorithm - Example	1 Hour
Module - 3 (Myhill-Nerode Relations and Context Free Grammars)		**10 Hours**
3.1	Myhill-Nerode Relations (MNR) - Example, Properties of MyhillNerode Relation	1 Hour
3.2	Conversion of DFA to MNR (Proof of correctness not required)	1 Hour
3.3	Conversion of MNR to DFA(Proof of correctness not required)	1 Hour
3.4	Myhill-Nerode Theorem (MNT)	1 Hour
3.5	Applications of MNT	1 Hour
3.6	Context Free Grammar (CFG) - Example CFGs and formal definition	1 Hour
3.7	Proving correctness of CFGs	1 Hour
3.8	Derivation Trees and ambiguity	1 Hour
3.9	Chomsky Normal Form	1 Hour
3.10	Greibach Normal Form	1 Hour
Module - 4 (More on Context-Free Languages)		**8 Hours**
4.1	Nondeterministic Pushdown Automata (PDA) – Example PDAs, formal definition	1 Hour
4.2	Acceptance criteria - equivalence	1 Hour
4.3	Deterministic PDA	1 Hour
4.4	Conversion of CFG to PDA (No proof required)	1 Hour
4.5	Conversion of PDA to CGF - Part I (No proof required)	1 Hour
4.6	Conversion of PDA to CGF - Part II (No proof required)	1 Hour
4.7	Pumping Lemma for context-free languages (No proof required)	1 Hour
4.8	Closure Properties of Context Free Languages	1 Hour

Module - 5 (Context Sensitive Languages, Turing Machines)		9 Hours
5.1	Context Sensitive Grammar (CSG) - Examples, formal definition	1 Hour
5.2	Linear Bounded Automata (LBA) - Example LBA, formal definition	1 Hour
5.3	Turing Machine (TM) - TM as language acceptors - examples, formal definition	1 Hour
5.4	TM as transducers - examples	1 Hour
5.5	Robustness of the standard TM model - Multi-tape TMs, Nondeterministic TM	1 Hour
5.6	Universal Turing Machine	1 Hour
5.7	Halting Problem of TM - proof of its undecidability	1 Hour
5.8	Recursive and Recursively Enumerable Languages	1 Hour
5.9	Chomsky classification of formal languages	1 Hour
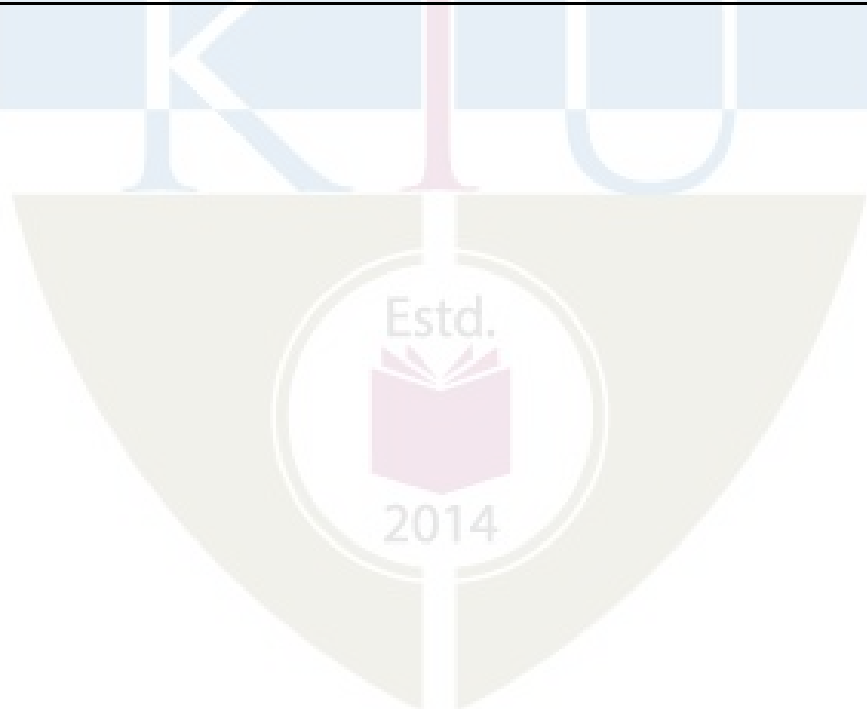
CST 303	COMPUTER NETWORKS	Category	L	T	P	Credit	Year of Introduction
		PCC	3	1	0	4	2019

Preamble: Study of this course provides the learners a clear understanding of how computer networks from local area networks to the massive and global Internet are built, how they allow computers to share information and communicate with one another. This course covers the physical aspects of computer networks, layers of OSI Reference model, and inter-networking. The course helps the learners to compare and analyze the existing network technologies and choose a suitable network design for a given system.

Prerequisite: Nil

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

CO#	Course Outcomes
CO1	Explain the features of computer networks, protocols, and network design models **(Cognitive Knowledge: Understand)**
CO2	Describe the fundamental characteristics of the physical layer and identify the usage in network communication **(Cognitive Knowledge: Apply)**
CO3	Explain the design issues of data link layer, link layer protocols, bridges and switches **(Cognitive Knowledge: Understand)**
CO4	Illustrate wired LAN protocols (IEEE 802.3) and wireless LAN protocols (IEEE 802.11) **(Cognitive Knowledge: Understand)**
CO5	Select appropriate routing algorithms, congestion control techniques, and Quality of Service requirements for a network **(Cognitive Knowledge: Apply)**
CO6	Illustrate the functions and protocols of the network layer, transport layer, and application layer in inter-networking **(Cognitive Knowledge: Understand)**

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✔	✔										✔
CO2	✔	✔	✔									✔
CO3	✔	✔	✔									✔
CO4	✔	✔	✔									✔
CO5	✔	✔	✔	✔								✔
CO6	✔	✔	✔			✔						✔

Abstract POs defined by National Board of Accreditation			
PO#	Broad PO	PO#	Broad PO
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and teamwork
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Lifelong learning

Assessment Pattern

Bloom's Category	Test 1 (Marks in percentage)	Test 2 (Marks in percentage)	End Semester Examination (Marks in percentage)
Remember	40	30	30

Understand	50	50	50
Apply	10	20	20
Analyze			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3

Continuous Internal Evaluation Pattern:

Attendance   : **10 marks**
Continuous Assessment Test   : **25 marks**
Continuous Assessment Assignment : **15 marks**

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks. The first series test shall be preferably conducted after completing the first half of the syllabus. The second series test shall be preferably conducted after completing the remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer anyone. Each question can have maximum 2 sub-divisions and carries 14 marks.

Syllabus

Module - 1 (Introduction and Physical Layer)

Introduction – Uses of computer networks, Network hardware, Network software. Reference models – The OSI reference model, The TCP/IP reference model, Comparison of OSI and TCP/IP reference models.

Physical Layer – Modes of communication, Physical topologies, Signal encoding, Repeaters and hub, Transmission media overview. Performance indicators – Bandwidth, Throughput, Latency, Queuing time, Bandwidth–Delay product.

Module - 2 (Data Link Layer)

Data link layer - Data link layer design issues, Error detection and correction, Sliding window protocols, High-Level Data Link Control(HDLC)protocol. Medium Access Control (MAC) sublayer –Channel allocation problem, Multiple access protocols, Ethernet, Wireless LANs - 802.11, Bridges & switches - Bridges from 802.x to 802.y, Repeaters, Hubs, Bridges, Switches, Routers and Gateways.

Module - 3 (Network Layer)

Network layer design issues. Routing algorithms - The Optimality Principle, Shortest path routing, Flooding, Distance Vector Routing, Link State Routing, Multicast routing, Routing for mobile hosts. Congestion control algorithms. Quality of Service (QoS) - requirements, Techniques for achieving good QoS.

Module - 4 (Network Layer in the Internet)

IP protocol, IP addresses, Internet Control Message Protocol (ICMP), Address Resolution Protocol (ARP), Reverse Address Resolution Protocol (RARP), Bootstrap Protocol (BOOTP), Dynamic Host Configuration Protocol (DHCP). Open Shortest Path First(OSPF) Protocol, Border Gateway Protocol (BGP), Internet multicasting, IPv6, ICMPv6.

Module – 5 (Transport Layer and Application Layer)

Transport service – Services provided to the upper layers, Transport service primitives. User Datagram Protocol (UDP). Transmission Control Protocol (TCP) – Overview of TCP, TCP segment header, Connection establishment &release, Connection management modeling, TCP retransmission policy, TCP congestion control.

Application Layer –File Transfer Protocol (FTP), Domain Name System (DNS), Electronic mail, Multipurpose Internet Mail Extension (MIME), Simple Network Management Protocol

(SNMP), World Wide Web(WWW) – Architectural overview.

Text Books

1. Andrew S. Tanenbaum, Computer Networks, 4/e, PHI (Prentice Hall India).
2. Behrouz A Forouzan, Data Communication and Networking, 4/e, Tata McGraw Hill

Reference Books

1. Larry L Peterson and Bruce S Dave, Computer Networks – A Systems Approach, 5/e, Morgan Kaufmann.

2. Fred Halsall, Computer Networking and the Internet, 5/e.

3. James F. Kurose, Keith W. Ross, Computer Networking: A Top-Down Approach, 6/e.

4. Keshav, An Engineering Approach to Computer Networks, Addison Wesley, 1998.

5. W. Richard Stevens. TCP/IP Illustrated Volume 1, Addison-Wesley, 2005.

6. William Stallings, Computer Networking with Internet Protocols, Prentice-Hall, 2004.

7. Request for Comments (RFC) Pages - IETF -https://www.ietf.org/rfc.html

Course Level Assessment Questions

Course Outcome1 (CO1)

    1. Compare TCP/IP and OSI reference model.
    2. The purpose of physical layer is to transport a raw bit stream from one machine to another. Justify.

Course Outcome2 (CO2)

    1. Write the physical and transmission characteristics of Optical Fibre Cable guided transmission media.
    2. The distance between the sender and receiver systems is about 200 KM. The speed of transmission is 2GB/s. Find out the propagation time?

Course Outcome3 (CO3)

    1. Ethernet frames must be at least 64 bytes long to ensure that the transmitter is still going in the event of a collision at the far end of the cable. Fast Ethernet has the same 64-byte minimum frame size but can get the bits out ten times faster. How is it possible to maintain the same minimum frame size?
   2. What do you mean by bit stuffing?

Course Outcome4 (CO4)

    1. Draw and explain the frame format for Ethernet.
    2. Give the differences between CSMA/CD and CSMA/CA protocol.

Course Outcome5 (CO5)

    1. Consider the given subnet in which distance vector routing is used, and the vectors just come in to router C as follows: from B: (5, 0, 8, 12, 6, 2); from D: (16, 12, 6, 0, 9, 10);

and from E: (7, 6, 3, 9, 0, 4). The measured delays from C to B, D, and E, are 6, 3, and 5, respectively. What is C's new routing table? Give both the outgoing line to use and the expected delay.
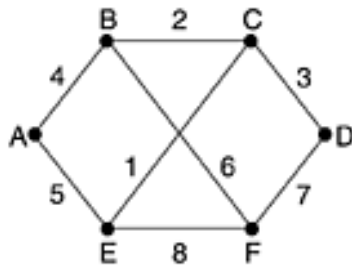
2. Illustrate the leaky bucket congestion control technique.

Course Outcome 6 (CO6)

1. How do you subnet the Class C IP Address 206.16.2.0 so as to have 30 subnets. What is the subnet mask for the maximum number of hosts? How many hosts can each subnet have?

2. Give the architecture of World Wide Web.

Model Question Paper

QP CODE: **PAGES:**

   ___

Reg No:_____

Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: CST 303

Course Name : Computer Networks

Max Marks: 100   **Duration: 3 Hours**

PART-A

(Answer All Questions. Each question carries 3 marks)

1. What does "negotiation" mean when discussing network protocols in a layered architecture? Give an example.

2. Define simplex, half-duplex, and full-duplex transmission modes. Give one example for each.

3. Data link protocols almost always put the CRC in a trailer rather than in a header. Why?

4. An 8-bit byte with binary value 10101111 is to be encoded using an even-parity Hamming code. What is the binary value after encoding?

5. Illustrate the Count to Infinity problem in routing.

6. Describe two major differences between the warning bit method and the Random Early Detection (RED) method.

7. The Protocol field used in the IPv4 header is not present in the fixed IPv6 header. Why?

8. How many octets does the smallest possible IPv6 (IP version 6) datagram contain?

9. Can Transmission Control Protocol(TCP) be used directly over a network (e. g. an Ethernet) without using IP? Justify your answer.

10. When Web pages are sent out, they are prefixed by MIME headers. Why?

(10x3=30)

Part B
(Answer any one question from each module. Each question carries 14 Marks)

11. (a) With a neat diagram, explain Open Systems Interconnection (OSI) Reference Model. **(8)**

    (b) Compare Twisted Pair, Coaxial Cable and Optical Fibre guided transmission media. **(6)**

OR

12. (a) Consider two networks providing reliable connection-oriented service. One of them offers a reliable byte stream and the other offers a reliable message stream. Are they identical? Justify your answer. **(8)**

    (b) Sketch the waveform in Manchester and Differential Manchester Encoding for the bitstream 11000110010. **(6)**

13. (a) A bit stream 10011101 is transmitted using the standard CRC method. The generator polynomial is $x^3 + 1$. Show the actual bit string transmitted. Suppose the third bit from the left is inverted during transmission. Show that this error is detected at the receiver's end.

    (8)

    (b) Explain the working of High-Level Data Link Control (HDLC) protocol.

    (6)

OR

14. (a) Explain the working of IEEE 802.11 MAC sublayer. **(10)**

    (b) Distinguish between Bridges and Switches. **(4)**

15. (a) Illustrate Distance Vector Routing algorithm with an example. **(8)**

    (b) Explain the characteristics of Routing Information Protocol (RIP). **(6)**

OR

16. (a) A computer on a 6-Mbps network is regulated by a token bucket. The token bucket is filled at a rate of 1 Mbps. It is initially filled to capacity with 8 megabits. How long can the computer transmit at the full 6 Mbps? **(8)**

    (b) Explain how routing is performed for mobile hosts. **(6)**

17. (a) Explain the address resolution problem using Address Resolution Protocol (ARP) and Reverse Address Resolution Protocol (RARP)with an example network. **(10)**

    (b) A network on the Internet has a subnet mask of 255.255.240.0. What is the maximum number of hosts it can handle? **(4)**

OR

18. (a) How do you subnet the Class C IP address 195.1.1.0 so as to have 10 subnets with a maximum of 12 hosts in each subnet. **(6)**

    (b) Draw IPv6 Datagram format and explain its features. **(8)**

19. (a) Distinguish the header formats of Transmission Control protocol (TCP) and User Datagram Protocol (UDP). **(8)**

    (b) Explain the principal Domain Name System (DNS) resource record types for **(6)**

IPv4.

OR

20. (a) What is the role of Simple Mail Transfer Protocol (SMTP) in E- mail? **(6)**

(b) With the help of a basic model, explain the working of World Wide Web (WWW). **(8)**

Teaching Plan

No	Contents	No of Lecture Hrs
Module – 1 (Introduction and Physical Layer) (10 hrs)		
1.1	Introduction, Uses of computer networks.	1 hour
1.2	Network Hardware, Local Area Networks (LAN), Metropolitan Area Networks (MAN), Wide Area Networks (WAN), Wireless networks, Home networks, Internetworks.	1 hour
1.3	Network Software, Protocol hierarchies, Design issues for the layers.	1 hour
1.4	Connection-oriented and Connectionless services, Service primitives, Relationship of services to protocols.	1 hour
1.5	Reference models, The OSI reference model.	1 hour
1.6	The TCP/IP reference model, Comparisonof OSI and TCP/IP reference models.	1 hour
1.7	Physical layer, Modes of communication, Simplex, Half-duplex, and Full-duplex, Physical topologies, Mesh, Star, Bus, Ring, Hybrid.	1 hour
1.8	Signal encoding, Manchester, Differential Manchester.	1 hour
1.9	Transmission media overview, Guided media (twisted pair, coaxial and fiber optic media), Unguided/wireless media (radio, microwave, and infrared).	1 hour
1.10	Performance indicators, Bandwidth (in Hertz and in Bits per Seconds),	1 hour

	Throughput, Latency (Delay), Queuing time, Bandwidth-Delay product.	
Module 2 – (Data Link Layer) (10 hrs)		
2.1	Data link layer design issues.	1 hour
2.2	Error detection and correction, Error correcting codes	1 hour
2.3	Error detecting codes.	1 hour
2.4	Sliding window protocols.	1 hour
2.5	High-Level Data Link Control(HDLC) protocol.	1 hour
2.6	Medium Access Control (MAC) sublayer, Channel allocation problem, Multiple access protocols.	1 hour
2.7	Ethernet, Ethernet cabling, Manchester encoding, Ethernet MAC sublayer protocol, Binary Exponential Backoff algorithm.	1 hour
2.8	Ethernet performance, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, IEEE 802.2: Logical Link Control.	1 hour
2.9	Wireless LANs, 802.11 protocol stack, Physical layer, MAC Sublayer protocol, Frame structure.	1 hour
2.10	Bridges &switches, Bridges from 802.x to 802.y, Repeaters, Hubs, Bridges, Switches, Routers, and Gateways.	1 hour
Module 3 - (Network Layer) (8 hrs)		
3.1	Network layer design issues.	1 hour
3.2	Routing algorithms, The Optimality Principle, Shortest path routing, Flooding.	1 hour
3.3	Distance Vector Routing.	1 hour
3.4	Link State Routing.	1 hour
3.5	Multicast routing, Routing for mobile hosts.	1 hour

3.6	General principles of congestion control, Congestion prevention policies, Congestion control in virtual circuit subnets.	1 hour
3.7	Congestion control algorithms, Congestion control in Datagram subnets, Load shedding, Jitter control.	1 hour
3.8	Quality of Service, Requirements, Techniques for achieving good Quality of Service.	1 hour
Module 4 – (Network Layer in the Internet) (9 hrs)		
4.1	Network layer in the Internet, Internet Protocol (IP).	1 hour
4.2	IP Addresses, Subnets, Classless Inter-Domain Routing (CIDR).	1 hour
4.3	IP Addresses, Network Address Translation (NAT).	1 hour
4.4	Internet Control Message Protocol (ICMP), Address Resolution Protocol (ARP), Reverse Address Resolution Protocol (RARP).	1 hour
4.5	Bootstrap Protocol (BOOTP), Dynamic Host Configuration Protocol (DHCP).	1 hour
4.6	Open Shortest Path First (OSPF) protocol.	1 hour
4.7	Border Gateway Protocol (BGP).	1 hour
4.8	Internet multicasting.	1 hour
4.9	IPv6, Header format, Extension headers, Internet Control Message Protocol version 6 (ICMPv6).	1 hour
Module 5 - (Transport Layer and Application Layer) (8 hrs)		
5.1	Transport Service, Services provided to the upper layers, Transport service primitives. User Datagram Protocol (UDP).	1 hour
5.2	Transmission Control Protocol (TCP), TCP segment header, Connection establishment &release, Connection management modeling.	1 hour
5.3	TCP retransmission policy, TCP congestion control.	1 hour
5.4	Application layer, File Transfer Protocol (FTP).	1 hour

5.5	Domain Name System (DNS).	1 hour
5.6	Electronic Mail, Multipurpose Internet Mail Extension (MIME).	1 hour
5.7	Simple Network Management Protocol (SNMP).	1 hour
5.8	World Wide Web, Architectural overview.	1 hour
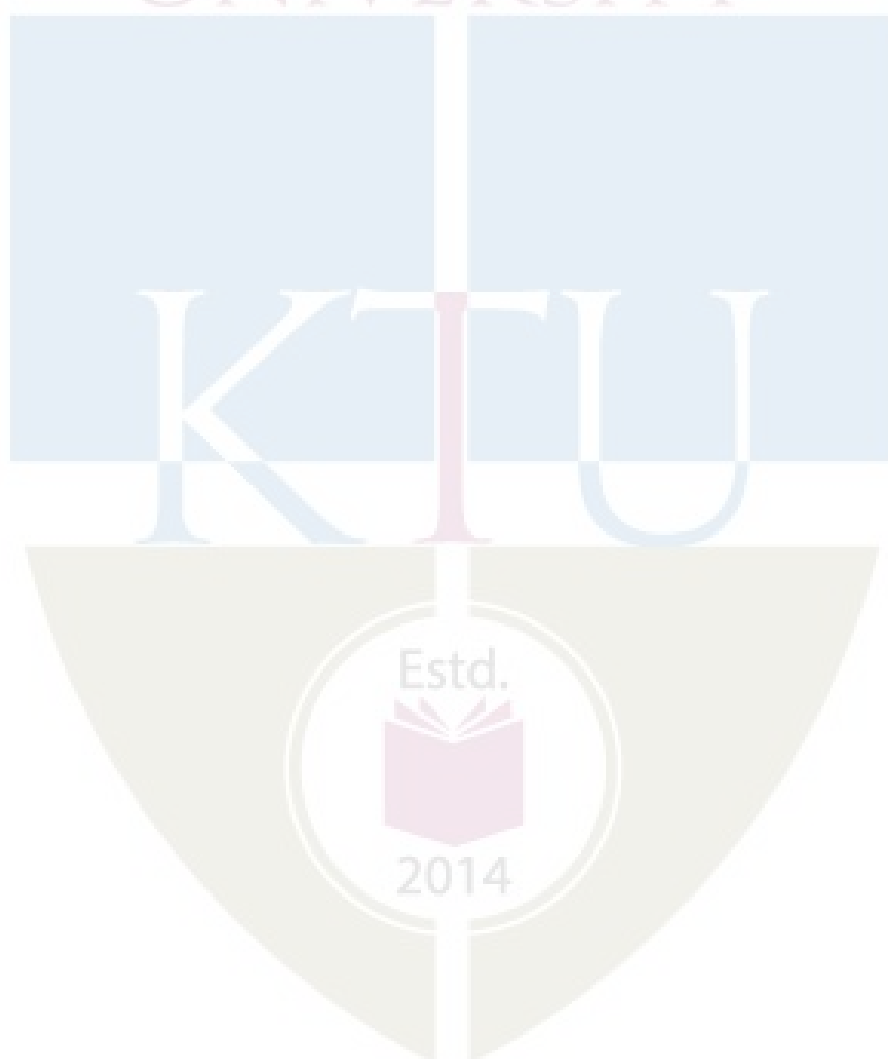
CDT305	DATA ANALYTICS	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	3	1	0	4	2020

Preamble: This course helps the learner to understand the basic concepts of data analytics. This course covers mathematics for data analytics, predictive and descriptive analytics of data, classification, and clustering & text analytics. It enables the learners to perform data analysis on a real world scenario using appropriate tools.

Prerequisite: Database, Programming Languages

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

CO 1	Explain the key concepts of data analytics (Cognitive Knowledge Level: Understand)
CO 2	Apply appropriate techniques to convert raw data into suitable format for practical data analytics tasks (Cognitive Knowledge Level: Apply)
CO 3	Extend the concept of association rule mining in real world scenario (Cognitive Knowledge Level: Understand)
CO 4	Select appropriate clustering and classification algorithms for various applications and extend data analytics methods to the new domains of data (Cognitive Knowledge Level: Apply)
CO 5	Understand the basics of text analytics and text classification (Cognitive Knowledge Level: Understand)

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	⊘	⊘										⊘
CO2	⊘	⊘										⊘
CO3	⊘	⊘	⊘									⊘
CO4	⊘	⊘	⊘									⊘

CO5	✓	✓								✓	

Abstract POs defined by National Board of Accreditation				
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	**PO7**	Environment and Sustainability
PO2	Problem Analysis	**PO8**	Ethics
PO3	Design/Development of solutions	**PO9**	Individual and team work
PO4	Conduct investigations of complex problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Lifelong learning

Assessment Pattern

	Continuous Assessment Tests		End Semester Examination Marks
Bloom's Category	**Test1 (percentage)**	**Test2 (percentage)**	
Remember	40	40	40
Understand	40	40	40
Apply	20	20	20
Analyze			
Evaluate			
Create			

Mark distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance: 10 marks

Continuous Assessment Tests   : 25 marks

Continuous Assessment Assignment: 15 marks

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks

First Internal Examination shall be preferably conducted after completing the first half of the syllabus and the Second Internal Examination shall be preferably conducted after completing remaining part of the syllabus.

There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly covered module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly covered module), each with 7 marks. Out of the 7 questions in Part B, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have a maximum of 2 subdivisions and carries 14 marks.

SYLLABUS

Module- 1(Introduction to Data Analytics)

Introduction to Data Analytics – Analytics Process Model, Analytical Model Requirements. Data Analytics Life Cycle overview, Association of two variables - Discrete variables, Ordinal and Continuous variable, Probability calculus - probability distributions , Hypothesis Testing - Basic definitions.
Proximity measures -Data Objects, Attribute types, Dissimilarity and Similarity measures.

Module- 2 (Data Preprocessing)

Statistical description of data- Central tendency, dispersion, Range, Quartiles, Variance, Standard Deviation, and Interquartile Range, graphic displays.

Data Preprocessing – Cleaning, Integration, Reduction, Transformation, Discretization.

Module -3 (Mining Frequent Patterns)

Mining Frequent Patterns-Associations and Correlations, Apriori, FP-growth, Pattern Evaluation Method. Advanced Pattern Mining - Rare patterns, Meta rule guided mining of Association Rules.

Module- 4 (Classification and Clustering)

Classification - General Approach to classification, Decision tree induction, Attribute selection measures, Naive Bayes Classification. Clustering-K-Means, Agglomerative, Divisive, BIRCH, DBSCAN.

Module- 5 (Text Processing)

Text Processing - Boolean retrieval, Example IR problem, inverted index, processing Boolean queries, tokenization, stemming, phrase queries, vector space model, finite automata and language model, query likelihood model, naïve bayes text classification.

Text Books:
1. Christian Heumann and Michael Schomaker, "Introduction to Statistics and DataAnalysis", Springer, 2016
2. Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, Third Edition, Elsevier, 2012.

Reference Books:
1. Christopher D Manning, Raghavan, P., and Schutze, H.. Introduction to Information Retrieval. Cambridge University Press
2. Mining Text Data. Charu C. Aggarwal and ChengXiang Zhai, Springer, 2012.
3. Bart Baesens," Analytics in a Big Data World: The Essential Guide to Data Science and its Business Intelligence and Analytic Trends" John Wiley & Sons, 2013.
4. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, " Introduction To Data Mining",Person Education, 2007.

Sample Course Level Assessment Questions

Course Outcome 1 (CO1): Given two objects represented by the tuples (22, 1, 42, 10) and (20, 0, 36, 8), compute the dissimilarity between the tuples.

Course Outcome 2 (CO2): Suppose that the data for analysis includes the attributes age. The age values for the data tuples are 13, 15, 16, 16, 19, 20, 20, 21, 22, 22, 25, 25, 25, 25, 30, 33, 33, 35, 35, 35, 35, 36, 40, 45, 46, 52, 70. Construct the five-number summary for the dataset.

Course Outcome 3(CO3): Find the frequent item sets in the database using *apriori* algorithm.

Course Outcome 4 (CO4): What are decision trees? Explain how decision trees are useful in data mining.

Course Outcome 5 (CO5): Explain Boolean Retrieval with an example.

Model Question Paper

QP CODE:

Reg No: _____

Name: _____   **PAGES : 4**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: **CDT 305**

Course Name: Data Analytics

Max.Marks:100   **Duration: 3 Hours**

PART A

Answer All Questions. Each Question Carries 3 Marks

1. Define Data analytics. What are the different types of attributes?

2. Compare any three probability distributions.

3. What is dimensionality reduction?

4. Explain the methods to determine correlation.

5. Draw and explain the conditional FP-tree.

6. Explain join and prune step in *Apriori* algorithm..

7. State and explain Bayes Theorem.

8. What is Clustering? Explain the taxonomy of Clustering methods.

9. Explain Naïve Bayes Text Classification.

10. Explain about Inverted Index

(10x3=30)

Part B
(Answer any one question from each module. Each question carries 14 Marks)

11. (a) Explain with a neat diagram the steps involved in the process of the Knowledge Discovery from data. **(10)**

(b) Discuss the different OLAP operations. **(4)**

OR

12. (a) Discuss any five implementation issues associated with data mining. **(6)**

(b) Given two objects represented by the tuples (22, 1, 42, 10) and (20,0,36,8) ,compute dissimilarity between the tuples. **(8)**

13. (a) Analyze the methods of normalization with an example. **(6)**

(b) Explain the methods used to handle noisy data. Given the values for attribute age as 13,15,16,16,19,20,20,21,22,22, 35, 35
i) Illustrate smoothing by bin means and bin boundaries.
ii) Determine the outlier in the above database **(8)**

OR

14. (a) Suppose that the data for analysis includes the attributes age. The age values for the data tuples are 13, 15, 16, 16, 19, 20, 20, 21, 22, 22, 25, 25, 25, 25, 30, 33, 33, 35,35, 35, 35, 36, 40, 45, 46, 52, 70. Construct the five-number summary for the dataset. **(8)**

(b) Explain Data Transformation in detail   . **(6)**

15. (a) Consider a database having 10 transactions and min_sup 2 **(10)**

   a) Find the frequent itemsets in the database using Apriori algorithm.

TID	ITEMS BOUGHT
T1	{jam, biscuit, milk}
T2	{chocolate, butter, jam}
T3	{jam, milk, juice}
T4	{chocolate, butter, juice}
T5	{biscuit, juice, milk}
T6	{jam, milk, chocolate, butter}
T7	{chocolate, butter, milk}
T8	{biscuit, milk}
T9	{jam, milk, chocolate, butter}
T10	{biscuit, juice}

(b)   b) List the disadvantages of Apriori algorithm. Briefly explain a solution for the limitation of Apriori technique. **(4)**

OR

16. (a) How are support and confidence measures used in generating association rules. **(4)**

(b) Find all frequent itemsets using FP-growth. Let min sup=60% and min conf=80%. Compare the efficiency with Apriori algorithms. **(10)**

TID	ITEMS BOUGHT
T100	{ M, O, N, K, E, Y }
T200	{ D, O, N, K, E, Y }
T300	{ M, A, K, E }
T400	{ M, U, C, K, Y }
T500	{ C, O, O, K, I, E }

17. a What are decision trees? Explain how decision trees are useful in data mining. **(4)**

   b The training data for a classifier is given below. Using a Bayesian Classifier to classify the tuple (Red, SUV, Domestic) as stolen or not stolen. **(10)**

No	Color	Type	Origin	Stolen
1	Red	Sports	Domestic	Yes
2	Red	Sports	Domestic	No
3	Red	Sports	Domestic	Yes

4	Yellow	Sports	Domestic	No
5	Yellow	Sports	Imported	Yes
6	Yellow	SUV	Imported	No
7	Yellow	SUV	Imported	Yes
8	Yellow	SUV	Domestic	No
9	Red	SUV	Imported	No
10	Red	Sports	Imported	Yes

(8

18. (a) Explain about Attribute Subset Selection Measures with an example. **(7)**

    (b) Describe each of the following
    i) BIRCH
    ii) DBSCAN

    (7)

19. (a) Differentiate tokenization and stemming with an example. **(7)**

    (b) Describe language models for IR.
    i) Finite automata and language model
    ii) Query likelihood model

    (7)

OR

20. (a) Explain Boolean Retrieval with an example. **(7)**

21. (b) Describe the vector space model . **(7)**

Teaching Plan

CDT305 Data Analytics	45 Hours
Module- 1(Introduction to Data Analytics)	**(10 hours)**
1.1 Introduction to Data Analytics – Analytics Process Model,	1 hour
1.2 Analytical Model Requirements	1 hour
1.3 Data Analytics Life Cycle	1 hour
1.4 Association of two variables	1 hour

1.5	Probability distributions	1 hour
1.6	Probability distributions	1 hour
1.7	Hypothesis Testing	1 hour
1.8	Basic definitions.	1 hour
1.9	Data Objects ,Attribute types	1 hour
1.10	Dissimilarity and Similarity measures	1 hour
Module- 2 (Data Preprocessing)		**(10 hours)**
2.1	**Central tendency**	1 hour
2.2	**Dispersion, Range**	1 hour
2.3	Quartiles, Variance	1 hour
2.4	Standard Deviation, Interquartile Range	1 hour
2.5	**Graphic displays**	1 hour
2.6	Cleaning	1 hour
2.7	Integration	1 hour
2.8	Reduction	1 hour
2.9	**Transformation**	1 hour
2.10	**Discretization**	1 hour
Module -3 (Mining Frequent Patterns)		**(7 hours)**
3.1	**Mining Frequent Patterns**	1 hour
3.2	Associations and Correlations	1 hour
3.3	Apriori algorithm	1 hour
3.4	FP-growth algorithm	1 hour
3.5	**Multi Dimensional Space**	1 hour
3.6	**Rare patterns**	1 hour
3.7	**Meta rule guided mining of association rules**	1 hour
Module- 4 (Classification and Clustering)		**(9 hours)**
4.1	General Approach to classification	1 hour
4.2	Decision tree induction	1 hour
4.3	Attribute selection measures	1 hour

4.4	Naive Bayes Classification	1 hour
4.5	K-Means	1 hour
4.6	Agglomerative Approach for clustering	1 hour
4.7	Divisive Approach	1 hour
4.8	Hierarchical - BIRCH Algorithm	1 hour
4.9	Density Based - DBSCAN Algorithm	1 hour
Module- 5 (Text Processing)		**(9 hours)**
5.1	Boolean Retrieval	1 hour
5.2	Example IR Problem	1 hour
5.3	Inverted Index	1 hour
5.4	Processing Boolean Queries, Tokenization	1 hour
5.5	Stemming, Phrase Queries	1 hour
5.6	Vector Space Model	1 hour
5.7	Finite Automata And Language Model	1 hour
5.8	Query Likelihood Model	1 hour
5.9	Naïve Bayes Text Classification	1 hour

CDT307	BIG DATA PROCESSING	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	3	1	0	4	2020

Preamble: The purpose of the syllabus is to get an overview of storage, retrieval and processing of big data. This course aims at providing a foundation in various tools and techniques employed to handle Big Data, and cover the various technologies of Big Data such as Map Reduce, Hadoop, Hbase, Pig, Hive and Spark. As data continues to grow it is known that via big data solutions, organizations generate insights and make well-informed decisions, discover trends, and improve productivity.

Prerequisite: Database, Programming Languages

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

CO 1	Understand big data and trivial data and build and maintain reliable, scalable, distributed systems (Cognitive Knowledge Level: Understand)
CO 2	Infer knowledge about the distributed storage and processing of large datasets and extend the effective data storage mechanisms using HDFS and HBase (Cognitive Knowledge Level: Understand)
CO 3	Model the distributed processing of large data sets across clusters using simple programming models (Cognitive Knowledge Level: Apply)
CO 4	Identify the basics of stream computing and build applications using Hive (Cognitive Knowledge Level: Apply)
CO 5	Build applications using Pig and spark (Cognitive Knowledge Level: Apply)

Mapping of course outcomes with program outcomes

	PO 1	PO 2	PO 3	PO 4	PO 5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1	✓											✓
CO2	✓	✓	✓									✓
CO3	✓	✓	✓									✓
CO4	✓	✓	✓									✓

CO5	✓	✓										✓

Abstract POs defined by National Board of Accreditation			
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	**PO7**	Environment and Sustainability
PO2	Problem Analysis	**PO8**	Ethics
PO3	Design/Development of solutions	**PO9**	Individual and team work
PO4	Conduct investigations of complex problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Lifelong learning

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test1 (percentage)	Test2 (percentage)	
Remember	40	40	40
Understand	40	40	40
Apply	20	20	20
Analyze			
Evaluate			
Create			

Mark distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance: 10 marks
Continuous Assessment Tests   : 25 marks
Continuous Assessment Assignment: 15 marks

Internal Examination Pattern:
Each of the two internal examinations has to be conducted out of 50 marks

First Internal Examination shall be preferably conducted after completing the first half of the syllabus and the Second Internal Examination shall be preferably conducted after completing the remaining part of the syllabus.

There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly covered module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly covered module), each with 7 marks. Out of the 7 questions in Part B, a student should answer any 5.

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have a maximum of 2 subdivisions and carries 14 marks.

SYLLABUS

Module 1(Introduction to Big data and R)

Introduction to Big data -Evolution of Big data, Big data characteristics, RDBMS and Big Data, History of Hadoop, Hadoop Ecosystem, Core Components.

Introduction to R – Features of R Language, Vectors, Filtering, Creating Matrices , Applying Functions to Matrix Rows and Columns, Lists , Creating List , General List Operations, Data Frames , Creating Data Frames , Matrix like Operations in Frames , Applying Functions to Data Frames ,Reading and Writing Files.

Module 2 (Hadoop Distributed File System)

HDFS- Architecture, Using HDFS Files, HDFS Design, Blocks, Namenodes and Data nodes, Basic File system Operations, Hadoop Specific File Types, Anatomy of a file

Module 3 (MapReduce Programming)

Data Processing with MapReduce: Execution Pipeline, Runtime Coordination and Task Management in MapReduce, Designing MapReduce implementations: Using MapReduce as a framework for parallel processing, Face Recognition Example - Simple Data Processing with MapReduce, Inverted Indexes Example, Road Enrichment Example.

Module 4 (Stream Data Model and Hive)

Introduction to Stream - Concepts, Stream Data Model and Architecture, Sampling Data in a Stream, Filtering Streams, Counting Distinct Elements in a Stream. Hive - Features, Data types and file formats, primitive and collection data types, HiveQL, Creating tables, Dropping Tables, Alter table.

Module 5 (Pig and Spark)

Pig -Installing and Execution, Data Model, Pig Latin: Structure , Functions.

Spark- History of spark, Storage layers for spark, Core spark concepts, RDD basics, RDD Operations.

Text Book

1. Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich ,Professional Hadoop Solutions
2. Tom White ,Hadoop: The Definitive Guide, O'Reilly Media 3rd Edition

Reference Books

1. Jure Leskovec, Anand Rajaraman and Jeffrey David Ullman, "Mining of Massive Datasets", Cambridge University Press, 2014
2. BIG DATA, Black Book TM, DreamTech Press, 2016 Edition
3. Seema Acharya, Subhasni Chellappan, "Big Data And Analytics", Wiley Publications
4. Holden Karau, Andy Konwinski, Patrick Wendell, Matei Zaharia, Learning Spark, O'Reilly
5. Nathan Marz and James Warren, "BIG DATA- Principles and Best Practices of Scalable Real-time Systems"
6. Jason Rutherglen, Dean Wampler, Edward Capriolo, Programming Hive, O'Reilly
7. Norman Matloff , "The Art of R Programming: A Tour of Statistical Software Design", NoStarch Press
8. Jared P. Lander, "R for Everyone: Advanced Analytics and Graphics", Addison-Wesley Data & Analytics Series

Sample Course Level Assessment Questions

Course Outcome 1 (CO1): With the help of a neat diagram, explain the core components of Hadoop Ecosystem.

Course Outcome 2 (CO2): Discuss on the general guidelines for HBase Schema Design.

Course Outcome 3(CO3): Given a links graph and terrain model, convert two dimensional (x,y) links into three-dimensional (x, y, z) links. Implement the following problem by using Map Reduce.

Course Outcome 4 (CO4): Discuss on how to count distinct elements in a Stream.

Course Outcome 5 (CO5): Draw the Spark architecture and explain the role of different components.

Model Question Paper

QP CODE:

Reg No: _____

Name: _____   **PAGES : 2**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: *:* **CDT307**

Course Name: Big Data Processing

Max. Marks : 100   **Duration: 3 Hours**

PART A

Answer All Questions. Each Question Carries 3 Marks

1. How are big data and hadoop related to each other?

2. Discuss the general list operations in R with example.

3. Write a brief note on features and column families of HBase.

4. Compare the specific file types of HDFS.

5. How does Map Reduce Framework provide support for application development?

6. Describe the Map Reduce job implementation in the case of Face Recognition example.

7. Briefly explain about Filtering Streams.

8. Make a note on partitioned and managed tables in Hive.

9. Identify the ways in which a pig program can be executed.

10. List the ways in which Spark RDD can be created. **(10x3=30)**

Part B

(Answer any one question from each module. Each question carries 14 Marks)

11. (a) With a neat diagram explain the core components of Hadoop Ecosystem **(12)**

    (b) List the newer capabilities and components beyond core components in Hadoop Ecosystem. **(2)**

OR

12. (a) Explain in detail about the Matrix handling in R. **(10)**

    (b) Write a short note about how the different types of files can be read and written using R. **(4)**

13. (a) Explain the HDFS Architecture with a neat diagram. **(8)**

    (b) In addition to ordinary files, HDFS also introduces specialized file types to provide much richer functionalities. Explain in detail about the Hadoop specific File Types. **(6)**

14. (a) Explain the data model and architecture of HBase. **(10)**

(b) Discuss on the general guidelines for HBase Schema Design. **(4)**

15. (a) Discuss in detail about the Road Enrichment **(8)**

(b) How can MapReduce be used to solve linear equations? **(6)**

OR

16. (a) Given a links graph and terrain model, convert two dimensional (x,y) links into three-dimensional (x, y, z) links. Implement the following problem using Map Reduce. **(9)**

(b) Explain the common Map Reduce Design Gotchas. **(5)**

17. (a) Explain in detail the Stream Data Model and its architecture. **(9)**

(b) Write the syntax to create a table and partition in Hive. **(5)**

OR

18. (a) Describe about Data Types and File Formats in Hive. **(10)**

(b) Discuss on how to count distinct elements in a Stream. **(4)**

19. (a) Write about Pig Latin Structure and functions **(10)**

(b) Discuss the Storage layers for Spark. **(4)**

OR

20. (a) Compare in detail about the datatypes used in Pig. **(6)**

(b) Draw the Spark architecture and explain the role of different components . **(8)**

Teaching Plan

CDT 307 Big Data Processing		45 hours
Module -1 (Introduction to Big data and R)		**(10 hours)**
1.1	Evolution of Big data, Big data characteristics	1 hour
1.2	RDBMS and Big Data, Issues with Relational Model	1 hour
1.3	History of Hadoop	1 hour
1.4	Hadoop Ecosystem and Core Components	1 hour
1.5	Features of R Language, Vectors	1 hour
1.6	Filtering and Creating Matrices	1 hour
1.7	Applying Functions to Matrix Rows and Columns	1 hour
1.8	Creating List and General List Operations	1 hour
1.9	Creating Data Frames and Matrix like Operations in Frames	1 hour
1.10	Applying Functions to Data Frames and Reading and Writing Files	1 hour
Module- 2 (HDFS)		**(9 hours)**
2.1	**HDFS Architecture**	1 hour
2.2	**UsingHDFS Files ,HDFS Design**	1 hour
2.3	Blocks, Namenodes and Data nodes	1 hour
2.4	Basic File system Operations	1 hour
2.5	**Hadoop Specific File Types**	1 hour
2.6	Anatomy of a file read	1 hour
2.7	Anatomy of a file write	1 hour
2.8	HBase Architecture	1 hour
2.9	HBase Schema Design	1 hour
Module -3 (MapReduce Programming)		**(9 hours)**

3.1	**Execution pipeline**	1 hour
3.2	Runtime Coordination and Task Management in MapReduce	1 hour
3.3	Using MapReduce as a framework for parallel processing	1 hour
3.4	Face Recognition	1 hour
3.5	**Simple Data Processing with MapReduce**	1 hour
3.6	**MapReduce programs**	1 hour
3.7	**Inverted Indexes Example**	1 hour
3.8	**Building joins with MapReduce**	1 hour
3.9	**Road Enrichment Example**	1 hour
Module- 4 (Stream Data Model and Hive)		**(9 hours)**
4.1	Introduction to Stream Concepts	1 hour
4.2	Stream Data Model and Architecture	1 hour
4.3	Sampling Data in a Stream	1 hour
4.4	Filtering Streams	1 hour
4.5	Counting Distinct Elements in a Stream	1 hour
4.6	Features	1 hour
4.7	Data types and file formats	1 hour
4.8	primitive and collection data types	1 hour
4.9	HiveQL, Creating tables ,Dropping Tables, Alter table	1 hour
Module- 5 (Pig and Spark)		**(8 hours)**
5.1	Pig -Installing and Execution	1 hour
5.2	Data Model	1 hour
5.3	Pig Latin: Structure	1 hour
5.4	Functions	1 hour
5.5	History of spark, Storage layers for spark	1 hour
5.6	Core spark concepts	1 hour
5.7	RDD basics	1 hour
5.8	RDD Operations	1 hour

CST 309	MANAGEMENT OF SOFTWARE SYSTEMS	Category	L	T	P	Credit	Year of Introduction
		PCC	3	0	0	3	2019

Preamble: This course provides fundamental knowledge in the Software Development Process. It covers Software Development, Quality Assurance, Project Management concepts and technology trends. This course enables the learners to apply state of the art industry practices in Software development.

Prerequisite: Basic understanding of Object Oriented Design and Development.

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

CO1	Demonstrate Traditional and Agile Software Development approaches **(Cognitive Knowledge Level: Apply)**
CO2	Prepare Software Requirement Specification and Software Design for a given problem. **(Cognitive Knowledge Level**: **Apply**)
CO3	Justify the significance of design patterns and licensing terms in software development, prepare testing, maintenance and DevOps strategies for a project. **(Cognitive Knowledge Level: Apply**)
CO4	Make use of software project management concepts while planning, estimation, scheduling, tracking and change management of a project, with a traditional/agile framework**. (Cognitive Knowledge Level: Apply**)
CO5	Utilize SQA practices, Process Improvement techniques and Technology advancements in cloud based software models and containers & microservices. **(Cognitive Knowledge Level: Apply**)

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✔	✔	✔	✔		✔						✔
CO2	✔	✔	✔	✔		✔				✔	✔	✔
CO3	✔	✔	✔	✔				✔		✔	✔	✔
CO4	✔	✔	✔	✔		✔			✔	✔	✔	✔
CO5	✔	✔	✔	✔		✔						✔

	Abstract POs defined by National Board of Accreditation		
PO#	**Broad PO**	**PO#**	**Broad PO**
PO1	Engineering Knowledge	**PO7**	Environment and Sustainability
PO2	Problem Analysis	**PO8**	Ethics
PO3	Design/Development of solutions	**PO9**	Individual and team work
PO4	Conduct investigations of complex problems	**PO10**	Communication
PO5	Modern tool usage	**PO11**	Project Management and Finance
PO6	The Engineer and Society	**PO12**	Lifelong learning

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test1 (Percentage)	Test2 (Percentage)	
Remember	30	30	30
Understand	40	40	50
Apply	30	30	20
Analyse			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance   : **10 marks**

Continuous Assessment Tests   : **25 marks**

Continuous Assessment Assignment   : **15 marks** (Each student shall identify a software development problem and prepare Requirements Specification, Design Document, Project Plan and Test case documents for the identified problem as the assignment.)

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks.

First Internal Examination shall be preferably conducted after completing the first half of the syllabus and the Second Internal Examination shall be preferably conducted after completing the remaining part of the syllabus.

There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly covered module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A. Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly covered module), each with 7 marks. Out of the 7 questions in Part B, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have a maximum of 2 subdivisions and carries 14 marks.

Syllabus

Module 1 : Introduction to Software Engineering (7 hours)

Introduction to Software Engineering - Professional software development, Software engineering ethics. Software process models - The waterfall model, Incremental development. Process activities - Software specification, Software design and implementation, Software validation, Software evolution. Coping with change - Prototyping, Incremental delivery, Boehm's Spiral Model. Agile software development - Agile methods, agile manifesto - values and principles. Agile development techniques, Agile Project Management. Case studies : An insulin pump control system. Mentcare - a patient information system for mental health care.

Module 2 : Requirement Analysis and Design (8 hours)

Functional and non-functional requirements, Requirements engineering processes. Requirements elicitation, Requirements validation, Requirements change, Traceability Matrix. Developing use cases, Software Requirements Specification Template, Personas, Scenarios, User stories, Feature identification. Design concepts - Design within the context of software engineering, Design Process, Design concepts, Design Model. Architectural Design - Software Architecture, Architectural Styles, Architectural considerations, Architectural Design Component level design - What is a component?, Designing Class-Based Components, Conducting Component level design, Component level design for web-apps. Template of a Design Document as per "IEEE Std 1016-2009 IEEE Standard for Information Technology Systems Design Software Design Descriptions". Case study: The Ariane 5 launcher failure.

Module 3 : Implementation and Testing (9 hours)

Object-oriented design using the UML, Design patterns, Implementation issues, Open-source development - Open-source licensing - GPL, LGPL, BSD. Review Techniques - Cost impact of Software Defects, Code review and statistical analysis. Informal Review, Formal Technical Reviews, Post-mortem evaluations. Software testing strategies - Unit Testing, Integration Testing, Validation testing, System testing, Debugging, White box testing, Path testing, Control Structure testing, Black box testing, Testing Documentation and Help facilities. Test automation, Test-driven development, Security testing. Overview of DevOps and Code Management - Code management, DevOps automation, Continuous Integration, Delivery, and Deployment (CI/CD/CD). Software Evolution - Evolution processes, Software maintenance.

Module 4 : Software Project Management (6 hours)

Software Project Management - Risk management, Managing people, Teamwork. Project Planning, Software pricing, Plan-driven development, Project scheduling, Agile planning. Estimation techniques, COCOMO cost modeling. Configuration management, Version management, System building, Change management, Release management, Agile software management - SCRUM framework. Kanban methodology and lean approaches.

Module 5 : Software Quality, Process Improvement and Technology trends (6 hours)

Software Quality, Software Quality Dilemma, Achieving Software Quality Elements of Software Quality Assurance, SQA Tasks , Software measurement and metrics. Software Process Improvement(SPI), SPI Process CMMI process improvement framework, ISO 9001:2000 for Software. Cloud-based Software - Virtualisation and containers, Everything as a service(IaaS, PaaS), Software as a service. Microservices Architecture - Microservices, Microservices architecture, Microservice deployment.

Text Books

1. Book 1 - Ian Sommerville, Software Engineering, Pearson Education, Tenth edition, 2015.
2. Book 2 - Roger S. Pressman, Software Engineering : A practitioner's approach, McGraw Hill publication, Eighth edition, 2014
3. Book 3 - Ian Sommerville, Engineering Software Products: An Introduction to Modern Software Engineering, Pearson Education, First Edition, 2020.

References

1. IEEE Std 830-1998 - IEEE Recommended Practice for Software Requirements Speciﬁcations
2. IEEE Std 1016-2009 IEEE Standard for Information Technology—Systems Design— Software Design Descriptions

3. David J. Anderson, Kanban, Blue Hole Press 2010
4. David J. Anderson, Agile Management for Software Engineering, Pearson, 2003
5. Walker Royce, Software Project Management : A unified framework, Pearson Education, 1998
6. Steve. Denning, The age of agile, how smart companies are transforming the way work gets done. New York, Amacom, 2018.
7. Satya Nadella, Hit Refresh: The Quest to Rediscover Microsoft's Soul and Imagine a Better Future for Everyone, Harper Business, 2017
8. Henrico Dolfing, Project Failure Case Studies: Lessons learned from other people's mistakes, Kindle edition
9. Mary Poppendieck, Implementing Lean Software Development: From Concept to Cash, Addison-Wesley Signature Series, 2006
10. StarUML documentation - https://docs.staruml.io/
11. OpenProject documentation - https://docs.openproject.org/
12. BugZilla documentation - https://www.bugzilla.org/docs/
13. GitHub documentation - https://guides.github.com/
14. Jira documentation - https://www.atlassian.com/software/jira

Course Level Assessment Questions

Course Outcome 1 (CO1):
1. What are the advantages of an incremental development model over a waterfall model?
2. Illustrate how the process differs in agile software development and traditional software development with a socially relevant case study. (Assignment question)

Course Outcome 2 (CO2):
1. How to prepare a software requirement specification?
2. Differentiate between Architectural design and Component level design.
3. How does agile approaches help software developers to capture and define the user requirements effectively?
4. What is the relevance of the SRS specification in software development?
5. Prepare a use case diagram for a library management system.

Course Outcome 3 (CO3):
1. Differentiate between the different types of software testing strategies.
2. Justify the need for DevOps practices?
3. How do design patterns help software architects communicate the design of a complex system effectively?

4. What are the proactive approaches one can take to optimise efforts in the testing phase?

Course Outcome 4 (CO4):

1. Illustrate the activities involved in software project management for a socially relevant problem?
2. How do SCRUM, Kanban and Lean methodologies help software project management?
3. Is rolling level planning in software project management beneficial? Justify your answer.
4. How would you assess the risks in your software development project? Explain how you can manage identified risks?

Course Outcome 5 (CO5):

1. Justify the importance of Software Process improvement?
2. Explain the benefits of cloud based software development, containers and microservices.
3. Give the role of retrospectives in improving the software development process.
4. Illustrate the use of project history data as a prediction tool to plan future socially relevant projects.
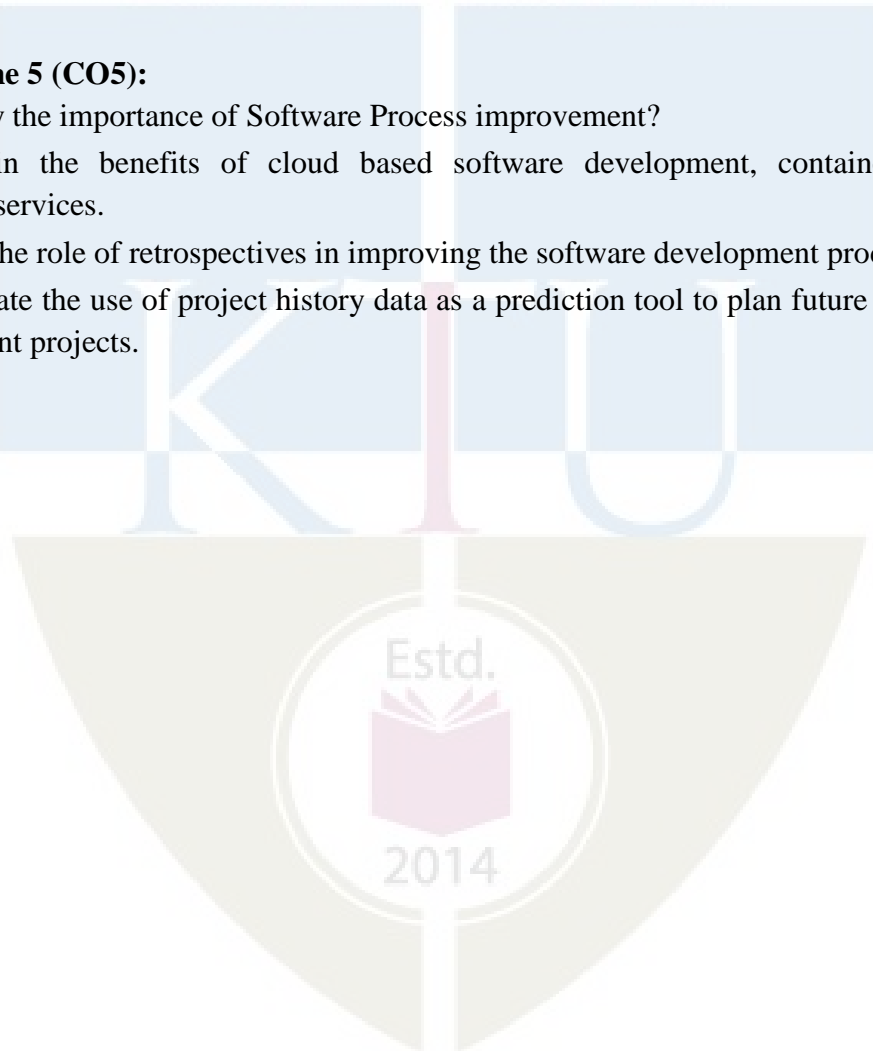
Model Question Paper

QP CODE:
Reg No:_____
Name :_____   **PAGES : 3**
APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIFTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR
Course Code: CST 309
Course Name: Management of Software Systems

Duration: 3 Hrs   **Max. Marks :100**

PART A
Answer all Questions. Each question carries 3 marks

1. Why professional software that is developed for a customer is not simply the programs that have been developed and delivered.

2. Incremental software development could be very effectively used for customers who do not have a clear idea about the systems needed for their operations. Justify.

3. Identify any four types of requirements that may be defined for a software system

4. Describe software architecture

5. Differentiate between GPL and LGPL?

6. Compare white box testing and black box testing.

7. Specify the importance of risk management in software project management?

8. Describe COCOMO cost estimation model.

9. Discuss the software quality dilemma

10. List the levels of the CMMI model?   **(10x3=30)**

Part B
(Answer any one question from each module. Each question carries 14 Marks)

11. (a) Compare waterfall model and spiral model

                                                                 (8)

(b) Explain Agile ceremonies and Agile manifesto

(6)

12. (a) Illustrate software process activities with an example.

(8)

(b) Explain Agile Development techniques and Agile Project Management **(6)**

13. (a) What are functional and nonfunctional requirements? Imagine that you are developing a library management software for your college, list eight functional requirements and four nonfunctional requirements. **(10)**

(b) List the components of a software requirement specification?

(4)

OR

14. (a) Explain Personas, Scenarios, User stories and Feature identification? **(8)**

(b) Compare Software Architecture design and Component level design **(6)**

15. (a) Explain software testing strategies. **(8)**

(b) Describe the formal and informal review techniques. **(6)**

OR

16. (a) Explain Continuous Integration, Delivery, and Deployment CI/CD/CD)

(8)

(b) Explain test driven development **(6)**

17. (a) What is a critical path and demonstrate its significance in a project schedule with the help of a sample project schedule. **(8)**

(b) Explain plan driven development and project scheduling. **(6)**

OR

18. (a) Explain elements of Software Quality Assurance and SQA Tasks. **(6)**

(b) What is algorithmic cost modeling? What problems does it suffer from when **(8)**

compared with other approaches to cost estimation?

19. (a) Explain elements of Software Quality Assurance and SQA Tasks. **(8)**

    (b) Illustrate SPI process with an example. **(6)**

OR

20. (a) Compare CMMI and ISO 9001:2000. **(8)**

    (b) How can Software projects benefit from Container deployment and Micro service deployment? **(6)**

Teaching Plan

No	Contents	No of Lecture Hrs
Module 1 : Introduction to Software Engineering (7 hours)		
1.1	Introduction to Software Engineering.[Book 1, Chapter 1]	1 hour
1.2	Software process models [Book 1 - Chapter 2]	1 hour
1.3	Process activities [Book 1 - Chapter 2]	1 hour
1.4	Coping with change [Book 1 - Chapter 2, Book 2 - Chapter 4]	1 hour
1.5	Case studies : An insulin pump control system. Mentcare - a patient information system for mental health care. [Book 1 - Chapter 1]	1 hour
1.6	Agile software development [Book 1 - Chapter 3]	1 hour
1.7	Agile development techniques, Agile Project Management.[Book 1 - Chapter 3]	1 hour
Module 2 : Requirement Analysis and Design (8 hours)		
2.1	Functional and non-functional requirements, Requirements engineering processes [Book 1 - Chapter 4]	1 hour
2.2	Requirements elicitation, Requirements validation, Requirements change, Traceability Matrix [Book 1 - Chapter 4]	1 hour
2.3	Developing use cases, Software Requirements Specification Template [Book 2 - Chapter 8]	1 hour

2.4	Personas, Scenarios, User stories, Feature identification [Book 3 - Chapter 3]	1 hour
2.5	Design concepts [Book 2 - Chapter 12]	1 hour
2.6	Architectural Design [Book 2 - Chapter 13]	1 hour
2.7	Component level design [Book 2 - Chapter 14]	1 hour
2.8	Design Document Template. Case study: The Ariane 5 launcher failure. [Ref - 2, Book 2 - Chapter 16]	1 hour
Module 3 : Implementation and Testing (9 hours)		
3.1	Object-oriented design using the UML, Design patterns [Book 1 - Chapter 7]	1 hour
3.2	Implementation issues, Open-source development - Open-source licensing - GPL, LGPL, BSD [Book 1 - Chapter 7]	1 hour
3.3	Review Techniques - Cost impact of Software Defects, Code review and statistical analysis. [Book 2 - Chapter 20]	1 hour
34	Informal Review, Formal Technical Reviews, Post-mortem evaluations. [Book 2 - Chapter 20]	1 hour
3.5	Software testing strategies - Unit Testing, Integration Testing, Validation testing, System testing and Debugging (basic concepts only). [Book 2 - Chapter 22]	1 hour
3.6	White box testing, Path testing, Control Structure testing, Black box testing. Test documentation [Book 2 - Chapter 23]	1 hour
3.7	Test automation, Test-driven development, Security testing. [Book 3 - Chapter 9]	1 hour
3.8	DevOps and Code Management - Code management, DevOps automation, CI/CD/CD. [Book 3 - Chapter 10]	1 hour
3.9	Software Evolution - Evolution processes, Software maintenance. [Book 1 - Chapter 9]	1 hour
Module 4 : Software Project Management (6 hours)		
4.1	Software Project Management - Risk management, Managing people, Teamwork [Book 1 - Chapter 22]	1 hour
4.2	Project Planning - Software pricing, Plan-driven development, Project scheduling, Agile planning [Book 1 - Chapter 23]	1 hour
4.3	Estimation techniques [Book 1 - Chapter 23]	1 hour
4.4	Configuration management [Book 1 - Chapter 25]	1 hour

4.5	Agile software management - SCRUM framework [Book 2 - Chapter 5]	1 hour
4.6	Kanban methodology and lean approaches.[Ref 9 - Chapter 2]	1 hour
Module 5 : Software Quality, Process Improvement and Technology trends (6 hours)		
5.1	Software Quality, Software Quality Dilemma, Achieving Software Quality. [Book 2 - Chapter 19]	1 hour
5.2	Elements of Software Quality Assurance, SQA Tasks , Software measurement and metrics. [Book 3 - Chapter 21]	1 hour
5.3	Software Process Improvement (SPI), SPI Process [Book 2 - Chapter 37]	1 hour
5.4	CMMI process improvement framework, ISO 9001:2000 for Software. [Book 2 - Chapter 37]	1 hour
5.5	Cloud-based Software - Virtualisation and containers, IaaS, PaaS, SaaS.[Book 3 - Chapter 5]	1 hour
5.6	Microservices Architecture - Microservices, Microservices architecture, Microservice deployment [Book 3 - Chapter 6]	1 hour

CDL331	DATA ANALYTICS LAB	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	0	0	3	3	2019

Preamble: The course aims to offer students a hands-on experience on data analytics concepts using problem-oriented learning. The data analytics tool is used for the purpose of acquainting the students with the algorithms and computational paradigms that allow computers to find patterns and regularities in databases, perform prediction and forecasting, and generally improve their performance through interaction with data. Data analytics has become increasingly important in the enterprise as a means for analyzing and shaping business processes and improving decision-making and business results.

Prerequisite: Fundamental knowledge in python and Data Analytics

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

CO1	Illustrate the data mining concepts using a data mining toolkit and visualize the result.**(Cognitive knowledge: Understand)**
CO2	Implement the data pre-processing tasks in data sets. **(Cognitive knowledge: Apply)**
CO3	Implement the algorithms for supervised data mining tasks such association rule mining, classification, clustering and regression.**(Cognitive knowledge: Apply)**
CO4	Implement the algorithms for unsupervised data mining tasks **Cognitive knowledge: Apply)**
CO5	Implement the algorithms for text mining.**(Cognitive knowledge: Apply)**

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✔	✔	✔		✔			✔		✔		✔
CO2	✔	✔	✔		✔			✔		✔		✔
CO3	✔	✔	✔		✔			✔		✔		✔
CO4	✔	✔	✔		✔			✔		✔		✔
CO5	✔	✔	✔		✔			✔		✔		✔

Abstract Pos defined by National Board of Accreditation			
PO#	Broad PO	PO#	Broad PO
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and teamwork
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Lifelong learning

Assessment Pattern:

Bloom's Category	Continuous Assessment Test(Internal Exam) Marks in percentage	EndSemester Examination Marks in percentage
Remember	20	20
Understand	20	20
Apply	60	60
Analyse		
Evaluate		
Create		

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	75	75	3 hours

Continuous Internal Evaluation Pattern:

Attendance   : 15 marks

Continuous Evaluation in Lab   : 30 marks

Continuous Assessment Test   : 15 marks

Viva Voce   : 15 marks

Internal Examination Pattern: The marks will be distributed as Algorithm30 marks, Program 20 marks, Output 20 marks and Viva 30 marks. Total 100 marks which will be converted out of 15 while calculating Internal Evaluation marks.

End Semester Examination Pattern: The percentage of marks will be distributed as Algorithm 30 marks, Program 20 marks, Output 20 marks and Viva30 marks. Total 75 marks.

Operating System to Use in Lab   : Linux

Compiler/Software to Use in Lab   : Weka or any open source tool

Programming Language to Use in Lab   : Python, R

Fair Lab Record:

All Students attending the Big Data Lab should have a Fair Record. The fair record should be produced in the University Lab Examination. Every experiment conducted in the lab should be noted in the fair record. For every experiment in the fair record, the right-hand page should contain Experiment Heading, Experiment Number, Date of experiment, Aim of the Experiment and the operations performed on them, Details of experiment including algorithm and result of Experiment. The left-hand page should contain a print out of the code used for experiment and sample output obtained for a set of input.

SYLLABUS

DATA ANALYTICS LAB

* mandatory

1) Familiarize Weka tool or any other data analytics tool and perform an explorative data analysis. *
2) Find the dissimilarity and similarity between the nominal and numeric attributes. *
3) Implement an algorithm to find similarity between documents.
4) Find correlation between numeric and nominal attributes. *
5) Implement Apriori algorithm for finding frequent patterns.*
6) Implement algorithms for mining association rules.
7) Implement FP growth algorithm for finding frequent patterns.
8) Implement k-means clustering algorithm. *
9) Evaluate Information Gain of an attribute in the dataset.
10) Implement Decision Tree classifier. *
11) Implement Naïve Bayes classifier. *
12) Implement outlier detection algorithms.
13) Implement back propagation algorithm. *
14) Implement a micro project. *

DATA ANALYTICS LAB - PRACTICE QUESTIONS

1) Write a program in python to rank a query point based on Euclidean, Manhattan and Minkowski distance measures in a 2D data set.
2) Write a program in python to represent a set of documents as vectors.
3) Write a program in python to rank documents based on cosine similarity.
4) Write a program in python to convert a Decision Tree into "if –then -else rules".
5) Write a program in python to implement the PAM algorithm.
6) Write a program in python to mine association rules using apriori algorithm.
7) Write a program in python to perform weight and bias updation of multilayer perceptron using back propagation learning. Perform 2 epochs.
8) Write a program in python to implement text classification using Naïve Bayes algorithm.
9) Write a program in python to find the split point of a numeric attribute using information gain measure.

10) Write a program in python to perform single linkage.

11) Write a program in python to perform complete linkage.

12) Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.

13) Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions.

CSL 333	DATABASE MANAGEMENT SYSTEMS LAB	Category	L	T	P	Credits	Year of introduction
		PCC	0	0	3	2	2019

Preamble:

The Database Management Systems course is intended to impart the elementary concepts of a database management system to students and equip them to design and implement a database application based on those concepts. This course helps the learners to get practical exposure on database creation, SQL queries creation, transaction processing and NoSQL & MongoDB based operations. The course enables the students to create, manage and administer the databases, develop necessary tools for the design and development of the databases, and to understand emerging technologies to handle Big Data.

Prerequisite: A sound knowledge of the basics of relational DBMS.

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

CO#	Course Outcomes
CO1	Design database schema for a given real world problem-domain using standard design and modeling approaches. **(Cognitive Knowledge Level: Apply)**
CO2	Construct queries using SQL for database creation, interaction, modification, and updation. **(Cognitive Knowledge Level: Apply)**
C03	Design and implement triggers and cursors. (Cognitive Knowledge Level: **Apply**)
C04	Implement procedures, functions, and control structures using PL/SQL**. (Cognitive Knowledge Level: Apply)**
CO5	Perform CRUD operations in NoSQL Databases. **(Cognitive Knowledge Level: Apply)**
C06	Develop database applications using front-end tools and back-end DBMS. **(Cognitive Knowledge Level: Create)**

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	✔	✔	✔		✔			✔		✔		✔
CO2	✔	✔	✔		✔			✔		✔		✔
CO3	✔	✔	✔	✔	✔			✔		✔		✔
CO4	✔	✔	✔	✔	✔			✔		✔		✔
CO5	✔	✔	✔		✔			✔		✔		✔
CO6	✔	✔	✔	✔	✔	✔		✔	✔	✔	✔	✔

Abstract POs defined by National Board of Accreditation			
PO#	Broad PO	PO#	Broad PO
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Life long learning

Assessment Pattern:

Bloom's Category	Continuous Assessment Test (Internal Exam)Percentage	End Semester Examination Percentage
Remember	20	20
Understand	20	20
Apply	60	60
Analyse		
Evaluate		
Create		

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	75	75	3 hours

Continuous Internal Evaluation Pattern:

Attendance : **15 marks**
Continuous Evaluation in Lab : **30 marks**
Continuous Assessment Test : **15 marks**
Viva-voce : **15 marks**

Internal Examination Pattern : The marks will be distributed as Schema/Logic: 30 marks, Program/Queries: 20 marks, Output: 20 marks, and Viva: 30 marks. Total 100 marks which will be converted out of 15 while calculating Internal Evaluation marks.

End Semester Examination Pattern:

The marks will be distributed as Schema/Logic: 30 marks,
Program/Queries: 20 marks, Output: 20 marks, and Viva: 30 marks. Total 100 marks will be converted out of 75 for the End Semester Examination.

DBMS software: Oracle, MySQL, SQL Server, PostgreSQL, MongoDB.
Front end Tool: Java

Fair Lab Record:

All Students attending the DBMS Lab should have a Fair Record. The fair record should be produced in the University Lab Examination. Every experiment conducted in the lab should be noted in the fair record. For every experiment in the fair record, the right hand page should contain Experiment Heading, Experiment Number, Date of Experiment, Aim of Experiment, Schemas/Menu & Form Design, and Query questions. The left hand page should contain Queries and sample output(relations created, Form, and Menu Output) obtained for a set of input.

Syllabus

1. Design a database schema for an application with ER diagram from a problem description **.
2. Creation, modification, configuration, and deletion of databases using UI and SQL Commands **.
3. Creation of database schema - DDL (create tables, set constraints, enforce relationships, create indices, delete and modify tables). Export ER diagram from the database and verify relationships** (with the ER diagram designed in step 1).

4. Database initialization - Data insert, Data import to a database (bulk import using UI and SQL Commands)**.
5. Practice SQL commands for DML (insertion, updating, altering, deletion of data, and viewing/querying records based on condition in databases)**.
6. Implementation of built-in functions in RDBMS**.
7. Implementation of various aggregate functions in SQL**.
8. Implementation of Order By, Group By & Having clause **.
9. Implementation of set operators nested queries, and join queries **.
10. Implementation of queries using temp tables.
11. Practice of SQL TCL commands like Rollback, Commit, Savepoint **.
12. Practice of SQL DCL commands for granting and revoking user privileges **.
13. Practice of SQL commands for creation of views and assertions ** .
14. Implementation of various control structures like IF-THEN, IF-THEN-ELSE, IF-THEN-ELSIF, CASE, WHILE using PL/SQL **.
15. Creation of Procedures, Triggers and Functions**.
16. Creation of Packages **.
17. Creation of Cursors **.
18. Creation of PL/SQL blocks for exception handling **.
19. Database backup and restore using commands.
20. Query analysis using Query Plan/Show Plan.
21. Familiarization of NoSQL Databases and CRUD operations**.
22. Design a database application using any front end tool for any problem selected. The application constructed should have five or more tables**.

** mandatory

Text Books

1. Elmasri R. and S. Navathe, Database Systems: Models, Languages, Design and Application Programming, Pearson Education, 2013.
2. Sliberschatz A., H. F. Korth and S. Sudarshan, Database System Concepts, 6/e, McGraw Hill, 2011.

References

1. Adam Fowler, NoSQL for Dummies, John Wiley & Sons, 2015
2. NoSQL Data Models: Trends and Challenges (Computer Engineering: Databases and Big Data), Wiley, 2018

Practice Questions

Design a normalized database schema for the following requirement.

The requirement: A library wants to maintain the record of books, members, book issue, book return, and fines collected for late returns, in a database. The database can be loaded with book information. Students can register with the library to be a member. Books can be issued to students with a valid library membership. A student can keep an issued book with him/her for a maximum period of two weeks from the date of issue, beyond which a fine will be charged. Fine is calculated based on the delay in days of return. For 0-7 days: Rs 10, For 7 – 30 days: Rs 100, and for days above 30 days: Rs 10 will be charged per day.

Sample Database Design

BOOK (**Book_Id**, Title, Language_Id, MRP, Publisher_Id, Published_Date, Volume, Status) // Language_Id, Publisher_Id are FK (Foreign Key)

AUTHOR(Author_Id, Name, Email, Phone_Number, Status)

BOOK_AUTHOR(Book_Id, Author_Id) // many-to-many relationship, both columns are PKFK (Primary Key and Foreign Key)

PUBLISHER(Publisher_id, Name, Address)

MEMBER(Member_Id, Name, Branch_Code, Roll_Number, Phone_Number, Email_Id, Date_of_Join, Status)

BOOK_ISSUE(Issue_Id, Date_Of_Issue, Book_Id, Member_Id, Expected_Date_Of_Return, Status) // Book+Id and Member_Id are FKs

BOOK_RETURN(Issue_Id, Actual_Date_Of_Return, LateDays, LateFee) // Issue_Id is PK and FK

LANGUAGE(Language_id, Name) //Static Table for storing permanent data

LATE_FEE_RULE(FromDays, ToDays, Amount) // Composite Key

EXERCISES

1. Create a normalized database design with proper tables, columns, column types, and constraints
2. Create an ER diagram for the above database design.
3. Write SQL commands to
   a. Create a database by name *Library*. Drop the database and re-create it.
   b. Create DDL statements and create the tables and constraints (from the design) in the database created in step-a (*Library*)

    Notes: [Create a script file and execute it. Create the script file in such a way that,,if the table exists, drop the tables and recreate)]

    c. Create and execute DROP TABLE command in tables with and without FOREIGN KEY constraints.

    d. Create and execute ALTER TABLE command in tables with data and without data.

    e. Create and execute SQL commands to build indices on Member_Id and Book_Id on table Book_Issue.

    f. Create and execute GRANT/REVOKE commands on tables.

    g. Create and execute SQL commands to insert data into each of the tables designed

    h. Learn and execute bulk import of data to tables from CSV files (insert 1000 records of books into the BOOK table from a CSV file).

    i. Create and execute UPDATE/DELETE commands on tables. Try to update/delete rows with Primary and Foreign Keys. Try bulk updates or deletes using SQL UPDATE statement

4. Write SQLQuery to retrieve the following information

    a. Get the number of books written by a given author

    b. Get the list of publishers and the number of books published by each publisher

    c. Get the names of authors who jointly wrote more than one book.

    d. Get the list of books that are issued but not returned

    e. Get the list of students who reads only 'Malayalam' books

    f. Get the total fine collected for the current month and current quarter

    g. Get the list of students who have overdue (not returned the books even on due date)

    h. Calculate the fine (as of today) to be collected from each overdue book.

    i. Members who joined after Jan 1 2021 but has not taken any books

5. Book return should insert an entry into the Book_Return table and also update the status in Book_Issue table as 'Returned'. Create a database *TRANSACTION* to do this operation (stored procedure).

6. Create a database view 'Available_Books', which will list out books that are currently available in the library

7. Create a database procedure to add, update and delete a book to the Library database (use parameters).

8. Use cursors and create a procedure to print Books Issue Register (page wise – 20 rows in a page)

9. Create a history table (you may use the same structure without any keys) for the MEMBER table and copy the original values of the row being updated to the history table using a TRIGGER.

10. NoSQL Exercise

    a. Practice Mongo DB CRUD operations. Refer:
       https://docs.mongodb.com/manual/crud/

b. You may use a MongoDB local installation or cloud MongoDB services like MongoDB Atlas for this exercise

c. For documentation: Refer: https://docs.mongodb.com/manual/introduction/

11. Application Development Problem examples:

1) Inventory Control System.
2) Material Requirement Processing.
3) Hospital Management System.
4) Railway Reservation System.
5) Personal Information System.
6) Web Based User Identification System.
7) Timetable Management System.
8) Hotel Management System.
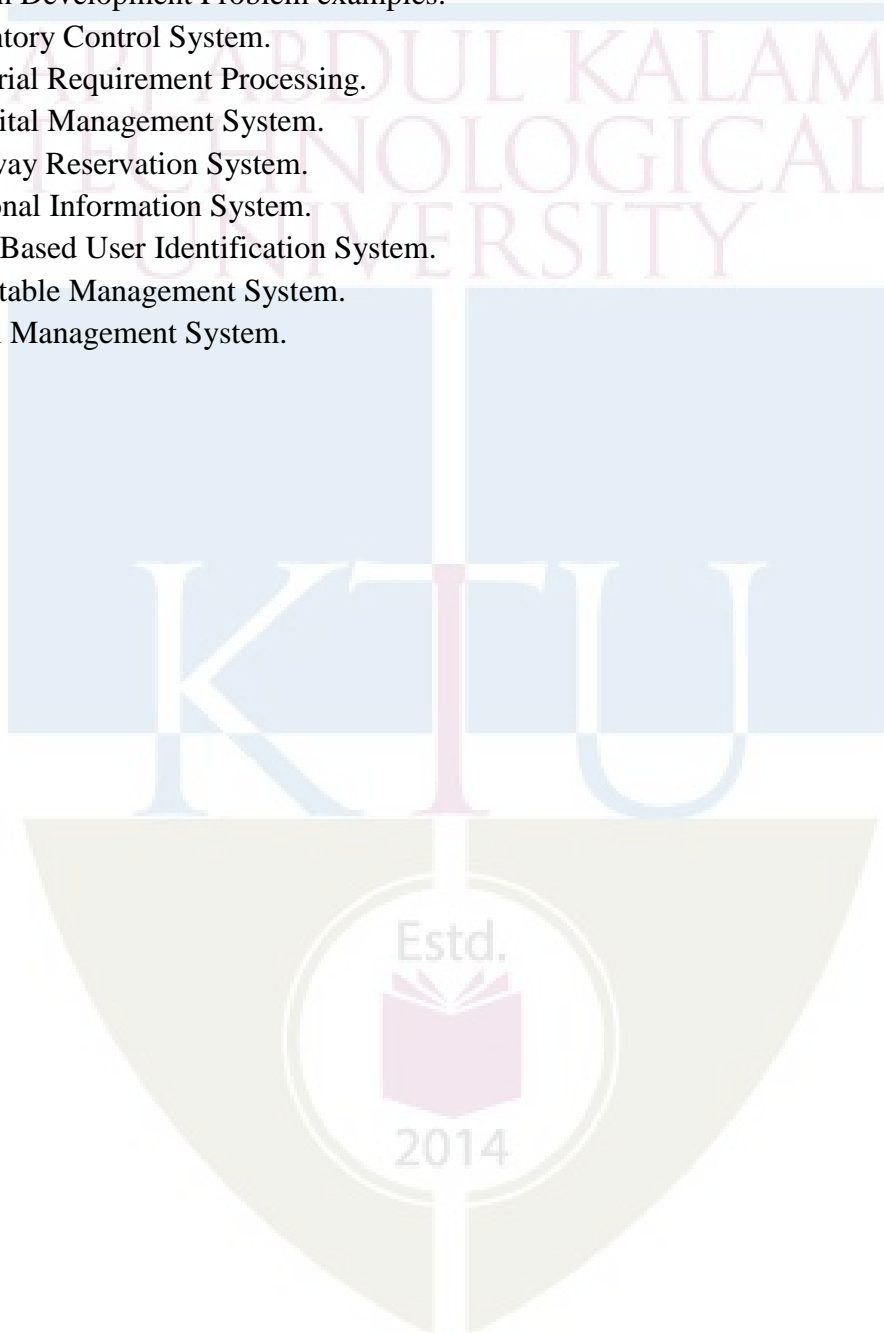
MCN 301	DISASTER MANAGEMENT	Category	L	T	P	CREDIT	YEAR OF INTRODUCTION
		Non - Credit	2	0	0	Nil	2019

Preamble: The objective of this course is to introduce the fundamental concepts of hazards and disaster management.

Prerequisite: Nil

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

CO1	Define and use various terminologies in use in disaster management parlance and organise each of these terms in relation to the disaster management cycle (Cognitive knowledge level: **Understand**).
CO2	Distinguish between different hazard types and vulnerability types and do vulnerability assessment (Cognitive knowledge level: **Understand**).
CO3	Identify the components and describe the process of risk assessment, and apply appropriate methodologies to assess risk (Cognitive knowledge level: **Understand**).
CO4	Explain the core elements and phases of Disaster Risk Management and develop possible measures to reduce disaster risks across sector and community (Cognitive knowledge level: **Apply**)
CO5	Identify factors that determine the nature of disaster response and discuss the various disaster response actions (Cognitive knowledge level: **Understand**).
CO6	Explain the various legislations and best practices for disaster management and risk reduction at national and international level (Cognitive knowledge level: **Understand**).

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2				2				2		2
CO2	2	3	2		2	2	3			3		2
CO3	2	3	2	2	2	2	3			3		2
CO4	3	3	3		2	2	3					2
CO5	3	3			2	2	3					2
CO6	3					2	3	3				2

Abstract POs defined by National Board of Accreditation			
PO#	Broad PO	PO#	Broad PO
PO1	Engineering Knowledge	PO7	Environment and Sustainability
PO2	Problem Analysis	PO8	Ethics
PO3	Design/Development of solutions	PO9	Individual and team work
PO4	Conduct investigations of complex problems	PO10	Communication
PO5	Modern tool usage	PO11	Project Management and Finance
PO6	The Engineer and Society	PO12	Life long learning

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks
	Test 1 (Marks)	Test 2 (Marks)	
Remember	10	10	20
Understand	25	25	50
Apply	15	15	30
Analyze			
Evaluate			
Create			

Mark Distribution

Total Marks	CIE Marks	ESE Marks	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance   : 10 marks

Continuous Assessment - Test   : 25 marks

Continuous Assessment - Assignment   : 15 marks

Internal Examination Pattern:

Each of the two internal examinations has to be conducted out of 50 marks. First series test shall be preferably conducted after completing the first half of the syllabus and the second series test shall be preferably conducted after completing remaining part of the syllabus. There will be two parts: Part A and Part B. Part A contains 5 questions (preferably, 2 questions each from the completed modules and 1 question from the partly completed module), having 3 marks for each question adding up to 15 marks for part A. Students should answer all questions from Part A.

Part B contains 7 questions (preferably, 3 questions each from the completed modules and 1 question from the partly completed module), each with 7 marks. Out of the 7 questions, a student should answer any 5.

End Semester Examination Pattern:

There will be two parts; Part A and Part B. Part A contains 10 questions with 2 questions from each module, having 3 marks for each question. Students should answer all questions. Part B contains 2 questions from each module of which a student should answer any one. Each question can have maximum 2 sub-divisions and carries 14 marks.

MCN 301 Disaster Management

Module 1

Systems of earth

Lithosphere- composition, rocks, soils; Atmosphere-layers, ozone layer, greenhouse effect, weather, cyclones, atmospheric circulations, Indian Monsoon; hydrosphere- Oceans, inland water bodies; biosphere

Definition and meaning of key terms in Disaster Risk Reduction and Management- disaster, hazard, exposure, vulnerability, risk, risk assessment, risk mapping, capacity, resilience, disaster risk reduction, disaster risk management, early warning systems, disaster preparedness, disaster prevention, disaster mitigation, disaster response, damage assessment, crisis counselling, needs assessment.

Module 2

Hazard types and hazard mapping; Vulnerability types and their assessment- physical, social, economic and environmental vulnerability.

Disaster risk assessment –approaches, procedures

Module 3

Disaster risk management -Core elements and phases of Disaster Risk Management

Measures for Disaster Risk Reduction – prevention, mitigation, and preparedness.

Disaster response- objectives, requirements; response planning; types of responses.

Relief; international relief organizations.

Module 4

Participatory stakeholder engagement; Disaster communication- importance, methods, barriers; Crisis counselling

Capacity Building: Concept – Structural and Non-structural Measures, Capacity Assessment; Strengthening Capacity for Reducing Risk

Module 5

Common disaster types in India; Legislations in India on disaster management; National disaster management policy; Institutional arrangements for disaster management in India.

The Sendai Framework for Disaster Risk Reduction- targets, priorities for action, guiding principles

Reference Text Book

1. R. Subramanian, Disaster Management, Vikas Publishing House, 2018

2. M. M. Sulphey, Disaster Management, PHI Learning, 2016

3. UNDP, Disaster Risk Management Training Manual, 2016

4. United Nations Office for Disaster Risk Reduction, Sendai Framework for Disaster Risk Reduction 2015-2030, 2015

Sample Course Level Assessment Questions

Course Outcome 1 (CO1):
1. What is the mechanism by which stratospheric ozone protects earth from harmful UV rays?

2. What are disasters? What are their causes?

3. Explain the different types of cyclones and the mechanism of their formation

4. Explain with examples, the difference between hazard and risk in the context of disaster management

5. Explain the following terms in the context of disaster management (a) exposure (b) resilience (c) disaster risk management (d) early warning systems, (e) damage assessment (f) crisis counselling (g) needs assessment

Course Outcome 2 (CO2):
1. What is hazard mapping? What are its objectives?

2. What is participatory hazard mapping? How is it conducted? What are its advantages?

3. Explain the applications of hazard maps

4. Explain the types of vulnerabilities and the approaches to assess them

Course Outcome 3 (CO3):
1. Explain briefly the concept of 'disaster risk'

2. List the strategies for disaster risk management 'before', 'during' and 'after' a disaster
3. What is disaster preparedness? Explain the components of a comprehensive disaster preparedness strategy

Course Outcome 4 (CO4):
1. What is disaster prevention? Distinguish it from disaster mitigation giving examples

2. What are the steps to effective disaster communication? What are the barriers to communication?

3. Explain capacity building in the context of disaster management

Course Outcome 5 (CO5):

1. Briefly explain the levels of stakeholder participation in the context of disaster risk reduction

2. Explain the importance of communication in disaster management

3. Explain the benefits and costs of stakeholder participation in disaster management

4. How are stakeholders in disaster management identified?

Course Outcome 6 (CO6):
1. Explain the salient features of the National Policy on Disaster Management in India

2. Explain the guiding principles and priorities of action according to the Sendai Framework for Disaster Risk Reduction

3. What are Tsunamis? How are they caused?

4. Explain the earthquake zonation of India

QP CODE: **PAGES:3**

Reg No:_____   **Name :**_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIFTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: MCN 301

Course Name: Disaster Management

Max.Marks:100   **Duration: 3 Hours**

PART A

Answer all Questions. Each question carries 3 Marks

1. What is the mechanism by which stratospheric ozone protects earth from harmful UV rays?

2. What are disasters? What are their causes?

3. What is hazard mapping? What are its objectives?

4. Explain briefly the concept of 'disaster risk'

5. List the strategies for disaster risk management 'before', 'during' and 'after' a disaster

6. What is disaster prevention? Distinguish it from disaster mitigation giving examples

7. Briefly explain the levels of stakeholder participation in the context of disaster risk reduction

8. Explain the importance of communication in disaster management

9. What are Tsunamis? How are they caused?

10. Explain the earthquake zonation of India

Part B
Answer any one Question from each module. Each question carries 14 Marks

11.   a. Explain the different types of cyclones and the mechanism of their formation   [10]

        b. Explain with examples, the difference between hazard and risk in the context of disaster management
[4]

<div align="center">OR</div>

12. Explain the following terms in the context of disaster management   [14]

(a) exposure (b) resilience (c) disaster risk management (d) early warning systems, (e) damage assessment (f) crisis counselling (g) needs assessment

13.   a. What is participatory hazard mapping? How is it conducted? What are its advantages?

        [8]

        b. Explain the applications of hazard maps   [6]

<div align="center">OR</div>

14.   Explain the types of vulnerabilities and the approaches to assess them   [14]

15.   a. Explain the core elements of disaster risk management   [8]

        b. Explain the factors that decide the nature of disaster response   [6]

<div align="center">OR</div>

16.   a. What is disaster preparedness? Explain the components of a comprehensive disaster preparedness strategy   [6]

        b. Explain the different disaster response actions   [8]

17.   a. Explain the benefits and costs of stakeholder participation in disaster management [10]

        b. How are stakeholders in disaster management identified?   [4]

<div align="center">OR</div>

18.   a. What are the steps to effective disaster communication? What are the barriers to communication?   [7]

        b. Explain capacity building in the context of disaster management   [7]

19. Explain the salient features of the National Policy on Disaster Management in India

[14]

OR

20. Explain the guiding principles and priorities of action according to the Sendai Framework for Disaster Risk Reduction [14]

Teaching Plan

	Module 1	5 Hours
1.1	Introduction about various Systems of earth, Lithosphere- composition, rocks, Soils; Atmosphere-layers, ozone layer, greenhouse effect, weather	1 Hour
1.2	Cyclones, atmospheric circulations, Indian Monsoon; hydrosphere- Oceans, inland water bodies; biosphere	1 Hour
1.3	Definition and meaning of key terms in Disaster Risk Reduction and Management- disaster, hazard,	1 Hour
1.4	Exposure, vulnerability, risk, risk assessment, risk mapping, capacity, resilience, disaster risk reduction, Disaster risk management, early warning systems	1 Hour
1.5	Disaster preparedness, disaster prevention, disaster, Mitigation, disaster response, damage assessment, crisis counselling, needs assessment.	1 Hour
	Module 2	5 Hours
2.1	Various Hazard types, Hazard mapping; Different types of Vulnerability types and their assessment	1 Hour
2.2	Vulnerability assessment and types, Physical and social vulnerability	1 Hour
2.3	Economic and environmental vulnerability, Core elements of disaster risk assessment	1 Hour
2.4	Components of a comprehensive disaster preparedness strategy approaches, procedures	1 Hour
2.5	Different disaster response actions	1 Hour
	Module 3	5 Hours
3.1	Introduction to Disaster risk management, Core elements of Disaster Risk Management	1 Hour
3.2	Phases of Disaster Risk Management, Measures for Disaster Risk Reduction	1 Hour
3.3	Measures for Disaster prevention, mitigation, and preparedness.	1 Hour

3.4	Disaster response- objectives, requirements. Disaster response planning; types of responses.	1 Hour
3.5	Introduction- Disaster Relief, Relief; international relief organizations.	1 Hour
	Module 4	**5 Hours**
4.1	Participatory stakeholder engagement	1 Hour
4.2	Importance of disaster communication.	1 Hour
4.3	Disaster communication- methods, barriers. Crisis counselling	1 Hour
4.4	Introduction to Capacity Building. Concept – Structural Measures, Non-structural Measures.	1 Hour
4.5	Introduction to Capacity Assessment, Capacity Assessment; Strengthening, Capacity for Reducing Risk	1 Hour
	Module 5	**5 Hours**
5.1	Introduction-Common disaster types in India.	1 Hour
5.2	Common disaster legislations in India on disaster management	1 Hour
5.3	National disaster management policy, Institutional arrangements for disaster management in India.	1 Hour
5.4	The Sendai Framework for Disaster Risk Reduction and targets	1 Hour
5.5	The Sendai Framework for Disaster Risk Reduction-priorities for action, guiding principles	1 Hour