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:

- $L_1 = \{a^p | p is\ a\ prime\ number\}$
- $L_2 =$

$\{x\{0,1\}^* | x is\ the\ binary\ representation\ of\ a\ decimal\ number\ which\ is\ a\ multiple\ of 5\}$

- $L_3 = \{a^n b^n c^n | n \geq 0\}$
- $L_4 = \{a^m b^n c^{m+n} | m > 0, n \geq 0\}$
- $L_5 = \{M\#x | M halts\ on x\}$. 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:
   $L = \{x \in \{0,1\}^* | \text{there are no consecutive } 1\text{'s in } x\}$

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 DFAD 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)**

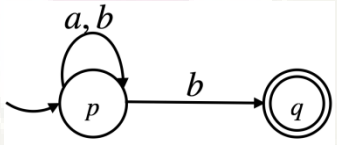
$$L = \{x \in \{0,1\}^* | x\ is\ a\ binary\ representation\ of\ a\ natural\ number\ which\ is\ a \text{multiple of } 5\}$$

OR

12. (a) Write a Regular grammar G for the following language Ldefined as: $L = \{x \in \{a,b\}^* | xdoes\ not\ conatin\ consecutiveb's\}$. **(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: $S \rightarrow aA$ and $A \rightarrow aA|bA|b$. **(7)**

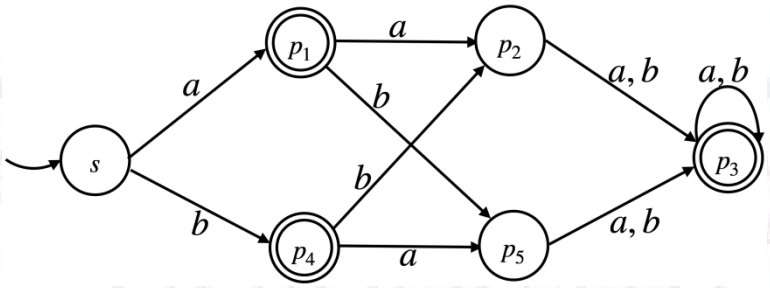
13. (a) Using Kleen's construction, obtain the regular expression for the language represented by the following NFA **(8)**



(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) Obtain the minimum -state DFA from the following DFA. **(8)**



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

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

(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: $\{S \rightarrow aSa|bSb|SS|\epsilon\}$ into Chomsky Normal form. **(6)**

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

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

OR

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

(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, 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 $b = 2$. **(7)**

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

OR

20. (a) Design a Turing machine to obtain the sum of two natural numbers $a$and b, 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 $b = 2$. **(7)**

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

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 □ transitions - examples, formal definition	1 Hour
1.6	Equivalence of DFA and NFA with and without □ 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 □ transition	1 Hour
2.3	Conversion of NFA with □ 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?

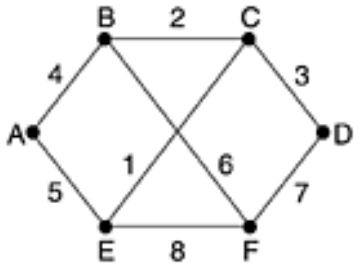
Course Outcome4 (CO4)

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

CST 305	SYSTEM SOFTWARE	Category	L	T	P	Credit	Year of Introduction
		PCC	3	1	0	4	2019

Preamble:

The purpose of this course is to create awareness about the low-level codes which are very close to the hardware and about the environment where programs can be developed and executed. This course helps the learner to understand the machine dependent and machine independent system software features and to design/implement system software like assembler, loader, linker, macroprocessor and device drivers. Study of system software develops ability to design interfaces between software applications and computer hardware**.**

Prerequisite: A sound knowledge in Data Structures, and Computer Organization

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

CO#	Course Outcomes
CO1	Distinguish **softwares** into system and application software categories. **(Cognitive Knowledge Level: Understand)**
CO2	Identify **standard** and extended architectural features of machines. (**Cognitive Knowledge Level: Apply)**
CO3	Identify machine dependent features of system software (**Cognitive Knowledge Level: Apply)**
CO4	Identify machine independent features of system software. (**Cognitive Knowledge Level: Understand)**
CO5	Design **algorithms** for system softwares and analyze the effect of data structures. (**Cognitive Knowledge Level: Apply)**
CO6	Understand the features of device drivers and editing & debugging tools.(**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	✓	✓	✓	✓								✓
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**	Lifelong learning

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination Marks(%)
	Test 1 (%)	Test 2 (%)	
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

Continuous Internal Evaluation Pattern:

Attendance : **10 marks**
Continuous Assessment Test (Average of series Tests 1&2) : **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 carry 14 marks.

Syllabus

Module-1 (Introduction)

System Software vs Application Software, Different System Software– Assembler, Linker, Loader, Macro Processor, Text Editor, Debugger, Device Driver, Compiler, Interpreter, Operating System (Basic Concepts only). SIC & SIC/XE Architecture, Addressing modes, SIC & SIC/XE Instruction set , Assembler Directives.

Module-2 (Assembly language programming and Assemblers)

SIC/XE Programming, Basic Functions of Assembler, Assembler Output Format – Header, Text and End Records. Assembler Data Structures, Two Pass Assembler Algorithm, Hand Assembly of SIC/XE Programs.

Module-3 (Assembler Features and Design Options)

Machine Dependent Assembler Features-Instruction Format and Addressing Modes, Program Relocation. Machine Independent Assembler Features –Literals, Symbol Defining Statements, Expressions, Program Blocks, Control Sections and Program Linking. Assembler Design Options- One Pass Assembler, Multi Pass Assembler. Implementation Example-MASM Assembler.

Module-4 (Loader and Linker)

Basic Loader Functions - Design of Absolute Loader, Simple Bootstrap Loader. Machine Dependent Loader Features- Relocation, Program Linking, Algorithm and Data Structures of Two Pass Linking Loader. Machine Independent Loader Features -Automatic Library Search, Loader Options. Loader Design Options.

Module-5 (Macro Preprocessor ,Device driver, Text Editor and Debuggers)

Macro Preprocessor - Macro Instruction Definition and Expansion, One pass Macro processor Algorithm and data structures, Machine Independent Macro Processor Features, Macro processor design options. Device drivers - Anatomy of a device driver, Character and block device drivers, General design of device drivers. Text Editors- Overview of Editing, User Interface, Editor

Structure. Debuggers - Debugging Functions and Capabilities, Relationship with other parts of the system, Debugging Methods- By Induction, Deduction and Backtracking.

Text book

1. Leland L. Beck, System Software: An Introduction to Systems Programming, 3/E, Pearson Education Asia

References

1. D.M. Dhamdhere, Systems Programming and Operating Systems, Second Revised Edition, Tata McGraw Hill.
2. John J. Donovan, Systems Programming, Tata McGraw Hill Edition 1991.
3. George Pajari, Writing UNIX Device Drivers, Addison Wesley Publications (Ebook : http://tocs.ulb.tu-darmstadt.de/197262074.pdf).
4. Peter Abel, IBM PC Assembly Language and Programming, Third Edition, Prentice Hall of India.
5. Jonathan Corbet, Alessandro Rubini, Greg Kroah-Hartman, Linux Device Drivers, Third Edition, O.Reilly Books
6. M. Beck, H. Bohme, M. Dziadzka, et al., Linux Kernel Internals, Second Edition, Addison Wesley Publications,
7. J Nithyashri, System Software, Second Edition, Tata McGraw Hill.
8. The C Preprocessor http://gcc.gnu.org/onlinedocs/gcc-2.95.3/cpp_1.html -

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. List out two system software and two application software.

Course Outcome 2 (CO2):

1. How is upward compatibility between SIC and SIC/XE machines maintained?
2. Write a sequence of instructions for SIC/XE to divide BETA by GAMMA, setting ALPHA to the integer portion of the quotient and DELTA to the remainder. Use register-to-register instructions to make the calculation as efficient as possible.

Course Outcome 3 (CO3):

1. How do control sections and program blocks differ?
2. Can an assembler incorporating program blocks function using the same data structures as that of a normal two pass assembler? Justify your answer

Course Outcome 4 (CO4):

1. What are literals used for? Does the use of literals change the design of an assembler?

Course Outcome 5 (CO5):

1. Design an assembler that can assemble a source program with different control sections.

Course Outcome 6 (CO6):

1. Describe any one commonly used debugging method.

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 305

Course Name: System Software

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

PART A

Answer All Questions. Each Question Carries 3 Marks

1. Differentiate between system software and application software.
2. What are assembler directives? List out any five assembler directives in SIC.
3. Explain the different data structures used in the implementation of Assemblers.
4. List out the functions performed by an assembler.

5. What is a Literal? How is a literal handled by an assembler.

6. What are control sections? What is the advantage of using them?

7. Differentiate between linking loader and linkage editor? Which of these is preferable in a program development environment?

8. What is Automatic Library Search?

9. How should a programmer decide whether to use a macro or a subroutine to accomplish a given logical function?

10. Differentiate between character and block device drivers

(10x3=30)

Part B

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

11. (a) Differentiate between compilers and Interpreters. . **(4)**

(b) Explain the architecture and addressing modes of SIC machine. **(10)**

OR

12. (a) Explain the addressing modes supported by SIC/ XE machine with suitable illustrations. **(8)**

(b) Explain the difference between **(6)**
i) A1 RESW 3 and A1 WORD 3
ii) B BYTE C'23' and B BYTE X'23'
iii) END and END LABEL

13. (a) Let NUMBERS be an array of 100 words. Write a sequence of SIC/XE instructions to find the maximum of these numbers. **(6)**

(b) Perform hand assembly of the above written program using two pass assembler and show the status of various data structures and object program create. **(8)**

OR

14. (a) Write down and explain the second pass of a two pass assembler algorithm. **(8)**

(b) What is a Program Block. What is its advantage? With suitable example, explain how Program Blocks are handled by SIC assembler. **(6)**

15. (a) What is a Program Block. What is its advantage? With suitable example, explain how Program Blocks are handled by SIC assembler. **(7)**

(b) What is a forward reference? With example, illustrate how forward references are handled by a single pass assembler? **(7)**

OR

16. (a) With suitable examples explain machine dependent assembler features. **(8)**

(b) Explain with examples, the need and working of multipass assembler. **(6)**

17. (a) With the data structures used, state and explain two pass algorithm for a linking loader. **(10)**

(b) Explain about bootstrap loader. **(4)**

OR

18. (a) Explain about machine independent loader features **(9)**

(b) What is Dynamic Linking? With example, illustrate how dynamic linking is performed. **(5)**

19. (a) Write down the single pass macro processor algorithm and with suitable example illustrate its working. **(10)**

(b) How are unique labels generated during Macro Expansion? **(4)**

OR

20. (a) Explain Text Editor structure in detail with a neat diagram. **(7)**

(b) Explain the different debugging methods in detail. **(7)**

Teaching Plan

No	Contents	No: of Lecture Hours
Module -1 (Introduction) (9 hours)		
1.1	System Software Vs. Application Software , Different System Software– Assembler, Linker, Loader, Macro Processor	1 hour
1.2	Text Editor, Debugger, Device Driver, Compiler, Interpreter, Operating System(Basic Concepts only)	1 hour
1.3	SIC Architecture	1 hour
1.4	SIC Addressing modes	1 hour
1.5	SIC Instruction set & Assembler directives	1 hour
1.6	SIC/XE Architecture	1 hour
1.7	SIC/XE Instruction format	1 hour
1.8	SIC/XE Addressing modes	1 hour
1.9	SIC/XE Instruction set	1 hour
Module -2 (Assembly language programming and Assemblers) (8 hours)		
2.1	SIC Programming	1 hour
2.2	SIC/XE Programming	1 hour
2.3	Basic Functions of Assembler	1 hour
2.4	Assembler output format – Header, Text and End Records	1 hour
2.5	Assembler data structures	1 hour
2.6	Pass 1 of two pass SIC assembler algorithm	1 hour
2.7	Pass 2 of two pass SIC assembler algorithm	1 hour
2.8	Hand assembly of SIC Program	1 Hour
Module-3 (Assembler design options)(11 hours)		

3.1	Machine dependent assembler features-Instruction format and addressing modes, program relocation	1 hour
3.2	Hand assembly of SIC/XE program	1 Hour
3.3	Machine Independent assembler features – Literals	1 hour
3.4	Machine Independent assembler features – Symbol defining statements, expression	1 hour
3.5	Machine Independent assembler features – program blocks	1 hour
3.6	Machine Independent assembler features – program blocks illustration with examples	1 hour
3.7	Machine Independent assembler features – Control sections and program linking.	1 hour
3.8	Machine Independent assembler features – Control sections and program linking. Illustration with example	1 hour
3.9	Assembler design options- One Pass assembler	1 hour
3.10	Multi pass assembler	1 hour
3.11	Implementation example: MASM Assembler	1 hour
Module-4 (Linker and Loader) (8 hours)		
4.1	Basic Loader functions - Design of absolute loader	1 hour
4.2	Simple bootstrap Loader	1 hour
4.3	Machine dependent loader features- Relocation	1 hour
4.4	Machine dependent loader features- Program Linking algorithm and data structures of First pass of two pass Linking Loader	1 hour
4.5	Machine dependent loader features- Program Linking algorithm and data structures of Second pass of two pass Linking Loader	1 hour
4.6	Machine independent loader feature - Automatic library search	1 hour
4.7	Machine independent loader features - Loader options	1 hour
4.8	Loader Design Option- Linking Loader, Linkage Editor, Dynamic Linking	1 hour
Module –5 (Macro Preprocessor, Device drivers, Text Editors, Debuggers) (9 hours)		
5.1	Macro Preprocessor- Macro Instruction Definition and Expansion	1 hour

5.2	One pass Macro processor algorithm and data structures	1 hour
5.3	One pass Macro processor Algorithm and data structures illustration with example	1 hour
5.4	Machine Independent Macro Processor Features- generation of unique labels, Concatenation of macro parameter, Keyword macro parameters	1 hour
5.5	Machine Independent Macro Processor Features- Conditional Macro Expansion	1 hour
5.6	Macro processor design options	1 hour
5.7	Device drivers- Anatomy of a device driver, Character and block device drivers, General design of device drivers	1 hour
5.8	Text Editors- Overview of Editing, User Interface , Editor Structure	1 hour
5.9	Debuggers :- Debugging Functions and Capabilities, Debugging Methods- By Induction, Deduction and Backtracking.	1 hour

CST 307	MICROPROCESSORS AND MICROCONTROLLERS	Category	L	T	P	Credit	Year of Introduction
		PCC	3	1	0	4	2019

Preamble: The course enables the learners capable of understanding the fundamental architecture of microprocessors and micro controllers. This course focuses on the architecture, assembly language programming, interrupts, interfacing of microprocessors with peripheral devices and microcontrollers and its programming. It helps the learners to extend the study of latest processors and develop hardware based solutions.

Prerequisite : Sound knowledge in Logic System Design and Computer organization & architecture.

CO#	Course Outcomes
CO1	Illustrate the **architecture**, modes of operation and addressing modes of microprocessors **(Cognitive knowledge: Understand)**
CO2	Develop 8086 **assembly** language programs. **(Cognitive Knowledge Level: Apply**)
CO3	Demonstrate interrupts, its **handling** and programming in 8086. **(Cognitive Knowledge Level: Apply**))
CO4	Illustrate how different **peripherals** (8255,8254,8257) and memory are interfaced with microprocessors. (**Cognitive Knowledge Level: Understand**)
CO5	Outline features of **microcontrollers** and develop low level programs. **(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 (%)**
	Test1 (%)	**Test2 (%)**	
Remember	**20**	**20**	**20**
Understand	**40**	**40**	**40**
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 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 maximum 2 sub-divisions and carries 14 marks.

Syllabus

Module-1(Evolution of microprocessors):

8085 microprocessor (-Basic Architecture only). 8086 microprocessor – Architecture and signals, Physical Memory organization, Minimum and maximum mode of 8086 system and timings. Comparison of 8086 and 8088.Machine language Instruction format.

Module-2 (Addressing modes and instructions):

Addressing Modes of 8086. Instruction set – data copy /transfer instructions, arithmetic instructions, logical instructions, string manipulation instructions, branch instructions, unconditional and conditional branch instruction, flag manipulation and processor control instructions. Assembler Directives and operators. Assembly Language Programming with 8086.

Module- 3 (Stack and interrupts):

Stack structure of 8086, programming using stack- Interrupts - Types of Interrupts and Interrupt Service Routine- Handling Interrupts in 8086- Interrupt programming. -

Programmable Interrupt Controller - 8259, Architecture (Just mention the control word, no need to memorize the control word)- Interfacing Memory with 8086.

Module- 4 (Interfacing chips):

Programmable Peripheral Input/output port 8255 - Architecture and modes of operation- Programmable interval timer 8254-Architecture and modes of operation- DMA controller 8257 Architecture (Just mention the control word, no need to memorize the control word of 8254 and 8257)

Module- 5 (Microcontrollers):

8051 Architecture- Register Organization- Memory and I/O addressing- Interrupts and Stack- 8051 Addressing Modes- Instruction Set- data transfer instructions, arithmetic instructions, logical instructions, Boolean instructions, control transfer instructions- Simple programs.

Text Books

1. Bhurchandi and Ray, Advanced Microprocessors and Peripherals, Third Edition McGraw Hill.
2. Raj Kamal, Microcontrollers: Architecture, Programming, Interfacing and System Design, Pearson Education.
3. Ramesh Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, Penram International Publishing Pvt. Ltd.

Reference Books

1. Barry B. Brey, The Intel Microprocessors – Architecture, Programming and Interfacing, Eighth Edition, Pearson Education.
2. A. NagoorKani, Microprocessors and Microcontrollers, Second Edition, Tata McGraw Hill
3. Douglas V. Hall, SSSP Rao, Microprocessors and Interfacing, Third Edition, McGrawHill Education.

Sample Course Level Assessment Questions

Course Outcome1 (CO1):

1) Describe how pipelining is implemented in 8086 microprocessor
2) Illustrate maximum mode signals in 8086.

Course Outcome 2(CO2):

1) Write an 8086 assembly language program for sorting a sequence of N, 8 bit numbers. Describe the modifications that can be done on the above program so that it will sort N, 16 bit numbers. Rewrite the program with those modifications also.

Course Outcome 3 (CO3):

1) Design an interface between 8086 CPU and two chips of 16 x 8 EPROM and

two chips of 32K x 8 RAM. Select the starting address of EPROM suitably.

The RAM address must start at 00000H.

2) Give the sequence of instructions for setting the IVT for interrupt type 23H. Assume the Interrupt Service Routine, is present in the code segment named CODE.
3) Describe the role of Interrupt Request register and In service register in 8259.

Course Outcome 4(CO4):

1) Show how to interface an 8255 with 8086 to work as an I/O port with the following specifications. Initialize port A as output, port B as input and port C as output. Port A address should be 05A0H. Write a program to sense switch positions SW 0 -SW 7 connected to port B. The sensed pattern is to be displayed on port A, to which 8 LED's are attached, while port C lower displays *number of off switches* out of total 8 switches.
2) Specify the importance of the DMA address register and Terminal count register in 8257.

Course Outcome 5(CO5):

1) Write an 8051 assembly language program to count the number of 1's and 0's in a given 8 bit number
2) Write an 8051 assembly language program for computing the square root of an 8 bit number.

Model Question Paper

QP CODE:

Reg No: _____

Name: _____ **PAGES : 4**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B.TECH. DEGREE EXAMINATION, MONTH & YEAR

Course Code: CST 307

Course Name: Microprocessors and Microcontrollers

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

PART A

Answer All Questions. Each Question Carries 3 Marks

1. Describe the functions of following signals in 8086
   a)NMI b)ALE
2. List any three differences between 8085 and 8086 microprocessors.
3. Assume AL register is having the value 7FH. What will be the content of AL after the following instructions are executed
   a)ROR AL,01 b)SAR AL,01
4. Specify the use of following assembler directives - EQU , EVEN
5. Differentiate between maskable and non maskable interrupts?
6. Define Interrupt Service Routine? How to find the address of the ISR corresponding to a given interrupt in 8086?
7. Give the purposes of the signals DRQ, TC and MARK in 8257?
8. How 8254 is used as a square wave generator?
9. Differentiate between indirect and indexed addressing modes in 8051.

10. Write the sequence of 8051 instructions to store any two numbers at two consecutive locations 70H and 71H, multiply them and store the result in location 72H. **(10x3=30)**

Part B

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

11. (a) Specify the significance of segmentation and how it is implemented in 8086 **(5)**

(b) Explain the maximum mode signals in 8086. **(9)**

OR

12. (a) Write down the differences between 8086 and 8088 processors **(4)**

(b) Explain the physical memory organization of 8086 with a neat diagram. How does the 8086 processor accesses a word from an odd memory location? How many memory cycles does it take? **(10)**

13. (a) Write an 8086 assembly language program for finding the sum of the squares of first N natural numbers. Calculate the squares of each number using a subroutine SQUARE. **(10)**

(b) Describe any four control transfer instructions in 8086. **(4)**

OR

14. (a) Write an 8086 assembly language program for printing the reverse of a given input string. **(5)**

(b) Explain the addressing modes for sequential control flow instructions in 8086. **(9)**

15. (a) Give the stack structure of 8086. **(5)**

(b) Explain the architecture of 8259 with diagram **(9)**

OR

16. (a) Interface 32Kx8 RAM using four numbers of 8Kx8 memory chips and 16Kx8 ROM using two numbers of 8Kx8 EPROM chips. The address map is given as RAM starts at 00000H and ROM ends at FFFFFH **(10)**

(b) Describe the predefined interrupts in 8086 **(4)**

17. (a) Explain the architecture of 8255 with a neat diagram **(10)**

(b) Identify the mode and I/O configuration for ports A, B and C of an 8255 after its control register is loaded with 86 H? **(4)**

OR

18. (a) Define Direct Memory Access (DMA)and illustrate the role of a DMA controller? Explain the register organization of 8257 and state how these registers are used during DMA transfer operations. **(8)**

(b) Explain the architecture of 8254 timer chip **(6)**

19. (a) Explain the architecture of 8051 microcontroller. **(9)**

(b) Write an 8051 assembly language program for adding two matrices whose elements are stored sequentially in some memory location. Assume suitable locations. **(5)**

OR

20. (a) Explain the internal data memory organization of 8051. **(9)**

(b) Describe the control transfer instructions of 8051microcontroller. **(5)**

Teaching Plan

No	Contents	No of Lecture Hrs
Module 1 : (Evolution of microprocessors) (9 hours)		
1.1	Overview of 8085 microprocessor	1 hour
1.2	Architecture of8085	1 hour
1.3	Architecture of 8086	1hour
1.4	Signals in 8086	1hour
1.5	Physical Memory organization	1hour
1.6	Minimum and maximum mode 8086 system and timings(Lecture 1)	1hour
1.7	Minimum and maximum mode 8086 system and timings(Lecture 2)	1hour
1.8	Comparison of 8086 and 8088	1hour
1.9	Machine language Instruction format	1hour
Module 2 :(programming of 8086) (9 hours)		
2.1	Addressing Modes of 8086	1 hour
2.2	Instruction set – data copy/transfer instructions	1hour
2.3	arithmetic instructions, logical instructions	1hour
2.4	string manipulation instructions, branch instructions	1hour
2.4	unconditional and conditional branch instruction	1hour
2.5	flag manipulation and processor control instructions	1hour
2.6	Assembler Directives and operators	1hour
2.7	Assembly Language Programming with 8086(Lecture 1)	1hour
2.8	Assembly Language Programming with 8086(Lecture 2)	1hour
2.9	Assembly Language Programming with 8086(Lecture 3)	1hour
Module 3 : (stack and Interrupts) (9 hours)		
3.1	Stack structure of 8086, programming using stack.	1hour
3.2	Types of Interrupts and Interrupt Service Routine.	1hour
3.3	Handling Interrupts in 8086(Lecture 1)	1hour
3.4	Handling Interrupts in 8086(Lecture 2)	1hour

3.5	Interrupt programming.	1hour
3.6	Programmable Interrupt Controller -8259 (Lecture 1)	1hour
3.7	Programmable Interrupt Controller -8259 (Lecture 2)	1hour
3.8	Interfacing Memory with 8086 (Lecture 1)	1hour
3.9	Interfacing Memory with 8086 (Lecture 2)	1hour
Module 4 :(Interfacing chips) (7 hours)		
4.1	Programmable Peripheral Input/output port- 8255 (Lecture 1)	1hour
4.2	Programmable Peripheral Input/output port- 8255 (Lecture 2)	1hour
4.3	Programmable Peripheral Input/output port- 8255 (Lecture 3)	1hour
4.4	Programmable interval timer 8254 (Lecture 1)	1hour
4.5	Programmable interval timer 8254 (Lecture 2)	1hour
4.6	DMA controller 8257 Architecture (Lecture 1)	1hour
4.7	DMA controller 8257 Architecture (Lecture 2)	1hour
Module 5 : (Microcontrollers) (11 hours)		
5.1	8051 Architecture (Lecture 1)	1hour
5.2	8051 Architecture (Lecture 2)	1hour
5.3	Register Organization, Memory and I/O addressing	1hour
5.4	Interrupts and Stack	1hour
5.5	Addressing Modes	1hour
5.6	Data transfer instructions, Arithmetic instructions	1hour
5.7	Logical instructions,	1hour
5.8	Boolean instructions	1hour
5.9	Control transfer instructions	1hour
5.10	Programming of 8051 (Lecture 1)	1hour
5.11	Programming of 8051(Lecture 2)	1hour

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 SpeciÞcations
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

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	PO 9	PO1 0	PO1 1	PO1 2
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.

SYLLABUS

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

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: 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]

OR

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]

OR

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]

OR

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]

OR

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

CSL 331	SYSTEM SOFTWARE AND MICROPROCESSORS LAB	Category	L	T	P	Credit	Year of Introduction
		PCC	0	0	4	2	2019

Preamble: The aim of this course is to give hands-on experience in how microcontrollers, and microprocessors can be programmed. The course also aims to enable students to design and implement system software. The student should get familiar with assembly level programming of microprocessors and microcontrollers, interfacing of devices to microcontrollers, resource allocation algorithms in operating systems and design and implementation of system software.

Prerequisite: Sound knowledge in Operating systems

CO1	Develop 8086 programs and execute it using a microprocessor kit. **(Cognitive Knowledge Level: Apply) .**
CO2	Develop 8086 programs and, debug and execute it using MASM assemblers **(Cognitive Knowledge Level: Apply)**
CO3	Develop and execute programs to interface stepper motor, 8255, 8279 and digital to analog converters with 8086 trainer kit **(Cognitive Knowledge Level: Apply)**
CO4	Implement and execute different scheduling and paging algorithms in OS **(Cognitive Knowledge Level: Apply)**
CO5	Design and implement assemblers, Loaders and macroprocessors. **(Cognitive Knowledge Level: Apply)**

Mapping of course outcomes with program outcomes

	PO1	PO2	PO3	PO4	PO 5	PO 6	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 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 Algorithm 30 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 marks will be distributed as Algorithm 30 marks, Program 20 marks, Output 20 marks and Viva 30 marks. Total 100 marks will be converted out of 75 for End Semester Examination.

Operating System to Use in Lab **:** Linux
Compiler/Software to Use in Lab **:** gcc
Programming Language to Use in Lab **:** Ansi C
Any compatible assembler can be used for implementation of 8086 programs

Fair Lab Record:

All Students attending the System Software and Microprocessors 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, Details of Experiment including algorithm and Result of Experiment. The left hand page should contain a print out of the code used for the experiment and sample output obtained for a set of input.

Syllabus

MICROPROCESSOR LAB

I. Assembly Language Programming Exercises/Experiments using 8086 Trainer kit
II. Exercises/Experiments using MASM (PC required)
III. Interfacing Exercises/Experiments with 8086 trainer kit through Assembly Language programming
IV. Exercises/Experiments using 8051 trainer kit

SYSTEM SOFTWARE LAB:

I. Experiments related to the operating system.
II. Exercises/Experiments related to the assemblers, loaders and macroprocessors

Text Books

1. Bhurchandi and Ray, Advanced Microprocessors and Peripherals, Third Edition McGraw Hill.
2. Andrew S Tanenbaum, "Modern Operating Systems" , 4th Edition, Prentice Hall, 2015.
3. Leland L. Beck, System Software: An Introduction to Systems Programming, 3/E, Pearson Education Asia, 1997.

Reference Books

1. A. NagoorKani, Microprocessors and Microcontrollers, Second Edition, Tata McGraw Hill
2. Douglas V. Hall, SSSP Rao, Microprocessors and Interfacing, Third Edition, McGrawHill Education.
3. William Stallings, "Operating systems", 6th Edition, Pearson, Global Edition, 2015.
4. Garry Nutt, Nabendu Chaki, Sarmistha Neogy, "Operating Systems", 3rd Edition, Pearson Education.
5. D.M. Dhamdhere, Systems Programming and Operating Systems, Second Revised Edition, Tata McGraw Hill.

Practice Questions

MICROPROCESSORS LAB : List of Exercises/ Experiments
(Minimum 10 Exercises (at least 2 questions from each part I, II, III & IV)) : 2 Hrs/week

I. Assembly Language Programming Exercises/Experiments using 8086 Trainer kit

1. Implementation of simple decimal arithmetic and bit manipulation operations.
2. Implementation of code conversion between BCD, Binary, Hexadecimal and ASCII.
3. Implementation of searching and sorting of 16-bit numbers.

II. Exercises/Experiments using MASM (PC Required)

4. Study of Assembler and Debugging commands.
5. Implementation of decimal arithmetic (16 and 32 bit) operations.
6. Implementation of String manipulations.
7. Implementation of searching and sorting of 16-bit numbers.

III. Interfacing Exercises/Experiments with 8086 trainer kit through Assembly Language Programming

8. Interfacing with stepper motor - Rotate through any given sequence.
9. Interfacing with 8255 (mode0 and mode1 only).
10. Interfacing with 8279 (Rolling message, 2 key lockout and N-key rollover implementation).

11. Interfacing with Digital-to-Analog Converter.

IV. Exercises/Experiments using 8051 trainer kit

12. Familiarization of 8051 trainer kit by executing simple Assembly Language programs such as decimal arithmetic and bit manipulation.
13. Implementation of Timer programming (in mode1).

SYSTEM SOFTWARE LAB: List of Exercises/ Experiments

(Minimum 8 Exercises (at least 3 and 5 questions from each part V and VI)) : 2 Hrs/week

V. Exercises/Experiments from operating system

1. Simulate the following non-preemptive CPU scheduling algorithms to find turnaround time and waiting time.
   a) FCFS b) SJF c) Round Robin (pre-emptive) d) Priority
2. Simulate the following file allocation strategies.
   a) Sequential b) Indexed c) Linked
3. Implement the different paging techniques of memory management.
4. Simulate the following file organization techniques
   a) Single level directory b) Two level directory c) Hierarchical
5. Implement the banker's algorithm for deadlock avoidance.
6. Simulate the following disk scheduling algorithms.
   a) FCFS b) SCAN c) C-SCAN
7. Simulate the following page replacement algorithms:
   a)FIFO b)LRU c) LFU

VI. Exercises/Experiments from assemblers, loaders and macroprocessor

1. Implement pass one of a two pass assembler.
2. Implement pass two of a two pass assembler.
3. Implement a single pass assembler.
4. Implement a two pass macro processor
5. Implement a single pass macro processor.
6. Implement an absolute loader.
7. Implement a relocating loader

CSL 333	DATABASE MANAGEMENT SYSTEMS LAB	Category	L	T	P	Credits	Year of introduction
		PCC	0	0	4	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.