CST308	COMPREHENSIVE COURSE WORK	CATEGORY	L	T	P	CREDIT	YEAR OF INTRODUCTION
		PCC	1	0	0	1	2019

Preamble: The objective of this Course work is to ensure the comprehensive knowledge of each student in the most fundamental core courses in the curriculum. Five core courses credited from semesters 3, 4 and 5 are chosen for the detailed study in this course work. This course helps the learner to become competent in cracking GATE, placement tests and other competitive examinations

Prerequisite:

1. **Data Structures**
2. **Operating Systems**
3. **Computer Organization And Architecture**
4. **Database Management Systems**
5. **Formal Languages And Automata Theory**

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

CO1 :	Comprehend the concepts and applications of data structures (Cognitive Knowledge Level: **Understand)**
CO2 :	Comprehend the concepts, functions and algorithms in Operating System (Cognitive Knowledge Level: **Understand)**)
CO3 :	Comprehend the organization and architecture of computer systems (Cognitive Knowledge Level: **Understand)**
CO4 :	Comprehend the fundamental principles of database design and manipulation (Cognitive Knowledge Level: **Understand)**
CO5 :	Comprehend the concepts in formal languages and automata theory 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	✓	✓										✓

Assessment Pattern

Bloom's Category	**End Semester Examination**
Remember	**10**
Understand	**20**
Apply	**20**
Analyse	
Evaluate	
Create	

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE Duration**
50	**0**	**50**	**1 hour**

End Semester Examination Pattern: Objective Questions with multiple choice, a maximum of four options. Question paper includes fifty questions of one mark each, distributed equally from all the five identified courses.

Syllabus

Full Syllabus of all five selected Courses.

1. **Data Structures(CST201)**
2. **Operating Systems(CST206)**
3. **Computer Organization And Architecture(CST202)**
4. **Database Management Systems(CST204)**
5. **Formal Languages And Automata Theory(CST301)**

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**DATA STRUCTURES**	
1.1	Mock Test on Module 1, Module 2 and Module 3	1 hour
1.2	Mock Test on Module 4 and Module 5	1 hour
1.3	Feedback and Remedial class	
2	**OPERATING SYSTEMS**	
2.1	Mock Test on Module 1 and Module 2	1 hour
2.2	Mock Test on Module 3, Module 4 and Module 5	1 hour
2.3	Feedback and Remedial class	1 hour
3	**COMPUTER ORGANIZATION AND ARCHITECTURE**	
3.1	Mock Test on Module 1, Module 2 and Module 3	1 hour
3.2	Mock Test on Module 4 and Module 5	1 hour
4	**DATABASE MANAGEMENT SYSTEMS**	
4.1	Mock Test on Module 1, Module 2 and Module 3	1 hour
4.2	Mock Test on Module 4 and Module 5	1 hour

4.3	Feedback and Remedial class	
5	**FORMAL LANGUAGES AND AUTOMATA THEORY**	
5.1	Mock Test on Module 1, Module 2 and Module 3	1 hour
5.2	Mock Test on Module 4 and Module 5	1 hour
5.3	Feedback and Remedial class	1 hour

Model Question Paper

QP CODE:

Reg No: _____

Name: _____ **PAGES : 9**

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SIXTH SEMESTER B.TECH DEGREE EXAMINATION, MONTH & YEAR

Course Code: CST308

Course Name: Comprehensive Course Work

Max. Marks: 50 **Duration: 1 Hour**

Objective type questions with multiple choices. Mark one correct answer for each question. Each Question Carries 1 Mark

1. Consider the following sequence of operations on an empty stack.
   push(22); push(43); pop(); push(55); push(12); s=pop();
   Consider the following sequence of operations on an empty queue.
   enqueue(32);enqueue(27); dequeue(); enqueue(38); enqueue(12); q=dequeue();
   The value of s+q is _____
   (A) 44 (B) 54 (C) 39 (D) 70

2. A B-tree of order (degree)5 and of height 3 will have a minimum of ___ keys.
   A. 624
   B. 249
   C. 124
   D. 250

3. Construct a binary search tree by inserting 8, 6, 12, 3, 10, 9 one after another. To make the resulting tree as AVL tree which of the following is required?
   (A) One right rotation only
   (B) One left rotation followed by two right rotations
   (C) One left rotation and one right rotation
   (D) The resulting tree itself is AVL

4. In a complete 4-ary tree, every internal node has exactly 4 children or no child. The number of leaves in such a tree with 6 internal nodes is:
   (A) 20 (B) 18 (C) 19 (D) 17

5. Select the postfix expression for the infix expression *a+b-c+d*(e/f)*.
   (A) ab+c-d+e*f/ (B) ab+c-def/*+
   (C) abc-+def/*+ (D) ab+c-def/*+

6. Consider a hash table of size seven, with starting index zero, and a hash function (2x + 5)mod7. Assuming the hash table is initially empty, which of the following is the contents of the table when the sequence 1, 4, 9, 6 is inserted into the table using closed hashing? Note that '_' denotes an empty location in the table.
   (A) 9, _, 1, 6, _, _, 4 (B) 1, _, 6, 9, _, _, 4
   (C) 4, _, 9, 6, _, _, 1 (D) 1, _, 9, 6, _, _, 4

7. **Compute the time complexity of the following function:**

```
void function(int n)
{
        int count = 0;
        for (int i=n/2; i<=n; i++)
                for (int j=1; j<=n; j = j + 2)
                        for (int k=1; k<=n; k = k * 2)
                                count++;
}
```

   A. $O(n^2 \log n)$
   B. $O(n \log^2 n)$
   C. $O(n^3)$
   D. $O(n \log n^2)$

8. How many distinct binary search trees can be created out of 6 distinct keys?
   (A) 7 (B) 36 (C) 140 (D) 132

9. Which tree traversal performed on a binary search tree, results in ascending order listing of the keys?
   A. Pre-order
   B. In-order
   C. Post-order
   D. Level-order

10. You are given pointers to first and last nodes of a singly linked list, which of the following operations are dependent on the length of the linked list?
   (A) Delete the first element
   (B) Insert a new element as a first element
   (C) Add a new element at the end of the list
   (D) Delete the last element of the list

11. Suppose a disk has 400 cylinders, numbered from 0 to 399. At some time the disk arm is at cylinder 58, and there is a queue of disk access requests for cylinder 66, 349, 201, 110, 38, 84, 226, 70, 86. If Shortest-Seek Time First (SSTF) is being used for scheduling the disk access, the request for cylinder 86 is serviced after servicing _____ number of requests.
   (A) 1 (B) 2 (C)3 (D)4

12. If frame size is 4KB then a paging system with page table entry of 2 bytes can address _____ bytes of physical memory.
   (A) 2^12 (B) 2^16 (C) 2^18 (D) 2^28

13. Calculate the internal fragmentation if page size is 4KB and process size is 103KB.
   (A) 3KB (B) 4KB (C) 1KB (D) 2KB

14. Which of the following scheduling policy is likely to improve interactiveness?
   (A) FCFS (B) Round Robin
   (C) Shortest Process Next (D) Priority Based Scgeduling

15. Consider the following program

```
        Semaphore X=1, Y=0
Void A ( )                          Void B ( )
{                                   {
    While (1)                           While (1)
    {                                   {
    P(X);                               P(Y);
    Print'1';                           P(X);
    V(Y);                               Print'0';
```

```
        }                                   V(X);
}                                           }
                                    }
```

The possible output of the program:

(A) Any number of 0's followed by any number of 1's.

(B) Any number of 1's followed by any number of 0's.

(C) 0 followed by deadlock

(D) 1 followed by deadlock

16. In a system using single processor, a new process arrives at the rate of 12 processes per minute and each such process requires 5 seconds of service time. What is the percentage of CPU utilization?

    (A) 41.66 (B) 100.00 (C) 240.00 (D) 60.00

17. A system has two processes and three identical resources. Each process needs two resources to proceed. Then

    (A) Deadlock is possible (B) Deadlock is not possible

    (C) Starvation may be present (D) Thrashing

18. Which of the following is true with regard to Round Robin scheduling technique?

    (A) Responds poorly to short process with small time quantum.

    (B) Works like SJF for larger time quantum

    (C) Does not use a prior knowledge of burst times of processes.

    (D) Ensure that the ready queue is always of the same size.

19. Thrashing can be avoided if

    (A) the pages, belonging to working set of programs, are in main memory

    (B) the speed of CPU is increased

    (C) the speed of I/O processor is increased

    (D) none of the above

20. The circular wait condition can be prevented by

    (A) using thread

    (B) defining a linear ordering of resource types

    (C) using pipes

    (D) all of the above

21. Consider the following processor design characteristics.

    I. Register-to-register arithmetic operations only

    II. Variable instruction format

    III. Hardwired control unit

Which of the characteristics above are used in the design of a RISC processor?

(A) I only (B) I and II only (C) I and III only (D) I, II and III

22. A 64-bit processor can support a maximum memory of 8 GB, where the memory is word-addressable (one word is of 64 bits). The size of the address bus of the processor is atleast ____ bits.
(A) 30 (B) 31 (C) 32 (D) None

23. The stage delays in a 4-stage pipeline are 900, 450, 400 and 350 picoseconds. The first stage (with delay 900 picoseconds) is replaced with a functionally equivalent design involving two stages with respective delays 600 and 550 picoseconds. The throughput increase of the pipeline is _____ percent.
(A) 38 (B) 30 (C) 58 (D) 50

24. Consider a direct mapped cache of size 256 Kilo words with block size 512 words. There are 6 bits in the tag. The number of bits in block (index) and word (offset) fields of physical address are is:
(A) block (index) field = 6 bits, word (offset) field = 9 bits
(B) block (index) field = 7 bits, word (offset) field = 8 bits
(C) block (index) field = 9 bits, word (offset) field = 9 bits
(D) block (index) field = 8 bits, word (offset) field = 8 bits

25. The memory unit of a computer has 1 Giga words of 64 bits each. The computer has instruction format, with 4 fields: an opcode field; a mode field to specify one of 12 addressing modes; a register address field to specify one of 48 registers; and a memory address field. If an instruction is 64 bits long, how large is the opcode field?
(A) 34 bits (B) 24 bits (C) 20 bits (D) 14 bits

26. A computer has 64-bit instructions and 28-bit address. Suppose there are 252 two-address instructions. How many 1-address instructions can be formulated?
(A) 2^24 (B) 2^26 (C) 2^28 (D) 2^30

27. Determine the number of clock cycles required to process 200 tasks in a six-segment pipeline.(Assume there were no stalls),each segment takes 1 cycle.
(A) 1200 cycles (B) 206 cycles (C) 207 cycles (D) 205 cycles

28. Match the following Lists:

P.DMA	1.Priority Interrupt
Q. Processor status Word	2.I/O Transfer
R. Daisy chaining	3.CPU

S. Handshaking 4.Asynchronous Data Transfer

(A) P-1, Q-3, R-4, S-2 (B) P-2, Q-3, R-1, S-4

(C) P-2, Q-1, R-3, S-4 (D) P-4, Q-3, R-1, S-2

29. Pipelining improves performance by:
    (A) decreasing instruction latency
    (B) eliminating data hazards
    (C) exploiting instruction level parallelism
    (D) decreasing the cache miss rate

30. The advantage of ..... is that it can reference memory without paying the price of having a full memory address in the instruction.
    (A) Direct addressing (B) Indexed addressing
    (C) Register addressing (D) Register Indirect addressing

31. Let E1, E2 and E3 be three entities in an E/R diagram with simple single-valued attributes. R1 and R2 are two relationships between E1 and E2, where R1 is one-to-many, R2 is many-to-many. R3 is another relationship between E2 and E3 which is many-to-many. R1, R2 and R3 do not have any attributes of their own. What is the minimum number of tables required to represent this situation in the relational model?
    (A) 3 (B) 4 (C) 5 (D) 6

32. Identify the minimal key for relational scheme R(U, V, W, X, Y, Z) with functional dependencies F = {U → V, V → W, W → X, VX → Z}
    (A) UV (B) UW (C) UX (D) UY

33. It is given that: “Every student need to register one course and each course registered by many students”, what is the cardinality of the relation say “Register” from the “Student” entity to the “Course” entity in the ER diagram to implement the given requirement.
    (A) M:1 relationship (B) M:N relationship
    (C) 1:1 relationship (D) option (B) or(C)

34. Consider the relation branch(branch_name, assets, branch_city)
    SELECT DISTINCT T.branch_name FROM branch T, branch S WHERE T.assets > L.assets AND S.branch_city = "TVM" .
    Finds the names of
    (A) All branches that have greater assets than all branches located in TVM.
    (B) All branches that have greater assets than some branch located in TVM.
    (C) The branch that has the greatest asset in TVM.
    (D) Any branch that has greater asset than any branch located in TVM.

35. Consider the following relation instance, where "A" is primary Key.

A1	A2	A3	A4
1	1	1	Null
5	2	5	1
9	5	13	5
13	13	9	15

Which one of the following can be a foreign key that refers to the same relation?
(A) A2 (B) A3 (C) A4 (D) ALL

36. A relation R(ABC) is having the tuples(1,2,1),(1,2,2),(1,3,1) and (2,3,2). Which of the following functional dependencies holds well?
(A) A → BC (B) AC → B (C) AB → C (D) BC → A

37. Consider a relation R with attributes A, B, C, D and E and functional dependencies A→BC, BC→E, E→DA. What is the highest normal form that the relation satisfies?
(A) BCNF (B) 3 NF (C) 2 NF (D) 1 NF

38. For the given schedule S, find out the conflict equivalent schedule.
S : r1(x); r2(Z) ; r3(X); r1(Z); r2(Y); r3(Y);W1(X); W2(Z); W3(Y); W2(Y)
(A) T1→T2→T3 (B) T2->T1->T3
(C) T3→T1→T2 (D) Not conflict serializable

39. Specialization is _____ process.
(A) top-down (B) bottom up
(C) Both (A) and (B) (D) none of these

40. If D1, D2, .., Dn are domains in a relational model, then the relation is a table, which is a subset of
(A) D1+D2+ … +Dn (B) D1×D2× … ×Dn
(C) D1 ∪ D2 ∪ ⋯ ∪ Dn (D) D1–D2– … –Dn

41. Which of the following strings is in the language defined by the grammar:
S -> aX
X -> aX|bX|b
(A) aaaba (B) babab (C) aaaaa (D) ababb

42. Consider the regular expression (x+y)*xyx(x+y)* where Σ = (x,y). If L is the language represented by this regular expression, then what will be the minimum number of states in a DFA recognizing L ?
(A) 2 (B) 3 (C) 4 (D) 5

43. Which of the following cannot handle the same set of languages?
    (A) Deterministic Finite Automata and Non-Deterministic Finite Automata
    (B) Deterministic Push Down Automata and Non-Deterministic Push Down Automata
    (C) All of these
    (D) None of these

44. Which of the following statement is correct?
    (A) L1 = { If $a^n b^n$ | n = 0,1, 2, 3 ..} is regular language
    (B) L2={ all strings of equal number of a's and b's } is not a regular language
    (C) Both L1 and L2 are regular
    (D) None of these

45. Which of the following problem(s) is/are decidable?
    (I) Whether a CFG is empty or not.
    (II) Whether a CFG generates all possible strings.
    (III) Whether the language generated by a Turing Machine is regular.
    (IV) Whether the language generated by DFA and NFA are same.
    (A) I and II (B) II and III (C) II and IV (D) I and IV

46. Consider the following languages
    L 1 = { a^n b^n c^m | n , m > 0 } and L 2 = { a^n b^m c^m | n , m > 0 }
    Which of the following statements is false?
    A) L1 intersection L2 is a context-free language
    B) L1 union L2 is a context-free language
    C) L1 and L2 are context-free language
    D) L1 intersection L2 is a context sensitive language

47. Which of the following regular expressions defined over the alphabet Σ = {0,1} defines the language of all strings of length l where l is a multiple of 3?
    (A) (0 + 1 + 00 + 11 + 000 +111)* (B) (000 + 111)*
    (C) ((0 + 1)(0 + 1)(0 + 1))* (D) ((000 + 01 + 1)(111 + 10 + 0))*

48. Determine the minimum number of states of a DFA that recognizes the language over the alphabet {a, b} consisting of all the strings that contain at least three a's and at least four b's.

    (A) 6 (B) 12 (C) 15 (D) 20

49. Which of the following is not true?
    (A) Power of deterministic finite automata is equivalent to power of non-deterministic finite automata.
    (B) Power of deterministic pushdown automata is equivalent to power of non-deterministic pushdown automata.
    (C) Power of deterministic Turing machine is equivalent to power of non-deterministic

Turing machine.

(D) All the above

50. Regular expression a+b denotes the set :
    (A) {a}
    (B) {Epsilon, a, b}
    (C) {a, b}
    (D) None of these

QNo	Ans. Key	QNo	Ans. Key	QNo	Ans. Key	QNo	Ans. Key	QNo	Ans. Key
1	(C)	11	(C)	21	(C)	31	(C)	41	(D)
2	(B)	12	(D)	22	(A)	32	(D)	42	(C)
3	(A)	13	(C)	23	(D)	33	(A)	43	(B)
4	(C)	14	(B)	24	(C)	34	(B)	44	(B)
5	(D)	15	(D)	25	(B)	35	(B)	45	(D)
6	(D)	16	(B)	26	(D)	36	(D)	46	(A)
7	(A)	17	(B)	27	(D)	37	(A)	47	(C)
8	(D)	18	(C)	28	(B)	38	(D)	48	(D)
9	(B)	19	(A)	29	(C)	39	(A)	49	(B)
10	(D)	20	(B)	30	(D)	40	(B)	50	(C)