SEMESTER -4

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT202	PRINCIPLES OF OBJECT ORIENTED TECHNIQUES	PCC	3	1	0	4

Preamble:

This course is intended to make the students capable of

1. Compare the capabilities of Object oriented and Procedure oriented programming languages.
2. Model the problem scenarios using object oriented concepts and UML.
3. Develop robust programs by optimally utilising the capabilities JAVA programming language.

Prerequisite: Programming Concepts

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

CO No	Course Outcomes	Bloom's Category
CO 1	Describe the specific capabilities of Object-Oriented paradigm compared to procedure oriented paradigm	Understand
CO 2	Explain the use of object oriented concepts to analyse the given problem.	Understand
CO 3	Describe the different inheritance features available in Java	Understand
CO 4	Construct robust programs using Exception Handling	Apply
CO 5	Construct applets utilising multithreading, event handling and Graphical User Interface, also model the problem scenarios using UML diagrams.	Apply

Mapping of course outcomes with program outcomes

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

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember			
Understand	25	25	50
Apply	25	25	50
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 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 student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Compare and contrast the implementation of data abstraction in procedure oriented and object oriented language.

2. Explain how encapsulation helps in data security. Justify your answer by comparing the scenario in procedure oriented languages.

3. Describe TWO features of object oriented programming languages that promote code reuse.

Course Outcome 2 (CO2):

1. Describe about the statement "String is a primitive data type or not in C++.

2. Describe the use of 'static' functions in C and Java.

Course Outcome 3(CO3):

1. Explain the difference between the object oriented design concepts of generalisation and specialisation, and describe how these relate to the inheritance feature in object oriented programming languages.
2. Describe how is-a and has-a inter-class relationships may be implemented in object oriented programming, giving code examples to support your answer.
3. What is multiple inheritance? Discuss how multiple inheritance is implemented in Java.

Course Outcome 4(CO4):

1. Experiment with runtime and compile time errors. Would you rather have an error discovered at run time or compile time?
2. Experiment with out of bound exception with example code.
3. Build java programs using following constructs.

   a) try {}

   b) catch {}

   c) throw()

Course Outcome 5(CO5):

1. Experiment with multithreaded applets.

2. Experiment with inter-process communication mechanism in java.

3. Design a class diagram of the following System: Vending Machine. A vending machine sells small, packaged, ready to eat items (chocolate bars, cookies, candies, etc.). Each item has a price and a name. A customer can buy an item, using a smart card (issued by the vending machine company) to pay for it. No other payment forms (i.e. cash, credit card) are allowed. The smart card records on it the amount of money available. The functions supported by the system are: Sell an item(choose from a list of items, pay item, distribute item)Recharge the machine Set up the machine (define items sold and price of items)Monitor the machine (number of items sold, number of items sold per type, total revenue)The

system can be used by a customer, a maintenance employee (who recharges items in the machines), an administrator (who sets up the machine).

Model Question paper

Course Code: ITT202

Course Name: PRINCIPLES OF OBJECT ORIENTED TECHNIQUES

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

PART A

Answer all Questions. Each question carries 3 Marks

1. Explain the use of 'static' functions in C and Java.
2. Comment on the statement "String is a primitive data type or not in C++.
3. Explain the use of 'this' keyword in Java.
4. Write a short note on implementation of "write once, run anywhere" concept in Java
5. Explain encapsulation using class in java.
6. Write short note on inner calss in Java.
7. Explain the use of dynamic method dispatch.
8. Differentiate between 'throw', 'throws', and 'Throwable'.
9. Explain event handling model with diagram.
10. Write short note on sand box security model for applets.

Part B

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

11.a) Compare and contrast the implementation of data abstraction in procedure oriented and object oriented language. 7Marks

b) Discuss how encapsulation helps in data security. Justify your answer by comparing the scenario in procedure oriented languages. 7 Marks

OR

12. a) Write a short note on garbage collection in java. 6 Marks

b) Describe with example, TWO features of object oriented programming languages that promote code reuse. 8 Marks

13. a) Compare and contrast overriding and overloading with examples.

6 Marks

b) With an example, discuss the use of passing objects as parameters.

8 Marks

OR

14.a) Discuss the uses of 'static' keyword with example scenarios. 7 marks

b) Examine the use of 'final' keyword in the context of access control.

7Marks

15.a) Explain the difference between the object oriented design concepts of generalisation and specialisation, and describe how these relate to the inheritance feature in object oriented programming languages. 6 marks

b) Describe how is-a and has-a inter-class relationships may be implemented in object oriented programming, giving code examples to support your answer.

8 Marks

OR

16.a) What is multiple inheritance? Discuss how multiple inheritance is implemented in Java. 7 marks

b) Compare and contrast the usage of abstract class and interface in Java. Give examples of each. 7 Marks

17.a) Discuss the difference between runtime and compile time errors. Would you rather have an error discovered at run time or compile time? 8 Marks

b) Explain out of bound exception with example code. 6 marks

OR

18. a) Explain the use of following constructs in Java with example.

i)try {}

ii)catch {}

iii)throw() 6 Marks

b) Elaborate on the interprocess communication mechanism in java.

8 Marks

19. a) Discuss how to implement a multithreaded applet with an example.

6 Marks

b) Explain with an example the event model in Java. 8 Marks

OR

20. a) Differentiate between static and dynamic models in UML. 4 Marks

b) Draw a class diagram of the following System: Vending Machine. A vending machine sells small, packaged, ready to eat items (chocolate bars, cookies, candies, etc.). Each item has a price and a name. A customer can buy an item, using a smart card (issued by the vending machine company) to pay for it. No other payment forms (i.e. cash, credit card) are allowed. The smart card records on it the amount of money available .The functions supported by the system are:Sell an item(choose from a list of items, pay item, distribute item)Recharge the machine Set up the machine (define items sold and price of items)Monitor the machine (number of items sold, number of items sold per type, total revenue)The system can be used by a customer, a maintenance employee (who recharges items in the machines), an administrator (who sets up the machine).

10 Marks

Syllabus

Module 1	No. of Lectures
Object-Oriented Programming vs Procedure-Oriented Programming, Procedural Languages - The Object-Oriented Approach - Characteristics of Object-Oriented Languages Objects –Classes – Inheritance – Reusability - Creating New Data Types - Polymorphism and Overloading ,Object oriented concepts in Java -Java Overview: Java virtual machine, data types, operators, control statements, Classes fundamentals, objects, methods, constructors, this keyword, Garbage collection	10 hours
Module 2	
Overloading Methods, Overloading Constructors, Using Objects as Parameters, Call by value and Call by reference, Acess control, use of static and final keywords, Nested and Inner classes	8 hours
Module 3	
Derived Class and Base Class, Usage of super keyword, Creating a Multilevel Hierarchy, Method Overriding, Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Definition and appliction of Packges and Interfaces	8 hours
Module 4	
Fundamentals of exception handling, Exception Types, Using try and catch, throw, throws, finally, Java's Built-in Exceptions, Creating Exception subclasses, the Java Thread Model, Creating a Thread, Creating Multiple Threads, Thread Priorities, Synchronization, Interthread	9 hours

Communication	
Module 5	
Event Handling-delegation event model, event classes, sources, listeners. String class - basics. Applet basics and methods, AWT- working with frames, graphics, color, font. AWT Control fundamentals. Swing overview, Introduction to Object Oriented Modelling ,Unified Modeling Language**,** UML class diagram, Use-case diagram, Familiarisation of UML tools, Case study	10 hours

Text Books

1. Herbert Schildt, Java: The Complete Reference, 8/e, Tata McGraw Hill, 2011.

2. Bahrami A., Object Oriented Systems Development using the Unified Modeling Language, McGraw Hill, 1999.

Reference Books

1. Flanagan D., Java in A Nutshell, 5/e, O'Reilly, 2005.

2. Sierra K., Head First Java, 2/e, O'Reilly, 2005.

3. Balagurusamy E., Programming JAVA a Primer, 5/e, McGraw Hill, 2014.

4. Barclay K., J. Savage, Object Oriented Design with UML and Java, Elsevier, 2004.

5. James Rumbaugh.,Unified Modeling Language Reference Manual,Addison-Wesley Professional,2005

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Object Oriented concepts**	**10 Hours**
1.1	Object-Oriented Programming vs Procedure-orientated Programming, Procedural Languages - The Object-Oriented Approach - Characteristics of Object-Oriented Languages	3 hours
1.2	Objects –Classes – Inheritance – Reusability - Creating New Data Types - Polymorphism and Overloading	3 hours
1.3	Object oriented concepts in Java -Java Overview: Java virtual machine, data types, operators, control statements, Classes fundamentals, objects, methods, constructors, this keyword, Garbage collection	4 hours
2	**Method overloading**	**8 Hours**

2.1	Overloading Methods, Overloading Constructors, Using Objects as Parameters	4 hours
2.2	Access control, use of static and final keywords, Nested and Inner classes	4 hours
3	**Inheritance**	**8 Hours**
3.1	Derived Class and Base Class, Usage of super keyword, Creating a Multilevel Hierarchy, Method Overriding	4 hours
3.2	Dynamic Method Dispatch, Using Abstract Classes, Using final with Inheritance, Definition and application of Packages and Interfaces	4 hours
4	**Exception handling and Multithreaded Programming**	**9 Hours**
4.1	Fundamentals of exception handling, Exception Types, Using try and catch, throw, throws, finally, Java's Built-in Exceptions, Creating Exception subclasses.	4 hours
4.2	The Java Thread Model, Creating a Thread, Creating Multiple Threads, Thread Priorities, Synchronization, Interthread Communication	5 hours
5	**Event Handling, AWT and UML**	**10 Hours**
5.1	Event Handling-delegation event model, event classes, sources, listeners. String class – basics. Applet basics and methods	3 hours
5.2	AWT- working with frames, graphics, color, font. AWT Control fundamentals. Swing overview	3 hours
5.3	Introduction to Object Oriented Modelling-Unified Modelling Language, UML class diagram, Use-case diagram, Familiarisation of UML tools, Case study	4 hours

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT204	COMPUTER ORGANIZATION	PCC	3	1	0	4

Preamble

This syllabus has been prepared to meet the following objectives.

1. To impart an understanding of the internal organization and operations of a computer.
2. To introduce the concepts of processor logic design.
3. To introduce the concept of pipe-lining and its hazards.
4. To understand and analyze various issues related to memory hierarchy.
5. To introduce the various modes of data transfer between CPU and I/O devices.

Prerequisite: ITT201 Digital System Design

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

CO No	Course Outcome(CO)	Bloom's Category
CO 1	Describe the basic organization of computer and different instruction formats and addressing modes.	Understand
CO 2	Analyze the basic operations and sequencing of control signals	Analyze
CO 3	Represent the design of registers and arithmetic logic unit	Understand
CO 4	Examine the concept of pipe-lining and various hazards associated with it	Analyze
CO 5	Compare the performance of memory systems like cache and DRAM and Select appropriate interfacing standards for I/O devices.	Analyze

Mapping of course outcomes with program outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	-	-	-	-	-	-	-	-	1	1
CO2	3	3	3	2	-	-	-	-	-	-	1	1
CO3	3	2	3	-	-	-	-	-	-	-	1	1
CO4	3	3	3	3	2	-	-	-	-	-	1	2
CO5	3	3	3	3	1	-	-	-	-	-	1	2

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Test		End-Semester Examination
	1	2	
Remember	12	8	16
Understand	10	12	24
Apply	20	20	40
Analyse	8	10	20
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 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 student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO1):
1.Explain the importance of different addressing modes in computer architecture with suitable example
2.How is the operation X = (A + B) * (C + D) / (E+F) is performed using:
a) Three address instruction
b) Two address instruction
c) One address instruction

Course Outcome 2 (CO2):

1. Enumerate the sequence of actions involved in executing an unconditional branch instruction.
2.Write down the sequence of actions needed to fetch and execute the instruction:
Store R6, X(R8).

Course Outcome 3 (CO3):

1.Draw the block diagram for the hardware that implements the following statement x + yz: AR ← AR + BR where AR and BR are two n-bit registers and x, y, and z are control variables. Include the logic gates for the control function. (The symbol + designates an OR operation in a control or Boolean function and an arithmetic plus in a micro operation.)
2. Illustrate the difference in performance of an Arithmetic Right Shifter & a Logical Right Shifter

Course Outcome 4 (CO4):

1.A5-stage pipelined processor has Instruction Fetch(IF), Instruction Decode (ID), Operand Fetch (OF), Perform Operation (PO) and Write Operand (WO) stages. The IF, ID, OF and WO stages take 1 clock cycle each for any instruction. The PO stage takes 1 clock cycle for ADD and SUB instructions, 3 clock cycles for MUL instruction, and 6 clock cycles for DIV instruction respectively. Operand forwarding is used in the pipeline. What is the number of clock cycles needed to execute the following sequence of instructions?

Instruction	Meaning of instruction
I1 :MUL R2 ,R0 ,R1	R2 = R0 *R1
I1 :DIV R5 ,R3 ,R4	R5 = R3/R4
I2 :ADD R2 ,R5 ,R2	R2 = R5+R2
I3 :SUB R5 ,R2 ,R6	R5 = R2-R6

2. The instruction pipeline of a RISC processor has the following stages: Instruction Fetch (IF), Instruction Decode (ID), Operand Fetch (OF), Perform Operation (PO) and Writeback (WB), The IF, ID, OF and WB stages take 1 clock cycle each for every instruction. Consider a sequence of 100 instructions. In the PO stage, 40 instructions take 3 clock cycles each, 35 instructions take 2 clock cycles each, and the remaining 25 instructions take 1 clock cycle each. Assume that there are no data hazards and no control hazards. How many clock cycles are required for completion of execution of the sequence of instruction?

Course Outcome 5 (CO5):

1. A computer has a 256 KByte, 4-way set associative, write-back data cache with block size of 32 Bytes. The processor sends 32 bit addresses to the cache controller. Each cache tag directory entry contains, in addition to address tag, 2 valid bits, 1 modified bit and 1 replacement bit. How many bits are there in the tag,set and word field of an address?
2. Discuss DRAM scheduling policies.

Course Outcome 6 (CO6):

1. What is the basic advantage of using interrupt initiated data transfer over transfer under program control without an interrupt? What is asynchronous data transfer? Explain in detail.
2. Explain the working of Universal Serial Bus (USB).

Model Question Paper

PART A **(10*3=30)**

(Each question carries 3 Marks)

1. What are fundamental phases of the instruction cycle?
2. The register R1 = 12, and R2= 13. The instruction ADD R1, R2 is in memory location 2000H. After the execution of the instruction, what will be the value of PC, MAR, IR and R1?.
3. What do you meant by logic micro operations?
4. Design a 4bit combination logic shifter.
5. "Increasing the number of pipeline stages will decrease the execution time of the program". True or False? Justify your answer.
6. What is operand forwarding? What is its significance?
7. For a 16KB, 4-way associative cache with block size 16 bytes, what is the number of tag bits per block if the physical address capacity is 16MB?
8. List the advantages of memory interleaving
9. Compare Polling and Vectored Interrupts.
10. What is DMA? What do you meant by Burst mode?

PART B **(5*14=70)**

(Each full question carries 14 marks)

11.a) Discuss the sequencing of control signals for the following instructions.

i) Load R1,10(R2) ii) Add R1, R2 (8 marks)

b) Compare and contrast memory mapped IO over programmed IO. (6 marks)

OR

12.a) Illustrate with example, explain the different types of addressing modes in a RISC processor. (9 marks)

b) Discuss how stack used for subroutine call. (5 marks)

13.a) Design a 4 bit arithmetic unit with two selection variables s0 and s1 and two n-bit data inputs A&B and input carry Cin

s1	s2	Cin=0	Cin=1	
0	0	F=A	F=A+1	
0	1	F=A+B	F=A+B+1	
1	0	F=A+B'	F=A+B'+1	
1	1	F=A-1	F=A	

(9 marks)

b) Explain the design of an accumulator. (5 marks)

OR

14. a) Design an adder/subtractor circuit with one selection variable s and two inputsA and B. When s=0, the circuit performs A+B and when s=1 it performs A-B, by taking 2's complement of B. (9marks)

b) Explain the design of status register. (5 marks)

15.a) Consider an instruction pipeline with four stages with the stage delays 5 nsec, 6 nsec, 11 nsec, and 8 nsec respectively. The delay of an inter-stage register stage of the pipeline is 1 nsec. What is the approximate speedup of the pipeline in the steady state underideal conditions as compared to the corresponding non-pipelined implementation? (5 marks)

b) Discuss structural hazards and control hazards with examples (9 marks)

OR

16. a) A 5-stage pipelined processor has the stages: Instruction Fetch (IF), Instruction Decode (ID), Operand Fetch (OF), Execute (EX) and Write Operand (WO). The IF, ID, OF, and WO stages take 1 clock cycle each for any instruction. The EX stage takes 1 clock cycle for ADD and SUB instructions, 3 clock cycles for MUL instruction, and 6 clock cycles for DIV instruction. Operand forwarding is used in the pipeline (for data dependency, OF stage of the dependent instruction can be executed only after the previous instruction completes EX). What is the number of clock cycles needed to execute the following sequence of instructions?

MUL R2,R10,R1
DIV R5,R3,R4
ADD R2,R5,R2
SUB R5,R2,R6 (7 marks)

b) Discuss various types data hazards in a RISC Instruction pipeline with appropriate examples. (7 marks)

17. a) Consider an application running on a multiprocessor system that takes 600 cycles, (during which processors are stalled), to handle a local cache miss leading to referencing a remote memory. The CPI for all references that hit in cache is 1 cycle. If 0.2% of cache access result in a local miss, how much faster will the system run if it has a perfect cache that never miss. (5 marks)

b) Discuss organization of DRAM in detail. (9 marks)

OR

18.a) Discuss open page and closed page row buffer management policy in DRAM Controller (9 marks)

b) Given a cell array of 8K(8192), with Clock cycle=4 and Clock Rate=133MHZ. In DRAM, the period for refreshing all rows is 16ms whereas 64ms in SDRAM. Find out the Refresh Overhead of SDRAM when compared to DRAM (5 marks)

19.a) Discus different types of interrupt handling methods (7 marks)

b) Explain the working of SCSI. (7 marks)

OR

20.a)Discuss various bus arbitration methods. (7 marks)

b) Explain the working of PCI. (7 marks)

Syllabus

Module 1 (10 hours)
Basic Structure and Operation of Computers – functional units –operational concepts – memory operations – addressing modes – instruction sequencing – basic I/O – subroutine calls – execution of a complete instruction – sequencing of control signals.
Module 2 (8 hours)
Processor Logic Design and Organization – register transfer logic – micro operations – conditional control statements. Design of arithmetic unit, logic unit, ALU and shifter – Accumulator.
Module 3 (9 hours)
RISC – RISC instruction set – pipelining – hazards and mitigation.
Module 4 (11 hours)
Memory – cache memory, mapping and performance improvement. DRAM organization. Memory controllers-scheduling
Module 5 (7 hours)
Peripheral Subsystem – I/O organization – interrupts – DMA – bus arbitration – standard I/O interfaces.

Text Books:

1. Patterson D.A. and J. L. Hennessey, Computer Organization and Design, 5/e, Morgan Kauffmann Publishers, 2013.
2. Hamacher C., Z. Vranesic and S. Zaky, Computer Organization,5/e, McGraw Hill,2011.
3. M. Morris Mano, Computer System Architecture, 3/e, Pearson Education, 2007.
4. Bruce Jacob, David T. Wang, and Spencer Ng, Memory Systems: Cache, DRAM, Disk, 1/e Morgan Kauffmann Publishers, 2007.

References:

1. William Stallings, Computer Organization and Architecture: Designing forPerformance, Pearson, 9/e, 2013.
2. Computer Architecture: Pipelined and Parallel Processor Design M.J. Flynn Published byNarosa Publishing House, 2012
3. Rajaraman V. and T. Radhakrishnan, Computer Organization and Architecture,Prentice Hall, 2011.
4. Messmer H. P., The Indispensable PC Hardware Book, 4/e, Addison-Wesley, 2001

Course Content & Lecture Schedule

Module 1: Fundamentals of Computer Organization		**10 hours**
1.1	Basic Structure of computers–functional units –basic operational concepts –bus structures –software.	**2 hours**
1.2	Memory locations and addresses –memory operations – instructions and instruction sequencing – addressing modes – ARM Example (programs not required).	**4 hours**
1.3	Basic I/O operations –stacks, subroutine calls. Basic processing unit – fundamental concepts –instruction cycle - execution of a complete instruction – multiple-bus organization –sequencing of control signals.	**4 hours**
Module 2:Processor Logic Design		**8 hours**
2.1	Register transfer logic –inter register transfer – arithmetic, logic and shift micro operations –conditional control statements.	**4 hours**
2.2	Design of arithmetic unit, logic unit, arithmetic logic unit and shifter – status register –processor unit –design of accumulator.	**4 hours**
Module 3: RISC Instruction Pipelining		**9 hours**
3.1	Introduction to RISC instruction set, load store architecture	**3 hours**
3.2	Overview of pipelining, pipelined datapath and control	**2 hours**
3.3	Pipeline hazards, hazard mitigation techniques.	**4 hours**
Module 4: Memory system : Cache & DRAM		**11 hours**
4.1	Introduction to cache memory, cache mapping, block replacement techniques, measuring and improving cache performance .	**4 hours**
4.2	Introduction to DRAM system, DRAM organization-Memory interleaving.	**2 hours**
4.3	Memory controllers, Address mapping, DRAM Scheduling policies, Row Buffer management policies- DRAM Refreshing	**5 hours**

	Module 5: Peripheral Subsystem	**7 hours**
5.1	I/O organization: accessing of I/O devices –interrupts	**2 hours**
5.2	Direct memory access –buses –bus arbitration	**2 hours**
5.3	Interface circuits –standard I/O interfaces (PCI, SCSI, USB)	**3 hours**

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT206	Database Management Systems	PCC	3	1	0	4

Preamble: Database Management Systems course is intended to deliver students the elementary concepts of a database management system and equips them to design and implement a database application built over those concepts. It also introduces to them advanced level areas like transaction processing, concurrency control and recovery management. The current trend, unstructured data - NoSQL is unveiled too.

Prerequisite: NIL

Course Outcome (CO): After completion of the course, the student will be able to

CO No.	CO	Bloom's Category
CO1	Describe the fundamental concepts of databases.	Understand
CO2	Construct an Entity-Relationship (ER) model and transform to relational schema.	Apply
CO3	Develop queries for relational database in the context of practical applications.	Apply
CO4	Model and design relational databases following the design principles.	Apply
CO5	Describe the concepts of control and recovery techniques in transaction processing and NoSQL database.	Understand

Mapping of Course Outcomes with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	3	-	-	-	-	-	-	-	-	-
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CO3	1	1	2	2	3	-	-	-	-	-	-	2
CO4	2	2	3	2	-	-	-	-	-	-	-	-
CO5	2	2	3	-	-	-	-	-	-	-	-	-

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests(Marks)		End Semester Examination (Marks)
	1	2	
Remember	5		30
Understand	30	20	30
Apply	15	30	40

Mark Distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks

Continuous Assessment Test (2 numbers) : 25 marks

Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 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 student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

CO1: Explain 3-Schema architecture of database system with the help of a neat diagram.

CO2: Construct an ER diagram for a college database given the following statements:

- A college contains many departments
- Each department can offer any number of courses
- Many instructors can work in a department
- An instructor can work only in one department
- For each department there is a Head
- An instructor can be head of only one department

- Each instructor can take any number of courses
- A course can be taken by only one instructor
- A student can enroll for any number of courses
- Each course can have any number of students

CO3: Build SQL queries for each of the following relation schema given below:

employee (employee-name, street, city)
works (employee-name, company-name, salary)
company (company-name, city)
manages (employee-name, manager-name)

a. Find the names, street addresses, and cities of residence of all employees who work for First Bank Corporation and earn more than $10,000.
b. Find all employees in the database who do not work for First Bank Corporation.
c. Find all employees in the database who earn more than each employee of Small Bank Corporation.
d. Find the company that has the most employees.
e. Find those companies whose employees earn a higher salary, on average, than the average salary at First Bank Corporation.

CO4: Experiment with the table shown below:

branchNo	*branchAddress*	*telNos*
B001	8 Jefferson Way, Portland, OR 97201	503-555-3618, 503-555-2727, 503-555-6534
B002	City Center Plaza, Seattle, WA 98122	206-555-6756, 206-555-8836
B003	14 – 8th Avenue, New York, NY 10012	212-371-3000
B004	16 – 14th Avenue, Seattle, WA 98128	206-555-3131, 206-555-4112

a. Why is this table not in 1NF?
b. Describe and illustrate the process of normalizing the data shown in this table to third normal form (3NF).
c. Identify the primary, alternate and foreign keys in your 3NF relations.

CO5: Consider the following four schedules due to three transactions (indicated by the subscript) using read and write on a data item x, denoted by r(x) and w(x) respectively. Check which one of them is conflict serializable.

a. r1(x); r2(x); w1(x); r3(x); w2(x)

b. r2(x); r1(x); w2(x); r3(x); w1(x)

c. r3(x); r2(x); r1(x); w2(x); w1(x)

d. r2(x); w2(x); r3(x); r1(x); w1(x)

Model Question paper

Course Code: ITT 206

Course Name: Database Management Systems

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

Part-A
(Answer all questions. Each question carries 3 marks)

1. List three significant differences between a file-processing system and a DBMS.
2. List three reasons why database systems support data manipulation using a declarative query language such as SQL, instead of just providing a library of C or C++ functions to carry out data manipulation.
3. Why are duplicate tuples not allowed in a relation?
4. What is union compatibility? Why do UNION, INTERSECTION, and DIFFERENCE operations require that the relations on which they are applied be union compatible?
5. What is done when INSERT operation violates one or more constraints?
6. What are assertions? How do they differ from triggers?
7. Let R(A,B,C,D,E,P,G) be a relational schema in which the following FDs hold: {AB->CD, DE->P, C->E, P->C, B->G}. What is the highest normal form the relation schema R is in?
8. Why are Armstrong's axioms considered sound and complete?
9. What are the ACID properties for data integrity in DBMS? Explain each of them.
10. Discuss about the lock compatibility matrix.

Part -B

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

Module -I

11.

a. Construct an E-R diagram for a hospital with a set of patients and a set of medical doctors. Associate with each patient a log of the various tests and examinations conducted. Make suitable assumptions that are valid. (8 marks)

b. Explain the 3-schema architecture for database systems with a diagram. (6 marks)

12.

a. Construct an E-R diagram for a car insurance company whose customers own one or more cars each. Each car has associated with it zero to any number of recorded accidents. Each insurance policy covers one or more cars and has one or more premium payments associated with it. Each payment is for a particular period of time, and has an associated due date, and the date when the payment was received. You can make suitable and valid assumptions. (8 marks)

b. What are the different types of database end users? Discuss the main activities of each. (6 marks)

Module -II

13.

a. Given below is the schema of a database that keeps track of student enrollment in courses and the books adopted for each course:

STUDENT(ssn, name, major, bdate)

COURSE(course#, cname, dept)

ENROLL(ssn, course#, quarter, grade)

BOOK_ADOPTION(course#, quarter, book_isbn)

TEXT(book_isbn, book_title, publisher, author)

Using relational algebra specify the following queries:

- List the number of courses taken by all students named John Smith in Winter 2009 (i.e., Quarter=W09).
- Produce a list of textbooks (include Course#, Book_isbn, Book_title) for courses offered by the 'IT' department that have used more than two books.
- List any department that has all its adopted books published by 'Pearson Publishing'.

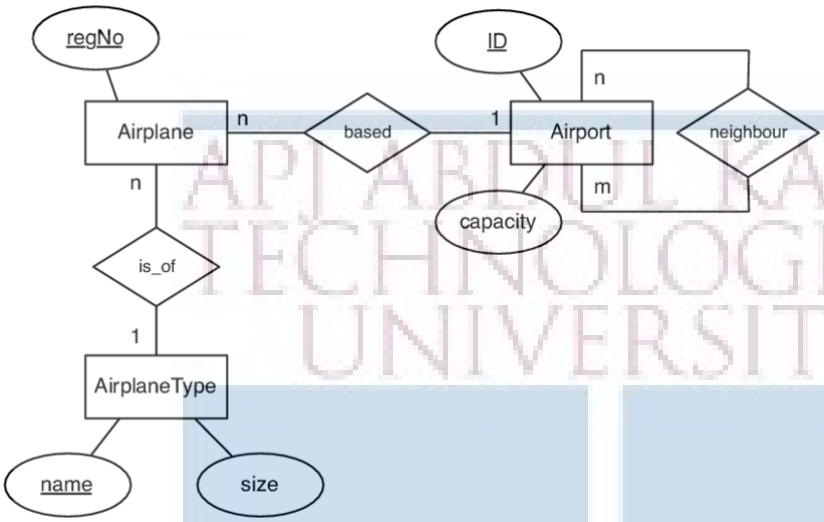
(9 marks)

b. What are the possible approaches for mapping binary 1:1 relations in an ER diagram?

(5 marks)

14.

a. Convert the ER model below into its equivalent relational schema: (5 marks)



b. Consider the following relational schema for a library:

MEMBER (memb_no, name, dob)

BOOKS (isbn, title, authors, publisher)

BORROWED (memb_no, isbn, date)

Write the following queries in relational algebra:

- Find the names of members who have borrowed any book published by "McGraw-Hill".
- Find the name and membership number of members who have borrowed more than five different books published by "MorganKaufmann".
- For each publisher, find the name and membership number of members who have borrowed more than five books of that publisher.

(9 marks)

Module-III

15.

a. For the EMPLOYEE schema given below:

EMPLOYEE (employee_name, street, city)

WORKS (employee_name, company_name, salary)

COMPANY (company_name, city)

MANAGES (employee_name, manager_name)

write SQL queries for the following:

- Find the names and cities of residence of all employees who work for "Gramin Bank Corporation".

- Find all employees in the database who earn more than each employee of "Co-operative Bank Corporation".
- Assume that the companies may be located in several cities. Find all companies located in every city in which "Kerala Bank Corporation" is located.
- Find the company that has the most employees. (9 marks)

b. Why does SQL not automatically eliminate duplicate tuples in the results of its queries? (5 marks)

16.

a. For the database schema given below:

STUDENT (name, stud_no, class, major)

COURSE (course_name, course_no, credit_hours, department)

SECTION (section_identifier, course_no, semester, year, instructor)

GRADE_REPORT (stud_No, section_identifier, grade)

PREREQUISITE (course_no, prerequsitie_no)

write SQL queries for the following:

- Insert a new student, <'Nikhila, 25, 1,'Math'>, in the database.
- Change the class of student 'Anirudh' to 2.
- Insert a new course, <'Knowledge Engineering', 'IT4390', 3, 'IT'>.
- Delete the record for the student whose name is 'Kripa' and whose student number is 17. (9 marks)

b. What is a correlated nested query in SQL? Give an example. (5 marks)

Module -IV

17.

a. Determine if the FD sets

F = {A → C, AC → D, E → AD, E → H} and

G = {A → CD, E → AH} are functionally equivalent. (7 marks)

b. Illustrate the following problems with suitable examples:

- Generation of spurious tuples
- Type-2 insertion anomaly

(7 marks)

18.

a. Using Ullman's algorithm, check whether the relation schema R(A,B,C,D,E) decomposed into R1(A,D), R2(A,B), R3(B,E), R4(C,D,E) and R5(A,E) and the FD set

{A -> C

B -> C

C -> D

DE->C

CE -> A}

is lossy or lossless. (7 marks)

b. Given an FD set F= {A->BC, B->C, A->B, AB->C}. Find its minimal cover. (7 marks)

Module -V

19.

a. With a diagram, discuss the various states of a transaction. (4 marks)

b. What is log based recovery? Explain deferred database modification. (10 marks)

20.

a. Explain the two-phase locking protocol. How does it implement lock conversions to assure serializability? (10 marks)

b. What are checkpoints? How are they implemented? (4 marks)

Syllabus

MODULE 1: INTRODUCTION (9 HOURS)
Fundamentals of Database Management Systems (DBMS),Database System Concepts and Architecture, Entity-Relationship Model, ER Diagrams
MODULE 2: RELATIONAL MODEL (8 HOURS)
Relational Model Concepts, Transformation of ER diagram to Relational Schema, Relational Algebra Operations
MODULE 3: STRUCTURED QUERY LANGUAGE (SQL) (11 HOURS)
SQL Overview, Data Manipulation Language (DML), Advanced DML
Module 4: DATABASE DESIGN (7 HOURS)
Database Design Guidelines, Normalization using Functional Dependencies
Module 5: TRANSACTION PROCESSING AND INTRODUCTION TO NoSQL (10 HOURS)
Transaction Processing Concepts, Characterizing Schedules, Concurrency Control Techniques, Recovery Techniques, Introduction to NoSQL Databases

Text Books

1. Elmasri R. and S. Navathe, *Database Systems: Models, Languages, Design and Application Programming*, Pearson Education, 2013.

2. Silberschatz A., H. F. Korth and S. Sudarshan, *Database System Concepts*, 6/e, McGraw Hill, 2011.

Reference Books

1. C.J.Date, A.Kannan, S.Swamynathan, ―An Introduction to Database Systems, Eighth Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, ―Database Management Systems, Fourth Edition, McGraw-Hill College Publications, 2015.
3. G.K.Gupta,"Database Management Systems", Tata McGraw Hill, 2011.
4. Xun (Brian) Wu, SudarshanKadambi, DevramKandhare, Aaron Ploetz, Seven NoSQL Databases in a Week:1st Edition, Kindle Edition.

Course Contents and Lecture Schedule

No.	Topic	No. of Lectures
1	**Introduction**	**9**
1.1	**Fundamentals of Database Management Systems**: Characteristics of DBMS, Database Users, Advantages of using DBMS.	2
1.2	**Database System Concepts and Architecture:** Data Models, Schemas, Instances and Database State. Three-Schema Architecture, Data Independence, Database Languages and Interfaces.	3
1.3	**Entity-Relationship Model**: Basic concepts - Entity, Attributes and Keys, Relationship Sets, Degree of Relationship Types, Roles and Structural Constraints.	2
1.4	**ER Diagrams**: Naming Conventions and Design Issues.	2
2	**Relational Model**	**8**
2.1	**Relational Model Concepts**: Domains, Attributes, Tuples and Relations, Relational Model Constraints and Relational Database Schemas.	3
2.2	**Transformation of ER diagram to Relational Schema.**	2
2.3	**Relational Algebra Operations:** SELECT, PROJECT, RENAME, Set Theoretic Operations, JOIN and DIVISION.	3
3	**Structured Query Language**	**11**

3.1	**SQL Overview**: Basic Structure, Data Definition Language Commands – CREATE, DROP and ALTER, Arithmetic Operations.	3
3.2	**Data Manipulation Language**: DML Commands - INSERT, SELECT, DELETE and UPDATE, Nested Queries, Set Operations, Aggregate Functions and Grouping, JOIN Operations	4
3.3	**Advanced DML:** Complex Queries, Views, Stored Procedures, Handling Exceptions and Triggers.	4
4	**Database Design**	**7**
4.1	**Database Design Guidelines**: Anomalies in Database Design – Insertion, Deletion and Modification, Functional Dependency (FD) – Closures, Armstrong's Axioms, Equivalence,Minimal Cover (proofs not required).	3
4.2	**Normalization using Functional Dependencies**: Normal Forms(NF) - INF, 2NF, 3NF and Boyce - Codd Normal Form, Lossless Join and Dependency Preserving Decompositions.	4
5	**Transaction Processing and Introduction to NoSQL**	**10**
5.1	**Transaction Processing Concepts**: Transaction Concepts, ACID Properties, Transaction States.	2
5.2	**Characterizing Schedules:** Based on Recoverability and Serializability.	2
5.3	**Concurrency Control Techniques**: Types of Locks, Lock Based Protocols-Two Phase Locking protocol, Timestamp Based Protocols, Deadlock and Starvation.	3
5.4	**Recovery Techniques**: Recovery Based on Deferred Update and Immediate Update, Shadow Paging.	2
5.5	**Introduction to NoSQL Databases**	1

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITL202	OBJECT ORIENTED TECHNIQUES LAB	PCC	0	0	3	2

Preamble:

This lab is intended to make the students capable of

Understanding the importance of Object Oriented Programming in designing the Software applications,

Implementing programs using Object oriented concepts of inheritance and polymorphism,

Analysing the given problem to design multithreaded programs,

Developing robust programs using exception handling features in Java.

Prerequisite: ITT202 PRINCIPLES OF OBJECT ORIENTED TECHNIQUES

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

CO No	Course Outcome(CO)	Bloom's Category
CO 1	**Solve** the given problem by applying Object oriented features and Java concepts.	Apply
CO 2	**Implement** the concept of method and constructor overloading	Apply
CO 3	**Implement** the concept of inheritance Apply	Apply
CO 4	**Use** the concept of multithreading and modify an existing program with proper exception handling	Apply
CO 5	**Build** Robust programs in JAVA using AWT and SWING	Apply

Mapping of course outcomes with program outcomes

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

3/2/1: High/Medium/Low

Assessment Pattern

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance : 15 marks
Continuous Assessment : 30 marks
Internal Test (Immediately before the second series test) : 30 marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks
(a) Preliminary work : 15 Marks
(b) Implementing the work/Conducting the experiment : 10 Marks
(c) Performance, result and inference (usage of equipments and trouble shooting) :25Marks
(d) Viva voce : 20 marks
(e) Record : 5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Develop a program in Java to display the details of bank account using Class.
2. Develop a program in Java to implement Stack operations using Class.
3. Construct a Java class to store some employee details and provide methods to set and get values.

Course Outcome 2 (CO2)

1. Develop a Java program to implement functions to display an input integer, string and float values using the concept of method overloading

2. The Fibonacci sequence is defined by the following rule. The first 2 values in the sequence are 1, 1. Every subsequent value is the sum of the 2 values preceding it. Develop a Java program that uses both recursive and no recursive functions to print the nth value of the Fibonacci sequence

Course Outcome 3(CO3):

1. Develop a Java program to read and print students data using inheritance Class person: name, age, gender
   Class student inherits from person: mark1, mark2, mark3, total marks, grade.

2. Develop a java program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contain only the method printArea( ) that prints the area of the given shape.

3. Suppose your institution wishes to maintain a database of its employees. The database is divided into a number of classes whose (Assistant Professor, Associate Professor, Professor etc). Construct a Super Class Person to store personal information. Derive all the above classes from the Class. Develop a Java program to specify all the classes and define functions to create the database and retrieve individual information as and when required. Support at least 5 employees on each category.

Course Outcome 4 (CO4):

1. DEvelop a Java application that executes two threads. One thread displays —"Hello" in every 1000 milliseconds and other displays — "World" in every 3000 milliseconds. Create the threads by extending the Thread class

2. Construct a Stack Class with proper exception handling mechanisms. While doing a Pop operation, if the stack is empty then display an error message. While doing a Push operation, if the stack is full then display corresponding error message.

3. Develop a java program that implements a multi-thread application that has three threads. First thread generates random integer for every 1 second and if the value is even, second thread computes the square of the number and prints and if the value is odd, the third thread will print the value of cube of the number.

Course Outcome 5 (CO5):

1. Develop a java program that simulates a traffic light using AWT. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "stop" or "ready" or "go" should appear above the buttons in a selected colour. Initially there is no message shown.

2. Develop a program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a NumberFormatException. If Num2 were Zero, the program would throw an Arithmetic Exception Display the exception in a message dialog box

3. Develop a Java program that works as a simple calculator using SWING. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.

LIST OF EXPERIMENTS

Cycle	Name of Experiment
I	Program to implement Simple Classes for understanding objects, member functions and Constructors. write Classes having: (i) Methods without arguments (ii) Methods with argument (iii) Constructors (iv) Methods with default arguments
II	Programs to implement (i) Method overloading (ii) Constructor overloading (iii) Static functions (iv) Inner class (v) Nested classes
III	Programs to implement Inheritance
IV	Programs to implement (i) Multi threading (ii) Exception handling (iii) Thread synchronization
V	Program to implement Graphical user Interface using: (i) AWT (i) SWING

Reference Books

1. Herbert Schildt, Java: The Complete Reference, 8/e, Tata McGraw Hill, 2011.
2. Flanagan D., Java in A Nutshell, 5/e, O'Reilly, 2005.
3. Sierra K., Head First Java, 2/e, O'Reilly, 2005.
4. Balagurusamy E., Programming JAVA a Primer, 5/e, McGraw Hill, 2014.

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITL204	DATABASE MANAGEMENT SYSTEMS LAB	PCC	0	0	3	2

Preamble:

Database Management Systems Lab course is intended to provide students a hands on experience in database management concepts. It also provides astrong formal foundation in database concepts, technology and practice to the students. It gives an exposure to design and develop applications.

Prerequisite:

CODE	COURSE NAME	DESCRIPTION	SEM
ITT206	Database Management Systems	Gives concepts of database management systems and exposure to database programming, modelling and design.	4

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

CO No.	DESCRIPTION	Blooms' Taxonomy
CO1	Construct database using DDL, DCL and basic DML commands in SQL.	Apply
CO2	Build nested and join queries.	Apply
CO3	Applyprocedural SQL concepts like view, exception handling, stored procedure, function, trigger, cursor in various database applications.	Apply
CO4	Design and develop database applications.	Create

Mapping of Course Outcomes with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12
CO1	2	1	2	-	1	-	-	-	-	-	-	1
CO2	2	2	1	1	1	-	-	-	-	-	-	-

CO3	3	2	2	1	-	-	-	-	-	-	-	-
CO4	2	3	3	2	-	-	-	-	-	-	-	-

3/2/1: High/Medium/Low

Assessment Pattern

Mark distribution

Total Marks	**CIE**	**ESE**	**ESE Duration**
150	75	75	2.5 hours

Continuous Internal Evaluation Pattern:

Attendance :15 marks
Continuous Assessment :30 marks
Internal Test (Immediately before the second series test) :30 marks

End Semester Examination Pattern: The following guidelines should be followed regarding award of marks

1. a. Database Design : 10 Marks
   b. Implementation of Project : 15 Marks
2. Performance, result and inference (usage of application tool and trouble shooting) : 25 Marks
3. Viva voce : 20 Marks
4. Record : 5 Marks

General instructions: Practical examination to be conducted immediately after the second series test covering entire syllabus given below. Evaluation is a serious process that is to be conducted under the equal responsibility of both the internal and external examiners. The number of candidates evaluated per day should not exceed 20. Students shall be allowed for the University examination only on submitting the duly certified record. The external examiner shall endorse the record.

LIST OF EXPERIMENTS (Experiments No.10 & 11 are not mandatory)

1. Familiarization of Data Definition Language (DDL)and Data Control Language (DCL) commands.
2. Familiarization ofData Manipulation Language (DML) commands (INSERT, SELECT, DELETE and UPDATE).
3. Implementation of various Aggregate functions and Groupingin SQL.
4. Implementation of Nested Queries.
5. Implementation of Join Queries.
6. Creation of Views.
7. Creation of Stored Procedures and Functions.
8. Exception Handling in SQL.
9. Creation of Triggers and Cursors.
10. Familiarization of Transaction Control Language(TCL) Commands.
11. Familiarization of NoSQL databaseusing MongoDB.
12. Develop an application to demonstrate database connectivity.

CLASS PROJECT (One project per group of at most four members)

Applications like Library Management System, Hospital Management System, Student Management Systems, Reservation Systems etc. can be considered as project topics.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Create a table project and for each project retrieve the project number, project name and the number of employees who work on that project.
2. Retrieve the social security number of all employees who work on project number 1,2 or 3

Course Outcome 2 (CO2)

3. Create a table employee with employee number, name, SSN, salary and department number and display the minimum salary of employee whose salary is greater than salary of all employees in department 5.

Course Outcome 3(CO3):

4. Createa SQL procedure application for exception using continue and exit handler

5. Create a table and perform cursor operations and trigger

Course Outcome 4 (CO4):

6. Develop a data driven GUI application in any domain (bank, library, hospital etc.)
    a. Implementation of student management system
    b. Implementation of any reservation system

Text Books

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts, McGraw-Hill Education (Asia), Fifth Edition, 2006.
2. AtulKahate, Introduction to Database Management Systems, Pearson
3. C. J. Date, A. Kannan and S. Swamynathan, An Introduction to Database Systems, Pearson Education, Eighth Edition, 2009.
4. Patrick O'Neil and Elizabeth O'Neil, Database Principles, Programming and Performance, Harcourt Asia Pte. Ltd., First Edition, 2001.
5. Peter Rob and Carlos Coronel, Database Systems Design, Implementation and Management, Thomson Learning-Course Technology, Seventh Edition, 2007.
6. RamezElmasri, Shamkant B. Navathe, Fundamentals of Database Systems (7th Edition), Pearson Education Ltd.
7. Shio Kumar Singh, Database Systems Concepts, Designs and Application, Pearson Education, Second Edition, 2011.

SEMESTER -4

MINOR

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT282	DATABASE MANAGEMENT	VAC	3	1	0	4

Preamble: This course aims at facilitating the student to understand the various functionalities of DBMS software and perform many operations related to creating, manipulating and maintaining databases for Real-world applications and student to understand the various designing concepts, storage methods, querying and managing databases.

Prerequisite: Nil

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

CO_NO	Course Outcome(CO)	Bloom's Category
CO 1	Impart the basic understanding of the theory and applications of database management systems.	Level 2 : Understand
CO 2	Give basic level understanding of internals of database systems.	Level 2 : Understand
CO 3	Construct simple and moderately advanced database queries using Structured Query Language (SQL)	Level 3: Apply
CO 4	Understand and successfully apply logical database design principles and database normalization.	Level 3: Apply
CO 5	Give understanding of organization of Physical Data in DBMS and expose to some of the recent trends in databases	Level 2 : Understand

Mapping of course outcomes with program outcomes

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

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	20
Understand	20	20	40
Apply	20	20	40

Analyse			
Evaluate			
Create			

Mark distribution

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

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 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 student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. Compare structured data and unstructured data?
2. Explain the advantages of DBMS?
3. Relate Entity, Entity Set, and Entity Type?

Course Outcome 2 (CO2)

1. Explain about Integrity Constraints
2. Describe views in DBMS?
3. Explain the purpose of DML commands in SQL

Course Outcome 3(CO3):

1. Develop SQL queries.
2. Experiment with the use of group by and having clause in sql

3. Build SQL query to find the name of the maximum salaried employee in each department

Course Outcome 4 (CO4):

1. Let R= (A, B, C, D, E, F) be a relation scheme with the following dependencies:

   C->F, E->A, EC->D, A->B. Identify the key for R?

2. Experiment with 3NF with example
3. Make use of lossless and dependency preserving decompositions?

Course Outcome 5 (CO5):

1. Explain the use of Query Optimization
2. Compare Non-clustered and clustered index
3. Explain the concept of ACID properties in DBMS
4. Explain Semantic Web, RDF, GIS

Model Question paper

Course Code: ITT282

Course Code: DATABASE MANAGEMENT

Max Marks:100 Duration: 3hr

PART A

Answer all questions, each carries 3 marks

1. List any three categories of database users, highlighting any one important characteristic of each category.

2. In a relationship of degree 2, how can we decide if an attribute of the relationship can be moved to one of the entity sets?

3. Distinguish between total and partial participation constraints with the help of real examples.

4. Illustrate DELETE and UPDATE clauses using typical examples.

5. Given a relation R(A,B,C,D,E,F) with functional dependencies A→B, B→D, D→EF, F→A, compute {D}+ and {EF}+.

6. What are fully functional dependencies and partial functional dependencies? Give an example to distinguish between these?

7. Define the following:

(a) physical record

(b) logical record

(c) blocking factor

8. How is clustering index different from primary index?

9. What are the desirable properties of transactions? Explain.

10. What is the significance of check-pointing. (10*3=30)

PART B

Answer all questions, each carries 14 marks

11. a) Design an ER diagram to represent the following scenario: A company has many employees working on a project. An employee can be part of one or more projects. Each employee works on a project for certain amount of time. Assume suitable attributes for entities and relations. Mark the primary key(s) and the cardinality ratio of the relations. (9)

b) What are logical data independence and physical data independence? What is the difference between them? Which of these harder to realize? Why? (5)

OR

12. a) With the help of neat diagram, explain three schema architecture of DBMS. (9)

b) How is weak entity type different from a strong entity type? Give an example. (5)

13. a) With the help of an example, compare DML and DDL. (6)

b) Consider the following relational schema:

Suppliers(sid:integer, sname:string, city:string, street:string)

Parts(pid:integer, pname:string, color:string)

Catalog(sid:integer, pid:integer, cost:real)

Write SQL query to find the names of all suppliers who have not supplied only blue parts.(8)

OR

14. a)Explain the aggregate functions in SQL? (6)

b) Consider the following relational schema:

employee(empId, empName, empDept)

customer(custId, custName, salesRepId, rating)

salesRepId is a foreign key referring to empId of the employee relation. Assume that each employee makes a sale to at least one customer. Write SQL query to find the names of all the employees with all their customers having a 'GOOD' rating. (8)

15. a) Explain three uses of attribute closure algorithm (5)
    b) Given a relation R(A,B,C,D,E,F,G, H) with keys BD and C and functional dependencies D→G, E→F and H→C, decompose the R into the highest normal form possible. (9)

OR

16. a) What are Armstrong's axioms (5)
    b) Given a relation R(A1,A2,A3,A4,A5) with functional dependencies A1→A2A4 and A4→A5, check if the decomposition R1(A1,A2,A3), R2(A1,A4), R3(A2,A4,A5) is lossless. (9)
17. a) Illustrate structure of B-Tree and B+-Tree and explain how they are different. (5)

    b) Consider an EMPLOYEE file with 10000 records where each record is of size 80 bytes. The file is sorted on employee number (15 bytes long), which is the primary key. Assuming un-spanned organization, block size of 512 bytes and block pointer size of 5 bytes, compute the number of block accesses needed for retrieving an employee record based on employee number if (i) No index is used (ii)Multi-level primary index is used. (9)

OR

18. a) Distinguish between dense index and sparse index (5)

    b) Explain heuristics-based query optimization. (9)

19. a) Check if the following schedules are conflict-serializable using precedence graph. If so, give the equivalent serial schedule(s). r3(X), r2(X), w3(X), r1(X), w1(X). (7)

    b) Explain the concept behind the following:

    (i) Log base recovery.

    (ii) Deferred database modification. (7)

OR

20. a) Why Concurrency Control Is Needed? What are the different types of problems we may encounter when two transactions run concurrently? Illustrate each problem with suitable examples. (7)

    b)Explain the characteristics of data in GIS. (7)

Syllabus

Module 1 (7 Hours)
Introduction: Data: structured, semi-structured and unstructured data, Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS. Database architectures and classification. Entity-Relationship Model: Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets.
Module 2 (8 Hours)
Relational Model: Structure of relational Databases, Integrity Constraints, synthesizing ER diagram to relational schema .**Database Languages:** Concept of DDL and DML relational algebra. **Structured Query Language (SQL**): Basic SQL Structure, Set operations, Aggregate Functions, nested sub-queries, Views, assertions and triggers.
Module 3 (10 Hours)
Relational Database Design: Different anomalies in designing a database, normalization, functional dependency (FD), Armstrong's Axioms, closures, Equivalence of FDs, minimal Cover. Normalization using functional dependencies, INF, 2NF, 3NF and BCNF, lossless and dependency preserving decompositions.
Module 4 (10 Hours)
Physical Data Organization: index structures, primary, secondary and clustering indices, Single level and Multi-level indexing, B+- Trees .Query Optimization: heuristics-based query optimization.
Module 5 (10 Hours)
Transaction Processing Concepts: overview of concurrency control and recovery acid properties, serial and concurrent schedules, conflict serializability, Two-phase locking, failure classification, storage structure, stable storage, log based recovery, deferred database modification, check-pointing, **Recent topics :** Semantic Web and RDF, GIS, biological databases .

Text Books

1. Elmasri R. and S. Navathe, Database Systems: Models,Languages,Design and Application Programming, 6e,2013.
2. Sliberschatz A., H. F. Korth and S. Sudarshan, Database System Concepts, 6/e, McGraw Hill, 2011.
3. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, McGrawHill Education, 3rd Edition, 2003.

Reference Books

1. Powers S., *Practical RDF*, O'Reilly Media, 2003.

2. Plunkett T., B. Macdonald, *et al.*, *Oracle Big Data Hand Book*, Oracle Press, 2013.
3. Peter Rob and Carlos Coronel, Database System- Design, Implementation and Management (7/e), Cengage Learning, 2007.

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Introduction**	**7 Hours**
1.1	Data: structured, semi-structured and unstructured data, Concept & Overview of DBMS	2
1.2	Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS, Database architectures and classification.	2
1.3	Entity-Relationship Model: Basic concepts, Design Issues, Mapping Constraints, Keys, Entity- Relationship Diagram, Weak Entity Sets.	3
2	**Relational Model**	**8 Hours**
2.1	Structure of relational Databases, Integrity Constraints, synthesizing ER diagram to relational schema	3
2.2	Database Languages**,** Concept of DDL and DML relational algebra.	2
2.3	Basic SQL Structure, Set operations, Aggregate Functions, nested sub-queries, Views, assertions and triggers.	3
3	**Relational Database Design**	**10 Hours**
3.1	Different anomalies in designing a database, normalization	3
3.2	Functional dependency (FD), Armstrong's Axioms, closures, Equivalence of FDs, minimal Cover.	3
3.3	Normalization using functional dependencies, INF, 2NF, 3NF and BCNF, lossless and dependency preserving decompositions.	4
4	**Physical Data Organization**	**10 Hours**
4.1	index structures, primary, secondary and clustering indices	3
4.2	Single level and Multi-level indexing, B+- Trees	3
4.3	Query Optimization: heuristics-based query optimization.	4
5	**Transaction Processing Concepts**	**10 Hours**
5.1	overview of concurrency control and recovery, acid properties, serial and concurrent schedules, conflict serializability	3
5.2	Two-phase locking, failure classification, storage structure, stable storage, log based recovery, deferred database modification, check-pointing	4
5.3	Semantic Web and RDF, GIS, biological databases.	3

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT284	COMPUTER NETWORKS	VAC	3	1	0	4

Preamble: The syllabus is prepared with a view to equip the Engineering Graduates to learn basic concepts in computer networking, and to design, inspect and evaluate network models and protocols for real world applications.

Prerequisite: Nil

Course Objectives

- To introduce the basic terminology and concepts used in computer networking
- To understand data link layer services and protocols
- To learn and apply the process of routing and IP addressing in Internet

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

CO No.	Course Outcome (CO)	Bloom's Category Level
CO 1	Examine different network design models and protocols	Level 1: Remember
CO 2	Inspect data link layer issues and protocols	Level 2: Understand
CO 3	Apply the process of routing and IP addressing in Internet	Level 3: Apply
CO 4	Understand transport layer services and congestion control mechanisms	Level 2: Understand
CO 5	Demonstrate the working of various application layer protocols such as HTTP, SMTP, POP3, FTP and DNS. Explain various Internet control protocols used to manage and monitor network traffic.	Level 2: Understand

Mapping of Course Outcomes with Program Outcomes

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

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category Levels	Continuous Assessment Tests		End Semester Examination
	1	2	
BL 1: Remember	10	10	20
BL 2: Understand	30	30	60
BL 3: Apply	10	10	20
BL 4: Analyse			
BL 5: Evaluate			
BL 6: Create			

Mark distribution

Total Marks	Continuous Internal Evaluation (CIE)	End Semester Examination (ESE)	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be *two* parts; **Part A** and **Part B**. Part A contain 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 student should answer *any one*. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO 1):

1. List the various layers of the OSI reference model.
2. What are the different types of network topologies?
3. What are the various devices used in different layers of the TCP/IP reference model.
4. Define a Protocol Data Unit (PDU).

Course Outcome 2 (CO 2):

1. Compare and contrast the functionalities of hubs, bridges and switches.
2. Explain the main features of Fast Ethernet?
3. Explain the different fields in IEEE 802.3 frame format?

4. Explain the techniques for detecting burst errors in data transmission.

Course Outcome 3 (CO 3):

1. Experiment with the working of Distance Vector Routing algorithm.
2. A block is assigned an IP address 201.99.88.119/22. Identify the IP address of the first and last host of this block.
3. What is super-netting? What is its application in classless addressing?
4. What is the relevance of Token Bucket algorithm in computer networks?

Course Outcome 4 (CO 4):

1. Explain the appropriateness of using a pseudo-header in TCP for computing checksum.
2. Illustrate the steps involved in TCP connection establishment and release.
3. Explain with the help of an example, the working of Remote Procedure Calls.
4. Describe the various congestion control mechanisms in transport layer.

Course Outcome 5 (CO 5):

1. Explain how a Domain Name System (DNS) works.
2. Compare link state routing algorithms with distance vector routing protocols
3. Explain the suitability of various error correcting codes to deal with single-bit and burst errors in data transmission.
4. Describe the major design issues in network layer.
5. Describe the working of SMTP, IMAP and POP3 mail transfer protocols.

Model Question Paper

Part A

Answer all questions. Each question carries 3 marks. (10 * 3 = 30 Marks)

1. List the main characteristics of different types of Computer Networks.
2. Define Maximum Transmission Unit (MTU) of a protocol data unit.
3. Briefly explain the various types of CSMA protocols.
4. A message 11001001 has to be transmitted using the CRC polynomial $x^3 + 1$ to protect it from errors. Compute the message that should actually be transmitted.
5. How does link state routing build and distribute the link state packets?
6. One of the IP addresses of a block of address is 201.99.88.119/22. Find the range of the assignable IP address.

7. What is traffic shaping? Compare traffic shaping with traffic policing.
8. Why is Token Bucket algorithm relevant in networks?
9. How can ARP and RARP be used to resolve addresses in computer networks?
10. What happens when an FTP control connection breaks while data transfer is in progress?

Part B

Answer all questions. Each question carries 14 marks. (5 * 14 = 70 Marks)

11. List and explain the main features of all the seven layers of the TCP/IP reference model.

OR

12. Explain the major design issues for the network layer.
13. Why do Ethernet frames require a minimum frame size? Discuss how Gigabit Ethernet solves this problem.

OR

14. How do burst errors occur? Explain how Hamming codes can be effectively used to deal with burst errors.
15. Compute the IP address of the 5^{th} host in the 6^{th} subnet of a network whose network address is given by 192.168.0.1 and subnet mask is given by 255.255.255.240.

OR

16. What is count-to-infinity problem? Discuss any two methods to practically solve this problem.
17. Illustrate with suitable examples, the operation of Go-Back-N and Selective-Repeat sliding window protocols.

OR

18. Describe the TCP segment header format. Clearly indicate the significance of each flag.
19. Differentiate between persistent and non-persistent HTTP connections. Discuss the message formats of HTTP request and response.

OR

20. Describe the working of SMTP, IMAP and POP3 protocols in a simple mail transfer scenario.

Syllabus

Module 1 (7 Hours)
Computer Networks - Types of Networks, Reference models - OSI and TCP/IP, Internet - The network edge, The network core, Network access, Delay and loss, Protocol layers and services - Design issues for the layers - Interface and Services
Module 2 (9 Hours)
Data Link layer design Issues - Flow Control and ARQ techniques, Services - Error detection and correction, Protocols - HDLC, MAC, Multiple access protocols, MAC Sub layer - IEEE 802 for LANs and MANs, IEEE 802.3, 802.4, 802.5, Devices - Hubs, Bridges and Switches, VLAN, High-speed LANs - Gigabit Ethernet.
Module 3 (10 Hours)
Network layer - services, IPv4 - IP Addressing - Classless and Classfull Addressing. Sub-netting and super-netting, Routing in Internet - Shortest path routing, Flooding, Distance Vector Routing, Link State Routing, RIP and OSPF, IPV6, Internet Multicasting, Multicast routing.
Module 4 (10 Hours)
Transport layer services and primitives, UDP - Segment Structure, Remote Procedure Call, TCP - Segment Header, Connection establishment and Release, Transmission Policy, Congestion Control - General principles, Quality-of-Service requirements - Traffic shaping.
Module 5 (9 Hours)
Internet Control and Management Protocols - ICMP, SNMP, ARP and RARP, Application Layer - HTTP - Overview, Persistent and non-persistent connections, Message formats, Cookies, FTP, Electronic Mail - SMTP, POP3 and IMAP, DNS - services and caching policies.

Text Books

1. F. Kurose and K. W. Ross, Computer Networking: A Top-Down Approach Featuring Internet, 6/e, Pearson Education, 2012.
2. A. S. Tanenbaum and D. J. Wetherall, Computer Networks, 5/e, Pearson, 2013.
3. L. L. Peterson and B. S. Davie, Computer Networks, A systems approach, 5/e, Morgan Kaufmann, 2011.

Reference Books

1. William Stallings, Computer Networking with Internet Protocols, Prentice-Hall, 2004.
2. Behrouz A. Forouzan, TCP/IP Protocol Suite, 4/e, Mc Graw Hill

3. Behrouz A. Forouzan, Data Communications and Networking, 4/e, Tata McGraw Hill.
4. Fred Halsall, Computer Networking and the Internet, 5/e.

Course Contents and Lecture Schedule

Sl. No.	Topic	No. of Lectures
1	**Computer Networks – Fundamentals**	**7 Hours**
1.1	Types of Networks, Reference models - OSI and TCP/IP.	2
1.2	Internet - The network edge, The network core, Network access, Delay and loss.	2
1.3	Protocol layers and services - Design issues for the layers - Interface and Services.	3
2	**Data Link layer**	**9 Hours**
2.1	Design Issues - Flow Control and ARQ techniques, Services - Error detection and correction.	3
2.2	Protocols - HDLC, MAC, Multiple access protocols, MAC Sub layer - IEEE 802 for LANs and MANs.	3
2.3	IEEE 802.3, 802.4, 802.5, Devices - Hubs, Bridges and Switches, VLAN, High-speed LANs - Gigabit Ethernet.	3
3	**Network layer**	**10 Hours**
3.1	Services, IPv4 - IP Addressing.	3
3.2	Classless and Classfull Addressing. Sub-netting and super-netting	3
3.3	Routing in Internet - Shortest path routing, Flooding, Distance Vector Routing, Link State Routing, RIP and OSPF, IPV6, Internet Multicasting, Multicast routing.	4
4	**Transport layer**	**10 Hours**
4.1	Services and primitives, UDP - Segment Structure, Remote Procedure Call.	3
4.2	TCP - Segment Header, Connection establishment and Release, Transmission Policy.	3
4.3	Congestion Control - General principles, Quality-of-Service requirements - Traffic shaping.	4
5	**Application layer**	**9 Hours**
5.1	Internet Control and Management Protocols - ICMP, SNMP, ARP and RARP.	3
5.2	Application Layer - HTTP - Overview, Persistent and non-persistent connections, Message formats, Cookies.	2
5.3	FTP, Electronic Mail - SMTP, POP3 and IMAP, DNS - services and caching policies.	4

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT286	SOFTWARE PROJECT MANAGEMENT TECHNIQUES	VAC	3	1	0	4

Preamble: The syllabus is prepared with the view of preparing the Engineering Graduates capable of understanding essential concept of software project management and software development process.

Prerequisite: Basics of programming, software engineering.

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

CO No.	Course Outcome (CO)	Bloom's Category
CO1	**List** the activities in Software Project Management.	Level 1: Remember
CO2	**Summarize** different Software Process Models	Level 2: Understand
CO3	**Explain** methods for software cost estimation	Level 2: Understand
CO4	**Analyze** Project Scheduling and risk management methods.	Level 3: Apply
CO5	**Illustrate** the methods to manage and control projects and people in an organization.	Level 2: Understand

Mapping of course outcomes with program outcomes

COs	PROGRAMME OUTCOMES (PO)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	-	1	-	-	2	-	3	1	3	1
CO2	-	-	-	-	-	-	-	-	2	2	3	1
CO3	2	1	-	1	2	-	-	-	3	3	3	1
CO4	1	3	-	-	1	-	-	-	3	3	3	1
CO5	-	1	-	1	1	-	3	-	2	2	3	1

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	20
Apply	20	20	70
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 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 student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO1):

1. List the characteristics which make software projects different from other project.
2. List out the activities within stepwise planning
3. What are the various activities covered by software project management.
4. Define portfolio management of software projects. Discuss with examples

Course Outcome 2 (CO2):

1. Illustrate SRUM in details
2. Explain the phases of software development
3. Describe the rapid software development method
4. Explain Agile model in detail.

Course Outcome 3 (CO3):

1. Write short note on reliability metrics.
2. Write the steps in cost-benefit analysis comprises
3. Classify the project sizing metrics.
4. Describe COCOMO model with appropriate data

Course Outcome 4 (CO4):

1. Experiment with network planning models.
2. Experiment with the different steps in project scheduling.
3. Make use of resource allocation and cost scheduling methods in software projects.

Course Outcome 5 (CO5):

1. Explain the methods to visualize the progress of the project.
2. Summarize the setting of checkpoints.
3. Illustrate the salient features of fixed price and time and material contract models
4. Explain the procedure of change control
5. Compare intrinsic and extrinsic motivation.
6. Explain the Oldham-Hackman job characteristic model
7. Explain in detail about the team structures

Model Question Paper

PART A **(10*3=30)**

(Each Question carries 3 Marks)

1. Identify the characteristics which make software projects different from other project.
2. List out the activities within stepwise planning
3. Examine the steps in cost-benefit analysis comprises
4. Classify the project sizing metrics.
5. Illustrate network planning models with example.
6. Define critical path.
7. Identify the methods to visualize the progress of the project.
8. Summarize the setting of checkpoints.
9. Differentiate intrinsic and extrinsic motivation.
10. List some obstacles for good group decision making

PART B **(5*14=70)**

11. Explain the various activities covered by software project management.

OR

12. Explain portfolio management of software projects. Discuss with examples.
13. Illustrate SRUM in details

OR

14. Describe COCOMO model with appropriate data.
15. Discuss the steps in project scheduling.

OR

16. Explain resource allocation and cost scheduling in software projects.
17. Illustrate the salient features of fixed price and time and material contract models

OR

18. Elaborate on the procedure of change control
19. Discuss in detail about the team structures

OR

20. Explain the Oldham-Hackman job characteristic model.

Syllabus

Module 1: Project Planning (8 hrs)
Introduction to Software Project Management, Management tasks
Module 2: Project Cost Estimation (10 hrs)
Software process and Process Models, Cost Estimation
Module 3: Project Scheduling and Risk Management (11 hrs)
Project schedules, Critical Path Analysis, Risk identification
Module 4: Project Management And Control (9 hrs)
Framework for Management and control, Analysis and Project tracking
Module 5: Project Staffing (7 hrs)
Managing people, methods of staff selection, Team structures

Text Books

T1. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Sixth Edition, Tata McGraw Hill, New Delhi, 2017

Reference Books

R1. Roger S. Pressman, Software Engineering: A practitioner's approach, 8th Edition (Indian Edition), McGraw Hill. 2019
R2. Harold Kerzner,Program Management-A System Approach Planning Scheduling And Controlling, 12th Edition, Wiley, 2017.
R3. Sunitha E.V, Sarath K.S, Software Project Management, Jyothis Publishers 2019.
R4. Jack Marchewka, Information Technology Project Management 5th edition. John Wiley & Sons (2012). ISBN: 978-1-118-91101-3. 2016.

Course Contents and Lecture Schedule

Sl. No	**Module 1: Project Planning**	**8hrs**
1.1	Introduction to Software Project Management – importance, Activities, Methodologies – types of Software Projects – Setting objectives.	2
1.2	Management Principles – Management Control – Project portfolio Management	2
1.3	Cost-benefit evaluation technology – Risk evaluation	2
1.4	Strategic program Management – Stepwise Project Planning.	2
	Module 2 Project Cost Estimation	**10 hrs**
2.1	Software process and Process Models – Rapid Application development – Agile methods	3
2.2	Extreme Programming – SCRUM – Managing interactive processes.	2
2.3	Basics of cost estimation – Effort and Cost estimation techniques – LOC, FP, COSMIC Full function points	3
2.4	COCOMO models - A Parametric Productivity Model.	2
	Module 3: Project Scheduling and Risk Management	**11 hrs**
3.1	Objectives of Activity planning – Project schedules – Activities	1
3.2	Sequencing and scheduling –Network Planning models – Forward Pass & Backward Pass techniques – Critical path (CRM) method.	3
3.3	Risk identification – Assessment – Monitoring – PERT technique	2
3.4	Monte Carlo simulation –Resource Allocation	2
3.5	Creation of critical patterns – Cost schedules.	3

	Module 4: Project Management And Control	**9hrs**
4.1	Framework for Management and control – Collection of data.	2
4.2	Project termination – Visualizing progress – Cost monitoring	2
4.3	Earned Value Analysis- Project tracking	2
4.4	Change control - Software Configuration Management	2
4.5	Managing contracts	1
	Module 5: Project Staffing	**7 hrs**
5.1	Managing people – Organizational behavior	1
5.2	Methods of staff selection – Motivation – The Oldham-Hackman job characteristic model	3
5.3	Ethical and Programmed concerns – Working in teams – Decision making – Team structures – Virtual teams – Communications genres – Communication plans.	3

SEMESTER -4

HONOURS

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT292	MATHEMATICAL FOUNDATION FOR NETWORKING	VAC	3	1	0	4

Preamble: The course is intended to provide the concepts of random variable, random processes and probability distribution. It also covers the basics of queuing theory and linear programming techniques.

Prerequisite: Background in calculus and linear algebra.

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

	Course outcomes	Bloom's Category
CO 1	Express linear programming and apply simplex method linear programming problem	Apply
CO 2	Apply sensitivity analysis on LPP and solve transportation problems	Apply
CO 3	Summarizethe characteristics of random processes and demonstrate the applications of Poisson processes.	Understand
CO 4	Compare and Contrast the various queuing models	Understand
CO 5	Apply the queuing theory on different applications	Apply

Mapping of course outcomes with program outcomes

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

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	20	20	20
Understand	20	20	70
Apply	10	10	10
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 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 student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

A progressive university has decided to keep its library open round the clock and gathered that the following numbers of attendants are required to re-shelve the books:

Time of day (hours)	Minimum number of attendants required
0–4	4
4–8	7
8–12	8
12–16	9
16–20	14
20–24	3

If each attendant works eight consecutive hours per day, formulate the problem of finding the minimum number of attendants necessary to satisfy the requirements above as a LP problem.

Course Outcome 2 (CO2)

Find the solution of the following problem using Karmarkar's method:

Minimize $f = 2x_1 + x_2 - \mathbf{x}_3$

subject to:

$x_2 - x_3 = 0$

$x_1 + x_2 + x_3 = 1$

$x_i \geq 0, i = 1, 2, 3$

Course Outcome 3(CO3):

Cars arrive at a gas station according to a Poisson process at an average rate of 12 cars per hour. The station has only one attendant. If the attendant decides to take a 2-minute coffee break when there are no cars at the station, what is the probability that one or more cars will be waiting when he comes back from the break, given that any car that arrives when he is on coffee break waits for him to get back?

Course Outcome 4 (CO4):

Consider an airport runway for arrivals only. Arriving aircraft join a single queue for the runway. Where, the service time is exponentially distributed with a rate μ = 27 arrivals / hour . And the Poisson arrivals with a rate λ = 20 arrivals / hour.

i. What will be the quantities of the queuing system?

ii. Suppose we are in holidays and the arrival rate increases λ = 25 arrivals / hour How will the quantities of the queuing system change?

iii. Now suppose we have a bad weather and the service rate decreases μ = 22 arrivals / hour ‰ How will the quantities of the queuing system change?

Course Outcome 5 (CO5):

Consider a steady state open network with three exponential nodes with parameters (μ1, μ2, μ3) and Poisson arrivals to node 1. Customers follow one of two routes through the network: node 1 to node 2 (with probability p) and node 2 to node 3 (with probability q=1-p). Write down the arrival rates λi at node i (i=1, 2, 3). Use Little's theorem and Jackson's theorem to obtain the mean waiting time spent by a customer in the network and show that if μ2= μ3, this is least when p = q =1/2.

Model Question paper

Course Code: ITT292

Course Name: MATHEMATICAL FOUNDATION FOR NETWORKING

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

PART A

Answer all Questions. Each question carries 3 Marks

1. How do you solve a maximization problem as a minimization problem?
2. How many basic solutions can an LP problem have? Why?

3. State the following LP problem in standard form:

$$\text{Maximize } f = -2x_1 - x_2 + 5x_3$$

subject to

$$x_1 - 2x_2 + x_3 \leq 8$$
$$3x_1 - 2x_2 \geq -18$$
$$2x_1 + x_2 - 2x_3 \leq -4$$

4. Write the dual of the following linear programming problem:

$$\text{Maximize } f = 50x_1 + 100x_2$$

subject to

$$2x_1 + x_2 \leq 1250$$
$$2x_1 + 5x_2 \leq 1000$$
$$2x_1 + 3x_2 \leq 900$$
$$x_2 \leq 150$$

where

$$x_1 \geq 0 \text{ and } x_2 \geq 0$$

5. University buses arrive at the Students' Centre to take students to their classes according to a Poisson process with an average rate of 5 buses per hour. Chris just missed the last bus. What is the probability that he waits more than 20 minutes before boarding a bus?

6. Calculate the autocorrelation function of the periodic function $X(t) = A\sin(\omega t + \varphi)$, where the period $T = 2\varphi/\omega$, and A, φ, and ω are constants.

7. Prove that the exponential distribution has both the lack of memory and the minimum property.

8. A monitor on a disk server showed that the average time to satisfy an I/O request was 100 milliseconds. The I/O rate was about 100 requests per second. What was the mean number of requests at the disk server?

9. Draw the state transition rate diagram of an M/M/C queueing model.

10. What do you mean by balking and reneging?

PART B

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

11. a. Find the solution of the following LP problem graphically: **(7 Marks)**

$$\text{Minimize } f = 3x_1 + 2x_2$$

subject to

$$8x_1 + x_2 \geq 8$$
$$2x_1 + x_2 \geq 6$$
$$x_1 + 3x_2 \geq 6$$
$$x_1 + 6x_2 \geq 8$$
$$x_1 \geq 0, x_2 \geq 0$$

b. Prove that the feasible region of a linear programming problem is convex. **(7 Marks)**

OR

12. A manufacturer produces three machine parts, A, B, and C. The raw material costs of parts A, B, and C are \$5, \$10, and \$15 per unit, and the corresponding prices of the finished parts are \$50, \$75, and \$100 per unit. Part A requires turning and drilling operations, while part B needs milling and drilling operations. Part C requires turning and

milling operations. The number of parts that can be produced on various machines per day and the daily costs of running the machines are given below:

Machine part	Number of parts that can be produced on		
	Turning lathes	Drilling machines	Milling machines
A	15	15	
B		20	30
C	25		10
Cost of running the machines per day	$250	$200	$300

Formulate the problem of maximizing the profit. **(14Marks)**

13. A metallurgical company produces four products, A, B,C, and D, by using copper and zinc as basic materials. The material requirements and the profit per unit of each of the four products, and the maximum quantities of copper and zinc available are given below:

	Product				Maximum quantity available
	A	*B*	*C*	*D*	
Copper (lb)	4	9	7	10	6000
Zinc (lb)	2	1	3	20	4000
Profit per unit ($)	15	25	20	60	

a. Find the number of units of the various products to be produced for maximizing the profit.
b. Find the effect of changing the profit per unit of product D to $30.
c. Find the effect of changing the available quantities of copper and zinc to 4000 and 6000 lb, respectively.
d. If product C requires 5 lb of copper and 4 lb of zinc (instead of 7 lb of copper and 3 lb of zinc) per unit, find the change in the optimum solution.

(14Marks)

OR

14. The Childfair Company has three plants producing child push chairs that are to be shipped to four distribution centers. Plants A, B, and C produce 12, 17, and 11 shipments per month, respectively. Each distribution center needs to receive 10 shipments per month. The distance from each plant to the respective distributing centers is given below:

	Distance			
	Distribution Centres			
	1	2	3	4

Plants	A	80 KM	130 KM	40 KM	70 KM
	B	110 KM	140 KM	60 KM	100 KM
	C	60 KM	120 KM	80 KM	90 KM

The freight cost for each shipment is Rs.100 per Kilometer. How much should be shipped from each plant to each of the distribution centers to minimize the total shipping cost?

a. Formulate this problem as a transportation problem by constructing the appropriate parameter table.
b. Draw the network representation of this problem.
c. Obtain an optimal solution.

(14 Marks)

15. Alan is conducting an experiment to test the mean lifetimes of two sets of electric bulbs labelled A and B. The manufacturer claims that the mean lifetime of bulbs in set A is 200 hours, while the mean lifetime of the bulbs in set B is 400 hours. The lifetimes for both sets are exponentially distributed. Alan's experimental procedure is as follows: He started with one bulb from each set. As soon as a bulb from a given set fails (or burns out), he immediately replaces it with a new bulb from the same set and writes down the lifetime of the burnt-out bulb. Thus, at any point in time he has two bulbs on, one from each set. If at the end of the week Alan tells you that 8 bulbs have failed, determine the following:

b. The probability that exactly 5 of those 8 bulbs are from set B.
c. The probability that no bulb will fail in the first 100 hours.
d. The mean time between two consecutive bulb failures. **(14Marks)**

OR

16. Two random processes X(t) and Y(t) are defined as follows: **(14Marks)**

$$X(t) = A\cos(\omega 1 t + \Theta)$$
$$Y(t) = B\sin(\omega 2 t + \Phi)$$

where ω1, ω2, A, and B are constants, and Θ and Φ are statistically independent random variables, each of which is uniformly distributed between 0 and 2π.

a. Find the cross correlation function $R_{XY}(t, t + \tau)$, and show that X(t) and Y(t) are jointly wide-sense stationary.
b. If Θ = Φ, show that X(t) and Y(t) are not jointly wide-sense stationary.
c. If Θ = Φ, under what condition are X(t) and Y(t) jointly wide-sense stationary?

17. a. An airport has a single runway. Airplanes have been found to arrive at the rate of 15 per hour. It is estimated that each landing takes 3 minutes. Assuming a Poisson process for arrivals and an exponential distribution for landing times. Find the expected number of airplanes waiting to land and expected waiting time. What is the probability that the waiting will be more than 5 minutes? **(6 marks)**

b. Explain Markovian Birth Death process and obtain the expressions for steady state probabilities. **(8 marks)**

OR

18. a. A tax consulting firm has 3 counters in its office to receive people who have problems concerning their income, wealth and sales taxes. On the averages 48 persons arrive in an 8 hr day. Each tax advisor spends 15 mins on the average on an arrival. If the arrivals are Poisson distributed and service times are according to exponential distribution, find (i) the average number of customers in the system. (ii) the average number of customers waiting to be serviced. (iii) the average time a customer spends in the system. **(6 marks)**

b. Derive Erlang B formula. **(8 marks)**

19. a. What is Pollaczek-Khinchin formula? Derive the expression. **(8 marks)**

b. Consider a closed Jackson network where the service time at each queue is independent of the number of customers at the queue. Suppose that for a given number of customers, the utilization factor of one of the queues, say queue I, is strictly larger than the utilization factors of the other queues. Show that as the number of customers increases, the proportion of time that a customer spends in queue I approaches unity. **(6 marks)**

OR

20. a. State and prove Jackson's theorem. (**8 marks)**

b. Write short notes on closed Jackson networks and cyclic queues. (**6 marks)**

Syllabus

Module 1: 9 hours
(Text-1: Relevant topics from chapter-3) Linear Programming I: Simplex Method – Applications of Linear Programming – Standard Form of a Linear Programming Problem – Geometry of Linear Programming Problems– Definitions and Theorems – Solution of a System of Linear Simultaneous Equations – Pivotal Reduction of a General System of Equations – Identifying an Optimal Point – Improving a Nonoptimal Basic Feasible Solution – Two Phases of the Simplex Method
Module 2 : 10 hours
(Text-1: Relevant topics from chapter-4) Linear Programming II: Duality in Linear Programming – Symmetric Primal–Dual Relations – General Primal–Dual Relations – Primal–Dual Relations When the Primal Is in Standard Form – Duality Theorems – Dual Simplex Method – Sensitivity or Postoptimality Analysis – Changes in the Right-Hand-Side Constants b_i – Changes in the Cost Coefficients c_j – Addition of New Variables – Changes in the Constraint Coefficients a_{ij} – Transportation Problem – Karmarkar's Interior Method – Statement of the Problem – Conversion of an LP Problem into the Required Form.
Module 3: 9 hours
(Text-2: Relevant topics from sections-8.1-8.5, 8.7, 10.5)

Random processes and classification, mean and autocorrelation, wide sense stationary (WSS) processes, autocorrelation and power spectral density of WSS processes and their properties, Poisson process-distribution of inter-arrival times, combination of independent Poisson processes(merging) and subdivision (splitting) of Poisson processes (results without proof)
Module 4: 9 hours
(Text-3: Chapter 1, Chapter 2 – Section 2.1 to 2.7) Introduction - Measures of System Performance, Characteristics of Queueing Systems, Little's Law, Some General Results. Stochastic Processes - Poisson Process, Exponential Distribution, Discrete Time Markov Chains, Continuous Time Markov Chains. Simple MarkovianQueueing Models - Birth-Death Processes - Single-Server Queues (M/M/1) – Multi server Queues (M/M/c) - Choosing the Number of Servers, Queues with truncation (M/M/c/K), Erlang's loss formula (M/M/c/c), Queues with unlimited service
Module 5 : 8 hours
(Text-3: Chapter 2- Section 2.8 to 2.12, Chapter 4- Section 4.1 to 4.4) **(M/G/1 Queue – Text-4 : Chapter 3, Section 3.5)** Finite Source Queues, State Dependent Service, Queues with Impatience, Transient Period, Busy Period Analysis, M/G/1 Queue, Series Queues, Open Jackson Networks, Closed Jackson Networks, Cyclic Queues

Text Books

1. Singiresu S. Rao, "Engineering Optimization: Theory and Practice, 4th Edition", Wiley 2009
2. Oliver C. Ibe, "Fundamentals of Applied Probability and Random Processes (Second Edition)", Academic Press, 2014
3. John F. Shortle, James M. Thompson, Donald Gross, Carl M. Harris, "Fundamentals of Queueing Theory, 5th Edition", Wiley 2018
4. Dimitri P. Bertsekas and Robert G. Gallager, "Data Networks," (2nd edition) Prentice Hall, 1992, ISBN 0132009161

Reference Books

1. Geoffrey R. Grimmett, David R. Stirzaker, Probability and Random Processes, Oxford University Press, USA; 3 edition, 2001.
2. Douglas C. Montgomery and George C. Runger, Applied Statistics and Probability for Engineers, Wiley, 2006.

3. Hamdy A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson Education (2008).

4. G. V. Reklaitis, A. Ravindran, K. M. Ragsdell, "Engineering Optimization: Methods and Applications", Wiley (2006).

5. Leonard Kleinrock, "Queueing Systems. Volume 1: Theory", Wiley-Interscience, 1975.

6. Leonard Kleinrock, "Computer Applications, Volume 2, Queueing Systems", Wiley-Interscience. 1975.

7. Karlin, K. and Taylor, H. M.," A First Course in Stochastic Processes", Academic Press. 1975

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**MODULE 1**	**9 hours**
1.1	Linear Programming I: Simplex Method – Applications of Linear Programming – Standard Form of a Linear Programming Problem	2 Hrs
1.2	– Geometry of Linear Programming Problems– Definitions and Theorems	2 Hrs
1.3	Solution of a System of Linear Simultaneous Equations – Pivotal Reduction of a General System of Equations	2 Hrs
1.4	Identifying an Optimal Point	1 Hrs
1.5	Improving a Nonoptimal Basic Feasible Solution – Two Phases of the Simplex Method	2Hrs
2	**MODULE 2**	**10 hours**
2.1	Duality in Linear Programming – Symmetric Primal–Dual Relations – General Primal–Dual Relations – Primal–Dual Relations When the Primal Is in Standard Form – Duality Theorems – Dual Simplex Method	3 Hrs
2.2	Sensitivity or Postoptimality Analysis – Changes in the Right-Hand-Side Constants b_i – Changes in the Cost Coefficients c_j – Addition of New Variables – Changes in the Constraint Coefficients a_{ij}	3 Hrs
2.3	Transportation Problem – Karmarkar's Interior Method – Statement of the Problem – Conversion of an LP Problem into the Required Form	4 Hrs
3	**MODULE 3**	**9 hours**
3.1	Random processes and classification, mean and autocorrelation,	3 Hrs

3.2	wide sense stationary (WSS) processes, autocorrelation and power spectral density of WSS processes and their properties,	3 Hrs
3.3	Poisson process-distribution of inter-arrival times, combination of independent Poisson processes(merging) and subdivision (splitting) of Poisson processes (results without proof)	3 Hrs
4	**MODULE 4**	**9 hours**
4.1	Introduction - Measures of System Performance, Characteristics of Queueing Systems, Little's Law, Some General Results.	2 Hrs
4.2	Stochastic Processes - Poisson Process, Exponential Distribution, Discrete Time Markov Chains, Continuous Time Markov Chains.	3 Hr
4.3	Simple MarkovianQueueing Models - Birth-Death Processes - Single-Server Queues (M/M/1) – Multi server Queues (M/M/c) -	2 Hrs
4.4	Choosing the Number of Servers, Queues with truncation (M/M/c/K), Erlang's loss formula (M/M/c/c), Queues with unlimited service	2 Hrs
5	**MODULE 5**	**8 hours**
5.1	Finite Source Queues, State Dependent Service	2 Hr
5.2	Queues with Impatience, Transient Period, Busy Period Analysis	3 Hr
5.3	M/G/1 Queue, Series Queues, Open Jackson Networks, Closed Jackson Networks, Cyclic Queues	3 Hrs

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT294	NUMBER THEORY	VAC	3	1	0	4

Preamble:

Number theory doesn't suffer too much abstraction and the consequent difficulty in conceptual understanding. Hence it is an ideal topic which acts like an essential bridge or tool from Mathematics to Information Technology. Important topics such as congruence, divisibility, Chinese remainder theorem, Classical results in Number theory, Application to ciphers are included in this course. Enthusiastic students will be able to acquire knowledge to read and enjoy their own more applications of Number theory.

Prerequisite: Linear Algebra and Calculus

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

CO No	Course Outcome(CO)	Bloom's Category
CO 1	Examine results involving divisibility, greatest common divisor, Least Common multiple and a few applications	Apply
CO 2	Demonstrate theory and methods to solve Linear Difference Equations	Understand
CO 3	Summarize theory of congruence	Understand
CO 4	Solve linear congruent equations	Apply
CO 5	Illustrate three classical theorems of Number theory and Apply number theory to ciphers.	Apply

Mapping of course outcomes with program outcomes

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

3/2/1: high/medium/low

Assessment Pattern

Bloom's Category	Continuous Assessment Tests		End Semester Examination
	1	2	
Remember	10	10	10
Understand	20	20	50
Apply	20	20	40

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 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 student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Course Level Assessment Questions

Course Outcome 1 (CO1):

1. State Division algorithm.

2. List the first 4 Catalan numbers.

3. Distinguish between Fibinacci and Fermat numbers.

Course Outcome 2 (CO2)

1. State Fundamental theorem of Arithmetic

2. What is 73 congruent modulo 8.

3. State Chinese Remainder Theorem

Course Outcome 3(CO3):

1. State Fermat's little theorem
2. List first 3 Mersenne primes
3. Define Euler's Phi function

Course Outcome 4 (CO4):

1. Describe any two primality tests
2. Find primitive roots of 23.
3. State Lagrange's theorem

Course Outcome 5 (CO5):

1. Define Affine cipher
2. Define Hill ciphers
3. What is RSA crypto system.

Model Question paper

Course Code: IIT294

Course Name: NUMBER THEORY

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

PART A

Answer all questions. Each question carries 3 marks

1. Define polygonal numbers with examples using recurrence relation.
2. Express 3ABCsixteen in base ten.
3. Prove that any two consecutive Fibanacci numbers are relatively prime.
4. Evaluate (2076; 1776).
5. State Fermat's Little theorem.
6. Compute $\sum_{d|n}\varphi(d)$ for n = 12.
7. Verify that 2 is a primitive root modulo 9.
8. Explain perfect numbers and Mersenne primes with example
9. Using the exponentiation modulus p = 3037 and the enciphering key e = 31, encipher the message 'ALL IS WELL '.
10. Briefly explain RSA-crypto system.

PART B

Answer one full question from each module. Each full question carries 14 marks

MODULE 1

11. (a) Find the number of positive integer less than 3076 which are

(i) Divisible by 19 (ii) Not divisible by 24 (iii) Divisible by 17

(b) Prove that there are infinitely many primes

12. (a) Find a formula for $\sum_{i=1}^{n} F_i$

(b) Show that $641 \mid f_5$

MODULE 2

13. (a) Find the number of trailing zeros in 234!

(b) Solve $12x \equiv 18 (\mathrm{mod} 15)$

14. (a) Solve for x such that $x \equiv 1 (\mathrm{mod} 3)$; $x \equiv 4 (\mathrm{mod} 5)$; $x \equiv 6 (\mathrm{mod} 7)$

(b) Find the canonical decomposition and positive factors of 2520

MODULE 3

15. (a) State and prove Wilson's theorem

(b) Determine if there exist a positive integer f(m) such that $a^{f(m)} \equiv 1 (\mathrm{mod}\, m)$ for m = 12.

16. (a) Find the number of positive integers less than 500 and relative prime to 500. Also find the number and sum of positive divisors of 500.

(b) Find the reminder when 24^{1947} is divided by 17.

MODULE 4

17. (a) Compute $\mathrm{ord}_{21} 5$

(b) Find the incongruent primitive roots modulo 19.

18. (a) State Lucas' theorem and verify that 823 is a prime using Lucas' theorem. (Take x= 2)

(b) Solve $8x^5 \equiv 3 (\mathrm{mod} 13)$

MODULE 5

19. (a) Using the matrix A = $A = \begin{bmatrix} 3 & 2 & 6 \\ 5 & 7 & 11 \\ 13 & 4 & 11 \end{bmatrix}$, encrypt the English proverb "A PROVERB IS THE CHILD OF EXPERIENCE ".

(b) Using the RSA enciphering modulus n = 2773 and the enciphering key e = 21, encrypt the message "SILENCE IS GOLDEN".

20. (a) Decrypt the cipher text message 0010 0325 2015 2693 2113 2398 2031 1857 that was created using the RSA enciphering key (e; n) = (21; 2773).

(b) Draw a block diagram for conventional cryptosystem and explain the terms.

Syllabus

Module 1 (9 hours)
Polygonal numbers – Pyramidal numbers – Catalan numbers – Division algorithm – Base b representations – Number patterns – Prime and composite numbers – Fibonacci and Lucas numbers – Fermat numbers
Module 2 (9 hours)
Greatest common divisor – Euclidean algorithm – Fundamental theorem of arithmetic – Least common multiple – Linear Diaophantine Equations – Congruences – Linear congruences – divisibility tests – Modular designs – Check digits – Chinese remainder theorem – General Linear systems - 2×2 Linear systems
Module 3 (11 hours)
Wilson's theorem – Fermat's little theorem – Euler's theorem – Euler's Phi function – Tau and Sigma function – Perfect numbers – Mersenne Primes
Module 4 (8 hours)
Order of a positive integer – Primality tests – Primitive roots of primes – Composites with primitive roots – The algebra of indices
Module 5 (8 hours)
Affine ciphers - Hill ciphers - Exponentiation ciphers – RSA Crypto system

Text Book

1. Thomas Koshy , "Elementary Number Theory with Applications (2/e)", Elsever Academic Press, 2007, ISBN: 978-0-12-372487-8.

Reference Books

1. David M Burton, "Elementary Number Theory (7/e)", McGraw Hill, 2011, ISBN : 978-0-07-338314-9

2. Gareth A Jones and J Mary Jones , "Elementary Number Theory", Springer Undergraduate Mathematics series, 1998, ISBN : 978-3-540-76197-6

3. Kenneth H Rosen, "Elementary Number Theory" (6/e)", Pearson Education, 2018, ISBN: 9780134310053

Course Contents and Lecture Schedule

No	Topic	No. of Lectures
1	**Module 1**	**9 Hours**
1.1	Polygonal numbers – Pyramidal numbers	1
1.2	Catalan numbers	1
1.3	Division algorithm	1
1.4	Base b representations – Number patterns	1
1.5	Prime and composite numbers	1
1.6	Fibonacci and Lucas numbers	3
1.7	Fermat numbers	1
2	**Module 2**	**9 Hours**
2.1	Greatest common divisor – Euclidean algorithm	1
2.2	Fundamental theorem of arithmetic - Least common multiple	1
2.3	Linear Diaophantine Equations	1
2.4	Congruences – Linear congruences	2
2.5	divisibility tests – Modular designs – Check digits	1
2.6	Chinese remainder theorem	2
2.7	General Linear systems - 2×2 Linear systems	1
3	**Module 3**	**11 Hours**
3.1	Wilson's theorem – Fermat's little theorem	4
3.2	Euler's theorem – Euler's Phi function	4
3.3	Tau and Sigma function	2
3.4	Perfect numbers – Mersenne Primes	1
4	**Module 4**	**8 Hours**
4.1	Order of a positive integer	2
4.2	Primality tests	3
4.3	Primitive roots of primes – Composites with primitive roots	2
4.4	The algebra of indices	1
5	**Module 5**	**8 Hours**
5.1	Affine ciphers	2
5.2	Hill ciphers	2
5.3	Exponentiation ciphers	2
5.4	RSA Crypto system	2

CODE	COURSE NAME	CATEGORY	L	T	P	CREDIT
ITT296	MICROPROCESSOR AND MICROCONTROLLER PROGRAMMING	VAC	2	1	1	4

Preamble: Microprocessor and Micro controller programming course is intended to deliver students the concepts of Microprocessors and Micro-controllers. It also helps them to learn how to write an 8051 program assembly language and also in C programming language. Introduction to Interfacing of micro-controllers, its use and applications are also covered in the syllabus.

Prerequisite: C programming

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

CO No	Course Outcome(CO)	Bloom's Category
-CO 1	Describe the basic architectures of microprocessor based systems	Understand
CO 2	Develop a simple assembly program for a 8086 microprocessor	Apply
CO 3	Design a basic 8051 program in Assembly language	Apply
CO 4	Simulate assembly programs using simulation tools and design 8051 programs in C programming language	Apply
CO 5	Utilize various interfacing techniques of micro-controllers	Apply

Mapping of course outcomes with program outcomes

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	-	2	-	-	-	-	-	1	3
CO3	3	3	3	-	2	-	-	-	-	-	1	3
CO4	3	3	3	-	3	-	-	-	-	-	1	3
CO5	3	-	-	-	3	3	-	-	3	2	3	3

3/2/1: High/Medium/Low

Assessment Pattern

Bloom's Category	Continuous Assessment Test		End Semester Examination
	1	2	
Remember	15	15	30
Understand	15	15	30
Apply	20	20	40
Analyse			
Evaluate			
Create			

Mark distribution

Total Marks	CIE	ESE	ESE Duration
150	50	100	3 hours

Continuous Internal Evaluation Pattern:

Attendance : 10 marks
Continuous Assessment Test (2 numbers) : 25 marks
Assignment/Quiz/Course project : 15 marks

End Semester Examination Pattern: There will be two parts; Part A and Part B. Part A contain 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 student should answer any one. Each question can have maximum 2 sub-divisions and carry 14 marks.

Sample Course Level Assessment Questions

Course Outcome 1 (CO1):
1. Differentiate CISC and RISC processors
2. With the help of an example show the set and reset conditions of CY, AC and P flag of 8051 micro controller

Course Outcome 2 (CO2):
1. Write an 8086 program to sort N numbers.

2. Write an 8086 program to find the sum of N numbers

Course Outcome 3 (CO3):

1. Write an 8051 program to find the factorial of a given number.
2.Write an 8051 assembly code to generate look up table for Fibonacci numbers.

Course Outcome 4 (CO4):

1. Write an 8051 C program to toggle bits of P1 ports continuously with 250 ms.
2. Write an 8051 C program to convert 11111101(FDH) to decimal and display the digits on port p0, p1 and p2.

Course Outcome 5 (CO5):

1. Explain the function of pins of 9 pin RS 232 connector
2. Illustrate different modes of operations of 8255 with respect to control words.

Model Question Paper

PART A **(10*3=30)**

(Each question carries 3 Marks)

1.Compare microprocessor, microcomputer and micro-controller

2.Differentiate PIC and AVR Micro-controllers

3.List the instructions which are used for memory operation in 8088 microprocessor.

4.Explain the purpose of the following signals in 8086

(i) READY (ii) HOLD

5.Write a program to do data conversions from HEX to ASCII in 8051 assembly code.

6.Explain MOV, MOVC, MOVX instructions of 8051 Micro-controller.

7. Discuss any three data types of 8051 C.

8. Illustrate with an example how arrays are used in 8051 C programs.

9.Describe different modes of operation of the following peripheral ICs:

i) 8255 ii) 8257

10.Write the Control Word Format in 8255.

PART B **(5*14=70)**

(Each full question carries 14 marks)

11. a) ExplainVan Neumann and Harvard Architecture. (6 marks)

b) Draw the memory map and briefly explain the memory organization for 128 byte internal RAM of 8051 micro-controller. (8 marks)

OR

12.a) Explain the functions of ports in 8051 micro-controller. How can P1 be used as both output and input port? (5 marks)

b) Draw the pin diagram of 8051 micro-controller and explain the function of each pin.(9 marks)

13. a) Compare the architectural features of 8086 and 8088 processors. (7 marks)

b) An array of 10 numbers is stored in the internal data RAM starting from location 30 H. Write an assembly language program to sort the array in ascending order starting from location 40 H. (7 marks)

OR

14. a) Draw the architectural diagram of 8086 microprocessor and explain. (9 marks)

b) Write an assembly program to add N numbers. (5 marks)

15. a) Assuming crystal frequency of 11.0592 MHz, write an 8051 assembly program to generate a square wave of 50Hz frequency on pin P2.0 of 8051 Micro-controller.
[Hint: Interfacing is not to be considered here for generating square wave] (6 marks)

b) Discuss the addressing modes of 8051 Instruction set. (8 marks)

OR

16. a) Write an 8051 based assembly language program to perform addition of two 2x2 matrices. (7 marks)

b) Write an 8051 based assembly language program to covert a hexadecimal number to a BCD. Number. (7 marks)

17. a) Write an 8051 C program to generate the 500us time delay using T1M2(timer1 and mode2). (7 marks)

b) Write an 8051 C program to read the P1.0 and P1.1 bits and then issue an ASCII character to P0 based on the following conditions. That is if the data from P1.1 and P1.0 is 00, send '0' if 01 send '1', if 10 send '2' . (7 marks)

OR

18. a) Write an 8051 C to get a byte of data from port P0. If the data is greater than 100 send it to P1 otherwise send it to P2. (7 marks)

b) Write an 8051 C program to toggle all the bits of P0, PI, and P2 continuously with a 250 ms delay.' Use the sfr keyword to declare the port addresses. (7 marks)

19. a) Explain the architecture of programmable interrupt controller 8259. (7 marks)

b)Explain the interfacing of 8 bit ADC using 8051 micro-controller. (7 marks)

OR

20. a) Explain Keyboard Display controller 8279. (5 marks)

b) Give the advantage of using 8279 for keyboard/display interface? What are scan lines used for? Explain (i) Encoded Scan Mode and (ii) Decoded scan mode. (9 marks)

Syllabus

Module 1:(8 hours)
Microprocessor Based Systems: Digital Computer, Microprocessor, Microcomputer, Micro-controller, Van Neumann and Harvard Architecture, CISC and RISC Processors; **Micro-controllers:** Historical background; organization and architectural features of micro-controller 8051 ,Introduction to AVR and PIC micro-controllers
Module 2:(10 hours)
Organization and architectural features of microprocessor 8086,Introduction to 8088 microprocessors, **Introduction of assembly language program**-Complete 8086 instruction set and Basic programs in assembly language for 8086 should be covered & asked in the exam.
Module 3:(9 hours)
8051 programming in Assembly language : Introduction to instruction set: instruction format, addressing modes of 8051, Data transfer instructions, I/O Port programming, Arithmetic and Logical instructions, Bit level instructions, Branching instructions , Concept of stack, subroutine and related instructions, writing programs (like time delay using loop, data conversions HEX to ASCII, BCD to ASCII, use of look up table etc) in assembly language 8051
Module 4:(10 hours)
Introduction to Program Development Environment (IDE)Tools: Introduction to a simulator: Edge Simulator- Edsim - Programming &Testing using IDE. **8051 Programming in C:**Data types, programming for time delay, I/O programming, Logic operations, Control statements and loops, Functions and Arrays in embedded C, Data conversion programs in 8051 C, Accessing code of ROM space & Data serialization using 8051 C.
Module 5:(8 hours)

Interfacing of micro-controllers: Interfacing of memory devices - data transfer techniques and I/O ports (8255); keyboard and display devices(8279) - programmable interrupt and DMA controllers (8257) - sensors, transducers, actuators, A/D and D/A Converters - standard interfaces - RS232, USB, Simple interfacing programs using 8051- (Group Mini projects can be given. Can be evaluated as Assignments. Interfacing programs need not be asked for exams)

Text Books

1. R. Gaonkar, Microprocessor Architecture, Programming, and Applications with the 8085, 6/e,Penram International Publishers.
2. A. Pal, Microprocessors: Principles and Applications, 1990,Tata McGraw-Hill.
3. K. J. Ayala, The 8051 Microcontroller Architecture, Programming and Applications, 2/e, Penram International Publishers.
4. Mazidi ,Mazidi, McKinlay, Microcontroller and Embedded Systems, 2/e, Pearson Education.
5. R. Kapadia, 8051 Microcontroller and Embedded Systems, 1/e, Jaico Publishing House.
6. Abubeker K M, 80C51 μC - Embedded C & ALP Programming-ISBN-978-1648921216, Notionpress publications, Singapore, 2020 , first edition.

Course Content and Course Schedule

	Module 1: Microprocessor Based Systems and Micro controllers	**8 hours**
1.1	Introduction to Digital Computer and Microprocessor	1 hour
1.2	Introduction to Microcomputer, Micro-controller	1 hour
1.3	Introduction to Van Neumann and Harvard Architecture	1 hour
1.4	Introduction to CISC and RISC Processors,	1 hour
1.5	Micro-controllers: Historical background	1 hour
1.6	Architecture of micro-controller 8051	1 hour
1.7	Register and memory organization of 8051	1 hour

1.8	Introduction to AVR, PIC and ARM micro controllers	1 hour
Module 2: Architecture of 8086 & Introduction of assembly language program		**10 hours**
2.1	Architecture of microprocessor 8086	1 hour
2.2	Memory Organization of 8086	1 hour
2.3	Introduction to 8088 microprocessor	1 hour
2.4	Introduction of assembly language program	1 hour
2.5	Instruction Types and Addressing modes	1 hour
2.6	Data transfer instructions, I/O Port programming, Arithmetic instructions	1 hour
2.7	Logical and Bit level instructions, Branching instructions	1 hour
2.8	Introducing Sample assembly language programs for 8086 (Square, Square Root & Cube Root of a Number, Factorial of an 8-bit Number, Generation of Fibonacci Series, HCF and LCM of Two Numbers, Bubble Sorting, Largest and Smallest Number of an Array, Code conversion – HEX to Decimal & ASCII to HEX, HEX to ASCII, BCD to ASCII and Matrix Addition. These programs can be done during tutorial/practical)	1 hour
2.9	Writing/Doing the above set of programs in assembly language for 8086 - Tutorial/Practical	1 hour
2.10	Writing/Doing the above set of programs in assembly language for 8086 - Tutorial/Practical	1 hour
Module 3: 8051 programming in Assembly language		**9 hours**
3.1	Introduction to instruction types and instruction format	1 hour
3.2	Introduction to Instruction sets and addressing modes of 8051	1 hour
3.3	Data transfer instructions, I/O Port programming, Arithmetic instructions	1 hour
3.4	Logical and Bit level instructions	1 hour
3.5	Branching instructions (Jump and loop Jump and call)	1 hour
3.6	Writing /Doing Programs in 8051-Tutorial/Practical	1 hour
3.7	Concept of stack, subroutine and related instructions	1 hour

3.8	Writing programs (like time delay using loop, data conversions HEX to ASCII, BCD to ASCII, use of look up table etc)in assembly language 8051	1 hour
3.9	Writing /Doing Programs in 8051-Tutorial/Practical	1 hour
Module 4: Introduction to Tools & 8051 Programming in C		**10 hours**
4.1	Introduction to Program Development Tools (IDE): Concept of IDE, Editor, Assembler, Compiler, Linker, Simulator, Debugger and assembler directives.	1 hour
4.2	Introduction to a simulator: Edge Simulator- Edsim - Programming using Simulator-Testing programs using IDE	1 hour
4.3	Writing /Doing Programs in 8051 using Tools -Practical in Lab	1 hour
4.4	8051 Programming in C: Data types in 8051 C	1 hour
4.5	Programming for time delay, I/O programming in 8051 C	1 hour
4.6	Logic operations in 8051 C, Control statements and loops in embedded C	1 hour
4.7	Doing Programs in 8051 using Tools - Practical in lab	1 hour
4.8	Functions and Arrays in embedded C, Data conversion programs in 8051 C	1 hour
4.9	Accessing code ROM space using 8051 C, Data serialization using 8051 C	1 hour
4.10	Doing Programs in 8051in C -Practical in lab	1 hour
Module 5: Interfacing of micro-controllers		**8 hours**
5.1	Introduction to Interfacing of micro-controllers: Use and Applications	1 hour
5.2	Interfacing of memory devices; data transfer techniques and I/O ports (8255)	1 hour
5.3	Interfacing of keyboard and display devices(8279)	1 hour
5.4	Programmable interrupt and DMA controllers (8257)	1 hour
5.5	Doing Interfacing programs in 8051 using Tools - Practical in lab	1 hour
5.6	Interfacing of sensors, transducers, actuators	1 hour
5.7	A/D and D/A Converters - standard interfaces - RS232, USB	1 hour
5.8	Doing Interfacing programs in 8051 using Tools - Practical in lab	1 hour