Scheme and Syllabus

For

M.Tech. Programme

In

(Information Technology, Computer Science & Engineering, Information Security)
And
(Electronics & Communication Engineering, Digital Communication, Signal Processing,
RF & Microwave Engineering, VLSI Design)

Of

Regular & Weekend Programme

Guru Gobind Singh Indraprastha University
Sector – 16 C, Dwarka
New Delhi – 110 078, India
www.ipu.ac.in
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#### (Regular Programme)

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(Computer Science & Engineering)
Regular Programme

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Master of Technology  
(Computer Science & Engineering)  
Regular Programme

**Third Semester**

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Master of Technology  
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Regular Programme

Fourth Semester

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*Non University Exam System

NOTE:

1. The total number of credits of the Programme M. Tech. = 108.
2. Each student shall be required to appear for examination in all courses, But for the award of the degree a student shall be required to earn the minimum of 100 credits out of 108. However only Elective Courses and Term papers may be dropped towards counting for total credits of 100 to award M. Tech. Degree.
Master of Technology  
(Information Technology)  
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First Semester

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Master of Technology  
(Information Technology)  
Regular Programme 

Second Semester

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Electives (Choose any TWO)

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### Master of Technology (Information Technology) Regular Programme

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Master of Technology  
(Information Technology)  
Regular Programme

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*Non University Exam System

**NOTE:**

1. The total number of credits of the Programme M. Tech. = 108.
2. Each student shall be required to appear for examination in all courses. But for the award of the degree a student shall be required to earn the minimum of 100 credits out of 108. However only Elective Courses and Term papers may be dropped towards counting for total credits of 100 to award M. Tech. Degree.
Master of Technology
(Information Security)
Regular Programme

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* NUES: Non University Examination
Master of Technology
(Information Security)
Regular Programme

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*Non University Exam System
Master of Technology
(Information Security)
Regular Programme

Third Semester

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*Non University Exam System
Master of Technology  
(Information Security)  
Regular Programme

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*Non University Exam System

NOTE:

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SCHEME OF EXAMINATION
M.Tech. (Electronics & Communication Engineering)
Regular Programme

FIRST SEMESTER EXAMINATION

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* NUES : Non University Examination
# SCHEME OF EXAMINATION

**M.Tech. - (Electronics & Communication Engineering)**

Regular Programme

## SECOND SEMESTER EXAMINATION

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**Total**

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Scheme of Examination for M.Tech.(Regular & weekend) Programme has been approved by BoS of USICT on dated 28/05/2012 and AC subcommittee on dated 6th July, 2012 and 5th November,2012. This scheme is effective from academic session 2015-16. Minor correction has been approved in BoS held on 16th September 2015. The correction has been approved in 40th meeting of Academic Council, dated 1st March, 2016.
SCHEME OF EXAMINATION
M.Tech. - (Electronics & Communication Engineering)
Regular Programme

THIRD SEMESTER EXAMINATION

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SCHEME OF EXAMINATION

M.Tech. - (Electronics & Communication Engineering)
Regular Programme

FOURTH SEMESTER EXAMINATION

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*Non University Exam System

NOTE:

3. The total number of credits of the Programme M. Tech. = 108.
4. Each student shall be required to appear for examination in all courses, but for the award of the degree a student shall be required to earn the minimum of 100 credits out of 108. However, only elective courses and Term Papers may be dropped towards counting for total credit of 100 to award M.Tech. Degree)
Master of Technology  
(Digital Communication)

First Semester

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Master of Technology
(Digital Communication)

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**Master of Technology**  
(Digital Communication)

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Master of Technology
(Digital Communication)

Fourth Semester

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Total: - 30

*Non University Exam System

NOTE:

1. The total number of credits of the Programme M. Tech. = 108.
2. Each student shall be required to appear for examination in all courses, but for the award of the degree a student shall be required to earn the minimum of 100 credits out of 108. However, only elective courses and Term Papers may be dropped towards counting for total credit of 100 to award M.Tech. Degree)
SCHEME OF EXAMINATION
M.Tech. (Signal Processing)

FIRST SEMESTER

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* NUES : Non University Examination
SCHEME OF EXAMINATION
M.Tech. (Signal Processing)
Regular Programme

SECOND SEMESTER

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* NUES : Non University Examination
### SCHEME OF EXAMINATION

M.Tech. (Signal Processing)
Regular Programme

#### THIRD SEMESTER EXAMINATION

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SCHEME OF EXAMINATION

*M.Tech. (Signal Processing)*

Regular Programme

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*Non University Exam System

NOTE:

1. The total number of credits of the Programme M. Tech. = 108.
2. Each student shall be required to appear for examination in all courses. However, for the award of the degree a student shall be required to earn the minimum of 100 credits (Elective Courses may be dropped only)
**SCHEME OF EXAMINATION**

*M.Tech. ((RF and Microwave Engineering))
Regular Programme*

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M.Tech. (RF and Microwave Engineering)

**SECOND SEMESTER**

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SCHEME OF EXAMINATION
M.Tech. (RF and Microwave Engineering)

THIRD SEMESTER

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Total  20  4  28
SCHEME OF EXAMINATION

M.Tech. (RF and Microwave Engineering)

FOURTH SEMESTER EXAMINATION

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*Non University Exam System

NOTE:

1. The total number of credits of the Programme M. Tech. = 108.
2. Each student shall be required to appear for examination in all courses, but for the award of the degree a student shall be required to earn the minimum of 100 credits out of 108. However, only elective courses and Term Papers may be dropped towards counting for total credit of 100 to award M.Tech. Degree)
# SCHEME OF EXAMINATION

**M.Tech. (VLSI Design)**

**Regular Programme**

## FIRST SEMESTER EXAMINATION

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**Total**

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* NUES : Non University Examination
SCHEME OF EXAMINATION

M.Tech. - (VLSI Design)
Regular Programme

SECOND SEMESTER EXAMINATION

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Practical/Viva voce

| MEVS-652  | Lab-4 (ESD Lab)                        | - | 2   | 1       | 226                 |
| MEVS-654  | Lab-5 (AVLSI Lab)                      | - | 2   | 1       | 226                 |
| MEVS-656  | Lab-6 (LPVLSI Lab)                     | - | 2   | 1       | 226                 |
| MEVS-658* | Term Paper II                          | - |    | 2       | 226                 |

Total 20 6 25

* NUES : Non University Examination
### SCHEME OF EXAMINATION

**M.Tech. - (VLSI Design)**  
Regular Programme

### THIRD SEMESTER EXAMINATION

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* NUES : Non University Examination
SCHEME OF EXAMINATION

M.Tech. - (VLSI Design)
Regular Programme

FOURTH SEMESTER EXAMINATION

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*Non University Exam System

NOTE:

3. The total number of credits of the Programme M. Tech. = 108.
4. Each student shall be required to appear for examination in all courses. However, for the award of the degree a student shall be required to earn the minimum of 100 credits (Elective Courses may be dropped only)
## SCHEME OF EXAMINATION
Master of Technology
(Computer Science & Engineering)
Weekend Programme

### First Semester

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The scheme is effective from academic session 2015-16. Minor correction has been approved in BoS held on 16th September 2015. The correction has been approved in 40th meeting of Academic Council, dated 1st March, 2016.
SCHEME OF EXAMINATION  
Master of Technology  
(Computer Science & Engineering) 
Weekend Programme  

Second Semester  

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Scheme of Examination for M.Tech.(Regular & weekend) Programme has been approved by BoS of USICT on dated 28/05/2012 and AC subcommittee on dated 6th July, 2012 and 5th November,2012. This scheme is effective from academic session 2015-16. Minor correction has been approved in BoS held on 16th September 2015. The correction has been approved in 40th meeting of Academic Council, dated 1st March, 2016.
The scheme of examination for M.Tech. (Regular & weekend) Programme has been approved by BoS of USICT on dated 28/05/2012 and AC subcommittee on dated 6th July, 2012 and 5th November, 2012. This scheme is effective from academic session 2015-16. Minor correction has been approved in BoS held on 16th September 2015. The correction has been approved in 40th meeting of Academic Council, dated 1st March, 2016.
### SCHEME OF EXAMINATION
Master of Technology
(Computer Science & Engineering)
Weekend Programme

#### Fourth Semester

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**Total** 12 2 17 -
SCHEME OF EXAMINATION
Master of Technology
(Computer Science & Engineering)
Weekend Programme

Sixth Semester

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NOTE:

1. The total number of credits of the Programme M. Tech. = 108.
2. Each student shall be required to appear for examination in all courses. However, for the award of the degree a student shall be required to earn the minimum of 100 credits (Elective Courses may be dropped only)
# SCHEME OF EXAMINATION

**Master of Technology**  
(Information Technology)  
Weekend Programme

**First Semester**

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SCHEME OF EXAMINATION
Master of Technology
(Information Technology)
Weekend Programme

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SCHEME OF EXAMINATION  
Master of Technology  
(Information Technology)  
Weekend Programme

Third Semester

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# SCHEME OF EXAMINATION
## Master of Technology
### (Information Technology)
#### Weekend Programme

## Fourth Semester

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SCHEME OF EXAMINATION
Master of Technology
(Information Technology)
Weekend Programme

Fifth Semester

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**NOTE:**

1. The total number of credits of the Programme M. Tech. = 108.
2. Each student shall be required to appear for examination in all courses. However, for the award of the degree a student shall be required to earn the minimum of 100 credits (Elective Courses may be dropped only)
SCHEME OF EXAMINATION
Master of Technology
(Electronics & Communication Engineering)
Weekend Programme

First Semester

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* NUES : Non University examination System
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* NUES : Non University examination System
SCHEME OF EXAMINATION
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Weekend Programme

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* NUES : Non University examination System
SCHEME OF EXAMINATION
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Weekend Programme

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* NUES : Non University examination System
SCHEME OF EXAMINATION
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Weekend Programme

Fifth Semester

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* NUES : Non University examination System
SCHEME OF EXAMINATION
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Sixth Semester

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*Non University Exam System

NOTE:

1. The total number of credits of the Programme M. Tech. = 108.
2. Each student shall be required to appear for examination in all courses, but for the award of the degree a student shall be required to earn the minimum of 100 credits out of 108. However, only elective courses and Term Papers may be dropped towards counting for total credit of 100 to award M.Tech. Degree)
MECS-601    Advanced Data Structure    L    T/P    C

4    0    4

INSTRUCTIONS TO PAPER SETTERS:

Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

Unit - 1

Elementary Data Structure: Arrays, Sparse Matrices, strings, stack, queues, Evaluation of Expressions, Linked list, Polynomials: Representation and Operations, binary Trees and operations, Binary search trees: Operation and Characteristics

Unit - 2

Binary Heaps, Amortized analysis of Data structures, Balanced Search Trees, AVL trees, augmented data structure, Red Black Trees and properties

Unit - 3

Graph representation and implementation, searching of a graph, application of BFS and DFS

Data structure for Sets, Disjoint Set and Union – find problem and implementation, Basic Hash function and collision resolution Hash Tables (Universal Hashing, Perfect Hashing) implementation and Applications

Unit - 4

External sorting, Multiway search trees, B and B + Trees implementation, Digital Search Trees, Multiway Tries, Suffix Trees and applications

Text:


References:

MECS-603 Advanced Software Engineering

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Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit.

Each question should be 10 marks

**Unit-I**
Introduction: Software Crisis, Software Processes & Characteristics, Software life cycle models, Waterfall, Prototype, Evolutionary and Spiral Models, Overview of Quality Standards like ISO 9001, SEI – CMM.

Software Requirements analysis & specifications: Requirement engineering, requirement elicitation techniques like FAST, QFD & Use case approach, requirements analysis using DFD, Data dMEionaries & ER Diagrams, Requirements documentation, Nature of SRS, Characteristics & organization of SRS.

**Unit-II**


**Unit-III**


**Unit-IV**


Test Books:

Reference Books:

Scheme of Examination for M.Tech.(Regular & weekend) Programme has been approved by BoS of USICT on dated 28/05/2012 and AC subcommittee on dated 6th July, 2012 and 5th November, 2012. This scheme is effective from academic session 2015-16. Minor correction has been approved in BoS held on 16th September 2015. The correction has been approved in 40th meeting of Academic Council, dated 1st March, 2016
MECS -605 Advances in Data & Computer communications  

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**INSTRUCTIONS TO PAPER SETTERS:**

Maximum Marks : 60

Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

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Each question should be 10 marks

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**Unit-I**


LAN Overview, Ethernet, High-Speed Ethernet, Gigabit Ethernet, Switched LAN Basics, Wireless LANs (IEEE 802.11)

**Unit-II**


Addressing in TCP/IP Networks, IPv6 & ICMPv6, ARP, RARP, Unicast Routing protocols, Multicast routing protocols, Advance features of IP routers.

**Unit-III**

User Datagram Protocol (UDP), Transmission Control Protocol (TCP) and Stream Controlled Transmission Protocol (SCTP)

DNS, Telnet, FTP & TFTP, Electronic-mail: SMTP, POP, IMAP, SNMP, WWW: HTTP

**Unit-IV**


Textbooks:


References:

2. Wayne Tomasi, “Introduction to Data communications and Networking”, Pearson Ed. 2007
4. Laurra Chappell (Ed), “Introduction to Cisco Router Configuration”, Techmedia
MECS -607 Advance Computer Architecture

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Unit-I

Parallel computer models:
The state of computing, Classification of parallel computers, Multiprocessors and multicomputers, Multivector and SIMD computers.

Program and network properties:
Conditions of parallelism, Data and resource Dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain Size and latency, Program flow mechanisms, Control flow versus data flow, Data flow Architecture, Demand driven mechanisms, Comparisons of flow mechanisms.

Unit-II

System Interconnect Architectures:
Network properties and routing, Static interconnection Networks, Dynamic interconnection Networks, Multiprocessor system Interconnects, Hierarchical bus systems, Crossbar switch and multiport memory, Multistage and combining network.


Unit-III

Pipelining: Linear pipeline processor, nonlinear pipeline processor, Collision free scheduling, Instruction pipeline Design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch Handling techniques, branch predMEion, Arithmetic Pipeline Design, Computer arithmetic principles, Static Arithmetic pipeline, Multifunctional arithmetic pipelines.

Unit-IV

Multiprocessors and Multicomputers: Multiprocessors System Interconnects, Hierarchal Bus system, Multistage and combining networks, Three generations of multicomputer, Message Passing Mechanism Deadlock and virtual channels,


TEXT BOOKS:

REFERENCES:
INSTRUCTIONS TO PAPER SETTERS:

Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

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Each question should be 10 marks

UNIT-I


UNIT-II

Struts, Struts architecture, Struts classes - ActionForward, ActionForm, ActionServlet, Action classes, Understanding struts-config.xml, Struts Tiles, Combining Struts and Tiles, Tiles file structure, Understanding Tiles Definitions and Attributes.

UNIT-III

Hibernate: Comparison between JDBC and HIBERNATE, Principles of Object Relational Mapping, Hibernate configuration, HQL making objects persistent, Hibernate semantics, Session management, flushing, concurrency and Hibernate, Optimistic and Pessimistic Locking, Object mapping Mapping simple properties, Single and multi valued associations, Bi-directional associations, Indexed collections, Querying, Session management, Transaction integration and demarcation.

UNIT-IV


Web Services: Interoperability in Web Services, Service-Oriented Architectures SOAP, SOAP message structure, handling errors WSDL, UDDI.

Text Books:

Reference Books:
1. Holzner , Struts : Essential skills , TMH
2. Reference Books:
5. Govind Sesadri, “Enterprise java Computing: Application and Architectures”, Cambridge University
6. Publications, 1999
7. Ivan Bayross , sharanam shah Java Server Programming , shroff Publishers
### INSTRUCTIONS TO PAPER SETTERS:

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**Unit-I**

MATLAB Usage and Computational Errors: Introduction to MATLAB, Types of Computer Errors, IEEE 64-bit Floating-Point Number Representation, Vectors in MATLAB, Efficient programming techniques

System of Linear Equations: Solution for a System of Linear Equations, Solving a System of Linear Equations, Inverse Matrix, Decomposition (Factorization), Iterative Methods to Solve Equations

**Unit-II**

Interpolation and Curve Fitting: Interpolation by Lagrange, Newton, and Chebyshev Polynomial, Hermite Interpolating Polynomial, Cubic Spline interpolation, Straight Line, Polynomial Curve, and Exponential Curve Fit, Fourier transform


**Unit-III**


Ordinary Differential Equations: Euler’s Method, Runge-Kutta Method, PredMEor-Corrector Method, Vector Differential Equations, Boundary Value Problem (BVP)

**Unit-IV**

Optimization: Unconstrained Optimization, Constrained Optimization, MATLAB Built-In Routines for Optimization, Matrices and Eigenvalues: Eigenvalues and Eigenvectors, Power Method, Jacobi Method

Partial Differential Equations: Elliptic, Hyperbolic, and Parabolic PDE, Finite Element Method (FEM) for solving PDE,

**Text Books**


**Reference Books**

2. ”Introduction to MATLAB® for Engineers”, W.J Palm, McGraw-Hill
Scheme of Examination for M.Tech.(Regular & weekend) Programme has been approved by BoS of USICT on dated 28/05/2012 and AC subcommittee on dated 6th July, 2012 and 5th November, 2012. This scheme is effective from academic session 2015-16. Minor correction has been approved in BoS held on 16th September 2015. The correction has been approved in 40th meeting of Academic Council, dated 1st March, 2016

MECS-613 Advanced Operating System

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Each question should be 10 marks

UNIT – I


Memory Management: Background, Logical versus Physical Address space, swapping, Contiguous allocation, Paging, Segmentation, Segmentation with Paging

Virtual Memory: Demand Paging, Page Replacement, Page-replacement Algorithms, Performance of Demand Paging, Allocation of Frames, Thrashing

UNIT – II


CPU Scheduling: Basic Concepts, Scheduling Criteria, Scheduling Algorithms, Multiple-Processor Scheduling, Real-Time Scheduling, Algorithm Evaluation

Process Synchronization: Background, The Critical-Section Problem, Synchronization Hardware, Semaphores, Classical Problems of Synchronization, Critical Regions, Monitors.

UNIT – III

Deadlocks: System Model, Deadlock Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, Recovery from Deadlock, Combined Approach to Deadlock Handling

Device Management: Techniques for Device Management, Dedicated Devices, Shared Devices, Virtual Devices; Device Characteristics-Hardware Consideration, Input or Output Devices, Storage Devices, Channels and Control Units, Independent Device Operation, Buffering, Multiple Paths, Block Multiplexing, Device Allocation Consideration,

Secondary-Storage Structure: Disk Structure, Disk Scheduling, Disk Management, Swap-Space Management, Disk Reliability, Stable-Storage Implementation

UNIT – IV


TEXT BOOKS:


REFERENCES:

MECS-615 Theory of Computation

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UNIT-I


UNIT-II


UNIT-III


UNIT-IV


TEXT BOOKS:

REFERENCES
Paper Code: MECS – 651  
Subject: Lab 1  
This Lab Course will be based on ADS.

Paper Code: MECS – 653  
Subject: Lab 2  
This Lab Course will be based on Advanced Software Engineering

Paper Code: MECS – 655  
Subject: Lab 3  
This Lab Course will be based on Advanced DCC

Paper Code: MECS – 657* (NUES)  
Subject: Term Paper I
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Paper Code: MECS – 602

L T C
Subject: Object Oriented Analysis & Design  4 0 4

INSTRUCTIONS TO PAPER SETTERS:

Work should be done on A4 size paper. There should be no margins. Each question should be answered in a separate sheet. Questions should be written legibly and clearly. Use blue or black ink.

Maximum Marks : 60

Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

UNIT I
Object Oriented Design Fundamentals: The object model - Classes and Objects, Complexity ,Classification, Notation, Process - Pragmatics - Binary and entity relationship, Object types - Object state, OOSD life cycle

UNIT II
Object Oriented Analysis: Overview of Object Oriented Analysis, Shaler/Mellor, Coad/Yourdon, Rumbaugh, Booch’s Approach towards the analysis, UML ,Usecase, Conceptual model, Behaviour ,Class, Analysis patterns, Overview, Diagrams, Aggregation.

UNIT III

UNIT IV
Managing Object Oriented Development Managing analysis and design - Evaluation testing - Coding - Maintenance Metrics, case Studies In Object Oriented Development Design of foundation class libraries - Object Oriented databases - Client/Server computing - Middleware.

Text Books:

Reference Books:
1. Yogesh Singh, RuchikaMalhotra , Object oriented software engineering, PHI 2012
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UNIT I
Relational Databases: Integrity Constraints revisited, Extended ER diagram, Relational Algebra & Calculus, Functional, Multivalued and Join Dependency, Normal Forms, Rules about functional dependencies.
Query Processing and Optimization: Valuation of Relational Operations, Transformation of Relational Expressions, Indexing and Query Optimization, Limitations of Relational Data Model, Null Values and Partial Information.

UNIT II
Deductive Databases :Datalog and Recursion, Evaluation of Datalog program, Recursive queries with negation.
Objected Oriented and Object Relational Databases: Modeling Complex Data Semantics, Specialization,Generalization, Aggregation and Association, Objects, Object Identity, Equality and Object Reference, Architecture of Object Oriented and Object Relational Databases
Parallel and Distributed Databases: Distributed Data Storage – Fragmentation & Replication, Location and Fragment Transparency Distributed Query Processing and Optimization, Distributed Transaction Modeling and concurrency Control, Distributed Deadlock, Commit Protocols, Design of Parallel Databases, Parallel Query Evaluation.

UNIT III
Active Database and Real Time Databases: Triggers in SQL, Event Constraint and Action: ECA Rules, Query Processing and Concurrency Control, Compensation and Databases Recovery
Image and Multimedia Databases: Modeling and Storage of Image and Multimedia Data, Data Structures – R-tree, k-d tree, Quad trees, Content Based Retrieval: Color Histograms, Textures, etc., Image Features, Spatial and Topological Relationships, Multimedia Data Formats, Video Data Model, Audio & Handwritten Data, Geographic Information Systems (GIS)

UNIT IV
WEB Database: Accessing Databases through WEB, WEB Servers, XML Databases, Commercial Systems.
Data Warehousing: Data Warehousing Architecture, Multidimensional Data Model, Update Propagation OLAP Queries. Data Mining: Knowledge Representation Using Rules, Association and Classification Rules, Sequential Patterns, Algorithms for Rule Discovery
Case Study: Oracle Xi

Text Books:

Reference Books:
INSTRUCTIONS TO PAPER SETTERS:

Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

UNIT I
Review of various Design and Analysis Techniques and their comparisons: Overview of Divide-and-Conquer, Dynamic Programming and Greedy Algorithms, Comparison of dynamic programming and Greedy algorithm with Knapsack as case study Theoretical foundation of greedy algorithm, Matroids and Greedy methods, A Task Scheduling problem as a Matroid. Comparisons of all techniques with reference to their time complexity, space complexity, guaranteed optimization and Stability.

UNIT II

UNIT III

UNIT IV

Text Books:

Reference Books:
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UNIT I
Introduction to software life cycle, Management activities in a software project,

Requirements engineering: Requirements Elicitation, Requirement Elicitation techniques, Requirement Analysis, Requirement Analysis Models, Requirement Documentation, Requirement Management

UNIT II
Size Estimation: Function Point Analysis from DFD’s, ER diagram, Function Point Analysis from Use Case Diagram & Class Diagram, Mask II FPA, LOC estimation, Conversion between size measures

UNIT III
Effort, schedule & cost estimation: Estimation factors, COCOMO-II, Estimation by Analogy, Validating Software Estimates
Tools: Software Estimation Tools

UNIT IV
Industry Resources; IFPUG, UQAM-SEMRL, COSMIC, IEEE, Two latest Research papers to be covered

Text Books:

Reference Books:
UNIT I

UNIT II
Processes and Inter-Process Communication: timers, polling vs interrupts, environment, fork, exec, wait, environment, exit and wait, pipe, fifos, message queues, semaphore

UNIT III
Network Programming: Sockets, Operation, Socket types, Domains Name Binding, Closing Sockets, I/O Multiplexing, Client/Server Models, Connection Based Services, Handling Out of Band Data, Connectionless Services, Design issues of Concurrent and iterative servers, Socket options

UNIT IV
XDR and Remote Procedure Calls, Network Programming at the level of Programming Language (can use Java or Python as case study)

Text Books:

Reference Books:
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UNIT I

UNIT II

UNIT III

UNIT IV
Rough Sets: Introduction, Imprecise categories Approximations and Rough Sets, Reduction of Knowledge, Decision Tables, and Applications.

Text Books:

Reference Books:
INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60

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Each question should be 10 marks

UNIT I
System definition and components, stochastic activities, continuous and discrete systems, system modeling, types of models, static and dynamic physical models, static and dynamic mathematical models, full corporate model, types of system study.

UNIT II
System simulation, why & when to simulate, nature and techniques of simulation, comparison of simulation and analytical methods, types of system simulation, real time simulation, hybrid simulation, simulation of pure-pursuit problem, single-server queuing system and an inventory problem, Monte-Carlo simulation, Distributed Lag models, Cobweb model.

UNIT III
Simulation of continuous systems, analog vs. digital Simulation, Simulation of water reservoir system, Simulation of a servo system, simulation of an autopilot, Discrete system simulation, fixed time-step vs. even to even model, generation of random numbers, test for randomness, Monte-Carlo computation vs. stochastic simulation. System dynamics, exponential growth models, exponential decay models, modified exponential growth models, logistic curves, generalization of growth models, system dynamic diagrams

UNIT IV
Introduction to SIMSCRIPT: Program, system concepts, origination, and statements, defining the telephone system model.
Simulation of PERT Networks, critical path computation, uncertainties in activity duration, resource allocation and consideration. Simulation languages and software, continuous and discrete simulation languages, expression based languages, object oriented simulation, general purpose vs. application - oriented simulation packages, CSMP-III, MODSIM-III.

Text Books:

Reference Books:
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UNIT I
Introduction:
What is measurement and why do it? Measurement in software engineering, scope of software metrics.
The Basics of Measurement:
Representational theory, Measurement & Models, Measurement Scales and Scale Types, Meaningfulness in Measurement

UNIT II
A Goal Framework for Software Measurement:
Classifying software measures, Determining what to measure, Applying the framework
Empirical Investigation & Data Collection:
Four Principles of Investigation, Planning formal experiments, What is good data, How to define the data, How to collect data, When to collect data.

UNIT III
Analyzing Software Measurement Data:
Analyzing the results of experiments, Analysis Techniques, Overview of statistical tests
Measuring Internal Product Attributes, Size and Structure:
Aspects of Software Size, Length, Reuse, Functionality, Complexity, Types of Structural Measures, Modularity and information flow attributes, Object Oriented Metrics

UNIT IV
Measuring External Product Attributes:
Modeling Software Quality, Measuring aspects of quality
Measurement and Management:
Planning a measurement program, Measurement in practice, empirical research in software engineering.

Text Books:

Reference Books:
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Paper Code: MECS – 620
Subject: Distributed Computing

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UNIT I

Fundamentals of Distributed & Parallel Computing:
Architectural models for distributed and mobile computing systems, Basic concepts indistributed computing, Classification of Parallel Computers, Parallel Computer Architecture,

Distributed Operating Systems:
Overview, network operating systems, Distributed file systems, Middleware, client/server model for computing.

UNIT II

Communication:
Layered protocols, RPC, RMI, Remote objects, Basic Algorithms in Message Passing Systems, Leader Election in Rings, and Mutual Exclusion in Shared Memory, Message Passing, PVM and MPI.

Process Concepts:
Threads, Clients and Servers, Code migration, Agent based systems, Distributed objects, CORBA, Distributed COM.

UNIT III

Synchronization:
Clock synchronization, Logical clocks, Election algorithms, Mutual exclusion, Distributed transactions, Naming concepts, Security in distributed systems.

Consistency, Replication and Fault Tolerance:

UNIT IV

Parallel Systems:
Basic Concepts: Introduction to parallel processing, Parallel processing terminology, Design of parallel algorithms, Design of Parallel Databases, Parallel Query evaluation, Operating System for Parallel Computers.

Text Books:

Reference Books:
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Paper Code: MECS – 624
Subject: Advanced Computer Graphics

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**UNIT I**

Raster graphics, Vector graphics, Basic raster graphics algorithms for drawing 2 D Primitives line, circles, ellipses, arcs etc., Anti aliasing and its techniques. Clipping: clipping points, line and area clipping. & polygon filling algorithm.

**UNIT II**

Geometric Transformation: 2D transformations like translation, rotation, scaling, reflection and shearing etc., composite transformation and homogeneous coordinate system in transformation. 3D transformations, window to viewport transformations, projection: Types of projection methods, perspective projection with different location of centre of projection.

Graphics Hardware: Hardcopy & display techniques, Input devices, image scanners etc.,

**UNIT III**

Modeling: parametric and non parametric. Curves and its blending methods. Uniform, non uniformcurves, rational and non rational curves, NURBS, Surfaces and its generation techniques. Hardware and software color models and its applications in different fields.


**UNIT IV**

Procedural modeling, fractals and its generation techniques, grammar-based models, multi-particle system, concepts of hardware and software rendering. Animation: introduction to 2D and 3D animation. Dynamics and role of dynamics in animation

**Text Books:**


**Reference Books:**

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Paper Code: MECS – 652  
Subject: Lab 4  
This Lab Course will be based on Object Oriented Software Engineering.

Paper Code: MECS – 654  
Subject: Lab 5  
This Lab Course will be based on Advanced Database Management System.

Paper Code: MECS – 656  
Subject: Lab 6  
This Lab Course will be based on Advanced Algorithm Analysis & Design.

Paper Code: MECS – 658* (NUES)  
Subject: Term Paper II
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**Paper Code:** MECS – 701  
**Subject:** Advanced Data Warehousing & Data Mining  

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Each question should be 10 marks

**UNIT I**

Review of Data Warehousing:  
Introduction to Data Warehousing: Evolution of Data Warehousing, Data Warehousing concepts, Benefits of Data Warehousing, Comparison of OLTP and Data Warehousing, Why Have a Separate Data Warehouse, Problems of Data Warehousing.  
Data Warehousing Architecture  
Architecture: Operational Data and Data store, Load Manager, Warehouse Manager, Query Manager, Detailed Data, Lightly and Highlys summarised Data, Archive/Backup Data, Meta-Data, 2-tier, 3-tier and 4-tier data warehouse architecture

**UNIT II**

Multidimensional Data Modeling  
Principles of dimensional modeling: From Tables and Spreadsheets to Data Cubes, the STAR schema, STAR Schema Keys, Advantages of the STAR Schema Dimensional Modeling: Updates to the Dimension tables, miscellaneous dimensions, the snowflake schema, Fact Constellations, aggregate fact tables, families of STARS, Measures: Their Categorization and Computation, Concept Hierarchies, OLAP Operations in the Multidimensional Data Model, A Starnet Query Model for Querying Multidimensional Databases

**UNIT III**

Data Warehouse Implementation,  
Efficient Computation of Data Cubes, Indexing OLAP Data, Efficient Processing of OLAP Queries, Metadata repository, Data warehouse back-end tools and utilities  
Data Preprocessing  
Why preprocess the data? Data cleaning, Missing values, Noisy data, Inconsistent data, Data integration and transformation, Data reduction: Data cube aggregation, Dimensionality reduction, Data compression, Numerosity reduction  
Discretization and concept hierarchy generation for numeric data and categorical data

**UNIT IV**

Data Mining Basics: What is Data Mining, The knowledge discovery process, OLAP versus data mining, data mining and the data warehouse, Major Data Mining Techniques, Cluster detection, decision trees, memory-based reasoning, link analysis, neural networks, genetic algorithms, moving into data mining, Data Mining Applications, Benefits of data mining, applications in retail industry, applications in telecommunications industry, applications in banking and finance

**Text Books:**
1. Morgan Kaufmann - Data Mining - Concepts and Technique  

**Reference Books:**
INSTRUCTIONS TO PAPER SETTERS:

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**UNIT I**
Functional Testing: Boundary Value Analysis, Equivalence Class Testing, Decision Table Based Testing, Cause Effect Graphing Technique.

**UNIT II**
Structural Testing: Control flow testing, Path testing, Data Flow Testing, Slice based testing, Mutation Testing
Software Verification: Verification methods, SRS verification, SDD verification, Source code reviews, User documentation verification, Software project audit,

**UNIT III**
Creating Test Cases from Requirements and use cases:
Use case diagram and use cases, Generation of Test cases from use cases, Guidelines for generating validity checks, Strategies for data validating, Database testing, Regression Testing: What is Regression Testing?, Regression test cases selection, Reducing the number of test cases, Risk analysis, Code coverage prioritization technique
Software Testing Activities: Levels of Testing, Debugging, Software Testing Tools, and Software test Plan

**UNIT IV**

**Text Books:**

**Reference Books:**
UNIT I
Introduction to Cloud Computing, Definition, Characteristics, Components, Cloud provider, SAAS, PAAS, IAAS and Others, Organizational scenarios of clouds, Administering &Monitoring cloud services, benefits and limitations, Deploy application over cloud, Comparison among SAAS, PAAS, IAAS, Cloud computing platforms: Infrastructure as service: Amazon EC2, Platform as Service: Google App Engine, Microsoft Azure.

UNIT II
Introduction to Cloud Technologies, Study of Hypervisors, SOAP, REST, Compare SOAP and REST, Webservices, AJAX and mashups-Web services, Mashups: user interface services, Virtual machine technology, virtualization applications in enterprises, Pitfalls of virtualization, Multi-entity support, Multi-schema approach, Multi-tenancy using cloud data stores, Data access control for enterprise applications.

UNIT III

UNIT IV

Text Books:
2. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper (Wiley India Edition)
3. Cloud Security & Privacy by Tim Malhar, S.Kumaraswamy, S.Latif (SPD, O’REILLY)

Reference Books:
1. Cloud Computing Bible by Barrie Sosinsky, Wiley India
INSTRUCTIONS TO PAPER SETTERS:

Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit.

Each question should be 10 marks

UNIT I
Introduction to e-Commerce
Network Infrastructure for e-commerce
Intranet, Extranet, & Internet, Internet Backbone in India, ISP and services in India, OSI Model, Standards & Overview of TCP/IP, Internet Security, e-commerce & Internet.

UNIT II
E-commerce Models
e-Advertising& Marketing
The new age of information-based Marketing, Emergence of internet as a competitive advertising media, Market Research, Weakness in Internet Advertising, e-Advertising & Marketing in India.

UNIT III
Electronic Payment System
Introduction to Payment Systems, On-Line Payment Systems, Pre-Paid e-Payment System, Post-Paid e-Payment System, Requirements Metrics of a Payment System.
Electronic Data Exchange
EDI- Definitions & Applications, Standardisation and EDI, EDI- Legal Security and Privacy Issues, Advantages & Limitations of EDI.

UNIT IV
E-Security
e-CRM
CRM, what is e-CRM, it’s Applications, The e-CRM Marketing in India, Major Trends, Global Scenario for e-CRM, CRM utility in India.

Text Books:

Reference Books:
UNIT I
Complexity of Information Management: Proliferation of Data, Data Center Evolution, Managing Complexity, I/O and the five pillars of technology, Storage Infrastructure, Evolution of Storage

UNIT II
Introduction to Networked Storage: Storage Networking Overview, Direct Attached Storage, Storage Area Networks, Case study – Applying SAN concepts, Network Attached Storage, Case study – Applying NAS concepts, IP SAN, CAS, Hybrid Network Storage Based Solutions/ Emerging Technologies, Case study – Applying SAN, NAS, IP SAN concepts

UNIT III
Introduction to Information Availability: Business Continuity Overview, Data Availability, Business Continuity – Local, Case study – Applying local information availability strategies, Business Continuity – Remote, Case study – Applying remote information availability strategies, Disaster Recovery

UNIT IV
Managing and Monitoring: Monitoring in the Data Center, Case study – Monitoring exercise, Management in the Data Center, Case study – Managing exercise
Case Studies must be supported by laboratory

Text Books:

Reference Books:
Paper Code: MECS – 711  
Subject: Software Quality Management  

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Each question should be 10 marks

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**UNIT I**

**UNIT II**
Tailoring the Software Quality Assurance Program: Reviews, Walkthrough, Inspection, and Configuration Audits.
Evaluation: Software Requirements, Preliminary design, Detailed design, Coding and Unit Test, Integration and Testing, System Testing, types of Evaluations.

**UNIT III**
Trend Analysis: Error Quality, Error Frequency, Program Unit Complexity, Compilation Frequency.

**UNIT IV**
Corrective Action as to Cause: Identifying the Requirement for Corrective Action, Determining the Action to be Taken, Implementing the Correcting the corrective Action, Periodic Review of Actions Taken.

**Text Books:**

**Reference Books:**
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### UNIT I
Overview of the signal processing of Deterministic signals: Time domain and frequency domain response of the linear-shift invariant systems..

### UNIT II

### UNIT III

### UNIT IV

### Text Books:

### Reference Books:
UNIT I
Introduction:
Concept of Multimedia, Media & data stream, main properties of multimedia system, Data
stream characteristics for continuous media Multimedia Applications, Hardware& Software
requirements of multimedia product development. Basic concepts of Video & animation. Conventional animation system, Computer based animation, Authoring Tools, Categories of
Authoring Tools.
UNIT II
Compression Techniques: Lossless and Lossy compression, Run length coding, Statistical
Coding, Transform Coding, JPEG, MPEG. Text compression using static Huffmann
Technique, Dynamic Huffmann Technique, Arithmetic Technique.
Modelling: NURBS modeling, NURBS curve generating techniques, Curve editing
techniques, NURBS Surface generation methods and surface editing operations for creating
models.
UNIT III
Animation: Introduction, Basics of animation techniques, tweaning & morphing, Motion
Graphics 2D & 3D animation. Key frame animation, Reactive animation, Path animation,
imparting non linearity in to the path of the animation, character animation: Forward
kinematics & Inverse kinematics techniques to animate the skeletons. Skin binding methods,
Deformers and animation editors.
UNIT IV
Dynamics: Role of Dynamics in creation of animation, concept of dynamic engine. Soft bodies
Rendering: Rendering types: Hardware and software rendering. Concepts of rendering
globals. Interactive photo realistic rendering, Line rendering, Box rendering etc. Special
Effects: Shading & Texturing Surfaces, Lighting, Special effects.
Working with MEL: Basics & Programming

Text Books:
1. FredHalsall , “ Multimedia communication” Addison wesley

Reference Books:
1. Andleigh and Thakrar, “Multimedia system design”, PHI Publications
3. Maya manuals.
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Each question should be 10 marks

UNIT I
Introduction :Introduction to Cyber World, Types of cyber-attacks, Cyber Crime and Digital Fraud, Cyber-attacks and cyber security , Information warfare and cyber terrorism,
Overview of Types of computer forensics i.e. Media Forensics, Network forensics (internet forensics), Machine forensic, Email forensic (e-mail tracing and investigations)

UNIT II
Understanding Computer Investigations : Preparing a Computer Investigations, Taking a systematic approach, Understanding Data recovery workstations and software, Conducting an Investigation, Completing the case, .

UNIT III

UNIT IV
Computer Forensics Tools and Software: Helix, DTsearch, S-tools, Camouflage, Recovery of Deleted files in windows and Unix , Hardware forensic tools like Port scanning and vulnerability assessment tools like Nmap , Netscanetc. Password recovery e.g. Passware, Mobile forensic tools , DOS file systems and Forensic tools, Password encryption analyzer

Text Books:

Reference Books:
File System Forensic Analysis by Brian Carrier, addition Wesley
2. Windows Forensic Analysis DVD Toolkit (Book with DVD-ROM), Harlan Carvey, syngress Publication

Paper Code: MECS – 717
Subject: Cyber Crime Investigations & Cyber Forensics

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Maximum Marks : 60
UNIT I

UNIT II

UNIT III

UNIT IV
Reliability, Basic Concepts, Non-blocking Commitment Protocols, Reliability and concurrency Control, Determining a Consistent View of the Network, Detection and Resolution of Inconsistency, Checkpoints and Cold Restart, Distributed Database Administration, Catalog Management in Distributed Databases, Authorization and Protection, Object Management, Object Identifier Management, Object Migration, Distributed Object Storage, Object Query Processing, Object Query Processor Architectures, Query Processing Issues, Query Execution, Transaction Management, Transaction Management in Object DBMSs, Transactions as Objects.

Text Books:
1. Distributed Database Principles & Systems, Stefano Ceri, Giuseppe Pelagatti, McGraw-Hill

Reference Books:

Paper Code: MECS – 721
Subject: Network Management

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Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit.

Each question should be 10 marks

UNIT I

UNIT II

The SNMP Communication Model, Functional model SNMP Management: SNMPv2: Major Changes in SNMPv2, SNMPv2 System Architecture, SNMPv2 Structure of Management Information, The SNMPv2 Management Information Base, SNMPv2 Protocol, Compatibility With SNMPv1

SNMP Management: RMON: What is Remote Monitoring?, RMON SMI and MIB, RMON1, RMON2, ATM Remote Monitoring, A Case Study of Internet Traffic Using RMON

UNIT III

UNIT IV

Future Directions

Text Books:

Reference Books:
Paper Code: MECS – 751
Subject: Lab 7

This Lab Course will be based on Advanced Data Warehousing & Data Mining.

Paper Code: MECS – 753
Subject: Lab 8

This Lab Course will be based on AD. Software Testing.

Paper Code: MECS – 755 *(NUES)
Subject: Term Paper III

Paper Code: MECS – 757 (NUES)
Subject: Minor Project
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UNIT-I
Overview of computer security: threats, vulnerabilities, controls, risk, confidentiality, integrity, availability, security policies, security mechanisms, prevention, detection, deterrence, Malicious code, viruses, Trojan horses, worms

UNIT-II
Basic Cryptography: Stream and block ciphers, Encryption, Classical cryptosystems, symmetric cryptography, asymmetric cryptography, Digital Signature, Digital certificates, Message digests and authentication codes

UNIT-III
Database Security: Security and privacy requirements, reliability, integrity, and privacy, inference data mining, k-anonymity.
Security in conventional operating systems: Memory, time, file, object protection requirements and techniques, Protection in contemporary operating systems

UNIT-IV
Network security: eavesdropping, spoofing, modification, denial of service attacks, network security techniques: firewalls, virtual private networks, Intrusion detection, techniques to provide privacy in Internet applications and protecting digital content from unintended use.
Management of security: Security policies, Risk analysis, Physical threats and controls
Legal aspects of security, Privacy and ethics

Text Books:

Reference books
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Unit-I
Basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, planning a cellular system, analog & digital cellular systems. Elements of Cellular Radio Systems Design: General description of the problem, concept of frequency reuse channels, co-channel interference reduction factor, desired C/I from a normal case in an omni directional antenna system, cell splitting, consideration of the components of cellular systems, Introduction to co-channel interference, co-channel measurement design of antenna system, antenna parameter and their effects.

Unit-II
General introduction, obtaining the mobile point to point mode, Radio propagation characteristics: models for path loss, shadowing and multipath fading, propagation over water or flat open area, foliage loss, propagation near in distance, long distance propagation, point to point prediction model characteristics, cell site, antenna heights and signal coverage cells, mobile to mobile propagation, Characteristics of antennas, antenna at cell site, mobile antennas, Frequency management, fixed channel assignment, non-fixed channel assignment, traffic & channel assignment, Why hand off, types of handoff and their characteristics, handoff analysis, dropped call rates & their evaluation.

Unit-III
Modulation methods in cellular wireless systems, OFDM, Block Coding, convolution coding and Turbo coding, FDMA/TDMA, CDMA. FDM/TDM Cellular systems, Cellular CDMA, soft capacity, Earlang capacity comparison of FDM/TDM systems and Cellular CDMA.

Unit-IV
GSM Architecture, Mobility management, Network signaling, Frequency allocation and control, Base System and Master System, GSM, DCS 1800, Various value added services, Mobile IP, Wireless LAN, Routing protocols for MANETs: DSDV, DSR, AODV, Role of TCP in MANETs.

TEXT BOOKS:

REFERENCE BOOKS:

Paper Code: MEIT – 602

Subject: Advanced Mobile Computing

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**UNIT I**


Motivation for a specialized MAC: Hidden and Exposed terminals. Near and Far terminals; Multiple access with collision avoidance, Polling, Inhibit sense multiple access; CDMA: Spread Aloha multiple access


**UNIT II**


**UNIT III**


Mobile Transport Layer: Traditional TCP: Congestion control, Slow start, Fastretransmit/fast recovery, Implications on mobility; Indirect TCP, Snooping TCP, Mobile TCP, Fast retransmit/fast recovery, Transmission/time-out freezing, Selective retransmission, Transaction oriented TCP.

**UNITIV**


Wireless devices and their Operating System: PalmOS; Windows CE; EPOC; SymbianOS; Linux for Mobile Devices. Mobile Agents


**Text Books:**


**Reference Books:**

1. Rappaport, "Wireless Communications Principals and Practices".
3. K. Pahlavan, P. Krishnamurthy, "Principles of Wireless Networks".
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### UNIT I

Introduction to Software Project Management: Software development as a project; Stakeholders in software project; Software product, process, resources, quality, and cost; Objectives, issues, and problems relating to software projects. Overview of Project Planning: Steps in project planning; Defining scope and objectives; work breakdown structure; Deliverables and other products; time, cost, and resource estimation; Alternatives in planning; Project Evaluation: Strategic assessment; Technical assessment; Cost-benefit analysis; Cash flow forecasting; Cost-benefit evaluation techniques; Break-even analysis; Risk evaluation Selection of Appropriate Project Approach: Choosing development technology and methodology; choice of process model; Rapid application development; Waterfall model; V-process model; Spiral model; Prototyping.; Incremental delivery.

---

### UNIT II

Software Effort Estimation : Problem in software estimation; Effort estimation techniques; Expert judgement; Estimation by analogy; Delphi technique; Algorithmic methods; Top-down and bottom-up estimation; Function point analysis; Object points; COCOMO model.  
Activity Planning : Network planning model; Activity-on-arrow network; Precedence network; Forward pass; Backward pass; Critical path; Slack and float. Risk Analysis and Management : Nature and categories of risk in software development; risk Identification; Risk assessment; Risk mitigation, monitoring, and management; Evaluating schedule risk using PERT.

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### UNIT III

Recourse Allocation : Nature of project resources; Identifying resource requirement of activities; Allocating and scheduling resources; cost of resources; Standard, planned, and actual cost; Cost variance; time-cost trade-off. Project Tracking and Control : Measurement of physical and financial progress; Earned value analysis; Status reports; Milestone reports; Change control. Contract Management : Outsourcing of products and services; Types of contracts; Stages in contract placement; Terms of contract; Contract monitoring; Acceptance testing.

---

### UNIT IV

Managing People and Organizing Teams : Organizational behaviour; Recruitment and placement; Motivation; Group behaviour; Individual and group decision making; Leadership and leadership styles; forms of organizational structures. Software Quality Assurance: Planning for quality; Product versus process quality management; Procedural and quantitative approaches; Defect analysis and prevention; Statistical process control; Pareto analysis; Causal analysis; Quality standards; ISO 9000; Capability Maturity Model; Quality audit. Configuration Management : Configuration management process; Software configuration items; Version control; change control; Configuration audit; Status reporting.

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### Text Books:


### Reference Books:

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Each question should be 10 marks

**UNIT I**

Raster graphics, Vector graphics, Basic raster graphics algorithms for drawing 2 D Primitives line, circles, ellipses, arcs etc., Anti-aliasing and its techniques. Clipping: clipping points, line and area clipping. & polygon filling algorithm.

**UNIT II**

Geometric Transformation: 2D transformations like translation, rotation, scaling, reflection and shearing etc., composite transformation and homogeneous coordinate system in transformation. 3D transformations, window to viewport transformations, projection: Types of projection methods, perspective projection with different location of centre of projection.

Graphics Hardware: Hardcopy & display techniques, Input devices, image scanners etc.,

**UNIT III**


**UNIT IV**

Animation: introduction to 2D and 3D animation. Dynamics and role of dynamics in animation. Different 3D animation techniques like key frame animation, path animation, reactive animation and Forward and Inverse Kinematics Skelton animation.

**Text Books:**


**Reference Books:**

Paper Code: MEIT – 651  
Subject: Lab 1  
This Lab Course will be based on ADS.

Paper Code: MEIT – 653  
Subject: Lab 2  
This Lab Course will be based on Advanced Software Engineering

Paper Code: MEIT – 655  
Subject: Lab 3  
This Lab Course will be based on Advanced DCC

Paper Code: MEIT – 657* (NUES)  
Subject: Term Paper I
Paper Code: MEIT – 652  
Subject: Lab 4  
This Lab Course will be based on Advanced Mobile Computing.  
**40 marks: internal evaluation**  
**60 marks: external evaluation**  

Paper Code: MEIT – 654  
Subject: Lab 5  
This Lab Course will be based on Advanced Software Project Management.  
**40 marks: internal evaluation**  
**60 marks: external evaluation**  

Paper Code: MEIT – 656  
Subject: Lab 6  
This Lab Course will be based on Computer Graphics & Animation.  
**40 marks: internal evaluation**  
**60 marks: external evaluation**  

Paper Code: MEIT – 658* (NUES)  
Subject: Term Paper II  
**100 marks: internal evaluation**
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UNIT I

**Introduction:** Uncertainty and information, measure of information, Entropy, properties of entropy, information rate, entropy of binary memory less source, extension of DMS, information measure for continuous random variables, sources with finite memory, Markov sources,

**Source coding:** source coding theorem, prefix coding, kraft McMillan inequality, Huffman coding, Shannon-Fano coding, Arithmetic coding, Lempel-Ziv algorithm, run length encoding and PCX format

UNIT II

**Channel models:** channel matrix, loss less, noise less, deterministic, binary symmetric channels, conditional and joint entropy, mutual information, properties of mutual information, channel capacity, channel coding theorem, channel coding theorem to BSC, Channel capacity theorem, Shannon limit.

UNIT III

**Channel coding:** Linear block codes, generator and parity check matrix, perfect codes, Hamming codes, repetition codes, decoding of linear block codes, syndrome decoding, Properties of syndrome, minimum distance consideration, error detection & correction capabilities

Cyclic codes, polynomial, division algorithm, matrix description, encoder for cyclic code, syndrome calculator, cyclic redundancy check codes, Maximum length codes, Golay codes, BCH codes, Reed Solomon codes.

UNIT IV

Convolution codes, convolution code encoder, code tree, trellis and state diagram, impulse response and polynomial description of convolution codes, maximum likelihood decoding, Viterbi algorithm, distance properties of convolution code, sequential decoding, turbo codes, turbo decoding. Trellis coded modulation, Secure coding, Introduction to cryptography

**Text Books:**


**Reference Books:**

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Each question should be 10 marks

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**UNIT I**

Concepts of Reliability:
Failure of systems and its modes: Measure of Reliability, Reliability Function, Hazard Rate MTBF and their interrelations.

Reliability Data Analysis:
Data Sources, Data Collection, Use of Reliability data, Reliability Analysis, Performance Parameters, Calculation of Failure Rate, Application of Weibull distribution.

**UNIT II**

System Reliability and Modeling:
Series Systems, Parallel systems, Series Parallel systems, Time dependence, Reliability determination, Standby systems, $r$ out of $n$ configurations, Methods of tie set and cut sets of or reliability evaluation, Simulation and Reliability Prediction, Monte Carlo Method.

**UNIT III**

Maintainability and Availability:

**UNIT IV**

Life Testing of Equipment:
Nondestructive tests, Destruction tests and their mathematic modeling, Quality and Reliability, Measurement & Prediction of Human Reliability, Reliability and safety, Safety margins in critical devices, Case studies.

Value Engineering:
Techniques in value Engineering, Structures of Engineering. Reliability Management.

**Text Books:**

**Reference Books:**
Paper Code: MEIT – 751
Subject: Lab 7

This Lab Course will be based on Advanced Data Warehousing & Data Mining.
40 marks: internal evaluation  60 marks: external evaluation

Paper Code: MEIT – 753
Subject: Lab 8
This Lab Course will be based on Information Theory & Coding.
40 marks: internal evaluation  60 marks: external evaluation

Paper Code: MEIT – 755 * (NUES)
Subject: Term Paper III
100 marks: internal evaluation

Paper Code: MEIT – 757
Subject: Minor Project
40 marks: internal evaluation  60 marks: external evaluation
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**UNIT I**

Introduction to Network models-ISO-OSI, SNA, Appletalk and TCP/IP models. Review of Physical layer and Data link layers, Review of LAN (IEEE 802.3, 802.5, 802.11b/a/g, FDDI) and WAN (Frame Relay, ATM, ISDN) standards.

**UNIT II**

Network layer
ARP, RARP, Internet architecture and addressing, internetworking, IPv4, overview of IPv6, ICMP, Routing Protocols- RIP, OSPF, BGP, IP over ATM.

Transport layer
Design issues, Connection management, Transmission Control Protocol (TCP), User Datagram Protocol (UDP), Finite state machine model.

**UNIT III**

Application layer
WWW, DNS, e-mail, SNMP, RMON
Network Security: Cryptography, Firewalls, Secure Socket Layer (SSL) and Virtual Private Networks (VPN).

**UNIT IV**

Case study
Study of various network simulators, Network performance analysis using NS2

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**Text Books/ References:**

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UNIT-I
Theory, foundations, and applications of modern cryptography. Steganography, One-way functions; pseudo-randomness and random number generators

UNIT-II
Encryption; authentication; symmetric cryptography, asymmetric cryptography: public-key cryptosystems; digital signatures, message authentication codes

UNIT-III
Remote user authentication, notions of security; zero knowledge/ interactive proofs, multi-party cryptographic protocols, key exchange and applications,

UNIT-IV
Cryptanalysis of cryptographic primitives and protocols, such as by side-channel attacks, differential cryptanalysis, or replay attacks; and cryptanalytic techniques on deployed systems etc.

Text Books:

Reference Books:
1. Cryptography and Network Security by Stalling, PHI
2. Cryptography by Behrouz A. Forouzan, TMH
4. Cryptography and hardware security By Stalling, W PHI
Paper code: MEIS-609
Subject: Decision Support Systems and Methods

INSTRUCTIONS TO PAPER SETTERS:

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Unit-I
Introduction to decision support systems (DSS), decisions and decision makers, decisions in the organization, modeling decisions processes.

Unit-II
Group decision support systems and groupware technologies, DSS architecture, hardware and operating system platforms

Unit-III
Expert systems and artificial intelligence, Introduction to data warehousing.

Unit-IV
Introduction to Data Mining, DSS software tools, building and implementing DSS.

Text Books:


Reference Books:

INSTRUCTIONS TO PAPER SETTERS:

Maximum Marks : 60

Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit.

Each question should be 10 marks

UNIT-I
Web 2.0: search, content networks, user-generated content, blogging, social networking, social media, tagging, social bookmarking, rich Internet applications, web services, location-based services, Web 2.0 monetization and business models, Evaluation of web applications, future of the Web.

UNIT-II
Extensible Hypertext Markup Language (XHTML): XHTML syntax, headings, linking, images, special characters and horizontal rules, lists, tables, forms, internal linking, meta elements.

UNIT-III
Cascading Style Sheets (CSS): separation of content and presentation, inline styles, embedded style sheets, conflicting styles, linking external style sheets, positioning elements, backgrounds, element dimensions, box model and text flow, media types, building a CSS drop-down menu, user style sheets.

UNIT-IV
JavaScript: client side scripting, control statements, functions, arrays, objects, events. Document object model: objects and collections. Extensible Mark up Language (XML) and RSS: Advantages and applications, structuring data, XML namespaces, Document Type Definitions (DTDs), XML vocabularies, RSS.

Text Books:

Reference Book:
UNIT-I


UNIT-II

Markov Decision Process, Static Games: Interactive decision Problems, Describing static Games, Solving Games using Dominance, Nash Equilibria, Existence of Nash Equilibria, Walsarian and other equilibria, Analysis of optimal strategies

UNIT-III

Finite Dynamic Games: Game trees, Information sets, Behavior Strategies, Sub Game perfection, Nash Game Equilibrium Refinements

UNIT-IV

Games with continuous strategies Sets: Infinite strategy sets, The Cournot Duopoly Model. Infinite Dynamic Games: Repeated Games, Iterated Prisoners Dilemma, Folk Theorems

Text Books:
2) Andrew M. Colman, “Game theory and its applications “ , Psychology Press; 1995

Reference Books:
Scheme of Examination for M.Tech.(Regular & weekend) Programme has been approved by BoS of USICT on dated 28/05/2012 and AC subcommittee on dated 6th July, 2012 and 5th November, 2012. This scheme is effective from academic session 2015-16. Minor correction has been approved in BoS held on 16th September 2015. The correction has been approved in 40th meeting of Academic Council, dated 1st March, 2016.
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**Paper code: MEIS-651**

**Paper:** Lab –I

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40 marks: internal evaluation 60 marks: external evaluation

Lab will be according to the course of Advance Computer Network

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**Paper code: MEIS-653**

**Paper:** Lab –II

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40 marks: internal evaluation 60 marks: external evaluation

Lab will be according to the course of Introduction to Computer Security.

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**Paper Code MEIS-655**

**Paper:** Lab –III

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40 marks: internal evaluation 60 marks: external evaluation

Lab will be according to the course of Advance Database

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**Paper code: MEIS-657**

**Paper:** Term paper-I

| Total credit |
| 2 |

100 marks: internal evaluation
UNIT I

**Information:**
Security testing versus Traditional software testing, SQL Injection attack pattern, The paradigm shift of security testing, High level Security testing Strategies,
The fault Injection model of testing, Prioritizing your work, using tools.

**How vulnerabilities get into all software:**
Design versus implementation vulnerabilities, common secure design issues, poor use of cryptography, tracking users and their permissions, flawed input validation, weak structural security, programming language implementation issues, platform implementation issues, generic application security implementation issues , SQL Injection, Problems during the development process,

UNIT II

**Secure software development lifecycle:** Fitting security testing into software development lifecycle, security requirements, architectural and design reviews, secure coding guidelines, Black/gray/white box Testing, developing applications securely, determining exploitability.

**Risk leased Security Testing:** Information Gathering, Runtime Inspection, Identifying threat paths, Ranking the risks associated with vulnerability.

UNIT III

**Analysis:White, grey and Black Box testing:** White box testing, Black box testing, gray box testing, Fuzzers, sniffers, Debuggers, hardware, network attacks.

**Generic Network Fault Injection:** Network Port Discovery, Port scanning, Proxies , Injector, Building the fault injection data set.

UNIT IV

**Web application:**
Targeting the application, brute- force session and Resource ID’s, Cookie gathering, Cross-site scripting.

**Web application:** By passing Authorization, SQL injection, Database scheme Discovery, Executing commands on the SQL server, Hidden files in HTTP.

**Text Books:**

**Reference Books:**
Paper Code: MEIS-606

INSTRUCTIONS TO PAPER SETTERS:

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1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

UNIT I

UNIT II
Development of concepts required for risk-based planning and risk management of computer and system. Incident response planning, Disaster recovery planning, Crisis management, Business continuity planning, model for a consolidated contingency plan.

UNIT III
Planning for security: Information security policy, Standards and practices, Enterprise information security policy(EISP), Issue- specific security policy( ISSP), System-specific policy(SSP), ACL policies, Rule policies, Policy management Visa international security model, Hybrid framework for a blueprint of an Information security system, Design of security architecture.

UNIT IV
Technological hazards, and terrorist; implications for emergency response, vulnerability of critical infrastructures.

Text books:

Reference Books:
Paper Code: MEIS-608
Paper: Technical Foundations for E-Commerce

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**UNIT I**

**UNIT II**

**UNIT III**

**UNIT IV**
Cybercrime and Cyber warfare, Security, Privacy and other social issues, Tiered Internet Services, E-Books, Web Services, Biometrics Authentication.

**Text Books/References:**

UNIT 1
Introduction to information warfare (IW), taxonomies of IW, cyberterrorism and information security, wireless information warfare, methods of information warfare: google bombing, creation of viruses and hactivism.

UNIT II
Intrusion detection: basic intrusion detection concepts, common intrusion detection methodologies; signature based, anomaly based, stateful protocol analysis.

UNIT III
Types of attacks: network based attack, host based attack. Denial of service attack, distributed denial of service attack, buffer overflow attack, sniffing, session hijacking, password attack, Trojan horses, viruses, worms etc.

UNIT IV
Countermeasures of information warfare: authentication, encryption, auditing, monitoring, various types of firewalls, different intrusion detection and prevention systems (IDPS); host based IDPS, network based IDPS, wireless IDPS. Limitations of these countermeasures of information warfare.

Text Books:

Reference Books:
1. Cybersecurity operations handbook by Rittinghouse&Hencock, Elsevier digital press
3. Cryptography and network security, by B.A. Forouzan, TMH
INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

UNIT I
Definitions of real time systems, Typical real time applications, Hard versus soft real time systems, a reference model of Real-Time systems, commonly used approaches for real time scheduling. Real time system life cycle, structured design approaches including event-based, process-based and graph based theoretical model, Real-Time programming. Ada as a real time programming language.

UNIT II
Real time operating systems, overview, time services and scheduling mechanisms, other basic operating system functions, capabilities of commercial real time operating systems.

UNIT III
Real time data bases vs general-purpose databases, main memory databases, transactions and concurrency control issues, disk scheduling algorithms, predictability, serialization, consistency, and databases for hard real time systems.

UNIT IV
Fault tolerance techniques, definitions, fault types, fault detection, fault and error containment, redundancy, integrated failure handling.

Text Books / References:
UNIT I

UNIT II

UNIT III

UNIT IV

Text books:
1. Ad Hoc Wireless Networks, Architecture and Protocols by C. Siva Ram Murthy

Reference Book:
1. Handbook of research on wireless security by Yan zhangjunzhengmiao ma.
INSTRUCTIONS TO PAPER SETTERS:  Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

UNIT I
Over view of bio metrics - Benefits of biometric security – Verification and identification and enrollment – Basic working of biometric matching – Accuracy – False match rate – False non-match rate – Failure to enroll rate – Derived metrics – Layered biometric solutions. Biometric system security

UNIT II
Finger scan – Features – Components – Operation (Steps) – Competing finger Scan technologies – Strength and weakness. Types of algorithms used for interpretation. Facial Scan - Features – Components – Operation (Steps) – Competing facial Scan technologies – Strength and weakness. Iris Scan - Features – Components – Operation (Steps) – Competing iris Scan technologies – Strength and weakness. Voice Scan - Features – Components – Operation (Steps) – Competing voice Scan (facial) technologies – Strength and weakness.

Unit III

UNIT IV

Text Books:

Reference Books:
INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60

1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

UNIT I
(Competitive strategies for the information economy, network economics)
Telecommunications and networking as applied to enterprises in the commercial and public sector.

UNIT II
A survey of the technologies and applications of telecommunications systems with emphasis on LANs and Internet technologies.

UNIT III
Selection of technologies and configurations necessary to support business applications. Competitive, economic, and political factors that influence technology innovation in public and private organizations, domestically and internationally.

UNIT IV
Management of research and development: project selection, resource allocation, technology planning, management of development projects. Quality, manufacturing, and intellectual property issues.

Text Books:
1. Alex Roland, Philip Shiman ,"Strategic computing”, 1983
Paper Code: MEIS - 709
Paper: Quantum Information Processing

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INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
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UNIT I
Basic principles of quantum mechanics, quantum gates and circuits, classical computation vs. quantum computation, quantum computing models

UNIT II
Quantum algorithms: The prime factorization, Simon, and Grover algorithm; Classical and Quantum information theory: Entropy, information; communication channels, distinguishing two orthogonal (quantum) states, correlations between two systems, no cloning - of nonorthogonal states, density matrices and mixed states, interaction with the environment, the most famous cat!

UNIT III
Quantum cryptography: Quantum Key Distribution, BB84 protocol, Security of QKD, Implementation of QKD via photons; Breaking RSA system

UNIT IV
Quantum teleportation, Quantum hardware: Ion traps, nuclear magnetic resonance, optical cavities; Solid state implementations: Josephson junctions, quantum dots, circuit design; Quantum error correction; Fault tolerance

Text Books:
1. Dimitris G. Angelakis, “Quantum information processing”
2. Ivan S. Oliveira, Tito J. Bonagamba, “NMR quantum information processing”

Reference Books:
1. Peter Lambopoulos, David Petrosyan, “Fundamentals of quantum optics and quantum information”
2. Antonella Karlson, “Quantum information processing and communication in Europe”
3. Gregg Jaeger, “Quantum information: an overview”

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UNIT I
Threats of viruses, worms, malicious codes etc., models of propagation and their epidemic spread; Methods of worm detection- Static analysis, Dynamic analysis; Limitation and Benefit of detection scheme; Future computer worms- super worm (spyBot.Keg, Mytob).

UNIT II
Dos attacks and defense against these attacks; History and trends in DDOS attacks, DDOS tools, DDOS defense principles, DDOS defense methods; Classification of hackers, Defense against hacking- honey pots, honey nets.

UNIT III
Architecture for robust and flexible Internet services- Ninja architecture, State event- driven architecture (SEDA), CORBA, DCOM; Active networks-DAN architecture, Security issues with active networks

UNIT IV
Introduction to critical infrastructure protection (CIP)- MBVA approach, CIP issues and analysis tools, The CIKR Sectors & Governance, Design of scalable test beds for simulation of attacks against critical infrastructures- DETERS, EMULAB, Twtestbed

Text Books:

Reference Books:
1. Basic of network security , firewall by Niit , PHI
2. Cryptography and Network Security by Stalling, PHI
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**INSTRUCTIONS TO PAPER SETTERS:**

Maximum Marks : 60

1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

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**UNIT I**

Understanding Computers, Internet and Cyber Laws, intellectual property, defamation, privacy concerns, censorship, cyber fraud, e-commerce law, information security legal liabilities, insurance law, the clash of laws, cyber law dispute resolution, the law of linking, cyber crime

**UNIT II**

Protection of Intellectual Property Rights in Cyberspace in India, Compensation and Adjudication of Violations of Provisions of IT Act and Judicial Review, Some Important Offences under the Cyberspace Law and the Internet in India, Other Offences under the Information Technology Act in India

**UNIT III**

The Role of Electronic Evidence and the Miscellaneous Provisions of the IT Act, Legal Aspects of Electronic Records/Digital Signatures, The Rules and Regulations of Certifying Authorities in India

**UNIT IV**


**Text Books / References:**

1. Cyber Law and IT Protection, Chander Harish
INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60

1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

UNIT-1

Basic Financial Mathematics
Time Value of Money, Annuities, Amortization, Yields, Bonds, Price Volatility, Duration, Convexity
Introduction, Spot Rates, Extracting Spot Rates from Yield Curves, Static Spread, Spot Rate Curve and Yield Curve, Forward Rates, Term Structure Theories, Duration and Immunization Revisited

UNIT-2

Fundamental Statistical Concepts
Introduction, The Binomial Option Pricing Model, The Black–Scholes Formula, Using the Black–Scholes Formula, American Puts on a Non-Dividend-Paying Stock, Options on a Stock that Pays Dividends, Traversing the Tree Diagonally

UNIT-3

Sensitivity Analysis of Options
Sensitivity Measures (“The Greeks”), Numerical Techniques, Corporate Securities, Barrier Options, Interest Rate Caps and Floors, Stock Index Options, Foreign Exchange Options, Compound Options, Path-Dependent Derivatives, Forward Contracts, Futures Contracts, Futures Options and Forward Options, Swaps, Stochastic Processes, Martingales (“Fair Games”), Brownian Motion, Brownian Bridge

UNIT-4

Continuous-Time Financial Mathematics

Text Books:


Reference Books:

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Paper Code: MEIS-719
Paper: Security Issues in Information Systems

|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Text Books:**

**Reference Books:**
PRACTICALS

Paper code: MEIS-751
Paper: Lab –VII

| 40 marks: internal evaluation | 60 marks: external evaluation |

Lab will be based on Mobile & Wireless network security.

Paper code: MEIS-753
Paper: Lab –VIII

| 40 marks: internal evaluation | 60 marks: external evaluation |

Lab will be based on Computer Crime Investigation & Forensics.

Paper code:MEIS-755*
Paper: Term paper-III

| 100 marks: internal evaluation |

Paper code: MEIS-757
Paper: Minor Project

| 40 marks: internal evaluation | 60 marks: external evaluation |

Objective: Students are required select a topic of their interest and develop a minor project on it. The student will submit a synopsis at the beginning of the semester for the approval to the project committee in a specified format (available on www.ipu.ac.in). The student will have to present the progress of the work through seminars. A report must be submitted to the college for evaluation purpose at the end of the semester in a specified format.
Paper Code: MEEC-601
Paper: Optoelectronics and Optical Fibre Communication

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INSTRUCTIONS TO PAPER SETTERS:

Maximum Marks : 60

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Unit-1
Introduction: Key elements of OFC system, Advantages of Optical Fiber, Optical Spectral Bands, Channel Capacity, Windows & Spectral Bands, Wave properties, Basic Optical Fiber Structures, Ray Optics Presentation, meridional rays and skew rays, Concept of Modes in dielectric slab waveguide, mode theory for circular waveguide, linearly polarized modes, Cutoff wavelength mode field diameter, normalized frequency of single mode fiber

Unit - 2

Unit-3
Sources & Detectors: LED-principle, material, double heterojunction LED, efficiency, modulation of an LED, Laser diode-Principle, modes threshold condition, efficiency, laser diode rate equation, PIN photo detector, Avalanche photodiode, photodectector noise, detector response time

Unit-4
Optical amplifiers, EDFA, Amplifier gain, WDM concepts, Fiber grating filters, Optical TDM, Subscriber multiplexing, SONET/SDH, OCDMA

Text Books:
1. Senior J., optical fiber communications, principles & practice, PHI.

Reference Books:
1. Gowar J., optical communication systems, PHI.
2. William B. Jones jr., Introduction to optical fiber communication systems, Holt, Rinehart and Winston, Inc.
3. Fiber Optic Communication Systems by Mynbev, Pearson
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2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

Unit I

Unit II

Unit III
Frequency Domain Realization of Digital Filters, Radix-2 FFT Algorithm. Introduction to Multirate digital signal processing

Unit IV

Text:

References:
Paper Code: MEEC-606

Paper: Advanced VLSI Design

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2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

Unit 1

**Introduction** : Basic principle of MOS transistor, Introduction to large signal MOS models (long channel) for digital design.

**MOS Circuit Layout & Simulation and manufacturing** : scaling, MOS SPICE model and simulation, CMOS layout: design rules, Transistor layout, Inverter layout, NMOS and CMOS basic manufacturing steps.

Unit 2

**The MOS Inverter** : Inverter principle, the basic CMOS inverter, transfer characteristics, logic threshold, Noise margins, switching characteristics, Propagation Delay, Power Consumption.

**Combinational MOS Logic Design** : Static MOS design, Ratioed logic, Pass Transistor logic, complex logic circuits.

Unit 3

**Sequential MOS Logic Design**
Static latches, Flip flops & Registers, Dynamic Latches & Registers, CMOS Schmitt trigger, Astable Circuits.
Memory Design: ROM & RAM cells design

**Dynamic MOS design** : Dynamic logic families and performances.

**Clock Distribution** Clock Distribution. Input and Output Interface circuits.

Unit 4

**Subsystem design**
Design styles, design concepts: Hierarchy, Regularity, Modularity, Locality. CMOS Sub system design: Adders, Multipliers.

**Text Books**


**Reference Books**

Unit - I

**Introduction:**
Introduction to Network models-ISO-OSI, SNA, Appletalk and TCP/IP models. Review of Physical layer and Data link layers, Review of LAN (IEEE 802.3, 802.5, 802.11b/a/g, FDDI) and WAN (Frame Relay, ATM, ISDN) standards.

Unit- II

**Network layer**
ARP, RARP, Internet architecture and addressing, internetworking, IPv4, overview of IPv6, ICMP, Routing Protocols- RIP, OSPF, BGP, IP over ATM.

Unit- III

**Transport layer**
Design issues, Connection management, Transmission Control Protocol (TCP), User Datagram Protocol (UDP)

**Application layer**
WWW, DNS, e-mail, SNMP, RMON

Unit- IV

**Network Security:** Cryptography, Firewalls, Secure Socket Layer (SSL) and Virtual Private Networks (VPN).
Study of various network simulators, Network performance analysis using NS2

**TEXT BOOKS:**

**REFERENCES:**
Unit I
Classification of transmission lines: Planar, quasiplanar and 3-D structures, their basic properties, field distribution and range of applications. Types of MICs and their technology, Propagating models, Analysis of MIC by conformal transformation Numerical analysis, Hybrid mode analysis, Substrate materials and fabrication steps in MIC

Unit II
Introduction to microstrip line, slot line and coplanar wave guide
Microstrip circuit design: Introduction, Impedance transformers, Directional couplers, branch line couplers, filters, resonators. Design and Fabrication of Lumped elements for MICs, Comparison with distributed circuits

Unit III
Non-reciprocal components and active devices for MICs: Ferromagnetic substrates and inserts, Microstrip circulators, Phase shifters, Microwave transistors, Parametric diodes and Amplifiers, PIN diodes, Transferred electron devices, IMPATT, BARITT, Avalanche diodes

Unit IV
MMIC technology: Fabrication process of MMIC. Hybrid MICs, Configuration, Dielectric substances, thick and thin film technology, Testing methods, Encapsulation and mounting of Devices.

Text Books:

1. Microwave Engineering using Microstrip Circuits – E H Fooks, R A Zakarevicius-prentice Hall
2. Microwave Microwave Engineering By D.M.Pozar,

Reference Books:

2. Liao S.Y.: Microwave Circuits & Devices. PHI
INSTRUCTIONS TO PAPER SETTERS:

Maximum Marks : 60

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

Objective: To model the random variables and random process applied to telecommunications system and to learn the methods of system simulation and performance evaluation.

UNIT – I
SIMULATION OF RANDOM VARIABLES RANDOM PROCESS
Generation of Random numbers and Sequence, Gaussian and Uniform random numbers Correlated random sequences, testing of random numbers generators, Stationary and Uncorrelated Noise, Goodness of fit test.

UNIT – II
MODELING OF COMMUNICATION SYSTEMS
Radio frequency and Optical sources, Analog and Digital signals, Communication channel and Models, Free Space channels, Multipath channel and discrete channel noise and interference.

UNIT – III
ESTIMATION OF PERFORMANCE MEASURE FOR SIMULATION
Quality of Estimator, Estimation of SNR, Probability density function and Bit Error Rate, Monte Carlo method, Importance Sampling method, Extreme Value Theory.

UNIT – IV
SIMULATION AND MODELING METHODOLOGY

TEXTBOOKS

REFERENCES
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**INSTRUCTIONS TO PAPER SETTERS:**

Maximum Marks : 60

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2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

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**Unit I**

*Introduction to Cellular Mobile Systems*

A basic cellular system, performance criteria, uniqueness of mobile radio environment, operation of cellular systems, planning a cellular system, overview of generations of cellular systems.

Elements of Cellular Radio Systems Design and interference

General description of the problem, concept of frequency reuse channels, co-channel interference reduction factor, desired C/I from a normal case in an omni directional antenna system, cell splitting, consideration of the components of cellular systems. Introduction to co-channel interference, co-channel measurement design of antenna system, antenna parameter and their effects.

---

**Unit II**

*Cell Coverage for Signal & antenna structures*

General introduction, obtaining the mobile point to point mode, propagation over water or flat open area, foliage loss, propagation near in distance, long distance propagation, point to point prediction model- characteristics, cell site, antenna heights and signal coverage cells, mobile to mobile propagation. Characteristics of basic antenna structures, antenna at cell site, mobile antennas.

Frequency Management & Channel Assignment, Hand Off & Dropped Calls

Frequency management, fixed channel assignment, non-fixed channel assignment, traffic & channel assignment. Why hand off, types of handoff and their characteristics, dropped call rates & their evaluation.

---

**Unit III**

*Modulation methods and coding for error detection and correction*

Introduction to Digital modulation techniques, modulation methods in cellular wireless systems, OFDM. Block coding, convolution coding and Turbo coding. Multiple access techniques: FDMA, TDMA, CDMA; Time-division multiple access (TDMA), code division multiple access (CDMA), CDMA capacity, probability of bit error considerations, CDMA compared with TDMA.

---

**Unit IV**

*Second generation, digital, wireless systems*

GSM, IS_136 (D-AMPS), IS-95, mobile management, voice signal processing and coding.

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**Text Books:**

2. Mobile wireless communications; Mischa Schwartz, Cambridge University press, UK, 2005

**Reference Books**

2. Wireless communication principles and practice, 2nd Ed, Theodore S rappaport, Pearson Education.
3. 3G wireless Demystified; Lawrence Harte, Mc. Graw Hill pub.
5. Wireless communication theory, Blake, pub: Thomson Delmar 2004
Unit - I

Introduction
The basic goal of statistics: draw conclusions based on data. Various aspects of statistics ranging from formulating the question, designing experiments to address the question, collecting the data, and analyzing the data, Random sample drawn from a parameterized family of distributions, Review of Probability: Sample spaces and events, Kolmogorov's axioms, principles of combinatorics including permutations and combinations, conditional probability and independence, Bayes' theorem, random variables, probability mass functions for discrete random variables, probability density functions for continuous random variables, cumulative distribution functions, expected value, mean and variance of a distribution, selected discrete and continuous distributions.

Unit – II

Collecting Data: Types of statistical studies, observational studies, basic sampling designs, Summarizing and Exploring Data, Sampling Distributions of Statistics: Sampling Distribution of the Sample Mean, Sampling Distribution of the Sample Variance, Student's t-distribution, Snedecor-Fisher's F-distribution

Unit – III

Basic Concepts of Inference: Point Estimation, Maximum Likelihood Estimation, Confidence Interval Estimation, Hypothesis Testing, Likelihood Ratio Tests; Inferences for Single Samples: Inferences on Mean (Large Samples), Inferences on Mean (Small Samples), Inferences on Variance (if time permits)

Unit - IV


Textbook:

INSTRUCTIONS TO PAPER SETTERS:

Maximum Marks : 60

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Unit I
Basic Concepts of Radiation, Radiation from Apertures, Synthesis of Array Antennas, Microstrip Antennas, EMIs/EMC/Antenna Measurements

Unit-II
Radiation from surface current and current line current distribution, Basic antenna parameters, Radiation mechanism-Current distribution of fn Antennas, Impedance concept-Balance dto Unbalanced transformer Field equivalence principle, Rectangular and circular apertures, Uniform distribution on an infinite ground plane, Aperture fields of Horn antenna-Babinet's principle, Geometrical theory of diffraction, Reflector antennas, Design considerations - Slot antennas

Unit-III
Types of linear arrays, current distribution in linear arrays, Phased arrays, Optimization of Array patterns, Continuous aperture sources, Antenna synthesis techniques Radiation mechanisms, Feeding structure, Rectangular patch, Circular patch, Ring antenna, Input impedance of patch antenna, Microstrip dipole,

Unit-IV
Microstrip arrays Log periodic, Bi-conical, Log spiral ridge Guide, Multi turn loop, Travelling Wave antenna, Antenna measurement and instrumentation, Amplitude and Phase measurement, Gain, Directivity, Impedance and polarisation measurement, Antenna range, Design and Evaluation

Text Book:

Reference Books:
INSTRUCTIONS TO PAPER SETTERS:

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Unit – I: Multiplexing

Unit – II: Digital Switching
Switching Functions, Space Division Switching, Time Division Switching, two-dimensional switching: STS Switching, TST Switching, No.4 ESS Toll Switch, Digital Gross-Connect Systems, and Digital Switching in an Analog Environment. Elements of SSNO7 Signaling.

Unit – III: Network Synchronization Control and Management

Unit – IV: Digital Subscriber Access and traffic analysis

Text:

References:
Scheme of Examination for M.Tech.(Regular & weekend) Programme has been approved by BoS of USICT on dated 28/05/2012 and AC subcommittee on dated 6th July, 2012 and 5th November, 2012. This scheme is effective from academic session 2015-16. Minor correction has been approved in BoS held on 16th September 2015. The correction has been approved in 40th meeting of Academic Council, dated 1st March, 2016.
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Objective: The objective of the paper is to facilitate the student with the understanding of embedded system design and ARM architecture in particular. The prerequisites are to have basic understanding of programming concepts and embedded programming in C and C++, RTOS.

Unit – I

Unit – II
ARM Embedded System, ARM Processor Fundamentals: Registers, Pipeline, Exceptions, Interrupts and vector tables, ARM Processor family, ARM Instruction Set, Thumb Instruction Set

Unit – III
Overview of C compiler and Optimization: Register allocation, Functions Calls, Pointer aliasing, Structure arrangement, Portability issues, writing and optimizing ARM assembly code

Unit – IV
Interrupts and interrupt handling Scheme, firmware and Boot loader, Real-Time operating Systems: Context Switching, task tables and kernels, Time Slice, Scheduler algorithms: RMS, Deadline monotonic Scheduling; Priority Inversion, Tasks, Threads and process, Exceptions, Exception handling

Text books:
1. Embedded Systems Architecture by Tammy Overgaard; Elsevier Publisher; 2005
2. ARM System Developer’s Guide by A.N. Sloss, D. Symes and C. Wright; Elsevier Publisher; 2006

Reference books:
1. Embedded System Design by Steve Heath, Elseveir Publisher; 2006
2. Embedded Systems by Raj Kamal, TMH; 2006
3. Embedded Microcomputer Systems, Thomson Publisher; 2005
4. Embedded system Design, Kluwer Academic Publisher; 2005
5. An Introduction to the design of small-scale embedded Systems by T. Wilmshurst, Palgrav publisher; 2001
INSTRUCTIONS TO PAPER SETTERS:

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Unit-I
Generalized Instrumentation system, Measurement systems, control system, Features of personal computers, PC_Based Instrumentation Systems, Data Acquisition systems, PC interfaces. 
Signal Conditioning and Op Amp circuits.

Unit-II
Principles of Data acquisition and Interfacing
Sampling concepts, D/A converter, A/D converters, Data Acquisition Configurations, Expansion, Buses, Parallel port, Plug-in Boards, Data Acquisition using GPIB, Data Acquisition serial interfaces, Network Data Acquisition.

Unit-III
Application Examples in Measurement and Control
PC based data - Acquisition systems - Industrial process measurements, like flow temperature,pressure, and level PC based instruments development system.

Sensors and Actuators
Temperature sensor, Displacement Sensors, Pressure Sensors, Flow sensors, Actuators.

Unit-IV
Introduction to LabVIEW: Software environment, front panel, block diagram, palettes, loops, structures and tunnels, arrays, clusters, plotting data.

Modular Programming: Modular programming in LabVIEW, creating an icon, building a connector pane, displaying subVIs and express Vis as icons or expandable nodes, creating subVIs from sections of VIs, opening and editing subVIs, placing subVIs on block diagrams, creating stand alone applications.

Text Book:

References:
5. N. Mathivanan, “PC-Based Instrumentation”, PHI, 2009
Scheme of Examination for M.Tech.(Regular & weekend) Programme has been approved by BoS of USICT on dated 28/05/2012 and AC subcommittee on dated 6th July, 2012 and 5th November, 2012. This scheme is effective from academic session 2015-16. Minor correction has been approved in BoS held on 16th September 2015. The correction has been approved in 40th meeting of Academic Council, dated 1st March, 2016
INSTRUCTIONS TO PAPER SETTERS:  Maximum Marks: 60

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Unit-I

Unit-II

Unit-III


Unit-IV

Applications of Fuzzy Logic:

Text Book:

Reference Books:
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**Paper code:** MEEC-651  
**Paper:** Lab-I  
**L T/ P C:** 0 4 2

Lab based on Optoelectronics and OFC.

**Paper code:** MEEC-653  
**Paper:** Lab-2  
**L T/ P C:** 0 4 2

Lab based on Advanced Digital Communication.

**Paper code:** MEEC-655  
**Paper:** Lab-3  
**L T/ P C:** 0 4 2

Lab based on IC Technology (through Tanner Tool or Cadence Tool)

**Paper code:** MEEC-657*  
**Paper:** Term Paper-I  
**L T/ P C:** 0 4 2

Lab based on Elective/ or Research work

* NUES : Non University Examination
Scheme of Examination for M.Tech.(Regular & weekend) Programme has been approved by BoS of USICT on dated 28/05/2012 and AC subcommittee on dated 6th July, 2012 and 5th November, 2012. This scheme is effective from academic session 2015-16. Minor correction has been approved in BoS held on 16th September 2015. The correction has been approved in 40th meeting of Academic Council, dated 1st March, 2016

**Lab based on AMC**

Paper code: MEEC-652  
Paper: Lab-4  
L T/ P C  
0 4 2

**Lab based on ASP.**

Paper code: MEEC-654  
Paper: Lab-5  
L T/ P C  
0 4 2

**Lab based on Adv. VLSI Design**

Paper code: MEEC-656  
Paper: Lab-6  
L T/ P C  
0 4 2

**Lab based on Elective/ or Research work**

Paper code: MEEC-658*  
Paper: Term Paper-I  
L T/ P C  
0 4 2

* NUES : Non University Examination
INSTRUCTIONS TO PAPER SETTERS:  
Maximum Marks : 60
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Unit I

Unit II
Transport layer & Security protocols

Unit III
Wire Sensor Networks: Introduction and overview of WSN, Applications of Sensor Networks, Sensor network architecture, Architecture of WSNs Hardware components, Energy consumption of sensor nodes, Operating systems and execution environments, some examples of sensor nodes, Network Architecture: Sensor networks scenarios, Optimization goals and figures of merit, Design principles for WSNs, Service interfaces of WSNs, Gateway concepts.

Unit IV
Communication Protocols:

Text Book:
1. Ad HOC Wireless Networks: Architectures & Protocols, By C Siva Ram Murty & BS Manoj 2nd Ed, Pearson Education.

Reference:
Scheme of Examination for M.Tech.(Regular & weekend) Programme has been approved by BoS of USICT on dated 28/05/2012 and AC subcommittee on dated 6th July, 2012 and 5th November, 2012. This scheme is effective from academic session 2015-16. Minor correction has been approved in BoS held on 16th September 2015. The correction has been approved in 40th meeting of Academic Council, dated 1st March, 2016

**Paper Code:** MEEC-705
**Paper:** Embedded Systems & RTOS

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**Unit – I**


**Unit – II**

Real-Time Scheduling: Clock-Driven Approach: Static, Timer-Driven Scheduler, General structure of Cyclic schedules, Cyclic Executives, Improving the average response time for aperiodic jobs, Scheduling sporadic jobs, Practical consideration and generalizations, Algorithm for constructing static schedules, Pros and Cons of clock-driven scheduling


**Unit – III**

Scheduling Aperiodic and Sporadic Jobs in Priority-Driven systems: Assumptions and approaches, Deferrable servers, Schedulability of deadline-driven systems in the presence of deferrable server, Sporadic server, Constant utilization, total bandwidth and weighted fair-queuing servers, Slack stealing in deadline-driven systems, Slack stealing in fixed-priority systems, Scheduling of sporadic jobs, Real time performance for jobs with soft timing constraints, A two level scheme for integrating scheduling

**Unit - IV**

Resource and Resource Access Control: Assumption on resources and their usage, Effects of resources contention and Resource access control, Non preemptive critical sections, basic priority-inheritance protocol, basic priority-ceiling protocol, stack based, priority-ceiling protocol, use of priority-ceiling protocol in dynamic-priority systems, preemption ceiling protocol, controlling accesses to multiple-unit resources.

Multiprocessor scheduling, resource access control and synchronization: Model of multiprocessor and distributed systems, task management, multiprocessor priority-ceiling protocol, elements of scheduling algorithm for end-to-end periodic tasks, Schedulability of fixed-priority end-to-end periodic tasks, end-to-end tasks in heterogeneous systems, predictability and validation of dynamic multiprocessor systems

**Text Books:**

1. Real-Time systems by Jane W. S. Liu, Pearson Education India, 2007

**References:**

4. Mobile Development Handbook by Andy Wigley, Daniel Moth and Peter Foot, Microsoft Press, WP Publisher, 2005
5. Embedded Programming with the Microsoft .NET Micro Framework by Donald Thompson and Rob S. Miles, WP Publisher, 2007
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Unit-I
Biological analogy, Architecture classification, Neural Models, Learning Paradigm and Rule, single unit mapping and the perception.

Unit-II
Feed forward networks – Review of optimization methods, back propagation, variation on Backpropagation, FFANN mapping capability, properties of FFANN’s Generalization.

Unit-III
PCA, SOM, LVQ, Adaptive Resonance Networks.

Unit-IV
Hopfield Networks, Associative Memories, RBF Networks.

Applications of Artificial Neural Networks: Regression, applications to function approximation, Classification, Blind Source Separation.

Text Book:

References:
Paper Code: MEEC-709  
Paper: Multimedia Communication  

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**Unit-I**  
**Multimedia Communication:** Multimedia information representation. Multimedia Networks, Multimedia applications, Network QoS and application QoS.

**Unit-II**  

**Unit-III**  
**Detailed study of MPEG 4:** coding of audiovisual objects, MPEG 4 systems. MPEG 4 audio and video, profile and levels. MPEG 7 standardization process of multimedia content description, MPEG 21 multimedia framework, Significant features of JPEG 2000, MPEG 4 transport across the internet
Synchronization: notion of synchronization, presentation requirements, reference model for synchronization

**Unit-IV**  
**Introduction to SMIL:** Multimedia operating System, Resource management and process management techniques.
**Multimedia communication across networks:** Layered video coding, error relevant video coding techniques, multimedia transport across IP networks and relevant products such as RSVP, RTP, RTCP, DVMRP, multimedia in mobile networks, multimedia broadcast networks, and content based retrieval in digital libraries.

**Text Book:**  

**Reference Book:**  
INSTRUCTIONS TO PAPER SETTERS:
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Unit-I
Fundamental Principles of Cryptology; Classical Cryptosystems and Their Analysis , Modern Private Key Cryptosystems: Data Encryption Standard; Advanced Encryption Standard (Rijndael)

Unit-II
Public Key Encryption (e.g., RSA, discrete log based systems) Applications of Cryptography (e.g., digital signatures, security protocols, zero-knowledge identification, games)

Unit-III
Coding Theory (error correcting codes and cryptographic applications) Techniques from Number theory, Finite fields, Elliptic curves, Probability, Complexity Theory

Unit-IV
Information Theory, Quantum Computers

Text Book:
INSTRUCTIONS TO PAPER SETTERS:

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2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

Unit-1
Sensors types and classification – mechanical, acoustic, magnetic, thermal, chemical, radiation and biosensors.

Unit-2
Micro sensors.
Sensors based on surface-acoustic wave devices.

Unit-3
Micromachining techniques
MEMS for automotive, communication and signal processing applications.

Unit-4
Modeling and simulation of microsensors and actuators. Sensors and smart structures.
Micro-opto-electro-mechanical sensors and system.

Text Books:

Reference Book:
Unit-I
Phone line modem-ISDN. Broadband technologies. Cable, DLS, fiber and wireless access technologies. Digital subscriber lines.

Unit-II
ADSL, RADSL, IDSL, HDSL, SDSL, VDSL. Standards for XDSL and comparison. Cable modem. DOCSIS.

Unit-III

Unit-IV
Direct broadcast satellite. MMDS. LMDS. WIDIS. 3G wireless systems. IMT2000.

Text Book:
2. M.P. Clarke

References Book:
2. Mervana & C.Le,
4. W. Vermillion, End-to-End DSL Architecture, Cisco
In the AVR microcontroller and its application paper, the following guidelines are provided:

**INSTRUCTIONS TO PAPER SETTERS:**

Maximum Marks: 60

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2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

**UNIT – I**

Microcontroller architecture, The AVR RISC Microcontroller Architecture: AVR family architecture, Register File, Memory access and instruction Execution, I/O Memory, I/O Ports.

**UNIT – II**

AVR Instruction Set: Program and data addressing modes, Arithmetic & Logic Instruction, Program Control Instruction, Data Transfer Instruction

AVR Hardware Design Issues: Power source, Operating clock sources, Reset circuit

**UNIT – III**

Hardware & Software Interfacing with AVR: Lights & switches, Stack operation in AVR Processors, Implementing Combinational Logic, Connecting the AVR to the PC serial port, Expanding I/O, Interfacing analog to Digital converters and DAC, Interfacing with LED/LCD displays, Stepper motor interface with AVR.

**UNIT – IV**

Communication links for the AVR Processor: RS-232 Link, RS-422/423 link, SPI and microwave bus, IrDA Data link, CAN

AVR System Development tool: Code assembler, Code simulator, Evaluation boards, AVR emulator, Device Programmer

**TEXT BOOKS:**

1. Dhananjay V. Gadre, “Programming and Customizing the AVR Microcontroller”, TMH 2003
INSTRUCTIONS TO PAPER SETTERS:

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2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

Unit-I
Matrix algebra, Inversion of Matrices, Rotational groups, matrix representation of co-ordinate transformation.

Manipulator kinematics: kinematics: Introduction, solvability, algebraic solution by reduction to polynomial, standard frames, repeatability and accuracy, computational considerations.

Unit-II
Manipulator dynamics: introduction, acceleration of rigid body, mass distribution, Newton’s equation, Euler’s equation, Iterative Newton-Euler dynamic formulation, closed dynamic equation, Lagrangian formulation of manipulator dynamics, dynamic simulation, computational consideration.

Trajectory Generation: Introduction, general considerations in path description and generation, joint space schemes, Cartesian space schemes, Path generation in runtime, Planning path using dynamic model.

Unit-III
Linear control of manipulators: Introduction, feedback and closed loop control, second order linear systems, control of second-order systems, Trajectory following control, modeling and control of a single joint.

Unit-IV
Robot Programming languages & systems: Introduction, the three level of robot programming, requirements of a robot programming language, problems peculiar to robot programming languages.

Off-line programming systems: Introduction, central issues in OLP system, cimstation, automating subtasks in OLP systems.

Text Books:
INSTRUCTIONS TO PAPER SETTERS:

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Unit I:
Review of parallel plate wave-guide: analysis of TEM mode, TE Modes and TM Modes, Surface Waves on grounded dielectric slab: analysis of TE Modes, TM Modes
Strip line: study of different Modes, electrostatic solution, propagation constant, characteristic impedance, attenuation

Unit II:
Microstrip lines: properties, Quasi static and frequency dependant closed form models, modes in microstrip line. Variational method, conformal transformation, numerical analysis
Analysis for effective relative permittivity, dispersion, propagation constant, characteristic impedance, surface waves, resonance
Losses in microstrip lines. Effect of conductor thickness and shielding on propagation characteristic of microstrip.

Unit III:
Microstrip discontinuities: open end, corners, bends, steps, junctions, and gaps.
Microstrip Passive components: branch line coupler, hybrid ring coupler, power dividers, resonators, filters

Unit IV:
Introduction to slotlines, coupled lines, Coplanar lines, defective ground structure, surface integrated waveguide structure

Text Books
2. Microwave Microwave Engineering By D.M.Pozar,

Reference Books:
1. Microstrip Lines and Slotlines – K C Gupta-Artech Publishing
2. Foundations for microstrip design – T C Edward-John Wiley &Sons
INSTRUCTIONS TO PAPER SETTERS: 

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Unit-I 
Description: Active lowpass filter design. Gain-tuning and passive-tuning, immittance calculations, and high-frequency lowpass filters. Frequency and time domain analysis of lowpass, highpass, bandpass, and bandstop filters. Classical filters. Active filter classification including gain-sensitivity limitations.

Unit-II 

Unit-III 

Unit-IV 
Active Filter Classification: Signal flow graphs, 2nd order RC active filters, first and second-order decompositions, Class A, A_, B, C, C_, D, and E filters. Lowpass Filters: Lowpass filter classes, filter design sheets, lowpass filter compilations, component selection, lowpass filter design examples, gain-tuned lowpass filters, passive-tuned lowpass filters, immittance calculations, high-frequency filters, alternatives to cascade design.

Textbook: 
Lab based on Adhoc Sensors Networks

Paper code: MEEC-753
Paper: Lab-8


Paper code: MEEC-755*
Paper: Term Paper III

Lab based on Elective/ or Research work

Paper code: MEEC-752
Paper: Dissertation

Lab based on Elective/ or Research work

Paper code: MEEC-754*
Paper: Seminar & Progress Report

Paper code: MEEC-756*
Paper: Term Paper IV

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Paper code: MEDC-601

Paper: Advance Digital Communication

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**UNIT I**

**Waveform coding Techniques:** Discretization in time and amplitude, linear quantizer, quantization noise power calculations, signal to quantization noise ratio, non-uniform quantizer, a-Law & μ-law, companding, encoding and PCM, Channel noise and error probability, DPCM and DM, Coding speech at low bit rates, PredMEion and adaptive filters, Baseband shaping for data transmission, PAM signals and their power spectra, Nyquist criterion, ISI and eye pattern.

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**UNIT II**

**Digital modulation techniques:** Binary and M-ary modulation techniques, Bit vs. symbol error probability and bandwidth efficiency, ASK, FSK, PSK Modulation techniques, comparison of QPSK, MSK & GMSK systems, Coherent and Non-Coherent detection techniques, Phase-Locked loops, Probability of error calculation for M-ary systems.

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**UNIT III**

**Equalization:** Optimal Zero-Forcing Equalization, Fractionally Spaced and Transversal Filter Equalizers, Adaptive Linear Equalizer, Pass band Equalization.

**Fading & Diversity:** Types of diversity, Receiver Diversity, Performance analysis for Rayleigh Fading, The Diversity-Interference Trade-off.

The Gaussian MIMO Channel, Basics of MIMO systems.

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**UNIT IV**

**Error control coding:** Concept of channel coding, Channel coding & Channel capacity theorems, Linear block codes, cyclic codes and convolution codes, Viterbi decoding algorithm, Turbo codes, Trellis codes, TCM.

**Spread-spectrum modulation:** Pseudo noise sequences, direct sequence and frequency-Hop spread spectrum, Signal-space dimensionality and processing gain.

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**Text Books:**


**Reference Books:**

Paper code: MEDC-602  
Paper: Advanced Information Theory & Coding

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UNIT I  
Measure of Information, Information contents of discrete memoryless sources, Entropy & Mutual Information, Source coding theorem: Huffman coding, Shannon-Fano coding, Lempel-Ziv algorithm, Prefix codes,

UNIT II  
Channel Coding theorem, Channel capacity theorem, Channel models, BSC, DMC, Lossless, Noiseless channels, Linear Block codes, Systematic & Non-Systematic codes, Repitition codes, Hamming codes, Cyclic codes, Cyclic Redundancy check (CRC) codes, Golay codes, BCH Codes, Read-Solomon codes.

UNIT III  
Convolutional codes, Polynomial representation of Convolutional codes, Tree, State and Trellis diagrams, Maximum-likelihood/Viterbi Decoding of Convolutional codes, Concept of Interleaving, Turbo Codes, Turbo decoding,

UNIT IV  
Combined coding and Modulation, Trellis Coded Modulation (TCM), Mapping by set partitioning, TCM decoder, TCM for fading channels, Concept of Space time Trellis Codes.

Text Books:  
2. Introduction to Error Control Codes by Salvatore Gravano, Oxford University Press

Reference Books:  
UNIT-I
Introduction to optical fibers, Modes of propagation, Attenuation, Dispersion in single mode and multimode fibers, Non-linear optical effects.

UNIT-II
Optical sources and transmitters: LEDs, Laser diodes, Line codes (RZ, NRZ, Manchester, AMI codes), Receivers: p-i-n photodiodes, APDs, Noise sources, Signal-to Noise Ratio, Bit-error rate (BER), Optical Pre-amplifier design.

UNIT-III
Optical amplifiers: Semiconductor optical amplifier, EDFA, Dispersion Compensation: Pre-post compensation, Dispersion Compensating Fiber (DCF), Dispersion Compensating Grating (DCG) (Simulation Exercises on OptiSystem/OptiSim).

UNIT-IV
Research Directions: Wavelength Division Multiplexing (WDM) systems, Orthogonal Frequency Division Multiplexing (OFDM), Optical Code Division Multiple Access (OCDMA), Optical Time Division Multiplexing (OTDM), Solitons (Exercises on OptiSystem/OptiSim).

Text Books:
2. Fiber-Optic Communication Systems - by GP Aggarwal - John Wiley & Sons

Reference Books:
2. Related IEEE/IEE publications
INSTRUCTIONS TO PAPER SETTERS:  
1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

Unit-I

Unit-II
Data Transmission in GSM. HSCSD, GPRS, EDGE.

Unit-III

Unit-IV

Text Books:
1) Theodore S. Rappaport, Wireless Communications Principles & Practice, Pearson Education
2) Jochen Schiller, Mobile Communications, Pearson Education.

Reference books:
2) Raj Pandya, Mobile & Personal Communication Systems And Service, PHI.
INSTRUCTIONS TO PAPER SETTERS:

Maximum Marks : 60

1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

UNIT I
Introduction Signals and signal Processing, characterization & classification of signals, Review of passive circuits and filters, Filter Approximation theory (Maximally flat and Chebychev), of magnitude and/or delay, Ladder design and Leapfrog filter design. Practical design considerations, effect of op-amp non-idealities.

UNIT II
Linear and non-linear applications of op-amps and OTAs, Active filter (Single amplifier biquads, Multiple feedback filters, Integrator loop Multiple amplifier filters employing opamp and OTA), oscillator design using op-amps and OTAs. Use of computers in filter design, IC timers.

UNIT III

UNIT IV

Text Books:
2. Design of Analog Filters: Passive, Active-RC and Switched Capacitor By Laker, Ghausi and Schaumann Publisher: Prentice Hall.

References:
1. Continuous-time active filter design By Deliyanis, Sun and Fidler, Wiley,
4. Selected research papers from Journals
UNIT I
Concept of fading, factors influencing fading, types of fading and characteristics of fading channels, fading margin, statistical models for multipath fading channels, optimum receivers for fading channels.

UNIT II
Radio propagation over wireless channel: General considerations about radio waves and wireless channels, propagation mechanism, free space propagation model, ground wave propagation, ionospheric propagation, channel noise and losses, satellite link, influence of multipath effect on signal propagation, fading effects to signals & frequency components, shadowing, signal outages in fading channels.

UNIT III
Introduction to channel modeling, representation of discrete channel by filter, Rayleigh fading model, Rician fading model, Nakagami fading model, comparison of Rayleigh, Rician and Nakagami Fading models.

UNIT IV
Performance of single channel receivers over fading channels, Trellis Coded Modulation (TCM), coded communications over fading channels.

Text Books:

Reference Books:
1) Mobile Communication Systems by Wesolowshi.
3) Wireless Communications by Upena Dalal.
UNIT I
Review of data communication techniques, Data transmission, line coding, error control coding, Data switching, circuit switching, message and packet switching.

UNIT II
Network model ISO-OSI model, primitives and services, Elements of queuing. Data link control Simplex, pipelined and sliding window protocols, simplex performance analysis, X 25 data link layer, Random access techniques, Pure, slotted and finite population ALOHAs, Stability in ALOHAs.

UNIT III
Routing and congestion control static, adaptive, centralized and distributed routing procedures, congestion control, Local Area Networks LAN topologies and protocols, IEEE 802.x protocols, implementation and performance issues, High speed LANs. Switching and Bridging, Basic Internetworking (IP), Routing, Implementation and Performance.

UNIT IV
Advanced Internetworking - The Global Internet, Routing Areas, Interdomain Routing (BGP), IP version 6 (IPv6), Multicast, Multicast Addresses, Multicast Routing (DVMRP, PIM, MSDP), Multiprotocol Label Switching (MPLS), Destination-Based Forwarding, Explicit Routing, Virtual Private Networks and Tunnels, Routing among mobile devices, Challenges for Mobile Networking, Routing to Mobile Hosts (Mobile IP).

Text Books:
2. Computer Networks By Larry Peterson, Bruce Davie

Reference Books:
Scheme of Examination for M.Tech.(Regular & weekend) Programme has been approved by BoS of USICT on dated 28/05/2012 and AC subcommittee on dated 6th July, 2012 and 5th November, 2012. This scheme is effective from academic session 2015-16. Minor correction has been approved in BoS held on 16th September 2015. The correction has been approved in 40th meeting of Academic Council, dated 1st March, 2016

Paper code: MEDC-608
Paper: Satellite Communication

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INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60
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2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

UNIT-I

UNIT-II
SPACECRAFT SUB SYSTEMS AND EARTH STATION: Altitude and Orbit Control, Telemetry and Tracking, Power Systems, Communication Subsystems, Transponders, Antennas, Equipment Reliability, Earth Stations, Example of payloads of operating and planned systems.

UNIT-III
SPACE LINKS: Satellite Link Design - Satellite uplink -down link power Budget, Basic Transmission Theory, System Noise Temperature, G/T Ratio, Noise Figure, Design of Down links, Domestic Satellite Systems Using Small Earth stations, Uplink Design, Design of Satellite Link for Specified (C/N).

UNIT-IV
MULTIPLE ACCESS TECHNIQUES AND NETWORK ASPECTS: Single access vs. multiple access, FDMA, TDMA, Single channel per carrier (SCPC) access - Code division multiple access (CDMA). Demand assignment techniques, Mobile satellite network design, ATM via satellite, TCP/IP via satellite - Call control, Hybrid satellite-terrestrial networks. VSATs.
SERVICES AND APPLICATIONS: Fixed and mobile services, Multimedia satellite services, advanced applications based on satellite platforms.

Text Books:

Reference Books:
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<th>Paper code: MEDC-651</th>
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Lab based on Advanced Digital Communication Systems.

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Lab based on OFC Systems

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Lab based on Advanced Signal Processing.

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<td>Paper: Term Paper-I</td>
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Lab based on Elective/ or research work

* NUES : Non University Examination
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- *Non University Program

The student will have to present the seminars and progress reports at the interval of four weeks during the semester. Minimum two seminars will be held during the semester.
**INSTRUCTIONS TO PAPER SETTERS:**

Maximum Marks : 60

1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

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**Unit -I**


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**Unit-II**


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**Unit-III**


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**Unit-IV**


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**Text Books :**


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**Reference Books:**

1) Raj Pandya, Mobile & Personal Communication Systems And Service, PHI.
3) Jochen Schiller, Mobile Communication, Pearson education
INSTRUCTIONS TO PAPER SETTERS:  
Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

UNIT I

UNIT II

UNIT III

UNIT IV

TEXT BOOKS:
1) Broadband Communication Systems by Cajetan Akujuobi and Matthew Sadiku, Scitech Publishing.
2) Introduction to broadband Communication Systems By Cajetan M. Akujuobi and MNO Sadiku, Chapman & Hall.

REFERENCE BOOKS:
2) Optical Networks A Practical Perspective by Rajiv Ramaswami, Kumar N. Sivarajan, Galen H. Sasaki.
Paper code: MEDC-705

Paper: High performance communication networks

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<th>UNIT</th>
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<tr>
<td>UNIT-I</td>
<td>Basics of Networks: Telephone, computer, cable television and wireless network, networking principles, digitization: Service integration, network services and layered architecture, traffic characterization and QOS, networks services, network elements and network mechanisms.</td>
</tr>
<tr>
<td>UNIT-II</td>
<td>Packet switched networks: OSI and IP models, Fast and Gigabit Ethernets, FDDI, DQDB, frame relay, SMDS, internet working with SMDS. Internet and TCP IP networks: overview, internet protocols, TCP and VDP, performance of TCP/IP networks circuit switched networks, SONET, DWDM, fibre to home, DSL, intelligent networks, CATV.</td>
</tr>
<tr>
<td>UNIT-III</td>
<td>ATM and Wireless networks: Main features, addressing, signaling and routing, ATM header structure, adaptation layer, management and control, BISDN, interworking with ATM, wireless channel, link level design, channel access, network design and wireless networks.</td>
</tr>
<tr>
<td>UNIT-IV</td>
<td>Optical networks and Switching: Optical links, WDM systems, cross-connects, optical LANs, optical paths and networks, TDS and SDS, modular switch designs, packet switching, distribution, shared, input and output buffers.</td>
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Text Books:

Reference Books:
Paper code: MEDC-707

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UNIT I

UNIT II
CODE GENERATION: Coding – Maximal sequences – Linear Code Generator – Auto Correlation and Cross Correlation of codes– Composite codes – Chip rate and code length – Choosing a linear code – Generating high rate codes – Code selection and Signal spectra – Initial Synchronization – Tracking

UNIT III

UNIT IV

TEXT BOOKS:

REFERENCE BOOKS:
Paper code: MEDC-709
Paper: Selected topics on Recent Technologies in Wireless & Mobile Comm’ n

**INSTRUCTIONS TO PAPER SETTERS:**

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**UNIT I**

Wireless Multiple Access and Multiplexing Techniques, Time-Domain and Frequency-Domain Analyses of Signals and Systems, Spread Spectrum Techniques Wireless Channel Parameters (Delay Spread and Doppler Spread), Comparison between Signal (OFDM & CDMA) Parameters and Channel Parameters, Brief Reviews on Random Variables and Probability Modeling

**UNIT II**

Direct Sequence Spread Spectrum Techniques, Walsh Code, Pseudo Random Code, Mean and Variance of Random Codes, Rake Receiver, Capacity Analysis & Power Control, Multipath Effects (Delay Spread and Distortion) and Rake Receiver Approach, Capacity Analysis of Cellular CDMA Communication Systems, Power Control in CDMA Communication Systems

**UNIT III**

Synchronous CDMA, Auto and Cross Correlations of Spreading Codes and Signals, Synchronous Code Division Multiple Access (CDMA) Systems, Bit-Error-Rate Analysis of Synchronous CDMA Systems


**UNIT IV**

Ultra Wideband (UWB) Communications, Radio Frequency IDentification (RFID) Technology, Miscellaneous Modern Wireless Communication Techniques and Systems

**TEXTBOOKS**

1. Mobile wireless communications, author Mischa Schwartz, publisher Cambridge
2. *Wireless Communication*, 1/e author Upena Dalal, publisher oxford

**REFERENCES**

1. OFDM Baseband Receiver Design for Wireless Communications by Tzi-Dar Chiueh, Pei-Yun Tsai, Wiley
2. From GSM to LTE: An Introduction to Mobile Networks and Mobile Broadband by Martin Sauter, Wiley
Scheme of Examination for M.Tech.(Regular & weekend) Programme has been approved by BoS of USICT on dated 28/05/2012 and AC subcommittee on dated 6th July, 2012 and 5th November, 2012. This scheme is effective from academic session 2015-16. Minor correction has been approved in BoS held on 16th September 2015. The correction has been approved in 40th meeting of Academic Council, dated 1st March, 2016.

**Objective:** Students are required select a topic of their interest and develop a minor project on it. The student will submit a synopsis at the beginning of the semester for the approval to the project committee in a specified format (available on www.ipu.ac.in). The student will have to present the progress of the work through seminars. A report must be submitted to the college for evaluation purpose at the end of the semester in a specified format.

*Non University Program*

The student will have to present the seminars and progress reports at the interval of four weeks during the semester. Minimum two seminars will be held during the semester.
Objective: Students are required to select a topic of their interest and prepare a dissertation on it. The student will submit a synopsis at the beginning of the semester for the approval from the project committee in the specified format. Synopsis must be submitted within two weeks. The first defense, for the dissertation work, should be held within one month. Dissertation Report must be submitted in specified format (available on www.ipu.ac.in) to the college for evaluation purpose.

Paper code: MEDC-754*  
Paper: Seminar & Progress report  
100 marks: internal evaluation

Paper code: MEDC-757*  
Paper: Term Paper-IV  
40 marks: internal evaluation 60 marks: external evaluation

*Non University Program

The student will have to present the seminars and progress reports at the interval of four weeks during the semester. Minimum two seminars will be held during the semester.
INSTRUCTIONS TO PAPER SETTERS:

UNIT I

UNIT II
Random Processes: Concept of random variables, functions on joint-PDF, joint-CDF of random variables, 1st and 2nd characteristic function, Definition and classification, stochastic integrals, WSS processes, Fourier transforms of random processes, correlation functions, Ergodicity, power spectral density.

UNIT III

UNIT IV
Optimum Filtering: Matched filters for deterministic signals in white and coloured Gaussian noise. Wiener filters for random signals in white and coloured Gaussian noise. Discrete and continuous time filters.

Text books:
1) Probability, Random Variables and Stochastic Processes By A. Papoulis, S. Pillai, McGraw-Hill.

Reference Book
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<tr>
<td>UNIT II</td>
<td>Classical detection Theory: Binary and m-ry hypothesis testing, Bayes’ criterion, NP test, the general Gaussian problem, min-max test, erasure decision problem;</td>
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<tr>
<td>UNIT III</td>
<td>Classical estimation theory: random parameter estimation; MMSE absolute error cost function, uniform error cost function estimators, CRLB for random parameter case, non-random parameter estimation; ML estimator, CRLB.</td>
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<tr>
<td>UNIT IV</td>
<td>Composite and non-parametric hypothesis testing: Sign test, Wilcoxon test.</td>
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**Text Books/ References:**

INSTRUCTIONS TO PAPER SETTERS:  
Maximum Marks : 60

1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

UNIT I
Approximation theory of magnitude and/or delay, review of passive circuits and filters.

UNIT II
Practical design considerations, effect of op-amp non-idealities, Linear and non-linear applications of op-amps and OTAs, Active filter/oscillator design using op-amps and OTAs, Various design methods,

UNIT III
Use of computers in filter design, IC timers, IC Function generators, Multipliers, PLL.

UNIT IV
Elements of switched capacitor circuits, CCD and SAW filters, D/A and A/D converters.

Text books:
2) Design of Analog Filters: Passive, Active-RC and Switched Capacitor By Laker, Ghausi and Schaumann Publisher: Prentice Hall.

Reference Books
2. Continuous-time active filter design By Deliyanis, Sun and Fidler, Wiley.
3. Selected research papers from Journals

Paper code: MESP-603
Paper: Analog Signal Processing

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INSTRUCTIONS TO PAPER SETTERS:

Maximum Marks : 60

1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

UNIT-I
Introduction
Signals and signal Processing, characterization & classification of signals, typical Signal Processing operations, example of typical Signals, typical Signals Processing applications.

Time Domain Representation of Signals & Systems

UNIT-II
Z-transforms, Inverse Z-transform, properties of Z-transform, & its applications in system analysis & design. Discrete Fourier Transform (DFT) & its properties, computation of the DFT of real sequences, Linear Convolution using the DFT.

UNIT-III
Digital Filter Structure

Digital Filter Design

UNIT-IV
Computation of Discrete Fourier Transform
Complexity of the DFT computation by direct method, Goertzel algorithm, Decimation –in-time FFT algorithms, Decimation-in frequency FFT algorithms.

Text Books:

References:
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Paper code: MESP-605

Paper: Mathematical Methods in Signal Processing

INSTRUCTIONS TO PAPER SETTERS:

1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

UNIT I
Introduction to Linear Algebra basics, Generalized inverses, regularization of ill-posed problems.

UNIT II
Eigen and singular value decompositions, generalized problems,

UNIT III
Interpolation and approximation by least squares and minimax error criteria,

UNIT IV
Optimization techniques for linear and nonlinear problems, Applications in various areas of signal processing.

Text book/ References:
1) Linear Algebra By Hofmann and Kunze, Prentice Hall.
2) Solving Least Squares Problems By Charles L. Lawson and Richard J. Hanson, SIAM Prentice Hall.
Paper code: MESP-606
Paper: Topics in Stochastic Processes

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UNIT I
Martingale convergence theorem, stopping times, sequential analysis,

UNIT II
Ergodic Theory: Measure preserving transformations, stationary processes, mixing conditions, ergodic theorem,

UNIT III

UNIT IV
Continuous time processes: Separability, continuity, measurability, stochastic integral.

Text Books/References:
3) Stochastic processes By Emanuel Parzen, Holden Day.
INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

UNIT I
Fundamentals of telecom systems, Principles of communication and signaling,

UNIT II
Fundamentals of transmission; mathematical models for Electrical Engineering networks, Tele-traffic engineering:

UNIT III
Telecom Management Networks, Protocols, Architectures for Broadband Networks, ATM, SDH/SONET;

UNIT IV
Access and Hybrid Networks; All optical networks.

Text book/References:
1) Introduction to broadband Communication Systems By Cajetan M. Akujuobi and MNO Sadiku, Chapman & Hall.
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**Paper code: MESP-608**
**Paper: Wavelet Transforms for Signal and Image Processing**

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**UNIT I**
Basics of functional Analysis; Basics of Fourier Analysis; Spectral Theory; Time-Frequency representations;

**UNIT II**
Non-stationary Processes; Continuous Wavelet Transforms; Discrete Time-Frequency Transforms;

**UNIT III**
Multi resolution Analysis; Time-Frequency Localization; Signal Processing Applications;

**UNIT IV**
Image Processing Applications

**Text Books/References:**

1) Wavelet Transforms & Time-Frequency Signal Analysis (Hardcover) By Lokenath Debnath, Birkhauser (USA).
3) A Wavelet Tour of Signal Processing By Stephane Mallat, Elsevier.
UNIT-I
Introduction: Statement of an Optimization problem, Classification of Optimization problems


UNIT-II
One-Dimensional Minimization Methods: Elimination Methods, Unrestricted Search Method, Fibonacci Methods, Interpolation Methods – Quadratic and Cubic Interpolation Methods


UNIT-III

Constrained Minimization Methods: Characteristics of a constrained problem, Direct Methods of feasible directions, Indirect Methods of interior and exterior penalty functions

UNIT-IV
Genetic Algorithm: Introduction to GA, fitness function, GA operators, Unconstrained and constrained optimization using Genetic algorithm, Global optimization using GA.

Text Books
2. Optimization Concepts and Applications in Engineering – Ashok D.Belegundu and Tirupathi R Chandrupatla — Pearson Education.

References
2. “Optimization for Engineering Design: Algorithms and Examples”, Kalyanmoy deb, PHI publication
Scheme of Examination for M.Tech.(Regular & weekend) Programme has been approved by BoS of USICT on dated 28/05/2012 and AC subcommittee on dated 6th July, 2012 and 5th November, 2012 and 5th November, 2012. This scheme is effective from academic session 2015-16. Minor correction has been approved in BoS held on 16th September 2015. The correction has been approved in 40th meeting of Academic Council, dated 1st March, 2016

Paper code: MESP-610
Paper: Mixed Signal Circuit Design

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<td>1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.</td>
<td></td>
</tr>
<tr>
<td>2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks</td>
<td></td>
</tr>
</tbody>
</table>

UNIT I
Sampling and Aliasing, SPICE Models for DACs and ADCs, Nyquist and Oversampled Converters, Ideal DAC, Ideal ADC, Viewing the Quantization Noise Spectrum Using Simulations, Voltage Spectral Density, Data Converter SNR, Effective Number of Bits, Clock Jitter, Improving SNR Using Averaging.

UNIT II
Decimating Filters for ADCs, Interpolating Filters for DACs, Sinc Filters, Discrete Analog Integrator, Modulators, Noise-Shaping Fundamentals and Data Converters, First-Order, Second-Order Noise-Shaping and Topologies; Higher-Order, Multibit, Cascaded and Bandpass Modulators; Submicron CMOS.

UNIT III

UNIT IV
Noise Performance of a Cascade of Amplifiers, Implementing Data Converters, R-2R Topologies for DACs, Voltage-Mode and Current-Mode R-2R DAC, Topologies Without an Op-Amp, Implementing ADCs, Implementing the S/H, Cyclic and Pipeline ADC.

Text Books/ References:
1) CMOS: Mixed-signal Circuit Design By R. Jacob Baker, Wiley-IEEE Press,
Paper code: MESP-612        L T P C
Paper: Digital Image Processing                  4 0 4

INSTRUCTIONS TO PAPER SETTERS:     Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit
should have two questions. However, student may be asked to attempt only 1 question from each unit. Each
question should be 10 marks

UNIT I
Introduction to 2-D Signals and Systems, Image Digitization, Image Transforms, Image Data Compression:
Transform Domain Coding, Predictive Coding, JPEG. Image Enhancement:

UNIT II
Image Restoration: Inverse Filtering, Algebraic Approach to Restoration, Wiener (LMS) approach, Constrained
Least Squares Restoration, Interactive and other methods for restoration.

UNIT III
Segmentation: Detection of Discontinuities, Edge Linking and Boundary Detection,

UNIT IV
Thresholding, Region-Oriented Segmentation, Selected Topics of Current Interest (for example multi-
resolution analysis, morphological processing etc.).

Text books/ References:
2) Digital Image Processing and Computer vision By Milan Sonka, CL-Engineering Publisher.
<table>
<thead>
<tr>
<th>Paper code: MESP-651</th>
<th>L T/ P C</th>
<th>0 4 2</th>
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<tbody>
<tr>
<td>Paper: Lab-I</td>
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Lab based on Signal Theory.

<table>
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<tr>
<th>Paper code: MESP-653</th>
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<tr>
<td>Paper: Lab-2</td>
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Lab based on Advanced Digital Communication.

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<tr>
<th>Paper code: MESP-655</th>
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<tr>
<td>Paper: Lab-3</td>
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Lab based on Analog Signal Processing.

<table>
<thead>
<tr>
<th>Paper code: MESP-657*</th>
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<tbody>
<tr>
<td>Paper: Term Paper-I</td>
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</table>

* NUES : Non University Examination
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<td>Paper: Lab-6</td>
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<td>Paper: Term Paper-II</td>
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<td>40 marks: internal evaluation</td>
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INSTRUCTIONS TO PAPER SETTERS:  
Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

UNIT I
Methods for fast computation of DFT including FFT, NTT and WTFA, Noise analysis of digital filters, Review of Discrete random signal processing: Discrete random processes, expectations, variance, co-variance, scalar product, energy of discrete signals, Parseval’s theorem,

UNIT II

UNIT III
AR, MA, ARMA signal modeling, parameter estimation using Yule-Walker method. Multirate Digital Signal Processing: Mathematical description of change of sampling rate, interpolation and decimation, continuous time model, Direct digital domain approach,

UNIT IV
decimation by an integer factor, interpolation by an integer factor, single and multistage realization, polyphase realization, application to sub band coding, Architecture and Applications of Digital Signal Processors.

Text books:

Reference Books
UNIT I
Mathematical preliminaries, Wiener filtering and MMSE estimates, Linear predication, Levinson-durbin algorithm and lattice.

UNIT II

UNIT III
Least Squares Algorithm: General Weighted Least Squares Methods, Recursive Least Squares Algorithm, Fast Least Squares Algorithm to AR modeling case,

UNIT IV
Special Topics, Introduction to array processing.

Text Books/References:
2) An Introduction to Statistical Signal Processing By Gray and Davisson, Cambridge University Press
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### INSTRUCTIONS TO PAPER SETTERS:

| Maximum Marks : 60 |
|---|---|
| 1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks. |
| 2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks |

### UNIT I
Range Doppler resolution, Spatial processors, Incoherent temporal processors,

### UNIT II
Coherent processors including deltix correlators, Doppler filtering,

### UNIT IV
Fast Fourier transform processors, Matched filtering hyperbolic FM systems,

### UNIT V
Target identification.

### Text book/References:
UNIT I
Introduction: Digital speech processing, Digital transmission and storage of speech, speech synthesis systems, speaker verification and identification systems, speech coding, speech recognition and enhancement of speech quality

Speech Production Mechanism: Physiological model, Articulatory phonetics, Acoustic phonetics, Digital Model of speech signal

UNIT II

Frequency Domain Method for Speech Processing: Relevant properties of fast Fourier transform and Z-transform for speech recognition, Short Time Fourier analysis: Fourier transform and linear filtering interpretations, Filter bank analysis

UNIT III
Homomorphic speech analysis: Homomorphic speech signal deconvolution, Real and complex cepstrum, Applications of cepstrum analysis to speech signals
Linear Predictive Analysis of speech: Basic Principles of linear predictive analysis, Auto correlation method, Covariance method, Solution of LPC equations, Cholesky method, Durbin’s Recursive algorithm

UNIT IV
Statistical models for Speech recognition: Vector quantization models applications in speaker recognition, Gaussian mixture modeling for speaker and speech recognition, hidden Markov modeling for isolated word and continuous speech recognition

Text Books:

Reference books
2. Speech and Audio Signal Processing, Ben Gold and Nelson Morgan, John Wiley and Sons, 2000
INSTRUCTIONS TO PAPER SETTERS: 
Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

UNIT I
Introduction to DSP systems, loop bound and Iteration bound. Pipelining and parallel processing, Retiming; definition, properties and techniques.

UNIT II
Unfolding; algorithm, properties and applications, Folding transformation and register minimization, Systolic architecture design, Fast convolution; Cook-toom algorithm, Winograd algorithm, Iterated and cyclic convolution.

UNIT III
Algorithmic strength reduction in Filters and Transforms, Pipelined and Parallel recursive and adaptive filters, Scaling and round-off noise, Digital lattice filter structures; Schur algorithm, low-power CMOS lattice IIR filters, Bit-level arithmetic architectures; bit serial filter design.

UNIT IV
Distributed arithmetic, Redundant arithmetic, Numerical strength reduction, Synchronous wave and asynchronous pipelines, Low-power design; power reduction techniques and power estimation approaches, Programmable digital signal processors.

Text Books/ References:
Sports scheme of examination for M.Tech. (Regular & weekend) programme has been approved by BoS of USICT on dated 28/05/2012 and AC subcommittee on dated 6th July, 2012 and 5th November, 2012. This scheme is effective from academic session 2015-16. Minor correction has been approved in BoS held on 16th September 2015. The correction has been approved in 40th meeting of Academic Council, dated 1st March, 2016.

<table>
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<tr>
<th>Paper code: MESP-711</th>
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<td>Paper: Optical Signal Processing</td>
<td>4 0 4</td>
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</table>

**INSTRUCTIONS TO PAPER SETTERS:**  
Maximum Marks : 60

1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

---

**UNIT I**

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**UNIT II**
Light Sources, Raster-Format, Spectrum Analyzer, Spatial Filtering, Interferometric Methods for Constructing Filters, Multiplexed Filters, Reference Function Optical Processors, Optical Signal Processor and Filter Generator, Effects of Small Displacements of Spatial Filters, Non-linear optical signal processing.

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**UNIT III**

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**UNIT IV**

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**Text books/ References:**
3) Related research papers from IEEE/IEE publications.
INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Course contents will be decided by the Board of Studies of USICT at the beginning of the semester.
INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: 60

1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

UNIT I
Review of bipolar and MOS transistor models, Circuit simulation using SPICE, Theory and design of operational amplifiers, Definition and measurement of performance characteristics,

UNIT II
Bipolar, BiCMOS and CMOS operational amplifiers, CMOS OTAs, circuit design examples,

UNIT III
operational mirrored amplifiers, Current-conveyors and their variants, current-feedback amplifiers, Current Mode Signal Processing. Techniques of Non linearity cancellation in analog CMOS circuits,

UNIT IV
Translinear-principle and its applications Log-domain and square-domain circuits

Text books:
1) Fundamentals of Microelectronics By Behzad Razavi, Wiley.
2) Analog VLSI: Signal and Information By Mohammed Ismail and Terri Fiez, McGraw Hill.

Reference Books
4. Selected research papers from Journals
UNIT I
Biomedical signal processing, biomedical applications of the wavelet transform, Analog versus digital circuitry Biomedical Signals and Images ECG and evolution of pacemakers: Hear, Cardiac Signals, Cardiac electrophysiology, relation of ECG components to cardiac events, clinical applications, History and development of Cardiac pacing, new features in modern pacemakers. Speech Signals: The source-filter model of speech production, spectrographic analysis of speech. Speech Coding: Analysis-synthesis systems, channel vocoders, linear prediction of speech, linear prediction vocoders.Imaging Modalities: Survey of major modalities for medical imaging: ultrasound, X-ray, CT, MRI, PET, and SPECT.MRI: Physics and signal processing for magnetic resonance imaging. Surgical Applications: A survey of surgical applications of medical image processing.

UNIT II
Sampling Revisited: Sampling and aliasing in time and frequency, spectral analysis. Image processing I: Extension of filtering and Fourier methods to 2-D signals and systems. Image processing II: Interpolation, noise reduction methods, edge detection, homomorphic filtering.Wavelet versus Fourier Analysis: Fourier transform, Windowing function. Wavelet transform (continuous-time and complex continuous-time), Signal processing with the wavelet transform (Singularity detection, denoising and compression).

UNIT III
Analog wavelet filters: The need for approximation; complex first order, Pade approximation, Bessel-Thomson, Filanovsky’s, Fourier series methods Optimal state-space description: State-space description, dynamic range optimization. Sparsity; Orthogonal transformations, Canonical form, Biquad structure. Sensitivity Ultra Low-power integrator design: \( G_m-C \) filters; \( nA/V \) CMOS transconductor, \( pA/V \) Delta-Gm transconductor Translinear (log-domain) filters; Class-A log domain filter designs Low-power class-AB sinh integrators; state-space formulation for class-AB log-domain integrators, companding sinh integrator Ultra low-power biomedical system design: Dynamic translinear cardiac sense amplifier for pacemakers QRS-complex wavelet detection using CFOS, Wavelet filter design, Morlet wavelet filter.

UNIT IV

Textbooks/References:
1) Ultra low-power biomedical Signal Processing, S. A. P. Haddad and W. A. Serdijn, Springer
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<th>L T/ P C</th>
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<td>Paper: Minor Project</td>
<td>0 4 2</td>
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</table>

| Objective: Students are required select a topic of their interest and develop a minor project on it. The student will submit a synopsis at the beginning of the semester for the approval to the project committee in a specified format (available on www.ipu.ac.in). The student will have to present the progress of the work through seminars. A report must be submitted to the college for evaluation purpose at the end of the semester in a specified format. |

<table>
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<tr>
<th>Paper code: MESP-757*</th>
<th>L T/ P C</th>
<th>40 marks: internal evaluation</th>
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<tr>
<td>Paper: Term Paper-III</td>
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</table>
Paper code: MESP-752  
*Paper: Dissertation  
**total credit**  
24

: Evaluation based on Final Thesis of the work done

**Objective:** Students are required to select a topic of their interest and prepare a dissertation on it. The student will submit a synopsis at the beginning of the semester for the approval from the project committee in the specified format. Synopsis must be submitted within two weeks. The first defense, for the dissertation work, should be held within one month. Dissertation Report must be submitted in specified format (available on www.ipu.ac.in) to the college for evaluation purpose.

Paper code: MESP-754*  
*Paper: Seminar & Progress report  
**total credit**  
4

100 marks: internal evaluation

- *Non University Program

The student will have to present the seminars and progress reports at the interval of four weeks during the semester. Minimum two seminars will be held during the semester.

Paper code: MESP-756*  
*Paper: Term Paper -IV  
**total credit**  
2

100 marks: internal evaluation

- *Non University Program

The student will have to present the seminars and progress reports at the interval of four weeks during the semester. Minimum two seminars will be held during the semester.
INSTRUCTIONS TO PAPER SETTERS:  

Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Unit I:
The Source Concept, Duality, Uniqueness, Image Theory, The Equivalence Principal, Fields in Half-space, The Induction Theorem, Reciprocity, Green’s Function

Unit II:
The Wave Function, Plane Waves, The Rectangular Waveguide, Alternative Mode Sets
The Rectangular Cavity, Partially Filled Waveguide, The Dielectric-Slab Waveguide, Surface-Guided Waves, Modal Expansion of Fields, Current in Waveguides

Unit III:
Other Guided Waves, Source of Cylindrical Waves, Two-dimensional Radiation, Waves Transformations, Scattering by Cylinders, Scattering by Wedges, Three-dimensional Radiation

Unit IV:
The Wave Function, The Spherical Cavity, Orthogonality Relationships, Space as a Waveguide, Other Radial waveguide, Other resonators

Text Books:

Reference Books:
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INSTRUCTIONS TO PAPER SETTERS:

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Unit I:
Complex Variables: Cauchy’s integral theorem, Fourier transform integrals with singularity, Singularity extraction technique, Branch point integrals. Saddle point.

Unit II:
Stationary phase method for evaluation of radiation integrals. Special Functions: Bessel functions, Fresnel integrals, etc

Unit III:
Computational Techniques: Classification based on integral and differential equation solution, time domain and frequency domain solutions.

Unit IV:
Introduction to Finite-difference, FDTD, finite element techniques in electromagnetics with applications. Perturbations of Cavity Walls, Cavity-material Perturbations, Waveguide Perturbations and Variational Techniques

Text Books:

Reference Books:
INSTRUCTIONS TO PAPER SETTERS:  
1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks. 
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<tr>
<th>Unit</th>
<th>Description</th>
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<tbody>
<tr>
<td>Unit I:</td>
<td>Review of EM Theory: Maxwell’s equations, fields in media and boundary conditions, wave equation and basic plane wave solutions, plane waves in dielectric and conducting media, energy and power.</td>
</tr>
<tr>
<td>Unit II:</td>
<td>Transmission lines and waveguides: field analysis of transmission lines, terminated lossless terminated line, quarter wave transformer, lossy transmission lines closed and dielectric guides, planar transmission lines.</td>
</tr>
<tr>
<td>Unit III:</td>
<td>Microwave Network analysis: Impedance and equivalent voltages and currents, scattering matrix and other parameters, signal flow graphs and network representation. Impedance matching and tuning.</td>
</tr>
<tr>
<td>Unit IV:</td>
<td>Analysis of planar transmission lines. Analysis of Coupled Transmission Line Structures, microwave resonators.</td>
</tr>
</tbody>
</table>

**Text Books:**

**Reference Books:**
INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Unit I:
Review of electromagnetic theory, Antenna and their different types, Radiation Mechanism and Current Distribution, Fundamental Parameters related to antenna (Radiation Pattern, Radiation Power Density, Directivity, Gain, Beamwidth, Antenna Efficiency, Bandwidth, Polarization, Radiation Efficiency, Antenna Factor) Radiation Integrals, Auxiliary Potential Functions and Construction of Solution, Solution of the inhomogeneous vector Potential Wave Equation, Far Field Radiation

Unit II:
Infinitesimal dipole, Small Dipole, Finite length and Half-Wavelength Dipole – Analysis using assumed current Distribution Small Circular loop, Circular Loop with constant current, Two Element Array N-Element Linear Array with uniform amplitude and spacing, Broadside and End-Fire Array, N-Element Linear Array: Three Dimensional Characteristic

Unit III:

Unit IV:
Basic of Microstrip Antenna, Designing of Rectangular Microstrip Antenna, Antenna Ranges, Gain Measurement, Radiation Pattern Measurement, Anechoic Chamber

TEXT BOOK

REFERENCE BOOK
Paper code: MERF-605
Paper: RF and Microwave Passive Circuits Design.

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<th>INSTRUCTIONS TO PAPER SETTERS:</th>
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<tr>
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</tbody>
</table>

Unit I:
Transmission lines for microwave circuits; waveguides. Stripline, microstrip, slot line, microwave circuit design principles; passive circuits.

Unit II:
Theory of Reflections, Design of Transformers, Tapered transformers, Impedance transformers, filters, hybrids, isolators etc., Design of Filters various Types Low Pass Band Pass and Band Stop. Analysis of Coupled Line Transmission Lines, Coupled Line Filters

Unit III:
Couplers in Planar Transmission Line and waveguide circuits: Directional coupling, hybrids, Power combining, transformer equivalent circuits, double tuned transformers, Transformers with magnetic and iron cores. Transmission lines, transformers and baluns. Waveguides, matching in waveguide circuits, waveguide junctions, coaxial lines, resistance impedance bridge, standing waves

Unit IV:
Techniques for Measurement of microwave signals and Passive Circuits.

Text Books:

Reference Books:
INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Unit I:

Unit II:
VNA, Passive and active circuit characterization using network analyzer. Power Sweep and Frequency sweep Measurements. Measurement of System parameters such as MDS, Dynamic range and 1 dB Compression Points.

Unit III:

Unit IV:
Time Domain Reflectometry. Measurements of Impedance, Measurement of Insertion and Differencial Phas, PC based automated microwave measurements; integration of measurement and design of microwave circuits.

Text Books:
2) Microwave Measurements, By R.J. Collier and A.D. Skinner, The Institution of Engineering and Technology, 1985

Reference Books:
INSTRUCTIONS TO PAPER SETTERS:

1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

UNIT-I
Introduction to radar systems: History, Radar modalities, Electromagnetic spectrum, basic operating principles (detection, ranging, Doppler, importance of phase), radar system components

Radar Equation and Radar Cross Section: The Decibel, term analysis and relation to basic radar components, system temperature, hard target versus distributed target, radar cross section and scattering basics

UNIT-II
Pulse, MTI and ATC Radar: Basic Elements of Pulse Radar, Radar Coverage, radar Parameters, determination of fundamental parameters of pulse radar.

UNIT-III
Function of ATC Radar, Receiver, Transmitter, Indicator unit, Phased Array Radar and Applications.
Fundamentals of Radar signal processing: Superheterodyne reception, I and Q demodulation, Pulsed-Doppler analysis, Matched Filtering, Ambiguity function, Pulse compression, Hard target (detection of signals in noise), Synthetic Aperture Radar (SAR), Doppler weather radar, Ionospheric sounding, Incoherent scatter radar

UNIT-IV
High resolution Radar: radar system target and surface imaging. Concepts and definitions, modern radar design, wideband waveforms and signal processing, synthetic high resolution radar, and synthetic aperture radar concepts.
Applications

Text Books

Reference Books
Paper code: MERF-608
Paper: Antenna and propagation for wireless communication Systems

INSTRUCTIONS TO PAPER SETTERS:

1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.


Text Books:

Reference book:
1) Wireless communication principles and practice by Rappaport, second edition
2) E.C. Jordan and Balmain, "Electro magnetic waves and radiating systems," PHI
Paper Code : MERF-610
Paper : High frequency Semiconductor Devices and circuits

INSTRUCTIONS TO PAPER SETTERS:  
Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

UNIT 1
Review of Semiconductor properties  Band Theory, electrical properties, optical properties, Types of semiconductors, Materials for Microwave semiconductor devices; Si, GaAs, GaN, Inp

UNIT 2
Microwave Field Effect Transistors, MESFETs; Principle of operation, Small signal equivalent circuit, Cutoff frequency and maximum oscillations frequency, transfer characteristics, HEMTs : Heterojunction BJTs; 2-DEG formation, performance characteristics, Electronic applications, Amplifier design using MESFET/HEMTs

UNIT 3
Transferred electron Devices; Gunn diodes, Gunn Effect, RWH theory, Modes of Gunn operation, LSA Diode, InP Diodes

UNIT 4
Avalanche Transit-time devices ; IMPATT diodes; TRAPATTs, BARITT diode Schotky diodes, Tunnel diodes and their applications

Reference
1. Microwave Devices and Circuits by Samuel Y. Liao, Pearson
2. Semiconductor Physics and devices by Donald A. Neamen, Tata McGraw Hill
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**Instructions to Paper Setters:**

**Maximum Marks: 60**

1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

**UNIT I**

Radar equation and Radar Cross Section. Methods for RCS estimation: GO, PO, GTD and PTD techniques.

**UNIT II**

Ray tracing. RCS of simple and complex targets. RCS enhancement. Scattering by imperfectly conducting surfaces;

**UNIT III**

Maliuzhinets’ formulation and characterization of Absorbers. Methods of RCS reduction.

**UNIT IV**

UNIT I

UNIT II

UNIT III

UNIT IV
Hybrid systems: Neuro-Fuzzy hybrid systems, Optimization and their applications.

Text Books:
1. Introduction to artificial neural systems - by J.M. Zurada.(Jaico Pub)
2. Neural Networks & Fuzzy Logic - by Bart Kosko

Reference Books
1. Li Min Fu," Neural Networks in Computer Intelligence", McGraw-Hill, Inc.
2. M. H. Hassun, “Fundamentals of Artificial Neural Networks”, PHI.
3. Fuzzy logic with engineering application - by ROSS J.T (Tata Mc)
5. Neural Networks - by Simon Haykin
6. Related research publications from IEEE/IEE.
Paper code: MERF-616
Paper: RF System Design

INSTRUCTIONS TO PAPER SETTERS:
Maximum Marks : 60

1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

UNIT-I
Introduction:; Radio receivers, Radiometers, Active and Passive Sensors, Noise emission for Passive Radiometers, Rx and Tx System Design, Receiver Noise Figure and Dynamic Range, Noise figure, Noise Temperature, Noise Figure in Cascaded Circuits, Noise Figure of a Mixer Circuit, Dynamic Range, 1 dB Compression Point, Minimum Detectable Signal, Inter-modulation and Intercept Points.

UNIT-II

UNIT-III
Amplifiers and power supplies: Power Gain, Power Gain for Unilateral Transistors, Stability Considerations, Constant Gain Circles for the Unilateral Case, Constant Noise Figure Circles, Amplifier specifications-gain, bandwidth and impedance, stability, amplifier design, noise considerations, class C class D amplifiers, Low Noise Amplifiers, High power amplifiers. Bandwidth Considerations, Broad Band Amplifiers, DC Bias Techniques.

UNIT-IV

TEXT BOOKS:

REFERENCE BOOKS:
Lab based on Advanced Electromagnetic Engineering.

Paper code: MERF-651
Paper: Lab-I
L T/ P C
0 4 2

Lab based on Microwave Theory and Circuits.

Paper code: MERF-653
Paper: Lab-2
L T/ P C
0 4 2

Lab based on RF and Microwave Passive Circuit Design.

Paper code: MERF-655
Paper: Lab-3
L T/ P C
0 4 2

Lab based on elective/or research work.

Paper code: MERF-657*
Paper: Term Paper-I
L T/ P C
0 4 2

* NUES : Non University Examination
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<tr>
<td>Paper: Lab-4</td>
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Lab based on Analytical and computational techniques.

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<tr>
<th>Paper code: MERF-654</th>
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<tbody>
<tr>
<td>Paper: Lab-5</td>
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Lab based on Antenna Theory

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<tr>
<th>Paper code: MERF-656</th>
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<tbody>
<tr>
<td>Paper: Lab-6</td>
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Lab Based on Microwave Measurement

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<tr>
<th>Paper code: MERF-658*</th>
<th>L T P</th>
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<tbody>
<tr>
<td>Paper: Term Paper-II</td>
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</table>

40 marks: internal evaluation 60 marks: external evaluation
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INSTRUCTIONS TO PAPER SETTERS: Maximum Marks: 60
1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

Unit I:
Aspects of EMC with examples, Common EMC units, EMC requirements for electronic systems, Radiated emissions, Conducted emissions, ESD. Application of EMC design, Wires, PCB lands, Component leads, resistors, capacitors, inductors and ferrites.

Unit II:
Electro-mechanical devices, Digital circuit devices. Mechanical switches (as suppression), Simple emission models for wires and PCB lands, Lice impedance stabilization network (LISN).

Unit III:
Power supply filters. Power supplies including SMPS . Three conductor lines and crosstalk, Shielded wires, Twisted wires, Multi-conductor lines and effects of incident fields, Shielding, Origin effects, prevention of ESD event, its hardware and immunity.

Unit IV:
System design for EMC, Grounding, System configuration, PCB design.

Text Books:

Reference Books:
INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

Unit I:

Unit II:

Unit III:
Finline structures and analysis, Transitions for various transmission lines, Resonators, Discontinuities, Measurement Techniques, Design of millimeter wave devices couplers, power dividers, filters, oscillators, mixers, switches, phase shifters and amplifiers Integrated Planar Hybrids with Waveguide-Finline-Planar Transmission Lines.

Unit IV:
Technology Advancements, Fabrication processes, Multilayer hybrid MICs/ MMIC techniques, thick and thin film technology, encapsulation, mounting and packaging of devices, Multi Chip Modular Technology, LTCC and HTCC Technology for Integration of Millimeter Wave and Microwave Circuits.

TEXT BOOKS:

REFERENCE BOOKS:
2. Analysis Methods for RF, Microwave, and Millimeter-Wave Planar Transmission Line Structures, CAM NGUYEN, JOHN WILEY & SONS, INC.
INSTRUCTIONS TO PAPER SETTERS:  
Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

UNIT I

UNIT II
Description on latest RF based technology like BiCMOS, SiG etc. Transistor circuits BJT and CMOS, Biasing circuits Modelling of active devices (MESFET) and passive devices (R, L, C, Microstrip line, Coplanar Waveguide etc) in a typical GaAs RFIC process. Basic Procedure of the design of GaAs RFICs, Introduction to CAD tools and simulation software for RFIC design.

UNIT III
Basic circuit topology and RFIC realisation of Wilkinson power divider, branch line coupler, Low Noise amplifier, Mixer, Phase shifter, Voltage Controlled Oscillator, SPST & SPDT Switch, Attenuator, Balun. High frequency analog circuits, Analog multiplier, mixer, PLL, Low noise Amplifiers

Unit IV
Basic circuit topology and RFIC realisation of Active inductors, Active circulators, Active Filters. Applications of RFICs, Advantages of System on chip. Oscillators, Power Amplifier

Text Books:
1) Robertson I.D. , “MMIC Design ” the institution of electrical engineers.

Reference Books:
3) Marsh Steve, “ Practical MMIC design” Artech House.
### INSTRUCTIONS TO PAPER SETTERS:

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**Unit I**

Statistical signal processing concepts, Basics of mobile wireless communications.

**Unit II:**

Radio-frequency signal modeling and channel characterization.

**Unit III:**

Smart antennas and generalized array signal processing. Source localization problem, Joint angle and delay estimation.

**Unit IV:**

Smart antenna array configurations, Mobile communication systems with smart antennas.

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**TEXT BOOKS:**


**REFERENCE BOOKS:**

1. Smart Antenna for Mobile Communications by Mohamed El-Said Shaban, BSD License, Sept 2009.
INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Unit 1

Search Engine Optimization: Techniques and Tools

Unit 2
Neural Networks
Introduction, Biological Neurons, Artificial Neurons – various models, transfer functions; Learning methods, Stability and Convergence, Functional units for Pattern Recognition tasks; Single Layered Perceptron, Multi Layered Perceptron, Examples.

Unit 3

Unit 4

Ant Colony Optimization (ACO): Biological background, Ant algorithm, Ant system, Maxminant system, NP-Hard problem, Data network routing problem, Application of ACO to various problems.

Reference Books:
3. Genetic Algorithm: Goldberg
**INSTRUCTIONS TO PAPER SETTERS:**

<table>
<thead>
<tr>
<th>Maximum Marks : 60</th>
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</table>

**Unit I:**

**Unit II:**
Electromagnetic Modeling of MEMS Switches, MEMS Switch Library, MEMS Switch Fabrication and Packaging, MEMS Switch Reliability and Power Handling.

**Unit III:**
Design of MEMS Switch Circuits, MEMS Phase Shifters, Distributed MEMS Phase Shifters and Switches, MEMS Varactors and Tunable Oscillators, Micro machined Inductors Reconfigurable MEMS Networks, Filters, Antennas, and Subsystem, Phase Noise Analysis of MEMS Circuits, Phase Shifters, and Oscillators, Future Work in RF MEMS.

**Unit IV:**

**Text Books:**
1) RF MEMS Theory, Design & Technology By Gabreil M. Rebeiz, Wiley Interscience, June 2002.

**Reference Books:**
2) RF MEMS and their Applications By Vijay K Varadan, K.J.Binoy,K.A.Jose,Wiley Interscience,Dec 2002.
INSTRUCTIONS TO PAPER SETTERS:

Maximum Marks : 60
1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

Syllabus will be design by the Board of studies of USICT at the beginning of semester.
Paper code: MERF-715                                      L T/P C 4 - 4
Paper: Radar Signal Processing

INSTRUCTIONS TO PAPER SETTERS:

1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

UNIT I
Modern signal processing techniques for high range-resolution radar systems, One- and two-dimensional signals,

UNIT II
high resolution radar, synthetic aperture radar, inverse synthetic aperture radar, radar tomography, ultra-wideband radar.

UNIT III
Coherent Radar Signal Processing, Signal characterization via the ambiguity function Characterization, One- and two-dimensional Fourier Processing,

UNIT IV
SAR and ISAR, Impulse radar

Text Books:

Reference Books:
INSTRUCTIONS TO PAPER SETTERS:

1. Question No. 1 should be compulsory and cover the entire syllabus and will be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

UNIT I
Introduction to adhoc networks – definition, characteristics features, applications. Characteristics of Wireless channel, Adhoc Mobility Models: Indoor and out door models.

UNIT II
MAC Protocols: design issues, goals and classification. Contention based protocols- with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15. HIPERLAN.

UNIT III

UNIT IV

TEXTBOOKS
1. C.Siva Ram Murthy and B.S.Manoj, Ad hoc Wireless Networks Architectures and protocols, 2nd edition, Pearson Education. 2007

REFERENCES:
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<td>Lab based on EM Interference and compatibility in system design</td>
<td>40 marks: internal evaluation</td>
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<th>Paper: Lab-8</th>
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<tr>
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<td>Lab based on Microwave &amp; Mm IC</td>
<td>40 marks: internal evaluation</td>
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<th>Paper code: MERF-755</th>
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<th>Paper: Minor Project</th>
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<td>40 marks: internal evaluation</td>
<td>60 marks: external evaluation</td>
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**Objective:** Students are required select a topic of their interest and develop a minor project on it. The student will submit a synopsis at the beginning of the semester for the approval to the project committee in a specified format (available on www.ipu.ac.in). The student will have to present the progress of the work through seminars. A report must be submitted to the college for evaluation purpose at the end of the semester in a specified format.

<table>
<thead>
<tr>
<th>Paper code: MERF-757*</th>
<th>L T/ P C</th>
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<td>40 marks: internal evaluation</td>
<td>60 marks: external evaluation</td>
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Paper code: MERF-752  
Paper: Dissertation  

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<th>: Evaluation based on Final Thesis of the work done</th>
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**Objective:** Students are required to select a topic of their interest and prepare a dissertation on it. The student will submit a synopsis at the beginning of the semester for the approval from the project committee in the specified format. Synopsis must be submitted within two weeks. The first defense, for the dissertation work, should be held within one month. Dissertation Report must be submitted in specified format (available on www.ipu.ac.in) to the college for evaluation purpose.

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<th>Paper code: MERF-754*</th>
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<td>Paper: Seminar &amp; Progress report</td>
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<th>100 marks: internal evaluation</th>
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<td>Paper: Term Paper-IV</td>
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<td>L T/ P C</td>
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</table>

- *Non University Program

The student will have to present the seminars and progress reports at the interval of four weeks during the semester. Minimum two seminars will be held during the semester.
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Paper Code: MEVS-603
Paper: VLSI Technology

L  T  C
4   -  4

INSTRUCTIONS TO PAPER SETTERS:
Maximum Marks : 60

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

Unit 1
Cleanroom technology - Clean room concept – Growth of single crystal Si, surface contamination, Chemical Mechanical Polishing, wafer preparation, DI water, RCA and Chemical Cleaning. Processing considerations: Chemical cleaning, getting the thermal Stress factors etc.

Epitaxy : Physical Vapour Deposition, Vapors phase Epitaxy Basic Transport processes & reaction kinetics, doping & auto doping, equipments, & safety considerations, epitaxial defects, molecular beam epitaxy, equipment used, film characteristics, SOI structure.

Unit 2
Diffusion :Diffusion from a chemical source in vapor form at high temperature, diffusion from doped oxide source, Ion Implantation, Annealing and diffusion from an ion implanted layer.

Unit 3
Lithography

Unit 4
Etching
Metallisation - Different types of metallization, uses & desired properties

Text Books

Reference Books
### INSTRUCTIONS TO PAPER SETTERS:

<table>
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<tr>
<th>Maximum Marks</th>
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1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

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**Unit 1**  
Introduction to analog design - Levels of abstraction, Robust analog design, MOS Device Models, MOS Device Capacitances, MOS small signal model, long channel vs. short channel, Single stage amplifier- Basic concepts, Common Source Stage, Source follower, Common Gate stage, Cascode Stage

**Unit 2**  

**Unit 3**  

**Unit 4**  
Voltage controlled oscillator, Phase Locked Loops (PLL) – Simple PLL, Charge Pump PLLs, Introduction to Switched - Capacitor Circuits – General Considerations, Sampling Switches, , Switched Capacitor Amplifiers, Switched Capacitor Integrator, Switched Capacitor Common Mode Feedback.

**Text Books:**


**Reference Books :**

Paper Code: MEVS-605  
Paper: Advanced VLSI Design  

INSTRUCTIONS TO PAPER SETTERS:  

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</table>

Maximum Marks : 60

3. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

4. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

Unit 1  
**Introduction [T1,T2]:** Basic principle of MOS transistor, Introduction to large signal MOS models (long channel) for digital design.

**MOS Circuit Layout & Simulation and manufacturing:** scaling, MOS SPICE model and simulation, CMOS layout: design rules, Transistor layout, Inverter layout, NMOS and CMOS basic manufacturing steps.

Unit 2  
**The MOS Inverter [T1]:** Inverter principle, the basic CMOS inverter, transfer characteristics, logic threshold, Noise margins, switching characteristics, Propagation Delay, Power Consumption.

**Combinational MOS Logic Design [T1] :** Static MOS design, Ratioed logic, Pass Transistor logic, complex logic circuits.

Unit 3  
**Sequential MOS Logic Design [T1]**  
Static latches, Flip flops & Registers, Dynamic Latches & Registers, CMOS Schmitt trigger, Astable Circuits.  
Memory Design: ROM & RAM cells design  
**Dynamic MOS design [T1]:** Dynamic logic families and performances.

**Clock Distribution [T1] [T2]**  
Clock Distribution. Input and Output Interface circuits.

Unit 4  
**Subsystem design [T2, R1]**  
Design styles, design concepts: Hierarchy, Regularity, Modularity, Locality. CMOS Sub system design: Adders, Multipliers.

**Text Books**


**Reference Books**

[R1] Neil Weste and David Harris :“ CMOS VLSI design” Pearson Education 2009.
INSTRUCTIONS TO PAPER SETTERS:  
Maximum Marks : 60

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

**Unit 1**

**Introduction [T1] [T2]:** Need for low power VLSI chips, Sources of power dissipation on Digital Integrated circuits. Emerging Low power approaches. Physics of power dissipation in CMOS devices.

**Device & Technology Impact on Low Power [R1]:** Dynamic dissipation in CMOS, Transistor sizing & gate oxide thickness, Impact of technology Scaling, Technology & Device innovation. Power estimation Techniques

**Unit 2**

**Simulation Power analysis [T1]:** SPICE circuit simulators, gate level logic simulation, capacitive power estimation, static state power, gate level capacitance estimation, architecture level analysis, data correlation analysis in DSP systems. Monte Carlo simulation. Probabilistic power analysis: Random logic signals, probability & frequency, probabilistic power analysis techniques, signal entropy.

**Unit 3**

**Low Power Techniques [T1]:** Circuit level: Power consumption in circuits. Flip Flops & Latches design, high capacitance nodes, low power digital cells library. Logic level: Gate reorganization, signal gating, logic encoding, state machine encoding, pre-computation logic.

**Unit 4**

**Low power Architecture & Systems [T1]:** Power & performance management, switching activity reduction, parallel architecture with voltage reduction, flow graph transformation, low power arithmetic components, low power memory design.

**Low power Clock Distribution [T2]:** Power dissipation in clock distribution, single driver Vs distributed buffers, Zero skew Vs tolerable skew, chip & package co design of clock network.

**Text Books:**


**Reference Books:**

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Paper Code: MEVS-608

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<tr>
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</table>

Unit 1: DISCRETE RANDOM SIGNAL PROCESSING

Unit 2 : SPECTRUM ESTIMATION

Unit 3: LINEAR ESTIMATION AND PREDICTION

Unit 4: ADAPTIVE FILTERS

MULTIRATE DIGITAL SIGNAL PROCESSING
Mathematical description of change of sampling rate - Interpolation and Decimation - continuous time model - Direct digital domain approach - Decimation by an integer factor - Interpolation by an integer factor - Single and multistage realization - poly phase realization - Application to sub band coding - Wavelet transform and filter bank implementation of wavelet expansion of signals.

Text Book:

Reference Books:
INSTRUCTIONS TO PAPER SETTERS:

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.
2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

Unit 1
Introduction to Algorithm, The role of algorithms in computing, Asymptotic notation, asymptotic analysis of recurrence relations, probabilistic analysis and randomized algorithm, the hiring problem, indicator random variables, Divide and conquer paradigm – Merge sort, Inversion counting, Dynamic Programming – Matrix Chain multiplication, Longest Common subsequence, optimal binary search trees Greedy Algorithm – Activity Selection problem, Theoretical foundation of greedy algorithm, Task Scheduling problem, Comparison of dynamic programming and Greedy algorithm with Knapsack as case study.

Unit 2

Unit 3
Matrix Operation (Properties, Strassen’s Algorithm, Solution of linear equation, Matrix inversion) Polynomial and FFT, Representation of polynomials, The DFT and FFT, efficient FFT implementation Number-Theoretic Algorithm, Elementary number-theoretic notion, Greatest common divisor, modular arithmetic, solving modular linear equation, the Chinese remainder theorem.

Unit 4
NP-Completeness, Polynomial time, Polynomial time verification, NP completeness and reducibility, NP-Completeness proofs Approximation Algorithms- the vertex-cover problem, Traveling-Salesman Problem, set covering problem.

Text Books:

Reference Books:
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**INSTRUCTIONS TO PAPER SETTERS:**

<table>
<thead>
<tr>
<th>Maximum Marks</th>
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**Unit 1[T1]**
Introduction, Main data structure & program organization, Geometrical manipulations, Ion implantation.

**Unit 2 [T1]**
A novel measurement technique for 2D implanted ion distributions, Introduction to partial differential equation solver.

**Unit 3 [T1]**
The merged multi grid method, Isothermal device modeling & simulation.

**Unit 4 [T1]**
Non-Isothermal device modeling & simulation, hydrodynamic device modeling & simulation.

**Text Books**


**Reference Books:**

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60

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Unit 1: VLSI DSP
Data Flow graph representation, Iteration Bound, Pipelining and Parallelism; Re-timing techniques, Unfolding-algorithm, properties and applications of unfolding, Folding transformation, register minimization in folded architectures, folding of multirate systems

Unit 2: Architecture Design
DSP system architectures, Systolic Array Design Methodology, Shared memory architectures. Mapping of DSP algorithms onto hardware, Implementation based on complex PEs, Shared memory architecture with Bit serial PEs. Pipelined and Parallel Architectures for Recursive and Adaptive Filters

Unit 3: Arithmetic Architectures
Bit level arithmetic architectures, redundant arithmetic, synchronous and asynchronous pipeline, low power design

UNIT 4: Case Study: TMS320CXX PROCESSOR
Architecture – Data formats, Addressing modes, Instruction sets and operations, Block diagram of DSP starter kit, Programs for processing real time systems

Text Book

Reference Books:
INSTRUCTIONS TO PAPER SETTERS:

Maximum Marks : 60

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UNIT-1
Logic Gates

UNIT-2
Combinational Logic Networks.

UNIT-3
Subsystem Design

UNIT-4
Floor-planning

Text Book:

Reference Book:
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2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Unit 1
Introduction to Personal Communication Services (PCS): PCS architecture, Mobility management, Networks signaling.
Global system for Mobile Communication (GSM) system overview: GSM Architecture, Mobility Management, Network signaling.

Unit 2

Unit 3

Unit 4
Global Mobile Satellite Systems: Case studies of IRIDIUM and GLOBALSTAR systems.

Text Books:

References Books :
INSTRUCTIONS TO PAPER SETTERS:

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

Unit-1
Introduction to Advanced Semiconductor Memories – Overview, Developments & Directions. SRAM Technologies – Basic SRAM Architecture & Cell Structures, SRAM selection Considerations, High Performance SRAMs, Advanced SRAM Architectures.

Unit-2
Low Voltage SRAMS, SOI SRAMS, BiCMOS SRAM, CAM. Memory Peripheral Circuitry – The Address Decoder, Sense Amplifier, Voltage References, Drivers / Buffers, Timing & Control, Memory Reliability & Yield. Power Dissipation in Memories – Sources of Power Dissipation, Partitioning of the Memory, Addressing the active power dissipation, Data Retention Dissipation.

Unit-3
DRAM – Technology & Evolution & Trends, DRAM Timing Specifications, EDO DRAMs, EDRAM, Synchronous DRAM, Enhanced Synchronous DRAM, Cache DRAM.

Unit-4

Text Books:

Reference Books:
INSTRUCTIONS TO PAPER SETTERS:  

Maximum Marks : 60

3. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

4. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Unit I: Introduction to Research Methodology
Meaning of research, objectives of research, meaning of research, motivation in research, types of research, scope of educational research, characteristics and prerequisites of educational research, types of educational research, research approaches, significance of research, research methods versus methodology, research and scientific method, importance of knowing how research is done, research process, criteria of good research, necessity of defining the problem.

Unit II: Techniques for Research Methodology
Defining research problems, hypothesis formulation, developing a research plan, research design, features of a good design, different research designs, and important concepts related to research design, methods for data collection.

Unit III: Data Analysis and Statistical Techniques
Data and their analyses, quantitative methods and techniques, Measure of central tendency, measures of variation, frequency distribution, analysis of variance methods, identifying the distribution with data, parameter estimation, Goodness-of-Fit tests- Chi-Square test, K-S Goodness-of-Fit test, Correlation analysis, Regression analysis, time series and forecasting, Introduction to discriminate analysis, factor analysis, cluster analysis, conjoint analysis.

Sampling methods, test of hypothesis

Unit IV : Algorithmic Research and Simulation
Algorithmic research problems, types of algorithmic research, types of solution procedure, steps of development of algorithm, steps of algorithmic research, design of experiments, steps of modeling, operations research models, application of models. Need for simulation, types of simulation, simulation language, fitting the problem to simulation study, simulation models, output analysis.

Books:
Paper Code: MEVS - 616
Paper: Evolutionary Algorithms for VLSI Design

INSTRUCTIONS TO PAPER SETTERS:

Maximum Marks : 60
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Unit 1

Unit 2
Basic Principles of Evolutionally Algorithms, Mutually dependent problems, Heuristic minimization, CAD of IC, Biological background, Genetic algorithm and Evolutionary algorithms, Extension of the concept.

Unit 3
Characteristics of Problem instances: Size of problem instance, Quality speed trade-off, Performance evaluations: Measuring performance, Design space exploration, Quality versus Speed

Unit 4
EA Tools, GAME: The Environment, Applications, Applications of EAS: Logic synthesis, mapping, testing, guidelines for CAD applications, Heuristic Learning: The learning model, Minimization of decision diagrams

Text Books:

Reference Books:
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### Paper Code: MEVS - 618

### Paper: Secured Hardware Design

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#### Unit 1

Introduction to security attacks, services and mechanism, introduction to cryptography. Conventional Encryption: Conventional encryption model, classical encryption techniques- substitution ciphers and transposition ciphers, cryptanalysis, stereography, stream and block ciphers. Modern Block Ciphers: Block ciphers principals, Shannon’s theory of confusion and diffusion, fiestal structure, data encryption standard(DES), strength of DES, differential and linear crypt analysis of DES, block cipher modes of operations, triple DES, IDEA encryption and decryption, strength of IDEA, confidentiality using conventional encryption, traffic confidentiality, key distribution, random number generation.

#### Unit 2

Introduction to graph, ring and field, prime and relative prime numbers, modular arithmetic, Fermat’s and Euler’s theorem, primarily testing, Euclid’s Algorithm, Chinese Remainder theorem, discrete logarithms. Principals of public key crypto systems, RSA algorithm, security of RSA, key management, Diffie-Hellman key exchange algorithm Elganel encryption.

#### Unit 3


#### Unit 4

Introduction to elliptic curves: Weierstrass equation, group law, projective space and points at infinity, elliptic curve in different characteristics, other models. Elliptic curve cryptography: elliptic curve-based Diffie-Hellman, El Gamal and Digital Signature Algorithm

### Text Books:

- [R2] Bruce Schiener, “Applied Cryptography”.

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Page 240
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Paper Code: MEVS - 620
Paper: Probability and Stochastic processing

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Unit 1: Introduction to Probability and Stochastic Processing
Probability models, Algebra of events, probability axioms, conditional probability, aye’s rules, Bernoulli traits. Discrete Random Variables: Discrete random variables, probability mass functions, discrete distribution functions-Bernoulli, Binomial, geometric, Poisson, hyper geometric & uniform distributions, probability generating function.

Unit 2
Continuous Random variable: Exponential distribution, memory less property, application to reliability, hypo exponential, Erlang, Gamma, hyper exponential & Normal distributions, order statistics, distribution of sums.

Unit 3
Stochastic Process, Classification, Discrete and continuous time markov chain, Poisson process, renewal process, little’s formula, Erlang Loss Model, M/M/1 Queue, M/M/m Queue Multidimensional Queue. Queueing Networks. Definitions and Notation. Performance Measures. Product-Form Queuing Networks. Algorithms for Product-Form Networks, priority Networks.

Unit 4

Text Book

Reference Book
[R2] S.P Gupta, Statistical Methods, Sultan Chand and Sons.
Code No: MEVS-651  
Lab-1  
L.  P   C  
-    2   1  
Experiment of the lab will be based on Digital System Design with Verilog.

Code No. : MEVS-653  
Lab-2:  
L.  P   C  
-    2   1  
Experiment of the lab will be based on VLSI Technology.

Code No: MEVS-655  
Lab-3  
L.  P   C  
-    2   1  
Experiment of the lab will be based on advanced VLSI Design.

Code No: MEVS-657*  
Term paper-1  
L.  P   C  
-    2    
Lab Experiment/Lab- project will be based on Elective/s/Research work

* Non University Exam
Code No: MEVS-652
Lab-1
Experiment of the lab will be based on ESD

Code No: MEVS-654
Lab-2:
Experiment of the lab will be based on Analog VLSI Design.

Code No: MEVS-656
Lab-3
Experiment of the lab will be based on low power VLSI Design

Code No: MEVS-658*
Term paper-2
Lab Experiment/Lab- project will be based on Electives

- NUES: Non University Exam
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Unit 1
VLSI automation Algorithms[T1]:
Introduction, Physical design flow, Partitioning: problem formulation, classification of partitioning algorithms, Group migration algorithms, simulated annealing & evolution,

Unit 2
Placement, floor planning & pin assignment[T1]: problem formulation, simulation base placement algorithms, other placement algorithms, constraint based floor planning, floor planning algorithms for mixed block & cell design. General & channel pin assignment.

Unit 3
Global Routing[T1]: Problem formulation, classification of global routing algorithms, Maze routing algorithm, line probe algorithm, Steiner Tree based algorithms.
Detailed routing[T1]: problem formulation, classification of routing algorithms, single layer routing algorithms, two layer channel routing algorithms, switchbox routing algorithms.

Unit 4
Over the cell routing & via minimization[T1]: two layers over the cell routers constrained & unconstrained via minimization.
Compaction[T1]: problem formulation, one-dimensional compaction, two dimension based compaction.

Text Books:

References Books:
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<table>
<thead>
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<tr>
<td>Paper: VLSI Design Test and Testability</td>
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INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks

Unit 1
Introduction: The need for testing, the problems of digital and analog testing, Design for test, Software testing. 

Unit 2
Digital test pattern generation: Test pattern generation for combinational logic circuits, Manual test pattern generation, Automatic test pattern generation - Roth's D-algorithm, Developments following Roth's D-algorithm, Pseudorandom test pattern generation, Test pattern generation for sequential circuits, Exhaustive, non-exhaustive and pseudorandom 70 test pattern Generation, Delay fault testing.

Unit 3
Signatures and self test: Input compression Output compression Arithmetic, Reed-Muller and spectral coefficients, Arithmetic and Reed-Muller coefficients, Spectral coefficients, Coefficient test signatures, Signature analysis and Online self test.

Unit 4
Testability Techniques: Functional Testing- Basic Issues, Exhaustive, pseudo exhaustive testing, Partitioning and ad hoc methods and Scan-path testing, Testability – Ad-Hoc design for testability, Board level and System level DFT approach, Some advance scan concepts, BIST-memory BIST, Logic BIST, Hardware description languages and test.

Testing of Analog and Digital circuits: Testing techniques for Filters, A/D Converters, RAM, Programmable logic devices and DSP.

Text Books

Reference Books:
INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60

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Unit 1

Unit 2
Basics of data converters: Successive approximation ADCs, Dual slope ADCs, High-speed ADCs (e.g. flash ADC, pipeline ADC and related architectures), High-resolution ADCs (e.g. delta-sigma converters

Unit 3
DAC, Mixed-signal layout, Interconnects and data transmission, Voltage-mode signaling and data transmission, Current-mode signaling and data transmission, Introduction to frequency synthesizers and synchronization.

Unit 4
Basics of PLL, Analog PLL, Digital PLL, DLL,

Text / Reference Books:

Paper Code: MEVS - 707 L T C
Paper: Hardware/Software Codesign 4 0 4

**INSTRUCTIONS TO PAPER SETTERS:**

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**Unit 1**

Introduction [T1]: Motivation hardware & software co-design, system design consideration, research scope & overviews. Hardware Software background: Embedded systems, models of design representation, the virtual machine hierarchy, the performance modeling, Hardware Software development.

**Unit 2**

Hardware Software co-design research[T1]: An informal view of co-design, Hardware Software tradeoffs, crosses fertilization, typical co-design process, co-design environments, limitation of existing approaches, ADEPT modeling environment. Co-design concepts: Functions, functional decomposition, virtual machines, Hardware Software partitioning, Hardware Software partitions, Hardware Software alterations, Hardware Software trade offs, co-design.

**Unit 3**

Methodology for co-design[T1]: Amount of unification, general consideration & basic philosophies, a framework for co-design. Unified representation for Hardware & Software : Benefits of unified representation, modeling concepts. An abstract Hardware & Software model : Requirement & applications of the models, models of Hardware Software system, an abstract Hardware Software models, generality of the model.

**Unit 4**

Performance evaluation[T1]: Application of the abstract Hardware & Software model, examples of performance evaluation. Object oriented techniques in hardware design: Motivation for object oriented technique, data types, modeling hardware components as classes, designing specialized components, data decomposition, Processor example.

**Text Books:**


**Reference Books:**

INSTRUCTIONS TO PAPER SETTERS: Maximum Marks : 60
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Unit 1
FPGA-Based Systems

Unit 2
FPGA Fabrics
Introduction, FPGA Architectures, SRAM-Based FPGAs, Permanently Programmed FPGAs, Chip I/O, Circuit Design of FPGA Fabrics, Architecture of FPGA Fabrics

Unit 3
Combinational Logic
Introduction, Combinational Network Delay, Power and Energy Optimization, Arithmetic Logic

Unit 4
Large-Scale Systems : Introduction, Busses, Platform FPGAs, Multi-FPGA Systems, Novel Architectures

Text Book:

Reference Books:
[R2] Evgeni Stavinov, “100 power Tips for FPGA”, OutputLogic.com (May 18, 2011)
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Unit 1: Modulation Techniques
Digital Modulation Techniques :- Analysis, Generation and Detection (Block Diagram), Spectrum and Bandwidth of Amplitude Shift Keying (ASK), Binary Phase Shift Keying (BPSK), Differential Phase Shift Keying (DPSK), Offset and Non-offset Quadrature Phase Shift Keying (QPSK), M-ary PSK, Binary Frequency Shift Keying (BFSK), M-ary FSK, Minimum Shift Keying, Quadrature Amplitude Modulation (QAM), Comparison of digital modulation techniques on the basis of probability of error, Matched Filter.

Unit 2: Pulse Modulation
Sampling of Signal, Sampling Theorem for Low Pass and Band Pass Signals, Aliasing, Pulse Amplitude Modulation (PAM), Time Division Multiplexing (TDM), Channel Bandwidth for PAM-TDM Signal, Types of Sampling, Instantaneous, Natural and Flat Top Sampling, Aperture Effect, PPM and PDM techniques, Pulse Code Modulation (PCM), Signal-to-Noise Ratio in PCM, Companding, Data Rate and Bandwidth of Multiplexed PCM Signal, Inter-symbol Interference, Eye Diagram, Line Coding NRZ, RZ, Biphasic., Differential PCM (DPCM), Delta Modulation (DM), and Adaptive Delta Modulation (ADM), Slope Overload Error ,Granular Noise,Comparison of various system in terms of Bandwidth and Signal-to-Noise Ratio.

Unit 3: Random Processes
Concept of Probability, Relative Frequency and Probability Conditional Probability and Independent Events, Random Variables, Discrete Random Variables, Cumulative Distribution Function(CDF), Probability Density Function(PDF),Statistical Averages (Means), Chebyshevs Inequality, Central Limit Theorem

Unit 4: Spread Spectrum Modulation
Pseudo noise sequences, notion of spread spectrum, direct sequence spread spectrum with coherent binary phase shift keying, signal space dimensionality and processing gain, probability of error, frequency hop spread spectrum, maximum length and Golay codes.

Text Books:
[T1] B. Sklar, Digital Communication, Pearson Education.

References:
[R1] Taub & Schilling, Principles of Communication system, TMH.
[R5] Schaum’s Outline series, Analog and Digital Communication.
[R7] Couch: Digital and Analog Communication, Pearson Education
UNIT 1
Overview of CMOS process in IC fabrication, MEMS system-level design methodology: Overview of MEMS, Overview of Microsystems fabrication Processes, Bulk Micromachining, Surface micromachining, LIGA Process. Microsystem Design: Design Considerations, Process design, Mechanical Design, Mechanical Design using FEM, CAD.

UNIT 2
Equivalent Circuit representation of MEMS: working principles of Microsystem, scaling laws in miniaturization, materials for MEMS and Microsystem, signal-conditioning circuits and sensor noise calculation.

UNIT 3
Pressure sensors with embedded electronics (Analog/Mixed signal): Accelerometer with transducer, Gyroscope, RF MEMS switch with electronics.

UNIT 4
Bolometer design. RF MEMS: Introduction to RF MEMS, Elements of RF circuit Design, Material and application of RF MEMS and Optical MEMS.

Text Books:

Reference Books
[R2] Ljubisa Ristic, Editor, Sensor Technology and Devices, Artech House, 1994
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Paper Code No : MEVS – 715
Paper : Network on Chip Design

L T C
4 0 4

INSTRUCTIONS TO PAPER SETTERS:
Maximum Marks : 60

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Unit 1

Basic Concepts of Network-on-Chip [T1]: Introduction to interconnection networks, Walk through of a simple network, Topology basics, Constraints and measures, Butterfly networks, Cube networks. Concentration and slicing, Non-blocking topologies, Topology overflow and wrapup, Routing basics and taxonomy, Oblivious routing, Adaptive routing, Routing mechanics

Unit 2


Unit 3


Unit 4


Text Books:

Reference Books:


[R3] Giovanni De Micheli, Luca Benini, Networks on Chips: Technology and Tools (Systems on Silicon), Morgan Kaufmann; 1 edition (August 3, 2006)
INSTRUCTIONS TO PAPER SETTERS:  
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Unit 1
Introduction: RF systems – basic architectures, Transmission media and Reflections, Maximum power transfer.

Unit 2
High frequency Amplifier design: Bandwidth estimation using open-circuit time constants Bandwidth estimation using short-circuit time constants Risetime, delay and bandwidth Zeros to enhance bandwidth Shunt-series amplifiers, tuned amplifiers Cascaded amplifiers.

Unit 3
Noise: Thermal noise, flicker noise review Noise figure.
LNA Design: Intrinsic MOS noise parameters, Power match versus noise match Large signal performance, design examples & Multiplier based mixers
Mixer Design: Subsampling mixers.
RF Power amplifier design: Class A, AB, B, C amplifiers, Class D, E, F amplifiers RF Power amplifier.

Unit 4

Text Books

Reference Books:
INSTRUCTIONS TO PAPER SETTERS: 

1. Question No. 1 should be compulsory and cover the entire syllabus. This question should have objective or short answer type questions. It should be of 20 marks.

2. Apart from Question No. 1, rest of the paper shall consist of four units as per the syllabus. Every unit should have two questions. However, student may be asked to attempt only 1 question from each unit. Each question should be 10 marks.

Unit 1 [T1]

Unit 2 [T1]

Unit 3 [T1]
Packaging Interconnects: Packaging structure, Body fabrication technology, External connections, chip connections, Lumped electrical parameter modeling of packages, calculation of circuit parameters, concept of partial conductance, skin effect calculations, Power distribution modeling from EM simulation

Unit 4 [T1]
Simulation of package effect: effect of SSN, effect of crosstalk, techniques for avoidance of crosstalk, switching noise avoidance, Noise detection in logic circuits, ATPG for stuck-at fault, ATPG for crosstalk, other test techniques

Text Books:

Reference Books:
[R1] Circuits, Interconnections, and Packaging for VLSI, H. B. Bakoglu, Addison-Wesley Pub (Sd) (January 1990)
Scheme of Examination for M.Tech.(Regular & weekend) Programme has been approved by BoS of USICT on dated 28/05/2012 and AC subcommittee on dated 6th July, 2012 and 5th November, 2012. This scheme is effective from academic session 2015-16. Minor correction has been approved in BoS held on 16th September 2015. The correction has been approved in 40th meeting of Academic Council, dated 1st March, 2016.

**Code No: MEVS-751**

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Experiment of the lab will be based on AVDA

**Code No: MEVS-753**

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Experiment of the lab will be based on VLSI Testing.

**Code No: MEVS-755***

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Lab Experiment/Lab- project will be based on Electives

*NUES: Non University Exam

**Paper Code: MEVS - 757**

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<td>Lab: Minor Project</td>
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The student will submit a synopsis at the beginning of the semester for the approval to the school project committee in a specified format. The student will have to present the progress of the work through seminars and progress report. A report must be submitted to the school for evaluation purpose at the end of the semester in a specified format.
Code No: MEVS-752  
Subject: Dissertation  
C  
24

The student will submit a synopsis at the beginning of the semester for the approval from the school project committee in a specified format. Synopsis must be submitted within a two weeks. The first defense, for the dissertation work, should be held with in a one month. Dissertation Report must be submitted in a specified format to the school for evaluation purpose.

Code No: MEVS-754*  
Subject: Seminar & Progress Report  
C  
4

The student will have to present the progress of the dissertation work through seminars and progress reports at the interval of four weeks.

Code No: MEVS-756*  
Subject: Term paper  
C  
2

*NUES: Non University Exam
INSTRUCTIONS TO PAPER SETTERS:

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UNIT – I
Review of Internet and Web, it's origin and growth, W3C, various versions of Web, Limitations of present web, Semantic Web as the next generation web and it's various concerns. Semantic Web roadmap, it's need and goal, capabilities and limitations, various issues, applications.

UNIT – II

UNIT – III
Ontology as a backbone for incorporating semantics and it's various significant concerns and issues, SPARQL Semantics execution and Query processing, optimization and execution along with implementation illustrations for filtering RDF using Jena and twinkled tool.

UNIT – IV
Significant concerns of Web Semantics like Semantic Web Services, Software agents, Search Engines, Information Extraction and Retrieval, Semantic Annotation, NLP, Web usage mining, Social Networks for Network Analysis and visualization etc.

TEXT BOOKS

REFERENCES
INSTRUCTIONS TO PAPER SETTERS:

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Each question should be 10 marks

UNIT – I

Competitive study of OS: UNIX, Multics.

UNIT – II

Unix file system - Measurements, The log-structured file system, server less Network file system, The coda file system.

UNIT – III

AFS, Virtual memory, user level virtual memory, software fault isolation, On-demand distillation, X-kernel, active message, Global network scheduling, Network optimization, synchronization scheduling.

UNIT – IV

Extensible operating system, issue of security in OS, cryptographic file system.

TEXT BOOKS/REFERENCES: