**DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING**
**PUNJABI UNIVERSITY, PATIALA**

**SCHEME AND SYLLABI**
FOR

**MASTER OF TECHNOLOGY (ELECTRONICS & COMMUNICATION ENGINEERING)**

**<u>REGULAR</u>**

**(SEMESTER SYSTEM)**

**BATCH 2019**

**DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING**
**PUNJABI UNIVERSITY, PATIALA**

**MASTER OF TECHNOLOGY (ELECTRONICS & COMMUNICATION ENGINEERING**
**ENGINEERING)**
**(REGULAR)**

**SCHEME OF COURSES**

**BATCH 2019**

| Sr. No. | Subject Title | Teaching | | | Credits | Sessional Awards | Theory Exam | Exam Hrs. | Total Marks |
|---|---|---|---|---|---|---|---|---|---|
| **SEMESTER-I** | | L | T | P | | | | | |
| 1. | Core Course-I | 3 | 1 | 0 | 4.0 | 50 | 50 | 3 hrs. | 100 |
| 2. | Core Course-II | 3 | 1 | 0 | 4.0 | 50 | 50 | 3 hrs. | 100 |
| 3 | Core Course-III | 3 | 1 | 0 | 4.0 | 50 | 50 | 3 hrs. | 100 |
| 4. | Elective Course -I | 3 | 1 | 0 | 4.0 | 50 | 50 | 3 hrs. | 100 |
| 5. | Elective Course -II | 3 | 1 | 0 | 4.0 | 50 | 50 | 3 hrs. | 100 |
| 6. | MEC-301    ELECTRONICS ENGG. LAB | 0 | 0 | 4 | 2.0 | 100 | --- | --- | 100 |
| | | | | | | | **TOTAL MARKS** | | **600** |
| **SEMESTER-II** | | L | T | P | **Credits** | | | | |
| 1. | Core Course-IV | 3 | 1 | 0 | 4.0 | 50 | 50 | 3 hrs. | 100 |
| 2. | Core Course-V | 3 | 1 | 0 | 4.0 | 50 | 50 | 3 hrs. | 100 |
| 3. | Core Course-VI | 3 | 1 | 0 | 4.0 | 50 | 50 | 3 hrs. | 100 |
| 4. | Elective Course -III | 3 | 1 | 0 | 4.0 | 50 | 50 | 3 hrs. | 100 |
| 5. | Elective Course -IV | 3 | 1 | 0 | 4.0 | 50 | 50 | 3 hrs. | 100 |
| 6. | MEC-302    SELF STUDY & SEMINAR | 0 | 0 | 6 | 3.0 | 100 | --- | --- | 100 |
| | | | | | | | **TOTAL MARKS** | | **600** |
| **SEMESTER-III** | | L | T | P | **Credits** | | | | |
| 1. | Elective Course –V | 3 | 1 | 0 | 4.0 | 50 | 50 | 3 hrs. | 100 |
| 2. | Elective Course -VI | 3 | 1 | 0 | 4.0 | 50 | 50 | 3 hrs. | 100 |
| 3. | Audit Course – 1 | 2 | 0 | 0 | 2.0 | 50 | --- | --- | 50 |
| 4. | Open Elective * | 3 | 0 | 0 | --- | --- | --- | --- | --- |
| 5. | MEC-303    PROJECT | 0 | 0 | 6 | 3.0 | 100 | ---- | --- | 100 |
| | | | | | | | **TOTAL MARKS** | | **350** |
| **SEMESTER-IV** | | L | T | P | **Credits** | | | | |
| 1. | MEC-401  DISSERTATION | 0 | 0 | 0 | 10 | --- | --- | --- | **400** |

* In addition to above mentioned subjects, there will be an optional 'Open Elective' course (non-compulsory). The student may opt any one 'Open Elective' subject from the list of Punjabi University approved open elective courses, offered by various University departments, with the consent of ACD/Head/Course Mentor of ECE department. The list of Open Elective Subjects will be notified by the department to the students.

The Open elective course is optional and not mandatory. Students can opt for this course as an additional subject.

## LIST OF CORE COURSES

MEC-101    WIRELESS AND MOBILE DATA COMMUNICATION
MEC-102    OPTICAL COMMUNICATION SYSTEM
MEC-103    VLSI DESIGN
MEC-104    MICROCONTROLLERS AND EMBEDDED SYSTEMS
MEC-105    ADVANCED DIGITAL SIGNAL PROCESSING
MEC-106    RESEARCH METHODOLOGY


## LIST OF ELECTIVES

MEC-201    ANTENNA SYSTEM ENGINEERING
MEC-202    DIGITAL IMAGE PROCESSING AND ANALYSIS
MEC-203    INFORMATION THEORY AND CODING
MEC-204    EMI AND EMC TECHNIQUES
MEC-205    SEMICONDUCTOR DEVICES AND MODELING
MEC-206    ARTIFICIAL NEURAL NETWORKS AND FUZZY SYSTEMS
MEC-207    MEMS AND MICROSYSTEMS TECHNOLOGY
MEC-208    TELECOMMUNICATION SWITCHING SYSTEMS AND NETWORKS
MEC-209    PROGRAMMABLE LOGIC CONTROLLER
MEC-210    NANOELECTRONICS DEVICES ENGINEERING
MEC-211    PARALLEL COMPUTING FUNDAMENTALS
MEC-212    SPEECH PROCESSING
MEC-213    COMPUTER SYSTEM ARCHITECTURE
MEC-214    MICROELECTRONICS TECHNOLOGY
MEC-215    ADVANCED DIGITAL SYSTEM DESIGN
MEC-216    ADVANCED MICROPROCESSORS AND INTERFACING
MEC-217    MULTIMEDIA COMPRESSION TECHNIQUES
MEC-218    MICROWAVE INTEGRATED CIRCUITS
MEC-219    GLOBAL TRACKING AND POSITIONING SYSTEMS
MEC-220    COMMUNICATION NETWORK SECURITY
MEC-221    RF SYSTEM DESIGN
MEC-222    DATA AND COMPUTER COMMUNICATION NETWORKS
**# MOOC**    MASSIVE OPEN ONLINE COURSE

# The subjects which the students can opt from MOOC will be notified by the department semester-wise time to time.

## SEMINAR AND MINOR PROJECT

MEC-301    ELECTRONICS ENGG. LAB
MEC-302    SELF STUDY & SEMINAR
MEC-303     PROJECT

## DISSERTATION

MEC-401    DISSERTATION

## AUDIT COURSE - 1

MEC 501 ENGLISH FOR RESEARCH PAPER WRITING

MEC 502 DISASTER MANAGEMENT

MEC 503 VALUE EDUCATION

MEC 504 STRESS MANAGEMENT BY YOGA

## DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

## PUNJABI UNIVERSITY, PATIALA

General Instructions to the Paper Setters

### M.Tech. in Electronics & Communication Engineering Regular/Part Time
### BATCH 2019
(Common for M.Tech. in Computer Engineering, Electronics and Communication Engineering, Mechanical Engineering Branches)

The M. Tech paper structure will be as shown below:

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**Pattern of Question Paper for End Semester Exam**

**TITLE OF SUBJECT (CODE----)**

Master of Technology (Branch) Section: ………..      TIME ALLOWED: 3 Hour
Roll. No………….      Maximum Marks: 50

**Note: - Section C is compulsory. Attempt any six questions selecting three questions from each of Sections A & B.**

**Section-A (From Section A of the syllabus)**
Q1.........................................................................
Q2.........................................................................
Q3.........................................................................
Q4.........................................................................
Q5.........................................................................      **3x5**

**Section-B (From Section B of the syllabus)**

Q6.........................................................................
Q7.........................................................................
Q8.........................................................................
Q9.........................................................................
Q10.........................................................................      **3x5**

**Section-C (From Whole Syllabus)**
Q11.
a).........................................................................
b).........................................................................
c).........................................................................
d).........................................................................
e).........................................................................
f).........................................................................
g).........................................................................
h).........................................................................
i).........................................................................
j).........................................................................      **10x2**

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*Note for the paper setter:*

1. The maximum duration to attempt the paper is 3 Hours.
2. Numbers of questions to be set are Eleven (11) as per the above format.
3. Section A and B contain five questions of 5 marks each. However these questions may be divided into subparts.
4. Section C is compulsory and contains ten (10) sub-parts of two (2) mark each.
5. The maximum limit on numerical questions to be set in the paper is 35% while minimum limit is 20% except for theoretical papers.
6. The paper setter shall provide detailed marking instructions and solution to numerical problems for evaluation purpose in the separate white envelopes provided for solutions.
7. The paper setters should seal the internal & external envelope properly with signatures & cello tape at proper place.
8. Log tables, charts, graphs, design data tables etc. should be specified, whenever needed. Use of Scientific calculator should be clearly specified.

### MEC- 101        WIRELESS AND MOBILE DATA COMMUNICATION

| L | T | P | Cr |
|---|---|---|----|
| 3 | 1 | 0 | 4  |

**Maximum Marks: 50**                                                 **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.
**Instructions for candidates:**  Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Course Objectives:** The student would be able to understand the basics of mobile communication and realize the problems encountered in day to day life encouraging him to find the solutions hence with.
**Course outcomes:** At the end of the course students will be able to - develops an ability to apply knowledge of engineering to design cell geometry, - understand the functioning of Digital cellular systems like GSM and CDMA, -  explain the techniques to overcome the effects of channel, -discuss the wireless local area networks

### SECTION-A
**Wireless Communication:** Introduction, Cellular concept, Frequency reuse, Co-channel and adjacent channel interference, Cell splitting, Handover, Call processing.

**Digital Cellular Mobile Systems:** Introduction, GSM digital cellular standard: GSM services, GSM architecture, GSM Radio aspects, Security aspects, Handover, Call flow sequence in GSM, Evolutionary directions
**CDMA Digital Cellular Standard:** Services, Radio aspects, Security aspects, Traffic channels, Key features of IS- 95 CDMA system, Evolutionary directions.

### SECTION-B
 **Equalization, Diversity and Channel Coding:** Introduction, Training a Generic Adaptive Equalizer, Linear Equalizers, Non-Linear Equalization, Algorithm for Adaptive Equalization, Diversity Techniques, RAKE Receiver, Interleaving, Block codes, Convolution Codes and Turbo Codes.

**Mobile Data Communications:** Overview of circuit switched and packet switched data services on cellular networks, Wireless local area networks: Introduction, IEEE 802.11 wireless LAN, Support of mobility on the internet:  Mobile IP

**References:**

*1. Jochen Schiller, "Mobile Communications", Pearson Education*

*2. Raj Pandya, "Mobile and Personal Communication-System and Services", PHI*

*3. W. Stallings, "Wireless Communications and Network", Pearson Education*

*4. T.S. Rappaport, " Wireless Communications: Principles & Practice*

**MEC-102      OPTICAL COMMUNICATION SYSTEM**

|  | L | T | P | Cr |
|---|---|---|---|---|
|  | 3 | 1 | 0 | 4 |

**Maximum Marks: 50**                                                                 **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.
**Instructions for candidates:** Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Course Objective:** This course is to develop advanced capabilities of understanding for design and analysis of high speed fiber optical communication systems. The main aim is to inculcate the analytical skills of real time problem solving and troubleshooting with modern high capacity multichannel optical transmission systems.

At the end of course the students should be thorough mathematical understanding of modern optical communication systems. They must be able to (a) design (b) Analyze (c) capable to suggest methods and their trade off for improve the performance of modern high capacity wavelength division multiplexed optical communication systems.

### Section-A
**Fiber Optic Guides:** Light wave generation systems, system components, optical fibers, SI, GI fibers, modes, Dispersion in fibers, Limitations due to dispersions, Fiber loss, non linear effects. Dispersion shifted and dispersion flattened fibers.

**Optical Transmitters & Receivers:** Basic concepts, LED structures spectral distribution, semiconductor lasers, gain coefficients, modes, SLM and STM operation, Transmitter design, PIN and APD diodes, Receiver design, noise, sensitivity and degradation, Receiver performance. **Lightwave Systems:** System architecture, design guidelines, long haul systems, source of power penalties.

### Section-B
**Multichannel Systems:** WDM lightwave systems, WDM components, TDM, subcarrier and code division multiplexing.

**Amplifiers:** Basic concepts, Semiconductor laser amplifiers Raman and Brillouin-fiber amplifiers, Erbium doped-fiber amplifiers, pumping phenomenon, LAN and cascaded In-line amplifiers.

**Dispersion Compensation:** Limitations, post-and pre-compensation techniques, Equalizing filters.

**Soliton System:** fiber soliton, Soliton based communication system design, High capacity and WDM soliton system.

**Coherent Lightwave System:** Coherent, homodyne and heterodyne keying formats, BER in synchronous and asynchronous receivers, sensitivity degradation and system performance.

**References:**
*1. G. P. Agrawal, "Fiber Optic Communication Systems," 2nd Edition, John Wiley & Sons, New York, 2003.*
*2. Frenz and Jain, "Optical Communication System," Narosa Publication, New Delhi, 1995.*
*3. G. Keiser, Optical fiber communication Systems, Mc Graw Hill, New York, 2000*
*4. Frenz and Jain, Optical Communication systems and Components, Narosa Publications, New Delhi, 2000*

## MEC-103     VLSI DESIGN

|  | L | T | P | Cr |
|---|---|---|---|---|
|  | 3 | 1 | 0 | 4 |

**Maximum Marks: 50**                                    **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.
**Instructions for candidates:** Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

The course is designed to give the student an understanding of the different design steps required to carry out a complete digital VLSI (Very-Large-Scale Integration) design in silicon. It will explore the CMOS devices and circuits, standard CMOS fabrication processes, CMOS design rules, static and dynamic logic structures, interconnect analysis, CMOS chip layout, simulation and testing, low power techniques, design tools and methodologies, VLSI architecture.

### SECTION-A
Introduction to VHDL, Data objects and Data types, Operators, Entity and Architecture declaration, Introduction to Behavioural, Dataflow and Structural style of modeling.

Assignment statements, Sequential statements, Conditional statements, Concurrent statements, Case statements, Array and Records, Functions, Packages & Libraries.
VHDL modeling of combinational circuits such as Adders, Subtractors, Multiplexers, Encoders, Decoders, Code converters, Comparators and Implementation of Boolean functions using Behavioural, Dataflow and Structural style of modeling.

VHDL Modeling of sequential circuits such as Flip Flops, Shift registers, Counters etc.

### SECTION-B
VLSI Design Flow, Design Methodologies, Abstraction Levels.

Design of NMOS inverter with resistive and active load, Design of CMOS inverter,Design of  2-input CMOS NAND gate, Design of 2-input CMOS NOR gate. CMOS Transmission gate.
Introduction to ROM, PLA, CPLDs and FPGA, FPGA arhitechture: SRAM based FPGAs, permanently programmed FPGAs. Structural details of Altera and XiLinx FPGAs.

Logic Implementation for FPGA's, Physical design for FPGAs, Introduction to Multi-FPGA systems.

**References:**
1. *"A VHDL Primmer": Bhasker; Prentice Hall*
2. *"VDHL-Analysis & Modelling of Digital Systems": Navabi Z; McGraw Hill*
3. *"FPGA Based System Design": Wayne Wolf; Pearson Education.*
4. *"An Engineering Approach to digital design" William I. Fletcher; Prentice Hall*
5. *Ashenden, P., The Designer's Guide To VHDL, Elsevier (2008) 3rd Ed.*
6.*Kang, S. and Leblebici, Y., CMOS Digital Integrated Circuits – Analysis and Design, Tata McGraw Hill (2008) 3rd ed.*
7. *Weste, N.H.E. and Eshraghian, K., CMOS VLSI Design: A Circuits and Systems Perspective, Addision Wesley (1998) 2nd ed.*

**MEC-104   MICROCONTROLLERS AND EMBEDDED SYSTEMS**

|   | L | T | P | Cr |
|---|---|---|---|----|
|   | 3 | 1 | 0 | 4  |

**Maximum Marks: 50**                                                    **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.
**Instructions for candidates:** Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Course Objective:** The course provides ability to understand the basic concepts of microcontroller and its internal architecture. The students would be able to learn the logic for assembly language programming. It also provides the understanding about interfacing of input output devices with microcontroller. So, the overall objective of this subject is to make students aware of microcontrollers and their applications for serial parallel communication, input output devices control and microcontroller based projects.

**SECTION-A**
**Introduction:** The Overview of 8051 Microcontroller Family, The Inside of 8051 Microcontroller, Pin Description of the 8051, Addressing Modes.

**Instruction Set:** Arithmetic, Logic and Single Bit Instructions, I/O instructions, etc.

**Assembly Language Programming:**   I/O Programming, Timer/Counter Programming, Serial communication, Interrupts Programming.

**SECTION-B**
**Introduction to Embedded Systems:** An Embedded System, Processor in the System, Hardware Units, Software, and Embedded System Examples.

**Processor and Memory Organization:** Structural Units in a Processor, Processor Selection for Embedded System, Memory Map, Interfacing Processor, Memories and I/O Devices.

**Devices and Buses:** I/O Devices, Timer and Counting Devices, Serial and Parallel Communication Between Networked Multiple Devices Using $I^2C$, CAN, ISA, PCI and advanced I/O Buses.

**Hardware-Software Co-design in an Embedded System:** Embedded System Project Management, Design Issues in system Development Process, Design Cycle, Use of Target System and In-Circuit Emulator, Software tools for Development of Embedded System, Issues in Embedded System Design, Case Studies.

**TEXT BOOKSs:**
*1. Mazidi, "The 8051 Microcontroller and Embedded Systems, Pearson*
*2. Raj Kamal, "Embedded Systems," Tata McGraw Hill*

*REFERENCE BOOKS*
*.Kenneth J. Ayala, "The 8051 Microcontroller," Penram International*

**MEC-105   ADVANCED DIGITAL SIGNAL PROCESSING**

| L | T | P | Cr |
|---|---|---|----|
| 3 | 1 | 0 | 4 |

**Maximum Marks: 50**                                                     **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.

**Instructions for candidates:**  Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Objectives:** Digital signal processing is important because virtually all signals e.g., Wifi, mobile, audio, video, images are represented and stored in a digital representation. The aim of course is to understand the use of digital processing, such as by computers, to perform a wide variety of signal processing operations such as filtering, noise cancelling, enhancing, distorting, smoothing or anything.

In the end of course, the students are able to apply DSP for analyzing, synthesizing, modify, separate, enhance, and modify various audio, image, video, and communication signals. They are able to apply DSP to electrical, and mechanical designs, and to control of power generation, power distribution, power optimization, navigation, guidance, air traffic control, commerce, scheduling, manufacturing, space exploration, medical imaging, medical care, medical monitoring, collision avoidance, various military offensive and defensive systems, and many more applications.

## SECTION-A

**Introduction:** Review of, classification of signals and systems, convolution, difference    equations, correlation.

**Fourier and Z Transforms:** Properties of Fourier and Z transforms, Frequency analysis of discrete time signals and LTI Systems.

**Discrete Fourier Transform:**  Definition and properties of DFT, Linear filtering methods using DFT, Frequency analysis of signals using the DFT.

**Fast Fourier Transform:** FFT algorithms and their applications, linear filtering approach to computation of the DFT.

## SECTION-B

**Implementation of Discrete Time systems:** Structure of IIR and FIR systems, state space analysis and structures, Quantization of filter co-efficients.

**IIR Filter Design:** IIR filter design by Impulse invariance, Bilinear Transformation, Matched-z Transformation and Approximation of Derivatives Methods Characteristics of commonly used Analog Filters.

**FIR Filter Design:** Symmetric & Antisymmetric FIR filter design by Frequency Sampling, Using windows methods.

**DSP Processors:** Introduction to DSP Processors, Architecture TMS 320C54X and ADSP 2100 DSP processors.

**Applications of DSP:** Applications of DSP in Communications, speech processing, image processing, Biomedical and in Radars with case studies.

*References:*
1. *Johan G. Proakis and Dimitris G. Manolakis, "Digital Signal Processing Principles, Algorithms and Applications," PHI*
2. *N. G. Palan, "Digital Signal Processing," Tech Max Publications Pune*
3. *Nair, " Digital Signal Processing: Theory, Analysis and Digital Filter Design," PHI*
4. *Digital Signal Processing By Mitra*
5. *Oppenheim & Schafer, "Digital Signal Processing," PHI*
6. *Sanjay Sharma (2014) A Textbook Of Digital Signal Processing by S K Kataria And Sons*

## MEC-106        RESEARCH METHODOLOGY

| L | T | P | Cr |
|---|---|---|----|
| 3 | 1 | 0 | 4  |

**Maximum Marks: 50**                                                              **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.

**Instructions for candidates:**  Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**The objective** of this course is to have a good understanding of inferential Statistics and Research Methodology as applicable in real life Business Management. The main objective of the course to develop a set of skills among the students to use the statistical tools at the workplace to solve research related and general decision problems. At the end of the course, the students should be able to - (1) develop the skills to identify the appropriate statistical techniques for the analysis of data; (2) analyse the data using appropriate statistical tool, and (3) learn how to collect, analyze, present and interpret research data.

### SECTION-A

Role of Research in Decision Making; Process of Research, Objectives of Research.

Methods of Research: historical, descriptive and experimental Alternative approaches to the study of the research problem and problem formulation. Formulation of hypotheses & testing of hypotheses

Introduction to statistical analysis:. Measurement of Central Tendancy: Mean, Median and Mode; Measure of Dispersion, Skewness and Kurtosis.

Sampling: Primary and secondary data, their collection and validation, methods of sampling: Simple random sampling, stratified random sampling and systematic sampling, Attitude Measurement land Scales: Issues, Scaling of attitude.

### SECTION-B

Probability and probability distributions; binomial, Poisson, exponential and normal distributions and their applications

Regression and correlation analysis Karl Pearson and Spearman Correlation. Tests of significance based on normal., t and chisquare distributions. Analysis of variance.

Interpolation of results, presentation, styles for figures, tables, text, quoting of reference and bibliography. Use of software for statistical analysis like SPSS, Mini Tab or MAT Lab, Report writing, preparation of thesis, use of software like MS Office.

### REFERENCES:

1. C.R Kothari, Research Methodology, Wishwa Prakashan
2. P.G Triphati, Research Methodology, Sultan Chand & Sons, N.Delhi
3. Fisher, Design of Experiments, Hafner
4. Sadhu Singh, Research Methodology in Social Sciences, Himalya Publishers
5. Stoufferetal, Measurement & Prediction, Wiley, N.York
6. J.W Bames, Statistical Analysis for Engineers & Scientists, McGraw Hill, N.York
7. Donald Cooper, Business Research Methods, Tata McGraw Hill, N.Delhi

**MEC-201     ANTENNA SYSTEM ENGINEERING**

| L | T | P | Cr |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Maximum Marks: 50**                                                      **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.
**Instructions for candidates:** Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Course Objective:** The objective of this course is to provide understanding of analytical skills for design of various types of antenna systems which is an important component of every wireless communication systems. In this information era of wireless communication, to design and analysis of smart antenna systems is the best skill of an electronics engineer. In these circumstances, antenna systems analysis and design plays important role for performance improvement of wireless gadgets and systems in complex environments where signal level is very low and bandwidth is very efficiently utilized.

At the end of the course the students will have good knowledge of various types of antenna which are used for different applications of wireless communications systems. The students will have design and analysis skills for performance improvement of various types of smart antenna systems which they can apply later during their research and industrial experiences. The students will be acknowledged with new advancements which are possible in the antenna system structures.

### Section-A
**Basic Concepts of Radiation:** Radiation mechanism, Basic sources of Radiation, Current distribution on antennas, Basic Antenna parameters.
**Analysis and Synthesis of Antennas:** Vector potential, Antenna theorems and definitions, dipole, loop, reflector, slot antennas, types of linear arrays, current distribution in linear arrays, Antenna synthesis techniques.
**Radiation From Apertures:** Field equivalence principle, Rectangular and circular apertures, Uniform distribution on an infinite ground plane, Aperture fields of Horn antenna-Babinets principle, Geometrical theory of diffraction, Reflector antennas, Design considerations - Slot antennas.

**Micro Strip Antennas:** Radiation mechanisms, Feeding structure, Rectangular patch, Circular patch, Ring antenna. Input impedance of patch antenna, Microstrip dipole, Microstrip arrays.

### SECTION-B
**Smart Antennas:** Spatial Radio Channel, Spatial processing for wireless systems: introduction, Vector channel impulse response & the Spatial signature, Spatial processing receivers, fixed beam forming networks, switched beam system, Adaptive antenna systems, Wide band smart antennas, Digital radio receiver & software radio smart antennas.
**MIMO Communication Systems:** Introduction, Basic Principle, Types: SIMO, MIMO, Space time block coding, SISO & MIMO Characteristics, Space time transmit diversity (STTD), MIMO Capacity gain, MIMO radio Channel model.

References:
1. *Joseph C. Liberti, Theodore S. Rappaport-"Smart Antennas for Wireless Communications IS95 and third generation CDMA Applications", Prentice Hall, Communications Engineering and Emerging Technologies Series, 2007*
2. *Kraus J.D., "Antennas for all Applications", III Edition, TMH, 2005*
3. *Collin R.E. and Zucker F.- "Antenna Theory" Part I, Tata McGraw Hill, 2005*
4. *Balanis A., "Antenna Theory Analysis and Design", John Wiley and Sons, New York, 2002.*

**MEC-202    DIGITAL IMAGE PROCESSING AND ANALYSIS**

| L | T | P | Cr |
|---|---|---|----|
| 3 | 1 | 0 | 4  |

**Maximum Marks: 50**                                                    **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.
**Instructions for candidates:**  Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Objective:** Give the students a general understanding of the fundamentals of digital image processing. Introduce the student to analytical tools which are currently used in digital image processing as applied to image information for human viewing. -To learn the fundamental concepts of digital image processing, -To study basic image processing operations, -To understand image analysis algorithms, -To expose students to current applications in the field of digital image processing, -Develop the student's ability to apply these tools in the laboratory in image restoration, enhancement and compression, - Understand differences between computer vision and image processing

## SECTION-A
**Introduction and Digital Image Fundamentals:** Fundamental steps in Image processing, Examples of fields that use digital Image processing, Image sensing and acquisition, Image Sampling and quantization, some basic relationships like neighbor's connectivity, distance measure between pixels.
Image Transforms: Discrete Fourier transform, some properties of two-dimensional Discrete Fourier transform, Fast Fourier transform, Inverse FFT.


**Image Enhancement:** Some basic Intensity transformation functions, Histogram processing, Smoothing using Spatial filters and frequency domain filters, Sharpening using spatial filters and frequency domain filter,
Image Restoration: Image Degradation model, Noise Models, Restoration in spatial domain: Mean filter, Order statistic.

## SECTION-B
**Image Compression:** Coding Inter-pixel and Psycho visual redundancy, Image Compression models, Error free compression: Huffman, Arithmetic, Runlength, Lossy Compression: Block Transform Coding based on DCT.
.

**Morphological Image Processing and Image Edge Detection:** Erosion and dilation, morphological algorithms, gray scale morphology. Detection of discontinuities, Edge linking and boundary detection, thresholding, Region Orientation Segmentation.
and Laplacian of Gaussian edge detector.

**Reference Books:**
1.   Rafael C. Gonzalez & Richard E. Woods, "Digital Image Processing", AWL.
2.   Andrew, "Fundamentals of digital image processing", PHI
3.   A.K. Jain," Fundamentals of Digital Image Processing", Pearson Education.
4.   W. K. Pratt," Digital Image Processing".
5.   Ramesh Jain, Brian G. Schunck, "Machine Vision", TMH.

### MEC-203   INFORMATION THEORY AND CODING

| L | T | P | Cr |
|---|---|---|----|
| 3 | 1 | 0 | 4 |

**Maximum Marks: 50**                                                                                                 **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.
**Instructions for candidates:** Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Objectives:** Course will help to analyze error performance of a digital communication system in presence of noise and other interferences and it will help to improve the performance of the system. The course will also build fundamental understanding of information theory and coding.

### SECTION-A

**Introduction:** Information, Entropy, Shanon's noiseless coding theorem, Source Coding, Channel Capacity, Shanon's Channel Capacity Theorem. Sampling Theorem: Practical Aspects and Signal Recovery.

**Waveform Coding:** PCM Channel Noise and error Probability. DPCM and DM Coding Speech at Low Bit Rates Prediction and Adaptive Filters. Base Band Shaping for data Transmission. PAM signals and their Power Spectra. Nyquist Criterion, ISI and eye Pattern Equalization.

### SECTION-B

**Binary and M-ary Modulation Techniques**: Coherent and Non Coherent Detection. Error probability and Bandwidth Efficiency. Bit error analysis Using Orthogonal Signaling.

**Channel Coding and Decoding Techniques:** Channel Coding- Block Codes, Cyclic Codes and Convolution Codes, Decoding, Viterbi Decoding Algorithm. Trellis Codes.

**References:**
1.  *Digital Communication Techniques: Signal Design and Detection by Simon, PHI*
2.  *Principles of Communication Systems By Taub and Shilling, Tata Mc-Graw Hill*
3.  *Digital and Analog communication By Couch, Pearson*
4.  *Communication Systems Engineering, By John G. Proakis Masoud Salehi, Pearson*

**MEC-204    EMI AND EMC TECHNIQUES**

| | L | T | P | Cr |
|---|---|---|---|---|
| | 3 | 1 | 0 | 4 |

**Maximum Marks: 50**                                                       **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.

**Instructions for candidates:** Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Objectives:** To familiarize with the fundamentals that are essential for electronics industry in the field of EMI / EMC. To understand EMI sources and its measurements. To understand the various techniques for electromagnetic compatibility. At the end of the course the student able to learn the concepts of Real-world EMC design constraints and make appropriate tradeoffs to achieve the most cost-effective design that meets all requirements. Designing electronic systems that function without errors or problems related to electromagnetic compatibility.

**SECTION-A**

**Introduction:** Aspects of EMC with Examples, Common EMC Units, EMC Requirements for Electronic Systems, Radiated Emission, Conducted Emission, ESD.

**EMC Design:** Application of EMC Design, wires, PCB Lands, Component Leads, Resistors, Capacitors, Inductors, ferrites, Electromechanical Devices, Digital Circuit Devices.

**SECTION-B**

**Application Design:** Mechanical Switches, Simple emission Model for Wires and PCB Lands, Lice Impedance Stabilization Network (LISN), Power Supply Filters, Power Supplies including SMPS, Three Conductor lines and Crosstalk, Shielded Wires, Twisted Wires, Multiconductor Lines and Effect of incident fields, Shielding and Origin effect.

**Immunity and Protection in Design:** Prevention of ESD event, its hardware and immunity, System Design for EMC, Grounding, System Configuration, PCB Design.

**References:**
*1. The Technician's EMI Handbook: Clues and Solutions By Joseph Carr*
*2. Grounding and Shielding Techniques By Ralph Morrison*
*3. EMC for Product Designers, Third Edition By Tim Williams*
*4. Printed Circuit Board Design Techniques for EMC Compliance By Mark I. Montrose*

## MEC-205   SEMICONDUCTOR DEVICES AND MODELING

| L | T | P | Cr |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Maximum Marks: 50**

**Maximum Time: 3 Hrs.**

**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.

**Instructions for candidates:** Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Objectives:** It explain the equations, approximations and techniques available for deriving a model with specified properties, for a general device characteristic with known qualitative theory, - Apply suitable approximations and techniques to derive the model referred to above starting from drift-diffusion transport equations (assuming these equations hold), - Offer clues to qualitative understanding of the physics of a new device and conversion of this understanding into equations, - Explain how the equations get lengthy and parameters increase in number while developing a compact model.

### SECTION-A

**Introduction:** Semiconductors, Integrated Circuit Fabrication Technology, Charge Transport in Semiconductors, Applications of PN junction, Bipolar Junction Transistor and Thyristers, JFET and MOSFET.

**Diode and Transistor Modeling:** Integrated Circuits Diodes and Transistors, Current Voltage Characteristics, Ebersmoll Model and Gummel-Poon Model of Bipolar Transistors. Current Gain, Early Effect and High Level Injection, 2-D effect, Transient Parameters.

### SECTION-B

**MOSFET Modeling:** MOSFETs, Analysis of MOSFET Parameters, Short Channel and Narrow Width Effects, Hot Electron Effects, MOSFET Models.

**FET Modeling:** FETs, Modulation Doped FETs, HEMTs, Heterojunctions and HBTs, Microwave and Optonic Devices, Outline of Numerical Approach to 2D and 3D Device Models.

**References:**
1. *Semiconductor Devices: Modeling and Technology By Das Gupta PHI*
2. *Semiconductor Devices By Kano Pearson Education*

**MEC-206       ARTIFICIAL NEURAL NETWORKS AND FUZZY LOGIC SYSTEMS**

|  | L | T | P | Cr |
|---|---|---|---|---|
|  | 3 | 1 | 0 | 4 |

**Maximum Marks: 50**                                                                 **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.
**Instructions for candidates:** Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Objective:** The objective of this course is to gain the concepts and have understanding of artificial neural networks, learning laws, neural network models, fuzzy logic basic theory and algorithm formulation and to solve real world problems. The course will also emphasize on the remarkable ability of neural networks to derive meaning from complicated or imprecise data which can be used to extract patterns and detect trends that are too complex to be noticed by either humans or other computer techniques. At the end of the course, students will be able to know about different neural networks, their architectures, training algorithms, concept of fuzzy logic, fuzzy Sets, fuzzy rules and fuzzy reasoning. They will have exposure to the applicability of neural networks and fuzzy logic.

**SECTION-A**
**Introduction**: Biological neuron physiology, brain specifications, artificial neural networks, historical development, ANN characteristics,  terminology and topology of neural networks, neuron model: McCulloh, Perceptron, ADALINE and MADALINE, Learning in artificial neural networks: supervised learning, unsupervised learning, reinforced learning, competitive learning, Learning Rules: Delta learning, Perception learning, Widrow Hoff learning, Correlation learning, Winner-take-all learning and Hebbian learning.

**Neural Network Paradigms:** Feed-forward and feedback neural networks, Back-propagation learning algorithm and its mathematical analysis, Hopfield model and its mathematical analysis, Kohonen model and its applications, introduction to radial basis function, applications of ANN.

**SECTION-B**
**Fuzzy Logic Fundamentals:** Basic concepts, propositional logic, linguistic variable, membership functions, operations and rules of fuzzy sets, fuzzy logic, Product, Composition, fuzzy rule generation, IF THEN ELSE Rule, Approximate reasoning, de-fuzzification.

**Fuzzy System Design:** Fuzzy system design, conventional control system vs. fuzzy logic control system, fuzzy logic control vs. PID control, industrial applications of fuzzy logic control, introduction to fuzzy neural networks and fuzzy neural control.

**References:**
*1. Stamatios V. Kartalopoulos, "Understanding Neural Networks and Fuzzy Logic," PHI*
*2. B. Yegnarayana, "Artificial Neural Networks," PHI*
*3. Ahmad M. Ibrahim, Introduction to Applied Fuzzy Electronics, PHI*
*4. T. J. Ross, "Fuzzy Logic with Engineering Applications", McGraw-Hill*
*5. J Nie & D Linkers, "Fuzzy Neural Control", PHI*
*6. J.M.Zurada, 'Iintroduction to Artificial Neural system", Jaico Publishers.*

**MEC-207**     **MEMS AND MICROSYSTEMS TECHNOLOGY**

| L | T | P | Cr |
|---|---|---|----|
| 3 | 1 | 0 | 4 |

**Maximum Marks: 50**                                                  **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.
**Instructions for candidates:** Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Objectives:** Students will be able to: understand basics of microfabrication, develop models and simulate electrostatic and electromagnetic sensors and actuators, understand material properties important for MEMS system performance, analyze dynamics of resonant micromechanical structures, understand the design process and validation for MEMS devices and systems, and learn the state of the art in optical microsytems.

### SECTION-A
**Introduction:** Introduction to Microsensors and MEMS, Evolution of Microsensors and MEMS, Microsensors and MEMS Applications.

**Microelectronics:** Microelectonic Technologies for MEMS, Micromachining Technology: Surface and Bulk Micromachining, Micromachined Microsensors- Mechanical, Interial, Chemical, Acoustic.

### SECTION-B
**Microsystems:** Micosystems Technology, Integrated Smart Sensors and MEMS, Interface Electronics for MEMS.

**Applications and Simulators:** MEMS Simulators, MEMS for RF Applications, Bonding and Packaging of MEMS, Future Trends.

**References:**
*1. MEMS and Microsystems Design and Manufacture   By Hsu, Tai- Ran,  Mac Graw Hill*
*2. Introduction ot Microelectromechanical Systems Engineering, By Nadim Maluf and Kirt     Williams, Artech House Publishing*
*3. MEMS Mechanical Sensors,"By Steve Beeby and Graham Ensel and Michael Kraft and Neil White, Artech House Publishin*

**MEC-208    TELECOMMUNICATION SWITCHING SYSTEMS AND NETWORKS**

|   | **L** | **T** | **P** | **Cr** |
|---|---|---|---|---|
|   | **3** | **1** | **0** | **4** |

**Maximum Marks: 50**                                                                                 **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.

**Instructions for candidates:**  Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Course objectives:** To learn Switching, Signaling and traffic in the context of telecommunication network. To expose through the evolution of switching systems from manual and electro mechanical systems to stored-program-controlled digital systems. To study signaling, packet switching and networks.

### SECTION-A
**Introduction:** Evolution of Telecommunications, basics of switching system, Telecommunication Networks.  Strowger Switching Systems, Crossbar Switching, Electronic Space Division Switching.

**Data Transmission:** Speech Digitization and Transmission, Time Division Multiplexing Switching, Frequency Division Multiplexing Switching, Code Division Multiplexing Switching, Applications of Optical Fiber Systems in Telecommunications.

### SECTION-B
**Data Networks:** Data Transmission in PSTNs, switching Techniques for Data Transmission, Data Communication Architecture, Link to Link and End to End Layers, Satellite Based Data Networks, LAN, MAN, Fiber Optic Networks, Data Network Standards, Protocol Stacks and Internetworking.

**Telephone Networks:** Subscriber Loop Systems, Transmission Plan and Systems, Numbering and Charging Plan, Signalling Techniques, cellular Mobile Telephony.

**Traffic Engineering:** Network traffic Load and Parameters,Grade of servicing and Blocking Probability, Modelling Switching Systems, incoming Traffic and service Time Characteristics, blocking Models and Loss Estimates, Delay Systems.

**Integrated Services Digital Networks(ISDN):** Network and Protocol Architecture, Transmission Channels, User Network Interfaces, Signalling, Numbering and addressing, ISDN Standards, Expert Systems in ISDN, Broadband ISDN.

**References:**
*1. Telecommunicaion Switching Systems and Networks By Thiagarajan Viswanathan, PHI*
*2. Telecommunication Switching,Traffic and Networks, By Flood, Pearson*
*3. ISDN and Broadband ISDN By Stallings, PHI*

**MEC-209   PROGRAMMABLE LOGIC CONTROLLER**

| L | T | P | Cr |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Maximum Marks: 50**                                                    **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**PURPOSE:** To provide sound knowledge in the concepts programmable logical controller programming.

**INSTRUCTIONAL OBJECTIVES:** To understand and use logical elements) To carry out programming using PLC Use of various PLCs to Automation problems in industries. Use of Human Machine Interfacing devices to enhance control & communication aspects of Automation.


**Section-A**

**PLC Basics:** Definitions of PLC, basic structure of PLC, working principles, data storage methods, inputs / outputs flag processing's, types of variables, definition of firmware, software, programming software tool and interfacing with PC (RS232 & TCP-IP).

**Basic PLC Functions:** Registers, Timer Functions, Counter Functions, Arithmetic Functions, Comparison Functions, Numbering Systems and Number Conversion Functions.

**Basic PLC Programming:** Logic, Conventional Ladder v/s PLC ladder, series and parallel function of OR, AND, NOT logic, Ex Or logic, Analysis of rung. Timer and Counter Instructions; on delay and Off delay and retentive timer instructions, PLC counter up and down instructions, combining counters and timers, Comparison and data handling instructions, Sequencer instructions. Programming On/Off Inputs to Produce On/ Off Outputs, Relation of Digital Gate Logic to Contact/ Coil Logic, creating Ladder Diagram from Process Control Descriptions, Ladder diagram of various gates, De Morgan's Theorem. PLC programming methods as per IEC 61131, Developing programs using Sequential Function Chart, Functional Block Diagram.

**Section-B**

**Data Handling Functions:**  PLC Skip and, PLC Data Move Systems and data Handling Functions.

**PLC Functions Handling with Bits:** Digital Bit Functions, Sequencer Functions and Matrix Functions.

**Advanced PLC Functions:** Analog PLC Operations, PID Control of Continuous Process, Networking of PLCs, Factors to Consider in Selecting a PLC, Analog control using PLC (PID controller configuration), Interfacing PLC to SCADA/DCS using communication link (RS232, RS485), Protocols (Modbus ASCII/RTU) and OPC, Development stages involved for PLC based automation systems, selection of PLC controller (case study) Centralized concept, Applications of HMI's, and Interfacing of HMI with controllers.


**RECOMMECONDED BOOKS:**

*1. John W. Webb, "Programmable Logic Controllers: Principles and Applications, PHI.*
*2. Gary Dunning, "Introduction to PLCs, Thomson Delmar.*
*3. Jay. F. hooper, "Introduction to PLCs".*

### MEC 210     NANOELECTRONICS DEVICES ENGINEERING

|   | L | T | P | Cr |
|---|---|---|---|----|
|   | 3 | 1 | 0 | 4 |

**Maximum Marks: 50**                                                       **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.
**Instructions for candidates:** Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Objective:** The aim of the course is to make the students familiar to nanoelectronics, nanodevices, tools used for synthesis/characterization of nanostructures, fundamental quantum mechanics behind nanoelctronics and molecular electronics. The students will also learn the working of silicon nanoelectronic device and CMOS microelectronic transistor in this course.

### SECTION-A
**Introduction:** Nano, Size matters, Fundamental Science Behind Nanotechnology, Tools of Nanosciences.

**Silicon Nanoelectronics and Ultimate CMOS Microelectronic Transistor:** Structure, operation, Obstacles to Miniaturization: Structure and  Operation of a MOSFET, Obstacles to Further Miniaturization of FETs.

### SECTION-B
**Solid State Quantum Effect and Single-electron Nanoelectronic Devices:**  Island, Potential Wells, and Quantum effects, Resonant Tunneling Devices, Distinction Among Types of nanoelectronic devices.

**Devices:** Other Energetic Effects, Taxonomy of Nanoelecronic Devices, Drawbacks and Obstacles to Solid-State Nanoelectronic Devices.

**Molecular Electronics:** Molecular Electronic Switches Devices, Background of Molecular Electronics, Molecular Wires, Quantum- effect Molecular Electronic Devices, Electromechanical Molecular Electronic Devices. Introduction to nanolithography devices.

**References:**
1. Ratner, "Nanotechnology, A Gentle Introduction to Next Big Idea," Pearson
2  Overview of Nanoelectronic Devices, IEEE Proceedings.
3. Silicon Nanoelectronics By Shunri Oda

**MEC-211      PARALLEL COMPUTING FUNDAMENTALS**

|   | L | T | P | Cr |
|---|---|---|---|----|
|   | 3 | 1 | 0 | 4  |

**Maximum Marks: 50**                                      **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.
**Instructions for candidates:** Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Objectives:** The goal of the course is to study the mathematical models, methods and technologies of parallel programming for multiprocessor systems. Learning the course is sufficient for a successful start to practice in the area of parallel programming.The spectrum of knowledge and skills presented in the course provides the solid basis for developing parallel software system and includes the following topics:  Overview of parallel computer architectures,  Modeling and analysis of parallel computations, Parallel algorithm and software design, Technologies of parallel program development, Parallel algorithms for solving time-consuming problems.

**SECTION-A**
**Introduction:**   Evolution, Parallel Processing Terminology, Data and Control Parallelism, Pipelining, Flynn's Taxonomy, Speedup, Scaled Speedup, and Parallelizability
PRAM Model, Parallel Algorithms.

**Multiprocessors:** Processor Arrays, Multiprocessors and Multi-computers. Processor Organizations, Processor arrays, Multiprocessors- UMA, NUMA, Multi-computers

**Parallel Processing:** Instruction level Parallel Processing, Pipelining of processing elements, Pipelining Limitations, Superscalar Processors, Very Long Instruction Word Processor

**SECTION-B**
**Interconnection Networks:** Basic Communication Operations, Interconnection Networks

**Mapping and Scheduling:** Embedding of task graphs in processor graphs, Dilation, Load Balancing on Multicomputers, Static Scheduling techniques, Deterministic and Non-deterministic models, Prevention of deadlocks

**Performance Evaluation of Parallel Computers:** Basics, Sources of Parallel overhead, Speed -Up Performance Laws, Amdhal's law, Scalability Metric, Performance Measurement Tools.

**References:**
*1. Michael J. Quinn, "Parallel Computing, Theory & Practice", McGraw-Hill*
*2. V Rajaraman & C S R Murthy, "Parallel Computers, Architecture and Programming", PHI*
*3. A. Grama, "Introduction to Parallel Computing ", Pearson Education*
*4. Hwang & Briggs F.A., "Computer Architecture and Parallel Processing"*

## MEC –212   SPEECH PROCESSING

| L | T | P | Cr |
|---|---|---|----|
| 3 | 1 | 0 | 4 |

**Maximum Marks: 50**                                          **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.
**Instructions for candidates:** Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Objective:** The main purpose of this course is to provide the learners with solid fundamental tools and experience on the applied technology in the array of speech processing. It also gives the opportunity to deepen and widen the understanding of this topic through the study of speech characteristics and its applications in various fields like coding. The course is one of the interesting applications of signal processing.

### SECTION-A
**Introduction:**  Fundamentals of Digital Speech Processing, Digital Models of the Speech Signal.

**Speech Processing Models:** Time Domain Models of Speech Processing, Digital Representation of Speech Waveform.

### SECTION-B
**Fourier Analysis and Homomorphic Speech Processing:** Short-Time Fourier Analysis, Homomorphic Speech Processing.

**Coding and Digital Speech Processing:** Linear Predictive Coding of Speech, Digital Speech Processing for Man-Machine- Communication by Voice.

**References:**
   1.  Rabiner, "Digital Processing of Speech Signals," Pearson
   2.  Thomas, 'Discrete Time Speech Signal Processing," Pearson

**MEC- 213      COMPUTER SYSTEM ARCHITECTURE**

|  | **L** | **T** | **P** | **Cr** |
|---|---|---|---|---|
|  | **3** | **1** | **0** | **4** |

**Maximum Marks: 50**                                                                **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.

**Instructions for candidates:**  Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Course Objectives:** To conceptualize the basics of organizational and architectural issues of a digital computer.  To analyze performance issues in processor and memory design of a digital computer. To understand various data transfer techniques in digital computer. To analyze processor performance improvement using instruction level parallelism.

## SECTION-A
**Basic Computer Organization:** Introduction, Organization & Architectural classification, Computer Evolution and Performance, computer System Buses, registers & stacks, ALU, CPU, Control Unit, Hardwired and Micro programmed Control.

**CPU Instruction Sets:** Characteristics, Functions, Addressing modes and Formats, CPU Structure, Processor & Register Organization, RISC and Superscalar Processors, PowerPC, Pentium processors etc.
**Computer Arithmetic:** Integer & Floating Point Arithmetic.

## SECTION-B
**Memory and I/O Devices:**  Internal & External memory, Virtual & High-Speed memories, I/O Devices & Modules, Programmed & Interrupt driven I/O, DMA.

**Parallel Processing and Pipelining:** Introduction, Parallelism in uniprocessor system, Memory interleaving, Pipelining and vector processing, Instructions and arithmetic pipelines, Array processor, parallel processing algorithms.

**References:**
*1. John P. Hayes, "Computer Architecture and Organization", McGraw-Hill*
*2. Stallings, "Computer Organization and Architecture", Pearson Education*
*3. M. M. Mano, "Computer System Architecture", PHI*
*4. Patterson and Hennessy, "Computer Architectures", Morgaon Kauffman*
*5.Mohamed Rafiquzzaman and Rajan Chandra, "Modern Computer Architecture," Galgotia Publications pvt.ltd.*

## MEC-214    MICROELECTRONICS TECHNOLOGY

| | L | T | P | Cr |
|---|---|---|---|---|
| | 3 | 1 | 0 | 4 |

**Maximum Marks: 50**                                                    **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.

**Instructions for candidates:** Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Objectives:** Micro Electronics is latest field of electronics which focus on study of different IC's and there design. The course offers various steps in detail for fabrication of IC's by understanding concept of different devices and circuits to be fabricated on IC's.Than course focus on various IC technologies from BIPOLAR to CMOS and there fabrication techniques. Than various packaging detail will be studied. There is a need for good amount of educated / trained manpower in Micro Electronics and VLSI Design related areas in the coming years to raise India's share in global VLSI Market. This is possible only through specialized programme in Micro Electronics and VLSI Design. The course is well suited for the current academic and industrial needs of India. Employment opportunities are ample in this field as industries recruit engineers on a global scale.

### SECTION-A

**Crystal Growth and Wafer Preparation:** Materials for formation of crystal, Electronic-Grade Silicon, Czochralski Crystal Growth, Silicon Shaping, Horizontal Bridgeman Method, Distribution of dopants, Zone refining, Silicon Float Zone process, Si-Wafer preparation.

**Epitaxial and Oxidation:** Silicon on insulators, Epitaxial growth, Techniques used for Epitaxial growth such as LPE, VPE, MBE. Growth Mechanism and Kinetics, Thin Oxides, Oxidation Techniques and Systems, Effect of impurities on the oxidation rate, Preoxidation Cleaning, Masking properties of $SiO_2$.

**Lithography:** Introduction, Optical Lithography, Electron Lithography, X-ray Lithography, Ion Lithography, Photolithography Process (Lift off technology, Fine line photolithography), Pattern Generation/Mask making, Contact and Proximity printing, Photoresists.

**Etching Techniques & Film Deposition:** Wet/Dry etching, Reactive Plasma etching techniques and applications, Size Control and Anisotropic Etch Mechanisms, Deposition Processes, Polysilicon and Silicon Dioxide Layer Deposition.

### SECTION-B

**Diffusion**: Models of Diffusion in Solids, Fick's One-Dimensional Diffusion Equations, Atomic Diffusion Mechanisms, Basic diffusion process (Diffusion equation, Diffusion profiles), Extrinsic diffusion, Lateral Diffusion.

**Ion Implantation:** Range Theory, Implantation Equipment, Annealing, Ion Implantation Process (Ion distribution, Ion stopping), Implant Damage and Annealing process (Furnace and RTA).

**Metallization:** Metallization Applications, Metallization Choices, Physical vapor Deposition, Patterning.
**VLSI Process Integration:** Introduction, Various IC Packaging methods and Materials, Isolation Techniques, Chip Testing, Wire Bonding techniques, Flip Chip technique,  NMOS IC Technology, CMOS IC Technology, Bipolar IC Technology.

**Recommended books:**
- S.M.Sze ,semiconductor device fundamentals,Addison Wesley
- Howe, R. T., and C. G. Sodini. *Microelectronics: An Integrated Approach*. Upper Saddle River, NJ: Prentice Hall, 1996. ISBN: 0135885183.
- C.Y. Chang and S.M. Sze (Ed), "ULSI Technology", McGraw-Hill Companies Inc., 1996.
- S.K.Gandhi, "VLSI fabrication Principles",John Wiley Inc., New York, 1983.
- Sorab K. Gandhi, "The Theory and Practice of Microelectronics", John Wiley & Sons
- Fonstad, C. G. *Microelectronic Devices and Circuits*. New York, NY: McGraw-Hill, 1994. ISBN: 0070214964.
- Sedra, A. S., and K. C. Smith. *Microelectronic Circuits*. 4th ed. New York, NY: Oxford University Press, 1998. ISBN: 0195116631.
- Pierret, R. F. *Semiconductor Device Fundamentals*. Upper Saddle River, NJ: Prentice Hall, 1995. ISBN: 0201543931.
- B.G Streetman, "VLSI Technology" , Prentice Hall, 1990. 7.
- A.S Grove, "Physics and Technology of semiconductor devices", John Wiley & Sons, 1967.

### MEC-215    ADVANCED DIGITAL SYSTEM DESIGN

|   | L | T | P | Cr |
|---|---|---|---|----|
|   | 3 | 1 | 0 | 4  |

**Maximum Marks: 50**                                    **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.
**Instructions for candidates:**  Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Objective:** To familiarize the student with the analysis, design and evaluation of digital systems of medium complexity that are based on SSI, MSI and Programmable logic devices. Also, to familiarize the students with the issues in the design of iterative networks, timing analysis of synchronous and asynchronous systems.

### SECTION-A
**Minimization and Design of Combinational Circuits:** minimization with theorems, Karnaugh Map, Variable-entered mapping and Tabulation method.
**MSI and LSI Circuits and Applications:** Arithmetic circuits, Comparators, Multiplexers, Code converters, EXOR AND-OR-INVERT Gates, Wired Logic, TRI -STATE BUS SYSTEM, Propagation Delay.

**SEQUENTIAL MACHINE FUNDAMENTALS:** Need for sequential circuits, Distinction between combinational and sequential circuits, Concept of memory, Binary Cell, Classification of sequential machines, Flip-Flop, Design of clocked Flop-Flops, Conversion of Flip- Flops.

**TRADITIONAL APPROCH TO SEQUENTIAL ANALYSIS AND DESIGN:** State Diagram, Analysis, Design of Synchronous sequential circuits, State Reduction, Minimizing the next state decoder, Out put decoder design, Counters, Design of Single Mode, Multi Mode Counters, Ring Counters. Shift Registers.

### SECTION-B
**MULTI INPUT SYSTEM CONTROLLER DESIGN:** System Controllers, timing and frequency considerations, MDS Diagram Generation, Synchronizing to systems and choosing controller Architecture, State Assignment, Next State Decoder, Next State decoder maps, Output Decoder, Control and display.

**SYSTEM CONTROLLER UTILIZING COMBINATION MSI/LSI CIRCUITS:** Using the MSI decoders in system controller, MSI multiplexes in system controller, Indirect- Addressed Multiplexer Configuration.

**ASYNCHRONOUS FINITE-STATE MACHINES:** Introduction, Asynchronous Analysis, The Design of Synchronous Machines, Cycles and races, Hazards, Read only memories, ROM'S PROMS and applications, Using the ROM random logic, Programmed Logic arrays, Applications of PLA

**References:**
*1. Wiilian I Fletcher, "An Engineering Approach to Digital Design," PHI*
*2. Morris Mano and Charles R. Kime, "Logic and Computer Design Fundamentals,"*

**MEC-216      ADVANCED MICROPROCESSORS AND INTERFACING**

| L | T | P | Cr |
|---|---|---|----|
| 3 | 1 | 0 | 4 |

**Maximum Marks: 50**                                          **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.
**Instructions for candidates:** Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Objective:** The aim of this subject to develop an in-depth understanding of 16 & 32 bit microprocessors and to provide solid foundation on interfacing the external devices to the microprocessor according to the user requirements to develop microprocessor based projects. The student will learn the internal hardware architecture organization of popular microprocessors and programming language. This subject also assists the students with an academic environment aware for a successful professional carrier.

### SECTION-A
**Introduction to Microprocessors:** Types of Processors, 16 Bit Microprocessors, Features and Internal Architecture of Microprocessor 8086, Register Organization and Block Diagram of 8086 Microprocessors. Addressing Modes of 8086, Pin Configuration of 8086, Maximum and Minimum Mode, 8284 Clock Generator, 8288 Bus Controller.

**Instruction Set:** 8086 Instruction Groups, Addressing Mode Byte, Segment Register Selection, Segment Override and 8086 Instructions.

**Debug and Assembler:** Debug Commands, Assembler Directives, Operators, Assembly Language Programming of 8086.

### SECTION-B
**Memory and I/O Interfacing:** Interfacing EPROM and RAM to 8086. I/O Interfacing Techniques. Interfacing of PPI 8255, Programmable DMA Controller 8237, Programmable Interrupt Controller 8259.

**32-Bit Microprocessors:** Introduction, features, architectures and addressing modes of 386, 486 and Pentium Microprocessors.

**References:**
*1. Walter A. Tribel and Avtar Singh, "8088 and 8086 Microprocessor, PHI*
*2. B. Bray, "Advanced Microprocessor and Interfacing", PHI*
*3. Hall, D.V., Microprocessor and Interfacing, Tata McGraw Hill Publishing Company, (2006).*
*4 Badri Ram, "Advanced Microprocessors and Interfacing," Tata McGraw hill*
*5. Gilmore, "Microprocessor Principles and Applications," Tata McGraw Hill*
*6. Ray and Bhurchandi, Advanced Microprocessors and Peripherals, 2nd Edition Tata McGraw Hill Publishing Company, 2004.*

*7. Gibson, Glenn A., Liu, Yu-Cheng., Microcomputer Systems: The 8086/8088 Family Architecture Programming And Design, Pearson, (2001)*
*8. Andrew N. Sloss, ARM System Developer's Guide, Morgan Kaufmann publications (2004).*
*9. M68000: 16/32-bit microprocessor: programmer's reference manual (4th ed.) Prentice-Hall, Inc. Upper Saddle River, NJ, USA ©1984 ISBN:0-13-566795-X.*
*10. Architecture, Programming and Design, Glenn A. Gibson*

**MEC-217    MULTIMEDIA COMPRESSION TECHNIQUES**

| L | T | P | Cr |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Maximum Marks: 50**                                            **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.

**Instructions for candidates:** Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Objectives:** Students will be able to explain scalar and vector quantization theory. Also they will be able to represent the multimedia data in different formats for various applications. Need for Multimedia compression technique and the different types of data can be explored.

### SECTION-A
**INTRODUCTION**: Brief history of data compression applications, Overview of information theory, redundancy. Overview of Human audio, Visual systems, Taxonomy of compression techniques. Overview of source coding, source theory, rate distribution theory, vector quantisation, structure quanitizers. Evaluation techniques-error analysis and methodologies.

**TEXT COMPRESSION:** Compact techniques-Huffmann coding-arithmatic coding-Shannon-Fano coding and dictionary techniques- LZW family algorithms. Entropy measures of performance-Quality measures.

**AUDIO COMPRESSION:** Audio compression techniques-frequency domain and filtering-basic subband coding-application to speech coding-G.722-application to audio coding-MPEG audio, progressive encoding for audio-silence compression, speech compression techniques-Vocoders.

### SECTION-B
**IMAGE COMPRESION:** Predictive techniques-PCM, DPCM, DM. Contour based compression-quadtrees, EPIC, SPIHT, Transform coding, JPEG, JPEG-2000, JBIG.

**VIDEO COMPRESSION :** Video signal representation, Video compression techniques-MPEG, Motion estimation techniques- H.261.Overview of Wavelet based compression and DVI technology, Motion video compression, PLV performance, DVI real time compression.

**References:**
1. *Mark Nelson,Data compression book, BPB Publishers,New Delhi,1998*
2. *Sayood Khaleed, Introduction to data compression, Morgan Kauffman ,London,1995*
3. *Watkinson,J.Compression in video and audio, Focal press,London.1995*
4. *Jan Vozer,Video compression for multimedia,AP profes,NewYork,1995.*

**MEC-218 MICROWAVE INTEGRATED CIRCUITS**

| L | T | P | Cr |
|---|---|---|---|
| 3 | 1 | 0 | 4 |

**Maximum Marks: 50**                                                    **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.

**Instructions for candidates:** Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Objectives:** Acquire knowledge about Microwave Integrated Circuits and to - gain knowledge of plannar transmission line for MIC, - gain knowledge and understanding of lumped elements for MIC, - develop understanding of the fundamentals required to design & implement Integrated Circuits operating at microwave frequencies, -acquire a knowledge about Microwave Semiconductor Devices.

**SECTION-A**

**MICROSTRIPS LINES, DESIGN, ANALYSIS:** Introduction, types of MICs and their technology, Propagating models, Analysis of MIC by conformal transformation, Numerical analysis, Hybrid mode analysis. losses in Microstrip, Introduction to slot line and coplanar waveguide.

**COUPLED MICROSTRIP, DIRECTIONAL COUPLERS AND LUMPED:** Introduction to coupled Microstrip, Even and odd mode analysis, Directional couplers, branch line couplers, Design and Fabrication of Lumped elements for MICs, Comparison with distributed circuits.

**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, Microwave transistors circuits.

**SECTION-B**

**MICROSTRIP CIRCUIOT DESIGN AND APPLICATIONS:** Introduction, Impedance transformers, Filters, High power circuits, Low power circuits, MICs in satellite and Radar

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

**References:**
1. Hoffman R. K. "HandBook of Microwave intergrated circuits", Artech House, Boston,1987.
2. Gupta K.C and Amarjit Singh,"Microwave Intergrated circuits" John Wiley, New York,1975.

**MEC-219 GLOBAL TRACKING AND POISIOTIONING SYSTEM**

| | L | T | P | Cr |
|---|---|---|---|---|
| | 3 | 1 | 0 | 4 |

**Maximum Marks: 50**                                                           **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.
**Instructions for candidates:** Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Objectives:** This course introduces the fundamental and advanced concepts, and applications of Global tracking and Positioning System to the postgraduate students. Fundamentals of Geodesy, GPS- Transit, NAVSTAR GPS, GLONASS, GALILEO; GPS segments- space, control and user, GPS codes- C/A, P, GPS receivers, GPS Orbits, GPS errors and accuracy, GPS Observables, GPS Survey Methods- static vs kinematic, single point vs relative positioning, GPS Modernization plans, GPS Applications can be explored.

**SECTION-A**
**INTRODUCTION:** Satelites, Introduction to Tracking and GPS System, Applications of Satelite and GPS for 3D position, Velocity, determination as function of time, Interdisciplinary application (eg,.Crystal dynamics, gravity field mapping, reference frame, atmospheric occulation)Basic concepts of GPS. Space segment, Control segment, user segment, History of GPS constellation, GPS measurement charecteristics, selective availability(AS), antispoofing (AS).

**ORBITS AND REFERENCE SYSTEMS:** Basics of satelite orbits and reference systems-Two-body problem, orbit elements, timre system and time transfer using GPS, coordinate systems, GPS Orbit design, orbit determination problem, tracking networks, GPS force and measurement models for orbit determination, orbit broadcast ephemeris, precise GPS ephemeris, Tracking problems

**GPS MEASUREMENTS:** GPS Observable-Measurement types (C/A Code,P-code,L1 and L2 frequencies for navigation, pseudo ranges),atmospheric delays(tropospheric and ionospheric),data format(RINEX),data combination(narrow/wide lane combinations, ionosphere-free combinations single, double, triple differences), undifferenced models, carrier phase Vs Intergrated Doppler, integer biases, cycle slips, clock error.
**SECTION-B**
**PROCESSING TECHNIQUES:** Pseudo range and carrier phase processing, ambiguity removal, Least square methods for state parameter determination, relation positioning, dilution of precision.

**GPS APPLICATIONS**: Surveying, Geophysics, Geodsey, airborne GPS, Ground transportation, Spaceborne GPS orbit determination, attitude control, meteorological and climate research using GPS.

**References:**
1. *B. Hoffman - Wellenhof, H. Lichtenegger and J. Collins, "GPS: Theory and Practice ", 4th revised edition, Springer, Wein, New york, 1997*
2. *A. Leick,"GPS Satelite Surveying",2nd edition, John Wiley & Sons, NewYork,1995*
3. *B. Parkinson, J. Spilker, Jr.(Eds),"GPS: Theory and Applications", Vol. I & Vol.II,AIAA,370 L 'Enfant Promenade SW,Washington,DC20024,1996*
4. *A. Kleusberg and P. Teunisen (Eds),GPS for Geodesy,Springer-Verlag,Berlin,1996*
5. *L. Adams, "The GPS.A Shared National Asset, Chair, National Accademy Press, Washington, DC, 1995.*

## MEC-220 COMMUNICATION NETWORK SECURITY

|  | L | T | P | Cr |
|---|---|---|---|---|
|  | 3 | 1 | 0 | 4 |

**Maximum Marks: 50**  
**Minimum Pass Marks: 40%**

**Maximum Time: 3 Hrs.**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.

**Instructions for candidates:** Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Objective:** The course covers basic security topics, including symmetric and public key cryptography, digital signatures, hash functions, and network security protocols. By the end of this course, students will understand basic security terms such as plaintext, cipher-text, encryption/decryption, and authentication. Students will be able to explain the basic number theory required for cryptographic applications, and manually encrypt/decrypt and sign/verify signatures using cryptographic approaches. Students will be able to identify typical security pitfalls in authentication protocols, and outline the protocols, i.e., AH and ESP protocols, for IP Security.

### SECTION-A

**CONVENTIONAL ENCRYPTION:** Introduction, Conventional encryption model, Steganography, Data Encryption Standard, block cipher, Encryption algorithms, confidentiality, Key distribution.

**PUBLIC KEY ENCRYPTION AND HASHING:** Principles of public key cryptosystems, RSA algorithm, Diffie-Hellman Key Exchange, Elliptic curve cryptology, message authentification and Hash functions, Hash and Mac algorithms, Digital signatures.

**IP SECURITY:** IP Security Overview, IP security Architecture, authentification Header, Security payload, security associations, Key Management.

### SECTION-B

**WEB SECURITY:** Web security requirement, secure sockets layer, transport layer security, secure electronic transaction, dual signature.

**SECURITY SYSTEM:** Intruders, Viruses, Worms, firewall design, Trusted systems, antivirus techniques, digital Immune systems.

**References:**

1. *William Stallings,"Cryptography and Network security", 2nd Edition ,Prentice Hall of India, New Delhi, 1999*
2. *Baldwin R and Rivest. R. "TheRC5,RC5-CBC,TC5-CBC-PAD and RC5-CT5 Algorithms,RFC2040",October1996.*

**MEC-221 RF SYSTEM DESIGN**

| | L | T | P | Cr |
|---|---|---|---|---|
| | 3 | 1 | 0 | 4 |

**Maximum Marks: 50**                                                **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.
**Instructions for candidates:** Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Objectives:** To design and analyse basic resonators and RF Filters, To study the operation and device characteristics of RF Active components, To design and analyze RF transistor amplifier, To understand the operation of Oscillators and mixers used in RF design, To explore waveguide circuits, modulation and detection circuits.

**SECTION-A**
**INTRODUCTION:** RF circuits, Impedance matching and Quality factor, Efficiency, Amplifiers, RF preamplifiers , filters, Frequency converters, Mixers, Radio receivers.

**OSCILLATORS AND PLL:** Relaxation oscillators, Series resonant oscillators, Negative resonant oscillators, Oscillator dynamics, Stability, oscillator noise, Design examples, phase locked loops-loop dynamics, analysis, Frequency synthesizers.

**AMPLIFIERS AND POWER SUPPLIES:** Amplifier specifications-gain,bandwidth and impedance, stability, Amplifier design, Noise considerations class C class D amplifiers High power amplifiers, Rectifiers, Switching converters, Boost and Buck circuits.

**SECTION-B**
**COUPLERS AND WAVEGUIDE CIRCUITS:** Directional coupling, Hybrids, Power combining, transformer equivalent circuits, Double tuned transformers, Transformers with magnetic and iron cores. Transmission lines, transformers Baluns, Waveguides, matching in wave guide circuits, Waveguide junctions, coaxial lines, resistance impedance bridge, standing waves.

**MODULATION AND DETECTION CIRCUITS:** AM, High level modulation, Digital to analog modulation, SSB, Angle and frequency modulation, Diode detectors, FM demodulators-Design. power detectors. Measurement of power, Voltage and Impedance. Swept frequency impedance measurements

**References:**
1. Jon B. Hagen, Radio Frequency Electronics, Cambridge university press,Cambridge,1996
2. James Hardy,"High Frequency Circuit Design", Resto Publishing Co.,NewYork,1979
3. Ian Hickman,"RF HandBook" Butter Worth Heinemann Ltd.,Oxford,1993.
4. Ulrich L. Rohde, T.T.N.Bucher,"Communication Recievers",Mc Graw Hill, New York,1998.
5. R. Ludcoig 'RF Circuit Design' Pearson Asia Education and P. Bretchko, New Delhi.2000.

## MEC- 222     DATA AND COMPUTER COMMUNICATION NETWORKS

|   | L | T | P | Cr |
|---|---|---|---|----|
|   | 3 | 1 | 0 | 4  |

**Maximum Marks: 50**                                            **Maximum Time: 3 Hrs.**
**Minimum Pass Marks: 40%**

**Instructions for paper-setter:** The question paper will consist of three sections A, B, and C. Sections A and B will have four questions each from the respective sections of the syllabus and each question will carry five marks. Section C will have one question with 10 short answer /objective type parts, which will cover the entire syllabus uniformly and each part will carry 2 marks.

**Instructions for candidates:**  Candidates are required to attempt three questions each from sections A and B of the question paper and the question in section C is compulsory.

**Objectives:** Show clear understanding of the basic concepts of data communications including the key aspects of networking and their interrelationship, packet switching, circuit switching and cell switching as internal and external operations, physical structures, types, models, and internetworking. Demonstrate the ability to unambiguously explain networking as it relates to the connection of computers, media, and devices (routing).  Able to intelligently compare and contrast local area networks and wide area networks in terms of characteristics and functionalities. Able to identify limitations of typical communication systems. Understand the concept of reliable and unreliable transfer protocol of data and how TCP and UDP implement these concepts, to understand the client/server model and socket API with their implications, skills to implement a network protocol based on socket programming.

## SECTION-A

**Data Communication Techniques:** Synchronous-Asynchronous Transmission, Digital Transmission, Transmission Media, Impairments, Data encoding Techniques

**Communication Networks:** Circuit switching, Message switching, Packet Switching. X.25, LAN Technologies, Virtual Circuits

**Network Reference Models**: OSI and TCP/IP, Layered architecture

**Data Link Layer:** Design issue, framing, error control, flow control, HDLC, SDLC, data link layer in the Internet (SLIP, PPP)

**Network Layer:** Routing Algorithms, shortest path, distance vector routing, Link state routing, and multicast routing. Congestion control, traffic shaping, leaky bucket, token bucket, choke packets, load shedding, internetworking- connection oriented and connectionless, fragmentation, internet architecture and addressing, IP protocol, ICMP, APR, RARP, OSPF, BGP, CIDR, IPv6.

## SECTION - B

**Transport and Session Layer:** Transport Service, quality of service, connection management, addressing, flow control and buffering, multiplexing, Internet transport protocols- TCP and UDP, Session layer-Dialogue management, synchronization and remote procedure call.

**Presentation Layer:** date representation, data compression, network security and cryptography.
**Application Layer:** DNS, SNMP, Telnet, TFTP, NFS E- mail, SMTP and World Wide Web

**References:**
*1. A. S. Tanenbaum, "Computer Networks", Pearson Education*
*2. W. Stallings," Data and Computer Communications", PHI*
*3. J.F. Kurose, K.W. Ross, "Computer Networking: A Top-Down Approach featuring the Internet", Pearson Education*
*4.  L.L. Peterson, B.S. Davie, "Computer Networks: A Systems Approach", Pearson Education*

**MEC 501**               **ENGLISH FOR RESEARCH PAPER WRITING**

**L - T - P - Cr.**
**2 - 0 - 0 - 2.0**

**Maximum Marks: 50  (Internal)**
**Minimum Pass Marks: 40%**                                **Lectures to be delivered: 24-30**

The objective of this course is to acquaint students to the skills of writing a good research paper. At the end of this course, the student should be able to: (1) understand that how to improve your writing skills and level of readability, (2) learn about what to write in each section, (3) understand the skills needed when writing a Title, (4) ensure the good quality of paper at very first-time submission.

### SECTION A
Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.

### SECTION B
Key skills needed when writing a Title, key skills needed, when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

**REFERENCES:**

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)

2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book.

4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

**MARKS DISTRIBUTION:**

| | | |
|---|---|---|
| MST - I | : | 15 |
| MST - II | : | 15 |
| ATTENDANCE | : | 10 |
| CONTINUOUS ASSESSMENT | : | 10 |

**MEC 502 DISASTER MANAGEMENT**

**L - T - P - Cr.**
**2 - 0 - 0 - 2.0**

**Maximum Marks: 50   (Internal)**
**Minimum Pass Marks: 40%**                                                      **Lectures to be delivered: 24-30**

The objective of this course is to acquaint students with the strengths and weaknesses of disaster management approaches. At the end of this course, the student should be able to: (1) learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response, (2) critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives, (3) develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations, (4) planning and programming in different countries, particularly their home country or the countries they work in

## SECTION A
**Introduction:** Disaster: Definition, Factors and Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

**Repercussions Of Disasters And Hazards**: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem.

**Natural Disasters:** Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks of Disease And Epidemics, War And Conflicts.

**Disaster Prone Areas in India:** Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

## SECTION B
**Disaster Preparedness and Management:** Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and other agencies, Media Reports: Governmental and Community Preparedness.

**Risk Assessment:** Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster risk situation. Techniques of risk assessment, Global Co-Operation in risk Assessment and Warning, People's Participation in risk assessment. Strategies for Survival.

**Disaster Mitigation:** Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

**REFERENCES:**

1. R. Nishith, Singh A.K, "Disaster Management in India: Perspectives, issues and strategies, New Royal book Company.
2. Sahni, Pardeep Et.Al. (Eds.), Disaster Mitigation Experiences and Reflections, Prentice Hall of India, New Delhi.
3. Goel S. L., Disaster Administration and Management Text and Case Studies, Deep & Deep Publication Pvt. Ltd., New Delhi.

**MARKS DISTRIBUTION:**

| | | |
|---|---|---|
| MST - I | : | 15 |
| MST - II | : | 15 |
| ATTENDANCE | : | 10 |
| CONTINUOUS ASSESSMENT | : | 10 |

## MEC 503 VALUE EDUCATION

**L - T - P - Cr.**
**2 - 0 - 0 - 2.0**

**Maximum Marks: 50 (Internal)**
**Minimum Pass Marks: 40%**                                    **Lectures to be delivered: 24-30**

The objective of this course is to imbibe good values in students. The course aims at inculcating knowledge of self-development, highlight the importance of Human values and developing the overall personality of students. At the end of this course, the student should be able to: (1) understand value of education and self- development, (2) let the students know about the importance of character.

### SECTION A

Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non- moral valuation. Standards and principles. Value judgements.

Importance of cultivation of values. Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline.

### SECTION B

Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

### REFERENCES:

1 Chakroborty, S.K., Values and Ethics for organizations Theory and practice, Oxford University Press, New Delhi

### MARKS DISTRIBUTION:

MST - I                              :        15

MST - II                             :        15

ATTENDANCE                           :        10

CONTINUOUS ASSESSMENT                :        10

**MEC 504 STRESS MANAGEMENT BY YOGA**

**L - T - P - Cr.**
**2 - 0 - 0 - 2.0**

**Maximum Marks: 50   (Internal)**
**Minimum Pass Marks: 40%**                                    **Lectures to be delivered: 24-30**

The objective of this course is to achieve overall health of body and mind and to overcome stress in students. At the end of this course, the student should be able to: (1) develop healthy mind in a healthy body thus improving social health also, (2) Improve efficiency.

## SECTION A

Definitions of Eight parts of yog. (Ashtanga)

Yam and Niyam.
Do`s and Don't's in life.
i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

## SECTION B

Asan and Pranayam
i) Various yog poses and their benefits for mind & body
ii) Regularization of breathing techniques and its effects
Types of pranayam

**REFERENCES:**

1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur

2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

**MARKS DISTRIBUTION:**

MST - I                          :        15

MST - II                         :        15

ATTENDANCE                        :        10

CONTINUOUS ASSESSMENT             :        10

**MEC-301 ELECTRONICS ENGINEERING LAB**

**L - T - P - Cr.**

**0 - 0 - 4 - 2.0**

Each student will be required to complete a course on Lab Work comprising of advanced Experiments related to Electronics Engineering. The experiments in the Lab Work will be decided by the concerned teacher/section-in charge. The student will be required to complete the prescribed Lab Course and other requirements related to evaluations of the Practical Course. The evaluation will be done by the committee of examiners constituted by Head of Department.

**MEC-302     SELF STUDY AND SEMINAR**

**L - T - P - Cr.**

**0  - 0  - 6 - 3.0**

Each student will be required to prepare a Seminar Report and present a Seminar on a topic in any of the areas of modern technology related to Electronics Engineering including interdisciplinary fields. The topic/title will be chosen by the student in consultation with the Faculty Advisor allocated to each student. The student will be required to submit the Seminar Report and present a talk to an audience of Faculty/Students in open defense in front of the Seminar Evaluation Committee having Faculty Advisor as one of its members. The Head of Department will constitute the Seminar Evaluation Committee.

## MEC -303    PROJECT

**L - T - P - Cr.**
**0 - 0 - 6 - 3.0**

Each student will be required to complete a Project and submit a Project Report on a topic on any of the areas of modern technology related to Electronics Engineering including interdisciplinary fields. The title and objectives of the Project will be chosen by the student in consultation with the Project Guide allocated to each student. The student will be required to present a talk to an audience of Faculty/Students in open defense in front of the **Project Evaluation Committee** having Project Guide as one of its members. The Head of Department will constitute the Project Evaluation Committee for the purpose of evaluation for internal assessment.

**MEC-401 DISSERTATION**

**L - T - P - Cr.**

**-- -- -- 10.0**

Each student will be required to complete a Dissertation and submit a written Report on the topic on any of the areas of modern technology related to Electronics & Communication Engineering including interdisciplinary fields in the Final semester of M.Tech. course. The title and objectives of the Dissertation will be chosen by the student in consultation with the Supervisor (s) and the same will be required to be defended by the student in open defense in front of the **Dissertation Monitoring Committee** approved by the Head of Department. The title and objectives will be approved by the Dissertation Monitoring Committee having main Supervisor as one of its members. The progress will also be monitored at weekly coordination meetings with the Supervisor (s). The student will be required to present a talk to the gathering in open defense in front of the Dissertation Monitoring Committee having main Supervisor as one of its members. The Dissertation Monitoring Committee will be constituted by Head of Department for the purpose examining the suitability of the work carried out by the student in the Dissertation for its evaluation by the external examiner. The Dissertation will be sent to the External Examiner for its evaluation only after its due approval by the Dissertation Monitoring Committee. The external evaluation will be done jointly by the main Supervisor and external examiner appointed by the Head of Department. The dissertation will be either approved or rejected. The external examiner will evaluate the dissertation and the viva-voce will be fixed by the Head of Department. After Viva-voce, the examiners (internal and external) will approve/reject the dissertation. In case, the dissertation is rejected, the candidate will rework and resubmit the dissertation. The dissertation will be again be evaluated jointly by the same external examiner and the Main Supervisor.

**PRE-SUBMISSION SEMINAR EVALUATION**      **160 MARKS**

**EXTERNAL THESIS EVALUATION**      **240 MARKS**

**TOTAL MARKS**      **400 MARKS**

**MINIMUM PASS Marks:**      **50% in Internal & External Examination Each**