SYLLABI

AND THE

REGULATIONS

FOR

Bachelor of Engineering (Electronics & Communication)
Third-Eighth Semesters
Examinations, 2012-2013
# SCHEME OF EXAMINATION FOR
BACHELOR OF ENGINEERING (ELECTRONICS & COMMUNICATION)

## Scheme of Examination of B.E.

### Third Semester

<table>
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<tr>
<th>Theory Paper Code</th>
<th>Paper Title</th>
<th>Hours/Week L+T</th>
<th>Credit</th>
<th>Marks Uni. Exam</th>
<th>Int. Marks</th>
<th>Hours/Week</th>
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<td>EC312</td>
<td>Signals &amp; Systems</td>
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<td>EC313</td>
<td>Filters &amp; Transmission Lines</td>
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### Fourth Semester

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* marks refer to mid semester evaluation and end semester evaluation
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<th>Hours/Week</th>
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Summer Training will be evaluated as Satisfactory/Unsatisfactory.

### Sixth Semester

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* marks refer to mid semester evaluation and end semester evaluation
### Seventh Semester

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**Elective - I**
- EC 711: Operating Systems
- EC 712: Radar Engineering
- EC 713: Web Technologies
- AS 701: Cyber Laws & IPR

### Eighth Semester

**OPTION - 1**

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**Elective - II and Elective III (Any Two):**
- EC 808: Digital Image Processing
- EC 809: Advanced Digital Communication
- EC 810: Neural Networks & Fuzzy Logic
- EC 811: Embedded System Design
- EC 812: Solid State Devices Modeling and Simulation
- EC 813: Analog & Mixed Signal Design
Elective-IV and Elective V (Any Two):
EC814: MEMS and Microsystems
EC815: Artificial Intelligence
EC816: Operation Research
EC817: Nano Technology
EC818: Satellite Communication
EC819: Research Methodology

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In 8th semester, student can exercise **Option 1 or Option 2** according to the following conditions:

A student may opt for one semester training in lieu of subject of 8th semester. The marks for six months training will be equal to the total marks of 8th semester study. A student can opt for six months semester training under following conditions:

a. The student got selected for the job in campus placement and the employer is willing to take that student for the training.

b. The student got offer of pursuing training from reputed government research organization/ govt. sponsored project/govt. research institution provided that student should not be paying any money to get trained. For pursuing this training student need the prior approval from the chairperson/coordinator of the respective department/ branch.

* marks refer to mid semester evaluation and end semester evaluation
THIRD SEMESTER

Paper Title: - Semiconductor Electronics (Theory)

Paper Code: EC 311  Max. Marks/ Credit: 50/3  Time: 3 hours

Course duration: 45 lectures of one hour duration each
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Transistor characteristics:  [10]
Junction transistor, transistor current components, current gain, transistor as an amplifier, common emitter, common base, common collector configurations, Input & output characteristics in CE, CB & CC configurations, photo transistor & its characteristics, Unijunction transistor & its characteristics.

Transistor at low frequencies:  [07]
Graphical analysis of CE configuration two port devices and hybrid model, h-parameters, Comparison of amplifier configurations of circuits

Transistor biasing and Thermal stabilization:  [07]
Concept of biasing & biasing of BJT circuits, Operating point, bias stability, stabilization against variation in Ico, Vbe, and β, thermal run away, thermal stability.

PART B

Field Effect Transistor:  [10]
Junction Field Effect Transistors, JFET characteristics, pinch off voltage and equivalent circuit, MOSFETs - their modes of operation and characteristics, equivalent circuit, biasing of FETs.

Classification of amplifiers, Class A large signal amplifier, second and higher harmonic distortion, transformer coupled amplifiers, Efficiency of amplifiers, Push pull amplifiers (class A & class B).

Recommended Books:
1. Integrated Electronics, Millman & Halkias (Mc-Graw Hill)
2. Microelectronics Circuits, AS Sedra & KC Smith (OXFORD)
3. Electronics Devices & Circuit Theory, RL Boylestead & L Nashelsky (PHI)
4. Electronic Circuit Analysis & Design, Donald A. Neamen (TMH)

Paper Title: - Semiconductor Electronics (Practical)

Paper Code: EC361  Credit: 1

List of Experiments
1. To study the specifications sheet & draw the characteristics of transistor in CB or CE configuration.
2. To study the specification sheet & draw the characteristics of FET in CD or CC configuration.
3. To draw the frequency response of a single stage BJT amplifier.
4. To measure the voltage and current gain of a BJT amplifier.
5. To measure the distortion in the output of a push pull amplifier.
To simulate the following using P-spice
1. Frequency Response of a single state FET amplifier.
2. Voltage and current gain of BJT amplifier.
3. Distortion of a push pull power amplifier.

Paper Title: - Signals & Systems

Paper Code: EC 312  Max. Marks / Credit: 50/4  Time: 3 hours

Course duration: 45 lectures of one hour duration each
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Signals & Systems:  (7)
Classification of Signals, Transformations of independent variable, Elementary Signals, Continuous time and Discrete time systems, System Properties.

Linear Time Invariant Systems:  (7)
Convolution sum and integral, Properties of LTI systems, Systems described by differential equations and difference equations.

Fourier series Representation:  (5)
Response of LTI systems to complex exponentials, Fourier series representation of continuous time and discrete time periodic signals, Properties of continuous time Fourier series, Properties of discrete time Fourier series, Filtering.

The Continuous Time Fourier Transform:  (4)

PART B

The Discrete time Fourier Transform:  (5)

Sampling:  (2)
The sampling Theorem, Reconstruction using Interpolation, Aliasing.

The Laplace Transform:  (8)

The Z-Transform:  (7)

Recommended Books:
2. Haykin, S., Van Veen, B.; "Signals and Systems";2e; Wiley; 2003
Paper Title: Filters & Transmission Lines (Theory)

Paper Code: EC 313  Max. Marks/ Credit: 50/3  Time: 3 hours

Course duration: 45 lectures of one hour duration each

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Impedance Functions and Networks functions: [10]
Concept of complex frequency, Transform Impedance and transform circuits, Network functions for the one port and two port, Calculation of network functions, Poles and Zeros for Network functions, Restrictions on Poles and Zeros, Locations for Driving Point and Transfer functions, Time domain behavior from Pole and Zero plot, Stability of Active networks.

Filter Synthesis: [12]
Classification of filters, Characteristics, impedance (input & characteristic) and propagation constant of pure reactive network, Ladder Network, T-section, Π-section, Pass and stop bands, Constant –K low pass and high pass filters, m-derived T and Π-section, Design of k and m-derived filters, Band pass filters, band elimination filters, Composite filters.

PART B

Two Port Parameters: [06]
Relationship of Two port variables, Short Circuit Admittance and Open circuit Impedance parameters, Transmission and hybrid parameters.

Sinusoidal Steady State Analysis: [03]
Network Synthesis for two terminal network, Foster and Cauer forms.

Transmission Lines: [14]
Line parameters, Inductance and capacitance of a line of two parallel conductors, inductance of coaxial line, Line of Cascaded T-section, Transmission line-general solution, Physical significance of the equations, the infinite line, wavelength, velocity of propagation, waveform distortion, distortionless line, telephone cable, Reflection on a line not terminated in Z_0, Reflection constant, Line calculation, Input and transfer impedance, open and short circuited lines, Reflection factor and reflection loss, parameters of open wire line and coaxial line at high frequencies, constants for the line of zero dissipation, Voltage and currents on dissipationless line, standing wave nodes, standing wave ratio. Input impedance of dissipationless line, power loss in unmatched lines, single stub matching and smithchart.

Recommended Books
Paper Title: Filters & Transmission Lines (Practical)

Paper Code: EC363  Credit: 1

List of Experiments
1. To Design & implement a constant K low pass / high pass filter.
2. To Design & implement a band pass filter.
3. To Design & implement a m-derived low pass / high pass filter.
4. To Design & implement a composite low pass/ high pass filter.
5. To Measure the characteristics and attenuation of a Transmission line.
6. To Measure the input impedance of a Transmission line.
7. To Measure the characteristics of a Transmission line.
8. To Study the Frequency characteristics and stationary waves of a Transmission line.
9. To Measure Signal Phase shift along the line.
10. Fault localization within the line.

Paper Title: Digital Electronics (Theory)

Paper Code: EC 314  Max. Marks/ Credit: 50/3  Time: 3 hours

Course duration: 45 lectures of one hour duration each
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Introduction  [10]
Representation of Logic, Logic Variables, Boolean Algebra, Boolean Expressions and minimization of Boolean expression using K-Map (up to five variables), Review of Logic Gates, Design & Implementation of Adder, Subtractor, Multiplexer, De-multiplexer, Encoder, Decoder, ROM, Digital Comparators, Code Converters

Flip-Flops  [4]
A 1-bit memory cell, clocked & unclocked flip flop, S-R Flip-Flop, JK Flip-Flop, Race around Condition, Master Slave Flip-Flop, D & T type Flip-Flop, Excitation table of Flip-flops, Conversion of flip-flops

Counters & Shift Registers  [8]
Ripple Counters, Design of Modulo-N Ripple counter, Presettable Counters, Up-Down counter, Design of synchronous counters with and without lockout conditions, design of shift registers with shift-left, shift-right & parallel load facilities, Universal shift Registers

PART B

Data Converters  [6]
Sample & Hold switch, D/A converters: Weighted resistor type, R-2R Ladder type, Modified weighted resistor type; A/D Converters: Flash type, Successive Approximation type, Counter-Ramp type, Dual Slope Type; Specifications of ADC & DAC

Digital Logic families  [8]
Characteristics of digital circuits: fan in, fan-out, power dissipation, propagation delay, Noise Margin, Transistor-transistor Logic (TTL), Types of TTL Gates (Schottky, Standard, low power, high speed), Tristate Logic & its applications, Emitter Coupled Logic (ECL), CMOS, Comparison of characteristics of TTL, ECL, and CMOS.

Semiconductor Memories & Programmable Logic
Memory Organization, ROM, PROM, EPROM, EEPROM, RAM, Static RAM, Dynamic RAM cell, Memory Cell, Reading & Writing Operation in RAM, PLA, PAL & FPGA

Recommended Books
2. Digital System Principles & Applications by R J Tocci (PHI)
4. Integrated Electronics by Millman & Halkias, TMH

Paper Title:- Digital Electronics (Practical)

Paper Code: EC364 Credit: 1

List of Experiments
1. To Study the data sheets of TTL and ECL gates
2. Implementation of Adder and Subtractor using Logic Gates.
3. Implementation of Binary Adder/Subtractor.
5. Design &implementation of Combinational circuits using Multiplexers
6. Design and implement a Universal shift register having shift-right, shift-left, SISO, PIPO capabilities.
8. Implementations of Ripple counter.
10. Implementation of Synchronous counters with unused states and/or avoiding Lock Out condition.
11. To convert 8 bit Digital data to Analog value using DAC
12. To convert Analog value into 8 bit Digital data using ADC
13. To Perform Arithmetic & Logic operations on two 4-bit binary numbers using an ALU.
14. To Transfer the Data between Three Registers through Tristate Circuit
15. To Understand Decoder/Driver and their applications with display. To display a count from 00 to 99 with a delay of N seconds.

Paper Title: Engineering Mathematics – III

Paper Code: AS301 Max. Marks/ Credit: 50/4 Time: 3 hours.

Course duration: 45 lectures of one hour duration each
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.
PART A

Sequences and Series:

Linear Algebra:
Concept of linear independence and dependence, Rank of a matrix: Row – Echelon form, System of linear equations: Condition for consistency of system of linear equations, Solution by Gauss elimination method. Inverse of a matrix: Gauss – Jordan elimination method (Scope as in Chapter 6, Sections 6.3 – 6.5, 6.7 of Reference 1). Eigen values, eigen vectors, Cayley – Hamilton theorem (statement only). Similarity of matrices, Basis of eigenvectors, diagonalization (Scope as in Chapter 7, Sections 7.1, 7.5 of Reference 1).

PART - B

Complex Functions:
Definition of a Complex Function, Concept of continuity and differentiability of a complex function, Cauchy – Riemann equations, necessary and sufficient conditions for differentiability (Statement only). Study of complex functions: Exponential function, Trigonometric functions, Hyperbolic functions, real and imaginary part of trigonometric and hyperbolic functions, Logarithmic functions of a complex variable, complex exponents (Scope as in Chapter 12, Sections 12.3 – 12.4, 12.6 – 12.8 of Reference 1).

Laurent Series of function of complex variable, Singularities and Zeros, Residues at simple poles and Residue at a pole of any order, Residue Theorem (Statement only) and its simple applications (Scope as in Chapter 15, Sections 15.1 – 15.3 of Reference 1). Conformal Mappings, Linear Fractional Transformations (Scope as in Chapter 12, Sections 12.5, 12.9 of Reference 1).

References:
C++ Constructs
Tokens, Expressions and control structures, various data types, and data structures, Variable declarations, Dynamic Initializations, Operators and Scope of Operators, Typecasting, Unformatted and formatted console I/O Operations

Functions
Classes and Objects: Prototyping, Referencing the variables in functions, Inline, static and friend functions. Memory allocation for classes and objects, Arrays of objects, pointers to member functions.

Constructors and Destructors
Characteristics and its various types, Dynamic Constructors, Applications, Order of Invocation, C++ garbage collection, dynamic memory allocation.

Polymorphism
Using function and Operater overloading, overloading using friend Functions, type conversions from basic data types to user defined and vice versa.

PART B
Inheritance
Derived classes, Types of Inheritance, Types of classes, Invocation of Constructors and Destructors in Inheritance, Aggregation, Composition, classification hierarchies, metaclass/abstract classes.

Pointers
Constant pointers, Use of this Pointer, Pointer to derived and base classes, virtual functions, Bindings, Pure virtual Functions and polymorphism

I/O Operations and Files
Classes for files, Operations on a file, file pointers

Generic Programming with Templates
Definition of class template, Function Templates, Overloading Template Functions, Class templates and member functions templates with parameters, Standard C++ classes, persistent objects, streams and files, namespaces, exception handling, generic classes, standard template library: Library organization and containers, standard containers, algorithm and Function objects, iterators and allocators, strings, streams, manipulators, user defined manipulators and vectors

Introduction to Object Oriented System, Analysis and Design

Recommended Books
1. Object Oriented Programming with C++ By Bala Guruswamy, TMH, Edition 3rd
3. The C++ Programming Language By Bjarne Stroutstrup, Edition 3rd
5. The Complete Reference to C++ By Schildt, TMH, Edition 4th

Paper Title:- Object Oriented Programming (Practical)

Paper Code: EC 365 Credit: 1
List of Experiments
1. Implementation of Functions, Classes and Objects
2. Constructors and Destructors
3. Operator Overloading and Type Conversion
4. Inheritance and Virtual Functions
5. Files
6. Exception Handling and Generic Programming
FOURTH SEMESTER

Paper Title: Communication Theory

Paper Code: EC413                Max. Marks/ Credit: 50/4                Time: 3 hours

Course duration: 45 lectures of one hour duration each
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Review of Fourier series & Fourier transform of Continuous time signals, Delta Function, power & energy spectral densities, Sampling Theorem

Random Signal Theory                         [8]

Noise & Interference                         [10]
Classification of Noise, Sources of noises, atmospheric shots, Thermal noise, Frequency domain representation of noise, superposition of noises, AWGN, Linear filtering of noise, Quadrature components of noise, Noise spectral density, Noise calculations, Noise Figures of devices & circuits, cascaded networks, Minimum Noise Figures of networks. Noise Temperature

PART B

Baseband Pulse Transmission                  [8]
Optimum Filters-Matched filters, Error rate due to noise, Inter symbol Interference, Nyquist Criterion for distortionless baseband transmission, Correlative level coding.

Basic Information Theory                    [14]
Concept Information, Entropies of Discrete Systems, Rate of transmission- Redundancy, Efficiency & Channel capacity, Source encoding including Huffman’s Technique, continuous Channel-Entropy maximization, Transmission rate of Channels, capacity of Noisy channels. Discussion of Shannon’s Coding theorem, Comparison of Analog & Digital Communication Systems with reference to the Ideal Channel Capacity Theorem.

Recommended Books
4. “An Introduction to Information Theory” F M Reza,
Paper Title: Analog Electronic Circuits (Theory)

Paper Code: EC 414

Max. Marks/ Credit: 50/4

Time: 3 hours

Course duration: 45 lectures of one hour duration each

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Response of transistor Amplifier

Review Biasing, classification of amplifier, distortion in amplifiers, frequency & phase response of an amplifier, RC coupled amplifier, its low and high frequency responses, transistor model at high frequencies for CE and Emitter follower configuration, high frequency response of two cascaded CE transistor stages

Feedback and Stability

Introduction to feedback, Basic-Feedback Concepts, Ideal Feedback Topologies, Voltage (Series-Shunt) Amplifiers, Current(Series-Shunt) Amplifiers, Transconductance(Series-Series) Amplifiers, Transresistance (Shunt-Shunt) Amplifiers,

Operational Amplifier

Differential Amplifier, Block diagram representation of a typical Op-amp, Interpreting of a typical set of data sheets, ideal op-amp, equivalent circuit of op-amp, ideal voltage transfer curve, open loop op-amp configuration, the practical op-amp, input offset voltage, input bias current, input offset current, total output offset voltage, thermal drift, noise, common mode configuration, CMRR, Frequency Response, Frequency response of internally compensated Op-Amps, Frequency response of Non-compensated OP-Amps, Open loop voltage gain as a function of frequency, Closed loop frequency response, Slew rate

PART B

Op-amp Applications

DC and AC Amplifiers, summing, Voltage–to-current converter, current to voltage converter, the Integrator, the Differentiator, Comparator, Zero-crossing detector, Voltage to frequency and frequency to voltage converters, Clippers and Clampers, Sample and Hold Circuit, Instrumentation Amplifier.

Active Filter, Oscillators & Tuned Amplifiers


Recommended Books

1. Electronics Circuit Analysis and Design by Donald A. Neamen, Tata McGraw Hill
3. Integrated electronics by Millman & Halkias, TMH, Latest Edition

Paper Title: Analog Electronic Circuits (Practical)

Paper Code: EC 464

Credit: 1
List of Experiments
1. To study the Pspice Simulation software
2. Design fabrication & testing of Differentiator Circuits using Op-Amp & simulate using P-spice
3. Design fabrication & testing of Integrator Circuits using Op-Amp & simulate using P-spice
4. Design fabrication & testing of adder/Subtractor Circuits using Op-Amp & simulate using P-spice
5. Design fabrication & testing of Clippers and Clampers Circuits using Op-Amp & simulate using P-spice
6. Design fabrication & testing of Universal Active filter & simulate using P-spice
7. To study the frequency response of OP-Amp & simulate using P-spice
8. To design Butter worth Low pass filter & simulate using P-spice
9. To design Butter worth High pass filter & simulate using P-spice
10. To design Butter worth Band pass filter & simulate using P-spice
11. To design Monostable & Free running Multivibrator using 555

Paper Title:  Microprocessors (Theory)

Paper Code: EC 415  Max. Marks/ Credit: 50/4  Time: 3 hours

Course duration: 45 lectures of one hour duration each
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Microprocessor Architecture and Microcomputer Systems:
Microprocessor Architecture Memory, Input and Output Devices, The 8085 MPU, Example of an 8085-Based Microcomputer, Memory Interfacing, The SDK-85 Memory System.

Interfacing I/O Devices:

Programming the 8085:
Introduction to 8085 Assembly Language Programming, 8085 Programming Model, Instruction Classification, Instruction Format, Data Transfer (Copy) Operations, Arithmetic Operations, Logic Operations, Branch Operations, Writing Assembly Language Programs.

Programming Techniques with Additional Instructions:

PART B

Counters and Time Delays:
Counters and Time Delays, Hexadecimal Counter, Modulo Ten, Counter, Generating Pulse Waveforms, Debugging Counter and Time-Delay Programs

Stack and Subroutines: Stack, Subroutine, Conditional Call and Return Instructions.

Interrupts : The 8085 Interrupt, 8085 Vectored interrupts.

Interfacing Data Converters:

General –Purpose Programmable Peripheral Devices:
The 8255A Programmable Peripheral Interface, Illustration: Interfacing Keyboard and Seven-Segment Display, Illustration: Bi-directional Data Transfer between Two Microcomputers, The 8254 Programmable Interval Timer, The 8259A Programmable Interrupt Controller, Direct Memory Access (DMA) and the 8257 DMA Controller, serial communication, Programmable communications interface 8251

Recommended Books


Paper Title: Microprocessors (Practical)

Paper Code: EC 465 Credit: 1

List of Experiments

1. Familiarization of 8085 kits.
2. Verification of arithmetic and logic operations using above kits. (At least 5 programs)
3. Development of interfacing circuits of various control applications based on 8085.
4. Application of assembly language using 8085 instructions set to develop various programs.
5. Applications of data movement instructions to develop relevant programs.

Paper Title: Communication Engineering

Paper Code: EC 416 Max. Marks/Credit: 50/4 Time: 3 hours

Course duration: 45 lectures of one hour duration each

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Amplitude Modulation Systems


Angle Modulation

Principles and generation of FM and PM signals, Reactance Modulator method, Armstrong Method, Detection of FM and PM signals, Slope Detectors, Foster Discriminator, Ratio detector, PLL detector, PLL and its characteristics, Pre-emphasis and De-emphasis, Noise consideration in FM and PM system, Block diagrams of FM Transmitter & FM receiver, Nonlinear effects in FM systems.

PART B

Pulse Modulation & Demodulation

**Baseband Pulse Transmission**


**Recommended Books**

1. Communication Systems by Simon Haykin, Wiley India Ltd.

**Paper Title**: Communication Engineering (Practical)

**Paper Code**: EC 466 Credit : 1

**List of experiments**

1. To measure the modulation index of AM signals using the trapezoidal method
2. To study DSB/ SC AM signal and its demodulation using product Detector Circuit.
3. To study the voltages and waveforms of various stages of super-heterodyne receiver
4. To measure the sensitivity and selectivity of a super heterodyne radio receiver
5. To study the voltages and waveforms of various stages of FM Receiver
6. To study the pulse code modulation and de-modulation circuit
7. To study the Time division multiplexing and de-multiplexing circuits.
8. To study delta modulation and demodulation circuits.
9. To study sigma delta modulation and demodulation circuits.
11. Study of modulation techniques on MATLAB

**Paper Title**: Electromagnetic Theory (Theory)

**Paper Code**: EC 417 Max. Marks/ Credit: 50/4 Time: 3 hours

**Course duration**: 45 lectures of one hour duration each

**Note for paper setter**: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

**PART A**

Maxwell's equation: [8]

Maxwell's equations in their integral and differential forms, Maxwell's equations in free space and in harmonically varying fields, Physical Interpretation and Boundary Conditions.

Plane waves in Dielectric and Conducting Media: [16]
Conductors and Dielectrics, Wave equations in conducting and dielectric media, its solution, Skin effect, relaxation time, impedance of the conducting medium. Reflection and transmission of the wave at a boundary, Poynting Vector: application to energy radiation, Velocities of propagation: group velocity, phase velocity, wave polarization.

**PART B**

**Guided Waves:**

**Wave Guides:**
Rectangular and Circular waveguides: T.M. & T.E. Modes, Wave impedance and characteristic impedances, Attenuation factor and Q of waveguides.

**Recommended Books:**
3. Antennas and Wave Propagation by G S N Raju, Pearson publications, Edition 1ST

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**Paper Title:** Data Structures & Algorithms (Theory)

**Paper Code:** EC 418  |  **Max. Marks/ Credit:** 50/3  |  **Time:** 3 hours

**Course duration:** 45 lectures of one hour duration each  
**Note for paper setter:** Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

**PART A**

**Introduction:**
Introduction to data structures, Introduction to Algorithms Complexity.

**Arrays, Stacks & Queues:**
Concepts; Basic operations & their algorithms: Transverse, Insert, Delete, Sorting of data in these data structures; Prefix, Infix, Postfix Notations.

**Lists:**
Concepts of Link List and their representation; Two way lists; Circular link list; Basic operations & their algorithms: Transverse, Insert, Delete, Searching and Sorting of data in List; Storage Allocation & Garbage Collection; Linked stack and queues; Generalized List; sparse matrix representation using generalized list structure.

**PART B**

**Trees:**
Binary Trees and their representation using arrays and linked lists, Trees and their applications, Binary tree transversal, Inserting, deleting and searching in binary trees, Heap & Heap Sort, General Trees, Thread binary tree, Height balance Tree (AVL), B-Tree.

**Graphs and their applications:**
Graphs, Linked Representation of Graphs, Graph Traversal and spanning forests, Depth first search, Breadth first search.

**Sorting & Searching:**
Insertion sort, Selection sort, Merging, Merge sort, Radix sort, Sequential & Binary Search, Indexed Search, Hashing schemes, Binary search Tree.

**Recommended Books**
2. Theory and problems of Data Structures Seymour Lipschutz (McGraw Hill), Edition 1st
FIFTH SEMESTER

Paper Title: Integrated Circuits (Theory)

Paper Code: EC 506 Max Marks/credit: 50/3 Time: 3 hours

Course duration: 45 lectures of one hour duration each
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Introduction:
General classification of Integrated Circuits, advantages of ICs over Discrete Components.

Thick Film and Thin Film Hybrid ICs:
Features of Hybrid IC technology, Thick Film technology, Thick film processing, Thick Film design, guidelines and applications of thick film hybrids. Thin film technology, Thin film processing, Thin film design, guidelines, advantage and applications of Thin film hybrids.

Monolithic IC Processes:

PART B

Monolithic Components:
Epitaxial devices and their characteristics, Bipolar IC process, P-N junction Isolation, Monolithic Bipolar transistor constructions, Dielectric isolation, Isoplaner and other IC structures, Monolithic Diodes, Monolithic Junction FETS, MOSFET technology, Short channel MOS structures, Typical NMOSIC technologies for VLSI chips, Complementary Symmetry MOSFET technologies, Monolithic resistors, Monolithic capacitor, IC crossover, Process Monitoring.

Recommended Books
1. Integrated circuits by K.R. Botkar, Khanna Publishers
3. VLSI Technology by Simon Sze, Tata Mc Grawhill

Paper Title: Microcontrollers and Interfacing (Theory)

Paper Code: EC 507 Max Marks/credit: 50/4 Time: 3 hours

Course duration: 45 lectures of one hour duration each
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.
PART A
The 8051 Architecture:- Overview of Microprocessor and Microcontroller, 8051 Architecture, Pin diagram, I/O port structure, Memory Organization, Specific Function Registers, Memory, Reset operation. Instruction Set Summary:- Addressing modes, Instruction types. Timer Operation:- Timer mode register, Timer Control Register, Timer modes and overflow flag, Clocking sources, Starting Stopping, and controlling the timers, Initializing and accessing timer registers, short intervals and long intervals, Baud rate generation, Serial Port Operation:- Serial port control register, Modes of operation, Initializing and accessing serial port registers, Multiprocessor communications, Serial port baud rates.

PART B
Interrupts:-Interrupt Organization, Processing Interrupts, Program Design using Interrupts, Serial port Interrupts, External Interrupts, Interrupt Timings , 8051 Assembly Language Programming:- Assembler operation, Assembly language program format, Assembler –time expression evaluation, Assembler directives, Assembler controls, Linker operation, Macros, Program structure and design, Real World Interfacing Interfacing of 8051 to LCD, ADC, DAC, Sensors, Stepper Motor, Keyboard. Interfacing to External Memory, Interfacing to the 8255.

Recommended Books

Paper Title: Microcontrollers and Interfacing (Practical)

Paper Code: EC 557 
Credit: 1

List of Experiments
1. Write programs for Data Moving Instructions, Byte Level and Bit Level Logical Operations, Rotate and Swap operations, Arithmetic Operations, Jump and Call Instructions, Calls and Subroutines, Interrupts and returns as follows:
2. Write a program to compute sum of N natural numbers.
3. Write a program to find the smallest element of an array of N integers.
4. Write a program to perform BINARY SEARCH on an array that is sorted in ascending order.
5. Write a program to compute the sum of odd elements of an array of 8-bit integers.
6. Compute the address of the elements of 5 x 5 matrix
7. Multiply two 2 x 2 matrices. Try to make it generalized.
8. Write programs for Timer Interrupts, Serial port Interrupts.
9. Write programs for Interfacing of 8051 to LCD, ADC, DAC, Sensors, Stepper Motor, keyboard, Interfacing to External Memory, Interfacing to the 8255.

Paper Title: VLSI Design (Theory)

Paper Code: EC 508 
Max. Marks/Credit: 50/3 
Time: 3 hours

Course duration: 45 lectures of one hour duration each
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

**PART A**

**Introduction to MOS Technology** (5)
Basic MOS transistors, Enhancement and Depletion mode transistors, nMOS fabrication.

**MOS Circuits** (7)
Parameters, Pass Transistor, nMOS inverter, CMOS inverter, MOS transistor circuit model, Latch up in CMOS circuits, Basic gates, depletion and enhance mode pull ups.

**MOS circuit Design Processes** (10)
MOS layers, Stick Diagrams, nMOS design style, CMOS design style, Design rules and layout, Lambda based design rules, contact cuts, Double Metal MOS process rules, CMOS lambda-based design rules.

**PART B**

**Circuit Characterization** (8)
Resistance estimation, Capacitance Estimation, Power dissipation, Inverter delays, super buffers, propagation delays, Charge sharing.

**CMOS Design Methods and Testing** (10)
Design strategies, CMOS chip design options, the need for testing, Design strategies for test, Chip-level test techniques

**VLSI Tools** (5)
Role of CAD tools in VLSI design process, Hierarchy of simulation tools, tanner tool, CMOS Layout tool: Microwind

**Recommended Books**
2. CMOS Digital Integrated Circuits- Sung- Mo (Steve) Kang and Yusuf Leblebici, Mc-graw Hill

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**Paper Title:** VLSI Design (Practical)

**Paper code: EC 558**

**Credit: 1**

**List of Experiments (T-SPICE)**
1. Introduction to Tanner tool.
3. Transient analysis of NOR, OR.
4. Transient analysis of NAND, AND.
5. DC and AC analysis of Inverter.
6. DC and AC analysis of Common source amplifier configuration.
7. DC and AC analysis of basic MOS based current mirror.

**References:**
Paper Title: Antennas & Wave Propagation (Theory)

Paper Code: EC 509  
Max Marks/credit: 50/3  
Time: 3 hours

Course duration: 45 lectures of one hour duration each

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Antenna Radiation
Antenna Parameters: Antenna impedance, Directional patterns, Effective length, Radiation Intensity, Directivity, Power gain, Efficiency, Effective area, Equivalent circuit, Front to back ratio, polarization and antenna temperature, Radiation field, Radiation power, Radiation resistance, Directivity and gain of an alternating current element, half wave dipole and quarter wave monopole, Effect of earth on patterns.

PART B

Antenna Arrays:
Multiplication of patterns, one dimensional broadside and endfire arrays, Feed network for arrays: series, shunt, delta matching, Impedance matching: Folded dipole, BALUNS and stubs, Yagi Uda array, log-periodic arrays, Dolph-Techebysheff arrays.

Recommended Books
1. Antennas and Wave Propagation by G S N Raju, Pearson publications
2. Antennas and Radio Wave Propagation by K D Prasad Satya Prakashan
4. Antenna and Radio Wave Propagation by Krauss, TMH
5. Antenna and Radio Wave Propagation by Ballanis, John Wiley & Sons

Paper Title: Digital System Design (Theory)

Paper Code: EC 510  
Max Marks/Credits: 50/3  
Time: 3 hours

Course Duration: 45 lectures of one hour each.

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.
PART A

Combinational Circuits: [20]

Error Correction and Detection: Error detection and correction techniques, Single error detection, Single error correction with double error

Fault detection and Location in combinational circuits: Different methods of detecting and locating Faults in combinational circuits.

PART B

Sequential Circuits [25]
Synchronous circuits: Concept of state diagram and state table, state assignment, Analysis and synthesis of sequential circuits, designs of Next state decoder and output decoder, state reduction, Machine minimization of completely and incompletely specified machines.


Fault detection and Location in sequential circuits.

Recommended Books
1. Switching and Finite Automata Theory by Kohavi, TMH.
2. Switching Theory & Logic Design by Rao, Pearson Ed.
3. Digital circuits and Logic Design By Lee, PHI.
5. Switching circuits for Engineers, Marcus, PHI
6. Introduction to Digital systems, James Palmier, David Perlman

Paper Title: Digital System Design (Practical)

Paper Code: EC 560 Credit: 1

List of Experiments
1. To Design and test the minimized circuit of Full Adder.
2. To Design and test the minimized circuit of BCD to Binary Converter
3. Implement decade counter using minimum number of gates
4. To test the minimized circuit of Decimal to BCD Encoder
5. Design and test hexadecimal to binary Encoder
6. Implement and test BCD to 7-Segment decoder
7. Design a sequence detector to detect a given sequence
8. Design and test twisted type ring counter
9. Implement the minimized circuit of Modulo-6 counter
10. To design, implement and test a 16 :4 multiplexer using logic gates.
11. To design, implement and test a 4:16 demultiplexer using logic gates.
12. Design & test Johnson Counter.
Paper title: Computer Networks (Theory)

Paper Code: EC511   Max Marks/credit: 50/4   Time: 3 hours

Course duration: 45 lectures of one hour duration each
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Introduction: [5]

Physical Layer: [5]
Data Communication concepts, Wired and Wireless transmission media, Transmission Impairments and Performance, Parallel and Serial Transmission, Switching, Circuit Switching, Packet Switching, and Virtual Circuit Switching, Introduction to PSTN.

Data Link Layer: [6]
Data link layer Design Issues, Framing, Error Detection and Correction, Flow Control, Sliding Window Protocols, HDLC, SLIP, and PPP.

Medium Access Control Sublayer: [6]
Channel Allocation, ALOHA, Slotted ALOHA, CSMA, CSMA/CD, IEEE LAN Standards: Ethernet (802.3), Gigabit Ethernet, Wireless LAN (802.11), Broadband Wireless (802.16), Bluetooth.

PART B

Network Layer: [12]
Network layer Design Issues, IPv4 and IPv6 Structure and addresses, Routing algorithms- Shortest path, Flooding, Distance Vector Routing and Link State Routing; General principles of Congestion Control, Congestion Control in Datagram and Virtual Circuit Subnets, Brief idea of Quality of Service, Internetworking, IP protocol, IP Addresses, Internet Control Protocols, Subnetting and Supernetting, ARP, NAT, DHCP.

Transport Layer: [5]
The Transport Service, Elements of Transport Protocols, TCP & UDP Protocols

Application Layer: [6]
Domain Name System, SMTP, FTP, TELNET, HTTP, WWW, SNMP, Multimedia, and Cryptography.

Recommended Books
SIXTH SEMESTER

Paper title: Advanced Microprocessors (Theory)

Paper Code: EC 607 Max Marks/credit: 50/4 Time: 3 hours

Course duration: 45 lectures of one hour duration each

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

8086 Architecture: [4]
CPU Architecture, Internal operation, addressing modes, instructions formats, Instruction execution timing.

Assembly Language Programming: [7]
Assembler Instruction formats, Data Transfer, Arithmetic, Branch, loop, machine control, logical, Shift and rotate instructions, Directives and operators.

Modular Programming: [4]
Linking & relocation, stacks, procedures, Interrupt and routines.

Byte And String Manipulation: [4]
String instruction, prefix, text editor, number format conversion.

I/O Programming: [3]
Fundamental I/O consideration programmed I/O, Interrupt I/O, Block Transfer and DMA.

PART B

System Bus Structure: [5]
Minimum mode, Maximum mode system bus timing and bus standard.

Numeric Data Processor: [8]
8087, NOP data types, Processor architecture

Intel 386 And 486 Microprocessors: [10]
Intel 386 Microprocessor, Intel 486 Microprocessor, 486DX Architecture, Register Organisation of 486 Microprocessor, memory organization, Virtual Memory, Memory Management Unit(MMU), Interrupts and Exceptions, Addressing Modes of 80486.

Recommended Books
2. Intel’s Microcontroller Handbook

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Paper Title: Advanced Microprocessors (Practical)

Paper Code: EC 657 Credit: 1

List of Experiments

1. Write a program to load register A, B, C and D with same constant (e.g. A1). Try to optimize your program in such a way that you use the smallest number of program bytes. Test your program in single step mode.
2. Assume that 4 bytes of data restored at consecutive locations of the data memory starting at location X. Write a program that loads register E with(X) i.e. With data contained at memory location X, D with (X+1), C with (X+2) and B with (X+3+0)
   (a) Use direct addressing mode (LDA)
   (b) Use register indirect addressing mode (M)
   Test your program in single step mode.

3. (a) Write a program which tests the zero condition of data byte specified at data memory location X. If it is zero, a 00 should be stored at location X+1, otherwise FF.
   (b) Write a program which tests the all–one–condition of data byte specified at date memory location X. If all the bytes are 1, store 01 at location X+1, otherwise 00.

4. Four bytes of data are specified at consecutive data memory locations starting X. Write a program which increments the value of 4 bytes by 1.

5. Two unsigned binary numbers are stored at consecutive data memory locations, X+1. Write a program for computing (X+1)-(X). The magnitude of the result should be stored at Y and the sign 00 if positive and 01 if negative at Y+1.

6. (a) A double precision number, i.e. a 16 bit unsigned number, is stored X and X+1, with low order byte at X. Another double precision number is stored at Y and Y+1. Add the two numbers and store the result a W and W+1.
   (b) Same as (a). Subtract the two numbers and store the result at W and W+1.

7. A code word is stored at memory location X. Write a program fro testing whether the code word belongs to 2/5 code, and set the location Y to FF if yes 00 if no. The code word is valid if three MSBs are zero and if the number if 1’s in the remaining 5 bits is 2 (2/5 Code).

8. A counter is defined as register (e.g. B) which gets decremented till zero. Define such a counter as subroutine. Write a program, which consist of two counters, You must implement the following steps
   1. Set initial value of counter to 1.
   2. Call counter subroutine.
   3. Set initial value of counter to 2.
   4. Call counter subroutine.
   5. Go back to step 1.

9. (a) N binary numbers are stored at consecutive data memory locations, starting at x, where N is defined at data member location “NUMBER”. Find the largest number and display it in the data field.
   (b) N binary numbers are started consecutive data member locations starting at X. Rearrange the numbers in ascending order.

10. A binary number is stored at data member locations X. Multiply the number by 10 and display the result in the address field (Hint: bx10=bx2 +bx8, a multiplication by 2 corresponds to a shift left on a bit).

11. An 8 bit binary number is stored at data memory locations. Y. Convert the decimal (BCD) and display the result in the address field.

12. Given 2 digit decimal number at data memory location X and X+1. Find the product using binary multiplications and display the result in address field.
13. Write a program for moving a data block starting address X to address Y. The addresses X, Y, as well as the block length are specified at some suitable data memory locations.

14. Write a program for moving a data block starting address X to address Y. The addresses X, Y as well as the block length are specified at some suitable data memory locations.

15. A two digit BCD number is stored at memory location X. Convert the number into binary and display the result in data field.

16. Divide a 16 bit number by a 8 bit number and display the result in data field.

17. Write a program for display of decimal numbers 00-99 in sequence with a delay of 15 seconds between any two consecutive numbers.

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Paper Title: Microwave Engineering (Theory)

Paper Code: EC608

Max Marks/Credit: 50/4

Time: 3 hours

Course duration: 45 lectures of one hour duration each

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Waveguide Components: [12]
Transitions, Discontinuities, Matched loads, Shorts, Flanges, Bends & Twists, Attenuator & phase shifters, Microwave Hybrid Circuits: Waveguide Tees, Magic (Hybrid) Tees, Scattering matrix of tees, Hybrid Rings (Rat-Race Circuits), Directional Couplers: Two Hole Directional Couplers, Scattering matrix of a directional coupler, Hybrid Couplers, Multi-hole couplers, Propagation in ferrites, Faraday rotation, Microwave Circulators: 3 port circulators and Isolators, YIG filter rectangular, Microwave cavities: Rectangular, Cylindrical Cavity Resonators, Q-factor of cavity resonator, aperture coupled cavity.

Measurements: [4]
Slotted waveguide, Swept Frequency Technique Detectors, Power & Impedance measurement.

Solid State Sources – I: [8]
Microwave BJTs, Heterojunction Bipolar Transistors (HBTs) and Tunnel Diodes, Metal-Semiconductor Field Effect Transistors (MESFET), High Electron Mobility Transistors (HEMT), Transferred Electron Devices (TEDs): GUNN Diode, LSA Diodes.

PART B

Solid State Sources – II: [4]

Microwave Tubes: [12]
Microwave Linear Beam Tubes: Klystron, Multicavity Klystron, Reflex Klystron, Helix Traveling-Wave Tubes (TWT), Coupled Cavity Travelling-Wave Tubes, Microwave Crossed-Field Tubes: Cylindrical Magnetron.

Microwave Transmission Lines: [5]
Recommended Books
3. Microwave Engineering---Special topics---R. Chatterjee, East-West Press
5. Elements of Microwave Engineering---R. Chatterjee, East-West Press

Paper Title: Microwave Engineering (Practical)

Paper Code: EC 658
Credit: 1

List of Experiments
4. Measurement of SWR.
5. Reflex klystron mode curves.
6. Antenna radiation pattern.
7. Verification of Diode law.
8. Gunn Oscillator characteristics.
9. Directivity & Coupling of a directional coupler
10. To verify the waveguide law.

Paper title: Digital Communication (Theory)

Paper Code: EC 609
Max Marks/credit: 50/4
Time: 3 hours

Course duration: 45 lectures of one hour duration each
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A
Signal Space Analysis:
Geometric Representation of Signals, Gram-Schmidt Orthogonalization Procedure. [4]

Digital modulation techniques:
PSK, FSK, MSK, QAM. Error calculations for PSK, FSK, MSK, QAM, Shannon’s limit, Signal to Noise Ratio Calculations in PCM and DM systems. [8]

Information theory and coding:
Entropy, Capacity of a Gaussian Channel. Block codes, Convolution coding and decoding, Soft and Hard decision decoding, State & Trellis diagrams, Viterbi Algorithm, Trellis decoded modulation. [10]

PART B
Multiplexing and Multiple Access: [8]
Allocation of communication Resources, FDM/FDMA, TDM/TDMA, CDMA, SDMA, Multiple Access Communications and Architecture, Access Algorithms.

Spread Spectrum Techniques: [8]

Signal design for band-limited channels for No Inter Symbol Interference: [7]
Pulse shaping to Reduce ISI, types of error-performance degradation, demodulation/detection of shaped pulses.

Recommended Books
1. Digital Communications by Bernard Sklar, PHI

Paper title: Digital Communication (Practical)

Paper Code: EC 659 Credit: 1

List of Experiments
1. Design and practical implementation of ASK systems
2. Design and practical implementation of PSK systems
3. Design and practical implementation of QPSK systems
4. Design and practical implementation of FSK systems
5. To study the application of CDMA in voice communications
6. To practically compare the noise in PCM and DM systems
7. To practically study Frequency Division Multiplexing.
8. To practically study Time Division Multiplexing.
9. Implementation of Viterbi algorithm using C-language

Paper Title: Computer Architecture & Organization (Theory)

Paper code: EC 610 Max Marks/credit: 50/3 Time: 3 hours

Course duration: 45 lectures of one hour duration each

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Register Transfer and Micro-Operations [6]
Register Transfer Language, Inter Register Transfer Arithmetic, Complements, fixed and floating point Representation, Micro-Operations, Shift Micro-Operations and Control Operations.

Basic Computer Origination and design [6]
Instruction Codes, Computer Instructions, Timing and Control, Execution of Instructions, Input, Output and interrupt, Design of Computer.

**Computer Software**

**Control Processor Organization**
Processor Bus Organization, ALU stack Organization, General Register Organization, Instruction Formats, Addressing Modes, Data Transfer and Manipulation, Program Control, Microprocessor Organization, Pipelining, Parallel Processing.

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### PART B

**Micro program Control Organization**
Control Memory, Address Sequencing, Micro program Sequences, Microinstruction Formats, and Software Aids.

**Arithmetic Processor Design**
Comparison and Subtraction of unsigned Binary Numbers, Addition, Subtraction, Multiplication, Division Algorithm, Processor configuration and control

**Input-Output & Memory Organization**
Input-Output interface, Asynchronous Data Transfer, DMA, Priority Interrupt, I/O Processor, Virtual Memory, Cache Memory, Associative memory, Memory Management Hardware.

### Recommended Books
1. M. Morris Mano, Computer system & Architecture, Pearson Education
3. M. Morris and Charles R. Kinre, Logic and computer design Fundamentals, Pearson Education

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### Paper Title: Control Systems

**Paper Code: EC611**

**Max Marks/credit: 50/3**

**Time: 3 hours**

**Course duration:** 45 lectures of one hour duration each

**Note for paper setter:** Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

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### PART A

**Introduction:**
History of automatic control, servomechanism, regulating systems, open loop, closed loop control systems, feedback, effect of feedback, linear and non linear control systems, block diagrams, Examples: speed control system, robot control system, temperature controls system, traffic control system, business control systems etc.

**Modeling:**
Differential equations of physical systems, electrical, mechanical, translational, rational, gear systems, thermal systems. Electrical, mechanical analogies, Laplace transforms, transfer function. Block diagram algebra, signal flow graphs, characteristic equation, Control system components: Error detectors potentiometer, synchros, stepper motor, ac and dc techogenenrators.
Time Domain Analysis:  
Typical test input signals, Transient response of the first order, second order system, Time domain specifications Dominant closed loop poles of higher order systems, Steady state error and error coefficients.

Stability:  
Concepts of absolute and relative stability pole zero location, Routh-Hurwitz criteria.

Root Locus Technique:  
Introduction, Root Locus Concept, Construction Root Loci, Stability analysis.

PART B

FREQUENCY RESPONSE:
Introduction, bode diagram, polar plots, log magnitude vs. phase plot, nyquist stability criterion, stability analysis, relative stability, Gain margin & Phase margin close loop frequency response.

INTRODUCTION TO DESIGN:
Necessity of compensation, lag and lead compensation, design of PID Controller.

STATE SPACE ANALYSIS:
Concept of State, state variable and state vector, state space modeling of continuous time and discrete time systems, solution of state equation, concepts of controllability and observability, pole-placement design.

Recommended Books
1. I.J. Nagrath and M. Gopal, Control Systems Engineering, Wiley Easter
3. K. Ogata, Modern Control Engineering, PHI
SEVENTH SEMESTER

Paper Title: Optical Communication (Theory)

Paper code: EC 708
Max. Marks: 100
Time: 3 hours

Course duration: 45 lectures of one hour duration each

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Overview of Optical Fibre Communication: [03]
Elements of basic communication system, communication system architecture, advantages of optical communication, Definition of dB and dBm.

Optical Fibre Wave Guides: [06]
Ray Theory of Transmission: Total Internal reflection, Acceptance Angle, Numerical Aperture, Electromagnetic mode theory for optical communication of both types of fibers viz step index fiber and graded index fibres.

Signal Degradation in Optical Fibres: [10]

PART B

Optical Sources and Detectors: [10]
Sources: Basic principle of surface emitter LED and edge emitter LED- material used, structure, internal quantum efficiency and characteristics, LASER Diode - material used, structure, internal quantum efficiency and characteristics, working Principle and characteristics of Distributed feedback (DFB) laser.
Detectors: PIN photodiode - material used, working principle & characteristics, Avalanche Photodiode: material used, working principle and characteristics.

Digital and Analog Transmission System: [12]
Overview of Analog Links, Carrier to Noise Ratio, Multichannel Amplitude & Frequency Modulation. Point to point Digital links, link power budget, Rise time budget. Introduction to Principle of WDM, Basic Application and types of Optical Amplifiers, Semiconductor Optical Amplifier, Eribum doped fiber amplifiers, Amplifier Noise.

Optical Fiber Measurements: [04]
Optical Power Meter, optical attenuator, Attenuation Measurements: Cutback technique, Insertion losses Method, Optical Time domain Reflectometer (OTDR), OTDR Trace, Eye Patterns.

Recommended Books
2. Optical Fiber Communication Principles & Practice by John M. Senior, PHI Publication
5. G.P. Agrawal, "Fiber Optic Communication" Wiley Publisher
List of Experiments

1. To study the propagation loss and bending loss in optical fiber.
2. To set up a fiber optic analog link.
3. To set up a digital fiber optic link.
4. Study of intensity modulation technique using analog and digital input signal.
5. To study the frequency modulation and demonstrate voice transmission through optic fiber using FM.
6. Measurement of optical power and propagation loss using optical power meter.
7. To determine the bit rate supported by the fiber optic link.
8. To study the characteristics of PIN diode.
9. To demonstrate the concept of WDM system.

Paper Title: Digital Signal Processing

PART A

Introduction: (6)

Review of Transforms: (6)

Frequency Domain Representation of Signals & Systems: (11)
Discrete Fourier Transform and its properties, Divide and Conquer approach to computation of DFT, Filtering of long data sequences, Fast Fourier Transform, Decimation in time and Decimation in frequency algorithms, Discrete Cosine Transform, Wavelet Transform.

PART B

Digital Filters: (11)
Ideal Filter vs Practical Filters, General Specifications and Design Steps, Comparison of FIR & IIR Filters, Design of FIR Filters using Window technique, Frequency sampling technique, Design of IIR Filters using Impulse Invariance technique, Bilinear Transformation, Design of IIR Filters using Butterworth, Chebyshev and Elliptic filter, Digital frequency transformation.
Implementation of Discrete Time Systems: (8)
Block diagrams and signal flow graphs for FIR and IIR systems, Direct form, Cascade form, Frequency Sampling Structures, and Lattice structures for FIR systems, Direct form, Cascade form, Parallel form, and Lattice and Lattice-Ladder Structures for IIR systems, Representation fixed point and floating point numbers, Finite word length effects, Arithmetic operations.

Multirate Signal Processing: (5)
Basic Sampling rate alteration devices, Multirate structures, Multistage design, Polyphase decomposition, Introduction to digital filter banks.

Recommended Books

Paper Title: Digital Signal Processing (Practical)

Paper code: EC 759 Max. Marks: 50

List of Experiments:
1. Introduction to MATLAB.
2. Generating & Plotting Discrete time signals.
3. Study the effect of noise on signals in MATLAB.
4. Inverse Z Transform.
5. Convolution of Causal & Non Causal sequences in MATLAB.
6. Auto & Cross-Correlation in MATLAB.
8. System Response to Arbitrary Inputs.
9. DFT & IDFT of two sequences.
10. FFT of two Sequences.
11. Circular Convolution.
13. FIR Filter Design using Window Method in MATLAB.
14. IIR Filter Design using Bilinear Transformation in MATLAB.
15. IIR Filter Design using Impulse Invariance in MATLAB.
16. Butterworth and Chebyshev Digital IIR Filters in MATLAB.
17. Implementation of Filter Structures.
18. Interpolation and Decimation of sequences.
20. Study of DSP kits.

Paper Title: Wireless Communication (Theory)
Course duration: 45 lectures of one hour duration each
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Introduction
Evolution of Mobile Communication Systems, Paging systems, cordless telephone systems, cellular telephone systems, comparison of common wireless communication systems, 2G cellular networks, 2.5 G wireless network, HSCSD, GPRS, EDGE technology, 3G wireless network, UMTS, 3G CDMA2000, 3G TD-SCDMA, Wireless Local Loop, Blue tooth and Personal Area Networks.

System Design Fundamentals
Frequency reuse, Channel alignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems, parameters for mobile multipath channel, Small scale fading.

PART B

Modulation Techniques
Amplitude modulation, Angle Modulation, Digital Modulation, Linear modulation techniques, Constant envelope modulation, spread spectrum modulation techniques, Equalization, Equalizers in communication receiver, Diversity techniques, RAKE receiver, Fundamentals of channel coding

Multiple Access Techniques
FDMA, TDMA, CDMA, SDMA

Wireless Networking
Difference between wireless and fixed telephone networks, development of wireless networks, ISDN

Wireless Systems
GSM, GSM Architecture, CDMA digital cellular standard, IS-95 system.

Recommended Books
1. Wireless Communications Principles and practice by Theodore S. Rappaport, Prentice Hall India
2. Modern Wireless Communications by Simon Haykin , Michael Moher , PHI
3. Wireless Communication and Networking By Jon W Mark, PHI

Note: Students are required to perform experiments from any six blocks by selecting at least two from each sub-block.

List of Practicals
1. Equipment orientation
   a. Familiarisation with spectrum analyser, simulation softwares, various kits to be used in the laboratory.
   b. Review of working of function generator, CRO, multimeter & other instruments.
2. Simulation and implementation of baseband digital signals
   a. Types of baseband signals: unipolar, polar, bipolar, RZ, NRZ, etc.
   b. Distortion and noise. Eye diagram.
3. Simulation and implementation of modulated digital signals
   a. PSK, ASK and FSK modulations.
   b. Demodulation with envelope detection and synchronous.
   c. PSK differential modulation.
   d. Quadrature modulations (QASK and QPSK).
   e. QAM modulation.
4. Global System for Mobiles (GSM)
   c. AT Commands
   d. Working of GSM mobile station.
5. Multiple Access
   a. Time division multiple Access
   b. Frequency division multiple access
6. Spread Spectrum communication systems
   a. Pseudo-noise coders
   b. Direct sequence spread spectrum communication systems
   c. Frequency hopped spread spectrum communication systems
   d. CDMA wireless computer communication systems
7. Channel Characteristics
   a. Multipath channel propagation characteristics
   a. Bit-error rate measurement
8. Wireless Networks
   a. Bluetooth wireless network.
   b. Wi-Fi
   c. Wi-Max

Paper title: Operating Systems

Paper Code: EC711 Max. Marks: 100 Time: 3 hours

Course duration: 45 lectures of one hour duration each

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Concept of an operating systems, batch system, Multi-programmed, Time sharing, Personal Computer System, Parallel system, Real time system, General system Architecture.

System components, operating system services, System calls, System Programs, System Structure, System design and implementation. Concept of process, process states, process state transition, process control block, operations of processes, concurrent processes, deadlocks, scheduling algorithms, scheduling criteria, Process Synchronization.

PART B

Concept of an operating systems, batch system, Multi-programmed, Time sharing, Personal Computer System, Parallel system, Real time system, General system Architecture.

System components, operating system services, System calls, System Programs, System Structure, System design and implementation. Concept of process, process states, process state transition, process control block, operations of processes, concurrent processes, deadlocks, scheduling algorithms, scheduling criteria, Process Synchronization.
Memory Management: [6]
Logical and physical address space, storage allocation and management techniques, swapping, concepts of multi programming, paging, segmentation, virtual storage management strategies, Demand Paging, Page Replacement Algorithms, Thrashing.

PART B

Information Management: [6]
File concept, Access method, Directory structure, Protection File system structure, Allocation methods, Free space management, Directory implementation, Disk structure, Disk Scheduling, Disk management, Swap space management.

Distributed-System Structures: [6]
Network operating system, Distributed operating systems, Remote services, Robustness, Design Issues.

Distributed file systems and Distributed Coordination: [6]

Case Studies: [5]
Unix O.S. Architecture, Operating system services, user perspective, representation of files in Unix system processes and their structure, Input-output system, Memory management, Unix shell, history and evolution of Unix system.

Recommended Books

Paper Title: RADAR ENGINEERING (Theory)

Paper code: EC 712 Max. Marks: 100 Time: 3 hours

Course duration: 45 lectures of one hour duration each
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Radar Fundamentals [7]

Radar Signal Processing: Moving Target Indicators & Doppler Processing [7]
Doppler & Moving Target Indicator(MTI) Fundamentals, MTI Principles & Methods, Blind Doppler Shifts & PRF Stagger, CW, High PRF, & Medium PRF Doppler Processing.

The Radar Equation [10]
Radar Equation Introduction, Points Targets in Noise, Radar Equation with Pulse Compression, Search Radars, Tracking Radars, CW & Pulse Doppler Radar, Area Targets & Clutter, Volume Targets & Clutter, Self-
Protection Jamming, Stando Jamming, Augmentation, Bistatic Radar Equation, including Missile Illumination, Losses in Radar Equation.

**PART B**

**Targets & Interfering Signals** [7]
Radar cross-section (RCS), Definition & Fundamentals, RCS Fluctuations, Target Fluctuation Models.

**Target Echo Information Extraction** [7]
Ranging, Target Velocity (Doppler Shift), Range & Velocity with CW & Pulse Doppler Waveforms, Radar height-finding.

**Radar Antennas** [7]

**Recommended Books**
1. Radar: Principles, Technology, Applications by Byron Edde (Pearson Education)
2. Introduction to Radar Systems by Skolnik (Mc Graw Hill)
3. Microwave and Radar Engg by M. Kulkarni, Umesh Publications

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**Paper Title:** Web Technologies (Theory)

**Paper Code:** EC 713 Max. Marks: 100 Time: 3 hours

**Course duration:** 45 lectures of one hour duration each

**Note for paper setter:** Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

**PART A**

**Internet and World Wide Web:** [6]
Introduction, Internet Addressing, ISP, types of Internet Connections, Introduction to WWW, WEB Browsers, WEB Servers, URLS, http, WEB applications, Tools for website creation.

**HTML:** [5]
Introduction to HTML, Lists, adding graphics to HTML page, creating tables, linking documents, frames, HTML and Style sheets

**Java Script:** [11]
Introduction, programming constructs: variables, operators and expressions, conditional checking, functions and dialog boxes, JavaScript DOM, creating forms, introduction to Cookies.

**PART B**

**Java:** [16]
Introduction to java objects and classes, control statements, arrays, inheritance, polymorphism, Exception handling, Multithreading, Building the Java Applets, Boxes, Radio Button, Managing Multiple controls, Scrollbars, Choice controls, Scrolling lists, Windows, Menu and Dialog Boxes, Pop up Windows, Graphics in Java, Mouse events, Drawing Objects, Fonts, Canvases, Images, Image maps, Graphics, Animation.

**XML:** [7]
Why XML, XML syntax rules, XML elements, XML attributes, XML DTD displaying XML with CSS.

**Recommended Books:**
Paper Title: Cyber Laws & IPR

Paper Code: AS 701

Max Marks: 100

Time: 3Hrs

Course duration: 45 lectures of one hour duration each

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Basics of Computer & Internet Technology  
[8]
Internet, ISP & domain name; Network Security; Encryption Techniques and Algorithms; Digital Signatures

Introduction to Cyber World  
[3]
Introduction to Cyberspace and Cyber Law; Different Components of cyber Laws; Cyber Law and Netizens

E-Commerce  
[8]
Introduction to E-Commerce; Different E-Commerce Models; E-Commerce Trends and Prospects; E-Commerce and Taxation; Legal Aspects of E-Commerce.

PART B

Intellectual Property Rights  
[11]
IPR, Copyright and Patents, International Treaties and Conventions, Business Software Patents, Domain Name Disputes and Resolution.

IT Act, 2000  
[11]
Reasons, Aims, Objectives and Applications, Regulators under IT Act, Role of Certifying Authority, Digital Signature Certificates, Duties of the Subscribers, Cyber Crimes-Offences and Contraventions, Grey Areas of IT Act.

Project Work  
[04]
Candidates will be required to work on a project. At the end of the course, students will make a presentation and submit the project report.

Recommended Books

PART A

Introduction

Image Perception
Structure of the human eye, light, luminance, brightness, contrast, image model, sampling and quantization-uniform and non uniform, basic relationships between pixels, Imaging geometry, Camera model, Perspective Transformation, stereo imaging.

Image Enhancement
Spatial domain methods, Enhancement by point processing, histogram processing, image subtraction, image averaging, spatial filtering, smoothing filters, sharpening filters, Enhancement in the frequency domain, Color image processing.

PART B

Image Transforms

Image Compression

Recommended Books
1. Digital Image processing by R.C. Gonzalez and R.F.Woods (Pearson Education)
4. Digital Image Processing and Analysis, by B. Chandra and D. Dutta Majumder
5. Algorithms for image Processing and Computer Vision by James R.Parker
7. Digital Image Processing using MATLAB by Woods & Gonzalez (Pearson Education)
Paper Title: Digital Image Processing (Practical)

Paper code: EC 858

List of Experiments (Based on MATLAB)
1. Intensity transformation
2. Histogram Processing.
3. Spatial Filtering.
5. Image Restoration.
6. Image Denoising
7. Color Image Processing
8. Wavelet Transform
9. Image Compression

Paper Title: Advanced Digital Communication (Theory)

Paper code: EC 809

Course duration: 45 lectures of one hour duration each

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A


Matched, correlation and optimum filters and symbol error rate. [4]

Access Technologies: Digital Subscriber line, Fiber, Cable, Broadband fixed wireless access. [2]

PART B

Digital CW modulation, BPSK, DPSK, QPSK, M’ary PSK, QASK, BFSK, Doubinary encoding, QPR coherent and non-coherent systems, error probabilities in PSK, DPSK, FSK, QPSK, 16 QAM, MSK, QPR and bit. [12]

Spread Spectrum techniques: DS, CDMA, FH, PN sequence, Power requirement, PN-sequence code, and Walsh’s code. [6]

ISDN: ISDN structure, Basic & Primary rate access, ISDN services. [3]

Signalling: In-Channel & common channel signalling, SS7. [2]

Recommended Books

Paper Title: Advanced Digital Communication (Practical)

List of Experiments: based on Theory

Paper Title: Neural Networks and Fuzzy Logic (Theory)

Course duration: 45 lectures of one hour duration each

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Fundamentals of Neural Networks

Supervised Learning
Learning and memory, Representation of perceptron, Linear separability, Perceptron Learning. Training of single layer and multi-layer, back propagation training algorithm, Applications of backpropogation, Universal function approximation.

Attractors Neural Networks
Introduction, Associative memory, Hopfield networks, Content addressable memory, Bidirectional associative memories.

PART B

ART Networks
Vector quantization & simplified ART architecture, Architectures & algorithms of ART1 & ART2 networks, Applications.

Self-organizing Feature Map
Introduction, Competitive learning, Mexican Hat networks, SOFM algorithm, Applications.

Fuzzy Logic
Basic concepts of Fuzzy Logic, Fuzzy vs Crisp set, Fuzzy uncertainty & Linguistic variables, membership functions, operations on fuzzy sets, fuzzy rules for approximate reasoning, variable inference techniques, defuzzification techniques, Applications of fuzzy logic, Fuzzy system design.

Recommended Books
1. Neural Networks – A Classroom Approach by Satish Kumar, TMH.
2. Neural Networks, fuzzy Logic, and Genetic Algorithms by Rajasekaran & Vijayalakhmi Pai, PHI.
5. Fuzzy Logic with engineering applications by Ross, Mc-Graw Hill

Paper Title: Neural Networks and Fuzzy Logic (Practical)
Paper code: EC 860
List of Experiments: based on Theory

Paper title: Embedded System Design (Theory)

Course duration: 45 lectures of one hour duration each
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A
Introduction Review of Embedded Hardware [10]
Memory, Microprocessors, Buses, Direct Memory Access, Interrupts, Built ins on the Microprocessor, Conventions used on Schematic, Microprocessor Architecture, Interrupt Basic, Shared Data Problems, Interrupt Latency.

PIC Micro controller & Interfacing [14]

PART B
Software Development & Tools: [9]
Software architectures, Round – Robin, Round-Robin with Interrupts, Function Queue Scheduling architecture, Introduction to assembler – Compiler –n Cross compilers and Integrated Development Environment IDE, Linker/ Locators, Simulators, Getting Embedded software into target System Debugging Strategies,

Introduction to Real Time Operating Systems: [5]
Task And Task States, Tasks and Data, Semaphores and shared data

Operating System Services: [7]
Message queues, Mailboxes and Pipes, Timer Function, Events, Memory Management, Interrupt Routines in an RTOS Environment, Basic Design Using RTOS.

Recommended Books
Paper Title: Embedded System Design (Practical)
Paper code: EC 861
List of Experiments: based on Theory

Paper Title: Solid State Devices Modeling and Simulation (Theory)
Paper Code: EC812               Max. Marks: 100               Time: 3 hours

Course duration: 45 lectures of one hour duration each
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART -A

PART-B
Junction field effect transistor: - JFET concepts, device characteristics, nonideal effects, equivalent circuit and frequency limitation, Metal oxide Semiconductor field effect transistors: - Metal semiconductor ohmic contacts, MOS structure and operation , capacitance - voltage characteristics ,small signal equivalent circuits, nonideal effects. Hetrojunctions: - hetrojunction materials , energy-band diagrams, current-voltage characteristics. Optical Devices :- Optical absorption, solar cell , Light Emitting device. [22]

References:

Paper Title: Solid State Devices Modeling and Simulation (Practical)
Paper code: EC 862
List of Experiments: based on Theory
Title: Analog and Mixed Signal Design (Theory)

Paper code: EC 813  
Max. Marks: 100  
Time: 3 hours

Course duration: 45 lectures of one hour duration each

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART- A
Theory and Design of Differential and operational Amplifier with Bipolar Technology, Analog VLSI issues in CMOS technologies, Basic MOS Models, SPICE Models and frequency dependent parameters. Single stage amplifiers:-basic concepts , common-source stage, source follower, common-gate stage. Passive and active current mirrors:-basic current mirrors, cascode current mirrors, active current mirrors. MOS Differential amplifier. CMOS op-amps:-Design of CMOS op-amp, compensation of op-amp, design of two state op-amp.  [23]

PART- B

Reference Books:

Paper Title: Analog and Mixed Signal Design (Practical)

Paper code: EC 863

List of Experiments: based on Theory

Title: MEMS & Microsystems

Paper code: EC 814  
Max. Marks: 100  
Time: 3 hours

Course duration: 45 lectures of one hour duration each
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART-A

Overview of MEMS and Microsystems [6]


Scaling Laws in miniaturization [6]
Introduction to scaling, Scaling in Geometry, scaling in rigid body dynamics, scaling in electrostatic forces, scaling in electromagnetic forces, scaling in electricity.

Materials for MEMS & Microsystems [5]
Substrate & wafer, active substrate material, silicon as substrate, gallium arsenide, quartz, piezoelectric materials, polymers, packaging material.

PART-B

Microsystems Fabrication Processes [7]
Photolithography, Ion implantation, Diffusion, Oxidation, Chemical Vapor Deposition, Physical vapor deposition, epitaxy, etching.

Overview of Micromachining [8]
Bulk micromachining, surface micromachining, LGA process.

Microsystems Design [7]

Reference Books:
1. MEMS & Microsystems: Design and Manufacture. Tai-Ran Hsu. Mc graw Hill.
2. MEMS, N Mahalik. Mc graw Hill.
3. MEMS and MOEMS Technology and Applications, P.Rai Choudhury. PHI.
4. Microsensors MEMS & Smart Devices, Gardner, CBS Publishers

Paper Title: Artificial Intelligence (Theory)

Paper code: EC 815 Max. Marks: 100 Time: 3 hours

Course duration: 45 lectures of one hour duration each
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A
Introduction:

Problem solving techniques:
State space search, control strategies, heuristic search, problem characteristics, production system characteristics, Generate and test, Hill climbing, best first search, A* search, Constraint satisfaction problem, Mean-end analysis, Min-Max Search, Alpha-Beta Pruning, Additional refinements, Iterative Deepening.

Planning:
The Planning problem, planning with state space search, partial order planning, planning graphs, planning with propositional logic, Analysis of planning approaches, Hierarchical planning, conditional planning, Continuous and Multi Agent planning

PART B
Knowledge representation:
Mapping between facts and representations, Approaches to knowledge representation, Propositional logic, predicate logic, Resolution, Resolution in proportional logic and predicate logic, Clause form, unification algorithm, procedural vs declarative knowledge, Forward vs Backward reasoning, Matching, conflict resolution, Non-monotonic reasoning, Default reasoning, statistical reasoning, fuzzy logic Weak and Strong filler structures, semantic nets, frame, conceptual dependency, scripts.

Introduction to Natural Language processing and expert system:

Recommended Books
5. DAN, W. Patterson, Introduction to AI and Expert Systems, PHI, latest Edition

Paper Title: Operations Research

Paper Code: EC-816 Max Marks: 50 Time: 3hrs.

Course duration: 45 lectures of one hour duration each
Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A
Optimization Problems:
Linear Programming: Graphical Method (Scope as in Chapter 1 of Reference 1), Solution of simultaneous linear equations: An overview (Scope as in Chapter 2, Sections 2.15 – 2.16 of Reference 1), Basic solutions, lines and hyperplanes, convex sets, extreme points, convex sets and hyperplanes (Scope as in Chapter 2,
Sections 2.19 – 2.21 of Reference 1), Reduction of any feasible solution to a system of equations to a basic feasible solution. Simplex Method: The simplex algorithm (Scope as in Chapter 3, 4 of Reference 1), Tableau format for simplex computations, Charnes’s M-method, Two phase method (Scope as in Chapter 5 of Reference 1), The revised simplex method (Scope as in Chapter 7 of Reference 1).

Duality theory: Formulation of the dual problem, Theorems on duality: Weak Duality Theorem, Strong Duality Theorem, Complementary Slackness Theorem, Dual Simplex Algorithm (Scope as in Chapter 8, Sections 8.1 – 8.12 of Reference 1).

Integer Linear Programming: Branch and Bound Algorithm, Cutting Plane Algorithm (Scope as in Chapter 9, Section 9.1 – 9.2 of Reference 2).

PART B

Transportation Problem:
Initial solution by North-West corner rule, Row minima method, Column minima method, Matrix minima method, Vogel’s method. Tableau of transportation problem, u-v algorithm for solving transportation problem. Degeneracy in transportation problem. (Scope as in Chapter 9 of Reference 1).

The Assignment Problem: Hungarian Method (Scope as in Chapter 5, Section 5.4 of Reference 2).

Traveling Salesman Problem (Scope as in Chapter 9, Section 9.3 of Reference 2).

CPM and PERT: Network representation, Critical path computations, Construction of time schedule, Linear programming formulation of CPM, PERT networks (Scope as in Chapter 6, Section 6.6 of Reference 2).

Basic Queuing Systems: Elements of a queuing model, Pure birth and pure death model, Generalized Poisson queuing model (Scope as in Chapter 17, Section 17.1 to 17.5 of Reference 2).

References:

Paper Title: Nano Technology (Theory)

Paper code: EC 817 Max. Marks: 100 Time: 3 hours

Course duration: 45 lectures of one hour duration each

Note for paper setter: Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

PART A

Introduction to Physics of the Solid State: [10]

**Properties of Individual Nanoparticles:**
Introduction to Semiconducting Nanoparticles, Introduction to Quantum Dots, wells, wires, Preparation of Quantum Nanostructures, Introduction to Carbon Nanotubes, Fabrication, Structure, Electrical properties, Vibrational properties, Mechanical properties.

**Biological Materials:**
Biological Building Blocks, Nucleic Acids, Biological Nanostructures.

**PART B**

**Tools:**
TEM, Infrared and Raman Spectroscopy, Photoemission and X-RAY spectroscopy, Electron microscopy, SPMs, AFMs, Electrostatic force Microscope, Magnetic force microscope

**Nanoscale Devices:**
Introduction, Nanoscale MOSFET-planer and non planer, Resonant-tunneling diodes, Single electron transistor, Quantum-Dot, Nano-electrochemical systems, Molecular/Bimolecular electron devices,

**Reference Books:**
1. Nanotechnology: G.Timp, Bell Labs, Murray Hill, NJ(Ed.)
2. Introduction to Nanotechnology-Charless P. Poole, Wiley International

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**Paper Title: Satellite Communications (Theory)**

**Paper code: EC 818**
Max. Marks: 100
Time: 3 hours

**Course duration:** 45 lectures of one hour duration each

**Note for paper setter:** Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

**PART-A**

**Communication Satellite: Orbit and Description**

**Satellite Sub-Systems**
Attitude and Orbit Control system, TT&C subsystem, Attitude Control subsystem, Power systems, Communication subsystems, Satellite Antenna Equipment.

**Satellite Link**
Basic Transmission Theory, System Noise Temperature and G/T ratio, Basic Link Analysis, Interference Analysis, Design of satellite Links for a specified C/N, (With and without frequency Re-use).

**PART-B**

**Propagation effects**
Introduction, Atmospheric Absorption, Cloud Attenuation, Tropospheric and Ionospheric Scintillation and Low angle fading, Rain induced attenuation, rain induced cross polarization interference.

**GPS Principles**: History of Navigation, GPS Constellation, Principle of operation, GPS Orbits, Orbital mechanics and Satellite position determination, Time reference, Various DOPs, signal structure, Code and carrier phase measurements, position estimation with pseudorange measurements. GPS applications

**Reference Books:**

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**Paper Title: Research Methodology (Theory)**

**Paper code: EC 819**

**Max. Marks: 100**

**Time: 3 hours**

**Course duration:** 45 lectures of one hour duration each

**Note for paper setter:** Total of Eight questions may be set covering the whole syllabus taking four from Part A & four from Part B. Candidates will be required to attempt any five questions taking at least two from each Part.

**PART A**

**Introduction to Educational Research**
Concept, types – basic, applied and action, Need for educational research

**Reviewing Literature**
Need, Sources – Primary and Secondary, Purposes of Review, Scope of Review, steps in conducting review.

**Identifying and Defining Research Problem**
Locating, analyzing stating and evaluating problem. Generating different types of hypotheses and evaluating them.

**Methods of Research**
Descriptive research design - survey, case study, content analysis, Ex-post Facto Research, Correlational and Experimental Research

**Sampling Techniques**

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Concept of population and sample' sampling techniques - simple random sampling, stratified random sampling, systematic sampling and cluster sampling, snow ball sampling, purposive sampling, quota sampling techniques. Determining size of sample.

**PART B**

**Design and Development of Measuring Instruments**
Tests, questionnaires, checklists, observation schedules, evaluating research instruments, selecting a standardized test.

**Procedure Of Data Collection**
Aspects of data collection, coding data for analysis

**Statistical Methods of Analysis**
Descriptive statistics: Meaning, graphical representations, mean, range and standard deviation, characteristics and uses of normal curve.
Inferential statistics: t-test, Chi-square tests, correlation (rank difference and product moment), ANOVA (one way), Selecting appropriate methods.

**Procedure for Writing a Research Proposal**
Purpose, types and components of research proposal.

**Procedure for Writing a Research Report**
Audiences and types of research reports, Format of research report and journal articles.

**Strategies for Evaluating, Research**
Disseminating and utilizing research – An Overview

**Recommended Books:**
3. CPSC: Developing Skills in Technician Education Research Modules 1 to 11 Singapore, Colombo Plan Staff College for Technician Education