



OSMANIA UNIVERSITY  
HYDERABAD – 500 007

No. 832 /I/ Acad-I/2013

Date: 11-06-2013

To

All the Members of the  
Board of Studies in Electronics & Communication Engineering,  
Osmania University,  
HYDERABAD.

Sir/Madam,

Sub:- Board of Studies in Electronics & Communication Engineering, O.U. -  
Convening of the meeting of the Board of Studies in Electronics &  
Communication Engineering on 15-06-2013 - Notice – Issued.

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A Meeting of the Board of Studies in Electronics & Communication Engineering is  
convened on Saturday, the 15<sup>th</sup> June, 2013 at 2.00 p.m. in the Dept. of Electronics &  
Communication Engineering, University College of Engineering, O.U., Hyderabad, to consider  
the following agenda:-

1. Revision of B.E. IV/IV Syllabus
2. Any other matter with the permission of the chair.

You are requested kindly to make it convenient to attend the Meeting on 15-6-2013.

BVS

File

(6)

Yours faithfully

*Rubharradn*  
ASST. REGISTRAR  
(Academic)

Contd...

**To**

1. The Chairperson, Board of Studies in ECE, O.U.
2. The Head, Dept. of ECE, O.U.
3. Prof. P. Anantha Raj, Dept. of ECE. O.U.
4. Dr. P. Chandrasekhar, Dept. of ECE, O.U.
5. Sri. G. Sateesh Reddy, Director, RCI Hyderabad.
6. Dr. M. Laxminarayana, Director, D.L.R.L. Hyderabad.
7. Sri. Anantha Krishnan, Sr. Vice President (Designs) ICOMM Tel, Plot No. 40-46  
IDA, Phase-I, B.N. Reddy Nagar, Cherlapally, Secunderabad.
8. Sri. P. Sudhakar, GM. (MSG) ECIL Hyderabad. 62
9. Sri. N. Ganesh, DGM, SLRDC, HAL, Balanagar, Hyderabad.
10. The Head, Dept. of ECE, MVSR College of Engineering, Nadargul, R.R.  
District.
11. The Head, Dept. of ECE., Vasavi College of Engg., Ibrahimah, Hyderabad.
12. The Head. Dept. of ECE, Muffakhamjah College of Engineering, Jubilee Hills,  
Hyderabad.
13. Dr. Madhavi Latha, Head Dept. of ECE. JNTUH. Hyderabad.
14. Prof. N.S. Murthy, Dept. of ECE NIT, Warangal.

**Copy to:-**

5. The Dean, Faculty of Engineering, O.U.
6. The Deputy Registrar (Accounts), Pay Bills Section, OU, with a request to make  
arrangements for payment of TA / DA to External Members.

ECE P/107



DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING  
UNIVERSITY COLLEGE OF ENGINEERING: OSMANIA UNIVERSITY  
HYDERABAD – 500007

**Minutes of the BOS meeting held on 15-06-2013 to finalize the BE 4/4 ECE syllabus.**

Members Present:

1. Dr.B.Rajendra Naik, Chairman BOS in ECE, UCE, OU.
2. HEAD, Dept of ECE,OU
3. Dr.P.Chandrasekhar, Dept of ECE,OU
4. Dr. K. Jaya Shankar, Prof. & Head, Dept. of ECE, Vasavi College of Engg.
5. Dr. G. Kanak Durga, HEAD Dept of ECE,MVSR College
6. Dr.Kaleem Fathima, HEAD, Dept of ECE, MJCET

*Special Invitees*

7. Dr. N.V. Koteswara Rao, HEAD, Dept of ECE CBIT
8. Mr. S.K. Ferooz, HEAD, Dept of ECE, Islamia Institute Technology for Women
9. Dr. N.H. Shoba Reddy, Dept. of ECE, Methodist Engg College

The following Members could not attend:

1. Sri.G.Sateesh Reddy, RCI, Hyderabad
2. Prof P.Ananth Raj, Dept of ECE,OU
3. Dr.M.Laxminarayana, DLRL
4. Prof N.S.Murthy, NITW
5. Sri.N.Ganesh, DGM HAL
6. Sri.P.Sudhakar, GM, ECIL
7. Sri.Anantha Krishnan, ICoMM, IDA, Cherlapally
8. HEAD, ECE, JNTUH

Chairman, Board of studies in ECE welcomed all the members and special invitees as there is no Quorum the meeting was adjourned and reassembled at 2.30pm. Chairman, BOS in ECE briefly explained about the minutes of two preliminary meetings held on 30<sup>th</sup> March 2013 at 11.00 AM at Stanley College of Engineering for Women, ABIDS and on 30<sup>th</sup> April 2013 at 10.30 am in the Dept of ECE, UCE OU respectively.

In continuation to that and during the meeting held on 15-06-2013, the revised contents of the syllabus were discussed and the following decisions were taken and were resolved by the BOS members.

The following points were discussed and resolved

1. It is resolved to accept the syllabus pertaining to various subjects as prepared by teachers of the constituent colleges with minor modifications.
2. It is resolved to request Prof.N.V.Koteswar Rao and Prof. Jaya Sankar to consolidate the syllabus pertaining to First and Second semester subjects respectively.
3. It is resolved to request Prof. Jaya Sankar, Vasavi College of Engg, to write the references in the standard form for all the 4/4 – 1<sup>st</sup> and 2<sup>nd</sup> semester subjects.
4. It is resolved to swap 'Embedded System' which was part of Elective-2 with 'Real-Time Operating Systems' in Elective – 1.
5. It is resolved to introduce 'System Automation and Control' in place of 'Testing and Stability' as part of Elective-1.
6. It is resolved to delete 'Analog and Mixed Signal Design' and introduce 'Entrepreneurship' as part of Elective-2.
7. It is resolved to delete 'Low power VLSI' and introduce 'Nano Technology' as part of Elective-3.
8. It is resolved to delete 'Statistical Signal Processing' and introduce 'Spectral Estimation Techniques' as part of Elective-3.
9. It is resolved to remove smart Antennas and introduce "Design of Algorithms and Computational Techniques".
10. It is resolved to shift 'Coding theory and Techniques' to Elective – 2, which is listed under Elective-1.
11. It is resolved to combine 'Radar Engineering' (Core) and 'Satellite Communication' (Elective-2) as a 'Radar and Satellite Communication' and is included in Second semester as a core subject with minor modifications.
12. It is resolved to include 'Cyber Security / Information Security' as part of Elective-1.
13. It is resolved to delete 'RF IC Design' and introduce 'Disaster Management' as part of Elective-3.



14. It is resolved to rename EC 432 as 'Electronic Design and Automation Lab' with updated syllabus.

15. It is resolved to introduce 06 new subjects in ECE:

1. EC 402:VLSI Design
2. EC 461:Real Time Operating Systems
3. EC 462:Coding theory and Techniques
4. EC 465:Wireless Sensor Networks
5. EC 471:Nano Technology
6. EC 474: Spectral Estimation Techniques

Apart from the above 06 subjects, two more Electives were introduced.

7. CS---:Cyber Security/Information Security
8. CE---:Disaster Management

The members authorized Chairman to prepare panel of Paper setters and Valuers to BE and ME in the academic year 2013-2014. Chairman BOS thanked all the members for their contribution in preparation of the syllabus. Finally, BOS thanked all members and invitees for their active participation and valuable time.



Dr.B.Rajendra Naik  
Chairman BOS  
ECE, UCE, OU.

**CHAIRMAN**  
**BOARD OF STUDIES**  
Dept. of Electronics & Commn. Engg.  
Osmania University,  
Hyderabad-500 007.


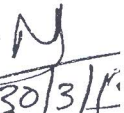
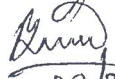
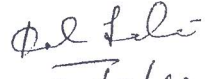


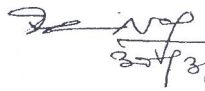
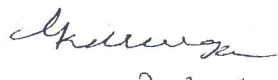
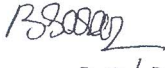
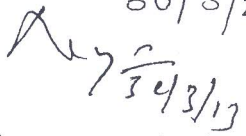
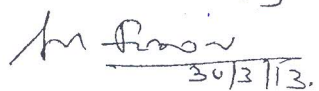
BOS Meeting held on 15/06/2013 at 2.30 PM - BGUUGCE  
The members were present Syllabus Rev:

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1. Dr. B. Rajendra Naik, BOS Annex
2. Dr. P. Chandra Sheela, Head, ECE, OCE, 15/6/13
3. Dr. N. V. Koteswara Rao Head ECB CBIT N
4. Dr. K. Jaya Sankar, Prof & Head, VCE, Agst 15/6/13
5. Dr. Shobha Reddy, Prof & Head, MCET, 15/6/13
6. SK. FAIROOZ, HOD, ISLEW, M Pannu
7. Dr. Kaleem Fatima, HOD, MCET, 15/6/13
8. Dr. G. Karan Kumar, HOD, MVSREC, 15/6/13



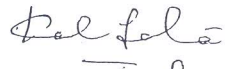
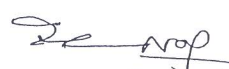

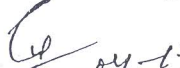

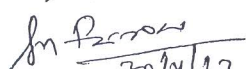




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BOS Meetings held on 30/03/13 at  
11.00 AM : at Stanley College of Engg, Abids, Hyd

- |                                  |                                     |  |
|----------------------------------|-------------------------------------|--|
| 1) K JAYA SANKAR<br>9440162196   | Prof & Head<br>ECE                  | <br>30/3        |
| 2) Dr N V K Rao<br>8466997205    | Prof & Head<br>ECE CBIT             | <br>30/3/13     |
| 3) B. Rajendra Nare              | BOS                                 | <br>30/3/13     |
| 4) Kaleem Fatima<br>9618073463   | Prof & Head.                        | <br>30/3/13     |
| 5) Shobha Reddy<br>9885045393    | Prof & Head                         | <br>30.3.13   |
| 6) K. N. Sahu<br>9866512654      | HOD ECE                             | <br>30-3-13   |
| 7) J. K. Nag                     | Assoc Prof<br>ECE                   | <br>30/3/13   |
| 8) Dr. G. KANAKA<br>9703804723   | Prof. & Head<br>ECE                 | <br>30/3/13   |
| 9) B. Sarala                     | Assoc. prof<br>ECE Dept,<br>MVSREC. | <br>30/3/2013 |
| 10) Dr M. A. NAJUM<br>9866166234 | Prof & Head<br>ECE                  | <br>30/3/13   |
| 11) SK. FAIROOZ<br>9391100031    | HOD ECE.<br>RSLEW                   | <br>30/3/13   |

BOS meeting held on 30/4/2013 at 10:30 AM in the  
Dept. of ECE, UCE, OU to discuss the 4th year ECE P/I  
Syllabus.

members present

- ① B. Rajendra Naik CBOS  30/4/13
- ② Dr. N.V. Koteswara Rao Head  
ECE Dept  
CBIT  30/4/13
- ③ DR. KALEEM FATIMA Head  
ECE, MJCT  30/4/13
- ④ J.K. NAG MJCT  
ECE  30/4/13
- 5) Dr. G. KANAKA DUREA: MUSR  
HECE  30/4/13
- 6) K. N. Sahu Head, ECE  
Stanley CETW  30-04-13
- 7) Dr. Shobha Reddy Head - ECE  
MCET  30/4
- 8) SR. FAROOZ Head ECE  
ISLEW  30/4/13
9. Dr. M.A. MAYEM Head of  
CBT  30/4/13
10. Dr. R. Hemalatha CBOS(A)  
ECE, UCE  30/4/13
11. K Jaye Shankar Prof & HOD  
ECE  30/4/13
12. Dr. P. Chandrasekar Head ECE  
UCE  30/4/13



WITH EFFECT FROM THE ACADEMIC YEAR 2013-14

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**SCHEME OF INSTRUCTION & EXAMINATION**  
**B.E IV/IV (REGULAR)**  
**ELECTRONICS & COMMUNICATION ENGINEERING**

**Semester-I**

Semester-I							
Sl. No.	Syllabus Reference No.	Subject	Scheme of Instruction		SCHEME OF EXAMINATION		
			Periods/week		Duration in Hours	Max. Marks	
			L/T	D/T		Univ. Exam	Sessional
		THEORY					
1.	EC 401	Microwave Engineering	4	-	3	75	25
2.	EC 402	VLSI Design	4	-	3	75	25
3.	EC 403	Computer Networks	4	-	3	75	25
4.	EC 404	Mobile Cellular Communication	4	-	3	75	25
5.	-	Elective-I	4	-	3	75	25
6.	ME 472	Industrial Administration and Financial Management	4	-	3	75	25
		PRACTICALS					
7.	EC 431	Microwave Engineering Lab	-	3	3	50	25
8.	EC 432	Electronic Design and Automation Lab	-	3	3	50	25
9.	EC 433	Project Seminar	-	3	-	-	25
		Total	24	9	-	550	225

**ELECTIVES**

*Expt 12 / for Mobile Communication*

Sl. No.	CODE	ELECTIVE - I
1	EC 411	Embedded Systems
2	EC 412	Optical Fiber Communication
3	EC 413	Digital Image Processing
4	EC 414	Multi Rate Signal Processing
5	EC 415	System Automation and Control
6	---	Cyber Security and Information Systems

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EC 401

## MICROWAVE ENGINEERING

### Instruction

4 Periods per week

Duration of University Examination

3 Hours

University Examination

75 Marks

Sessional

25 Marks

### UNIT - I

Guided Waves: Propagation of TE, TM and TEM waves between parallel planes. Velocity of propagation, wave impedance, attenuation in parallel plane guides.

### UNIT - II

Waveguides: TE and TM waves in rectangular and circular waveguides, Wave Impedance, Characteristic Wave Impedance, Attenuation and Q of waveguides. Cavity resonators, resonant frequency and Q, Applications of cavity resonator.

### UNIT - III

Microwave Circuits and Components: Concept of Microwave circuit, Normalized voltage and current, Introduction to scattering parameters and their properties, S parameters for reciprocal and Non-reciprocal components- Magic Tee, Directional coupler, E and H Plane Tees and their properties, Attenuators, Phase Shifters, Isolators and circulators.

### UNIT - IV

Microwave Tubes: High frequency limitations of conventional tubes, Bunching and velocity modulation, mathematical theory of bunching, principles and operation of two cavity, multi cavity and Reflex Klystron.

Theory of crossed field interaction; Principles and operation of magnetrons and crossed field amplifiers, TWT and BWO.

### UNIT - V

Microwave Solid State Devices: Principles of operation, characteristics and applications of Varactor, PIN diode, GUNN diode and IMPATT diode.

Elements of strip lines, microstrip lines, slot lines and fin-lines.

### Suggested Reading:

1. E. C. Jordan & Keith G. Balmain, "Electromagnetic Waves and Radiating Systems", 2/e, Pearson Education, 2006.
2. Samuel Y. Liao, "Microwave Devices and Circuits", 3/e, Pearson Education, 2003.
3. Rizzi P, "Microwave Devices and Circuits", 3/e, Pearson Education, 2003.
4. R. E. Collins, "Foundations for Microwave Engineering", 2/e, Wiley India Pvt. Ltd., 2012.

EC 402

VLSI DESIGN

P/115

**Instruction**

Duration of University Examination  
University Examination  
Sessional

**4 Periods per week**

3 Hours  
75 Marks  
25 Marks

**UNIT - I**

Introduction to HDLs, Basic Concepts of Verilog, Data Types, System Tasks and Compiler Directives.

Gate Level Modeling: Gate Types and Gate Delays. Dataflow Modeling: Continuous assignment and Delays. Design of Stimulus Block.

**UNIT - II**

Behavioural Modeling: Structured Procedures, Procedural Assignments, Timing control, Conditional statements, Sequential and Parallel Blocks, Generate Blocks. Switch level Modeling.

Tasks, Functions, Procedural Continuous Assignments, Design of Mealy and Moore state models using Verilog.

Logic Synthesis, Synthesis Design flow, Gate level Netlist.

**UNIT - III**

Introduction to MOS Technology, Basic MOS Transistor action: Enhancement and Depletion Modes. Basic electrical properties of MOS, Threshold voltage and Body Effect. Design of MOS inverters with different loads, Basic Logic Gates with CMOS: INVERTER, NAND, NOR, AOI and OAI gates. Transmission gate logic circuits, BiCMOS inverter.

**UNIT - IV**

MOS and CMOS circuit Design Process: MOS Layers, Stick diagrams, Lambda based Design rules and Layout diagrams. Basic Circuit Concepts: Sheet Resistance, Area Capacitance and Delay calculation.

**UNIT - V**

Combinational Logic: Manchester, Carry select and Carry Skip adders, Crossbar and barrel shifters, Multiplexer.

Sequential Logic: Design of Dynamic Register Element, 3T, 1T Dynamic RAM Cell, 6T Static RAM Cell.

D flip flop using Transmission gates. NOR and NAND based ROM Memory Design.

**Suggested Reading:**

1. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", 2/e, Pearson Education, 2008.
2. Michael D. Ciletti, "Advanced Digital Design with Verilog HDL", PHI, 2005.
3. Kamran Eshraghian, Douglas A. Pucknell, and Sholeh Eshraghian, "Essentials of VLSI circuits and systems", PHI, 2011.
4. John P. Uyemura, "Introduction to VLSI Circuits and systems", Wiley India Pvt. Ltd., 2011.



EC 403

P/116

## COMPUTER NETWORKS

### Instruction

4 Periods per week

Duration of University Examination

3 Hours

University Examination

75 Marks

Sessional

25 Marks

### UNIT - I

Data communication, Network Topologies: LAN, WAN, MAN, Types-Bus, Star, Ring, Hybrid. Line configurations. Reference Models: OSI, TCP/IP.

Data Link Layer: Design issues, Framing, Error Detection and Correction, Flow control Protocols: Stop and Wait, Sliding Window, ARQ Protocols, HDLC.

### UNIT - II

MAC Sub Layer: Multiple Access Protocols: ALOHA, CSMA, Wireless LAN. IEEE 802.2, 802.3, 802.11, 802.16 standards. Bluetooth, Bridges and Routers.

Circuit switching: Circuit Switching Principles and concepts.

Packet switching: Virtual circuit and Datagram subnets.

### UNIT - III

Network Layer: Network layer Services, Routing algorithms : Shortest Path Routing, Flooding, Hierarchical routing, Broadcast, Multicast, Distance Vector Routing, and Congestion Control Algorithms.

Internet Working: The Network Layer in Internet and ATM Networks.

### UNIT - IV

Transport Layer: Transport Services, Elements of Transport Layer, Connection management, TCP and UDP protocols, ATM AAL Layer Protocol.

### UNIT - V

Application Layer: Domain Name System, SNMP, Electronic Mail, World Wide Web.

Network Security: Cryptography Symmetric Key and Public Key algorithms, Digital Signatures, Authentication Protocols.

### Suggested Reading:

1. Andrew S Tanenbaum, "Computer Networks," 5/e, Pearson Education, 2011.
2. Behrouz A. Forouzan, "Data Communication and Networking," 3/e, TMH, 2008.
3. William Stallings, "Data and Computer Communications," 8/e, PHI, 2004.
4. S.Keshav, "An Engineering Approach to Computer Networks," 2/e, Pearson Education.



P/11.7

EC 404

## MOBILE CELLULAR COMMUNICATIONS

<b>Instruction</b>	<b>4 Periods per week</b>
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

### UNIT - I

Basic Cellular system and its operation, frequency reuse, channel assignment strategies, Handoff process, factors influencing handoffs, handoffs in different Generations, Interference and system capacity, Cross talk, Enhancing capacity and cell coverage, Trunked radio system.

### UNIT - II

Free space propagation model, three basic propagation mechanisms, practical link budget design using path loss models, outdoor propagation models: Durkin's model and indoor propagation model, partition losses. Small scale multipath propagation, Parameters of mobile multipath channels, types of small scale fading.

### UNIT - III

FDMA, TDMA, SSMA, FHMA, CDMA, SDMA, Packet radio protocols, CSMA, Reservation protocols.

### UNIT - IV

GSM: Services and Features, System architecture, Radio Sub system, Channel Types, Frame structure and Signal processing.

CDMA: Digital Cellular standard IS-95, Forward Channel, Reverse Channel.

### UNIT - V

Comparison of 1G, 2G and 2.5G, technology Features of 3G and 4G, WLAN, Bluetooth, PAN, Trends in Radio and Personal Communications, UMTS system architecture and Radio Interface, introduction to CDMA 2000.

### Suggested Reading :

1. Theodore.S. Rappaport, "Wireless Communications: Principles and Practice," 2/e, Pearson Education, 2010.
2. William. C.Y.Lee, "Mobile Communication Engineering," 2/e, Mc-GrawHill, 2011.
3. T.L.Singal "Wireless Communication Systems," 1/e, TMH Publications, 2010.
4. William.C.Y.Lee, "Mobile Cellular Telecommunications: Analog and Digital Systems," 2/e, Mc-Graw Hill, 2011.

ME 472

**INDUSTRIAL ADMINISTRATION & FINANCIAL MANAGEMENT****Instruction****4 Periods per week**

Duration of University Examination

3 Hours

University Examination

75 Marks

Sessional

25 Marks

**UNIT – I**

Industrial Organisation : Types of various business organisations, Organisation structures and their relative merits and demerits. Functions of management.

Plant Location and Layouts: Factors affecting the location of plant and layout. Types of layouts and their merits and demerits.

**UNIT – II**

Work Study: Definitions, objectives of method study and time study. Steps in conducting method study. Symbols and charts used in method study. Principles of motion economy. Calculation of standard time by time study and work sampling. Performance rating factor. Types of ratings. Jobs evaluation and performance appraisal. Wages, incentives, bonus, wage payment plans.

**UNIT – III**

Inspection and Quality Control: Types and objectives of inspection S.Q.C., its principles. Quality control by chart and sampling plans. Quality circles, introduction to ISO.

**UNIT – IV**

Optimisation: Introduction of linear programming and its graphical solutions. Assignment problems.

Project Management: Introduction to CPM and PERT. Determination of critical path.

Material Management : Classification of materials, Materials planning.

Duties of purchase manager. Determination of economic ordering quantities. Types of materials purchase.

**UNIT – V**

Cost Accounting: Elements of cost. Various costs. Types of overheads. Breakeven analysis and its applications. Depreciation. Methods of calculating depreciation fund. Nature of financial management. Time value of money. Techniques of capital budgeting and methods. Cost of Capital, Financial leverage.

**Suggested Reading**

1. Pandey I.M., "Elements of Financial Management", Vikas Publications House, New Delhi, 1994.
2. Khanna O.P., "Industrial Engineering and Management", Dhanapat Rai & Sons.
3. Marshall/Bansal, "Financial Engineering", PHI.
4. Keown, "Financial Management", 9/e, PHI.
5. Chandra Bose, "Principles of Management & Administration", PHI.

EC 431

MICROWAVE ENGINEERING LAB

P1119

**Instruction**

**3 Periods per week**

Duration of University Examination

3 Hours

University Examination

50 Marks

Sessional

25 Marks

**List of Experiments**

1. Characteristics of Reflex Klystron oscillator, finding the mode numbers and efficiencies of different modes.
2. Characteristics of Gunn diode oscillator, Power Output Vs Frequency, Power Output Vs Bias Voltage.
3. Measurement of frequency and Guide wavelength calculation:
  - i. Verification of the relation between Guide wavelength, free space wavelength and cutoff wavelength of X- band rectangular waveguide.
  - ii. Verification of the straight line relation between  $(1/\lambda_g)^2$  and  $(1/\lambda_0)^2$  and finding the dimension of the guide.
4. Measurement of low and high VSWRs: VSWR of different components like matched terminals, capacitive and inductive windows, slide screw tuner for different heights of the tuning posts etc.
5. Measurement of impedance.  
To find the parameters and scattering matrices of different microwave components like:
6. Directional coupler.
7. Tees: E plane, H plane and Magic Tee.
8. Circulator.
9. Measurement of radiation patterns for basic microwave antennas like horn and parabolic reflectors in E-plane and H-plane. Also to finding the gain, bandwidth and beamwidth these antennas.
10. Study of various antennas like dipoles, loops, Yagi antenna, log periodic antenna and their radiation pattern.
11. Mini Project:
  - i. To design microwave components such as: Directional couplers, circulators and Hybrid junctions using simulation software tools.
  - ii. To design antenna arrays such as: Binomial, Chebyshev, using software tools.



EC432

ELECTRONIC DESIGN AND AUTOMATION LAB

M/20

**Instruction**

Duration of University Examination  
University Examination  
Sessional

3 Periods per week

3 Hours

50 Marks

25

**Part A**

Write the Code using VERILOG, Simulate and synthesize the following

1. Arithmetic Units: Adders and Subtractors.
2. Multiplexers and Demultiplexers.
3. Encoders, Decoders, Priority Encoder and Comparator.
4. 8-bit parallel adder using 4-bit tasks and functions.
5. Arithmetic and Logic Unit with minimum of eight instructions.
6. Flip-Flops.
7. Registers/Counters.
8. Sequence Detector using Mealy and Moore type state machines.

Note:-

1. All the codes should be implemented appropriately using Gate level, Dataflow and Behavioral Modeling.
2. All the programs should be simulated using test benches.
3. Minimum of two experiments to be implemented on FPGA/CPLD boards.

**Part B**

Transistor Level implementation of CMOS circuits

1. Basic Logic Gates: Inverter, NAND and NOR.
2. Half Adder and Full Adder.
3. 4:1 Multiplexer.
4. 2:4 Decoder.

**Mini project:**

- i) 8 bit CPU
- ii) Generation of different waveforms using DAC
- iii) RTL code for Booth's algorithm for signed binary number multiplication
- iv) Development of HDL code for MAC unit and realization of FIR Filter
- v) Design of 4-bit thermometer to Binary Code Converter



M/12/

EC 433

## PROJECT SEMINAR

### Instruction

3 Periods per week

### Sessional

25 Marks

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of the state of the art topics in a broad area of his / her specialization.

Project seminar topics may be chosen by the student with advice and approval from the faculty members. Students are to be exposed to the following aspects of seminar presentation.

- Literature Survey
- Organization of the material
- Presentation of OHP slides / PC presentation
- Technical writing

Each student is required to:

1. Submit a one-page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes presentation through OHP, PC, Slide project followed by a 10 minutes discussion.
3. Submit a report on the seminar topic with list of references and slides used.

Seminars are to be scheduled from the 3<sup>rd</sup> week of the semester to the last week of the semester and any change in schedule should be discouraged..

For award of sessional marks students are to be judged by the last two faculty members on the basis of an oral and written presentation as well as their involvement in the discussions.

P/122

EC 411

**EMBEDDED SYSTEMS**  
(Elective - I)

**Instruction**

Duration of University Examination  
University Examination  
Sessional

4 Periods per week

3 Hours  
75 Marks  
25 Marks

**UNIT – I**

Introduction To Embedded Systems: Classification, Embedded Processor in a system, Embedded hardware, Software and devices in a system. Embedded System – on – chip, Design process in Embedded System, Challenges in Embedded System design.

**UNIT – II**

Introduction to RISC Processors, RISC concepts with ARM Processors, Registers, Current Program Status Register, Pipeline, Exceptions, Interrupts and vector table, Core Extensions, Architectural Revisions, ARM Processor Families. Introduction to ARM Instruction Set.

**UNIT – III**

Serial Bus Communication protocols: I<sup>2</sup>C, CAN, USB, Firewire-IEEE 1394 Bus standard, Advanced serial high speed buses. Parallel Bus device protocols: ISA, PCI, PCI-X, ARM Bus, Advanced parallel high speed buses. Internet Enabled Systems-Network protocols: HTTP, TCP/IP, Ethernet.

**UNIT – IV**

Embedded System design and co-design issues in system development process, Design cycle in the development phase for an Embedded Systems. Embedded software development tools: Host and Target Machines, Linker/Locators for embedded software, Embedded Software into the Target system.

**UNIT – V**

Testing on Host machine, Instruction Set Simulators, In-Circuit Emulator, Laboratory tools: Logic Analyzer IDE tool: Keil microvision for 8051 and ARM.  
Case Study: Embedded Systems design for automatic vending machines and digital clock.

**Suggested Readings:**

1. Raj Kamal, "*Embedded Systems-Architecture, Programming and Design*," 2/e, TMH, 2012.
2. Tammy Noergaard, "*Embedded Systems-Architecture*" *A comprehensive Guide for Engineers and Programmers*" Elsevier Publishers 2<sup>nd</sup> Edition, 2013.
3. David E.Simon, "*An Embedded software primer*," Pearson Education, 2004.
4. Steve Furber, "*ARM System on chip Architecture*," 2/e, Pearson Education.

P/12/17

EC 412

## OPTICAL FIBER COMMUNICATION (Elective-I)

### Instruction

Duration of University Examination  
University Examination  
Sessional

4 Periods per week

3 Hours  
75 Marks  
25 Marks

### UNIT – I

Evolution of fiber optic system, Elements of Optical Fiber Transmission link, Ray Optics, Optical Fiber Modes and Configurations, Mode theory of Circular Waveguides, Overview of Modes and Key concepts, Linearly Polarized Modes, Single Mode Fibers and Graded Index fiber structure.

### UNIT – II

Attenuation - Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Waveguides-Information Capacity determination, Group Delay, Material Dispersion, Waveguide Dispersion, Signal distortion in SM fibers-Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in Guided Index fibers, Mode Coupling, Design Optimization of Single Mode fibers-Refractive Index profile and cut-off wavelength.

### UNIT – III

Direct and indirect Band gap materials, LED structures, Light source materials, Quantum efficiency, LED power, Modulation of LED, laser Diodes, Modes and Threshold condition, Rate equations, External Quantum efficiency, Resonant frequencies, Laser Diodes, Temperature effects, Introduction to Quantum laser, Fiber amplifiers, Power Launching and coupling, Lensing schemes, Fiber-to-Fiber joints, Fiber splicing.

### UNIT – IV

PIN and APD diodes, Photo detector noise, SNR, Detector Response time, Avalanche Multiplication Noise, Comparison of Photo detectors, Fundamental Receiver Operation, preamplifiers, Error Sources, Receiver Configuration, Probability of Error, Quantum Limit.

### UNIT – V

Point-to-Point link system considerations -Link Power budget, Rise - time budget, Noise Effects on System Performance, Operational Principles of WDM, Solitons, Erbium-doped Amplifiers. Introductory concepts of SONET/SDH Network.

### Suggested Readings:

1. Gourd Keiser, "Optical Fiber Communication," 4/e, TMH, 2000.
2. J.Senior, "Optical Communication, Principles and Practice," PHI, 1994.
3. J.Gower, "Optical Communication System," PHI, 2001.
4. Binh, "Digital Optical Communications," First Indian Reprint 2013, (Taylor & Francis), Yesdee Publications.



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EC 413

**DIGITAL IMAGE PROCESSING**  
(Elective-I)

**Instruction**

Duration of University Examination  
University Examination  
Sessional

**4 Periods per week**

3 Hours  
75 Marks  
25 Marks

**UNIT – I**

Elements of Digital Image Processing Systems, Digital image representation, elements of visual perception, Image sampling and Quantization, Basic Relationships between pixels.

**UNIT – II**

Fourier transform, FFT, Discrete cosine transform, Hadamard transform, Haar transform, Slant transform and Hotelling transform and their properties.

**UNIT – III**

Spatial enhancement techniques: Histogram equalization, direct histogram specification, Local enhancement.

Frequency domain techniques : Low pass, High pass and Homomorphic Filtering, Image Zooming Techniques.

**UNIT – IV**

Image Degradation model, Algebraic approach to restoration, inverse filtering, Least mean square filter, Constrained least square restoration and interactive restoration. Speckle noise and its removal techniques.

**UNIT – V**

Redundancies for image compression, Huffman Coding, Arithmetic coding, Bit-plane coding, loss less and lossy predictive coding.

Transform coding techniques: Zonal coding and Threshold coding.

**Suggested Reading:**

1. Gonzalez R.C. and Woods R.E., "Digital Image Processing," 2/e, PHI, 2005.
2. Vipul Singh, *Digital Image Processing with Matlab and Lab view* Elsevier 2013.
3. Madhuri A.Joshi, "Digital Image Processing: An algorithmic Approach," PHI, 2006.
4. Qidwai, "Digital Image Processing," First Indian Reprint 2013, (Taylor & Francis), Yesdee Publications.

EC 414

**MULTI RATE SIGNAL PROCESSING**  
(Elective - I)

P/126

**Instruction**

**4 Periods per week**

Duration of University Examination

3 Hours

University Examination

75 Marks

Sessional

25 Marks

**Unit – I**

Review of fundamentals of Multirate Systems: Decimation by a integer factor  $D$ , Interpolation by a integer factor  $I$ , Sampling rate conversion by a rational factor  $I/D$ , Inter connection of building blocks, Polyphase representation, Multi stage implementation of sampling-rate conversion, Applications of Multirate systems.

**Unit – II**

Multirate Filter banks: Digital filter banks, Uniform DFT filter banks, Polyphase implementation of Uniform filter banks.

Nyquist filters:  $L^{\text{th}}$ -band filters, half band filters, design of Linear-phase  $L^{\text{th}}$  band FIR filters.

**Unit – III**

Quadrature - Mirror Filter banks : Two Channel QMF structure and analysis, Alias free filter bank, Alias - free realization, Alias - free FIR QMF bank, Alias - free IIR QMF bank, perfect reconstruction (PR) two - channel FIR filter bank, Alias - free  $L$  - Channel filter bank.

**Unit – IV**

Polyphase Representation. Condition for Perfect Reconstruction. Cosine - Modulated  $L$  - channel filter banks, Multilevel filter banks - filter with equal and unequal passband widths.

**Unit – V**

Introduction to wavelet theory, wavelet transform, Definition and Properties, Introduction to multi dimensional multirate signal processing.

**Suggested Reading:**

1. Mitra SK "Digital Signal Processing. A Computer Approach," TMH, 3/e, 2006.
2. Vaidyanathan PP "Multirate Systems and Filter Banks," Pearson Education.2008.
3. Emmanuel C, Ifeachor and Barrie W. Jervis, "Digital Signal Processing: A Practical Approach," 2/e, Pearson Education, 2004.
4. Bruce W. Suter, "Multirate and Wavelet Signal Processing," Volume 8, Academic Press,1998.

EC 415

**SYSTEM AUTOMATION AND CONTROL**  
(Elective - I)

P/122

<b>Instruction</b>	<b>4 Periods per week</b>
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

**UNIT – I**

Introduction to sensors and transducers: displacement, position, and proximity, velocity and motion, force, fluid pressure, liquid flow, liquid level, temperature, light. Selection of sensor.

**UNIT – II**

Data acquisition and Signal conditioning: various signal conditioning modules. Use of data acquisition. Fundamentals of Analog to digital conversion, sampling, amplifying, filtering, noise reduction. Criteria to choose suitable data acquisition equipment.

**UNIT – III**

Introduction to systems: Measurement and control. Basic system models. Mathematical models. Mechanical system building blocks, Electrical system building blocks, Fluid system building blocks and Thermal system building blocks. Engineering systems: Rotational – translational, Electromechanical, hydraulic-mechanical.

**UNIT – IV**

Dynamic responses of systems, system transfer functions, frequency response, closed loop controllers. Microcontroller basics, architecture, hardware interfacing, programming a microcontroller. Programmable logic controllers: basic structure, input/output processing, programming, selection of a PLC.

**UNIT – V**

Motion control and robotics: concepts of motion control system and real world applications. Components of a motion control system. Motion controller, Motors and mechanical elements, move types, Motor amplifiers and drives. Feed back devices and motion input/output.

**Suggested Reading:**

1. W. Bolton, "Mechatronics: Electronic control systems in mechanical and electrical Engineering," 3/e, Pearson Education, 2008.
2. Robert A. Witte, "Electronic Test Instruments: Analog and Digital Measurements," 2/e, Pearson Education, 2002.
3. Dan Neculescu, "Mechatronics," 1/e, Pearson Education, 2002.
4. De Silva, "Mechatronics," First Indian Reprint 2013, (Taylor & Francis), Yesdee Publications.

WITH EFFECT FROM THE ACADEMIC YEAR 2013-14

EC --- CYBER SECURITY TECHNIQUES AND INFORMATION SYSTEMS  
(Elective – I)

P/128

**Instruction**

Duration of University Examination

University Examination

Sessional

**3 Periods per week**

3 Hours

50 Marks

25 Marks



P1129

**SCHEME OF INSTRUCTION & EXAMINATION**  
**B.E IV/IV (REGULAR)**  
**ELECTRONICS & COMMUNICATION ENGINEERING**

**Semester-II**

Semester-II

Sl. No.	Syllabus Reference No.	Subject	Scheme of Instruction		SCHEME OF EXAMINATION		
			Periods/week		Duration in Hours	Max. Marks	
			L/T	D/T		Univ. Exam	Sessional
		THEORY					
1.	EC 451	Radar and Satellite Communication	4	-	3	75	25
2.	---	Elective - II	4	-	3	75	25
3.	---	Elective - III	4	-	3	75	25
		PRACTICALS					
4.	EC 481	Seminar	-	3	-	-	25
5.	EC 482	Project	-	6	Viva	GR (\$)	50
		Total	12	9	-	225	150

**ELECTIVES**

Sl. No.	CODE	ELECTIVE – II
1	EC 461	Real Time Operating Systems
2	EC 462	Coding Theory and Techniques
3	EC 463	Design of Fault Tolerant Systems
4	EC 464	Speech Processing
5	EC 465	Wireless Sensor Networks
6	ME 411	Entrepreneurship

Sl. No.	CODE	ELECTIVE – III
1	EC 471	Nano Technology
2	EC 472	Global Positioning Systems
3	EC 473	Neural Networks and Fuzzy Logic
4	EC 474	Spectral Estimation Techniques
5	LA 454	Intellectual Property Rights
6	---	Disaster Management

Mitigation

P/130

EC 451

## RADAR AND SATELLITE COMMUNICATION

### Instruction

4 Periods per week

Duration of University Examination

3 Hours

University Examination

75 Marks

Sessional

25 Marks

### UNIT-I

Introduction to radar, radar block diagram and operation, radar frequencies, Applications of radar, Prediction of range performance, minimum detectable signal, receiver noise, probability density function, SNR, Integration of radar pulses, radar cross-section of targets, PRF and range ambiguities, transmitter power, system losses.

### UNIT-II

Doppler effect, CW radar, FM CW radar, multiple frequency CW radar. MTI radar, delay line canceller, range gated MTI radar, blind speeds, staggered PRF, limitations to the performance of MTI radar, non-coherent MTI radar.

### UNIT-III

Tracking radar: sequential lobing, conical scan, monopulse: amplitude comparison and phase comparison methods, Radar antennas. Radar displays. Duplexer. Orbital aspects of Satellite Communication: Introduction to geo-synchronous and geo-stationary satellites, Kepler's laws, Locating the satellite with respect to the earth, sub-satellite point, look angles, mechanics of launching a synchronous satellite, Orbital effects, Indian scenario in communication satellites.

### UNIT-IV

Satellite sub-systems: Attitude and Orbit control systems, Telemetry, Tracking and command control system, Power supply system, Space craft antennas, multiple access techniques, comparison of FDMA, TDMA, CDMA.

### UNIT-V

Introduction to satellite link design, basic transmission theory, system noise temperature and G/T ratio, design of down link and uplink, design of satellite links for specified C/N, satellite data communication protocols.

### Suggested Reading

1. Merril. I. Skolnik, "Introduction to Radar Systems", 2/e, MGH, 1981.
2. Mark A. Richards, James A. Scheer and William A. Holm, "Principles of Modern Radar: Basic Principles," YesDee Publishing Pvt. Ltd., India, 2012.
3. Byron Edde, "Radar: Principles, Technology, Applications", Pearson, 2008.
4. Timothy Pratt and Charles Bostian, "Satellite Communications", John Wiley, 1986.
5. M. Richharia, "Satellite Communication Systems: Design Principles", MacMillan, 2/e, 2003.

EC481

## SEMINAR

### Instruction

Duration of University Examination  
University Examination  
Instruction  
Sessionals

### 3 Periods per week

3 Hours  
50 Marks  
3 Periods / Week  
25 Marks

Oral presentation is an important aspect of engineering education. The objective of the seminar is to prepare the student for a systematic and independent study of the state of the art topics in a broad area of his / her specialisation.

Seminar topics may be chosen by the students with advice from the faculty members. Students are to be exposed to the following aspects of a seminar presentation.

- Literature survey
- Organization of the material
- Presentation of OHP slides / PC presentation
- Technical writing

Each student is required to :

1. Submit a one page synopsis before the seminar talk for display on the notice board.
2. Give a 20 minutes presentation through OHP, PC, slide projector, followed by a 10 minutes discussion.
3. Submit a report on the seminar topic with list of references and slides used.

Seminars are to be scheduled the 3<sup>rd</sup> week to the last week of the semester and any change in schedule should be discouraged.

For award of sessional marks students are to be judged by at least two faculty members on the basis of an oral and a written presentation as well as their involvement in the discussions.



EC 482

P1/132

### PROJECT

Instruction	:	Periods / Week
Univ. Exam	:	Viva-voce: Grade(@)
Sessionals	:	50 Marks

**Dealing with a real-time problem should be the focus of under graduate project.**

Faculty members should prepare project briefs (giving scope and references) well in advance, which should be made available to the students in the department.

The project may be classified as hardware / software modeling / simulation. It may comprise any or all elements such as analysis, design and synthesis.

The department should appoint a project coordinator who will coordinate the following.

- Grouping of students ( a maximum of 3 in group )
- Allotment of projects and project guides
- Project monitoring at regular intervals.

All project allotment are to be completed by the 4<sup>th</sup> week of IV-Year, I-Semester, so that the students get sufficient time for completion of the project.

All projects will be monitored at least twice in a semester through individual presentations.

Every student should maintain a project dairy, wherein he/she needs to record the progress of his/her work and get it signed at least once in a week by the guide(s). If working outside and college campus, both the external and internal guides should sign the same.

Sessional marks should be based on the grades / marks, awarded by a monitoring project committee of faculty members as well as the marks given by the guide.

Efforts be made the some of the projects are carried out in reputed industries / research organizations with the help of industry coordinators. Problems can also be invited from the industries to be worked out through undergraduate projects.

Common norms should be established for final documentation of the project report by the respective department on the following lines:

1. The project title should be task oriented for example "Analysis and Modeling of ....."
2. Objectives of the project should be identified clearly and each student of the project batch should fulfill at least one of the objectives identified. The chapters of the project report should reflect the objectives achieved.
3. Contents of the report should include the following
  - a. Title page
  - b. Certificate
  - c. Acknowledgements
  - d. Abstract (limited to one/two paragraphs, page no.1 should start from this)



- p1133
- e. Contents (Ch. No.      Title of the chapter/section Page No.)
  - f. List figures (Fig. No.      caption of the figure      Page No.)
  - g. List of Tables (Table. No.      Caption of the table      Page No.)
  - h. List of Symbols (ex. C:      Velocity of light  $3 \times 10^8$  m/s )
  - i. Chapter I should be introduction (limited 4-5 Pages) This should contain sections as objectives of the project, technical approach, literature survey, the importance of the project and organization of the report.
  - j. Chapter II, Last two chapters should be on results with discussions and conclusions.
  - k. References in IEEE format which should be duly referred in the report.
  - l. Appendices  
The algorithm related to the software developed should be thoroughly discussed.
  - m. Index.

4. The project reports should be hard bound.

The project work if found inadequate and gets an Unsatisfactory grade, the candidate should repeat the project work with a new problem or improve the quality of work and report it again.

The project report should be evaluated and one of the following grades may be awarded at the external examination.

@: Excellent / Very Good / Good / Satisfactory / Unsatisfactory.

EC 461

# REAL TIME OPERATING SYSTEMS (ELECTIVE –II)

*Title P1/34  
change*

## Instruction

Duration of University Examination  
University Examination  
Sessional

*Code No-  
change*

4 Periods per week  
3 Hours  
75 Marks  
25 Marks

## Unit – I: Introduction to OS and RTOS

Architecture of OS (Monolithic, Microkernel, Layered, Exo-kernel and Hybrid kernel structures), Operating system objectives and functions, Virtual Computers, Interaction of O. S. & hardware architecture, Evolution of operating systems, Batch, multi programming. Multitasking, Multiuser, parallel, distributed & real –time O.S.

## Unit – II: Process Management of OS/RTOS

Uniprocessor Scheduling: Types of scheduling, *scheduling algorithms*: FCFS, SJF, Priority, Round Robin, UNIX Multi-level feedback queue scheduling, Thread Scheduling, Multiprocessor Scheduling concept, Real Time Scheduling concepts.

## Unit –III: Process Synchronization

**Concurrency:** Principles of Concurrency, Mutual Exclusion H/W Support, software approaches, Semaphores and Mutex, Message Passing, Monitors, Classical Problems of Synchronization: Readers-Writers Problem, Producer Consumer Problem, Dining Philosopher problem. **Deadlock:** Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, An Integrated Deadlock Strategies.

## Unit – IV: Memory & I/O Management:

Memory Management requirements, *Memory partitioning*: Fixed, dynamic, partitioning, Buddy System Memory allocation Strategies (First Fit, Best Fit, Worst Fit, Next Fit), Fragmentation, Swapping, Segmentation, Paging, Virtual Memory, Demand paging, Page Replacement Policies (FIFO, LRU, Optimal, clock), Thrashing, Working Set Model.  
*I/O Management and Disk Scheduling*: I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, Disk Scheduling (FCFS, SCAN, C-SCAN, SSTF), Disk Caches.

## Unit – V: RTOS APPLICATION DOMAINS

Comparison and study of RTOS: Vxworks and  $\mu$ COS – *Case studies*: RTOS for Image Processing – Embedded RTOS for voice over IP – RTOS for fault Tolerant Applications – RTOS for Control Systems.

## Suggested Reading:

1. Wayne Wolf, "Computers as Components: Principles of Embedded Computing System Design," 2/e, Kindle Publishers, 2005.
2. Tanenbaum, "Modern Operating Systems," 3/e, Pearson Edition, 2007.
3. Jean J Labrosse, "Embedded Systems Building Blocks Complete and Ready-to-use Modules in C," 2/e, 1999.
4. C.M.Krishná and G.Shin, "Real Time Systems," McGraw-Hill International Edition, 1997.

EC 462

P1135

## CODING THEORY AND TECHNIQUES (ELECTIVE –II)

<b>Instruction</b>	<b>4 Periods per week</b>
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

### Unit-I: Introduction

Coding for Reliable Digital Transmission and Storage, Types of codes, Modulation and Coding, Maximum Likelihood Decoding, Types of errors, Source coding: Shannon-Fano coding, Huffman codes, Run-Length Encoding, Lempel-Ziv codes.

### Unit II: Block codes

Important Linear Block Codes, Repetition codes, Hamming codes, a class of single error-correcting and double-error correcting codes, Reed-Muller codes, the (24,12) Golay code, Product codes, Interleaved codes.

### Unit III: Convolutional codes

Encoding, Structural properties, State diagram, Code tree diagram, Maximum-Likelihood decoding, Soft decision and hard decision decoding, the Viterbi algorithm.

### Unit IV: Low Density Parity Check codes

Introduction, Gallager's method of construction, Regular and Irregular LDPC codes, other methods of constructing LDPC codes, Tanner graphs, Decoding of LDPC codes.

### Unit V: BCH and RS codes

Groups, Fields, Binary arithmetic, Construction of Galois Fields  $GF(2^m)$ , Basic properties of Galois Fields, Introduction to BCH and RS codes.

### Suggested Reading:

1. Shu Lin and Daniel J. Costello, Jr. "Error Control Coding," 2/e, Pearson, 2011.
2. K Sam Shanmugum, "Digital and Analog Communication Systems," Wiley, 2010.
3. Simon Haykin, "Digital Communication," TMH, 2009.



EC 463

P/136

## Design of Fault Tolerant Systems (ELECTIVE –II)

Instruction	4 Periods/Week
Duration of University Exam	3 hours
Exam Marks.	75 Marks
Sessionals	25marks

### UNIT - I

Basic concepts of Reliability: Failures and faults, Reliability and failure rate, Relation between reliability & mean time between failure, Maintainability & Availability, reliability of series and parallel systems. Modeling of faults. Test generation for combinational logic circuits :conventional methods (path sensitisation, Boolean difference), Random testing, transition count testing and signature analysis.

### UNIT – II

Fault Tolerant Design-I: Basic concepts ,static,(NMR,use of error correcting codes), dynamic, hybrid and self purging redundancy, Siftout Modular Redundancy (SMR), triple modular redundancy, 5MR reconfiguration.

### UNIT – III

Fault Tolerant Design-II: Time redundancy, software redundancy, fail-soft operation, examples of practical fault tolerant systems, introduction to fault tolerant design of VLSI chips.

### UNIT - IV

Self checking circuits: Design of totally self checking checkers, checkers using m-out of a codes, Berger codes and low cost residue code, self-checking sequential machines, partially self-checking circuits. Fail safe Design: Strongly fault secure circuits, fail-safe design of sequential circuits using partition theory and Berger codes, totally self checking PLA design.

### UNIT - V

Design for testable combination logic circuits: Basic concepts of testability, controllability and observability. The Read-Muller expansion technique, level OR-AND-OR design, use of control and syndrome-testing design. Built-in-test, built-in-test of VLSI chips, design for autonomous self-test, design in testability into logic boards.

### Suggested Reading:

1. Parag K. Lala, *Fault Tolerant & Fault Testable Hardware Design*, (PHI) 1985
2. Parag K. Lala, *Digital systems Design using PLD's*, PHI 1990.
3. N.N. Biswas, *Logic Design Theory*, PHI 1990.
4. Konad Chakraborty & Pinaki Mazumdar, *Fault tolerance and Reliability Techniques for high – density random – access memories Reason*, 2002.



P/137

EC 464

**SPEECH PROCESSING  
(ELECTIVE -II)**

**Instruction**

Duration of University Examination  
University Examination  
Sessional

**4 Periods per week**

3 Hours  
75 Marks  
25 Marks

**UNIT - I**

Mechanism of speech production, source filter model of speech production, speech sounds .  
Differential PCM. Adaptive delta modulation, Adaptive differential PCM (ADPCM).  
Short time spectral analysis, cepstral analysis, Auto correlation function, Linear predictive  
analysis, pitch synchronous analysis.

**UNIT - II**

Short -time Energy function, zero crossing rate, End point detection, vector quantization.  
Format Tracking; Pitch extraction.

**UNIT - III**

Format synthesizer; Linear predictive synthesizer, phone use synthesis, Introduction to  
Text-to-speech and Articulator speech synthesis.

**UNIT IV**

Sub-band coding, Transforms coding, channel decoder, Formant decoder, cepstral decoder,  
linear predictive decoder, vector quantizer coder.

**UNIT V**

Problems in Automatic speech recognition, Dynamic warping, Hidden Markow models,  
speaker Identification / verification.

**Suggested Reading**

1. Daniel Jurefskey & James H. Martin, "*Speech and Language Processing*", Pearson Education, 2003.
2. Rabiner and Schafer, "*Digital Processing of Speech Signals*", PHI, 1978.
3. Owens F.J., "*Signal Processing of Speech*", Macmillan, 2000.
4. Papamchalis, "*Practical Approaches to speech coding*", PHI, 1987.

*Pl/ze*

EC 465

## WIRELESS SENSOR NETWORKS (ELECTIVE -II)

### Instruction

Duration of University Examination  
University Examination  
Sessional

4 Periods per week

3 Hours  
75 Marks  
25 Marks

### UNIT – I: OVERVIEW OF WIRELESS SENSOR NETWORKS

Challenges for Wireless Sensor Networks-Characteristics requirements-required mechanisms, Difference between mobile ad-hoc and sensor networks, Applications of sensor networks- Enabling Technologies for Wireless Sensor Networks

### UNIT II ARCHITECTURES:

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

### UNIT III NETWORKING SENSORS

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, Zigbee: IEEE 802.15.4 MAC Layer, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.

### UNIT IV INFRASTRUCTURE ESTABLISHMENT

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

### UNIT V SENSOR NETWORK PLATFORMS AND TOOLS

Operating Systems for Wireless Sensor Networks, Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

### Suggested Reading:

1. Holger Karl and Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks," John Wiley, 2005.
2. Feng Zhao and Leonidas J. Guibas, "Wireless Sensor Networks - An Information Processing Approach," Elsevier, 2007.
3. Kazem Sohraby, Daniel Minoli, and Taieb Znati, "Wireless Sensor Networks- Technology, Protocols and Applications," John Wiley, 2007.
4. Anna Hac, "Wireless Sensor Network Designs," John Wiley, 2003.

P/139

ME 411

**ENTREPRENEURSHIP  
(ELECTIVE -II)**

**Instruction**

Duration of University Examination  
University Examination  
Sessional

4 Periods per week

3 Hours

75 Marks

25 Marks

**UNIT - I**

Indian Industrial Environment – competence, Opportunities and Challenges. Entrepreneurship and Economic growth. Small Scale Industry in India – Objectives, Linkage among small, medium and heavy industries. Types and forms of enterprises.

**UNIT - II**

Identification and characteristics of entrepreneurs. Emergence of First generation entrepreneurs, environmental influence and women entrepreneurs. Conception and evaluation of ideas and their sources. Choice of Technology - Collaborative interaction for Technology development.

**UNIT - III**

Project formulation, Analysis of market demand, Financial and Profitability and analysis and Technical analysis. Project financing in India.

**UNIT - IV**

Project Management during construction phase, project organization, project planning and control using CPM, PERT techniques, Human aspects of project management. Assessment of tax burden.

**UNIT - V**

Behavioral aspects of entrepreneurs : Personality – determinants, attributes and models. Leadership concepts and models. Values and attitudes. Motivation aspects. Change behavior.

Time Management: Various approaches of time management, their strengths and weaknesses. The urgency addiction and time management matrix.

**Suggested Reading**

1. Vasant Desai , “Dynamics and Entrepreneurial Development and management”, HPH, 1997.
2. Prasanna Chandra, “Project- Planning, Analysis, Selection, Implementation and Review”, TMH, 1995.
3. Stephen R. Covey and A. Roger Merrill, “First Things First”, Simon and Schuster publication, 1994.
4. G.S. Sudha, “Organizational Behaviour”, NPH, 1996.
5. Robert D. Hisrich, Michael P. Peters, “Entrepreneurship”, 5/e, TMH, 2005.



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**NANO TECHNOLOGY  
(ELECTIVE –III)**

Instruction

4 Periods per Week

Duration of University Examination

3 Hours

University Examination

75 Marks

Sessional

25 Marks

**Unit –I**

Introduction to Physics of the Solid State: Structure, Size dependence of properties, Crystal structures, Face-Centered cubic nanoparticles, Tetrahedrally Bonded semiconductor structures, Lattice Vibrations, energy Bands, Effective masses, Fermi surfaces, Localized particles, Donors, Acceptors and Deep Traps, Mobility, Excitations. Introduction to Semiconducting Nanoparticles, Introduction to Quantum Dots, wells, Preparation of Quantum Nanostructures.

**Unit –II**

TEM, Infraed and Raman spectroscopy. Photoemission and X-RAY spectroscopy, Electron microscopy, SPMs, AFMs, Electrostatic force Microscope, Magnetic force microscope.

**Unit –III**

Biological analogies of Nano and Micro-electromechanical systems (NMEMS)- Applications Fabrication of MEMS-assembling and packaging - applications of NMEMS.

**Unit- VI**

Mathematical models and design of NMEMS-architecture-electro magnetic and its applications for Nano and Micro-electromechanical motion devices Molecular and Nano structure dynamics-molecular wires and molecular circuits.

**Unit –V**

Carbon nanotubes and nano devices-structural design of nano and MEM actuators and sensors configurations and structural design of motion nano-and micro-structures. Introduction to Intelligent control of Nano and Microelectronical Systems.

**Suggestion Reading :**

1. G.Timp, "Nanotechnology," Bell Labs, Murray Hill , NJ, USA.
2. Charles P. Poole, "Introduction to nanotechnology," Wiley International.
3. Eric Drexler, "Nano Systems: Molecular machinery, manufacturing and computation," John Wiley and Sons.
4. Lyschevski and Sergey Edward, "Nano and Microelectromechanical Systems: Fundamentals of Nano and Micro Engineering," CRC Press, 2000.



EC 472

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## GLOBAL POSITIONING SYSTEM (ELECTIVE -III)

Instruction

4 Periods per Week

Duration of University Examination

3 Hours

University Examination

75 Marks

Sessional

25 Marks

### Unit -I

GPS Fundamentals: GPS Constellation, Principle of operation, GPS Orbits, Orbits mechanics and satellite position determination, time references.  
Geometric dilution of precision : GDOP, VDOP, PDOP.

### Unit -II

Coordinate Systems: Geometry of ellipsoid, geodetic reference system. Geoids, Ellipsoid and Regional datum, WGS-84, IGS ECI, ECEF.

Various error sources in GPS: Satellite and Receiver clock errors, ephemeris error, atmospheric errors, the receiver measurement noise and UERE.

### Unit -III

GPS measurement: GPS signal structure, C/A and P-code and carrier phase measurement, position estimation with pseudo range measurement, Spoofing and antiSpoofing, GPS navigation, observation data formats.

### Unit- VI

GPS Augmentation systems: Principle of DGPS, Types of DGPS: LADPS, WADGPS. Satellite Based Augmentation system (SBAS) : WAAS, GAGAN.  
Ground Based Augmentation System (GBAS): LAAS.

### Unit -V

GPS Application: Surveying Mapping Marine, air and land Navigation, Military and Space Application. GPS Integration with GIS, INS, Pseudolite and Cellular.  
New Satellite Navigation system; GLONASS, Galileo System.

### Suggestion Reading:

1. Satheesh Gopi, "Global positioning system: Principles and Application," TMH, 2005.
2. Pratap Misra and Per Enge, "Global Positioning System Signals, Measurement, and Performance," Ganga- Jamuna Press, 2/e, Massachusetts, 2010.
3. B.Hofmann-Wellenhof, H.Lichtenegger, and J.Collins, "GPS Theory and Practice," Springer Verlag, 2008.
4. Bradford W.Parkinson and James J. Spilker, "Global Positioning system: Theory and Application," Vol.II, American Institution of Aeronautics and Astronautics Inc., Washington, 1996.

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P1142

## NEURAL NETWORKS AND FUZZY LOGIC (Elective - III)

Instruction	4 Periods per Week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

### UNIT – I

Evolution of neural networks; Artificial Neural Network: Basic model, Classification, Feed forward and Recurrent topologies, Activation functions; Learning algorithms: Supervised, Un-supervised and Reinforcement; Fundamentals of connectionist modeling: McCulloch – Pits model, Perceptron, Adaline, Madaline.

### UNIT-II

Topology of Multi-layer perceptron, Backpropagation learning algorithm, limitations of Multi-layer perceptron. Radial Basis Function networks: Topology, learning algorithm; Kohonen's self-organising network: Topology, learning algorithm; Bidirectional associative memory Topology, learning algorithm, Applications.

### UNIT-III

Recurrent neural networks: Basic concepts, Dynamics, Architecture and training algorithms, Applications; Hopfield network: Topology, learning algorithm, Applications; Industrial and commercial applications of Neural networks: Semiconductor manufacturing processes, Communication, Process monitoring and optimal control, Robotics, Decision fusion and pattern recognition.

### UNIT-IV

Classical and fuzzy sets: Introduction, Operations and Properties, Fuzzy Relations: Cardinality, Operations and Properties, Equivalence and tolerance relation, Value assignment: cosine amplitude and max-min method; Fuzzification: Membership value assignment- Inference, rank ordering, angular fuzzy sets. Defuzzification methods, Fuzzy measures, Fuzzy integrals, Fuzziness and fuzzy resolution; possibility theory and Fuzzy arithmetic; composition and inference; Considerations of fuzzy decision-making.

### UNIT – V

Basic structure and operation of Fuzzy logic control systems; Design methodology and stability analysis of fuzzy control systems; Applications of Fuzzy controllers. Applications of fuzzy theory.

#### Suggested Reading:

1. Limin Fu, "Neural Networks in Computer Intelligence," McGraw Hill, 2003.
2. Fakhreddine O. Karray and Clarence De Silva., "Soft Computing and Intelligent Systems Design, Theory, Tools and Applications," Pearson Education, India, 2009.
3. Timothy J. Ross, "Fuzzy Logic with Engineering Applications," McGraw Hill, 1995.
4. B.Yegnanarayana, "Artificial Neural Networks," PHI, India, 2006.



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**SPECTRAL ESTIMATION TECHNIQUES  
(ELECTIVE -III)**

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Instruction  
Duration of University Examination  
University Examination  
Sessional

4 Periods per Week  
3 Hours  
75 Marks  
25 Marks

**UNIT I**

Random variable, Random processes, stationary random processes, statistical average, statistical averages for joint random processes, Discrete-Time Random signals, Time averages for a Discrete Time Random processes, Mean-Ergodic Process, Correlation Ergodic Processes, Power density Spectrum, Representation of a Stationary Random Processes, Rational power spectra, Relation between the filter parameters and autocorrelation.

**UNIT II**

Forward and Backward linear prediction-Forward and Backward linear prediction, Relationship of an AR process to linear prediction, Solution of linear equations- The Levinson- Durbin algorithm, Wiener Filters- Wiener filters for Filtering and Prediction, FIR Wiener filter, Orthogonality Principle in linear Mean square Estimation, IIR Wiener Filter, Noncausal Wiener filter.

**UNIT III**

Power Spectrum Estimation: Estimation of Spectra from finite duration observation of a signal. Periodogram. DFT in power spectrum estimation. Non-parametric methods – Bartlett's, Welch's and Blackman-Tukey methods, Performance Characteristics of Nonparametric Power Spectrum Estimators, Computational requirements and performance characteristics.

**UNIT IV**

Parametric methods – Relation between auto correlation sequence and model parameters. Methods for AR model parameters. Yule – Walker method, Burg method, unconstrained Least squares methods. Sequential estimation methods. Selection of AR model order, Moving average (MA) and ARMA models for Power spectrum estimation.

**UNIT V**

Eigen Analysis algorithms for Spectrum estimation- Pisarenko's harmonic decomposition method. Eigen structure methods – MUSIC and ESPRIT. Order selection criteria. Filter Bank methods- Filter bank realization of the periodogram, Capon's minimum variance method.

**Suggested Reading:**

1. John G. Proakis and Dimitris G. Manolakis, "Digital Signal Processing-Principles, Algorithms and Applications," 4/e, Pearson/PHI, 2007.
2. D.G. Manolakis, Ingle and S.M. Kogon, "Statistical and Adaptive Signal Processing," McGraw Hill, 2000.
3. John G. Proakis, Rader, et al, "Algorithms for Statistical Signal Processing," Pearson Education, Asia Publishers, 2002.
4. Emmanuel Ifeachor and Barrie W. Jervis, "Digital Signal Processing - A Practical Approach," Pearson, 2004.

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**INTELLECTUAL PROPERTY RIGHTS  
(ELECTIVE –III)**

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Instruction	4 Periods per Week
Duration of University Examination	3 Hours
University Examination	75 Marks
Sessional	25 Marks

**UNIT – I**

Introduction: Meaning of Intellectual Property, Nature of I.P., Protection of I.P, Rightsd, Kinds of Intellectual Property Rights, International Conventions of Intellectual Property Rights, Patent Treaty 1970, GATT 1994, TRIPS & TRIMS. International Organization for Protection of IPR – WTO , WIPO, UNESCO.

**UNIT – II**

Patents: Meaning of Patent, Commercial significance, obtaining of patent, patentable subject, matter-rights and obligations of patentee, specification, Registration of patents, Compulsory licensing and licenses of rights, Revocation.

**UNIT – III**

Industrial Designs: Definition of Designs. Registration of Designs. Rights and Duties of Proprietor of Design. Piracy of Registered designs.

**UNIT – IV**

Trade marks: Meaning of trademark, purpose of protecting trademarks Registered trademark, procedure – passing off. Assignment and licensing of trademarks, Infringement of trademarks.

**UNIT – V**

Copy Right: Nature, scope of copyright, subject matter of copyright, right conferred by copyright, publication. Broadcasting, telecasting, computer programme, database right. Assignment, transmission of copyright, Infringement of copyright.

**Suggested Reading**

1. Cornish W.R., "*Intellectual Property – Patents, Copyright, Trademarks and Allied Rights*", Sweet & Maxwell, 1993.
2. P. Narayanan, "*Intellectual Property Law*", Eastern Law House, 2/e, 1997.
3. Robin Jacob & Danial Alexander, "*A guide book to Intellectual Property Patents*", Sweet and Maxwell, 4/e, 1993.
4. Ganguly, "*Intellectual Property: Unleashing the knowledge Economy*", TMH, 2003.



WITH EFFECT FROM THE ACADEMIC YEAR 2013-14

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DISASTER MANAGEMENT  
(ELECTIVE -III)

Instruction

Duration of University Examination

University Examination

Sessional

4 Periods per Week

3 Hours

75 Marks

25 Marks