**DEVI AHILYA VISHWAVIDYALAYA, INDORE**

**FACULTY OF ENGINEERING**

# SCHEME OF EXAMINATION
# &
# COURSE OF CONTENTS

**BE IV Year Programme**
**(ELECTRONICS & TELECOMMUNICATION ENGINEERING)**

**INSTITUTE OF ENGINEERING & TECHNOLOGY**
(www.iet.dauniv.ac.in)

**B. E. IV YEAR ELECTRONICS & TELECOMMUNICATION ENGINEERING**
**Th- Theory, CW – Class Work, SW – Sessional Work, Pr – Practical**

**Semester VII**

| | | | | | Maximum Marks | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S.No** | **Sub Code** | **Subject** | **L** | **P** | **TH** | **CW** | **SW** | **PR** | **TOTAL** |
| **1.** | **4ET501** | **Project-II** | **-** | **2** | **-** | **-** | **100** | **50** | **150** |
| **2.** | **4ET502** | **Digital communication** | **4** | **2** | **100** | **50** | **50** | **50** | **250** |
| **3.** | **4ET503** | **Microwave Engineering** | **4** | **2** | **100** | **50** | **50** | **50** | **250** |
| **4.** | **4ET504** | **Antenna & Wave Propagation** | **4** | **2** | **100** | **50** | **50** | **50** | **250** |
| **5.** | | **Elective-I** | **4** | **-** | **100** | **50** | **-** | **-** | **150** |
| | **TOTAL** | | **16** | **8** | **400** | **200** | **250** | **200** | **1050** |

**Semester VIII**

| | | | | | Maximum Marks | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **S.No** | **Sub Code** | **Subject** | **L** | **P** | **TH** | **CW** | **SW** | **PR** | **TOTAL** |
| **1.** | **4ET551** | **Circuit Design Using HDL** | **4** | **-** | **100** | **50** | **-** | **-** | **150** |
| **2.** | **4ET552** | **Optical Communication** | **4** | **2** | **100** | **50** | **50** | **50** | **250** |
| **3.** | **4ET553** | **IC Design Techniques** | **4** | **2** | **100** | **50** | **50** | **50** | **250** |
| **4.** | **4ET554** | **Satellite Communication & Navigation Systems** | **4** | **2** | **100** | **50** | **50** | **50** | **250** |
| **5.** | | **Elective-II** | **4** | **-** | **100** | **50** | **-** | **-** | **150** |
| | **TOTAL** | | **20** | **6** | **500** | **250** | **150** | **150** | **1050** |

**List of Elective Subjects**

**Semester VII, Elective -I**

| **S.No** | **Sub Code** | **Subject Name** |
|---|---|---|
| **1** | **4ET505** | **Wireless Communication** |
| **2** | **4ET506** | **T.V and Radar Engg.** |
| **3** | **4ET507** | **Network Security** |
| **4** | **4ET508** | **Embedded Systems** |
| **5** | **4ET509** | **Image Processing** |

**Semester VIII, Elective-II**

| **S.No** | **Sub Code** | **Subject Name** |
|---|---|---|
| **1** | **4ET555** | **Advance Random Process** |
| **2** | **4ET556** | **Operating Systems** |
| **3** | **4ET557** | **Artificial Intelligence** |
| **4** | **4ET558** | **Power Electronics** |
| **5** | **4ET559** | **Multimedia Communication** |

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|---|---|---|---|---|---|---|---|---|---|
| **Subject Code & Name** | **Instructions Hours per week** | | | **Marks** | **TH** | **CW** | **SW** | **Pr** | **Total** |
| **4ET501<br>Project Phase-II** | **L** | **T** | **P** | **Max** | **-** | **-** | **100** | **50** | **150** |
| **Duration of Theory Paper: Pr** | **-** | **-** | **2** | **Min** | | | **50** | **25** | **75** |

**Course Objective:** To provide a comprehensive hands on experience to the students about the development of a complete project starting from analysis to testing. The students can also take a research project for innovating a new idea and its implementation.

The major emphasis (but not limited to) shall be given on Microcontroller, Microprocessors, Analog and Digital Electronics/Communication ,VLSI and VHDL etc these are practice oriented areas of interest. The students shall be making the system, application or simulation packages depending upon the idea, technology chosen and expertise available. The architectural issues shall be important while the exposure to the technology needs to be gained by the students through thorough practice.

The students (in a batch) shall be required to be continuous interaction with the guide for the advice, guidance and facilities periodically and show the progress. They shall also be taking a certificate in the diary for satisfactory remarks or comments. Batch size shall be decided as per need and the quantum of the project.

The students shall make presentation and submit an originally drafted project reports periodically and at the end of the semester.

[1] Reference books and web links of the relevant material the must be consulted as advised by the guide.

Note: The requirement of relevant book may be submitted by the guide to the HOD/ Director for procurement.

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|---|---|---|---|---|---|---|---|---|---|
| **Subject Code & Name** | **Instructions Hours per week** | | | **Marks** | **TH** | **CW** | **SW** | **Pr** | **Total** |
| **4ET502<br>Digital Communication** | **L** | **T** | **P** | **Max** | **100** | **50** | **50** | **50** | **250** |
| **Duration of Theory Paper: 3 hrs** | **4** | **-** | **2** | **Min** | **35** | **25** | **25** | **25** | **110** |

**Objectives:** To introduce in-depth understanding of all the processes involved in digital communication systems.

**Prerequisite:** Knowledge of analog communication engineering and Fourier techniques.

**COURSE OF CONTENTS**

**Unit I**

Review of Fourier Techniques and Its Application For Linear System Analysis, Sampling & Quantization, Digital Coding Techniques, PCM, DPCM, ADPCM, DM, ADM, Vocoders , Line Coding NRZ, RZ, Biphase, Duo Binary Etc., Their Comparison and Spectrum Associated with their Waveforms.

**Unit II**

Eye Patterns, Inter Symbol Interference, Pulse Shaping, Complementary Error & Q Function, Chebyshev's Inequality. Optimum Filter, Matched Filter, Maximum likelihood Receiver Structure,

Digital Modulation Techniques : Binary PSK, QPSK, M-Ary FSK, MSK Etc, Their Generation, Reception, Signal Space Representation, Performance Analysis & Comparison of Digital Modulation Techniques in Presence of noise.

**Unit III**

Information Theory & Channel Coding : Concept of Amount of Information , Entropy , Information Rate , Coding To Increase Average Information per Bit, Shannon Theorem & Its Application , Channel Capacity , Capacity of Gaussian Channel, Binary Symmetric Channel, Binary Erasure Channel, Calculation of Channel Capacity for different channels, Shannon Hartley Theorem, Bandwidth & S/N Trade Off.

**Unit IV**

Source coding techniques: Kraft Enequality, Shannon Fano and Huffman Coding. Error control coding : Linear Block Codes, Systematic Linear Blocks Codes, Parity Check Matrix, Syndrome Testing, Cyclic code, Hamming Code, BCH Code, Convolution Codes, maximum Likelihood Decoding, Viterbi decoding.

**Unit V**

Fading Channels- Small scale fading, Large scale fading, Signal Time Spreading, Time Variance of the Channel caused by the Motion, Mitigating the degradation effects of Fading. Equalization, Linear and Non-Linear Equalization, Algorithms for adaptive Equalization, Diversity Techniques and its types.

**References:**

[1] Taub & Schilling, *Principles of Communication system*, TMH.
[2] Lathi B.P., *Modern analog and Digital Communication systems*, Oxford Uni. Press.
[3] Haykins Simon, *Digital Communication*, Wiley Publication.
[4] Proakis, *Digital communication*, McGraw Hill
[5] Schaum's Outline series, *Analog and Digital Communication*.
[6] B. Sklar, *Digital Communication*, Pearson Education.

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|---|---|---|---|---|---|---|---|---|---|
| **Subject Code & Name** | **Instructions Hours per week** | | | **Marks** | **TH** | **CW** | **SW** | **Pr** | **Total** |
| **4ET503<br>Microwave Engineering** | **L** | **T** | **P** | **Max** | **100** | **50** | **50** | **50** | **250** |
| **Duration of Theory Paper: 3 hrs** | **4** | **-** | **2** | **Min** | **35** | **25** | **25** | **25** | **110** |

**Course Objective:**The objective of this course is to give students the knowledge and understanding of the basic concepts of Microwave and its components. It gives emphasis to the basic microwave components theories, modeling, analysis, design and also their physical behaviors.

**Perquisites:** Basic Knowledge of EMFT, Analog Electronic

**COURSE OF CONTENTS**

**Unit I**

**Microwave components-**microwave frequencies, devices, systems, units of measure, hybrid circuits, waveguide tees, magic tees (hybrid trees), hybrid rings (rat-race circuits), waveguide corners, bends and twists, directional couplers, two-hole directional couplers, z & abcd parameters- introduction to s parameters, s matrix of a directional coupler, hybrid couplers, circulators and isolators, microwave circulators, microwave isolators.

**Unit II**

**Microwave linear-beam tubes (o type) and microwave crossed-field tubes (m type)** :limitations of conventional vaccum tubes, klystrons, reentrant cavities, velocity-modulation process, bunching process, output power,beam loading, multicavity klystron amplifiers, beam-current density, output current output power of 2-cavity klystron, 4-cavity klystron, reflex klystrons, velocity modulation, power output and efficiency, electronic admittance, helix TWTs, slow-wave structures, amplification process, convection current, axial electric field, wave modes, gain consideration, microwave crossed-field tubes , magnetron oscillators, cylindrical, coaxial and tunable magnetron.

**Unit III**

**Negative resistance devices, transferred electron devices (teds) and avalanche transit-time devices:** tunnel diode, gunn-effect diodes, gaas diode, background, gunn effect, RWH theory, differential negative resistance, two-valley model theory, high-field domain, modes of operation, LSA,INP,CDTE diodes, microwave generation ,amplification, avalanche transit-time devices, read diode, physical description, avalanche multiplication, carrier, external current, output power,quality factor, impatt, trapatt and baritt diodes their physical structures, negative resistance, power output and efficiency microwave performance, parametric devices, physical structures, nonlinear reactance and manley - rowe power relations, parametric amplifiers, applications.

**Unit IV**

**Strip lines and monolithic microwave integrated circuits**-Microstrip lines, characteristic impedance, losses, quality factor, parallel strip lines, distributed lines, characteristic impedance, attenuation losses, coplanar strip lines, shielded strip lines, references, problems, monolithic microwave integrated circuits, introduction, materials, substrate materials, conductor materials, dielectric materials, resistive materials, monolithic microwave integrated-circuit growth, mimic fabrication techniques, fabrication example.

**Unit V**

**Microwave communication and microwave measurements-**microwave communication and their applications, microwave antennas, slotted line vswr measurement, vswr through return loss measurements, power measurement, impedance measurement insertion loss and attenuation measurements- measurement of scattering parameters - measurement of 1 db, dielectric constant measurement of a solid using waveguide. microwave and its applications in medical home industry etc.

**References:**

[1].Samuel Y.LIAO, *Microwave Devices and Circuits,* 3/e, Prentice Hall of India-2003
[2]. Annapurna Das and Sisir K.Das, *Microwave Engineering*, Tata McGraw-Hill -2000
[3].R.E.Collin, *Foundations for Microwave Engineering.,*2/e, IEEE Press 2002
[4].David M.Pozar, *Microwave Engineering.* 2/e,John Wiley & Sons 2003
[5]P.A.Rizzi, *Microwave Engineering*- Passive circuits - PHI

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|---|---|---|---|---|---|---|---|---|---|
| **Subject Code & Name** | **Instructions Hours per week** | | | **Marks** | **TH** | **CW** | **SW** | **Pr** | **Total** |
| **4ET504<br>Antenna & Wave Propagation** | **L** | **T** | **P** | **Max** | **100** | **50** | **50** | **50** | **250** |
| **Duration of Theory Paper: 3 hrs** | **4** | **-** | **2** | **Min** | **35** | **25** | **25** | **25** | **110** |

**Course objective:** The objective of this course is to give students the knowledge and understanding of the basic concepts of antenna and radio wave propagation. It gives emphasis to the antenna theories, modeling, analysis and design and also the physical behaviors along with the radio wave propagation problems in telecommunication field.

**Prerequisite:** Knowledge of Electromagnetic field and theory, Fundamentals of Physics

**COURSE OF CONTENTS**

**Unit I**

Introduction to types of antennas, radiation mechanism, current distribution on thin wire antenna, radiation pattern like isotropic, directional and omnidirectional, Radiation intensity, gain ,directive gain, directivity, antenna efficiency, effective area, effective length, reciprocity theorem, radar equation, beam efficiency, bandwidth, polarization Antenna temperatures ,FBR ,radiation resistance, Equivalent noise temperature of antenna.

**Unit II**

Poynting theorem, wave equation in terms of electromagnetic potentials and their solution, short electric dipole, retarded vector potential, small current element, small dipole, Finite length dipole, Half wavelength dipole, Infinite perfect conductors, ground effects.

**Unit III**

Introduction to various form of array, array of n isotropic sources of equal and unequal amplitude and uniform spacing, design consideration of Braodside, Endfire, Dolph Tchebyscheff arrays, continous arrays, rectangular arrays, planar array , bionomial array circular array, and superdirectivity.

**Unit IV**

Hertz and Marconi antenna, ground and antenna losses, High frequency antenna, Dipole antenna, Harmonic antenna and inverted V antenna, Rhombhic Antenna, RDF,Loop antenna,Adcock Antennas & direction finder,Folded Antenna,Yagi Uda Antenna,Corner Reflected Antenna, Helical Antnenna,Horn Antenna, Slot Antenna,Microstrip Antenna,LPDA,Microwave Antenna, Antenna with parabolic reflector, Lens Antenna, Antenna Measurements.

**Unit V**

Modes of propogation,Sky wave propagation, Effect of earth's magnetic filed on Ionospheric radio wave propagation, Virtual heights,MUF,LUF,Skip distance,OWF,Ionospheric abnormalities,Multihop propagation, Duct propagation,VLF and ELF propagations.

**References:**

[1].K.D.Prasad, *Antenna and Wave Propagation,* 3/e, reprint-2007, Satya Prakashan, New Delhi.
[2]Constantine A.Balanis, *Antenna Theory: Analysis and Design,* 2/e, John Wiley & Sons Inc, Noida India
[3].John Daniel Kraus, Ronald J. Marhefka, *Antennas*, 3/e, McGraw-Hill Higher Education
[4].C.G.Christodoulou, P.F.Wahid, Fundamentals *of Antennas: Concepts and Applications*, SPIE
[5].S.R.Saunders, *Antennas and Propagation for Wireless Communication Systems*, 1/e, Wiley, John & Sons, Inc.
[6].Richard C. Johnson, Henry Jasik*, Antenna Engineering Handbook*, McGraw-Hill Companies

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|---|---|---|---|---|---|---|---|---|---|
| **Subject Code & Name** | **Instructions Hours per week** | | | **Marks** | **TH** | **CW** | **SW** | **Pr** | **Total** |
| **4ET505<br>Wireless Communication** | **L** | **T** | **P** | **Max** | **100** | **50** | **-** | **-** | **150** |
| **Duration of Theory Paper: 3 hrs** | **4** | **-** | **-** | **Min** | **35** | **25** | | | **60** |

**Course Objectives:** To provide the knowledge of different generation mobile communication system, cellular concept and the aspects of mobile radio environment which is very different than conventional communication system.

**Prerequisite:** It is expected to know the following concepts: Electromagnetic spectrum, analog and digital modulation techniques, channel coding, random variable and random process.

**COURSE OF CONTENTS**

**Unit I**
Introduction to wireless communication system, Concept of cellular mobile system, Frequency reuse, Channel assignment strategies, Handoff strategies, interference and system capacity, Trunking and grade of service improving coverage & capacity in cellular system.

**Unit II**
Multiple access techniques for wireless communications: FDMA, TDMA, CDMA. Packet radio protocols. Mobile radio propagation: Free space propagation model. Three basic propagation mechanisms: Reflection, Diffraction, Scattering, Brewster angle, ground reflection model, knife-edge diffraction model. Doppler Effect.

**Unit III**
Wireless systems and standards: GSM: Mobile services, system architecture, radio interface, Protocols, localization and calling, handover, security, Frame structure, GSM channel types New data services: HSCSD, GPRS, EDGE, DECT: System architecture.

**Unit IV**
Spread spectrum System: Fundamental concept of spread spectrum systems ( DSSS and FHSS), Pseudo noise sequences, CDMA Principles of operation, forward and reverse CDMA channel. Wireless systems and standards: IS-95, CDMA 2000, WCDMA. Modulation Techniques for mobile radio: GMSK, spread spectrum modulation techniques. Orthogonal frequency division multiplexing.Multi Carrier and spread spectrum : Multi-Carrier CDMA, Multi-Carrier -DS CDMA, Multi-Tone CDMA.

**Unit V**
Fundamentals of channel coding, Block codes, Convolution codes. Speech coding for wireless system applications: Introduction to DSP techniques in wireless telephone and broadcast system, speech coding techniques for audio and voice: Waveform coders and Vocoders, Channel vocoder, Formant vocoder, Voice-Excited vocoder, Cepstrum vocoder, Liner predictive coders (LPC), Multipulse Excited LPC, Code Excited LPC, Residual Excited LPC.

**Reference**s:
[1]. Theodore S. Rappaport, *Wireless Communications principles and practice*, Prentice Hall of India, 2002.
[2]. Kamilo Feher, *Wireless Digital Communications*, PHI Private Limited.
[3]. Jochen H. Schiller, *Mobile Communication*, Pearson éducation
[4]. William C.Y. Lee, *Wireless and Cellular Telecommunications*, Tata Mc-Grew Hill.
[5]. Vijay K. Garg, *Wireless Network Evolution 2G to 3G,* Pearson Education.

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|---|---|---|---|---|---|---|---|---|---|
| **Subject Code & Name** | **Instructions Hours per Week** | | | **Marks** | | | | | |
| **4ET551**<br>**Circuit Design Using HDL** | **L** | **T** | **P** | | **TH** | **CW** | **SW** | **PR** | **Total** |
| | **4** | **-** | **-** | **Max** | **100** | **50** | **-** | **-** | **150** |
| **Duration of paper: 3 hrs** | | | | **Min** | **35** | **25** | **-** | **-** | **60** |

**Course Objective:** To enable the students to translate a functional system description into appropriate digital blocks coded in VHDL.Perform synthesis, place, and route of a digital design into a target FPGA. Introduction of Analog and mixed signal design using VHDL-AMS

**Prerequisite:** Digital Design, C language.

**COURSE OF CONTENTS**

**Unit I Introduction to VLSI and HDL**

History of IC Design, IC Technology, Moore's Law, IC Design Constraints, Feature Size, VLSI Family, Programmable Logic Devices, Designing with Programmable Logic- Design Entry, Simulation, Synthesis, Implementation, Device Programming, EDA Tools, IP Cores, Gjeski's Y Chart.
Digital system design process, Hardware simulation, Levels of abstraction, VHDL requirements, Elements of VHDL Top down design, VHDL operators, Timing, Concurrency, Objects and classes.

**Unit II Behavioral Modeling**

Signal assignments ,Concurrent and sequential assignments., Entity Declaration, Architecture Body, Behavioral Modeling, Process statement, Loop control statements, Multiple Processes, Delay Models, Signal Drivers.

**Unit III Dataflow and Structural Modeling Techniques**

Data flow Modeling, Concurrent Assignment statements, Block statements, Resolution Functions, Structural Modeling, Component declaration and Instantiation, Generate statements.

**Unit IV Advance Topics in VHDL**

Generics and Configuration, Subprogram, Overloading, Packages and Libraries, Design Libraries, Attributes, Hardware Modeling Examples: Modeling of digital circuits used in communication, signal conditioning and Instrumentation blocks.

**Unit V Design for Synthesis and Introduction to VHDL-AMS**

Language directed view of synthesis, Inference from CSA statements, Inference from within Process, Inference using Signals v/s variables, Latch v/s Flip Flop Inference, Wait statements, Synthesis Hints, Synthesis for dataflow and structural models.
Introduction to VHDL-AMS, Free quantities, Terminal and Branch quantities, Attributes, Simultaneous statements, Analog structure description, Discontinuities and break statements, step specifications, Mixed signal description, Design Processing.

**References:**


[1]. J. Bhasker, *VHDL* Primer, 3/e, Addison Wesley, 1999.
[2]. Sudhakar Yalamanchili, *Introductory VHDL-From Simulation to Synthesis*, Pearson Education, 3/e Indian Reprint.
[3]. Douglas Perry, *VHDL*, 3/e Edition, McGraw Hill 2001.
[4]. Peter.J.Ashenden, The Designer's Guide to *VHDL-AMS*,
[5]. Charles.H.Roth, *Digital system Design using VHDL*, Thompson Publishers, 2/e Edition, 2007.
[6]. Ben Cohen, *VHDL*-Coding style and Methodologies, Kluwer academic Publishers, 1995.
[7]. Volnei. A.Pedroni, *Circuit Design with VHDL*, *MIT* Press Cambridge, 2004.

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|---|---|---|---|---|---|---|---|---|---|
| **Subject Code & Name** | **Instructions Hours per Week** | | | **Marks** | | | | | |
| **4ET552<br>Optical Communication** | **L** | **T** | **P** | | **TH** | **CW** | **SW** | **PR** | **Total** |
| | **4** | **0** | **2** | **Max** | **100** | **50** | **50** | **50** | **250** |
| **Duration of paper: 3 hrs** | | | | **Min** | **35** | **25** | **25** | **25** | **110** |

**Course Objective:** To provide the fundamentals of optical communication systems and its various elements.

**Prerequisite:** Knowledge of Electromagnetic fields & waves and basic concepts of Lasers and optical fiber

**COURSE OF CONTENTS**

**Unit I**

Introduction to optical fiber communication systems, Advantages of optical fiber communication over conventional electrical communication, review of optical fiber fundamentals, ray theory transmission, electromagnetic mode theory for optical propagation, cylindrical fiber; modes, mode coupling, step index fibers, graded index fibers, single mode fiber; cutoff wavelength, mode field diameter & spot size, effective refractive index.

**Unit II**

Transmission characteristics of optical fibers; attenuation, material absorption losses in silica glass fibers, linear scattering losses, nonlinear scattering losses, fiber bend loss, dispersion; intermodal dispersion, intra modal dispersion, modal noise, overall fiber dispersion, dispersion shifted fiber.

**Unit III**

Optical sources: Lasers & LEDs; review of basic concepts, semiconductor injection laser (injection laser diode), efficiency, injection laser characteristics; threshold current temperature dependence, dynamic response, frequency chirp, noise, reliability, comparison of LED & Lasers. Optical detectors: optical detection principle, absorption, quantum efficiency, responsivity, long wavelength cutoff, pin photodiode, avalanche photodiode, benefits and drawbacks with the avalanche photo diode.

**Unit IV**

Introduction to receiver, types of noise, receiver noise, p-n & p-i-n photodiode receiver, APD receiver. Optical Amplifiers; Semiconductor Optical Amplifiers (SOAs), Erbium doped fiber amplifiers, crosstalk in SOAs. Nonlinear effects; self phase modulation, cross phase modulation, four wave mixing, solitons.

**Unit V**

WDM concepts & components- overview of WDM, passive optical couplers; 2X2 fiber coupler, star couplers, Mach Zehender interferometer multiplexers, fiber grating filters, dielectric thin film filters.

**References:**


[1]. John M. Senior, *Optical Fiber Communications: Principles and Practice*, LPE, Pearson Education-2006.

[2]. Gerd Keiser, *Optical Fiber Communications,* Tata McGraw Hill Education Private Limited, New Delhi, 2008.

[3]. Joseph C. Palais, *Fiber Optic Communication*, PHI.

[4]. Gowar, *Optical Communication Systems*, PHI.

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|---|---|---|---|---|---|---|---|---|---|
| **Subject Code & Name** | **Instructions Hours per Week** | | | **Marks** | | | | | |
| **4ET553**<br>**IC Design Techniques** | **L** | **T** | **P** | | **TH** | **CW** | **SW** | **PR** | **Total** |
| | **4** | **0** | **2** | **Max** | **100** | **50** | **50** | **50** | **250** |
| **Duration of paper: 3 hrs** | | | | **Min** | **35** | **25** | **25** | **25** | **110** |

**Course Objective:** This course presents the fundamental of analog and Digital CMOS VLSI design with different VLSI design methodologies and combinational, sequential and semiconductor memory circuit design. It also covers the limitations of CMOS in NANO technology with introduction to the NANO Technology.

**Prerequisite:** Knowledge of semiconductor devices is required.

**COURSE OF CONTENTS**

**Unit I**

VLSI design flow, VLSI design style, introduction to the basic fabrication processes (wafer preparation, oxidation, diffusion, etching, metallization and lithography, etc.), Fabrication process Flow: basic Steps, the CMOS n-well Process. Metal oxide semiconductor (MOS) structure, Types of MOSFET: Enhancement and Depletion. Structure and operation of MOS transistor.

**Unit II**

Threshold voltage equation and energy band diagram of MOSFET, controlling of threshold voltage, MOSFET current – Voltage Characteristics. Transconductance, Drain conduction. Aspect ration, process parameters, second order effects, MOS small signal and Large signal model, MOS capacitances. Stick diagram rules for nMOS and CMOS technology, lambda based and micron based design rules. Layout design for CMOS inverter

**Unit III**

Analysis of different types of inverter circuit, CMOS inverter, transfer characteristic, calculation of propagation delay, rise time, fall time, noise margin and power dissipation for CMOS Inverter. Effect of threshold voltage and supply voltage on Delay and power dissipation. Limitations of CMOS in NANO scale circuit design.

**Unit IV**

CMOS logic**,** pseudo NMOS logic, pass transistor logic, Transmission Gate logic and Dynamic logic circuit design. Designing of Combinational logic circuit, sequential logic circuit design and semiconductor memory circuit.

**Unit V**

Basic concept of analog VLSI design, Common source stage, source follower, single ended and differential operation, common mode response, active current mirror, frequency response of amplifier, introduction to the operational amplifier.

**References:**


[1]. Sung-mo Kang and Yusuf Leblebici, *CMOS Digital Integrated Circuit analysis and Design,*
[2]. Tata McGraw-Hill, 3/e.
[3]. Behzad razavi, *Design of Analog CMOS Integrated Circuit*, Tata McGraw Hill, 11th reprint, 2006.
[4]. R. Jacob Baker, Harry W. Li and David E. Boyce, *CMOS Circuit design, layout and Simulation*, PHI, IEEE press, Series Edition,
[5]. Yuan Taur and Tak H. Ning, *Fundamentals of Modern VLSI Devices*, Cambridge university Press, Special Edition, 1998
[6]. Neil H.E. Weste and Kamran Esharhian, *Principal of CMOS VLSI design*, PHI, 2/e
[7]. Jan M. Rabaey, Digital Integrated Circuit, PHI, 2/e

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|---|---|---|---|---|---|---|---|---|---|
| **Subject Code & Name** | **Instructions Hours per Week** | | | **Marks** | | | | | |
| **4ET554**<br>**Satellite Communication & Navigation Systems** | **L** | **T** | **P** | | **TH** | **CW** | **SW** | **PR** | **Total** |
| | **4** | **0** | **2** | **Max** | **100** | **50** | **50** | **50** | **250** |
| **Duration of paper: 3 hrs** | | | | **Min** | **35** | **25** | **25** | **25** | **110** |

**Course Objective:** Students should get knowledge about satellites, their various aspects and about satellite communication. Different access techniques used and Navigations aids provided by satellites.

**Prerequisite:** Digital Communications, Antenna and Wave Propagation.

## COURSE OF CONTENTS

**Unit I**

Introduction to satellites, Kepler's First Law - Kepler's Second Law - Kepler's Third Law ,Satellite orbits- LEO,MEO,HEO,cicular,,elliptical orbits, Definitions of Terms for Earth-orbiting Satellites - Orbital Elements - Apogee and Perigee Heights - Orbital Perturbations - Effects of a Nonspherical Earth - Atmospheric Drag , Calendars - Universal Time - Julian Dates - Sidereal Time , Frequency Allocations for Satellite Services - Intelsat - U.S.Domsats - Polar Orbiting Satellites - Problems

**Unit II**

Look angle determination ,Launches and launch vehicles, Launching Orbits -, orbital effects in communication system performance, - Limits of Visibility - Near Geostationary Orbits - Earth Eclipse of Satellite - Sun Transit Outage - Problems - , satellite subsystem Attitude and orbit control system, Telemetry , tracking, command and monitoring system, Power system , Communication subsystem , - Antenna Subsystem, Control - Spinning Satellite Stabilization - Momentum Wheel Stabilization - Station Keeping - Thermal Control - - Transponders - Wideband Receiver.

**Unit III**

Satellite link design- Fixed Atmospheric and Ionospheric Losses - Link Power Budget Equation - System Noise - Antenna Noise - Amplifier Noise Temperature - Amplifiers in Cascade - Noise Factor - Noise Temperature of Absorptive Networks - Overall System Noise Temperature - Carrier-to-Noise Ratio - Uplink - Saturation Flux Density - Input Back Off - The Earth Station HPA - Downlink - Output Back off - Satellite TWTA Output - Effects of Rain - Uplink rain-fade margin - Downlink rain-fade margin - Combined Uplink and Downlink C/N Ratio - Intermodulation Noise.

**Unit IV**

Preassigned FDMA, Demand-Assigned FDMA, SPADE System. Bandwidth-limited a Power-limited TWT amplifier operation, FDMA downlink analysis.TDMA : Reference Burst; Preamble and Postamble, Carrier recovery, Network synchronization, unique word detection, Traffic Date, Frame Efficiency and Channel capacity, preassigned TDMA, Demand assigned TDMA, Speech Interpolation and Prediction, Downlink analysis for Digital transmission. Companion of uplink Power requirements for FDMA & TDMA. On-board signal processing for TDMA / FDMA operation, Satellite switched TDMA. Code-Division Multiple Access - Direct-Sequence spread spectrum - code signal c(t) - autocorrelation function for c(t) - Acquisition and trackling - Spectrum spreading and dispreading - CDMA throughput – Problems, Internet using satellites .

**Unit V**

Satellites and Navigational aids, Radio and satellite navigation, GPS- Global Positioning Satellite, GPS location GPS receivers and codes, satellite signal acquisition GPS navigation message, GPS signal levels, time accuracy, GPS receiver operation, Differential GPS Mobile Services - VSATs - Radarsat - - Orbcomm. DTH-(direct to home)

**References:**


[1]. Timothy Pratt - Charles Bostian & Jeremy Allmuti, *Satellite Communications*, John Willy & Sons (Asia) Pvt. Ltd.
[2]. Dennis Roddy, *Satellite Communications*, McGraw-Hill Publication
[3]. Wilbur L. Pritchars Henri G.Suyder Hond Robert A.Nelson, *Satellite Communication Systems Engineering*, 2/e, Pearson Education Ltd., 2003.
[4]. M.Richharia , *Satellite Communication Systems Design Principles, 2/e,* Macmillan Press Ltd.

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|---|---|---|---|---|---|---|---|---|---|
| **Subject Code & Name** | **Instructions Hours per Week** | | | **Marks** | | | | | |
| **4ET555**<br>**Advance Random Processes** | **L** | **T** | **P** | | **TH** | **CW** | **SW** | **PR** | **Total** |
| | **4** | **0** | **-** | **Max** | **100** | **50** | **-** | **-** | **150** |
| **Duration of paper: 3 hrs** | | | | **Min** | **35** | **25** | **-** | **-** | **60** |

**Course Objective:** To provide students with a broad coverage of concepts, theories and analysis methods for probability, random variables and stochastic processes, which serve as the foundation for advanced courses in communication system, signal processing, image processing and computer engineering fields

**Prerequisite:** Fundamental concept of Probability and random variables.

**COURSE OF CONTENTS**

**Unit I**

Basic concept of probability, Random Variable,Moments,Imortant Probability Distributions, Functions of Several Random Variable, Laws of Large numbers,Continous Random Variables, Expectations.

**Unit II**

Moments of Random function, Mean Ergodicity, Poisson process, Wiener Process and White Noise, Bandlimited Processes and Sampling Thoery, Determinstic signals in noise, Stationarity, Spectrum Estimation, Linear System, Entropy.Source Coding.

**Unit III**

Canonical Expansions, Karhunen-Loeve Theorem,Non Canonical Representation,Orthonormal transforms of Random Functions, Karhunen-Loeve Compression, Compression using Arbitrary Orthonormal Ssytems,Walsh Hadamard Transfrom,DCT,Power spectral density.

**Unit IV**

Mean Square Error Filters, Observation liner filters, Steepest Descent, Linear estimation of random vectors, Recursive Linear Filter, Linear filters via canonical expansions, Binary Filters.

**Unit V**

Markov Chains, Steady State distributions for Discrete time and Continuous time Markov Chains,Markov Random Fields, Random Boolean Model, Open and Closed Queuing Networks,Non-exponential service time distributions and multiple job types, Random sets.

**References:**


[1]. A Paoulis,S.U.Pillai,*Probability,Random Variables and Stochastic Processes,*4/e,Tata Mcgraw hill publishing Company.

[2]. K.S.Trivedi,*Probability&statistics with Reliability,Queuing and Computer Science Application,*EEE,Prentice Hall of India Private Limited.

[3]. E.R.Dougherty,*Random Processes for Image and Signal Processing,*EEE,Prentice Hall of India Private Limited.

[4]. Alberto Leon-Garcia, *Probability and Random Processes for Electrical Engineering*, 2/e, Prentice Hall of India Limited.

[5]. H. Stark and J. W. Woods, *Probability and Random Processes with application to Signal Processing*,3/e, Prentice Hall.

[6]. S.L.Miller, D.G.Childers, *Prbability and Random Process with Applications to Signal Processing and Communications,* Elsevier Academic Press.

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|---|---|---|---|---|---|---|---|---|---|
| **Subject Code & Name** | **Instructions Hours per Week** | | | **Marks** | | | | | |
| **4ET556** | **L** | **T** | **P** | | **TH** | **CW** | **SW** | **PR** | **Total** |
| **Operating Systems** | **4** | **0** | **-** | **Max** | **100** | **50** | **-** | **-** | **150** |
| **Duration of paper: 3 hrs** | | | | **Min** | **35** | **25** | **-** | **-** | **60** |

**Objective:** To provide an introduction to Operating System concepts and its design issues.

**Prerequisite:** Computer Organization.

**COURSE OF CONTENTS**

**Unit I Introduction**

Role of OS: Types of OS, Batch Systems; Multiprogramming; Time Sharing; Distributed & Real time OS. Computer structure and OS: System Architecture – I/O, Storage, Processors; System components- OS Services, System Calls , System Programs; System Design, Implementation and Generation.

**Unit II Process Management**

Concepts of process: Process status, Process description, Process model. Process Scheduling: Concepts, Scheduler organization, preemptive and non- preemptive scheduler strategies, scheduling algorithms: FCFS, SJN, Priority Scheduling, Round Robin Scheduling, Multiple Processor scheduling, Thread Concepts and Multiple threaded OS.

**Unit III Process Synchronization and Deadlock**

Process Co-operation, Concepts of Interprocess communication, Process Synchronization, Synchronization Issues, Critical Section problem, Mutual exclusion Primitives and Algorithms, Process Synchronization with semaphores. Concepts of Deadlock, Conditions for Deadlocks, Resource Concepts & Abstractions, Deadlock Prevention, Avoidance and Recovery, Banker Algorithms for Deadlock Avoidance.

**Unit IV Memory Management**

Swapping, Segmentation, Paging and Contiguous memory allocation. Virtual Memory: Demand Paging, Page replacement and Frame Allocation policies, Thrashing. File System: Concepts, Access Method, Directory Structure, and File System Management.

**Unit V I/O management and other issues**

Kernel, I/O hardware, I/O interfacing, I/O requesting and interrupts. Disk management: Disk Structure and Scheduling. Protection and Security. Linux: Kernel Organization, Process and resource management, Memory management, Introduction to Linux File System. Overview of Windows Operating System design.

**References:**


[1]. Silberschatz, Galvin and Gagne, *Operating System Principles*, 7th Ed. Addison Wesley.
[2]. Gary Nutt, *Operating Systems*, 3rd Ed. Pearson Education, India
[3]. Tanenbaum, *Modern Operating Systems*, PHI.
[4]. W. Stalling, *Operating Systems*, Macmillan.
[5]. H. M. Dietel , *Operating Systems*, Addison Wesley Longman.
[6]. Maurice J. Bach, *The design of Unix Operating system*, Pearson Education, India.
[7]. Sumitabha Das, *Unix Concepts & Applications: includes SCO Unix & Linux*, Tata McGraw Hill.

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| **Subject Code & Name** | **Instructions Hours per Week** | | | **Marks** | | | | | |
| **4ET557**<br>**Artificial Intelligence** | **L** | **T** | **P** | | **TH** | **CW** | **SW** | **PR** | **Total** |
| | **4** | **-** | **-** | **Max** | **100** | **50** | **-** | **-** | **150** |
| **Duration of paper: 3 hrs** | | | | **Min** | **35** | **25** | **-** | **-** | **60** |

**Course Objective:** To introduce the concepts of making computer systems intelligent through computational methods and techniques.

**Prerequisite:** Data Structure.

**COURSE OF CONTENTS**

**Unit I**
AI and AI Techniques; Problems, Problem space and Sate space; Production systems; Search techniques and algorithms.

**Unit II**
Knowledge Representation- Issues and Methods; Predicate logic- resolution and unification; Forward and backward Reasoning; Logic programming & Prolog.

**Unit III**
Symbolic computation- Uncertainty; Rule based systems; Statistical Reasoning; Fuzzy Logic; Expert systems; Decision support systems.

**Unit IV**
Semantic networks; Frames and Scripts; Conceptual Dependency; Game playing; Planning overview; Understating; Learning.

**Unit V**
Natural language processing- parsing, semantic analysis, ATN and RTNs; Connectionists models- neural networks; Speech and vision processing; Robotic actions.

**References:**
[1] E Rich, K Knight, Artificial Intelligence, 2/e, McGraw Hill, 1991.
[2] S Russell, P Norvig, Artificial Intelligence: A Modern Approach, 2/e, Pearson Education (PH), 2003.
[3] D W Patterson, Introduction to Artificial Intelligence and Expert Systems, PHI, 2007.
[4] P Winston, Artificial Intelligence, 3/e, Addison Wesley, 1992.

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|---|---|---|---|---|---|---|---|---|---|
| **Subject Code & Name** | **Instructions Hours per Week** | | | **Marks** | | | | | |
| **4ET558**<br>**Power Electronics** | **L** | **T** | **P** | | **TH** | **CW** | **SW** | **PR** | **Total** |
| | **4** | **0** | **0** | **Max** | **100** | **50** | | | **150** |
| **Duration of paper: 3 hrs** | | | | **Min** | **35** | **25** | | | **60** |

**Course Objective:** Advancements in semiconductor devices creates a revolution in power transmission, distribution and utilization, This course helps students to understand the basic concepts of power semiconductor devices which make students to analyze and design switch mode power electronic converters for various applications including microprocessor power supplies, renewable energy systems, and motor drives.

**Prerequisite:** Knowledge of Basic Electronics.

**COURSE OF CONTENTS**

**Unit I**

power semiconductor diodes and Transistors , Thyristors, Characteristic ,turn on methods ,Switching ,Gate Characteristic , Ratings , Protection , Heating, Cooling, Mounting, Serial /Parallel operation, Introduction to other member of Thyristors family like PUT, SUS, SCS, SITHs, Diac, Triac, RCT, GTO, Firing Circuits of Thyristors, Pulse Transformer in firing circuits, Triac Firing circuit.

**Unit II**

Thyristors Commutation techniques, Phase Control Rectifiers, Principal of phase Control , Full-wave controlled Converters, Single-Phase Full-wave Converters, Single-Phase Two-pulse Converters with Discontinuous Load Current, Three Phase- Thyristors Converters circuits, Dual Converters, Types of AC voltage controllers, Integral Cycle Control, Single –phase Voltage Controllers, sequence control of AC voltage controllers

**Unit III**

Choppers: Principle of Chopper Operation, Control Strategies, Step-up/down Choppers, Different types of Choppers circuits, Thyristors Chopper circuit. Inverters: Single- phase voltage source inverters, Fourier Analysis of Single-phase Inverters, Force –commutated Thyristors Inverters, Three Phase Bridge Inverters, Voltage Control in Single – phase Inverters, Pulse – width Modulated Inverters.

**Unit IV**

Principle of Cycloconverter, Three Phase Half wave Cycloconverter, Output voltage equation for a Cycloconverter. SMPS, UPS, HVDC transmission, Static Switches, Circuit Breakers, Solid State Relays, Resonant Converters

**Unit V**

Concepts of Electric drive, DC drive, Choppers drives, AC drives, Induction- Motor Drives, Speed control of Three-Phase induction Motors, Synchronous Motor Drives,

**References:**


[1] .Muhamed H.Rashid, *Power Electronics Circuits, Devices and Applications*, 3/e. 2004, PHI.
[2]. Singh and Kanchandani, *Power Electronics*, TMH
[3] .Sen, *Power Electronics*, TMH,
[4]. Dubey, *Thyristorised power controllers*, Wiley Eastern
[5]. Vithayathil, *Power Electronics – Principles and applications* McGraw-Hill.
[6]. Lander, *Power Electronics*, 3/e, McGraw-Hill.
[7]. Dr.P.S.Bimbhra, *Power Electronics,* 3/e, Khanna Publishers, New Delhi

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|---|---|---|---|---|---|---|---|---|---|
| **Subject Code & Name** | **Instructions Hours per Week** | | | **Marks** | | | | | |
| **4ET559** | **L** | **T** | **P** | | **TH** | **CW** | **SW** | **PR** | **Total** |
| **Multimedia Communication** | **4** | **0** | **-** | **Max** | **100** | **50** | **-** | **-** | **150** |
| **Duration of paper: 3 hrs** | | | | **Min** | **35** | **25** | **-** | **-** | **60** |

**Course Objective:** Give the student an introduction to the techniques and processes of Multimedia Communications. To create an understanding in the student of the fundamentals of Digital Video and Audio, Graphics, Text, Animation, and Interactivity

**Prerequisite:** It is expected to know the following concepts: Introductory preparation in mathematical analysis, matrix theory, probability, computer programming, and speech coding

**COURSE OF CONTENTS**

**Unit I**

Introduction to multimedia, Definition, Elements of multimedia, Need of multimedia, Applications, Goal & Objectives, Multimedia building blocks, Users of multimedia, Benefits of Multimedia, Training, Sales, Communication, Medicine. Multimedia & Internet.

**Unit II**

Converging technologies, Functions & subsystems (input, development & output). Multimedia PC workstation components. Multimedia platform, Multimedia H/w, System software, Multimedia OS File system (tiff, bmp, pcx, gif, jpeg etc.) Multimedia communication system.

**Unit III**

2D/3D animation fundamentals, color modules digital imaging, still and moving images, Video application, video capture, animation video, processing, video recovery techniques, Creating videos on the desktop, Television (Broadcast TV, HDTV), Compression standards, AVO, AVI file formats, NTSC, PAL, video/audio conferencing techniques and standards.

**Unit IV**

Basic sound concepts, audio, capture, music, speech sound processor, sound recovery technique, VOC and WAV file formats for sound. Compression standards (Audiovisual telephony & application) Mass storage systems for multimedia requirements, Magnetic devices, Optical devices, CD-ROM, DVD, scanners, types & specifications.

**Unit V**

Multimedia communication system, application subsystem: collaborative computing, session management, transport subsystem: requirement, transport layer and network layer, Quality of service and resource management: Basic concept, establishment and closing of the multimedia call, managing resources during multimedia transmission, architectural issue.

**References:**

[1]. Judith Jeffcote , *Multimedia in Practice* , PHI

[2]. Ralf Steinmetz, Klara Nahrstedt, *Multimedia Computing, Communication & Applications*

[3]. John Villamil, Casanova, *Multimedia, Production, Planning & Delivery,* PHI