SCHEME OF EXAMINATION
COURSE SRUCTURE & SYLLABUS

M.Sc. (ELECTRONICS) PROGRAMME
(SEMESTER SYSTEM)

FACULTY OF SCIENCE

Approved by Board of Studies in Electronics

Effective from Academic Session JULY 2020

School of Studies in Electronics and Photonics
Pt. Ravishankar Shukla University
Amanaka, GE Road Raipur (C.G.) 492010
WEBSITE: -www.prsu.ac.in

PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR

Scheme of Examination
M.Sc. (Electronics) Programme
(Semester System)

Effective from Academic Session JULY 2020

M.Sc. Electronics is a four semester course spread over the period of two years. Every semester course consists of four theory courses and two laboratory courses ,each theory course carrying weight-age of 100 marks (4 credits) and lab course of 100 marks (2 Credits). However, in the final semester, there will be one project in lieu of one practical.

The School of Studies in Electronics & Photonics, Pt Ravishankar Shukla University, Raipur offers this course on its campus. It is designed to offer in depth knowledge of the subject starting from its basic concepts to the state of art technologies in use today. Students are also provided extensive laboratory training on the course content and the current requirements of industries and R and D. In the final semester every student has to undertake a project. Moreover the course structure intends to inculcate strong laboratory skills so that the student can take up independent projects which will help to be an entrepreneur. The students passed out from the revised course will serve as quality human resource to take up the state of art research work of the Department. This course provides exposure to the students to the technologies in-vogue and trains them to take up projects relevant to the industrial needs, the R& D activities and self-employment opportunities. Advanced papers are offered to the students in the areas of Communications, Photonics, Nano and Opto Electronic Devices, Laser Technology Digital Signal Processing, Embedded Systems, Power Electronics and Microcontrollers. In addition the course caters to the requirements of providing complete exposure to NET/SET syllabus for Electronics formed by the U.G.C. . The student after passing the M.Sc. course has many opportunities of employment, self-employment and higher studies. Department of Higher Education, Govt. of Chhattisgarh has declared Electronics as allied subject of Physics for recruitment of Assistant Professor in colleges.. The students may opt for UGC –AICTE approved M.Tech. in Optoelectronics & Laser Technology in the department after M.Sc.

Employment Opportunities: - – Electronics and Telecommunication Industries. – I.T. Industries (India and Abroad). – Process and Manufacturing Industries. – Research and Development Laboratories. – Employment in Academic and Other Govt. Organizations.

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Educational Opportunities: - – Higher studies in I.I.T, I.I.Sc., and CERE Pilani. For M.Tech. and Ph.D. – Research in Pt. Ravishankar Shula University or any other University. M.Phil, M.Tech. and Ph.D. – M.Tech. /M.E courses of Various Universities in India and Abroad. –Higher Studies Like M.S. in relevant discipline and Research Opportunities in foreign universities. .

Eligibility Criteria: A student shall be held eligible to the admission to the M.Sc. course provided he/she has passed the B.Sc. examination with Electronics or Physics as one of the core subjects in all the three years. of this University or the degree of any other statutory University recognized as equivalent. A student with Bachelor in Vocation in Renewable Energy Technology & Management degree of the University is also eligible for admission to M.Sc Electronics course.

Semester – I

The following shall be the scheme of examination for the course:

Code	Theory	Marks			Credits
		Theory	Internal	Total	
ELT 101	Paper I : Analog Integrated Electronics and Physics of Electronic Materials	80	20	100	4
ELT 102	Paper II : Digital Design and Applications	80	20	100	4
ELT 103	Paper III : Signals, Mathematical and Computational Methods in Electronics	80	20	100	4
ELT 104	Paper IV : Optical , Quantum and Organic Electronics	80	20	100	4

Code	Practical	Experiment	Viva	Interna l	Max	Credits
ELP 105	1. Lab course "A" Analog Electronics"	60	20	20	100	2
ELP 106	2. Lab course "B" Digital Eectronics"	100	60	20	100	2
	Total (Theory & Lab)				600	20

Total Marks for Semester I =600 & Credit = 20

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Semester – II

Code	Theory	Marks			Credits
		Theory	Internal	Total	
ELT 201	Paper I Network Analysis and Synthesis	80	20	100	4
ELT 202	Paper II Microprocessor and C++ Programming	80	20	100	4
ELT 203	Paper III Analog and Digital Communication Systems	80	20	100	4
ELT 204	Paper IV Electromagnetic Plane wave, Transmission lines and Microwave Devices	80	20	100	4

Paper Code	Practical	Experiment	Viva	Internal	Max	Credits
ELP 205	1. Lab course "C" Analog and Digital Communication Lab	60	20	20	100	2
ELP 206	2. Lab course "D" – 8085 Microprocessor Programming, Study Cards and Interfacing Lab	60	20	20	100	2
	Total (Theory & Practical)				600	20

Total Marks for Semester II=600 & Credits=20

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Semester – III

Code	Theory	Marks			Credits
		Theory	Internal	Total	
ELT 301	Paper I (Code) Advance Microprocessors and Microcontroller (AMM)	80	20	100	4
ELT 302	Paper II Data Communication, Mobile and Wireless Communication	80	20	100	4
ELT 303	Paper III Photonics ~~or~~ ~~Paper III Instrumentation and Measurement~~	80	20	100	4
ELT 304	Paper IV Power Electronics, Information Theory and Coding	80	20	100	4

Code	Practical	Experiment	Viva Voce	Internal	Max	Credits
ELP 305	Lab course "E" - - Optical Electronics, Transducer and Instrumentation Lab	60	20	20	100	2
ELP 306	2. Lab course "F" – 8086 Microprocessor Programming, Interfacing and "C++" Programming Lab	60	20	20	100	2
	Total [Theory & lab]				600	20

Total Marks for Semester III = 600 & Credits=20

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Semester IV

Code	Theory	Marks			Credits
		Theory	Internal	Total	
ELT 401	Paper I Digital Signal Processing	80	20	100	4
ELT 402	Paper II (Code EL 402) Optical and Satellite Communication	80	20	100	4
ELT 403	Paper III (Code EL 403) Automatic Control System and Artificial Neural Network	80	20	100	4
ELT 404	Paper IV (Code EL 404). Embedded Systems , Microcontrollers and Advanced Instrumentation	80	20	100	4

Code	Practical	Experiment	Viva	Internal	Max	Credits
ELP 405	1. Lab course "G" - Optical Communication and 8051 Programming Lab	60	20	20	100	2
ELP 406	2. Project & Seminar	80	20	-	100	2
	Total [Theory & lab]				600	20

Total Marks for Semester IV = 600 & Credits=20

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SYLLABUS PRESCRIBED FOR THE EXAMINATION OF

M. Sc. Electronics (Semester System)

July - Dec 2020

Semester – I

Electronic devices play a crucial role in today's societies and in the physical sciences where they originated. Contemplating that in just a few decades, technology guiding electrons and photons has emerged that makes possible oral and visual communication between peoples on opposite sides of the planet is truly a triumph of science and technology. Present day information technology is based on the physical properties of semiconductors, in particular the functioning of the transistor. The intension of this paper is to take the students from the principles of quantum mechanics through the quantum theory of metals and semiconductors all the way to how devices are used to perform their duties in electric circuits

ELT 101 Paper 1 - Analog Integrated Electronics and Physics of Electronic Materials

Max. Marks: 80, Min. Marks: 16

Student should be allowed to use Programmable Scientific Calculator in Examination hall

Unit I – Physics of Electronic Materials

Crystal structures, classification of crystals, lattices, reciprocal lattice, Miller indices, amorphous materials. Lattice Vibration and Phonons, Bloch theorem, Phonons, Nearly Free electron theory. Dielectric properties, electronic polarisability, Clausius Mossotti relation, dielectric Constant static and frequency dependent. Introduction to Fermi Dirac and Bose Einstein Statistics.

Semiconductors: Direct and indirect band gap methods to determine the Forbidden gap, mobility and conductivity, intrinsic and extrinsic semiconductor, Impurities, carrier concentration, electrical properties of Ge and Si, experimental methods to study the electrical parameters, Drift and Diffusion, Hall effect, electrons and phonons in semiconductors.

Unit II –Quantum Electronics and Transistor model

Uncertainty principle, Experiments on duality, Schrodinger's equation and its applications to square well potential, square potential barrier (1D).

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Infinite array of potential wells, Kronig-Penny model, Barrier penetration, applications to tunnel diode, Josephson effect, Perturbation theory and its applications, Scattering.

Transistor at low frequency - Analysis of a transistor amplifier circuit using h-parameter, Emitter follower, comparison of transistor amplifier configurations, Miller's Theorem and its dual, cascading transistor amplifiers, High Electron Mobility Transistor (HEMT). Basics of Transistor biasing and stabilization

Unit III – Multistage and Feedback Amplifiers Analysis

Transistor at high frequencies, Hybrid – pi model, gain bandwidth product.

Multistage Amplifiers Analysis - Introduction, frequency response of an amplifier, band pass of cascaded stages, Coupling scheme - RC coupled, transformer coupled and direct coupled amplifiers, low frequency response of RC coupled stage, effect of emitter bypass capacitor on low frequency response, high frequency response of two cascaded CE transistor stages.

Feedback Amplifiers – Basic concept, types of feedback method of analysis of a feedback amplifier.

Unit IV – Operational Amplifier, Characteristics and Applications

Basic operational amplifier and its characteristics, characteristics of ideal and practical operation amplifier, parameters of operational amplifier, measurement of operational amplifier parameters, frequency response of operational amplifier,

Linear and Nonlinear Circuits analysis using operational amplifier - Inverting and Non inverting Amplifiers, Differentiator, Integrator, Voltage to current converter, Instrumentation amplifier, Sine wave Oscillator, Low pass and band – pass filters, Comparator, Multivibrator and Schmitt trigger, Triangular wave generator, Log and Antilog amplifiers

Unit V - Integrated Circuit Fabrication and Characteristics

IC fabrication – crystal growth, epitaxy, oxidation, lithography, doping, etching, isolation methods, metallization, bonding, MOS technology and VLSI, scaling of MOS devices, NMOS and CMOS structures and fabrication, Characteristics of MOS transistors and threshold voltage, NMOS and CMOS inverters, Charge-Coupled Device (CCD) – structure, charge storage and transfer, Basics of VLSI design, stick diagrams, Layout design rules.

TEXT BOOKS

1. Physics of Electronic Materials: Principles and Applications Jørgen Rammer

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Cambridge University Press,
2. Electronic Devices and Circuit Theory, 9th ed. Boylestad & Nashelsky PHI
3. Microelectronics - Jacob Millman, Arvin Grabel, Tata Macgraw-Hill
4. Physics of Semiconductor Devices: Shur PHI
5. A Textbook of Applied Electronics (M.E.) Sedha R S, S. Chand Pub.
6. Physics of Semiconductor Devices: Sze
7. Ramakant A.Gayakwad, 'OP-AMP and Linear IC's', Prentice Hall
8. Introduction to Quantum Mechanics J. Griffiths David Pearson
9. Principles of Electronic Material & Devices: S O Kasap
10. Quantum Mechanics Statistical Mechanics & Solid State Chattopadhyay D. and Rakshit P.C. S Chand & Company
10. Integrated electronics – Analog and digital circuits and systems Jacob Millman, Cristos, C. Halkias, Tata Macgraw-Hill

ELT-102 Paper 2 - Digital Design and Applications

Max. Marks: 80, Min. Marks: 16
Student should be allowed to use Programmable Scientific Calculator in Examination hall

Unit I - Basic Logic Circuit
Introduction of basic gates, universal gates, number systems and codes, Boolean algebra, switching characteristics of semiconductor devices, logic gate characteristics - speed of operation, power dissipation , figure of merit, fan in, fan out, noise margin. Logic families - RTL, DTL, TTL, ECL interfacing, ECL and TTL, MOS logic - MOSFET NAND and NOR gates, CMOS inverters, CMOS - NAND and NOR gates, interfacing CMOS and TTL, inter facing CMOS and ECL, comparison of logic families.

Unit II - Combinational Logic Design
Simplification of Boolean algebra using K-map, minterm and maxterm, design of binary adder, subtractor , digital comparator, parity generator/checkers, priority encoder, BCD to 7 - segments decoder, multiplexer , multiplexer tree, demultiplexer and demultiplexer tree.

Unit III - Sequential Circuit Design
Excitation table of flip flops – S - R, J-K, Master-Slave – JK, D and T flip-flops, clocked flip flop design – conversion of one form of flip flop to another type.
Analysis of clocked sequential circuits - State equation, state table, state diagram, state input equations, analysis with - flip flops, JK flip flops and T flip flops.
State reduction and assignment, design procedure – synthesis using D flip flops, JK Flip flops and T flip flops.

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Unit IV - Registers, Counters and A/D, D/A converters

Registers - Shift registers, application of shift registers, serial to parallel converter, parallel to serial converter.

Counters - Ring counter, modulo-n-counter, synchronous counter –ripple counter (binary, BCD) and up-down counter, asynchronous counters - ripple counter (binary , BCD) and up-down counter. Other counters – counter with unused states, ring counter, Johnson counter.

A/D, D/A Converters – D/A weighted register type, R/2R ladder type, D/A converter specifications, A/D converters - successive approximation type, parallel comparator, dual slop ADC using voltage to frequency conversion and frequency to time conversion.

Unit V - Memory and Programmable Logic

General Memory Operation; CPU-Memory Connections; ROM: Architecture, Timing, Types: MROM PROM, EPROM, EEPROM, Flash Memory;
RAM: Architecture & Operation of SRAM, DRAM; Memory Expansion; Introduction to Programmable Logic Devices (PLDs): PLA, PAL, GAL, CPLD, FPGA. Analysis and Design of digital circuits using HDL.

TEXT BOOKS

1. T. L. Floyd & R. P. Jain, Digital fundamentals, Pearson Education India, New Delhi.
2. M. Moris Mano, Digital Design, PHI Learning Pvt. Ltd. New Delhi.
3. A. P. Malvino & D. P. Leach, Digital Principals and Applications, Tata McGraw Hill, New Delhi.
4. A. P. Malvino & J. A. Brown, Digital Computer Electronics, Tata McGraw Hill, New Delhi.
5. A. Anand Kumar, Fundamentals of Digital Circuits, PHI Pvt. Ltd. New Delhi.
6. R. J. Tocci & N. S. Widmer, Digital Systems, Pearson Education India, New Delhi.
7. John. M. Yarbough, Digital Logic: Applications and Design, Thomson Brooks/Cole, Boston.
8. John F. Wakerly, Digital Design Principles and Practices, Pearson Education India, New Delhi.
9. M. Moris Mano, Computer System Architecture, PHI Pvt. Ltd. New Delhi.

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ELT 103 PAPER 3 – Signals, Mathematical and Computational Methods in Electronics

Max. Marks: 80, Min. Marks: 16
Student should be allowed to use Programmable Scientific Calculator in Examination hall.

UNIT I - Signal Analysis
Introduction – Classification of signals and systems, some ideal signals, energy signal, Power signals, energy and power spectral densities.
Fourier Series, Complex Fourier Spectrum, The Fourier Transform, Continuous Spectrum, Fourier Transform involving Impulse Function, Properties of Fourier Transform, Fourier Transform of Periodic Functions, Convolution, Sampling Theorem.

UNIT II – Linear Systems and State Variables Techniques
Introduction, System Function (Transfer Function), Distortion less Transmission, Paley-Wiener criterion, Correlation, Autocorrelation
State Variables Techniques - State variable concepts, form of the state equations, time domain and frequency domain solution of state equations, state transition matrix, state equations for networks, state equations from transfer functions.

UNIT- III- Probability and Random Signal Theory
Introduction, set theory, Introduction to Probability, Conditional Probability Statistical Impedance, Baye's Theorem, Random variables, Discrete and Continuous Random Variables, Joint Distributions, Characteristics of Random Variables, Binomial, Poisson and normal Distributions, Uniform and other Distributions, Random and Markov Processes.

UNIT IV - Mathematical Methods
Laplace Transform – Definition, transform of elementary function, properties of Laplace transform, convolution theorem, application to differential equation, simultaneous Linear equations with constant coefficients, unit step and unit impulse function
Special Function - Bessel equations, recurrence formula, expansion for Jo and J1, values of J1/2, generating function for Jn(x), equation reducible to Bessel equation

UNIT V – Computational Methods
Numerical Differentiation and Integration

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Finite Differences, Derivatives using Forward, Backward and Central Difference Formulae, Newton-Cote's Quadrature formula, Trapezoidal rule, Simpson's rules, Weddle's rule.

Numerical methods for Solution of Ordinary Differential Equation-Picards Method ,Taylor Series Method , Eulers and Modified Eulers methods, Runge and Runge Kutta Methods , Newton- Raphson Method, Gauss Elimination Method Predictor and Corrector Method.

TEXT BOOKS

1. Communication System- Analog and Digital - R.P.Singh & S.D. Sapre TMH.
2. Signal and System - Nagrath, Sharan and Ranjan. Mcgraw hill Publishing
3. Signal and Systems - Rodger E. Ziemer. Continuous and Discrete 2nd ed.Maxwell Macmillan Int. Edition,
4. Higher Engineering Mathematics - B.S. Grewal, Khanna Publications
5. Numerical Methods - Kandaswami,Thilagavathi and Gunavathi, S.Chand & Co.
6. An introduction to Numerical methods: A MATLAB approach by Abde/Wahab Kharab, Ronald B Guenther
7. Optoelectronics and Photonics Engineering Dutta, Partha S. Springer

Paper 4-Optical, Quantum and Organic Electronics

Max. Marks: 80, Min. Marks: 16
Student should be allowed to use Programmable Scientific Calculator in Examination hall

Unit I - Quantum Electronics

Coherent light sources, basic principle of lasers, laser pumping, stimulated emission, light amplification, threshold condition, Einstein's coefficient, laser rate equations for two, three and four level laser systems, variation of power around threshold, rectangular cavity, open plane resonator, mode locking and Q-switching of lasers.

Unit II - Applications of Quantum Electronics

Types of Lasers - Ruby Laser, He-Ne laser, Ar-ion laser, Co2 laser, Solid State Laser: Host material and its characteristics, doped ions Nd:YAG laser,
Liquid laser: Dye laser, Semiconductor laser

Laser Applications - Laser in manufacturing, laser cutting of material, laser marking, laser transmitter, measurement of distance through Laser

Unit III - Optical Display Devices

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Optical Display Devices - LED- Basic principle of operation, radiative recombination process, the spectrum of recombination process, the internal quantum efficiency, double hetrostructure, response time of LED, carrier configuration and modulation bandwidth, edge emitting LED, LED design. Liquid Crystal Display - construction, basic principle of emission, Plasma Display- construction, basic principle of emission

Unit IV - Photo Detectors and Organic Electronics

Photodiodes- General Principles, quantum efficiency, silicon P-N photodiodes, hetrojuncton photodiodes, Schottkey barrier diode, P-I-N photodiodes, avalanche photodiodes, and phototransistors.

Introduction to Organic Electronics, Organic versus Inorganic solids, Molecular materials, Organic Semiconductors, Electronic states in conjugated molecules, Conjugated polymers, Basics of OLED

Unit V - Electro-Optical Devices

Nonlinear Optics: Origin of nonlinearity, susceptibility tensor, phase matching, second harmonic generation, methods of enhancement, frequency mixing processes, nonlinear optical materials.

Electro-Optic Effect - Kerr effect, Pockels effect, Farady effect, Electro-Optic Modulator- Electro-optic phase modulator, electro-optic amplitude modulator, kerr modulator

Acousto-Optic Effect - Raman-Nath and Bragg Diffraction, Raman-Nath acousto optic Modulator, bragg modulator, acousto-optic modulator.

Magneto-Optic Effect - Faradays effect, magneto-optic modulator

TEXT BOOKS

1. Optical Electronics - Ghatak Thyagarajan, University Press
2. Optical Communication System - John Gower, PHI Publication.
3. Optoelectronics Devices & Systems - S.C. Gupta, PHI Publication
4. Optoelectronics - An Introduction - J.Wilson and J.F.B. Hawkes, PHI Publication.
5. Semiconductor Optoelectronic Devices, 2nd ed. **Bhattacharya PHI**
6. Pope and Swenburg, Electronic Processes in organic crystals and polymers, 2 nd Ed., Oxford
7. Organic molecular crystals, E.A. Sininsh EA and V. Capek.
8. Optoelectronics & Photonics Pronciples and Practices S.O. Kasap Pearson
9. Optical Processes in Solids Mark Fox Oxford Press
10. Optoelectronics and Optical Fiber Sensors A B Maity PHI

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SYLLABUS PRESCRIBED FOR THE EXAMINATION OF
M. Sc. Electronics
Jan-June 2021
Semester-II

Paper 1-Network Analysis and Synthesis

Max. Marks: 80, Min. Marks: 16
1. Student should be allowed to use Programmable Scientific Calculator in Examination hall.
2. Special graph paper viz. Polar graph & Semi log graph papers should be provided to the students in the examination hall.

Unit I - Mesh and Node Analysis and Network Theorems
Mesh and Node Analysis - Kirchhoff's laws , Star and Delta conversion, source transformation, mesh and node analysis of electric circuits, response of the network by differential equation and Laplace transform method ,initial conditions in the network.
Network Theorems - Thevenin's theorem, Norton's Theorem, Superposition, Millman theorem, Maximum power transfer theorem, and Reciprocity theorem, Tellegen theorem and Substitutions theorem .

Unit II – Coupled Circuit, Waveform Synthesis and Graph Theory Coupled Circuit – Dot convention and magnetic coupling
Waveform Synthesis – Standard signals, unit step function, ramp function, impulse function, initial and final value of f(t) from F(s), the convolution integral.
Graph Theory - Concept of a network graph, twigs and links, trees, co trees ,formation of incidence matrix ,cut-set matrix, tie-set matrix and loop currents, analysis of networks ,network equilibrium equation ,duality, network transformation

Unit III - Network Function and Frequency Response Plots
Network Function - Network function for one port and two port, the calculation of network functions - ladder networks and general networks, pole and zero of network functions, restrictions on pole and zero locations for driving point functions ,restrictions on pole zero locations ,time domain behavior from the pole and zero plot, stability of active networks.

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Frequency Response Plots- Magnitude and Phase plots, Root Loci, Bode Diagrams, Nyquist- Stability Criterion

Unit IV -Two Port Network Analysis

Relationship of two port variable , Z-parameters, Y- parameters, Hybrid parameters, ABCD parameters, conditions of reciprocity and symmetry, inter-relationship between parameter of two port network, different types of interconnections of two port networks.

Unit V- Network Synthesis

Concept, Procedure of Synthesis, Reactive Networks, Properties of Expressions of Driving point Admittances of L-C Networks, Pole-Zero Interpretations in L-C Networks. L-C Networks Synthesis-Foster's Canonic Form (First and Second Foster form), Significance of Elements in the Foster form, Cauer Canonic form of Reactive Networks-First and Second form of Cauer Networks, Applicability of Foster and Cauer forms, R-L & R-C Network Synthesis by Foster form, Identification of foster form , Identification of Admittance, R- L& R-C Network Synthesis by Cauer form, Identification of Admittance Function in Cauer form, Determination of end elements in Foster and Cauer R-L & R-C Networks.

TEXT BOOKS

1. Networks and System - D. Roy Choudhary, New Age International
2. Network Analysis: M.E. Van Valkenburg.PHI
3. Circuit theory (analysis and synthesis) - A. Chakrabarti, Dhanpat Rai and co.
2. Network Synthesis: M.E. Van Valkenburg.PHI

Paper 2 - Microprocessor and C++ Programming

Max. Marks: 80, Min. Marks: 16

1. Student should be allowed to use Non Programmable Scientific Calculator in Examination hall

Unit I - Micro-Computer System & 8085 Microprocessor Architecture

Microcomputer System & its operation- Overview of a basic Microcomputer structure and operation, Ideal microprocessor, Microprocessor evolution and types, Microprocessor initiated operation & Bus organization, internal data operation & registers, peripheral initiated operation.

Memory- Memory organization, memory map, memory & instruction fetch, types of memory. Interfacing Devices - Tri-state devices, buffer, decoder, encoder, latch.

Microprocessor Architecture - Introduction to 8085 Microprocessor, pin diagram & its function, bus timing, Demultiplexing of address & data Bus, generation of

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control signals, microprocessor architecture of 8085, decoding & execution of an instruction, memory interfacing, timing diagram of memory, read & write cycle.

Unit II - Instruction Set & Programming of 8085, Stack & Subroutines

Instruction classification, instruction format, addressing modes, basic instructions and simple programming ,Additional Instructions - DAA, DAD, LHLD.SHLD, PCHL, STC, XCHG, XTHL and programming, Code Conversion - BCD to Binary, Binary to BCD, Binary to ASCII, ASCII to Binary.

Stack & Subroutines - Concept of stack, PUSH/POP instruction, illustrative example, Concept of subroutines, call & return instruction, conditional call & return instruction, advanced subroutines concept.

Unit III - Counters, Time Delay, Interrupts & Interrupt Controller

Counters and Time Delay -Time delay using one register, Time delay using a register pair, flow chart & program for a hexadecimal counter and modulo 10 counter, delay calculations.

Interrupts - Interrupts of Intel 8085, hardware and software interrupts, vectored/non vectored interrupts, maskable/non- maskable interrupts, Interrupts priority concept, DI,EI, RIM, SIM instructions, pending interrupts.

Programmable Interrupt Controller - Architecture of 8259, initialization command words (ICW's), operational command words (OCW's), 8259 interrupts mode, simple initialization program for 8259.

Unit IV - Data Transfer & Peripheral Interfacing Devices, Co-processor

Format of data transfer, modes of data transfer, microprocessor controlled data transfer, peripheral control data transfer, peripheral I/O instruction, serial I/O lines, SOD and SID.

Programmable Peripheral Interfacing Devices - Programmable keyboard / display interface – 8279, Programmable peripheral interface – 8255, Programmable interval timer – 8253, Programmable Interrupt controller – 8259, Synchronous data communication device – 8251, DMA Controller 8257, RS 232 interface. Numeric co-processor 8087

Unit V- "Object Oriented Programming

Principles and Basic concepts, OOPs languages, Application of OOPs, Simple programming in C++, Tokens, expressions and control structures - Tokens, keyword, identifiers and constants, declaration of variables, operators in C++, manipulators, control structure.

Functions in C++ - main function, function references, return references, default arguments and constant arguments. Classes and Objects- C structures revisited,

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specifying class, C++ program with classes, arrays within Classes, memory allocation of objects, arrays of objects,
returning objects, pointer to members, local classes.

TEXT BOOKS

1. Microprocessor Architecture Programming - Ramesh S. Gaonkar & Application with 8085/8080 Penram Int. Pub2
2. 0000 to 8085: Introduction to Microprocessors for Engineers and Scientists, 2nd ed. Ghosh & Sridhar PHI
3. Fundamentals of Microcomputer & Microprocessor r - B.Ram, Dhanpat Roy Pub.
4. Object Oriented Programming E - Balaguruswamy with C++ Second Edition
5. PROGRAMMING IN C++ P.B.MAHAPATRA, S Chand & Co

ELT 203 Paper 3- Analog and Digital Communication Systems

Max. Marks: 80, Min. Marks: 16
1. Student should be allowed to use Non Programmable Scientific Calculator in Examination hall

Unit I Radiation and Propagation of Waves - Electromagnetic Radiation –Effect of environment, Propagation of waves –Ground Wave and Sky-wave Propagation – The ionosphere – Space waves – Tropospheric scatter propagation – Extraterrestrial communications
Introduction to Communication Systems -Block diagram of communication system –
Transmitter, Receiver, Modulation, Bandwidth requirements
Noise - Source of Noise, External Noise –Atmospheric Noise, Extra Terrestrial Noise, Industrial Noise, Internal Noise-Shot Noise, Resister or Johnson Noise ,Calculation of noise in Linear Systems, Noise Bandwidth, Power, Noise Temperature, Noise in Two Port Networks, Noise Figure, Cascaded stages, Measurement of Noise Figure, Signal in presence of Noise, Narrowband Noise.

Unit II – Amplitude Modulation System
Amplitude Modulation - Frequency spectrum of AM wave, Representation of AM wave, Power relation in AM wave, Single side band techniques – Suppression of carrier, suppression of side bands, vestigial side band,
Transmitters - Classification of radio transmitter, AM radio transmitter, Generation of AM -Transistor as AM Generator, balanced modulator, filter method, phase shift method, third method.

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Receivers – Classification of radio receiver, basic function of AM receiver, tuned radio frequency receiver, super heterodyne receiver, AM demodulation – RC demodulator, square law demodulator. Noise in Amplitude Modulated Systems, Comparison of various AM systems,

Unit III – Angle Modulation System

Angle Modulation – Frequency modulation, analysis of FM waveform, frequency spectrum, Bessel function, Narrowband FM and Wide Band FM, Phase modulation

FM Modulators and Transmitters - Method of frequency modulation – Direct method – reactance modulator (FET and varactor diode method), Indirect Method, pre-emphasis and de-emphasis

FM Demodulators and Receivers – Super heterodyne FM receiver – block diagram, amplitude limiter, FM demodulator –phase discriminator, ratio detector, PLL demodulator. Comparison of AM, FM and PM, , frequency division multiplexing(FDM).

Unit IV - Pulse Modulation System

Pulse Amplitude Modulation - Natural Sampling, flat top sampling, equalization signal recovery to holding, PAM modulator and demodulator. Pulse time modulation (PTM)- Generation of PTM signals, PTM modulator and Demodulator, time division multiplexing (TDM).

Pulse Code Modulation- Quantization of signals, quantization error, pulse code modulation (PCM), companding, Bandwidth of PCM System, Noise in PCM System, Differential pulse code modulation, Delta modulation, Adaptive Delta modulation.

Digital Modulation Techniques - Introduction, Binary Phase Shift Keying (BPSK), Differential Phase Shift Keying (DPSK), Quadrature Phase Shift Keying (QPSK), Quadrature Amplitude Shift Keying (QASK) and Binary Frequency Shift Keying (BFSK).

Unit V – Monochrome and Colour Television

Elements of a TV System - Concept of Picture and sound transmission and reception, Flicker, Composite Video Signal, signal transmission and Channel bandwidth, Monochrome picture tube, Television Camera tube - Vidicon and CCD. Monochrome TV transmitter and receiver (Block Diagram), Essentials of Colour TV - Three Colour theory, Luminance, Hue and saturation, Triniton Colour Picture tube, Block diagram of Colour TV transmitter and receiver, PAL Colour TV System. CCTV, HDTV, CATV and DTH, Concepts of Home Theatre

TEXT BOOKS

1. Principles of Communication Systems - Taub & Schilling, TMH
2. Principles of Communication Systems - George Kennedy, TMH
3, Communication System- Analog and Digital - R.P.Singh & S.D. Sapre TMH

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4. Radio Engineering - G. K. Mithal G.K. Pub.
5. Monochrome and Colour Television - R.L. Gulati, New Age International, Wiley Eastern Ltd. New Delhi.
8. Advanced Electronic Communication Systems: Tomasi PHI
9. Television Engineering – A.M. Dhake, TMH
10. Electronic communication, Roddy and Coolen, PHI, New Delhi,

ELT 204 Paper 4 - Electromagnetic Plane Wave, Transmission Lines and Microwave Devices

Max. Marks: 80, Min. Marks: 16

1. Student should be allowed to use Non Programmable Scientific Calculator in Examination hall

UNIT I - Electromagnetic Plane Wave

Electromagnetic Plane Wave - Electron motion in electric field , electron motion in magnetic field , electron motion in electromagnetic field, electric and magnetic wave equations, Maxwell equation, Poynting theorem, uniform plane wave and reflection, uniform plane wave propagation in free space and lossless dielectric, plane wave propagation in lossy media, Ionospheric propagation, conductors and dielectrics, skin depth, polarization, phase velocity and group velocity.

UNIT II - Transmission Lines and Antennas

Transmission Line - Basic equation , reflection and transmission coefficient , standing wave and standing wave ratio , line impedance and admittance, Determination of characteristics impedance, Fundamental of Smith Chart, Impedance Matching: Single and Double Stub Matching, microwave Coaxial Connectors.

Antennas – The Radiation mechanism, Current and Voltage distribution, Antennas gain, Antenna resistance, Bandwidth, Beam width and Polarization, effects of Antenna height, Dipole arrays, Folded dipole. Microwave Antennas - Parabolic reflector, Horn and Lens antenna, Special purpose antennas - Yagi, Log periodic and Loop antennas.

Radar– block diagram of Radar, frequencies and power used, Radar range equation.

UNIT III – Microwave Waveguides and Components

Waveguides - Rectangular Wave guide – TE and TM modes , power transmission, excitation in rectangular wave guide , circular wave guides – TE,TM and TEM mode,

Microwave Components - Waveguide Tee - E-plane tee, H-plane tee, Hybrid tee, scattering parameters (s-matrix), circulators, isolators , directional couplers.

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UNIT IV – Microwave Sources and Measurements

Microwave Sources - Reflex Klystron - principle of operation of velocity modulation, power output and efficiency, electronic admittance, Cylindrical Magnetron – principle of operation, equation of electron motions, cyclotron angular frequency , power output and efficiency.

Microwave measurement techniques, - Microwave bench, precautions, power measurement, bolometric method, attenuation, VSWR, impedance, frequency and Q of the cavity, standing wave measurements, impedance measurement, cavity resonator, dielectric measurements.

UNIT V - Microwave Semiconducting and Avalanche Transit -Time Devices

Microwave Semiconducting Devices

Microwave Transistor – Microwave Bipolar Transistor – principle and amplification phenomenon, power frequency limitation, Microwave Tunnel Diode – principle and characteristics of microwave tunnel diodes, JFET operation and characteristics. Microwave integrated circuit design, introduction, hybrid microwave integrated circuits (HMIC), monolithic microwave integrated circuit (MMIC), MIC materials, substrate material, conductor material, dielectric materials, resistive films, types of MIC'S, microwave monolithic integrated circuits (MMIC'S).

Transferred Electron Devices – Gunn Effect Diodes, GaAs diode Ridley Watkins Hilsum (RWH) theory – Differential negative resistance

Avalanche Transit -Time Devices - Read Diode - Avalanche multiplication, carrier current and external current, output power and quality factor. IMPATT Diodes and TRAPATT Diodes- Principles of operation, power output and efficiency

TEXT BOOKS

1. Microwave Devices and Circuits – Samuel Y. Liao, PHI Pub

2. Microwave Engineering – Annapurna Das, Sisir K. Das, Tata Mc Graw Hill.
3. Microwave and Radar Engineering - M. Kulkarni, Umesh Publication
4. Electronic Communication Systems - George Kennedy, 3rd Edition TMH
5. Introduction to electrodynamics by David J. Griffithe , PHI
6. Elements of engineering electromagnetics by Narayaaa Rao, PHI

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SYLLABUS PRESCRIBED FOR THE EXAMINATION OF

M. Sc. Electronics

July-Dec 2021

Semester III

ELT 301 Paper - 1 Advance Microprocessors and Microcontroller (AMM)

Max. Marks: 80, Min. Marks: 16

1. Student should be allowed to use Non Programmable Scientific Calculator in Examination hall

UNIT I *16-bit microprocessors*

8086 internal architecture; memory organization, 8086 basic configurations: minimum mode, maximum mode, 8284 clock generator, 8288 bus controller, system bus timings for minimum and maximum modes. Introduction to 8088, 80186, 80286, 80386, 80486

UNIT II *Programming of 8086*

8086 addressing modes, Instruction formats, instruction set: data transfer instructions, arithmetic instructions: binary, packed and unpacked arithmetic; branch instructions: conditional and unconditional branch instructions; loop instructions, flag manipulation instructions, shift and rotate instructions, byte and string; assembler directives; programming examples.

UNIT III *Interfacing*

Basic interfacing concepts; Interfacing memories: I/O mapped I/O, memory mapped I/O, 8086 memory interface, I/O operations: programmed I/O, Interrupt I/O, Direct memory access, Programming and interfacing of peripheral devices: programmable peripheral interface (8255), Interrupt controller (8259), DMA controller (8257); Co-processor (8087): architecture, data types, and interfacing.

UNIT IV *Microcontroller 8051*

8051 architecture: oscillator and clock, PC and data pointers, CPU registers, flags, and PSW; internal RAM; stack and stack pointer, SFRs, internal ROM, I/O ports; external memory; Counters and timers: timer counter interrupts, timing, timer modes of operation, counting, Serial Data I/O: serial data interrupts, data transmission, data reception, serial data transmission modes, Interrupts: timer flag interrupt, serial port

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interrupt, external interrupts, reset, interrupt control, interrupt priority, interrupt destinations, software generated interrupts.

UNIT V *Programming of Microcontroller 8051*

Instruction set: Moving data: addressing modes, external data moves, code memory read-only data moves, push and pop opcodes; Logical operations: byte and bit level logical operations, rotate and swap operations; Arithmetic operations: flags, incrementing and decrementing, addition, subtraction, multiplication and division, decimal arithmetic; Jump and call instructions: jump and call program range, jumps, calls and subroutines, interrupts and returns; simple programming examples.

TEXT BOOKS

1. Yu Cheng Liu, Glenn A. Gibson, **Microcomputer systems: The 8086/8088 family architecture, programming and design**, Prentice Hall of India, New Delhi.
2. Douglas V. Hall, **Microprocessors and interfacing**, Tata McGraw-Hill Company Limited, New Delhi.
3. Bhupinder Singh Chabra, **The Intel 8086/8088 microprocessor architecture programming design and interfacing**, Dhanpat Rai Publishing Company Limited, New Delhi.
4. Ramesh S. Gaonkar, **Microprocessor architecture, programming and application with 8085/8080A**, Wiley Eastern Limited, New York.
5. Kenneth J. Ayala, **The 8051 Microcontroller architecture, programming, and applications**, Penram International Publishing, India.
6. Barry B. Brey, **The Intel Microprocessors 8086/8088, 80186,80286, 80386 and 80486 Architecture, programming and interfacing,** Prentice Hall of India, New Delhi.
7. N. Senthil Kumar, M. Saravanan, S. Jeevananthan, S.K. Shah, **Microprocessors and Interfacing 8086,8051,8096 and advanced processors**, Oxford university press.

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ELT 302 Paper 2-Data Communication, Mobile and Wireless Communication

Max. Marks: 80, Min. Marks: 16

1. Student should be allowed to use Non Programmable Scientific Calculator in Examination hall

Unit I- Data Communication

Data Signal, Signaling & Data Transmission Media, Communication Mode-Half Duplex/Full Duplex, Data Communication System-Synchronous/Asynchronous Transmission, Serial/Parallel Data, Switching & Multiplexing-Circuit Switching, Message Switching, Packet Switching, Network Topology-Bus/Star/Ring/Mesh Topology, LAN, OSI Reference Model, Network Protocol(TCP/IP).

Unit II- Introduction to Mobile and Wireless Devices

Mobile and wireless devices, history, applications wireless transmission, frequencies for radio transmission, regulations, signals, antennas, signal propagation, multiplexing, modulation, wireless LANs and wireless WANs, spread spectrum, FHSS and DSSS spread spectrum technology, cellular systems, medium access control, specialized MAC.

Unit III- Telecommunications and Broadcast Systems

GSM, mobile services, system architecture, GSM subsystems, GSM communication frame, localization and calling, handover, security, new data services, satellite systems applications, GEO, LEO. MEO, routing, localization, broadcast systems, cyclic repletion of data.

Unit IV- Wireless Networks and others 3G Technologies

Wireless LAN, infrared v/s radio transmission, infrastructure and adhoc networks, IEEE 802.11, architecture (details of protocol not required), DFWMAC schemes, MAC frames, MAC management, roaming, HIPERLAN (just basics, frame and protocol details not required), Bluetooth, applications, physical layer, modes MAC layer, packet format, networking security, link management, brief discussions (frame details and protocols not required) on GPRS, DECT, TETRA, UMTS, IMT-2000, CDPD.

Unit V- Mobile Network and Transport Layers

Mobile network layer, requirements, entities, IP packet delivery, agent advertisement and discovery, registration, encapsulation and tunneling, optimization, messages, reverse tunneling, IPv6, DHCP, Mobile IP, DHCP, ad-hoc networks, mobile transport layer, traditional TCP, indirect TCP, snooping TCP,

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mobile TCP, fast transmit/fast recovery, transmission/time out freezing, selective retransmission, transaction oriented TCP.

TEXT BOOKS

1. Data Communication & Networking - Behrouz A Foruzon.
2. Wireless communications and networking" William Stallings, PHI
3. Data and Computer Communications – By William Stalling., 7th Ed., PHI
4. Mobile communications"-by Johan schiller, PEA, 2nd ED
5. Mobile and personal communications systems and services" Rajpandya, PHI
6. Computer Networks - Tanenbaum, PHI.
7 Data Communications and Distributed Networks, 3rd ed. Black PHI
8 Computer Networks: Protocols, Standards and Interfaces, 2nd ed. Black PHI

ELT 303 Photonics

Max. Marks: 80, Min. Marks: 16

Student should be allowed to use Programmable Scientific Calculator in Examination hall

Course Objectives:

- Photonic Devices have emerged as the key technology for optical communications, environmental sensing, biomedical diagnostics in the life sciences, energy efficient lighting and solar energy harvesting.
- Upon completion of this course, students should understand the functioning and design of most photonic devices in use. **Course Outcomes:**
- At the end of the Course students will be able to understand the basic components and devices of photonic integrated circuits.
- At the end of the Course, students should understand propagation in optical fiber couplers, fiber Bragg grating and long period fiber gratings and their applications
- At the end of Course, students should understand the area of silicon photonics which is an upcoming area of photonic integration with Electronics.

Unit I- Theory of Light, Light as Electromagnetic wave, Polarization of Light, Principle of superposition, Interference, Diffraction, Scattering, Photon nature of light, Light wave in homogeneous medium, Plane Electromagnetic Wave, Maxwell's Wave equation and Diverging Waves.
Basics of LED, and flexible display devices. Thin film deposition and characterization Techniques: XRD, TEM, SEM, EDX, Thin film active and passive devices,

Unit II -

Guide Wave Integrated Optic Devices: Planar and channel waveguides, Waveguide platforms on various materials and their fabrication techniques. Waveguide directional

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couplers, tapered waveguides and Y-junction splitters/combiners, Ring resonators, Mach-Zehnder interferometers/modulators. Sagnac interferometer/gyroscope. Coupling in and out of Photonic Integrated Circuits: Optical mode converters, prism and grating couplers.Wavelength-division multiplexing components: Mulitplexers, Demultiplexers, Multimode interferometers, Arrayed waveguide gratings.

Unit III - Solar Photovoltaics: Solar cell materials and their properties. Solar cell research: technology (silicon, organic, Dye sensitized, peroviakites), applications and limitations.Characterization and analysis: ideal cell under illumination- solar cell parameters,optical losses; electrical losses, surface recombination velocity, quantum efficiency - measurements of solar cell parameters; I-V curve & L-I-V characteristics, internal quantum yield measurements – effects of series and parallel resistance and temperature - loss analysis. Solar photovoltaic(PV) modules from solar cells, series and parallel connections, design and structure of PV modules.

Unit IV- Non Linear Optical processes

Introduction, Second Harmonic Generation,, susceptibility tensor, phase matching, propagation of EMW through second order nonlinear media, experimental technique in study second order non linearity Self Focussing and Defocussing, Optical Parametric Interactions, Chirped pulse amplifier, parametric oscillations, Optical Mixing, Four Wave Mixing, Multiphoton Absorption.

Unit V -Advances in Photonics and photonic Materials

Emerging materials for future Devices: Graphene, Carbon Nano tubes (CNT), ZnO, SiC etc. Low dimensional semiconductor devices – quantum wells, quantum wires, quantum dots

Silicon Photonics: Motivation towards silicon photonics, Silicon on Insulator (SOI) waveguides or nanowires .Optical fiber to silicon waveguide: edge, grating, evanescent coupling, spot-size converters. III-V integration with silicon photonics. Photonic modulators: electro-optical and thermo-optical effects.

Raman Scattering, Photrefractive effect, Photothermal Deflection effect, Photorefraction in diffusing medium, Squeezed state, Optical Solitons, Optical Bistability, Optical interconnect, Photonic switches, Optical Computers, Ultrafast phenomena

TEXT BOOKS

1. Optical Electronics - Ghatak Thyagarajan, University Press
2. Optoelectronics An Introduction: Wilson & Hawkes PHI
3. Optoelectronics & Photonics S.O.Kasap, Pearson
4. Optoelectronics Devices & Systems - S.C. Gupta, PHI Publication
5. Photonics Sasi Kumar PHI

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ELT 304 Paper 4- Power Electronics, Information Theory and Coding

Max. Marks: 80, Min. Marks: 16
1. Student should be allowed to use Non Programmable Scientific Calculator in Examination Hall

Unit I- Thyristors,Controlled Rectifiers and Commutation Techniques
Thyristors – Thyristor Characteristics, Two- transistor model of Thyristor, Turn ON and Turn OFF of Thyristor, di/dt protection, dv/dt protection, Type of Thyristors, Series operation and Parallel operation of Thyristors, Thyristor Firing Circuits, Unijunction Transistor. Controlled Rectifiers – Single Phase semiconverter with RL load, Single Phase full converter with RL load
Thyristor Commutation Techniques – Natural Commutation, Forced Commutation, Self Commutation, Complementary Commutation, External Pulse Commutation,

Unit II- AC Voltage Controllers, DC Choppers and Inverters
AC Voltage Controllers –Introduction, Principle of ON-OFF control, Principle of Phase control, Single Phase bi-directional controllers with inductive loads, Cycloconverters.
C Choppers – Principle of operation, Classification of Choppers – Class A, Class B, Class C, Class D and Class E Choppers.
Inverters-Introduction, classification of Invertors, Single phase, full bridge Voltage source inverter with RL load,

Unit III- Power Drives- DC Motor and AC Motor
DC Motor – Basic Characteristics, Speed control of DC motors – Armature voltage, Armature Resistance and Field flux controls, Solid state speed control of DC motor – Single Phase half wave converter, Single phase full wave converter.
AC Motor (Induction Motor) – Construction & Principle, Speed control of Induction motor – Stator voltage, Stator frequency, Pole changing, Rotor resistance and Slip power recovery control, Basic Construction and principle of Stepper motor

Unit IV – Power conditioners:
EMI/ RFI filter, CVT, Voltage regulators, Solid state regulators, UPS online & OFF line, reliability of UPS system. Batteries used for UPS, Important terms related to the UPS System & comparison of UPS system.
Applications of Power Electronics: Electronic ballast, Power factor correction, Induction heating, Dielectric heating.

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Unit V – Information Theory :Introduction, Unit of Information, Entropy, Rate of Information, Joint Entropy and Conditional Entropy, Mutual Information, Channel Capacity-noise-free channel, symmetric channel, Binary Symmetric channel & cascaded channel, Shannon's Theorem, Continuous Channel, Capacity of a Gaussian Channel: Shannon Hartley Theorem, Bandwidth S/N Trade-off.

Coding – Introduction, Coding Efficiency, Shannon-Fano Coding, Huffman Coding, Error-Control Coding, Block Codes, Convolution Codes.

TEXT BOOKS

1. Power Electronics - Muhammad H. Rashid, Prentice Hall of India, Second Edition, New Delhi
2. Power Electronics - A.K. Gupta & L.N. Singh, Dhanpat Rai Publishing Company, 1st Edition
3. Power Electronics - J. Asger, PHI Publication.
4. Communication System - R.P.Singh & S.D. Sapre TMH Analog and Digital
5. Power Electronics - R.M. Jalnekar & N.B. Pasalkar
6. Pspice Simulation of Power Electronic Circuits: Raymond Ramshaw
8. Communication Systems-Simon Haykin, John Wiley & sons, NY, 4th Edition
9. Information theory- F.M Reza, McGraw Hill
10. A Text book of Electrical Technology (Volume –II) - B. L. Thereja & A K Theraja, S Chand & Co. Ltd (2006)
11. Principles of Electrical Machines- V K Mehta & Mehta,S Chand & Co. Ltd (2006)
12. Elecrtrical Machines – A Hussain, Dhanpat Rai & Co

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SYLLABUS PRESCRIBED FOR THE EXAMINATION OF
M. Sc. Electronics
Semester-4
(Jan-June 2022)

ELT 401 Paper 1 -Digital Signal Processing

Max. Marks: 80, Min. Marks: 16
1. Student should be allowed to use Non Programmable Scientific Calculator in Examination hall

Unit I- Discrete Time Signals, Systems and Z-Transform
Discrete Time Signals, Systems-An introduction to analog signal processing, Discrete time signals & systems- discrete time signals (sequences), Linear shift, Invariant systems, Stability & Casuality, linear constant coefficient Differential equations, Frequency domain representation of discrete time systems & signals, Sampling of continuous time signals.
Z-Transform- Introduction, Z-transforms (of finite length sequences, Right sided, left sided & two sided sequences) Inverse Z-transform, Z-transform theorems & properties – Region of convergence of rational Z-transform, Linearity, Shift of a sequence, multiplication by an exponential sequence, Initial value theorem, Convolution of sequences, system functions.

Unit II-Discrete Fourier Transform
Discrete time fourier transform (DTFT), Representation of periodic sequence - Discrete Fourier series(DFS), Properties of the Discrete Fourier series- Linearity, Shift of a sequence, symmetry properties, periodic convolution; Fourier representation of finite duration sequences- The Discrete Fourier transform(DFT), Properties of discrete Fourier transform - Linearity, Circular shift of a sequence, Symmetry Properties, Circular convolution, Linear Convolution using the Discrete Fourier Transform.

Unit III- Fast Fourier Transform and Network Structures
Fast Fourier Transform (FFT), Inverse DFT, Radix FFT.
Signal Flow Graph Representation of Digital Network, Matrix Representation of digital

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Networks, Basic network structures for IIR systems (Direct form, cascaded form, and parallel form) Transposed forms, Basic network structures for FIR systems (direct form, cascaded form).

Unit IV- Digital IIR filter

Digital filter design techniques- design of IIR digital filters from analog filters, impulse invariance, Bilinear Transformation, Design examples: Analog-Digital Transformation – Digital Butterworth Filters (impulse invariance, bilinear transformation), Digital Chebyshev filters (impulse invariance, bilinear transformation), Comparison of IIR and FIR Digital Filters.

Unit V- Digital FIR filter

Finite impulse response (FIR) Filter Design, Rectangular, Triangular, Hanning, Hamming, Blackman and Kaiser Window, Linear phase and Optimal Filter .
Application Digital Signal Processing-speech processing, speech analysis- short term Fourier analysis, cepstral analysis & linear predictive analysis, speech coding, channel vocoder

TEXT BOOKS

1. Digital Signal Processing - A.V. Oppenheim & Schafer. PHI
2. Discrete Time Signal Processing - A.V. Oppenheim & Schafer. PHI
3. Digital Signal Processing - Johny Jonson, Pearson PHI
4. Digital Signal Processing - Proakis
5. Digital Signal Processing -Vallavaraj, Salivahanan, Ghanapriya, THM

ELT 402 Paper 2-Optical Communication and Satellite Communication

Max. Marks: 80, Min. Marks: 16
1. Student should be allowed to use Non Programmable Scientific Calculator in Examination hall

Unit I-Optical Fibers Optical fiber theory and applications, ages and disadvantages, parameters and types of optical fibers, Propagation of light through optical fiber ,single mode step index fiber, multimode step index fibers, multimode graded index fibers, Comparison of Three types of Optical fibers, Acceptance angle and acceptance cone, Numerical Aperture, , construction of optical fiber cables,
Transmission Characteristics of Optical Fiber: Attenuation in Optical Fibers, loss mechanisms - absorption and Rayleigh scattering, Radiation losses, Wavelength dispersion, intermodal and intramodal, Bending losses, Coupling losses: misalignment and mismatch losses

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Unit II- Principle of Optical Communication

Optical Fiber Communication System Block Diagram

Optical sources: Heterojunction LED, Edge emitting LEDs, Injection Laser LEDs

Light Detectors: PIN Diode and Avalanche Photodiode, Structure of In, GaAs APDs Characteristics of Light Detectors, Connector types and splices, Optical Fiber System Link Budget, Optical fiber manufacturing processes. Optical fiber testing and parameter (cut off

Wavelength, loss per unit length, numerical aperture, bending loss, connector/spliceloss) measurement

Unit III- Optical Fiber Communication Systems and Applications

Typical Fiber Optic Communication System, Optical Transmitter, Optical Receiver, Optical Repeaters, Optical Amplifiers, semiconductor optical amplifiers, EDFA, Raman Amplifier. Basic idea of WDM and DWDM systems, System Architecture: Point to point link, Distributed Network, AN Fiber Optic Sensors in Health care, Optical Computing, Optical Logic Gates

Unit IV-Satellite Communication - I

Satellite Communication – Introduction, Kepler's laws, orbit, Power systems, Satellite Frequency Allocations and Band Spectrum, Elements of a Satellite Communication System, Active and Passive Satellites, Modem and Codec, Communication Satellite Link Design – General Link Design Equations, Effective Isolated Radiated Power (EIRP), System Noise Temperature, C/N and G/T ratio, Atmospheric and Ionosphere Effects on Link Design, Uplink Design, Complete Link Design, Interference Effects on complete link design, Earth Station parameters.

Unit V- Satellite Communication - II

Satellite orbits – synchronous orbit, orbital parameters, Satellite location with respect to the earth, Look Angles, Earth coverage and Slant range. Satellite Transponder model, Satellite RF Front End, Satellite Carrier Processing, Antenna – Antenna parameters, Gain, Resistance, Bandwidth, Beam-width and polarization, Parabolic antenna, Application of Satellite Communication in Television - Direct Home Broadcast, Telephone services and Data Communication.

TEXT BOOKS

1. Optical Fiber Communication -G. Keiser, Mc. Graw Hill
2. Fiber Optics Communication -D. C. Agrawal
3. Satellite Communication -D.C. Agrawal, Khanna Pub.
4. Satellite Communication -R.M. Gagliardi
5. Fundamentals of Optical Fibre Communication: Satish Kumar PHI
6. Optical fibre and Laser Anuradha De New Age International Publishers
7. Optical Fiber Communication: V.S.Bagad Technical Publications

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8. Optical Fiber Communications', John Senior: PHI.
9 Electronic communications, Roddy and Coolen, PHI, New Delhi,

ELT 403 Paper 3- Automatic Control System and Artificial Neural Network

Max. Marks: 80, Min. Marks: 16
1. Student should be allowed to use Non Programmable Scientific Calculator in Examination Hall
2. Special graph paper viz. Polar graph & Semi log graph papers should be provided to the students in the examination hall.

Unit I - Fundamental of Control System
Basic Definition, Classification of Control System, Open Loop & Closed loops System, Effect of feedback on System response, Impulse Response & Transfer Function, Block diagram, Block Diagram Reduction Techniques. Signal Flow Graph-Basic Definition in SFG, Rule for SFG, Properties of SFG, Masons Gain Formula.

Unit II -Time Domain analysis and Stability of Linear Control System
Time Response of Continuous Data system, test Signal ,Steady State Errors and error constants, Unit Step response, Time Domain specifications, time Response of first order System, Transient Response of Prototype second order System, effect of adding a zero to the system, Stability of Linear Control System-Absolute Stability, Relative Stability, Routh-Hurwitz Criterion-Ruth Tabulation, Special Cases.

Unit III- Frequency Domain Analysis and Frequency Response Plots
Frequency Domain Analysis - Frequency Response of closed loop control System, Frequency Domain Specifications of prototype Second Order System, Nyquist Stability Criterion and plot, Root Loci- basic properties, Relative Stability-Gain Margin & Phase Margin, Correlation Between Time & Frequency response, Polar Plot, Bode Plot.

Unit IV-State Variable Analysis and Controllors
State Variable Analysis and Design – Concept of state variables, state model, state model for linear continuous time system, diagonalization, solution of state equations, concept of controllability and observability, PID Controller, Theory of lag, lead and lag-lead compensators.

Unit V- Artificial Neural Network
Introduction to ANS Technology-Models of a neuron, neural networks, viewed as directed graph, feedback from neurons to ANS, **Learning and training-** Hebbian,

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memory based, competitive, error-correction and learning. **Assignment problem** supervised and unsupervised learning. **Network architectures-Single layered-** feed forward networks, multi-layered feed forward networks, Activation and Synaptic Dynamic. **Stability and convergence-** single layered perception - least mean square algorithm, multilayered perceptions - backpropogation algorithm

TEXT BOOKS

1. Control systems Theory & Application - Samarajit Ghosh (Pearson Edu)
2. Control System Engineering - B.C.Kuo(PHI)
3. Control Systems Engineering - I.J. Nagrath, M. Gopal
4. Artificial Neural networks - B. Yagna Narayan
5. Neural Computing -Philips D. Wasserman
Theory and practice -Vannostrand Reinhold

ELT 404 Paper 4 – Embedded Systems , Microcontrollers and Advanced Instrumentation

Max. Marks: 80, Min. Marks: 16
1. Student should be allowed to use Non Programmable Scientific Calculator in Examination hall

Unit I- Introduction to Embedded systems:
Introduction, Application Areas, Categories of embedded systems, Overview of embedded systems architecture, Specialties of embedded systems, challenges and issues in embedded software development Recent Trends, hardware architecture, Software architecture,core platform development, boot sequence, development/testing tools.
Fundamentals of Internet of Things (IoT) for communication and Cloud Computing.

Unit – II
FPGA Architecture Introduction to Programmable logic, Basic Components of FPGA (LUT, CLB, Switch Matrix, IOB), Basic FPGA Architecture
PIC Microcontrollers – Introduction to PIC 16C6x/7x family microcontrollers, Architecture, Registers, Register File Structure, Addressing Modes, Instruction set. Interrupt Structure, Timers, Counters, I/O Port Concepts, Peripheral Interfacing and Applications,
Basics of ARM Architecture: Introduction to ARM microprocessor and its features, Architecture, Programming model.
CISC and RISC architecture comparison, advantages of RISC, Power saving methods

Unit III
Concept of Measurement & Transducers

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Basic concept of Measurement, Performance & Static Characteristics, Error in Measurement, Types of Errors-Gross, Systematic & Random,

Fundamental Concept Transducers – Resistance, Inductance, Capacitance, Piezoelectric, Thermoelectric, Hall effect, Photoelectric, Measurement of displacement, velocity, acceleration, force, torque, strain, temperature, pressure, flow, humidity, thickness, pH. Measuring Equipment – Measurement of R, L and C, Bridge and Potentiometers, voltage, current, power, energy, frequency/time, phase,

Unit IV- Instrumentation Electronics

Instrumentation Amplifiers, Basic Characteristics, D.C. Amplifiers, Isolation Amplifiers, Feedback Transducers system, feedback Fundamentals, Inverse Transducers, Temperature Balance System. Digital Multimeters, CRO, Digital Storage Oscilloscope, Spectrum Analyzer., Impedance analyzer

Advanced Instrumentation Systems

Semiconductor sensors; smart sensors; micro sensors; IR radiation sensors; ultrasonic sensors; fibre optic sensors; chemical sensors; bio sensors; thermometry and thermography; nano instrumentation; environmental pollution monitoring;

Unit V-Biomedical Electronic Instrumentation and Measurements

Introduction to biomedical instrumentation, sources of bioelectric potentials, electrodes- electrode theory, biopotential electrodes, biochemical transducers, cardiovascular measurements- electrocardiography, measurement of blood pressure, blood flow and heart sound, plethysmography, the elements of intensive care monitoring; calibration and reparability of patient monitoring equipment, pace makers. MEMS and its applications Sensors for IoT applications.

TEXT BOOKS

1. Embedded systems - Raj Kamal, TMH
2. Embedded/Real Time Systems – Dr.K.V.K.K.Prasad, dreamtech Press.
3. FPGA based System design by Wayne Wolf
4. 2. Digital Systems Design With FPGAs And CPLDs By Ian Grout, Elsevier(2008)
5. Unleash the System On Chip Using FPGAs and Handel C By Rajanish K. Kamat, Santosh A. Shinde, Vinod G Shelake, Springer (2010)
6. Design with PIC Microcontrollers – John B.Peatman, Pearson Education Asia
7. PIC Microcontrollers: An Introduction to Microelectronics, Martin P. Bates, Elsevier.

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8. D.V.S. Murti, **Transducers and Instrumentation**, PHI Learning Pvt Ltd, New Delhi.
9. Douglas A. Skoog, F. james Holler, and Stanley R. Crouch, **Instrumental Analysis**, CENGAGE Learning, Indian Edition.
7. Internet of Things (IoT) – Jeeva Jose, Khanna Publishers, Delhi

BOOK FOR REFERENCE:

1. Intel Embedded Microcontrollers and Processors Vol. I

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ELP 105 LAB COURSE "A"- ANALOG ELECTRONICS LAB

M.Sc. Electronics

July-Dec 2020

Semester I

Max. Marks: 100, Min. Marks: 20

1. To study the Astable and Monostable Multivibrator using IC741.
2. To study the RC Phase Shift Oscillator by determining its frequency of oscillation and Compare calculated and observed frequency.
3. To study the Schmitt Trigger using transistor and IC7413 by observing the output Waveform.
4. To study the Colpit Oscillator, determine its frequency of oscillation and compare the Calculated and observed frequency.
5. To study the Negative Feedback Amplifier by measuring closed loop gain and gain bandwidth product.
6. Calculation of barrier height and ideality factor at room temperature (for Si and GaAs devices) from the *I-V* characteristics.
7. Calculation of diode parameters at varying frequency from the *C-V* characteristics.
8. Calculation of semiconductor conductivity type and carrier concentration using Hall Effect.
9. Calculation of semiconductor resistivity and band gap using Four-Probe method.
10. Calculation of carrier mobility and drift velocity using an experimental setup.
11. Verification of following network theorems (1) Superposition (2) Thevenin`s (3) Nortan`s theorem.
12. To study and plot the MOSFET characteristics.
13. To study the Active Band pass filter and calculate its (1) Bandwidth: - Lower cutoff & upper cutoff frequency. (2) Quality factor.
14. Construct a Wein Bridge Oscillator and determine its frequency of oscillation and compare calculated and observed frequency.
15. To study the Active Low pass filter and to evaluate: -(1) Cutoff frequency, (2) Band pass gain, and (3) Plot the frequency response.
16. To study the Clipping circuits as positive and negative logic.
17. To study the Clamping circuits as positive and negative logic.
18. To Study the phototransistor characteristics.
19. To study the comparison of Schmitt trigger and phototransistor.

Syllabus revised & approved by Board of Studies in Electronics on 18th Jan., 2020

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20. Verification of the Maximum Power Transfer theorem.
21. . To study the characteristics of JFET (Junction field effect transistor) in common source configuration & evaluate— 1. AC drain resistance, 2. Amplification factor and 3. Drain Resistance.
22. To study the operation of Class B Amplifier.
23. To study the Z parameter of a passive Two Port Network.
24. To study the Op – Amp as voltage to current converter.
25. To study of characteristics of NPN transistor in common emitter configuration and evaluate— 1. Input resistance, 2. Output resistance and 3.Current gain.
26. To study the Active High pass filter and to evaluate:--
    a. Low cutoff frequency, (2) Bandpass gain, and (3) Plot the frequency response.
27. To study, identify and testing the electronic components using Physical and electronic equipments (CRO, Digital Multi Meter).
28. To study the Clipping and Clamping circuits as positive and negative logic using expEYES-17 kit.
29. To study transfer characteristic and functional verification of a Weighted Resistor D/A Converter.
30. To study transfer characteristic and functional verification of a Integrated D/A Converter.
31. To study transfer characteristic and functional verification of a Ladder Network D/A Converter.
32. To study and testing the working of a counter A/D converter.
33. To study and testing the working of a monolithic A/D converter.
34. To study and analysis of comparator operational amplifier.
35. To study of operational amplifier as Integrator and Differentiator.
36. To study of operational amplifier as Square Wave Generator.

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37. To study and observe buffer operational amplifier.

38. To study and observe operational amplifier as Adder and Subtractor.

Note : Each student has to perform at least fifteen experiments. The teacher in-charge may add or delete experiments as per the availability of the equipment and need of the course .

Reference Books

1 .Laboratory Experiments and PSPICE Simulations in Analog Electronics Maheshwari & Anand PHI

2 Laboratory Manual for Operational Amplifiers and Linear ICs, 2nd ed. Bell PHI

3. Student Reference Manual for Electronics Instrumentation Lab Wolf & Smith PHI

4. ELECTRONIC LAB PRIMER By B. Sasikala, S. Poorna Chandra S.Chand Pub

ELP 106 LAB COURSE "B"- DIGITAL ELECTRONICS LAB

M.Sc. Electronics

July -Dec 2020

Semester I

Max. Marks: 100, Min. Marks: 20

List of Experiments: -

1. Verify the following Boolean expressions--

i) A + A'B = A +B ii) AB + AB' = A

iii) AB + A'C + BC = AB + A'C iv) AB + A'C = (A + C)(A' + B).

2. To study the operation of 4 bit binary full adder and subtractor (IC 7483) having input and output carry bits. Add and subtract any two binary numbers of four bits.

3. To study the characteristics of C-MOS integrated circuits, verify the operation of C-MOS Inverter/NAND gate ICs and study the voltage level of C-MOS for proper ON/OFF (logic 1 or logic 0) condition.

4. To study the interfacing of C-MOS to TTL IC's and vice-versa. Different TTL logic gates and C-MOS logic gates with pull up resistance are provided for interfacing.

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5. To study the master slave J-K flip-flop and verify truth table.

6. To study R-S/D/T flip-flops using NAND ICs and verify truth table.

7. To study the operation of shift register as serial in parallel and parallel in serial mode.

8. To study the operation of shift register as parallel in parallel and serial in serial mode.

9. To study write/read operation of digital data into semiconductor memory using IC 7489. Store and retrieve some set of data. (RAM)

10. To study the operation and application of a modern LSI D/A converter. Parallel binary Inputs from switches are applied to DAC, which in turn converts the binary number into a proportional output voltage.

11. To study the operation of modulo-n-counter as MOD 3 & MOD 4 and verify the Truth Table.

12. To study the operation of modulo-n-counter as MOD 8 & MOD 9 and verify the Truth Table.

13. To study the operation of a Presetable Divide by N Counter and verify its truth table.

14. To study the operation of Multiplexer IC having 16: 1 channels.

15. To study the operation of Demultiplexer IC having 1:16 channels and 4 select inputs.

16. To study the operation of BCD Up-Down Counter.

17. To study the operation of Memory programming with seven segment display.

18. To study the operation of comparison of JK flip-flops and verify the difference with Timing diagram.

19. To study and verify the truth table of Parity Generator and Checker.

20. Verification of operation of IC 74190 as mod- N programmable counter.

21. To study the Binary to BCD converter.

22. To study the BCD to Decimal converter.

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23. To study the Binary to Gray code converter and Gray to Binary code converter.

24. To study the 4- bit Synchronous binary up/down counter.

25. To study the 4- bit Asynchronous binary up/down counter.

Any other experiment of equal standard relevant to syllabus can also be set.

Note: -Students have to perform at least 15 experiments from the above list.

Books:

1. Laboratory Manual for Operational Amplifiers and Linear ICs, 2nd ed. **Bell PHI**

2. Student Reference Manual for Electronics Instrumentation Lab Wolf & Smith **PHI**

ELP 205 LAB COURSE "C"- ANALOG AND DIGITAL COMMUNICATION LAB

M.Sc. Electronics

Jan-June 2021

Semester II

Max. Marks: 100, Min. Marks: 20

List of Experiments :-

Analog Communication

1. To study the operation of balanced modulator DSBSC using IC 1496.
2. To study the phase modulation using IC 2206 and calculate the modulation index.
3. To study amplitude modulation and demodulation and construct and AM generator and a diode detector and observe its operations under various conditions.
4. To demonstrate (i) use of 4046 PLL as an FM modulator. (ii) Use of 4046 PLL IC as an FM demodulator.
5. To study the characteristics and testing methods if TT attenuators.
6. To study the Carrier Wave (CW) operation of Klystron tube and determine its operating frequency.
7. To study the Square Wave operation of Klystron tube and determine its operating frequency.

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8. To study the modes of Klystron tube.

9. To determine the frequency and wavelength of rectangular waveguide, working on TE10 mode.

10. To determine the standing wave ratio (SWR) of Klystron tube.

11. To determine the Reflection Coefficient of Klystron tube.

Digital communication-

1. Study of signal sampling and reconstruction techniques and to verify Nyquist criteria and tracing.

2. Study of PAM, PWM and PPM modulation and demodulation techniques.

3. Study of TDM pulse amplitude modulation and demodulation.

4. Study of pulse code modulation and demodulation techniques.

5. Study of delta and adaptive-delta modulation methods.

6. Study of Phase Shift Keying Modulation and Demodulation Technique.

7. Study of Amplitude Shift Keying Modulation and Demodulation Technique.

8. Study of Frequency Division Multiplexing and Demultiplexing.

9. Study of Frequency Shift Keying (FSK) modulation.

9. Study of DPSK modulation.

Any other experiment of equal standard relevant to syllabus can also be set.
Note: -Students have to perform at least 10 experiments from the above list.

Books: Laboratory Experiments and PSPICE Simulations in Analog Electronics Maheshwari & Anand PHI

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ELP 206 LAB COURSE "D"- 8085 MICROPROCESSOR PROGRAMMING, STUDY CARDS AND INTERFACING LAB

M.Sc. Electronics
Jan-June 2021
Semester II

Max. Marks: 100, Min. Marks: 20

List of Experiments:-

1. Program of 8085 to add 8-bit numbers from memory & display result to C060H memory location & carry in C061 H.
2. Program of 8085 of 8085 to transfer the data of 16 consecutive locations into other 16 Consecutive locations in forward order and vice versa
3. Program of 8085 to search the memory location that contained 05 H data in a string of length of 16 byte and display it to memory location to C060 H.
4. Program of 8085 to search number of 05 H data in a string of length of 16 byte and display it to memory location to C060 H.
5. Program of 8085 to multiply two 8-bit numbers.
6. Program of 8085 to divide two 8-bit numbers.
7. Program of 8085 to solve a Boolean Equation which rep. Combinational logic as follows:-

   X= A' (B+C). D' + A.B. (D+C), A.B.C. & D are four independent variables.
8. Program of 8085 to convert BCD into its equivalent binary number.
9. Program of 8085 to convert Binary number into its equivalent unpacked BCD number.
10. Program of 8085 to count the number of Zeros, positive and negative number in a series of 16 bytes.
11. Program of 8085 to convert Binary number into its equivalent ASCII number.
12. Program of 8085 to convert ASCII into its equivalent binary number.
13. Program of 8085 to find the largest and smallest number in a data array.
14. Program of 8085 to arrange the data array in ascending and descending

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order.

15. Program of 8085 to add a series of data of 16 consecutive memory location and display the result in C060 H and carry in C061 H memory location using subroutine.

16. Program of 8085 to subtract two 8-bit data from memory location using 2's complement method and display the result in C060 H and borrow in C061 H.

Note: -Students have to perform at least 15 Programs of 8085 from the above list.

*** STUDY OF 8255 CARD ***

1. Program 8255 in mode-0; i.e. simples I/O mode Program Port-A, Port-B, Port-C in O/P mode, transmit data from keyboard to all the ports.

2. Repeat program no.(1), with all ports in I/P mode. Store data to M.P.U.'s registers

3. Program 8255 in B.S.R. mode. Set port-C in O/P mode Using appropriate delay set/reset PC.

4. Program 8255 in mode-1; i.e. strobe I/O mode Program Port-A, Port-B is in mode-1 and Port-A is in O/P mode and Port-B is in I/P mode and Port-C is used in control signal.

5. Program 8255 in mode 0 i.e. simple I/O mode. Program Port A in I/P mode and Prot B in output mode.

6. Program 8255 in mode 0 i.e. simple I/O mode/ Program Port B in I/P mode and Port A in output mode.

7. Program 8255 in mode 0 i.e. simple I/O mode. Program Port A in I/P mode, Port B in input mode. Read data from Port A&B, add it & display

*** STUDY OF 8253 CARD ***

8. Program 8253 in mode-0 i.e. interrupts on terminal count. Select counter c; Read/load lower 8-bits & then higher bits. Draw and explain the function of Gate, Out & Clock Signals.

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9. Program 8253 in mode 1. Draw and explain the function of GATE, OUT and CLOCK Signals.

10. Program 8253 in mode 2. Draw and explain the function of GATE OUT and CLOCK Signals.

11. Program 8253 in mode 3 to generate square wave. Draw and explain the function of GATE, OUT and CLOCK Signals.

*** STUDY OF LBDR CARD ***

12. Study of Buffer IC-74L8245 on L.B.D.R. Card using 8085 M.P.U. kit.

13. Study of Latch IC-74L8245 on L.B.D.R. Card using 8085 M.P.U. kit.

14. Study of LBDR as 2 & 4 decoder.

15. To access memory locations (RAM) specified by generation control signals on L.B.D.R.
card using 8085 M.P.U.

*** STUDY OF 8259 CARD ***

16. Study of master 8259 in stand-alone mode. Generate and interrupt request-using 8259
and display the respective interrupt in address field.

17. Study of 8259 in cascaded mode i.e. in 8259 as master and the other as slave. Generate
an interrupt request using 8259 and display the respective interrupt in address field.

*** STUDY OF 8251 CARD ***

18. Interface 8251 with 8085 M.P.U. and program it in asynchronous transmitter mode, use
8251 Group A.

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19. Interface 8251 with 8085 M.P.U. and program it in asynchronous receiver mode, use 8251 Group A.

20. Interface 8251 with 8085 M.P.U. and program it in synchronous transmitter mode, use 8251 Group A.

21. Interface 8251 with 8085 M.P.U. and program 8251 Group A is in synchronous transmitter mode and 8251 B is in synchronous receiver mode.

***STUDY OF 8237/57 CARD ***

22. Interface 8237 IC with 8085 M.P.U. memory to I/O transfer (Read Mode)

23. Interface 8237 IC with 8085 M.P.U. and Study memory to I/O transfer in block transfer mode (write mode).

24. Interface 8237 IC with 8085 M.P.U. and study I/O to memory transfer in single transfer mode (write mode)

25. Interface 8237 IC with 8085 M.P.U. and study I/O to memory transfer. In this mode data stored at 4150H to 415AH

Note: -Students have to perform at least 5 Study Cards from the above list.
PIO Card

***STUDY OF DAC CARDS ***

26. Program to demonstrate DAC as positive going staircase (or ramp) generator.

27. Program to demonstrate DAC as triangular wave generator.

28. Program to demonstrate DAC as exponential binary staircase generator.

29. Program to demonstrate DAC as R-C charging and discharging waveform.

***STUDY OF DYNA THUMBWHEEL CARDS ***

30. To study interfacing of Thumbwheel with microprocessor based system as Dyna-85.

***STUDY OF SERIAL DISPLAY INTERFACE CARDS ***

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31. To study interfacing of Serial Display Interface Card with microprocessor based system

as Dyna-85.

Note: -Students have to perform at least 2 PIO Cards from the above list

Any other experiment of equal standard relevant to syllabus can also be set.

ELP 305 LAB COURSE "E"- OPTICAL ELECTRONICS AND PHOTONICS M.Sc Electronics
July-Dec 2021
Semester III

Max. Marks: 100, Min. Marks: 20

List of Experiments: -

1- To calculate the diameter of a pinhole using Laser.

2- To observe the diffraction pattern and calculate the slit width using single slit.

3- To determine the Grating pitch of transmission Grating.

4- To study the output characteristic of Phototransistor.

5- To study the I-V characteristic of Photodiode.

6- To study the characteristic of LED.

7- To determine the I-V characteristics of PV module with varying radiation and temperature level.

8- To determine the P-V characteristics of PV module with varying radiation and temperature level.

9- To determine the I-V and P-V characteristics of series combination of PV module.

10- To determine the I-V and P-V characteristics of parallel combination of PV module.

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11- To show the effect of variation in tilt angle on PV module power.

12- To study the V-I characteristics of DIAC with positive and negative biasing.

13- To study the Optical transducer in Optically Controlled Switching System.

14 To study the Optical transducer characteristics of photovoltaic cell.

15- To study the Optical transducer characteristics of photoconductive cell.

16- To study the Optical transducer characteristics of filament Lamp.

17- To study the characteristics of phototransistor.

18- To study the characteristics of PIN photodiode.

19- To study the effect of variation in tilt angle on PV module power.

20- To determine the Planck's constant.

21- To study the I-V characteristic of LED using expEYES-17 kit.

22- To study the characteristic of LDR using expEYES-17 kit.

23- To calculate velocity of sound using expEYES-17 kit.

For Optional Paper Instrumentation Lab

Transducer control system Trainer kit

1. To study the characteristics of a 3 wire RTD and to observe the change in resistance as
   Temperature increases (Wheatstone bridge).
2. To study the application of 2 wire RTD in a potentiometer circuit.
3. To study the application of 3 wires RTD in a Wheatstone bridge circuit.
4. To study the characteristics of thermocouple and observe the change in output voltage with the change in temperature.
5. To study semiconductor diode as a temperature sensor.
6. To study transistor as a temperature sensor.

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7. To study the application of thermistor in a DC wheatstones bridge circuit.
8. To study the application of thermistor in a non- inverting Op – Amp circuit.

Thyristor Application trainer

1. To study & plot the SCR characteristics.
2. To study & plot the UJT characteristics.
3. To study & plot the DIAC characteristics.
4. To study & plot the TRIAC characteristics.

Virtual Instrumentation Using National Instrument LabView Software

1. Design a Virtual Instrument of Half adder digital circuit using LabView.
2. Design a Virtual Instrument of Full adder digital circuit using LabView.
3. Design a Virtual Instrument of Half subtractor digital circuit using LabView.
4. Design a Virtual Instrument of Full subtractor digital circuit using LabView.
5. Design a Virtual Instrument. to find maximum & minimum amplitude of given waveform using LabView.
6. Design a Virtual Instrument to convert Analog waveform to Digital waveform using LabView.
7. Design a Virtual Instrument to generate multitone waveform (sine & square) using LabView.
8. Design a Virtual Instrument to convert Celcius into equivalent Fahrenheit using LabView.

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ELP 306 LAB Course "F"- 8086 MICROPROCESSOR PROGRAMMING INTERFACING AND "C" PROGRAMMING LAB

M.Sc Electronics
July-Dec 2021
Semester III

Max. Marks: 100, Min. Marks: 20

List of Experiments:-

8086 ASSEMBLY LANGUAGE PROGRAMMING

1. Write a program to transfer an 8-bit data from register to C060H memory location.
2. Write a program to transfer an 16-bit data from register to C060H memory location.
3. Write a program to add two 8-bit data and result is stored in C060H.
4. Write a program to add two 16-bit data and result is stored in C060H.
5. Write a program to subtract two 8-bit data and result is stored in C060H.
6. Write a program to subtract two 16-bit data and result is stored in C060H.
7. Write a program to multiply two 8-bit data and result is stored in C060H.
8. Write a program to multiply two 16-bit data and result is stored in C060H.
9. Write a program to divide 16-bit data by 8-bit and result is stored in C060H.
10. Write a program to divide 32-bit data by 16-bit and result is stored in C060H.

*** STUDY OF 8255 CARD ***

Study the Interfacing of 8255 Study card with 8086 Microprocessor.

*** STUDY OF 8259 CARD ***

Study the Interfacing of 8259 Study card with 8086 Microprocessor.

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List of C Programming

1. Write a program to calculate the roots of quadratic equation Ax2+Bx+C=0.
2. Write a program to calculate the average of a set of n numbers including zero and negative numbers.
3. Write a program to sort an array element in ascending order using bubble sort technique.
4. Write a program to sort and array element in descending order using bubble sort technique.
5. Write a program to plot a sin (X).
6. Write a program to read and print a single dimension array A and B each having 10 elements write a program that prints out an array C having elements, which are sum of the elements of array A and B.
7. Write a program to find a row sum and column sum of a given matrix and built a new matrix with the help of row sum and column sum and previous matrix.
8. Write a program to read and print two-dimensional matrix of order nxm. Find the sum of diagonals.
9. Write a program that calculate and prints out the maximum and minimum of array.
10. Write a program for sorting names in alphabetical order.
11. Write a program to plot and exponential series.
12. Write a program to print the terms in the exponential series, till the term is equal to

    0.00001 also compute the exponential series of x,

    ex=1+x+x2/2!+x3/3!+.....+0.00001.
13. Write a program for matrix multiplication.
14. Write a program for matrix addition.
15. Write a program for the operation of (a) addition (b) subtraction (c) multiplication (d)

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Division, using switch command

16. Write a program to find the factorial of a given number and Fibonacci series using switch

command

17. Write a program to find the sum of natural numbers using function

Any other experiment of equal standard relevant to syllabus can also be set

ELP 405 LAB COURSE "G"- OPTICAL COMMUNICATION AND 8051 PROGRAMMING LAB

M.Sc. Electronics
Jan-June 2022
Semester IV

Max. Marks: 100, Min. Marks: 20

List of Experiments: -

Fiber Optics Communication kit

1. Study of setting up a fiber Optic Analog Link.
2. Study of setting up a fiber Optic Digital Link.
3. Study of Losses in Optical Fiber.
4. Measurement of Numerical aperture of a optical fiber.
5. Study of Manchester Coding & Decoding of optical signal.
6. Study of Time Division Demultiplexing through fiber optic link –B .
7. Measurement of Bit Error Rate of an optical signal through fiber optic link -B.
8. Study of Eye Pattern of fiber through fiber optic ling –B.
9. Forming PC to PC Communication Link using Optical Fiber & RS-232 Interface.
10. Study inverting amplifier using an Op-amp and test it by expEYES-17 kit.
11. Study inverting amplifier using an Op-amp and test it by expEYES-17 kit.
12. Study Intensity modulation and demodulation of analog signal transmission through a fiber optic cable.

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8051 Programming: -

Any 10 Basic programming in 8051 Microcontroller

General Programming Practical of 8051

1. Write a program to find the addition of two 8- Bit Numbers.
2. Write a Program to subtract Two 8 – Bit Numbers.
3. Write a Program to find Multiplication of Two 8- Bit Numbers.
4. Write a Program to find Division of Two 8- Bit Numbers.
5. Write a Program to find the Factorial of a given numbers.
6. Write a Program to transfer the Data block in Forward order.
7. Write a Program to transfer Data Block in Reverse order.
8. Write a Program to find Addition of Series of numbers.
9. Write a program for searching no. of (05H) in a given Memory Location.
10. Write a Program to find out no. of Even & Odd no. in a given Data Series.
11. Write a Program to count Zero, Positive, Negative no. in a given Data Series.
12. Write a program to count the numbers which are divisible by 3 in a given Data Series
13. Write a Program to find the largest number in a given Data Series.
14. Write a Program to find the smallest number in a given Data Series.
15. Write a Program to arrange the Data in ascending order.
16. Write a Program to arrange the Data in descending order.
17. Write a program to convert Binary Number to BCD Number.
18. Write a program to convert Binary Number to ASCII Number

Interfacing Practical of 8051

1. To Study & Analyze the Interfacing of 16×2 LCD.
2. To Study & Analyze the Interfacing of 5×7 LED Matrix.
3. To Study & Analyze the Interfacing of Seven Segment Display.
4. To Study & Analyze the Interfacing of ADC & DAC Module.

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5. To Study & Analyze the Interfacing of DC Motor.

6. To Study & Analyze the Interfacing of Stepper Motor.

7. To Study & Analyze the Interfacing of LEDs.

Any other experiment of equal standard relevant to syllabus can also be set.

ELP 406 Project & Seminar

Max. Marks: 100, Min. Marks: 20

Project

This course provides quality education to students on professional grounds. Apart from classroom lectures and Practical's, the students are also required to undertake a project in the fourth semester. This provides them with an opportunity to interact with the industry. Seminars are organized where eminent professionals from various organizations are invited.

Execution and documentation of a project on a specific topic with one of the following aspects

- o Part of ongoing research projects in the department
- o Developmental work related to industry requirements
- o State of the art new technological studies
- o Theoretical and experimental studies
- o Development of prototypes in the finished product form
- o Technical Writing and Project Documentation
- o Presentation and Appreciation.

Seminar

Each student shall present a seminar in the Fourth semester on a topic relevant to Electronics for about 30 minutes. The topic should not be a replica of what is contained in the syllabus. The topic shall be approved by the Seminar Evaluation Committee of the Department. The committee shall evaluate the presentation of students. A seminar report in the prescribed form shall be submitted to the department after the approval from the committee.

The topics of current relevance covering following aspects should be chosen

- o Collection of reference material
- o Assimilation of concepts and preparing document
- o Communication skills
- o Presentation styles and use of projection aids
- o Appraisal and evaluation of delivered seminars

Kathak 18.1-2020

SCHEME OF EXAMINATION, COURSE STRUCTURE & SYLLABUS

M.Tech. in Optoelectronics & Laser Technology

FACULTY OF SCIENCE

Approved by Joint Board of Studies in Electronics & Physics on 18th Jan.,2020

EFFECTIVE FROM ACADEMIC SESSION

JULY – 2020

Joint Program of
School of Studies in
Electronics and Photonics
&
School of Studies in
Physics and Astro-Physics

Pt. Ravishankar Shukla University
Raipur (C.G.) 492010
WEBSITE: www. prsu.ac.in

PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR (C.G.)

School of Studies in Electronics and Photonics &
School of Studies in Physics and Astro-Physics

SCHEME & SYLLABUS

M. Tech in Optoelectronics and Laser Technology
(UGC & AICTE Approved)

SESSION – 2020-2022

The Master of Science (MS) program in Photonics is designed to prepare students for technically demanding careers in industry as well as for post-master's graduate studies in photonics or related fields. It requires students to build depth in a photonics specialization selected from areas such as lasers and applications, photonics materials and devices, and fiber optics and optical communications. It has a practicum requirement that is satisfied by doing a Minor Project and Industrial training and taking two project-intensive courses Dissertation Phase –I and Phase-II.

The main goal of the master degree program is to prepare professionals with a high level of expertise in cutting-edge photonics technologies and being able to innovate using them, with a practical vision, providing sustainable solutions in different environments, having the proper tools to get involved in an industry demanding experts on those technologies, for creating starts-up or researching in that field.

Optoelectronics & Laser Technology is a highly interdisciplinary Masters programme concerned with fundamental physics of light and optical components as well as a wide range of applications which are essential to our high-tech society, for example our ability to communicate using IT technology.

The field of photonics covers all technical applications of light over the entire spectrum from ultraviolet through visible to near, mid, and far infrared light—and from lasers in CD players through the development of new, energy-saving light sources to integrated light wave circuits and optical fibers. Moreover, photonics plays an increasing role in biology and medicine, for instance in connection with food control or medical therapy, measurement methods for efficiency improvement of wind farms, and technologies capable of measuring the efficiency of combustion processes or carbon dioxide levels in the atmosphere.

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This master program aims at giving an extensive two-year teaching program from fundamentals to advanced research topics in Photonics and its interdisciplinary applications. Master students benefiting from this program will be able to work on today's new challenges in their academic or applied research carriers: understanding and control matter and optical phenomena at the ultimate nanometric scale, providing new imaging tools for the most complex biological processes from cells and tissues to clinical applications, bringing original tools in line with future optical devices.

It is worth-mentioning that in our country the number of postgraduate programmes on modern optics is a few, and in Chhattisgarh state, none of institutes and universities has M.Tech programme in Optoelectronics and Laser Technology. It is one of the programme in the country where Organic Electronics course was introduced after IIT, Kanpur This M.Tech. program is approved and supported by University Grants commission, New Delhi under its innovative Programme for Teaching and Research in Interdisciplinary and Emerging Areas and All India Council for Technical Education.

The interdisciplinary M. Tech Programme in Opto-Electronics and Laser Technology at PRSU, Raipur is offered jointly by S.O.S. in Electronics & Photonics and S.o.S. in Physics & Astro Physics, which has been running since 2008.. The main objective of the Programme is to generate trained professionals in the broad area of Opto-Electronics, Optical Communication and laser Technology with a strong background of engineering and science. Students who graduated in earlier batches are immensely contributing to growth of various industries and R&D organizations involved in the area of telecommunication, optical communication & networks, semiconductor technology, fiber integrated optics, Opto-Electronics, software etc.

Pt. Ravishankar Shukla University is one of the few Universities/ Institutions in India that have facilities for R & D activities and man Power training in Photonics and related areas. The department have collaboration with premier R & D institutes of national importance and students have an opportunity for one year project at BARC, Mumbai, RRCAT- Indore, CSIO-Chandigarh, CEERI –Pilani, IIT Mumbai, ISRO, RRI -Bangalore, PRL- Ahmadabad, IICT Hyderabad, , Raman Research Institute, Bangalore NPL New Delhi and other research centers of National & International reputation. They are getting placement in multinational companies, Industries, Academics and other private and Govt. Organizations.

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PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR (C.G.)

SYLLABUS

M. Tech. in Optoelectronics and Laser Technology

SEMESTER – I

JULY – DECEMBER, 2020

Course Code	Subject	Core/Elective	Marks			Credits
			Theory	Internal	Total	
OE-11	Modern Optics	C	80	20	100	4
OE-12	Laser Technology	C	80	20	100	4
OE-13	Optoelectronics	C	80	20	100	4
OE-14	Optical Communication	C	80	20	100	4
OE-15	Seminar	C	-	-	50	1
OE-16	Comprehensive Viva voce	C	-	-	Grade	
OE-17	Photonics Lab-I	C	External 120	Internal 30	150	3
OE-18	Quantum Optics	E	80	20	100	3
Total for Semester-I					700	23

18/1/2020

19/1/2020

SEMESTER – II

JANUARY - JUNE, 2021

Course Code	Subject	Core/ Elective	Marks			Credits
			Theory	Internal	Total	
OE-21	Physics of Advanced Materials	C	80	20	100	4
OE-22	Fiber Optics & Laser Instrumentation and Solar Photovoltaic Technologies	C	80	20	100	4
OE-23	Optical Networks	C	80	20	100	4
OE-24	Advance Optical Communication	C	80	20	100	4
OE-25	Seminar		-	-	50	1
OE-26	Comprehensive Viva Voce		-	-	Grade	
OE-27	Photonics Lab-II	C	External	Internal	150	3
			120	30		
OE 28	Theory-V	E	80	20	100	3
Total for Semester-II					**700**	**23**

Semester III

JULY – DECEMBER, 2021

Course Code	Subject	Core/Elective	Marks	Credits
OE-32	**Major Project Phase -I**	**C**	**400**	**18**

Semester IV

JANUARY - JUNE, 2022

Course Code	Subject	Marks	Credits
OE-41	**Major Project Phase -II**	400	18
OE-42	Comprehensive Viva- Voce	GRADE	
TOTAL CREDITS ALL SEMESTERS		**2200**	**82**

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PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR (C.G.)
SYLLABUS

SEMESTER – I
July-Dec. 2020

OE-11-MODERN OPTICS

Unit I

Classification of optical processes, optical coefficients, complex refractive index and dielectric constant.

Optical materials : Crystalline insulators and semiconductor, glasses, metal, molecular materials, doped glass and insulator characteristics, Optical Physics in the Solid state, crystal symmetry, electronics bands, vibronic band, the density of state, delocalized states and collective excitation.

Light propagation: Propagation of light in dense optical medium, Atomic oscillator, vibration oscillator, free electron oscillation, the Kramers – Kronig relationship, Dispersion, Optical anisotropy, birefringence. Matrix representation of polarization, Jones vector, Jones matrices, Jones calculus, orthogonal polarization. Reflection and refraction at a plane boundary, fresnel's equations.

Unit II

Excitons : Basic concept, free excitons in external electric and magnetic fields, Free Excitons at light densities, Frenkel excitons.

Luminescence: Light emission in solids, Interband luminescence, Direct and indirect gap materials, photoluminescence : Excitation and relaxation, degeneracy Photoluminescence spectroscopy.

Electroluminescence: General Principles of electroluminescence, light emitting diodes, diode laser.

Unit III

Electromagnetism in dielectrics, Electromagnetism fields and Maxwell equation. Electromagnetism waves, Quantum theory of radiative absorption and emission. Einstein coefficients, Quantum transition rates, selection rules. Basic concept of phonons, Polaritons and polarons.

Laser Plasma Interaction: Basic concepts and two-fluid description of plasmas, electromagnetic wave propagation in plasmas.

18/1/2020

Unit IV

Nonlinear optics : Non linear optics : Physical origin of optical nonlinearities, Non resonant and resonant nonlinearities, second order nonlinearities, Non liner frequency mixing, Crystal symmetry, Phase matching, Third order non linear media. Harmonic generation, mixing and parametric effects. multiphonon processes Two-photon absorption, saturated absorption, Spectroscopy Rayleigh, and Raman scattering. Stimulated Raman effect, Hyper Raman effect, Coherent Antistoke Raman scattering Self-focusing and self-phase modulation. Self-induced transparency. Solitons.

Unit V

Optical Design, Fourier Optics & Holography : Revision of geometrical optics. Fourier transforms. impulse response transfer function. Scalar diffraction, spatial and temporal coherence.

Holography: Image forming systems, The wavefront reconstruction process: Inline hologram, the off axis hologram, Fourier hologram, the lens less Fourier hologram. The reconstructed image: Image of a point, image magnification, orthoscopic and pseudoscopic images, effect of source size and spectral bandwidth. Thin hologram, volume hologram, volume transmission hologram and volume refraction holograms. Materials for recording holograms, holograms for displays, colour holography, holographic optical elements. Holographic interferometry: Real time holographic interferometry, double exposure holographic interferometry image hologram, Image forming systems, coherent and incoherent imaging. Spatial filtering. Holography (Fresnel, Fraunhofer, Fourier). Holographic techniques and applications. Fourier transforming property of thin lens.

REFERENCE BOOKS

1. Optical Electronics, A. Yariv Saunders
2. Optical Electronics, Ghatak & Thyagarajan, Cambridge U.K. 3.Essentials of Optoelectronics, A. Rogers (Chapman Hall) 4.Optical Properties of Solids Mark Fox
3. Jasprit Singh, Semi conductor Optoelectronics, McGraw Hill, 1995
4. P. Hariharan, Optical holography, (Cambridge University Press, 1984)

18/1/2020

July-Dec. 2020

OE-12 -LASER TECHNOLOGY

Unit I

Einstein Coefficients and Light Amplification

Introduction: The Einstein's coefficients, Quantum Theory for the Evaluation of the Transition Rates and Einstein Coefficients, Interaction with radiation having a broad spectrum, Introduction of a near monochromatic wave with an atom having a broad frequency response, More accurate solution for the two level system, Line broadening mechanisms, Saturation Behavior of homogeneously and homogeneously broadening transitions.

Unit II

Laser Rate Equations : Introduction, The three Level System, The Four level System, Variation of Laser Power around Threshold, Optimum Output coupling. Laser spiking.

Semi classical Theory of Laser: Introduction, Cavity Modes, Polarization of cavity medium : First order & Higher order theory.

Unit III

Optical Resonators: Introduction, modes of a rectangular cavity and the open planar resonator, The Quality factor, the ultimate line width of the laser, Transverse and longitudinal mode selection switching. Mode locking in Lasers Co focal Resonator system, Planar resonators, General Spherical Resonator.

Optical Pumping: Laser pumping requirement and techniques, Optical Pumping and Electrical discharge pumping. Introduction of Flash Lamp, Optically and diode pumped solid state lasers.

Unit IV

Properties of Laser Beams and laser Structures

Coherence properties of Laser Light : Temporal Coherence, Spatial Coherence, Directionality

Semiconductor: Interaction of photons with electrons and holes in semiconductors. Optical joint density of states, Structure and properties, operating principle, Threshold condition, Power output.

Heterojunction Laser: Principle and structure, Losses in heterostructure laser, Heterostructure laser materials.

Distributed feedback lasers: Principle of working, Coupled mode theory.

Quantum well laser, Gain in quantum well lasers, Multiquantum well lasers, Strained quantum well laser, Vertical cavity surface emitting lasers.

18/1/2020

Free Electron Lasers: Basic Concepts.

July-Dec. 2020

Unit V

Types and Some important applications of laser:

Properties of solid state laser materials, Ruby, Nd:YAG lasers, Er:lasers, Ti: Saphire laser, Excimer lasers. Gas dynamic CO_2 lasers, High Power Laser. Laser induced fusion: Introduction, The fusion process, laser energy requirements. The laser induced Fusion Reactors.

Lasers in Science: Harmonic Generation, Stimulated Raman Emission, Self-focusing, Lasers in Chemistry, Rotation of the Earth, Lasers in isotope Separation. Laser in light detection and ranging (LIDAR).

TEXT BOOKS

1. Lasers Theory and Applications : K. Thyagrajan and A.K. Ghatak, Macmillan Publication
2. Laser Fundmentals - Willaim T Selfvast, Cambridge Univ-Press, 2nd edn (2008). (Text)
3. Optical Electronics, Ghatak & Thyagarajan, Cambridge U.P. 0-521-31408-9
4. Essentials of Optoelectronic, A Rogers (Chapman Hall), 0-412-40890-2

REFERENCE BOOKS

1. Fowles G.R., Introduction to Modem Optics, 2nd Edition, Holt, Rienhart and Winston
2. Lasers and nonlinear optics, BB Laud, Wiley Eastern, 3rd edition (2004)
3. Optical Electronics – A Yariv (4th Ed. Saunders College Pub. (1991).
4. Principles of lasers - Svelto and DC Hanna, 4th edn, Plenum Press (1998)
5. Solid State Laser Engineering - Koechonar (Springer Verlag. 1991
6. Lasers, principles, types and applications-K R Nambiar, New Age International, Delhi (2004)
7. Free Electron Lasers by T.C. Marshall

18/1/2020

July-Dec. 2020

OE-13- OPTOELECTRONICS

Unit I

Optical process in Semiconductors

Electron hole pair formation and recombination, absorption in semiconductor, effect of electric field on Absorption, Franz-keldysh and stark effects, Absorption in Quantum wells and Quantum confined stark effect, relation between Absorption and emission spectra, Stokes shift in optical transition, Deep level transitions, Measurement of absorption and luminescence Spectra, Time resolved Photoluminescence.

Unit II

Materials Growth & Fabrication Growth of optoelectronics materials by MBE, MOCVD, Plasma CVD, photochemical deposition. Epitaxy, interfaces and junctions (advantages/disadvantages of growth methods on interface quality, interdiffusion and doping. Quantum wells and band gap engineering

Equipments for Thin Film Deposition: Working principle of Vacuum Coating Unit , Spin Coating Unit, Dip coating unit, Basics of Ellipsometer and Spray pyrolysis apparatus and their specifications and features.

Unit III

Organic Electronics

Molecular materials, Electronic state in conjugated molecules, Optical spectra of molecules, Electronic vibration transitions, the Franck Condon principle hydrocarbons, conjugated polymer, Conductivity and Mobility of nearly-fee Charge Carriers, Charge Carriers in Organic Semiconductors: Polarons, Shallow Traps and Deep Traps, Generation of Charge Carriers and Charge Transport: Experimental Methods. The TOF Method: Gaussian Transport. Space-Charge Limited Currents. Band or Hopping Conductivity, Electric-field Dependence, Charge Transport in Disordered Organic Semiconductors. The Bassler Model

Unit IV

Organic Optoelectronic Devices:

Organic Light-Emitting Diodes (OLEDs). The Principle of the OLED, Multilayer OLEDs. Structure, Fundamental processes Efficiency, Characterization of OLEDs

Organic photovoltaic diodes (OPVDs): Fundamental process, Exciton absorption, Exciton dissociation, Charge collection characterization of OPVDs, Relevant performance parameters.

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Unit V

Introduction to Semiconductor Device Simulation: Need of Simulation, Process Simulation, Device Simulation device simulation sequence, hierarchy of transport models, DD Model, Relationship between various transport regimes and significant length-scales.

Numerical Solution Methods - finite difference scheme, discretization of Poisson's and current continuity equations.

TEXT BOOKS

1. Organic Molecular Solids Markus Schwoerer (Author), Hans Christoph Wolf, Wiley-VCH; 1 edition (March 27, 2007).
2. Semiconductor Devices Modeling and Technology" by Nandita Das Gupta and Amitava Das Gupta, Prentice Hall of India Pvt.Ltd.
3. Computational Electronics :Dragica Vasileska and Stephen M. Goodnick, CRC Press.
4. Semiconductor Optoelectronics Devices: Pallabh Bhattacharya. Pearson Education.
5. Optical Electronics, A. Yariv Saunders.
6. Optical Electronics, Ghatak & Thyagarajan, Cambridge U.P. 0-521-31408-9.
7. Essentials of Electronic & Optoelectronics properties of semiconductor, Jasprit Singh, Cambridge University Press.

REFERENCE BOOKS

1. Organic Electronics: Materials, Manufacturing, and Applications Hagen Klauk Wiley-VCH; 1 edition.
2. Hand book of thin film technology, by L. I. Maissel and R. Glang.
3. Thin film phenomena, By K. L. Chopra.
4. Opto electronics -An introduction - J Wilson and J F B J iS Hawkers.(Prentice-Hall India, 1996).
5. Optical fibre communication - J M Senior (Prentice Hall India (1994).
6. Optical fibre communication systems - J Gowar (Prentice Hall 1995).
7. Introduction to optical electronics - J Palais (Prentice Hall, 1988).
8. Semiconductor opto electronics - J asprit Singh (McGraW-Hill, Inc, 1995).
9. Fibre Optics and Opto-electronics, R P Khare (Oxford University Press, 2004).
10. Opto electronics-Thyagaraj an and Ghatak, Cambridge Uni, Press (1997).

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OE-14- OPTICAL COMMUNICATION

Unit I

Need for fiber optic Communication, evolution of light wave systems and its components. Optical Fiber – their classification, essentials of electromagnetic theory – total internal reflection, Goos Hanchen shifts Dispersion in Single mode fiber, fiber losses, Non liner optical effects and polarization effect. Analysis of Optical fiber waveguides, electromagnetic mode. Theory for optical propagation attenuation and single distortion in optical waveguide. Characteristic equation of step-index fiber, modes and their cut-off frequencies, single-mode fibers, weakly guiding fibers, linearly polarized modes, power distribution. Graded-index fibers- WKB and other analysis, propagation constant, leaky modes, power profiles, dispersions – material, modal & waveguide, impulse response.

Unit II

Physics and Technology of Optical Fiber

Passive photonic components: FO cables, Splices, Connectors, Couplers, Optical filter, Isolator, Circulator and Attenuator, switches.

Fabrication of optical fibers: MOCVD, OVD, VAD, PCVD; measurement of RI, attenuation. Etc. Fiber devices, fiber Bragg gratings, long period gratings, fiber amplifiers and lasers. Application of optical fibers in science, industry, medicine and defense.

Unit III

Optical fiber systems, modulation schemes, Digital and analog fiber communication system, system design consideration, fiber choice, wavelength conversion, switching and cross connect Semiconductor Optical amplifier (SOA), characteristics, advantages and drawback of SOA, Raman amplifier, erbium doped fiber amplifier, gain and noise in EDFA, Brillion fiber amplifier, wideband Hybrid amplifier, noise characteristic, amplifier spontaneous emission, noise amplifier, noise figure, Cumulative and effective noise figure, Noise impairments, amplifier applications.

Unit IV

Optical Transmitters and Receivers : Basic concepts, Light emitting diodes, Semiconductor laser, characteristics, Transmitter design, Optical Receivers; Basic concepts, P-n and pin photo detector. Avalanche photo detector MSM photo detector, Receiver design, Receiver noise, Receiver sensitivity, Sensitivity degradation, performance.

Electro-optic effect, electro optic retardation. Phase and amplitude modulators, transverse electro optic modulators, Acousto-optic effect, Raman-Nath and Bragg regime, acousto-optic

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modulators, magneto optic effects.

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Unit V

Optical Multiplexing Techniques

Wavelength division multiplexing (WDM): Multiplexing Technique, Topologies and architectures, Wavelength shifting and reverse, Switching WDM demultiplexer, optical Add/drop multiplexer. Dense wavelength division multiplexing (DWDM): System consideration, Multiplexer and demultiplexers, fiber amplifier for DWDM, SONET/SDH Transmission, Modulation formats, NRZ and RZ signaling, DPSK system modeling and impairments.

OE-17- Photonics Lab- I

Experiments are to be performed in the Advance Photonics Laboratory of S. O.S. in Electronics Department.

L 1 Fiber Optics Lab:

1. Study of setting up a Optic Analog Link.
2. Study of setting up a fiber Optic Digital Link.
3. Study of Losses in Optical Fiber.
4. Measurement of Numerical aperture of a optical fiber.
5. Study of Manchester Coding & Decoding of optical Signal.
6. Study of Time Division Demultiplexing through fiber optic link – B.
7. Measurement of Bit Error Rate of an optical signal through fiber optic link – B.
8. Study of Eye Pattern of fiber through fiber optic ling – B.
9. Forming PC to PC Communication Link-using Optical Fiber & RS – 232 Interface.

L 2 – Laser Lab:

1. Study of Diode Laser characteristic.
2. Construction of laser beam expander.
3. Measurement of screw parameter.
4. Measurement of electro-optic coefficient.
5. Magneto-optic effect (Faraday Rotation)
6. High voltage sensor based on electro-optic effect.
7. Molecular Weight Measurement.
8. Holography.
9. To demonstrate the I-V and P-V characteristics of PV module with varying radiation and temperature level.
10. To demonstrate the I-V and P-V characteristics of series and parallel combination of PV modules.
11. To show the effect of variation in tilt angle on PV module power.

The students are required to perform 5 programs using MATLAB platform

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PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR (C.G.)

SYLLABUS
M. Tech in Optoelectronics and Laser Technology

SEMESTER – 2
JANUARY – JUNE, 2021

OE-21- PHYSICS OF ADVANCED MATERIALS

UNIT I

Nano Particles and Nano Structured Materials:

Properties of Individual Nano-Particle: metal nanoparticles, geometric and electronic structure, magnetic clusters, Semiconductor nanoparticles, optical properties, rare gas and molecular clusters, methods of synthesis of nanoparticles. Carbon nanostructure, C60 carbon nanotube and application.

Bulk nano structured materials: Solid disordered nanostructures, methods of synthesis, properties, metal nano-cluster composite glasses, porous silicon; Nano structured crystals.

UNIT II

Quantum Nanostructures and Nano-Machines/Devices:

Quantum wells, wires and dots, preparation, size & dimensionality effects, excitons, single electron tunneling, applications of quantum nanostructure. Super conductivity. Self-assembly, process of self-assembly, semiconductor islands, monolayers. Catalysis, surface area of nanoparticles, porous, and colloidal materials.

Nanomachines and Devices: Microelectromechanical system (MEMSs), Nanoelectromechanical system (NEMSs), Photonic nano & micro circuits, nano and micro fluidics. Application of NEMS and MEMS in Rf, Microfluilds, Optics, BioScience, and Precious Manufacturing.

UNIT- III

Solid state lasers: Material requirement for solid state lasers, Activator ions and centers, Material design parameters for semiconductor laser diode, choosing alloy composition and thickness, making ohmic contracts, Other III-V heterojunction laser materials. Introduction to organic laser. Material selection for light emitting diodes.

Electrical, Optical and Thermal properties of III-V and II-VI semiconductors required for optoelectronics devices for visible and IR range.

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Electroluminescent materials: Inorganic electroluminescence, AC powder EL, ACTFEL device, EL characteristics, EL excitation mechanism. Electroluminescence in Organic solids, Material useful for organic thin film EL devices, polymeric material for EL. LED Technologies for Light Emission and Displays. QLED.

UNIT IV

Characterization of Materials: Introduction to emission and absorption spectroscopy: Nature of electromagnetic radiation, electromagnetic spectrum, atomic, molecular, vibrational and X-ray energy levels Basics of UV-VIS spectroscopy: Radiation sources, wavelength selection, Cells and sampling devices, Detectors, Basic ideal of IR spectrometry: Correlation of Infrared spectra with Molecular Structure.

Fundamental of X-ray diffraction, Powder diffraction method, Quantitative determination of phases; Structure analysis. EDAX, Lithography (top down and bottom up), Contact preparation of thin films for device fabrication.

Epitaxial thin film techniques : Liquid phase epitaxy, vapour phase epitaxy, Metal Organic chemical vapour deposition, Atomic layer epitaxy.

UNIT V

Experimental Techniques: High resolution X ray diffraction, Double Crystal diffraction,

Drift mobility and Hall mobility, Hall effect for Carrier density and Hall mobility, Photoluminescence (PL) and Excitation Photoluminescence (PLE) Optical pump probe experiments.

Basic idea of Microscopic Techniques: Optical microscope, Scanning Electron Microscope (SEM), Transmission Electron microscope (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM), Thickness measurement – Gravimetric method, Basics of Ellipsometry: Optical parameter measurements (n and k).

TEXTS BOOKS

1. Nanotechnology by Charles P. Poole Jr. and Frank J. Owens (Willey Inter. Science pub 2003).
2. Nanostructures and Nanomaterials – Synthesis properties and Applications by Guozhong Cao (Empirical College Press World Scientific Pub. 2004).
3. Physics of Semiconductor Devices by S. M. Sze(Willey Int., 1981).
4. Instrumental methods of analysis, H. H. Willard, L. L. Merritt, J A Dean, F A Sellte, CBs Publishers New Delhi 1996.

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REFERENCE BOOKS

1. Scanning Electron Microscopy : OOtley.
2. Handbook of Electroluminescent Materials Ed. D. R. Vij Inst of Physics, Bristol and Philadelphia.
3. Electronic and Optoelectronic properties of Semiconductor, Jaspreet Singh, Cambridge University Press.
4. H. Baltes, O. Brand, Enabling Technology for MEMS and Nanodevices, Wiley, New York, 2004.

JANUARY – JUNE, 2021

OE-22- FIBER OPTICS LASER INSTRUMENTATION AND SOLAR PHOTOVOLTAIC TECHNOLOGIES

Unit I

OPTICAL FIBER AND THEIR PROPERTIES

Principle of light propagation through a fiber – Different types of fiber and their properties – Fiber materials and their characteristics – Transmission characteristic of fibers – absorption losses – scattering losses – Dispersion – measurement of optical fibers – optical sources – Optical detectors. Dispersion shifted Fiber Technologies.

Unit II

FIBER OPTIC SENSORS IN MEASUREMENTS

Fiber optic instrumentation system – Fiber optic sensors, Different types of modulators, Applicationin instrumentation, Interferometric method of length Measurement, Measurement of pressure, temperature, current, voltage, liquid level and strain. Magnetic and electric field sensors based on the characteristics like intensity, phase, polarization, frequency and wavelength of light wave , Plasmonic nano-sensors.

Laser Plasma Interaction: Basic concepts and two-fluid description of plasmas, electromagnetic wave propagation in plasmas.

Unit III

LASERS IN MEASUREMENTS AND TESTING

Laser for measurement of distance, velocity, acceleration, current, voltage, and atmospheric effect, Laser application in Spatial Frequency filtering. surface topology & optical component testing, beam modulation telemetry, laser Doppler velocimetry, surface velocity measurement using speckle patterns, measurements of rate and rotation using laser gyroscope.

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Basics of Interferometer:

Michelson interferometer, Fizeau interferometer, Fourier-transform interferometer, Fresnel interferometer, Holographic interferometer, Fabry–Pérot interferometer

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Unit IV

Lasers in Industry – Laser material processing: Laser matter interactions, mode of coupling energy from beam to the material. CW and pulsed heating and the resulting effect. Thermal processing of materials with lasers, Application in material processing, Laser Welding, Hole Drilling, Laser cutting, Laser Tracking, heat treatment, glazing, alloying, cladding, hardening of surfaces, semiconductor annealing and trimming.

BioMedical Application of Lasers: Medical applications of lasers; laser and tissue interaction – Laser instrument of surgery. Laser light scattering, application in biomedicine. Light transport in tissue.

Photochemical, photothermal, photomechanical effects and their therapeutic applications. Optical imaging and diagnosis. Biomedical Instruments.

Unit V

Solar Photovoltaic Technologies

Generation of Photo voltage, Light Generated current,, I-V equation, Solar Cell Characteristics, parameters of solar cells, Relation of Voc and Eg.

Design of solar cells: Upper limit of cell parameters, Losses in Solar Cell, Design for High Isc, Voc and FF Analytical Techniques: Solar Simulator-IV measurement, Quantum efficiency measurement, Minority carrier lifetime & diffusion length measurement.

TEXT BOOKs

1. Optical Fiber Communication, Keiser, G. McGraw Hill, Int. Student Ed.
2. John and Harry, Industrial Laser and their applications, McGraw Hill.
3. Solar Photovoltaics: Fundamentals, Technologies and Applications, C. S. Solanki, 2nd Edition Prentice Hall of India, 2011.
4. John F Ready, Industrial application of lasers. Academic press 1978.
5. John Crisp, Introduction to Fibre Optics , an imprint of Elsevier Science 1996.
6. Understanding Fiber Optics, 4th or 5th edition; Jeff Hech; Prentice Hall Publishers.
7. Optical Fiber Communication Principles and Systems, A. Selvarajan, S. Kar and T. Srinivas TMH.

REFERENCE BOOK

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1. Fiber Optic Communication System, G. P. Agarwal, Willey Eastern.
2. Introduction to Fiber Optics, A. Ghatak and K. Thyagrajan, Cambridge Univ. Press.
3. Laser Material processing by W.M. Steen.
4. M.L. Wolbarshi, Ed. Laser Applications in Medicine & Biology, Vol.1, 2 & 3 (Plenum, New York, 1971,74,77).
5. Solar cells: Operating principles, technology and system applications, by Martin A. Green, Prentice- Hall Inc, Englewood Cliffs, NJ, USA.

JANUARY – JUNE, 2021

OE-23- OPTICAL NETWORKS

Unit I

WDM Technology and Issue in WDM Optical networks: Introduction – Optical networks – WDM – WDM optical network evolution- Enabling Technology for WDM optical networks – WDM optical network architecture – Issue in Wavelength routed networks – Next generation optical Internet networks, The XG Network architecture, spectrum sensing, spectrum management, spectrum mobility, spectrum sharing, upper layer issues, cross – layer design.

Unit II

Wavelength Routing Algorithms : Introduction – Classification of RWA algorithms – Fairness and Admission control – Distributed control protocols – Permutation routing and Wavelength requirements Wavelength Rerouting algorithms : Introduction – benefits of wavelength routing – Issue in Wavelength routing – Light path Migration – Rerouting schemes – Algorithm AG – Algorithm MWPG – Rerouting in WDM networks with Sparse Wavelength conversion – Rerouting in Multifiber networks – Rerouting in Multifiber Unidirectional ring Networks .

Unit III

Wavelength Convertible networks : Introduction - need for Wavelength converters – Wavelength convertible switch architecture – routing in convertible networks – Performance evaluation of convertible networks – Networks with Sparse Wavelength conversion – Converter placement problem – Converter allocation problem.

Unit IV

Virtual topology Design: Introduction – Virtual Topology design problem – Virtual topology sub problems – Virtual topology design Heuristics – Regular virtual topology design – predetermined virtual topology and lightpath routes – Design of multi fiber networks.

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Virtual Topology Reconfiguration: Introduction – Need for virtual topology reconfiguration – Reconfiguration due to Traffic changes – reconfiguration for fault restoration.

Unit V

Network Survivability and provisioning: Failures and Recovery – Restoration schemes – Multiplexing techniques – Distributed control protocols. Optical Multicast routing – Next generation optical internet network.

JANUARY – JUNE, 2021

TEXT BOOKS

1. C. Siva Ram Murthy and Mohan Gurusamy, "WDM Optical Networks : Concepts, Design and Algorithms ", Prentice Hall India 2002.
2. Rajiv Ramasami and Kumar N. Sivarajan, " Optical networks : A Practical Perspective", A Harcourt publishers international company 2000.

OE-24-ADVANCED OPTICAL COMMUNICATION

Unit I

Introduction to optical components – optical amplifiers – types – issue in optical amplifiers – photonic switching – Cross connect – Wavelength conversion – Multiplexer – Demultiplexer, Filters– tunable filters, Photonic Crystal Fibers : Introduction, Guiding mechanism, modified total internal reflection and photonic bandgap guidance, properties and applications, introduction to OICs and its applications.

Unit II:

First Generation Optical Networks

SONET/SDH – multiplexing , element of a SONET/SDH infrastructure - SONET/SDH physical layer, Computer interconnects – ESCON, Fiber channel, HIPPI , Metropolitan area networks – FDDI, ATM, Layered Architecture - SONET/SDH layers – Second generation optical network layers.

Unit III

DWDM: Networks, Devices, and Technology :Fundamentals of DWDM Technology, Architecture and components, Working of DWDM, Topologies and Protection Schemes for DWDM, IP over DWDM Networks, Ethernet switching over DWDM, OTN (Optical Transport Networking), Capacity expansion and Flexibility in DWDM, Future of DWDM, Survivability in DWDM Networks.

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Unit IV

OTDM Technology

Important issues of OTDM – optical solitons. Optical pulse compression – fiber grating compressor soliton effect compressor. Modulation instability, fundamental and higher-order solitons, soliton lasers, soliton-based communication systems, fiber loss, frequency chirp, soliton interaction, design aspects, higher-order nonlinear effects. Broadcast OTDM networks, bit interleaving and packet interleaving, optical AND gates, nonlinear optical loop mirrors, terahertz optical asymmetric demultiplexer, switch based networks. Applications of solitons.

Unit -V

FTH and PON Technology

Proposed architecture and issues of Fiber to the home (FTH) – Passive Optical Network (PON), Near space communication – open air optical communication. Inter satellite link hops (ISL). Introduction to all optical networks (AON), Military, Civil, consumer and industrial applications.

Architecture and Analysis of Terabit Packet Switches Using Optoelectronic Technologies: Introduction, Transparant vs. Opaque, Electronic vs. Optical Buffers , An Overview of Related Work, Optical-Buffered Packet Switches, Electronic-Buffered Packet Switches, Generic Architecture of Optical Packet Switch, Optical Interconnection Networks (OIN) Based Architectures , All-Optical Packet Switching (AOPS) Based Architecture.

TEXT BOOKS :

1. Rajiv Ramaswami and Kumar N. Sivrajan, " Optical networks – A practical perspective", A Harcourt Publishers International Company 2000
2. R. G. Junsperger, " Integrated Optics – Theory and Technology, Springer Series in Optical Sciences", 3rd Edition 1991
3. Gerd Keiser, " Optical Fiber Communications" ,McGraw Hill International Edition 191
4. G. P. Aggarwal," Non Linear Optics", Academic Press.
5. Stamations V. Kartalopoulos, "Understanding SONET/ SDH and ATM Communication network for Next Millennium", PHI 2000.
6. C. Sivaram and mohan Gurusamy, " WDM Optical Networks : Concepts, Design and Algorithms" PHI India 2002.

REFERENCE BOOKS:

1. DWDM: Networks, Devices, and Technology 1st Edition, by "Stamatios, V. Kartalopoulos"
2. Broadband Networking ATM, Adh and SONET, " Mike Sexton, Andy Reid"
3. F. Poli, A. Cucinotta and S. Selleri : Photonic crystal fiber properties and application, Springer, 2007.
7. Optical Networks — Recent Advances: Recent Advances edited by Lu Ruan, Ding-Zhu Du, 2001 Kluwer Academic Publisher.

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JANUARY – JUNE, 2021

OE-27- PHOTONICS LAB –II

Experiments are to be performed in the Advance Photonics Laboratory of S.O.S. in Electronics & Photonics

EXPERIMENTS

1. To calculate the wavelength of Laser using Michelson interferometer.
2. To determine the size of tiny particles using Laser.
3. To determine the grating pitch of transmission grating.
4. To determine the wavelength of a Laser using meter scale ruling.
5. To find the refractive index of glass (transparent materials) by measuring Brewster angle.
6. To determine the bending losses that occurs in a multimode fiber when it is bent along various radii.
7. To determine the absorption coefficient of transparent materials (glass slide).
8. To study the variation of splice losses due to transverse offset, angular tilt and longitudinal separation.
9. To observe the refraction of light in liquid and to calculate its refractive index.
10. To study the wavelength dependence of attenuation in the given optical fiber.
11. To determine insertion loss of each channel of WDM mux, loss uniformity and optical cross talk in channels.
12. To setup optical Add/Drop multiplexer (OADM) using fiber Bragg grating .
13. To setup the WDM link with the given components and determine the total loss for each wavelength.
14. To find the refractive index of transparent Bar using diode Laser.
15. To observe the absorption of Laser light when various colors are introduced in its path.
16. Preparation of thin films with the help of Dip Coating Unit and resistance/ impedance measurement using Source measuring unit.
17. Preparation of thin films with the help of Spray pyrolysis method and resistance/ impedance measurement using Source measuring unit.
18. Preparation of thin films with the help of Spin Coating Unit and optical constant measurement using ellipsometer.
19. Measurement of absorbance and transmittance of solution by using photospectrometer.
20. To demonstrate the effect of shading on PV module output power.
21. To demonstrate the working of diode as Bypass diode and blocking diode.
22. Characterization of semiconductor devices and materials by using Agilant Semiconductor Parameter Analyzer.

Note: Students have to perform at least 15 experiments

18/1/2020

OE 28 Theory-V

The motivation for the course is to make the students understand the fundamentals and physics of photonic materials, devices and nano photonics, as well as nano-photonic devices. **The student may elect one from OE 28 [A] or OR 28 [B].**

OE 28[A] PHOTONICS MATERIALS AND DEVICES

UNIT I

Materials for nonlinear optics, preparation and characterization, evaluations of second order and third order nonlinear coefficients, 3 wave and 4 wave mixing in uniaxial and biaxial crystals.

UNIT II

Frequency up and Frequency down conversions, Photorefractive materials, phase conjugation and its applications.

UNIT III

AO Phenomenon, Raman-Nath and Bragg modulators, deflectors, spectrum analyser devices based on EO and MO effects.

UNIT IV

EL and POS devices, fluoride glass based fibres and their applications, optical fibre based signal processing.

UNIT V

Optical Integrated Circuits, architecture fabrication and applications, CD read/write mechanism, memory storage, information storage and retrivel using holography.

REFERENCE BOOKS

l. Optoelectronic devices and systems, SC Gupta, Prentice Hall India (2005) (Text)
2. Handbook of Nonlinear optical crystals - Dmtriev (Springer Verlag), 2003
3. Optical Electronics - Thyagaraj an and Ghatak W (Cambridge University Press), 1997

18/1/2020

[OE 28 B] NANOPHOTONICS

UNIT I

Foundations for Nanophotonics

Confinement of Photons and Electrons, Propagation Through a Classically Forbidden Zone: Tunneling, Localization Under a' Periodic Potential: Bandgap, Cooperative Effects for Photons and Electrons, Nanoscale Optical Interactions, Axial and Lateral Nanoscopic Localization, Nanoscale Confinement of Electronic Interactions, Quantum Confinement Effects, Nanoscopic Interaction Dynamics, Nanoscale Electronic Energy Transfer.
Near-Field Interaction and Microscopy : Near-Field Optics, Modeling of Near-Field Nanoscopic Interactions, Near-Field Microscopy, Aperture less Near-Field Spectroscopy and Microscopy, Nanoscale Enhancement of Optical Interactions, Time- and Space-Resolved Studies of Nanoscale Dynamics.

UNIT II

Quantum-Confined Materials : Quantum Wells, Quantum Wires, Quantum Dots Quantum Rings, Manifestations of Quantum Confinement, Optical Properties, Quantum-Confined Stark Effect, Dielectric Confinement Effect, Single-Molecule Spectroscopy, Quantum-Confined Structures as Lasing Media, Metallic Nanoparticles and Nanorods, Metallic Nanoshells Applications of Metallic Nano structures.
Growth and Characterization of Nanomaterials : Growth Methods for Nano materials, Epitaxial Growth, Laser-Assisted Vapor Deposition (LAND) Nano chemistry, Characterization of Nano materials, X-Ray Characterization, Transmission Electron Microscopy (TEM) Scanning Electron Microscopy (SEM), Scanning Probe Microscopy (SPM).

UNIT III

Nanostructured Molecular Architectures :Non covalent Interactions, Nanostructured Polymeric Media, Molecular Machines, Dendrimers, Supramolecular Structures, Monolayer and Multilayer Molecular Assemblies.
Photonic Crystals : Basics Concepts, Theoretical Modelling of Photonic Crystals, Features

of Photonic Crystals, Methods of Fabrication, Photonic Crystal Optical Circuitry Nonlinear Photonic Crystals, Photonic Crystal Fibers (PCF), Photonic Crystals and Optical Communications, Photonic Crystal Sensors.

18/1/2020

UNIT IV

Nanocomposites ,Nanocomposites as Photonic Media, Nanocomposite Waveguides, Random Lasers: Laser Paints, Local Field Enhancement, Multiphasic Nanocomposites, Nanocomposites for Optoelectronics.

Industrial nanophotonics: Nanolithography, Nanosphere Lithography, Dip-Pen Nanolithography, Nanoimprint Lithography, Nanoparticle Coatings, Sunscreen Nanoparticles, Self-Cleaning Glass Fluorescent Quantum Dots, Nano barcodes.

UNIT-V

Bio N ano photonics and nanomedicine :Bioderived Materials, Bioinspired Materials Bio templates, Bacteria as Biosynthesizers, Near-Field Bio imaging, Nanoparticles for Optical Diagnostics and Targeted Therapy, Semiconductor Quantum Dots for Bio imaging Bio sensing, Nano clinics for Optical Diagnostics and Targeted Therapy, Nanoclinic Gene Delivery Nano clinics for Photodynamic Therapy.

REFERENCE BOOKS

Nanophotonics : P N Prasad, Wiley Interscience (2003) (Text)

Biophotonics: P N Prasad, Wiley Publications (2004)

L. Novotny and B. Hecht, Principles of Nano-optics, Second Edition, Cambridge University Press, 2012

18/1/2020

Comprehensive Viva-Voce

A comprehensive viva -voce will be held immediately after the end of Semester I, II and IV. The Comprehensive Viva- Voce is intended to assess the student's understanding of various subjects he has studied during the M.Tech. course of study. The Viva-Voce would be conducted by a Board of Examiners consisting of the Head, Course Coordinator and all concerned Faculty Members of the both Electronics and Physics department. The Comprehensive Viva- Voce is evaluated on the basis of Grade. A candidate has to secure a minimum Grade to be declared successful. If he fails to obtain the minimum Grade, he has to reappear for the viva-voce during the next examination. The Grades are as follows.

RANGE	QUALITATIVE_ASSESSMENT/GRADE	
91% - 100%	O	Outstanding
81% - 90%	A	Very Good
71% - 80%	B	Good
61% - 70%	C	Fair
50% - 60%	D	Pass
Below 50%	F	Failure

18/1/2020

SEMESTER III (July – December, 2020)
Major Project Phase - I
&
SEMESTER IV (January – June, 2021)
Major Project Phase- II

Project Work Scheme

Project evaluation shall be done at the end of III and IV semesters and the students will have to submit a dissertation on his / her project work as per the Regulation for M.Tech. The problem may be selected form an appropriate Industry or Institution. The candidate is expected to work under the guidance of a project guide for at least for a period as decided. In case the project work is taken up in an external Industry/Institution, the project shall have two guides: one in the participating organization (Industry/Institution) who is the external guide and the other shall be one of the faculty members form Department who is the internal guide. The dissertation should be submitted within tow calendar years form the starting date of the third semester, Six copies of the dissertation have to be submitted to the M.Tech. Course Coordinator. These copies shall be distributed to the External examiner, Internal Examiner, Project guide (Faculty), Department Library and University Library and the Candidate.

Evaluation of Project Work

The project evaluation committee shall be responsible for the project work evaluation The project evaluation committee as per M.Tech. Regulation. The project guide (faculty from department) shall be the internal examiner. The external examiner shall be a technical expert in the concerned subject form any organization other than that of the project guide and is selected form the panel of experts submitted by the Course Coordinator. The dissertation shall be evaluated by the external examiner.

Three bound copies along with a soft copy of the dissertation shall be submitted to the Head of the Department/Coordinator within the last date prescribed by the Department / School for the purpose. The project work shall be evaluated through presentations and viva voce. The grade/marks shall be given to the students according to the level and quality of work and presentation/documentation.

18/1/2020

SCHEME OF EXAMINATION
& SYLLABUS of
Course Work for Ph.D. (ELECTRONICS)
PROGRAMME

FACULTY OF SCIENCE

Approved by Board of Studies in Electronics

Effective from Academic Session from starting

JULY 2020

School of Studies in Electronics and Photonics
Pt. Ravishankar Shukla University
Amanaka, GE Road, Raipur (C.G.) 492010
www.prsu.ac.in

PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR

SCHEME OF EXAMINATION & SYLLABUS PRESCRIBED FOR THE EXAMINATION OF COURSE WORK FOR Ph.D. (Electronics)

EFFECTIVE FROM JULY 2020

Scheme of Examination

The Course Work for PhD degree in Electronics is a six month course after completion of P.G. Degree in the subject. There shall be two compulsory papers based on the research areas of Electronics discipline. The structure of the course is given below:

S No	Theory Paper	Marks
1.	Research Methodology, Quantitative Methods & Computer Applications	100
2.	Review of Literature in Concerned Subject, Seminar/ Project Report	100
Total		**200**

Paper I

Research Methodology, Quantitative Methods & Computer Applications

Unit I - Introduction and Design of research

Meaning, objective and significance of research, types and parameters of research, research process, identification and definition of the research problem, definition of construct and variables, pure and applied research design, exploratory and descriptive design methodology, qualitative Vs quantitative research methodology, field studies, field experiments Vs laboratory experiments, research design in social and physical sciences.

Unit II - Data Analysis

Procedure for testing of Hypothesis, the null hypothesis, determining level of significance , type I and type II errors, grouped data distribution, measures of central tendency, measures of spread/dispersion, normal distribution, analysis of variance: one way, two

18-1-2020 1/8/2020

way, Chi square test and its application, students 'T' distribution, non parametric statistical techniques, binomial test, Correlation and regression analysis- discriminate analysis- factor analysis- cluster analysis, measures of relationship.

Unit III – Solar PV fundamentals and Emerging Solar Cell Technologies

P-N junction under illumination: Generation of Photo voltage, Light Generated current,, I-V equation, Solar Cell Characteristics, parameters of solar cells, Relation of Voc and Eg
Design of solar cells: Upper limit of cell parameters, Losses in Solar Cell, Design for High Isc, Voc and FF
Analytical Techniques: Solar Simulator-IV measurement, Quantum efficiency measurement, Minority carrier lifetime & diffusion length measurement.
Thin film solar cell technologies,: amorphous Si solar cells, CdTe solar cells, Quantum Dot Solar Cells, Dye Sensitized Solar cells, Perovskite Solar Cells, Present status of different PV technologies, Shockley-Queisser limit.

Unit IV – Molecular Devices and Semiconductor Device Simulation

Molecular Devices: Operation fundamentals of organic LEDs, Organic FETs and Organic solar cells, Basic physics underlying device operation, Fundamental benefits and limitations of the organic materials
Introduction to Semiconductor Device Simulation: Need of Simulation, Process Simulation, Device Simulation device simulation sequence, hierarchy of transport models, DD Model, Relationship between various transport regimes and significant length-scales.
Numerical Solution Methods - finite difference scheme, discretization of Poisson's and current continuity equations.

Unit V - Image Fundamentals –

Digital Image representation, fundamental steps in Digital Image processing, image acquisition, storage, processing, communication & display, Simple image model, sampling and quantization, some basic relationships between pixels: Neighbors of a pixel, connectivity, labeling of connected Components, Relations, distance Measures.
Image Transforms
Introduction to Fourier Transform, The Discrete Fourier Transform, some properties of two dimensional Fourier transform: Separability, translation, periodicity & conjugate symmetry, rotation, distributive and scaling, average value, convolution and correlation, sampling. The Fast Fourier Transform: FFT algorithm, number of operations, the inverse FFT, implementation. Other Separable Image Transforms: Walsh Transforms, Discrete Cosine Transform, Hadamard Transform, the Haar & Slant transform..
Study of basic functions of image processing toolbox of Matlab software

Reference Books –

1. Research in education, By J W Best and J V Kann. Pearson/ Allyn and Bacon.
2. Research Methodology - Methods and Techniques, C K Kothari, New Age International.

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3. Solar Photovoltaic's: Fundamentals, Technologies and Applications, C. S. Solanki, 2nd Edition, Prentice Hall of India, 2011.
4. Solar cells: Operating principles, technology and system applications, by Martin A. Green, Prentice-Hall Inc, Englewood Cliffs, NJ, USA,
5. Physics of Solar Cells: From Basic Principles to Advanced Concepts Peter Würfe Wiley-VCH; 1 edition
6. Organic Electronics: Materials, Manufacturing, and Applications Hagen Klauk Wiley-VCH; 1 edition
7. Organic Molecular Solids Markus Schwoerer (Author), Hans Christoph Wolf, Wiley-VCH; 1 edition (March 27, 2007)
8. Semiconductor Devices Modeling and Technology" by Nandita Das Gupta and Amitava Das Gupta, Prentice Hall of India Pvt.Ltd.
9. Digital Image Processing : Gonzalez and Woods, 2nd Edition, Pearson Education Publication
10. Fundamental of Digital Image Processing - A.K.Jain, PHI.

Paper – II

Review of Literature in Concerned Subject, Seminar/ Project Report

Review work related to latest developments in any related field excluding Ph.D. thesis topics.

The student should submit a detailed report of the review work and deliver a seminar before

submission of the report and one final seminar.

18.1.2020

Course Structure and Syllabus

CHOICE BASED CREDIT SYSTEM

IN

M.Sc.ELECTRONICSPROGRAMME

FACULTY OF SCIENCE

Approved by Board of Studies in Electronics

(Academic Session July 2020 and onwards)

School of Studies in Electronics and Photonics

Pt.RavishankarShuklaUniversity

Raipur (C.G.) 492010

www.prsu.ac.in

School of Studies in Electronics & Photonics,

Pt. Ravishankar Shukla University, Raipur

M. Sc. Electronics CBCS

Scheme &Syllabus

Session 2020-22

Sr. No.	Paper Code	Title of Elective Paper	Marks			Credit
			External	Internal	Total	
1.	ELCBCS-1	Basics of Electronics[a]	80	20	100	3
2.	ELCBCS-2	Fundamentals of Biomedical Equipments[b]	80	20	100	3

[a]For all students except students of Electronics and Physics

[b]For all students

- **Each elective paper comprises of three units and carries a total of 3 credits.**
- **Note: Student can earnmaximum of 6 credits or minimum of 3 credits out of the aforesaid elective papers.**
- **Enrolment of 10 students is minimum requirement for switching on the course for a particular semester with the maximum limit of 30 students**
- **The courses will be offered either during the second or the third semester.**
- **Classes will be held on 3pm to 4pm or 4pm to 5 pm.**
- **Basis of Selection: First come and first serve basis.**

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18.01.2020

Name of the Department - **SOS in Electronics and Photonics, PRSU, Raipur**

Course - Choice Based Course **ELCBCS-1,SecondSemester**

Name of Question Paper - **ELCBCS-1 Basics of Electronics**

Total Credit - **03**; Total Marks - **100**

Course Details- This course introduces students to the basic components of electronics: diodes, transistors, and op amps. It covers the basic operation and some common applications.

EL1 Basics of Electronics

Basic electronics-Introduction, Applications, Concepts of charge, potential, voltage, current, power and their units, Active and passive components,

Basic concepts and resistor circuits Resistor and its color codes, AC signals

AC circuits Introduction, Capacitors, Inductors, RC circuits, Response to a sine wave

Overview of Analog circuitry- Introduction to semiconductors, Conductors, Insulators, Diode and its type, Transistor and its types- NPN & PNP, Transistor as an amplifier and switch. Introduction to MOSFETS, Operational Amplifiers and Integrated Circuits.

Digital Electronics- Analog vs digital signals, Concept of amplitude and frequency, Number system and their conversions, Boolean arithmetic, De – Morgan laws, basic logic gates: their realization, Universal gates, Exclusive – OR and Exclusive NOR-gates.

Text Books

[1.] Basic Electronics for Scientists and Engineers, Dennis L. Eggleston, Cambridge University Press.

[2.] Basic Electronics and Linear Circuit by N. N. Bhargava, DC Kulshreshtha and S. C. Gupta,Tata McGraw-Hill

[3.] Electronic Devices and Circuit Theory, 9th ed. Boylestad&Nashelsky, PHI

[4.] Digital Principal and Application - Malvino Leach, Tata Macgraw Hill

[5.] Modern Digital Electronics - R.P. Jain, Tata Mcgraw

References

[6.] Basic Electronics Solid State by B. L. Thereja,S Chand

[7.] Electronic Devices & Circuit Analysis – K Lal Kishore, BS Publications

18.1.2020 18.01.2020

Name of the Department - **S.O.S. in Electronics and Photonics, PRSU, Raipur**

Course - Choice Based Course **ELCBCS-2,Third Semester**

Name of Question Paper - **ELCBCS-2 Fundamentals of Biomedical Equipments**

Total Credit - **03** ; Total Marks - **100**

Course Details-

EL2 Fundamentals of Biomedical Equipments

Basics of measuring instruments of electronics- Overview of electricity, Circuit basics, Concept of various measuring parameters- voltage, current, power, ohm's law, Kirchhoff's law.

Biomedical equipment overview- Electronics and Medicine, medical electronics, Importance of measuring instruments in Biomedical, Overview of Electrocardiograph- operation, origin of the ECG waveform

Electroencephalography (EEG) - Signal sources, Recording modes, Applications of the EEG; Techniques to Aid observation- X-ray and Radiography, Diagnostic Ultrasound.

Text Books-

- Principles of Medical Electronics and Biomedical Instrumentation- C. Raja Rao, S. K. Guha, Universities Press (India Limited)
- Introduction to Biomedical Instrumentation- Mandeep Singh, PHI Learning Pvt. Ltd.

Reference Books-

- Biomedical instrumentation and measurements – Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer
- Measurements And Instrumentation- A.V.BakshiU.A.Bakshi, Technical publication, Pune
- Biomedical Instrumentation and Measurment- R. Anandanatarajan, PHI

18.1.2020 18.01.2020

SCHEME OF EXAMINATION

&

COURSE STRUCTURE AND SYLLABUS

M.Phil. (ELECTRONICS)

PROGRAMME

FACULTY OF SCIENCE

Approved by Board of Studies in Electronics

Effective from Academic Session JULY 2020

School of Studies in Electronics and Photonics
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www.prsu.ac.in

PT. RAVISHANKAR SHUKLA UNIVERSITY, RAIPUR
SCHEME OF EXAMINATION & SYLLABUS PRESCRIBED FOR THE EXAMINATION OF

M.Phil in Electronics Programme
SESSION 2020-2021

1. Objective of the course:

- To provide academic progression to students obtaining M.Sc. degree willing to pursue an academic career
- To provide academic progression to professionals engaged in academic fields
- To provide a bridge course for an M.Sc. student so as to encourage him / her for research.
- To introduce emerging areas as discourses of study for promoting academic activities and research in related fields.

2. **Course Methodology:** A detailed treatment of each topic will be presented in class but a major portion of each class session will involve interaction and discussion. It is essential, therefore, that each student has a reading of the topic to be taken up in a class prior to attending the session. Written / presentation assignments will explore the issues and their logical consequences. Programming assignments will offer both programming experience and an opportunity to experiment with ideas. Dissertation work will involve students individually carry out a detail study on a topic and implement a related system.

Scheme of Examination :

The Master of Philosophy (M.Phil.) in Electronics is a full time course for one year after completion of M.Sc. in Electronics, Electronic Science, Physics, Instrumentation. Admission to M.Phil (Electronics) programme will be done through entrance examination. The course structure will contain three theory papers, seminar (two) and dissertation as outlined below:

S.No.	Theory paper	Marks
1.	Paper I : Research Methodology , Quantitative Methods and Computer applications	100
2.	Paper II - Photonics, Advanced Concepts in Solar Cell Technologies and Nano Science and Technology	100
3.	Paper III : Digital Image Signal Processing	100
4.	Seminar - Seminar based on theory paper (Best two out of three)	50
5.	Dissertation –(a) Final Seminar based on Dissertation (b) Dissertation Script evaluation (c) Viva – Voce	50 75 25
	Grand Total	**500**

18-1-2020

Paper I

Research Methodology, Quantitative Methods & Computer Applications

Unit I - Introduction and Design of research

Meaning, objective and significance of research, types and parameters of research, research process, identification and definition of the research problem, definition of construct and variables, pure and applied research design, exploratory and descriptive design methodology, qualitative Vs quantitative research methodology, field studies, field experiments Vs laboratory experiments, research design in social and physical sciences.

Unit II - Data Analysis

Procedure for testing of Hypothesis, the null hypothesis, determining level of significance , type I and type II errors, grouped data distribution, measures of central tendency, measures of spread/dispersion, normal distribution, analysis of variance: one way, two way, Chi square test and its application, students 'T' distribution, non parametric statistical techniques, binomial test, Correlation and regression analysis- discriminate analysis- factor analysis- cluster analysis, measures of relationship.

Unit III – Solar PV fundamentals and Emerging Solar Cell Technologies

P-N junction under illumination: Generation of Photo voltage, Light Generated current,, I-V equation, Solar Cell Characteristics, parameters of solar cells, Relation of Voc and Eg

Design of solar cells: Upper limit of cell parameters, Losses in Solar Cell, Design for High Isc, Voc and FF, Shockley-Queisser limit.

Analytical Techniques: Solar Simulator-IV measurement, Quantum efficiency measurement, Minority carrier lifetime & diffusion length measurement.

Thin film solar cell technologies,: amorphous Si solar cells, CdTe solar cells,Quantum Dot Solar Cells, Dye Sensitized Solar cells, Perovskite Solar Cells, Present status of different PV technologies,

Unit IV – Molecular Devices and Semiconductor Device Simulation

Molecular Devices: Operation fundamentals of organic LEDs, Organic FETs and Organic solar cells, Basic physics underlying device operation, Fundamental benefits and limitations of the organic materials

Introduction to Semiconductor Device Simulation: Need of Simulation, Process Simulation, Device Simulation device simulation sequence, hierarchy of transport models, DD Model, Relationship between various transport regimes and significant length-scales.

Numerical Solution Methods - finite difference scheme, discretization of Poisson's and current continuity equations.

Unit V - Image Fundamentals –

Digital Image representation, fundamental steps in Digital Image processing, image acquisition, storage, processing, communication & display, Simple image model, sampling and quantization, some basic relationships between pixels: Neighbors of a pixel, connectivity, labeling of connected Components, Relations, distance Measures.

Image Transforms

Introduction to Fourier Transform, The Discrete Fourier Transform, some properties of two dimensional Fourier transform: Separability, translation, periodicity & conjugate symmetry, rotation, distributive and scaling, average value, convolution and correlation, sampling. The Fast Fourier Transform: FFT algorithm, number of operations, the inverse FFT, implementation. Other Separable Image Transforms: Walsh Transforms, Discrete Cosine Transform, Hadamard Transform, the Haar & Slant transform.

Study of basic functions of image processing toolbox of Matlab software

Reference Books –

1. Research in education, By J W Best and J V Kann. Pearson/ Allyn and Bacon.
2. Research Methodology - Methods and Techniques, C K Kothari, New Age International.
3. Solar Photovoltaic's: Fundamentals, Technologies and Applications, C. S. Solanki, 2nd Edition, Prentice Hall of India, 2011.
4. Solar cells: Operating principles, technology and system applications, by Martin A. Green, Prentice-Hall Inc, Englewood Cliffs, NJ, USA,
5. Physics of Solar Cells: From Basic Principles to Advanced Concepts Peter Würfe Wiley-VCH; 1 edition
6. Organic Electronics: Materials, Manufacturing, and Applications Hagen Klauk Wiley-VCH; 1 edition
7. Organic Molecular Solids Markus Schwoerer (Author), Hans Christoph Wolf, Wiley-VCH; 1 edition (March 27, 2007)
8. Semiconductor Devices Modeling and Technology" by Nandita Das Gupta and Amitava Das Gupta, Prentice Hall of India Pvt.Ltd.
9. Digital Image Processing : Gonzalez and Woods, 2nd Edition, Pearson Education Publication
10. Fundamental of Digital Image Processing - A.K.Jain, PHI.

Paper II

Photonics, Advanced Concepts in Solar Cell Technologies and Nano Science &Technology

Unit I - Photonics

Classification of Optical processes, Optical coefficients, Optical materials, Concept of Excitons, Free and Frenkel excitons,

18-1-2020

Light emission in solids, Interband luminescence, direct gap materials, indirect gap materials, Photoluminescence.
General principle of electroluminescence devices, Light emitting diodes, Material selection for light emitting diodes, Diode lasers, Inorganic electroluminescence, ACTFEL device, EL characteristics, EL excitation mechanism.

Unit II - Advanced Concepts in Solar Cell Technologies

Need of sustainable energy sources, Sustainable Sun's energy, Concepts Fundamental limits on conversion efficiency Shockley-Queisser theory, Multiple Junction solar cells, Quantum dot solar cells, Intermediate band solar cells, Photon splitting and multi-application High efficiency c-Si solar cells, Staebler-Wronski effect
Fabrication of crystalline Si solar cells, Thin film crystalline Silicon solar cell technologies, Thin Cadmium Telluride and Copper Indium Gallium Selenide Cell Technologies.

Unit III -

Solar PV modules, Series and parallel connection of cells, Mismatch in series and parallel connection, PV module power output as function of temperature and solar radiation
Concentrators Photovoltaic (CPV) Cells- Light concentration, concentration ratio, Optics for CPV paraboloid reflector Compound parabolic concentrator Fresnel's Lens concentrator
Tracking requirement of CPV

Unit IV -

Introduction to thin films Two dimensional material, various methods of thin films growth, Molecular Beam Epitaxy (MBE), Controlled deposition of single Atomic Layer, Liquid Phase Epitaxy (LPE) ,and Vapour Phase Epitaxy (VPE), Characterization of thin Film. Application of thin film, Metal nanoclusters, semi conducting nanoparticles, rare gas and molecular clusters, methods of synthesis, carbon nanostructures, applications of carbon nanotubes, bulk nanostructured materials, solid disordered nanostructures, nanostructured crystals, photonic crystals.

Unit V -

Introduction to Nano science, Classification of Nano materials, Size dependence of properties, Energy Bands, Chemical Mechanical, Magnetic, Structural, Optical (linear & non-linear) properties of nanoparticles. Emergence of nanotechnology: Bottom-up & Top-down approach.

Reference Books -

1. Optical Properties of Solids Mark Fox Oxford University Press
2. Solar Photovoltaics: Fundamentals, Technologies and Applications, C. S. Solanki, Prentice Hall of India, 2011.
3. Solar cells: Operating principles, technology and system applications, by Martin A. Green, Prentice-Hall Inc, Englewood Cliffs, NJ, USA,

10-1-2020

Unit V - Image Representation, description and recognition

Representation schemes: chain codes, signature, boundary segments. Boundary descriptors: some simple descriptors, Fourier descriptors, Regional descriptors: topological descriptors, moments, Relational descriptors. Recognition: Elements of image analysis, patterns and patterns classes, Decision theoretic methods: matching, optimum statistical classifiers, structural methods. Interpretation: logical systems (predictive calculus), semantic networks, production systems.

Reference Books –

1. Digital Image Processing – Gonzalez and Woods, 2nd Edition, Pearson Education Publication
2. Digital Image Processing – Gonzalez and Woods, Pearson Education using Matlab Publication
3. Digital Image Processing – B.Chanda, D.Dutta and Majumdar Analysis, PHI Publication
4. Fundamentals of Digital Image Processing – S. Annadurai ,R.Shanmugalakshmi, Pearson education
5. Digital Image Processing - Rafael C Conzalez & Richard E. Woods, AWL.
6. Fundamental of Digital Image Processing - A.K. Jain, PHI.
7. Digital Picture Processing - Rose field Kak.
8. Digital Image Processing - W.K.Pratt.

Dissertation- Marks: 150

Students individually will carry out a detail study on a topic and implement a related system. The study must include literature survey, methodology and proposed work, experimental details and results, modifications to be included and future directions, applications etc. A report is to be prepared and submitted under the guidance of a supervisor. The report should contain design, implementation and experimental details. The topics involved in the work should be related to the courses undertaken by the student till this portion of progression under the programme and have contemporary relevance. It can involve research and development oriented works and be carried out with an eye on the needs of the industry. The work must be defended through a presentation in front of a panel constituted by selected experts. The quality of the work should be reflected by at least one publication in conference proceedings/ journals etc.

18-1-2020