RANI DURGAVTI VISHWAVIDYALAYA, JABALPUR
SYLLABUS

M. PHIL IN ELECTRONICS

(With Effect From the Session 2018-2019)

(In Accordance with the Provisions laid down in the Revised M.PHIL. Ordinance NO. 82)

The duration of the course shall be of two consecutive semesters/ one year.

First Semester : The credit of the M. Phil course work (24) credits will be as under

S.No.	Title of Paper	Max. Marks	Min. Passing Marks	Credit
Paper I	Research Methodology, Quantitative Methods and Computer Applications	100	50	4
Paper II	Review of Published Research in the relevant field	100	50	4
Paper III	Computer Application	100	50	4
Paper IV	Advance course in the relevant subject (Any one)	100	50	4
Paper V	Synopsis Submission	100	50	4
Paper VI	Comprehensive Viva-Voce	100	50	4

Second Semester

Upon satisfactory competition of course work, the M. Phil scholars shall be required to undertake research work (dissertation/thesis) in the second semester (24 credits). Along with some seminars and presentation as prescribed below :

S.No.	Title of Paper	Max. Marks	Min. Passing Marks	Credit
Paper I	Seminar	100	50	4
Paper II	Term Paper/ Assignment	100	50	4
Paper III	Final Dissertation/ Project Presentation	100	50	12
Paper IV	Comprehensive Viva	100	50	4

The candidate has to obtain a minimum of 55% of marks or its equivalent grade point in aggregate in the course work in order to be eligible to continue in the M. Phil programe and submit the dissertation /thesis. The candidate has to obtain a minimum of 55% of marks or equivalent grade point in aggregate in the second semester as well.

A candidate shall be declared to have successfully completed the course; if/she obtains minimum 50% passing marks or equivalent grade (c) in all the papers separately.

If a student obtains F or Ab grade in a paper/ subject, he/she will be treated to have failed in that paper. He/she have to reappear in the examination of that subject/ paper as and when conducted or arranged by the UTD in next semester. If the students fails in aggregate then he/she can opt upto, maximum of any two papers to reappear in the examination. Marks obtained earlier in continuous assessment may be carried forward and added to the marks obtained in repeat end semester examination to decide the grade in the

repeat course. No students shall be allowed to repeat the course to improve the grade if he/she pass the course. If he/she further fails in the course, he/she shall not be given another chance and he/she shall be out of the M.Phil programme.

FIRST SEMESTER

PAPER – I **100 Marks; 4 Credits**

Research Methodology, Quantitative methods and Experimental Techniques

UNIT – I

Research Methods and Design: Nature and objectives of research, Methods of research: historical, descriptive and experimental research process. Research Approaches and types of research. Research and the scientific Methods, Criteria of good research, Defining the research problem.

Research Design: Meaning and need for research design. Features of good design, Different research designs. Basic principles of experimental design. Limitations of experimentation.

UNIT – II

Quantitative Methods I: Nature and purpose of mathematical statistics. Experimental and collection of data. Tabulation and statistical inference, analysis of the solution and its Physical significance. Tabular and graphical representation of data. Bar and Pi diagrams, Relative frequencies, sample mean and sample variance. Random experiments, outcomes and events. Probability distribution (Binomial, Poission and Normal). Random sampling. Introduction to random and pseudo random numbers random number generators. Estimation of parameters, confidence intervals. Testing of hypothesis and decisions. Types of errors, goodness of fit χ^2 –test, method of least squares, fitting straight lines and polynomials. Data analysis using Fourier techniques. Idea of convolution and deconvolution.

UNIT-III

Quantitative Methods-II: Solution of coupled differential equation by Runge Kutta methods. Application to solution of Schrödinger equation for one dimensional box, one dimensional potential barrier and one dimensional harmonic oscillator. Solution of partial differential equation by the lattice method. Application to the solution of laplace equations(using BASIC).

General idea of mathematical modeling and simulations. Monte Carlo technique. Simulation of radioactive decay and random walk problem(using BASIC).

UNIT – IV

Experimental Techniques : General ideas of preparation of materials used in electronics – solid state reaction method, wet chemical method – size control by capping agent, sol – gel method, molecular beam epitaxy, Electro-deposition method.

General ideas of characterization using Interferometry, Mechanical Testing, TSDC XRD, SEM, AFM, Impedance spectroscopy, Optical absorption and emission. General idea of types of noise in experimental and methods of minimization.

UNIT – V

Experimental Instruments, Design and Measurement Techniques:

Digital Oscilloscope – Digital storage Oscilloscope (DSO), Digital Phosphor Oscilloscope (DPO), Signal generators – sine wave generators, Function generators, Frequency synthesis

techniques – direct analog synthesis, indirect synthesis, Digital signal generation – arbitrary waveform generator, arbitrary data generator. Distortion measuring instruments distortion, spectral analyzer, logic analyzer, logic state analyzer. Electronic counters – conventional reciprocal counters. Specifications of electronic counters – input characteristic, operating mode specifications. Digital multimeters. Design of Circuit using Digital LCR meters. General ideas of software's.

Reference Books:

1. Research Methodology – Method and Techniques – C.R. Kothari, New Age International Publisher, New Delhi – 2004.
2. Research Principles, Application and Laser – D.D. Sharma, S. Chand & Sons. Publisher.
3. Computational Physics – An Introduction – R.C. Verma, P.K. Ahluwalia & K.C. Sharma, New Age International Publisher, New Delhi – 1999.
4. Advanced Engineering Mathematics – E. Kreyszig, Wiley Eastern Ltd.
5. Experimental Methods in Modern A.C. Mellissions, A.P. New York, London.
6. Instrumental Methods of Analysis – Willard
7. Thin Films – K.L. Chopra
8. Nanotechnology : Principle and practices – S.K. Kulkarni
9. Semi conductor Measurement – Runyan
10. Multsim 2001 User's Mannual (Nl Instruments)
11. Electronic Instruments and Instrumentation Technology – M.M.S. Anand, PHI
12. A course in Electronic Measurement A K Swahbey
13. Semiconductor Devices modeling and Technology – Dasgupta & Dasgupta PHI.

PAPER-II 100 Marks; 4 Credits

REVIEW OF PUBLISHED RESEARCH IN THE RELEVANT FIELD

This includes report writing evaluation and presentation/Viva Voice each of 50 mark*s*

PAPER-III 100 Marks; 4 Credits

COMPUTER APPLICATION

UNIT-I

Concept of Computer Architecture : General Idea of Microprocessor types and specifications, Processor sockets and slots, Concept of computer interface, chip set, motherboard, Concept of bus systems and types, Memories : SRAM, DRAM, FRAM, EDORAM, SIMM, DIMM, DDR, Serial and Parallel communication ports : standard, use and configuration, USB, RS232, IEEE 488 interface.

UNIT-II

Introduction to UNIX/Linex operating system : Command cells, special character, command path and syntax, Directory layout, Commands for files systems and finding things, Pipe lining and re-direction, Information commands and other utilities, Concepts of PYTHON with simple examples.

UNIT-III

Advanced concept of Mathematica : Commands and variables, Symbolic computations with example, Manipulation of matrix, Plot of data and function, Use of import and export commands, Reading of data with special examples.

UNIT-IV

Introduction to Multisim Software : Commands, Wiring the schematic, Simulating the circuit, Transferring to PCB layout, Introduction to LAB VIEW : Environment basics, graphical programming, Basic commands and debugging tools, Introduction of exp EYES with computer control data acquisition system.

UNIT-V

1. Writing a program in BASIC for single Numerical Intergration of a function by Trapezoidal rule and Gaussian quadrature. Verification by MATHEMATICA/MATLAB /SCILAB.
2. Writing a programme in BASIC for plotting a function. Verification by MATHEMATICA/MATLAB /SCILAB.
3. Writing a programme in BASIC for Fourier Analysis/ Fourier synthesis of periodic signals Verification by MATHEMATICA/MATLAB /SCILAB.
4. Study the behavior of RC circuits using exp EYES.
5. Development of programme to read data in a .DAT file and calculate value of micro hardness and creates plots of micro hardness vs load using EXCEL.
6. Writing a programme in BASIC for least square fitting of data to a state line. Verification by MATHEMATICA/MATLAB /SCILAB.
7. PYTHON code to solve simple Physics problem and creating icon.
8. Design of simple electronic circuit and its simulation using multisim.

References:

1. Computer System Architecture, Moris Mano, Third Edition, Pearson Education
2. IBM PC and Clones : Govindraju, McGraw Hill Education
3. The Complete PC upgrade Guide, Mark Minasi,16th Edition, Joel Fugazotto
4. Complete guide to upgrading and repairing PC : Petter Nortorn, 2nd Edition, Sams
5. Introduction to LINUX command : Victor Gedris.
6. Manual of Mathematica
7. Manual of Multisim by National Instruments
8. Manual of LAB View by National Instruments
9. e-Manual of exp EYES
10. Numerical Methods for Scientific and Engineering Computations : M.K. Jain, S.R. K. Iyenger and R.K. Jain, 3rd Edition, New Age International (P) Ltd
11. Numerical Mathematical Analysis- James B. Scharborough, Oxford & IBH
12. Numerical Methods, E. Balaguruswamy Tata McGraw Hill
13. Computational Physics, K.C. Sharma, P.K. Ahluwalia, R.C. Verma, New Age International (P) Ltd

PAPER IV **100 Marks; 4 credits**

ADVANCE SUBJECTS IN THE RELEVANT FIELD (ANY ONE)

IV (a) – DIGITAL IMAGE SIGNAL PROCESSING

UNIT I

Digital Image Fundamentals

Introduction, Digital Image representation, Fundamental steps in Image Processing, Elements of Digital Image Processing system, Applications. Human Eye and Image formation; Sampling and quantization, some basic relationships among pixels-neighbor, Connectivity, Regions, Boundaries, distance measures.

UNIT II

Image Transformation and Enhancement

Introduction to the Fourier transform, The Discrete Fourier Transform, some properties of the two – Dimensional Fourier Transform, The Fast Fourier Transform. Image Enhancement – Image Enhancement background, Enhancement by point processing, Spatial Filtering, Enhancement in the Frequency Domian

UNIT III

Image Restoration and Image Compression

Degradation Model, Diagonalisation of Circulant and Block – Circulant materices, Inverse Filtering, Least mean square(wiener) filter, Constrained Least Square Restoration, Interactive Restoration. Coding, Interpixel, Psycho visual. Fidelity, Sourse and Channel Encoding, Elements of Information Theory, Loss Less and Lossy Compression, Image Compression Standards. Image Compression - Image Compression Fundamentals, Image Compression models, Image Compression standards.

UNIT IV

Color Image Processing, Recognition and Interpretation

Color fundamentals, Color Models, The RGB, CMY, CMYK, HSI model, Pseudo color Image processing, Color Transformations, Smoothing and sharpening, color segmentation.
Recognition and Interpretation - Elements of image analysis, Patterns and Pattern Classes, Decision - Theoretic Methods

UNIT V

Image Segmentation, Representation and Description

Detection of discontinuities, edge linking and boundary detection, Thresholding, The use of motion in segmentation. Representation and description – Representation Schemes, Boundary Descriptors, Relational Descriptors.

Reference Books –

1. Digital Image Processing - Gonzalez and Woods, 2nd Edition, Pearson Education Publication
2. Digital Image Processing Using MATLAB/SCILAB - Gonzalez and Woods, 2nd Edition, Pearson Publication
3. Digital Image Processing Analysis - B. Chandra, D. Dutta and Majumdar, PHI Publication

IV (b) – ELECTRONIC INSTRUMENTATION

UNIT-I

Electronic Instrument Design

Development cycle of an Electronic Instrument – System engineering, architecting, concept development, documentation, teamwork, design development, validation, verification and integration, Rapid prototyping, Field testing, failure, iteration and judgment. Circuit design, Circuit lay-out, power supplies, power, distribution, Cooling – heat transfer, thermal management, cooling choices-heat sinks, heat pipes and thermal pillows, fans and forced air cooling, liquid cooling, evaporation and refrigeration, Tradeoffs in design. Instrument-human interface, user centered design, ergonomics, utility, principles of appropriate operation. Packaging and enclosures-design for manufacturing, assembly and disassembly, Wiring, temperature, vibration and shock, rugged systems. Grounding and shielding design, safety and noise. Integration, production and logistics. Test leads, shielded cables-cable impedance, cable insulation, problems, flat cables, low capacitance probes, high voltage probes, current probes, special probes, binding posts, BNC connectors, N-type connectors, OSM connectors,

UNIT-II

Introduction to Electronic Instrumentation and Measurements

Significant figures, scientific notation, units and physical constants, Averages, decibel etc, measurement accuracy, precision, resolution, repeatability, reproducibility, hysteresis, sensitivity, range etc., Errors in measurement theoretical, static, dynamic, instrument insertion.

Power supplies using ICs: General purpose regulators, precision regulators (IC723,317, 337) fixed voltage regulators(78XX,&79XX) Switch mode regulators. Protection techniques: Protection against transients, RFI suppression, current limiting, voltage limiting,

Transducers - classification, requirements, basic physics, design considerations, Mechanical, thermal, optical, electrical, magnetic, chemical sensors, displacement, strain, vibration, pressure, flow, force and torque, temperature transducers. Actuators, electromechanical, electro thermal, electro optical and electrochemical actuators, working principles, specifications and application examples, relays, motors, heaters. Electronic components, modern package like SMDs, application circuits of sensors with electronic components, Signal conditioning circuits.

UNIT-III

Advanced Test & Measurement Instruments

Review of Test and Measurement instruments- Signal Generators , AF, Pulse, function generators, Arbitrary waveform generators, RF generators, Analog and Digital multimeters, LCR meters. Frequency meters, AF/RF power meter, Electrometer, EMI/EMC Tester. Cathode Ray Oscilloscope (Analog & Digital), Digital Storage Oscilloscopes, Block diagram, working principle and procedure of operation of Digital Storage Oscilloscopes, mixed signal oscilloscopes, medical oscilloscopes, Sampling oscilloscopes Spectrum analyzers, Impedance analyzer, Vector signal analyzer, Network analyzers, Logic analyzer, Automatic test equipment - PCB test and Inspection system, Semiconductor parameter analyzer.

UNIT-IV

Microprocessor Based Instrumention

Introduction to A/D and D/A Converter, ADC 0808, DAC 0809 and their interfacing with microprocessor, Data equaisation system. Design of microprocessor based frequency counter and signal generator, microprocessor based temperature measurement and control system, D.C. and Stepper motor control, Turbine monitors, Washing machine control system, Automation control systems.

Text / Reference Books:

1. Electronic Instrument Design H.R. Fowler, Oxford
2. Principles of Instruments and systems R.G. Gupta, TMH
3. Industrial Electronics T.E. Kissell, PHI
4. Instrument Engineer's Handbook– Process Control B.G. Liptak
5. Simplified design of linear Power supplies John D. Lenk,Butterworth-Heinemann
6. Simplified design of switching power supplies John D. Lenk, Butterworth-Heinemann
7. Regulated power supplies Irving M Gottlieb, TAB books
8. Practical Design of Power Supplies Ron Lenk, IEEE press +McGraw hill
9. Sensors & Transducers – Patranabis
10. Measurement Systems(Application & Design) - E.D.Doebelin
11. Transducers &Instrumentation - Rangan Mani Sharma
12. Silicon Sensors- Middlehock
13. T&M Instrument Catalogs and application notes, Agilent
11. T&M Instrument Catalogs and application notes, Keithley
13. Elements of Electronic Instrumentation and Measurements J. J. Carr, Pearson
14. Microprocessor-B. Ram
15. Microprocessor-Douglas V Hall
16. Microprocessor & Microcontroller - Krishnakanth

IV (c) : NANO-ELECTRONICS

UNIT I

Introduction to Nanostructures

Definition and importance of nanostructured materials, emergence of nanotechnology, classification of nanostructures, nanoporous materials, reason s of size dependent properties. Energy bands and concept of quantum confinement, electronic structure and density of states in 3D, 2D, 1D and 0D structures. Top down and bottom up approaches for preparation of nanostructures.

UNIT II

Thin semiconductor Heterostructures

Quantum well energy levels, excitons and shallow impurities in QW. Tunneling structures, coupled quantum wells and superlattices, modulation doping of heterostructures, carrier and exciton dynamics. Non-linear and electro-optic effects.

Elecrical conductivity in low dimensional systems, mobility in parallel transport and perpendicular transport, tunneling junction and tunneling, quantum transport, ballistic transport, transport of spin and spin transport. General idea about spintronics.

UNIT III

Application of Quantum Semiconductor Structures

Models of FETs, performance analysis, variants of heterojunction FETs. Two terminal and three terminal electronics devices based on perpendicular transport, quantum well lasers, single QW laser, multiple QW lasers, temperature dependence of threshold current, specific features of QW lasers, material systems for QW lasers.

UNIT IV

1D and 0D Structures

Fullerenes, carbon nanotubes and their applications, Micro and mesoporous materials, core shell structures, nano-grained structures, polymer nanocrystals and nanocomposites, supramolecu;ar structures.

Band-gap engineered quantum devices. Electrical devices based on 1D and 0D structures: resonant tunneling devices, single electron transistor etc. Optical devices based on 1D and 0D structures: luminescence, QD phosphors, AC power electrolimunescence and display devices, QD lasers photovoltaic effect, nanostrcurured solar cells.

Reference/Text Books

1. Quantum Semiconductor Heterostructures: Fundamentals and Applications; by Cloude Weisbuch and Borge Vinter; Academic Press 1991
2. Introduction to Nanotechnology; by Charles P. Poole, Jr. and Frank J.Owens, Wiley India 2007
3. Nanotechnology: Principles and Practices; by S.K.Kulkarni, Capital publishing Co. New Delhi, 2007
4. Introduction to Nanoelectronics; by Vlaadiniz U. Mitin, Cambridge University Press.

IV (d) : DATA COMMUNICATION

UNIT I

The OSI Model and TCP/IP Protocol suite: The OSI model, layers in the OSI model, TCP/IP protocol suite, addressing-physical logical and port addressing.

IP Addressing: Introduction, classful addressing-recognizing classes, classes and blocks, network addresses, sub-netting and super netting

UNIT II

ARP: ARP-Packet format, Encapsulation, operation, ARP over ATM, ARP Package

Internet Protocol: Datagram, Fragmentation, Checksum, IP package, Message Protocol: Types of messages, message format, error reporting, Query, Debugging tools, ICMP package.

UNIT III

Data gram Protocol(UDP): Process to process communication , User datagram, Checksum, UDP operation, uses of UDP, UDP package, Transmission control protocol: TCP services, TCP features, segment, TCP connection, state transmission diagram, flow control, congestion control, TCP timers, TCP package

UNIT IV

Routing protocol: Intra and Inter domain routing, distance vector routing, RIP protocol, link state routing, open shortest path first areas. Types of links, ospf packets, path vector routing, multicast and broadcast routing 1.

File transfer protocol (FTP): Connections, communication processing, file transfer, Trivial File Transfer protocol (TFTP): Message, connection, data transfer, UDP ports, and TFTP examples, World Wide Web: Artitecture, Web documents, HTTP.

BOOKS FOR STUDY:

1. TCP/IP PROTOCOL SUITE by Behrouz A. Forouzan. Third edition
2. Data Communication and Computer Networking- by Behrouz A. Forouzan. 3rd edition, TMH 2003

Reference Books –

1. Data and Computer Communications - William Stalling., 7th Ed., PHI/PE
2. Data Communication and Networks - Achyut S. Golbole, TMH, 2002
3. Computer Network - Andrew S. Tanenbaum. 4th Ed., PHI, 2002.

IV(e) VHDL

UNIT I

Introduction to VHDL: History, capabilities, hardware abstraction, Overview, basic terminology, entity declaration, architecture body, Configuration declaration, Package declaration, Model analysis, Simulation

UNIT II

Basic language elements: Data objects, classes and Data types, Operators, Identifiers, logical operators, Assignments and sequential statements and process, resolution functions.

UNIT III

Modeling style: Behavioral Modeling, data flow modeling, structural modeling with examples, component declaration, structural layout and generics.

UNIT IV

Subprograms and overloading, packages and libraries, concurrent statements, Application of functions and procedures, Model Simulation, Test bench generation. Design of microcomputer system, basic components, architecture and implementation of simple microcomputer system using VHDL.

Reference/Text Books

1. A VHDL Primer; by J.Bhaskar, II Edition, Pearson Education Asia
2. VHDL, by Douglas L.Perry, III Edition, Tata McGraw Hill
3. VHDL – Analysis and Modeling of Digital Systems, by Zainalabedin Navabi, McGraw Hill

PAPER V **100 Marks ; 4 credits**

Synopsis Submission

(Synopsis preparation/ write-up and presentation/ Viva-Voce each of 50 marks)

PAPER VI **100 Marks (4 credits)**

COMPREHENSIVE VIVA VOCE

Second Semester

PAPER I **100 Marks (4 credits)**

SEMINAR

(Two seminar each of 50 marks)

PAPER II **100 Marks (4 credits)**

TERM PAPER/ ASSIGNMENT

PAPER III **100 Marks (12 credits)**

FINAL DISSERTATION/ PROJECT PRESENTATION

PAPER IV **100 Marks (4 credits)**

COMPREHENSIVE VIVA-VOCE