

**VEER NARMAD SOUTH GUJARAT UNIVERSITY,  
DEPARTMENT OF PHYSICS  
SURAT- 395 007 (GUJARAT)  
Revised Syllabus (Effective from June-2010)**

**M.Sc. (ELECTRONICS)  
Structure for Semester II**

**SECOND SEMESTER:**

Course No.	Title	Theory / Lab. Hours per week			External Exam. Marks	Internal Marks	Total Marks
		Theory	Tutorial	Total Hours			
EL-421	Quantum Mechanics	04	01	05	70	30	100
EL-422	Instrumentation	04	01	05	70	30	100
EL-423	Microprocessors	04	01	05	70	30	100
EL-424	Analog and Digital Electronics	04	01	05	70	30	100
EL-425	Practicals	09	01	10	140	60	200

**Practicals** : 14 to 16 Practicals in each semester will be given in the Laboratory Work.

**DISTRIBUTION OF INTERNAL MARKS:**

For each Theory Papers :	Weight age of Marks
1. One Unit Test per Semester	15
2. One Tutorial Test per Paper Per Semester	10
3. One Assignment per Paper Per Semester	05
Total	30

For each Practical Course :	Weight age of Marks
1. One Practical Test per Semester	30
2. Assessment of Journal Per Semester	10
3. Viva Voce Examination	20
Total	60

**M.Sc. - I (Electronics) : SEMESTER- II**  
**EL - 421 : QUANTUM MECHANICS**

**Unit -1 :**

**The Schrödinger equation :**

Inadequacy of old quantum theory, De Broglie hypothesis, Heisenberg uncertainty principle, The Schrödinger equation, Normalization and probability interpretation, Non normalizable wave functions and Box normalization, Conservation of probability, Expectation value; Ehrenfest's Theorem, Admissibility Conditions on the wave function.

**Unit -2 :**

**Stationary states and energy spectra :**

Stationary states; Time Independent Schrödinger equation, A particle in a square well potential, Bound states in a square well ( $E < 0$ ), The square well; non localized states ( $E > 0$ ), The Schrödinger equation and the probability interpretation for an N particle system, The fundamental postulates of wave mechanics: Representation of states, Representation of dynamical variables; expectation values, observables.

**Unit -3 :**

**General Formalism of wave mechanics:**

The adjoint of an operator and self adjointness, The eigen value problem; Degeneracy, Eigen values and eigen-functions of self adjoint operators, The Dirac delta function, Observables; Completeness and normalization of eigen-functions, Closure, Physical interpretation of eigen values, eigen-functions and expansion coefficients, Momentum eigen-functions; Wave functions in momentum space, The uncertainty principle, States with minimum value for uncertainty product, Commuting observables; removal of degeneracy.

**Unit -4 :**

**Exactly soluble eigenvalue problems:**

Evolution of system with time; Constants of the motion, Non-interacting and interacting systems, Systems of identical particles, exactly soluble eigenvalue problems: The simple

harmonic oscillator, The Schrödinger equation and energy eigenvalues, The abstract operator method, The angular momentum operators, The eigenvalue equation for  $L^2$ ; separation of variables, Admissibility conditions on solutions; Eigenvalues, The eigenfunctions; Spherical harmonics, Physical interpretation, parity.

#### **Unit -5 :**

##### **Representations, Transformations and symmetries :**

Quantum states; state vectors and wavefunctions, The Hilbert space of state vectors; Dirac Notation, Dynamical variables and linear operators, Abstract operators; The quantum condition, The adjoint; self adjointness, Eigenvalues and eigenvectors, Expansion of identity; Projection operators, Representation of state vectors, Dynamical variables as matrix operators. Product of operators. Self-adjointness and Hermiticity, Continuous basis - The Schrodinger representation, Degeneracy; Labelling by commuting observables, Change of basis; Unitary transformations.

#### **Unit -6 :**

##### **Approximation methods for stationary states:**

Time independent Perturbation theory for discrete levels: Equations in various orders of perturbation theory, The non-degenerate case, The degenerate case- Removal of Degeneracy, The effect of an electric field on the energy levels of an atom ( Stark effect), Two- electron atoms, The variation method : Upper bound on ground state energy, Application to excited states, Trial function linear in Variational parameters.

#### **Reference Books**

1. A text book of Quantum Mechanics, by P. M. Mathews and K. Venkatesan (TMH)
2. Quantum Mechanics, by L. I. Schiff (McGraw, Hill)
3. Quantum Mechanics, by A. K. Ghatak and S. Lokanathan (Macmillan -India)
4. Quantum Mechanics, by Powell and Crasemann
5. Quantum Mechanics, by Frnaz Schwabl
6. Quantum Mechanics Vol.I, by A. Messiah,(North Holand)
7. Quantum Mechanics, by E. Merzbacher (Willey)

## **Theory Tutorials (EL- 421)**

1. Insignificance of de Broglie hypothesis in macrophysics,
2. General procedure to write down the Schrödinger equation for any system
3. Square potential barrier, quantum mechanical tunnelling
4. Relations giving the values of the commutators
5. Schmidt orthogonalization procedure
6. Prove that momentum operator is self adjoint
7. Interpretation of hydrogen atom wave-functions
8. Problems in three dimensions : Anisotropic and Isotropic Oscillators
9. The algebra of rotation generators
10. Transformation of dynamical variables
11. Problems of non-degenerate and degenerate time-independent perturbation theory
12. Estimate the ground state energy of a two-electron atom using variational method.

## **M.Sc. (Electronics) : Semester -II**

### **EL 422 :Instrumentation**

#### **Unit -1 :**

Functional elements of an instrument, Input - Output configuration of measuring instruments & instrument Systems, Methods of correction for interfacing & modifying inputs.

#### **Unit -2 :**

Filtering & Signal analysis passive & active filters, Types of filters, Frequency transformation, Realization of practical filters, Signal analyzers, Frequency analysis, methods of analysis, Application of Signal analysis.

#### **Unit -3 :**

##### **Optical Instruments :**

Spectroscopic Instrumentation, Visible & infrared Spectroscopy, Spectrometer design, Refraction & diffraction, Lenses & refractive optics, Dispersive elements, Spectrophotometers : Single beam null-type spectrophotometers, Double-beam Ratio-recording Spectrophotometers, Atomic absorption Spectrophotometers, Atomic absorption spectrophotometers, Atomic absorption Instrumentation.

#### **Unit -4 :**

##### **Electrodes, Sensors & Transducers :**

Sensor error source Tactics & signal processing for improved sensing, Electrodes for biophysical sensing, Medical surface electrodes, Micro electrodes, Temperature transducers.

Electro-Cardiographs : ECG Waveform, Other ECG signals, ECG Preamplifier, ECG Machine, ECG Machine Maintenance.

#### **Unit -5 :**

##### **Medical Laboratory Instrumentation :**

Overview of Clinical instrumentation, Colorimeter, Flame Photometer, Spectrophotometer, Blood Cell Counters, pH/ Blood Gas analyzers, Chromatograph, Auto-analyzer, Basic Renal Physiology, Renal Failure, Peritoneal Dialysis, Hemo-dialysis machine, High-flux & High efficiency dialysis, Electrical safety precautions, Faults, Troubleshooting & maintenance.

## **Unit -6 :**

Instrumentation for measuring anatomical & Physiological parameters of the brain, cerebral angiography, Cranial X-rays, Brain Scans, Electroencephalography, EEG electrodes & the 10-20 System, EEG diagnostic uses & sleep patterns, EEG system, Preamplifiers & EEG system specifications.

Environmental pollution monitoring instruments, Air pollution monitoring instruments, Carbon monoxide, Sulphur dioxide, Nitrogen Oxides, Hydrocarbons, Ozone, Automated wet-chemical air analysis, Water pollution monitoring instruments.

### **Reference Books**

1. Instrumentation measurement & feedback : B.E. Jones, TMH, 1980.
2. Measurement Systems, Applications and Design : E.O. doebelin, McGraw-Hill, 1975.
3. A course in mechanical measurements & Instrumentation, A.K.Sawhney, Dhanpat Rai & sons, 1980.
4. Instrumentation, Devices & Systems : C.S.Rangan, G.R.Sharma, V.S.V.Mani, TMH,1983
5. Introduction to Biomedical Equipment Technology: J.J.Carr & J.M.Brown, Pearson Education, Inc.2001.
6. Handbook of Analytical Instruments : R.S.Khandpur, TMH.
7. Principles of Electronic Instrumentation: A.James, Diefenderfer, W.B.Saunders,1972.
8. Measurement, Instrumentation & Experiment design in Physics & Engineering : M.Sayer & A. Mansingh, PHI, 2000.

### **Theory Tutorials (EL- 422)**

1. Overview of Autocorrelation & Crass correlation functions.
2. Lock-in-Amplifier operation & related Problems.
3. Overview of Laplace Transform.
4. Design of various types of filters.
5. Grating Spectrometer, Absorption Spectrometer & Double beam absorption Spectrometer.
6. ECG Faults & Troubleshooting.
7. Blood (Purpose & Components)
8. Blood tests (Cells & Chemistry)
9. EEG System artifacts, faults, trouble shooting & maintenance.

**M.Sc. (Electronics) : Semester -II**  
**EL- 423 :Microprocessor and its applications**

**Unit-1 (Review)**

Review of number systems, combinational and sequential digital electronics, memory elements, primary and secondary storage, microprocessor and microcomputers.

**Unit-2 (Microprocessor Architecture)**

Intel 8085, ALU, timing and control unit, registers data and address bus, pin configuration, instructions, opcode and operands, fetch operation, execute operation, machine cycle and state, instruction and dataflow, timing diagram for opcode fetch cycle, timing diagram for memory read/write operation, timing diagram for I/O read/write operation.

**Unit-3 (Assembly language programming)**

Intel 8085 Instruction set, instruction and data formats, addressing modes, status flags, data transfer group, arithmetic group, logical group, branch group, stack, I/O and machine control group.

**Unit-4 (Peripheral devices and their Interfacing)**

Address space partitioning, memory and I/O interfacing, hardware and software interrupts of Intel-8085, programmable peripheral interface, 8255-I/O port, 8251-Programmable communication interface, 8253-Programmable counter/interval timer, interfacing of DAC and ADC

**Unit-5 (Microprocessor applications)**

Delay subroutine, connecting common anode and common cathode type 7-segment displays, over current relays, directional relay, frequency measurement, phase angle and power factor measurement, measurement of voltage and current, measurement of reactance and resistance, KVA and KW measurement, temperature measurement, strain measurement, water level indicator.

## **Unit-6 (Introduction of 8086 Microprocessor)**

Introduction, 8086 Architecture, Addressing modes, 8086-instruction set,

### **Recommended Books:**

1. John Uffenbeck, Microcomputers and Microprocessors, Pearson Prentice Hall
2. R.S.Gaonkar, Microprocessor Architecture, Programming and applications, Wiley Eastern Limited,
3. B.Ram, Fundamentals of Microprocessors and Microcomputers, Dhanpat Rai Publications.
4. L.A.Leventhal 8080A-8085 Assembly Language Programming, McGraw-Hill Inc.

### **Theory Tutorials (EL- 423)**

- 1 Number representation
- 2 Application of combinational logic.
- 3 Application of sequential logic.
- 4 Fetch and execution timing of instructions
- 5 Simple assembly language programming
- 6 Assembly language programming-Arithmetic problems
- 7 Assembly language programming-Data arrangement
- 8 I/O related assembly language programming.
- 9 Interfacing related assembly language programming
- 10 Microprocessor application-I
- 11 Microprocessor application-II
- 12 Simple assembly language programming of 8086 Microprocessor.

## **M.Sc. (Electronics) : Semester -II**

### **EL- 424:Analog & Digital Electronics**

#### **Unit-1 :**

##### **MOSFET :**

Enhancement MOSFET, Enhancement MOSFET Volt-ampere characteristics, MOSFET Circuit symbols, MOSFET as a Resistance, biasing the enhancement MOSFET, Small Signal Operation of the enhancement MOSFET amplifier, MOS amplifier with enhancement MOS, Load MOS analog switches, CMOS devices, BIFET-BIMOS Circuits.

#### **Unit- 2 :**

Monolithic Integrated Circuit Technology, Planer process, bipolar transistor fabrication, fabrication of FETs, CMS Technology, Monolithic Diodes, Metal semiconductor contact, Integrated circuit resistors, Capacitors, Integrated circuit Packaging, Characteristics of integrated circuit components, Microelectronics circuit lay out.

#### **Unit -3 :**

BJT biasing for integrated circuits, Wilder current sources three transistor current sources, discrete component biasing and design, common-emitter amplifier with an emitter resistance high frequency response of a common-emitter stage, common-source stage at high frequency, emitter and source followers at high frequencies, time constant method of obtaining the response.

#### **Unit -4 :**

General Analysis of multistage feedback amplifiers, multi-loop feedback amplifiers, stability, test for stability compensations, frequency response of feedback amplifier the double pole transfer functions. Phase margin of the two-pole feedback amplifier, three pole feedback amplifier response, approximate analysis of a multi-pole feedback amplifier, approximate determination of the open-loop poles, compensation revisited.

#### **Unit -5 :**

NMOS, Inverter, Propagation delay of an NMOS inverter, NMOS logic gates, CMOS inverter, CMOS logic gates emitter-coupled logic circuits, Programmable RMOS, erasable ROMs, Programmable array logic, programmable logic arrays.

**Unit -6 :**

Dynamic MOS shift register, ratio-less shift register stages, CMOS domino logic RAM, Read-write memory cells, tri-polar RAM cells, charge-coupled devices, CCD structures, integrated injection logic.

**Recommended Books**

1. J.Millman and A.Grable, Microelectronics, McGraw Hill, 1987.
2. A.S.Sedra & K.C.Smith, Microelectronics Circuits, Holt-Saunders, Japan, 1991.
3. D.E.Hodges & H.G.Jackson, Analysis and Design of Digital integrated circuits, McGraw Hill, 1983.
4. P.R.Gray & R.G. Meyer, Analysis and design of Analog integrated circuits, John Wiley, 1984.

**Theory Tutorial (EL-424)**

1. BJT's and FET's.
2. VLSI Circuits design concepts.
3. Low Frequency & High Frequency response Models.
4. Bode Diagrams.
5. Operational Transfer Functions & Frequency Transfer Functions.
6. IC based Electronics Instruments.

**M.Sc. (Electronics) : Semester -II**  
**EL- 425**  
**Practicals**

1. To design, build & test Mono-stable Multivibrator.
2. To design, build & test Wein-bridge Oscillator using IC-741.
3. To design, build & test Band Pass Filter.
4. To design, build & test Analog to Digital Converter.
5. To design, build & test a ROM using diode matrix for BCD to seven segment Code conversion for 7-segment LED display.
6. To design, build & test Full Adder & Subtractor using basic & Ex-OR Gates.
7. To design, build & test 4-bit Binary down counter.
8. To design, build & test Gray to Binary code converter.
9. Study of Characteristics of Thermistor, Varactor Diode.
10. Study of Characteristics of Photodiode.
11. Study of Time division Multiplexing.
12. To design, build & test a 4-bit Serial input parallel output right Shift register using J-K flip-flops & its modification using D-flip flops.
13. Study of the Tri-stable PIPO registers using D-flip flops.
14. Study of PCM Encoder & Decoder.

**Reference Books**

1. OP-AMPS & Linear Integrated Circuits : Ramakant A. Gayakwad, PHI, 1988.
2. Solid State Pulse Circuit : David A. Bell, Reston Publishing Comp., Inc. Reston, Virginia, 1976.
3. Digital Principles & Application : Albert P. Malvino & Donald P. Leach, McGraw-Hill, International Editions, 1987.

**Laboratory Tutorials**

1. Study of PAM, PWM, & PPM Modulation & de-modulation.
2. Study of FSK & PSK
3. Study of Thermocouple & Thermistor
4. Study of Piezo-electric Transducer & LDR
5. Study of displacement measurement using Inductive Pick up.