B.Sc. (H) INSTRUMENTATION

THREE-YEAR FULL-TIME PROGRAMME
(Six-Semester Course)

COURSE CONTENTS
(Effective from the Academic Year 2011-2012)

UNIVERSITY OF DELHI
DELHI – 110 007
### Syllabus Structure for Semester I-VI (B.Sc (H) Instrumentation) Semester Mode

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- L - Lecture
- I - Interactive
- P - Practical
Courses with 4L and 1I : 4 Credits
Courses with Periods Practicals : 4 Credits (2 Periods lab equivalent to 1 Credit)
SEMESTER I  
INHT-101: Network Analysis

THEORY                             Marks: 100

40 Lectures

Unit 1

Basic Circuit Concepts: Voltage and current sources, Resistance, Capacitance, Inductance, Mutual Inductance, Series and Parallel elements, Duality, voltage division and current division.

Circuit Analysis: Kirchhoff’s Current Law (KCL), Kirchhoff’s Voltage Law (KVL), Node analysis, Mesh analysis, Star-Delta conversion.

Network Theorems: Superposition theorem, Thevenin’s theorem, Norton’s theorem, Reciprocity theorem, Millman’s theorem, Maximum power transfer theorem.

14 Lectures

Unit 2

DC Transient Analysis: Initially charged RC circuit, RL circuit with initial current, time constant, RL and RC circuits with sources, DC response of series RLC circuits (using differential equations).

6 Lectures

Unit 3

AC circuit analysis: Sinusoidal voltage and current, Definition of instantaneous, peak, peak to peak, root mean square and average values. Voltage-current relationship in resistor, inductor and capacitor. Phasor, complex impedance, power in AC circuits: instantaneous power, average power, reactive power, power factor. Sinusoidal circuit analysis for RL, RC and RLC circuits. Mesh analysis, node analysis and network theorems for AC circuits. Resonance in series and parallel RLC circuits, frequency response of series and parallel RLC circuits, Quality (Q) factor and bandwidth. Passive filters: low pass, high pass, band pass and band stop.

14 Lectures

Unit 4

Two Port Networks: Impedance (Z) parameters, Admittance (Y) parameters, Transmission (ABCD) parameters, Hybrid (h) parameters.

6 Lectures

Suggested Books:

INHT-102: Applied Physics

Theory

Marks: 100
40 Lectures

Unit 1

8 Lectures

Unit 2
Diffraction - Single, Double & N- Slit, Diffraction grating, Grating spectra, Rayleigh’s criterion and resolving power of grating.
Polarization- Phenomena of double refraction, Nicol prism, Production and analysis of plane, circular and elliptical polarized light, Fresnel’s theory of optical activity, Polarimeters.
Laser applications-Spontaneous and stimulated emission of radiation, Einstein’s Coefficients, construction and working of Ruby, He-Ne lasers and laser applications. Basic principles, different types of laser

14 Lectures

Unit 3
Nuclear Physics
Nucleus, constituent of nucleus, Properties of Nucleus size, mass, density, energy, charge, binding energy, nuclear angular momentum, Nuclear force, Radiation. detector- types of detectors, gas filled detectors, Ionization Chamber, Proportional Counter, GM Counter, Scintillation Detector and Semiconductor Detectors.

8 Lectures

Unit 4
Fluid Mechanics
Fluid properties; Surface Tension, Viscosity, equation, Bernoullis equation; Navier-Stokes Equations; Differential form of Energy equation. Reynold number, Incompressible and compressible Flow, Laminar and turbulent flows, Flow through pipes

10 Lectures

Text books
Ajoy Ghatak -Optics - (TMH)
Nuclear physics by Cohen
Fox and Mc Donald- Introduction to Fluid Mechanics
Ghatak and Thayagrajan-Optoelectronics

Suggested Books:
Aurthur Beiser -Concepts of Modern Physics - (Mc-Graw Hill)
Anuradha De. - Optical Fibre & Laser ( New Age )
Resnick, Halliday & Walker -Fundamental of Physics - (Wiely )
R.A. Serway & J.W. Jewett -Principles of Physics
INHT-103: Mathematics-I

THEORY                Marks: 100

40 Lectures

Unit 1

Sequences and series: Sequences, Limit of a sequence, Convergence, Divergence and Oscillation of a sequence, Infinite series, Necessary condition for Convergence, Standard Infinite Series: Geometric Series and Harmonic series, Tests for Convergence and Divergence, Comparison Test: Only for Series with Positive Terms, Cauchy’s Integral Test, D’Alembert’s Ratio Test, Cauchy’s nth Root Test, Raabe’s Test (Higher Ratio Test), Logarithmic Test, De Morgan’s and Bertrand’s Test, Alternating Series Leibnitz’s Theorem, Absolute Convergence and Conditional Convergence, Power Series.

Mean Value Theorems: Rolle’s Theorem, Lagrange’s Mean Value Theorem, Cauchy’s Mean Value Theorem, Generalized Mean Value Theorem.

10 Lectures

Unit 2

Partial Differentiation: Functions of Several Variables: Limit and continuity, Partial Differentiation, Variable Treated as Constant, Total Derivative, Partial Differentiation of Composite Functions: Change of Variables, Differentiation of an Implicit Function, Euler’s Theorem, Jacobian, Functional Dependence.

Maxima and Minima: Taylor’s Theorem for Functions of Two Variables, Maxima and Minima of Functions of Two Variables: with and without Constraints, Lagrange’s Method of Undetermined Multipliers.

Curve Tracing: Curves in Cartesian Form, Polar Curves, Parametric Curves.

10 Lectures

Unit 3


10 Lectures

Unit 4


10 Lectures

Suggested Books:

INHT 104: Chemistry

Unit 1
Chemical bonds and molecules: Recapitulation of general characteristics of ionic & covalent bonds and shapes of molecules, van der Waal forces of attraction (ion-dipole, dipole-dipole, dipole-induced dipole, and dispersion forces), polar covalent bond, hydrogen bond, effects of hydrogen bonding on physical properties, structure of water. Metallic bond, lattice energy, Born Haber cycle, Fajan’s rule, bond length, bond angle.

Periodic Table: Atomic, ionic and covalent radii, ionization energy, electro negativity and its scales, electron affinity, Lanthanide contraction, Inert pair effect, Slater rules.

Unit 2
Acid and Bases: Bronsted-Lowry theory, concept of leveling and differentiating solvents.

Organic reactions and their mechanisms, Types of reactions: Mechanism of S_N1 and S_N2 reactions (stereochemistry, nature of substrate, nucleophile and leaving group), Keto-enol tautomerism and its distinction from resonance. Structure and stability of reactive carbon species - carbonium ion, carbanion, free radical, carbenes. Electronic effects in molecules (inductive, hyperconjugation and resonance effects); cleavage of covalent bonds – homolysis and heterolysis. Electrophilic substitution in benzene. Reaction mechanisms of Aldol condensation, Hoffman bromamide rearrangement, Cannizzaro reaction, Friedel Craft reaction, Pinacol-pinacolone rearrangement, Beckmann rearrangement.

Unit 3
Stereochemistry: Optical activity and optical isomerism, specific molar rotation, asymmetric carbon atom, chirality, enantiomerism, relative configuration (R/S nomenclature of chiral centres, sequence rules), absolute configuration (D/L designation in carbohydrates), geometrical isomerism (cis/trans and E/Z nomenclature in olefins), isomers of lactic acid and tartaric acid

Aromaticity: Concept of aromaticity, Hückel’s rule as applied to benzene, naphthalene, anthracene, phenanthrene, thiophene, furan, pyrrole, pyridine, quinolene and cyclic cations & anions.

Unit 4

Chemical equilibrium: Reversible reactions, law of mass action, equilibrium constant, ionic equilibrium, theory of indicators, factors influencing equilibrium states, relation between Kp & Kc, buffer solution, hydrolysis of salt, pH, Ksp, common ion effect and its applications in mixture analysis.

ElectroChemistry: Standard electrode potential, electrochemical series, Nernst equation, Indicator and reference electrodes, pH and its measurements by glass electrode. Potentiometric determination of pH

Text Books
J. D. Lee, Concise Inorganic Chemistry, ELBS.
I. L. Finar, Volume I, II, Organic Chemistry, ELBS.
M. Barrow, Physical Chemistry, Tata McGraw-Hill.

Suggested Books:
Biochemistry by Lehninger.
1. Introduction to Basic Electronic Components (resistor, capacitor, inductor, diode and transistors).
2. Introduction to Test and Measurement Instruments (power supply, signal generator, multimeter, CRO, DSO).
3. Verify the Thevenin, Norton and Superposition Theorem.
4. Verify the Maximum Power Transfer Theorem.
5. RC Circuits: Time constant, differentiator, integrator.
6. Design a Low Pass RC Filter and study its frequency response.
7. Design a High Pass RC Filter and study its frequency response.
8. To study the generation of Lissajous figures.
9. To Measure the Z-parameters of a two-port network.
10. To study the frequency response of a Series LCR circuit and determine its (a) Resonant Frequency (b) Impedance at Resonance (c) Quality Factor Q (d) Band Width.
11. To study the frequency response of a Parallel LCR circuit and determine its (a) Resonant Frequency (b) Impedance at Resonance (c) Quality Factor Q (d) Band Width.

SOFTWARE BASED SIMULATIONS
1. Verify the Thevenin, Norton and Superposition Theorem
2. Verify the Maximum Power Transfer Theorem
3. RC Circuits: Time constant, differentiator, integrator.
4. Design a Low Pass RC Filter and study its frequency response.
5. Design a High Pass RC Filter and study its frequency response.
6. To study the generation of Lissajous figures.
7. To Measure the Z-parameters of a two-port network.
8. To study the frequency response of a Series LCR circuit and determine its (a) Resonant Frequency (b) Impedance at Resonance (c) Quality Factor Q (d) Band Width.
9. To study the frequency response of a Parallel LCR circuit and determine its (a) Resonant Frequency (b) Impedance at Resonance (c) Quality Factor Q (d) Band Width.

INHP 106: Instrumentation Practical - II Marks:100
Practical based on paper Applied Physics 4 classes /week

1. To determine the thermal conductivity of a good conductor by seearl’s method.
2. Determination of J, mechanical equivalent of heat by calendar and Barne’s method.
3. To determine the temperature coefficient of PRT (Platinum Resistance Thermometer).
4. To determine the dispersive power of prism using spectrometer and mercury source.
5. To determine the refractive index of a prism using spectrometer.
6. To determine the wavelength of sodium light by Newton’s Ring.
7. To find the wavelength of He-Ne Laser using transmission diffraction grating.
8. To find the thermal conductivity of poor conductors by Lee Disc Method.
9. To determine the coefficient of discharge of an orifice of a given shape.
10. Also to determine the coefficient of velocity and the coefficient of contraction of the orifice mouth piece.

**Practical based on paper Chemistry**

1. To estimate iron (II) ions by titrating with potassium permanganate.
2. To determine melting points and boiling points of organic compounds.
3. To detect extra elements (N, S, Cl, Br, I) in organic compounds (containing not more than one extra element).
4. To analyze the following functional groups in the given organic compound: Carboxylic acids, alcohols, phenols, aldehydes & ketones, carbohydrates (monosaccharide’s), amides, nitro compounds and primary amines.
5. To determine surface tension of a liquid using a stalagmometer.
6. To determine viscosity of a liquid using an Ostwald viscometer
SEMESTER II

INHT 201: C Programming and Data Structures

THEORY

MARKS: 100

40 Lectures

Unit 1

Introduction- Algorithm / pseudo code, flowchart, program development steps, structure of C program, identifiers, basic data types and sizes, Constants, variables, Operators, expressions, Input-output statements, if and switch statements, loops - while, do-while and for statements, break, continue, goto and labels. Designing structured programs, Functions, basics, parameter passing, storage classes- extern, auto, register, static, scope rules, block structure, user defined functions, standard library functions, recursive functions, header files, C preprocessor, example C programs.

10 lectures

Unit 2

Arrays- concepts, declaration, definition, accessing elements, storing elements, arrays and functions, two-dimensional and multi-dimensional arrays, applications of arrays. pointers- concepts, initialization of pointer variables, pointers and function arguments, address arithmetic, Character pointers and functions, pointers to pointers, pointers and multidimensional arrays, dynamic memory managements functions, command line arguments, C program examples.

10 lectures

Unit 3

Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self referential structures, unions, typedef, bitfields, C program examples. Input and output - concept of a file, text files and binary files, streams, standard I/o,Formatted I/o, file I/o operations, error handling, C program examples. Searching - Linear and binary search methods, sorting - Bubble sort, selection sort, Insertion sort, Quick sort, merge sort.

10 lectures

Unit 4

Introduction to data structures- singly linked lists, doubly linked lists, circular list, representing stacks and queues in C using arrays and linked lists, infix to post fix conversion, postfix expression evaluation. Trees- Binary tress, terminology, representation, traversals, graphs- terminology, representation, graph traversals (dfs & bfs)

10 lectures

Suggested Books:

4. B.W. Kernighan, Dennis M.Ritchie, The C Programming Language, Pearson Education
INHT- 202: Introduction to Instrumentation

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**Unit 1**

Basic concepts of instrumentation, generalized instrumentation systems block diagram representation, scope of instrumentation in Industrial organization.  

**4 Lectures**

**Unit 2**

**Measurement systems** - static (accuracy, sensitivity, linearity, precision, resolution, threshold, range, hysteresis, dead band, backlash, drift), impedance matching and loading, dynamic characteristics (types, fidelity, speed of response, dynamic error).

**6 Lectures**

**Unit 3**

**Definition of errors:** systematic errors, instrumental errors, environmental errors, random errors, loading errors, random errors, source of errors in measuring instruments, Uncertainties types, propagation of uncertainties

**4 Lectures**

**Unit 4**

**Transducers** - Classification, Active, Passive, Mechanical, Electrical, their comparison. Selection of Transducers: Desirable characteristics of transducers.

**Principle and working of following types:**

**26 Lectures**

**Text Books:**
- Electrical Measurements & Electronic Measurements by A.K. Sawhney

**Suggested Books:**
- Instrumentation- Devices and Systems By Rangan, Sarma, and Mani, Tata-McGrawHill
- Electronic Instrumentation by H.S Kalsi, McGrawHill
- Instrumentation measurements and analysis by Nakra & Choudhary
- Measurement & Instrumentation- DVS Murthy
INHT-203: Mathematics –II

THEORY

UNIT 1

vector space and linear transformation: vector spaces, subspaces, bases and dimensions, linear transformations, linear operator equations.


UNIT 2


Real and Complex Matrices: Real Matrices: Symmetric, Skew Symmetric, Orthogonal Quadratic Form, Canonical Form: or sum of the squares form, Transformation ( reduction ) of Quadratic Form to Canonical Form, Complex Matrices: Hermitian, Skew Hermitian, Unitary Matrices, Sylvester’s Law of Inertia.

UNIT 3


Elementary Complex Functions: Exponential Function, Trigonometric Functions, Hyperbolic Functions.

Complex Integration: Line Integral in Complex Plane, Cauchy’s Integral Theorem, Cauchy’s Integral Formula, Derivative of Analytic Functions.


UNIT 4


Suggested Books:

INHT-204: Biology

Theory

UNIT 1

Life: Definition and characteristics of life, Chemical organisation of cell: Molecular basis of life, inorganic and organic constituents, micro and macromolecules in the cell.

Techniques of Study: Microscopy (Simple, Compound, Electron-TM), Cell fractionation, Tissue Culture methods

UNIT 2


Chloroplast: structure, biogenesis, of chloroplast, function and mechanism of photosynthesis.

Mitochondria: Structure, biogenesis, function and mechanism of aerobic and anaerobic respiration, fermentation.

Nucleus: Structure, nucleosome organization of chromatin, chromosome structure, specialized chromosomes (polytene, lampbrush), Nuclear Division-cell cycle, mitosis, meiosis, cytokinesis.

UNIT 3

Genetics: History of Genetics, Mendel’s laws of inheritance, Deviations from Mendelian laws, dominance, relationships, lethal genes, epistasis, complementary, supplementary, duplicate and inhibitory genes. Linkage and crossing over: Discovery, incomplete linkage, coupling and repulsion hypothesis, crossing over, mechanism of recombination, a three point test cross, gene mapping.

Inheritance: Chromosome theory of Inheritance, Sex determination – Sex linked inheritance, extra chromosomal Inheritance

Chemical basis of heredity: DNA and RNA structure, DNA replication, transcription and translation.

UNIT 4

Human Physiology: Introduction to functional organization of human body, control of internal environment, Animal tissue

Body Fluid: Blood, Blood cell, lymph composition & function, erythropoiesis, blood groups, Rh factor, blood coagulation, blood pressure, regulation of blood pressure

Cardiovascular physiology: physiology of cardiac muscles, structure & function of heart, circulation, origin & conduction of cardiac impulses, cardiac cycle & cardiac output

Nerve Physiology: Nervous system, structure of nerve cell, origin & conduction of membrane potential, excitation of nerve fiber, basic function of nerve synapses, Saltatory nerve transmission

Respiration: mechanism of breathing, transport of gases, regulatory mechanism, O₂ dissociation curves, chloride shift, Bohr effect, Haldane effect, artificial respiration

Excretion: structure of excretory organs, urine formation, counter current principle, controlling factors, micturition, regulation of body fluids & acid base balance

Text Books:
Cell Biology by Darnell & Baltimore
Human Physiology by Guyton

Suggested Books:
Principles of Cell Biology by Kleinsmith & Kish
Physiology by Ganong
Cell Biology by Power(CB) 3rd edition
Principles of genetics by Gardener
Genetics by Stantsfield
Genetics a molecular approach by T.A.Brown
Recombinant DNA technology by Watson
Human Genetics by Jenkins
INHP 205: Instrumentation Practical - III

Practical based on paper Introduction to Instrumentation  Marks: 100
8 classes/week

Practical based on different types of transducers (any eight)-

1. Measurement of pressure, strain and torque using strain gauge.
3. Measurement of speed using photoelectric transducers and compass
5. Experiment of Opto coupler using photoelectric transducers.
6. Measurement of displacement using LVDT.
10. Measurement of Temperature using Temperature Sensors/RTD
11. Characteristics of Hall effect sensor.
12. Measuring change in resistance using LDR

INHP 206: Instrumentation Practical – IV  Marks: 100
4 classes/week

C Programming and Data Structures

Implement programs in C exemplifying:

1. Arithmetic operations
2. If-else construct
3. Switch construct
4. While, do while and for loop
5. Arithmetic operations for n x m matrices
6. Passing by reference and passing by value in functions
7. Inline parameter passing
8. Pointers and pointer arithmetic
9. String operations using pointers and arrays explicitly.
10. Bitwise operations
11. Invoking a few DOS routines such as interrupts using C procedures.
12. Structures

Practical based on paper Biology  4classes/week

Cell Biology
1. Study of various plant cell-types
2. To carry out gram staining for identifying bacteria
3. To prepare squash mounts from onion root-tips to study mitosis
4. To demonstrate the activity of enzyme amylase, urease and catalase and to study the effect of temperature and pH.
5. Micro chemical tests for the identification of Protein, Starch, Sugar, Fats
6. To study meiosis through permanent slides.

**Human Physiology**

1. Determination of ABO Blood Group & Rh factor
2. Preparation of blood smear observation of blood cell
3. RBC count and Haemoglobin estimation
4. Determination of ESR, PCV and DLC
5. To observe permanent slides of heart, Pituitary gland, spinal cord, Cerebellum,
6. lungs & trachea
7. To record systemic Arterial Blood Pressure
SEMESTER III
INHT 301: Digital Electronics

Theory

Marks: 100
40 Lectures

Unit 1

Number System and Codes: Decimal, Binary, Hexadecimal, Octal, BCD, conversion of one code to another, Complements (one’s and two’s), Signed and Unsigned numbers, Addition and Subtraction, Multiplication Gray and Hamming Codes.


Digital Logic families: Fan-in, Fan out, Noise Margin, Power Dissipation, Figure of merit, Current and Voltage parameters, RTL, DTL, TTL, ECL, HTL, MOS, CMOS.

10 lectures

Unit 2

Combinational Logic Analysis and Design: Standard representation of logic functions (SOP and POS), Karnaugh map minimization, Quine McCluskey minimization. Multiplexers (2:1, 4:1) and Demultiplexers (1:2, 4:1), Implementing logic functions with multiplexer, Adder (half and full) and subtractor, Encoder (8 to 3) and Decoder (3 to 8).

10 lectures

Unit 3

Sequential logic design: Latch, Flip flop (FF), S-R FF, J-K FF, T and D type FFs, Clocked FFs, Registers, Counters (ripple, synchronous and asynchronous, ring, modulo-N), State Table, State Diagrams and Sequential Machines.

10 lectures

Unit 4

A/D and D/A Converters: Successive Approximation ADC, R/2R Ladder DAC.

Memories: General Memory Operation, ROM, RAM (Static and Dynamic), PROM, EPROM, EEPROM, EAPROM.

10 lectures

Suggested Books:

INHT 302 Analog Electronics-I

THEORY

Marks: 100

Unit 1

**Diode Circuits:** Ideal diode, piecewise linear equivalent circuit, dc load line analysis, Quiescent (Q) point. Positive, negative and biased clipper circuits, clamping circuits. Half wave rectifier, center tapped and bridge fullwave rectifiers, calculation of efficiency and ripple factor.

**DC power supply:** Block diagram of a power supply, qualitative description of shunt capacitor filter, Zener diode as voltage regulator, temperature coefficient of Zener diode.

10 lectures

Unit 2

**The BJT:** Transistor current components and amplification. Transistor configurations: Common Base (CB), Common Emitter (CE) and Common Collector (CC) configuration, I-V characteristics and hybrid parameters, regions of operation, dc load line, Q point.

**CE amplifier:** Self bias arrangement of CE, dc and ac load line analysis. Hybrid equivalent of CE, Quantitative study of the frequency response of CE amplifier, effect on gain and bandwidth for cascaded CE amplifier (RC coupled).

**Power Amplifiers:** Heat sink, Classification of power amplifiers: A, B, C and AB, analysis of Class B push pull amplifiers (efficiency, power dissipation).

Single tuned amplifiers.

10 lectures

Unit 3

**Feedback Amplifiers:** Concept of feedback, negative and positive feedback, Negative feedback: advantages and disadvantages of negative feedback, voltage (series and shunt), current (series and shunt) feedback amplifiers, derivation of gain, input and output impedances for feedback amplifiers. Positive feedback: Barkhausen criteria for oscillations, Study of phase shift oscillator and Colpitts oscillator. Colpitts Crystal oscillator.

10 lectures

Unit 4

**The MOSFET:** The three configurations: Common Gate (CG), Common Source (CS) and Common Drain (CD), I-V characteristics, regions of operation, small signal equivalent circuit, dc load line, Q point.

**CS amplifier:** CS amplifier circuit analysis, Qualitative study of frequency response of CS amplifier.

10 lectures
Suggested Books:

INHT 303: Biochemistry

Theory  

Marks: 100

40 Lectures

Unit 1


10 Lectures

Unit 2


10 Lectures

Unit 3

Biochemical Communication: Hormones, Molecular mechanism of signal Transduction. C-AMP, C-AMP as a second messenger for number of regulator molecule, C-GMP also act as secondary messenger, Insulin receptor, Ca^{2+} as second messenger, Ion channels gated by ligand and membrane potential, Steroid and thyroid hormones, Neurotransmission. Membrane and Membrane Transport: Biological membrane, Membrane proteins. Passive transport a downhill process, Glucose permease of Erythrocytes, Chloride and Bicarbonate are cotransported across Erythrocyte membrane. Active transport result in solution movement against a concentration gradient, Active transport of Na^{+}, K^{+} ion gradient provide the energy for secondary active transport ion selective channels act in signal transcuton.

10 Lectures

Unit 4

Metabolism: Introduction to metabolic compartment of cell, Metabolism Pathways, overview of Intermediary metabolism, Experimental Approaches to the study of metabolism, Thermodynamics of phosphate compound, Oxidation Reduction reaction, Thermodynamics of life Glycolysis: Glycolytic pathways, utilization of Glucose, Reaction of Glycolysis, Fermentation: The anaerobic fate of Pyruvate, Control of metabolic flux, Metabolism of Hexoses other than Glucose, Feeder’s pathway, Gluconeogenesis. Glycogen Metabolism: Glycogen breakdown, Glycogen Synthesis, control of glycogen metabolism, Glycogen storage diseases (Vongerk’s syndrome) Citric Acid Cycle: Cycle overview, Metabolic sources of Acetyl CoA, enzymes of TCA, Regulation of TCA, Amphibolic nature of TCA. Other pathways of Carbohydrate Metabolism, Gluconeogenesis, Glyoxylate Pathway, Pentose Phosphate Pathway, Regulation of blood glucose concentration, Diabetic mellitus, conversion of carbohydrates into fats. Introduction to Lipid Metabolism, Amino Acid Metabolism, Nucleotide Metabolism.

10 Lectures

Suggested Books:
1. Zubey, Biochemistry
2. Stryer, Biochemistry
3. Lehninger, Biochemistry
### INHT 304: Signals and Systems

**THEORY**

**Marks: 100**

**Unit 1**

**40 Lectures**

**Signals and Systems:** Continuous and discrete time signals, Transformation of the independent variable, Exponential and sinusoidal signals, Unit impulse and unit step functions, Continuous-Time and Discrete-Time Systems, Basic System Properties.

**Unit 2**

**Linear Time-Invariant Systems (LTI):** Discrete time LTI systems, the Convolution Sum, Continuous time LTI systems, the Convolution integral. Properties of LTI systems, Commutative, Distributive, Associative, LTI systems with and without memory, Invertibility, Causality, Stability, Unit Step response. Differential and Difference equation formulation, Block diagram representation of first order systems.

**Unit 3**


**Fourier Transform:** Aperiodic signals, Periodic signals, Properties of Continuous-time Fourier transform, Convolution and Multiplication Properties, Properties of Fourier transform and basic Fourier transform Pairs.

**Unit 4**


**Suggested Books:**

INHT 304: Microbiology & Genetics

THEORY

Marks: 100
40 Lectures

Unit – 1

**Basic Concept of Microbiology** – The discovery of Microbial world, Spontaneous generation versus biogenesis, the germ theory of disease, Fermentation and Immunization.

**Survey of Microorganism** – A brief account of structural organization of the prion, viroid, virus, bacteria, protest and fungi.

7 Lectures

Unit – 2

**Cultivation of Microorganism** – Pure culture concept, types of culture media, Synthetic and complex media, sterilization, aseptic transfer, isolation technique, incubation, Microbial Nutrition, nutritional types of Microorganisms, and enrichment culture techniques.

**Microbial Metabolism** – Chemical principles of metabolism-autotrophic and heterotrophic metabolism. Secondary Metabolism, Transport mechanism. Ecological aspects of microbial metabolism. (Biogeochemical cycles carbon, hydrogen, oxygen, nitrogen & sulphur cycles, heavy metals).

**Microbial Growth** – The growth kinetics, batch and continuous (Turbidostat and Chemostat) culture of Microorganism, Factors influencing microbial growth (O2, water, pH, temperature, pressure, salinity), physical and chemical control of Microorganisms, antibiotic control of disease causing microorganisms.

15 Lectures

Unit – 3

**Applied Microbiology** – Basic concept of fermentation technology, Major Products of Industrial Microbiology: antibiotics, Amino acid, Organic acid, Enzymes. Microbial transformation of steroids. Microbial application in food industry, Pharmaceuticals, agriculture and Environment (water quality and Bio-degradation of Waste.)

10 Lectures

Unit – 4

**Mutation** – Numerical and structural changes in chromosomes, Gene mutation – spontaneous and induced mutation, base analogue, alkylating agent, acrating dye, de aminating agent, inhibition of nucleic acid precursors.

**Genetic Code** – Theory of genetic code, Gene function and its regulation – Protein synthesis. Regulation of gene expression, negative (Lac operon) and positive control (Arabinose).

08 Lectures

Suggested Books:

1. Microbiology by Pelzar
2. Principles of genetics by Gardener
3. Genetics by Stantsfield
4. Genetics a molecular approach by T.A. Brown
5. Cell Biology by Power (CB) 3rd edition
6. Cell Biology by Darnell & Baltimore
7. Principles of Cell Biology by Kleinsmith & Kish
8. Principles of genetics by Gardener
9. Genetics by Stantsfield
10. Genetics a molecular approach by T.A. Brown
11. Recombinant DNA technology by Watson
12. Human Genetics by Jenkins
13. Cell Biology by Karp (Gerald) 2nd edition
14. Cell Biology by Smith
15. Techniques in micro and cell biology by V.K. Sharma
Digital Electronics

1. To verify and design AND, OR, NOT and XOR gates using NAND gates.
2. Design a Full adder and a full subtractor circuit.
3. Design a 4x1 Multiplexer/ 3 to 8 decoder circuit using logic gates.
4. Implement a function (4 variable) with logic gates, MUX, Decoder ICs
5. Design a 4 bit parallel adder/subtractor circuit using 4 bit adder circuit IC
6. Design a seven-segment Display driver.
8. Design a Modulo N Asynchronous and Synchronous Counter using D/T/ JK Flip-Flop ICs.
9. Design a shift register using D/T/ JK Flip-Flops to study Serial and parallel shifting of data.
10. To design a digital to analog converer of given specifications.

Some of the experiments mentioned above may also be implemented using MULTISIM Software

Biochemistry Practical

Solutions:
(a) Preparation of molar, % solution and buffers
(b) Determination of Pka of acid
(c) Determination of PI for Casein

Chromatography:
(a) Separation of amino acids by descending paper chromatography
(b) Separation of leaf pigment and sugar by Thin Layer chromatography.

Electrophoresis:
(a) SDS-gel electrophoresis, Determination of Mol wt. Of proteins
(b) Agarose gel electrophoresis for DNA

Carbohydrates:
Qualitative test for sugars and preparation of osazone

Chromatography:
a) Preparation of gel permeation column
b) Separation of COCl₂ (Cobalt Chloride) and Blue dextran using sephantsex G-25

Spectrophotometer
(a) Determination of Beer’s Law and λ max of Cobalt chloride and Methyl orange.
(b) The UV absorption of protein and nucleic acid
(c) Estimation of protein by Bradford’s method and Lowry’s method
(d) Estimation of sugars by Anthrone method

Enzymes:
Isolation and partial purification of enzyme acid phosphatase from moong dal using ammonium sulphate precipitation and find out the activity of enzymes.
INHP 306: Instrumentation Practical - VI

Practical based on Analog Electronics-I

1. To study the Half wave rectifier and study the effect of C filter.
2. To study the Full wave rectifier and study the effect of C filter.
3. To study Fixed Bias, Voltage divide and Collector-to-Base bias Feedback configuration for transistor.
4. To design a Single Stage CE amplifier for a specific gain and bandwidth.
5. To study Class A, B and C Power Amplifier.
6. To study the Colpitt’s and Phase Shift Oscillator.
7. To study the frequency response of Common Source/ Common Gate FET amplifier.

Software Based Simulations (to run concurrently)

1. To study the Half wave rectifier and study the effect of C filter
2. To study the Full wave rectifier and study the effect of C filter
3. To study Fixed Bias, Voltage divide and Collector-to-Base bias Feedback configuration for transistor
4. To design a Single Stage CE amplifier for a specific gain and bandwidth
5. To study the Class A, B and C Power Amplifier
6. To study the Colpitt’s and Phase Shift Oscillator
7. To study the frequency response of Common Source/ Common Gate-FET amplifier

INHP – 306 Instrumentation Practical - VI

Instrumentation Practical – IX (INHT 304)

Practical based on Microbiology

1. Microscopic observation of economically important virus, bacteria (Cocci, bacilli, spirals), yeast (Saccharomyces cerevisiae), fungi (Rhizopus, Aspergillus, Pencillium, Neurospora, Puccinia, Agaricus), Protists (Chlaymodomonas, Euglena, Amoeba, Entamoeba and Paramecium) with the help of permanent slides and Electron Micrographs to study morphology and structure.
2. Sterilization and isolation techniques (streaking, spread plate and pour plate)
3. Isolation of microbes from soil, air and water.
4. Demonstration of anaerobic respiration using Saccharomyces cerevistae
5. Alcoholic fermentation of carbohydrates by using S. cervisae
6. Effect of temperature and pH on the growth of a bacterium
7. Isolation of Rhizobium from root nodules
8. Isolation of dermatophytes (fungi soil using baits such as nails, hair etc)

Practicals based on Genetics

1. Karyotype analysis – Allium cepa
2. Study of different stages of Meiosis – allium cepa/Phloxathyrous flower buds
3. Chiasma frequency – Allium cepa
4. To demonstrate the coiling of the chromosome- Allium cepa
5. Meiotic preparation to show chromosomal Aberrations- Rhoeo
6. Effect of colchicine and the induction of polyploidy
7. Determination of blood group (ABO series) in human beings
8. Identification of the inactive X-chromosome in buccal smear
SEMESTER IV

INHT-401: Industrial Instrumentations

Marks:100
40 Lectures

Unit 1


16 Lectures

Unit 2


10 Lectures

Unit 3

Pressure measurement-Units of pressure – manometers – different types – elastic type pressure gauges – Bourde type bellows – diaphragm – measurement of vacuum – McLeod gauge, Pirani and Ionisation Gauge – thermal conductivity gauges – Ionization gauge cold cathode and hot cathode types – testing and calibration of pressure gauges – dead weight tester. Vacuum pumps- Rotary and Diffusion

10 Lectures

Unit 4

Recorders: types, strip chart, circular, X-Y, oscillographic, magnetic tape, printers- dot matrix, ink jet, laser

04 Lectures

Text Books:

Suggested Books:
A.K. Sawhney, - A course in mechanical measurements and instrumentation, Dhanpat Rai & Co.
Basic Operational Amplifier: Concept of differential amplifiers, block diagram of an operational amplifier (IC 741)

Op-Amp parameters: input offset voltage, input offset current, input bias current, differential input resistance, input capacitance, offset voltage adjustment range, input voltage range, common mode rejection ratio, slew rate, supply voltage rejection ratio.

Op-Amp in open and closed loop configuration: Frequency response of an op-amp in open loop and closed loop configurations, Inverting, Non-inverting, summing and difference amplifier, Integrator, Differentiator, voltage to current converter, current to voltage converter.

Comparators: Basic comparator, Level detector, Voltage limiters, Regenerative comparator.

Signal generators: Phase shift oscillator, Wien bridge oscillator, Schmitt Trigger, Square wave generator, triangle wave generator, sawtooth wave generator, Voltage controlled oscillator (IC 566), Phase locked loops (PLL).

Multivibrators (IC 555): Block diagram, Astable and monostable multivibrator circuit, Voltage to frequency (V/F) and frequency and voltage (F/V) converter.

Signal Conditioning circuits: Sample and hold systems, Active filters: First order low pass and high pass butterworth filter, Second order filters, Band pass filter, Band reject filter, All pass filter, Logarithmic and exponential amplifiers.

Suggested Books:
INHT403: Statistical Methods and Reliability

THEORY

Unit 1

Unit 2
Probability

Unit 3
Nonparametric Statistics: Nonparametric tests: Sign test, Signed-Rank test, Rank-Sum test, Kruskal-Wallis test, Runs test. 5 Lectures

Unit 4
Reliability: Different types and modes of failure, causes of failure in electronic components, reliability theory, hazard rate, failure density function, availability, maintainability, mean time to failure and repair system structures: series, parallel, K-type, reliability evaluation, optional reliability and redundancy allocation, Fault tree analysis 15 Lectures

Suggested Books:
2. Mathematical Statistics by Freund, Prentice Hall, India
3. Introduction to Statistical Quality Control by Montgomery, John Wiley and Sons.
6. Reliability Engineering by S.Shreenath
INHT-404: Electronic Instrumentation

Marks: 100

Theory

Unit 1

Basic Measurement Instruments:
DC measurement: dc voltmeter, ohmmeter and ammeter. Digital type voltmeter, ammeter and ohmmeter ,digital multimeter, AC measurement , voltmeter, ammeter .Digital frequency meter: elements of frequency meter, universal counter and its different modes, measurement errors and extending the frequency range. Digital LCR-Q meter, digital wattmeter.

Unit 2


Unit 3

Frequency Spectrum, Distortion and wave measurement:
Spectrum analyzer, Harmonic distortion analyzer, intermodulation distortion analyzer, wave analyzer and distortion factor meter, Tuned circuit wave meter for frequency measurement, Different type of wave meters and factors affecting their accuracy, Lumped and cavity wavemeters, Q-meter and its applications.

Unit 4


Suggested Books:
Joseph J Carr, Elements of electronic instrumentation and measurement, Pearson Education
Rangan, Sarma and Mani, Instrumentation, devices and systems, Tata Mc-Graw Hill
H. S. Kalsi , Electronic Instrumentation, Tata Mc-Graw Hill.
Modern electronic Instrumentation and measurement techniques, Helfrick Cooper, Pearson Education
R. A. Witte, Electronic test instruments: analog and digital measurements, Tata Mc-Graw Hill
Electronic Test Instruments by Robert A. Witte, Pearson Education
Electronic Instrumentation and Measurement Techniques By William D. Cooper, Prentice Hall India
Electronic Instrumentation by Kalsi, Tata-McGraw Hill
NHP – 405: Instrumentation Practical – VII  
Marks: 100

Practical based on Electronic Instrumentation
4classes/week

1. Study and operation of Multimeters (Analog and Digital), Function Generator, Regulated Power Supplies
2. Study and Operation of CRO.
3. Two Stage RC Coupled Amplifier
4. Current shunt and Feedback Amplifier
5. Cascade Amplifier
6. Wien Bridge Oscillator using Transistors
7. RC Phase Shift Oscillator using Transistors
8. Simulation tools: Design and Simulation in Simulation Laboratory using P spice or MATLAB or Equivalent Simulation Software

Practical based on Industrial instrumentation
4classes/week

1. Discharge coefficient of orifice plate.
2. Calibration of pressure gauge.
3. Calibration of thermocouple
4. Calibration of RTD.
5. Level transmitters.
6 Conductivity meter calibration and measurements of conductivity of test solutions.
7. EM flowmeter and ultrasonic flowmeter.
8. Ratio control in combustion laboratory unit.
9. AC/DC meter calibrator.
10. To study of Circular chart recorder

INHP 406 Instrumentation Practical – VIII
Marks: 100

Practical based on Analog Electronics-II
8 classes/week

1. To design an amplifier of given gain for an inverting and non-inverting configuration using an op-amp.
2. To design an integrator using op-amp for a given specification and stud its frequency response.
3. To design a differentiator using op-amp for a given specification and stud its frequency response.
4. To design a First Order Low-pass filter using op-amp.
5. To design a First Order High-pass filter using op-amp.
6. To design a Second Order Low-Pass filter using op-amp.
7. To design a Second Order High-Pass filter using op-amp.
8. To design a Band Pass/ Band Reject filter using op-amp.
9. To design a RC Phase Shift Oscillator using op-amp for a given specification
Software Based Simulations (to run concurrently)

1. To design an amplifier of given gain for an inverting and non-inverting configuration using an op-amp.
2. To design an integrator using op-amp for a given specification and study its frequency response.
3. To design a differentiator using op-amp for a given specification and study its frequency response.
4. To design a First Order Low-pass filter using op-amp.
5. To design a First Order High-pass filter using op-amp.
6. To design a Second Order Low-Pass filter using op-amp.
7. To design a Second Order High-Pass filter using op-amp.
8. To design a Band Pass/ Band Reject filter using op-amp.
9. To design a RC Phase Shift Oscillator using op-amp for a given specification
SEMESTER V
INHT-501: Microprocessor   Marks: 100

40 Lectures

Unit 1
8085 pin diagram and architecture, CISC architecture, system bus architecture, internal registers, fetch-decode-execute cycle, Addressing modes and instruction set

Unit 2
Subroutines, stacks and its implementation, delay subroutines, hardware and software interrupts, programming based on above concepts

Unit 3
8086 pin diagram and internal architecture, Minimum and maximum operating modes, Functional Units of 8086, Bus Interface Unit and internal registers, Addressing modes of 8086. 8086 instruction set and assembly language programming

Unit 4
Strings, procedures & macros: 8086 string instructions, writing and using procedures, writing and using assembler macros, 8086 Assembler Directives, 8086 system connections and timing: Read and Write cycles and their timing diagrams, Wait state, Basic Interrupt processing, interrupt flag bits and interrupt instructions

Suggested Books:

INHT-502: Analytical Instrumentation-I   Marks: 100

40 Lectures

Unit 1

Unit 2
Separation techniques: Basic Chromatographic techniques, Planar (Paper, TLC/HPTLC) Column(gel permeation, ion exchange), Solvent extraction and centrifugation
Unit 3

Column Chromatography- Theory, Principle, Instrumentation and application of column chromatography (Gas Liquid Chromatography and High Performance Liquid Chromatography)

10 Lectures

Unit 4


Raman Spectroscopy: Principles, Mechanism of Raman Effect – Quantum theory and classical theory. Techniques and Instrumentation, Applications

14 Lectures

Text Books:

Suggested Books:
D.C. Harris, Quantitative Chemical Analysis, W.H.Freeman
Vogel’s Textbook of Qualitative Chemical Analysis, ELBS
W.Kemp, *Organic Spectroscopy*, ELBS

INHT 503: Electrical Machines & Control Systems

Marks:100

40 Lectures

Unit 1

Basic Power Devices and Circuits
Brief review of SCR, Diacs and Triacs, their construction, and IV characteristics. Two transistor model of SCR. Resistive and RC triggering circuits. Applications of SCRs: Basic series inverter circuit and the improved circuits, Parallel Inverters, Chopper circuit – Basic concept, step up and step down choppers. Jones and Morgan’s chopper.

10 Lectures

Unit 2

Electro-mechanical Machines: Principle of electromechanical conversion, DC motors, operational comparison between generator and motor action (without constructional comparison). Significance of back EMF, Maximum power, Torque and speed relation, Characteristics of series, shunt and Compound excited, necessity of motor starters, Three point starter, Speed control methods, SCR speed control using chopper and controlled rectifiers circuits.

10 Lectures

Unit 3

AC Machines: Types of transformers, Transformer Construction, E.m.f. equation, Transformer Losses, condition for maximum efficiency, all day efficiency, Auto transformers, Induction Motor, constructional features, Rotating magnetic field, generation of rotating magnetic field in single phase motors.

10 Lectures

Unit 4

Open loop and closed loop control system illustration, block representation, signal terminology, general explanation with illustration of servomechanism, regulation system, Linear and non linear controls, continuous and sampled data controls digital control.

Mathematical modeling and system representation: Differential equation of physical systems such as mechanical, electrical electromechanical, thermal, pneumatic, liquid level etc. Analogues System, Transfer function, block diagram representation and reduction technique, signal flow graph construction, terminology, algebra and Mason’s gain formula state equation, effects of feedback on variation of system parameters, system dynamics and effect of disturbances

10 Lectures

Suggested Books:

7. Control systems, Nagrath and Gopal, New Age International
8. Automatic Control Systems, Kuo, Wiley international
INHT-504: Biomedical Instrumentation-I          Marks:100

Theory        40 Lectures

Unit 1

Introduction to bioelectric potential, bioamplifier, components of man Instrument system, types of bio-medical systems, design factors and limitations of biomedical instruments, terms and transducers to various physiological events, types of bio-potential electrodes.

06 Lectures

Unit 2

Cardiac vascular system: origin of ECG, Instruments of ECG, bipolar system lead system I, II, III, Einthoven’s triangle, Augmented lead system, uni polar chest lead system, types of display.
Respiratory system: types of volume, types of measurements, Instrumentation of respiratory system, principle & types of pneumograph, Spirometer, pneumo tachometers, nitrogen wash out technique, apnoea detectors

15 Lectures

Unit 3


04 Lectures

Unit 4

Medical Imaging system: Thermal imaging system, working, IR detectors, application. Ultra sound, properties, its generation & detection, types of transducers, diagnostic application – A Scan, B Scan, M Scan( echo cardio graph), real time ultrasonic imaging, linear array scanners. Radiography- conventional X ray, properties, generation of X-ray, Fluoroscopy, X Ray computed tomography (CT Scanner) and computer-aided tomography (CAT)- principle, contrast scale, scanning system, processing unit, viewing, storage.

15 Lectures

Text Books:
Khandpur R. S. - Handbook of Biomedical Instrumentation, TMH

Suggested Books:
Bertil Jacobson & John G. Webster - Medicine and Clinical Engineering, PHI
Prof. S.k.VenkataRam- Bio-Medical Electronics and Instrumentation, Galgotia Publications
John G.Webster- Medical Instrumentation-Application and Design Wiley Student Edition)
L.Cromwell et al- Biomedical Instrumentation and Measurements PHI
INHP 505: Instrumentation Practical – IX  Marks: 100

Practical based on Analytical Instrumentation-I  4 classes/week

1. To determine the concentration of Na & K in the unknown sample using flame photometer
2. To find out the concentration of Potassium ions in the given sample using standard addition method
3. To find the concentration of various dyes in the given unknown solution
4. To select the appropriate filter and find the concentration of unknown solution
5. To carry out the spectrophotometric determination of any solutions
6. To find the moisture content in a given sample using Karl Fisher titrator
7. To determine the contents of unknown solution by using GC.
8. To analyze quantitatively in the given sample using interval standard in GC

Practical based on paper Biomedical Instrumentation I  4 classes/week

1. Characterization of bio potential amplifier for ECG signals.
2. Study on ECG simulator
3. Measurement of heart sound using electronic stethoscope. Study on ECG heart rate monitor /simulator
4. Study of pulse rate monitor with alarm system
5. Determination pulmonary function using spirometer (using mechanical system).
7. Study of Respiration Rate monitor/ apnea monitor
8. Study on ultrasound transducers based on medical system
10. Measurement of pulse rate using photoelectric transducer & pulse counting for known period.

INHP 506: Instrumentation Practical – X  Marks: 100

Practical based on Paper Microprocessor and Electrical Machines and Control Systems 8 classes/week

(To be implemented on both 8085 and 8086 microprocessors)

1. To write an assembly language program to perform basic mathematical operations (addition, subtraction, multiplication, division)
2. To write an assembly language program to generate first N terms of an A.P. / G.P. series
3. To write an assembly language program to generate first N terms of Fibonacci series
4. To write an assembly language program to arrange the given list of number in ascending / descending order
5. To write an assembly language program to calculate N!
6. To write an assembly language program to separate prime numbers in a given list of number
7. To write an assembly language program to convert a number from one number system to another
8. To write an assembly language program to design a clock
9. To write an assembly language program to calculate a mathematical expression (for e.g. \(2^N/N!\))
10. To write an assembly language program to calculate value of \(\sin(x)\)
11. To implement basic 8086 interrupts using assembler
12. Power measurement in single & three phase circuit.
13. Load characteristics of D.C. motor
14. Speed control of D.C. motor
15. Brake test of D.C. motor
16. Brake test of induction motor
17. Study of the Stepper motor
SEMESTER VI

INHT- 601: Analytical Instrumentation-II

Marks: 100

40 Lectures

Unit 1


6 Lectures

Unit 2


16 Lectures

Unit 3

Potentiometry
Introduction, reference and indicator electrodes, ion selective electrodes and their applications. Potentiometric titrations.

8 Lectures

Unit 4


10 Lectures

Text Book
R.S Khandpur- Analytical Instrumentation
Skoog and West: Analytical Instrumentation

Suggested Books:
Williard Meritt & Dean: Instrumental methods of analysis, (Dvan Nostr and Co)
Ewings E.W.: Instrumental methods of chemical analysis
B.E.Noltigk , Jones – Instrument Technology – Volume 2 & 3 (ELBS)
Ewings Analytical instrumentation handbook By Jack Cazes, Galen Wood Ewing
INHT-602 Biomedical Instrumentation-II  
Marks: 100

Theory  
40 Lectures

Unit 1


10 Lectures

Unit 2

Biotelemetery - design, single channel, bio telemetery transmitter and receiver system, based on AM, FM modulation, pulse modulation.

5 Lectures

Unit 3

Nuclear medicine system - radioactive emissions, rectilinear scanner, gamma camera, imaging system, ECT (emission coupled tomography), positron emission tomography, safety measures.

10 Lectures

Unit 4


15 Lectures

Text Books

Joseph J. Carr & John. M. Brown - Introduction to Biomedical Equipment technology  

Suggested Books:

J.G. Webster - Medical instrumentation application and design, Houghton Miffin Co., Boston USA.  
Leslie Cromwell, Fred J. Weibell and Erich A. Pfeiffer - Biomedical Instrumentations and Measurements (2e), PHI, 1991.
INHT-603: Statistical Quality Control

40 Lectures

Unit 1
Quality Concepts: Meaning of Quality, Approaches- Deming's Approach, Juran's Approach, Quality of Product, Quality of Service, Cost of Quality, Value of Quality, Difference between Inspection, Quality Control and Quality Assurance, Evaluation of Quality control, concept change, Quality Improvement Techniques Pareto Diagrams, Cause-Effect Diagrams Quality Circles, Kaizen, six sigma

10 Lectures

Unit 2
Control Charts: Chance and assignable causes, Statistical Basis of the Control Charts (basic principles, choices of control limits, sample size and sampling frequency, rational subgroups, analysis of pattern on control charts, warning limits, ARL, sensitizing rules for control charts, Control Charts for X-bar& R (statistical basis, development and use, estimating process capability; interpretation, the effect of non normality on the chart, the OC function, average run length and control chart for attribute (p,np,c)

10 Lectures

Unit 3
Design of experiment & Acceptance Sampling: Meaning, objective, and types of research, approaches, two factorial experiments, Taguchi Method. National quality Award and other quality awards, Principle of acceptance sampling. Producer’s and consumer’s risk. AOQL and LTPD, Sampling plans – single, double OC curve

10 Lectures

Unit 3

10 Lectures

Text Books:
S.Dalela - ISO 9000 Quality System

Suggested Books:
E.L.Grant & R.S. Kearenworth-Statistical Quality Control.
Kaoru Ishikawa-Guide to Quality Control, Asian Productivity Organization, Series
Jerry Banks –“Principles of Quality Control”, Wiley publisher.
Juran's Quality Control Handbook.
INHT-604: Microcontrollers and its applications

Theory 40 Lectures

Unit 1

Introduction to 8051 family microcontrollers. 8051 architecture, Register banks and Special Function Registers. Memory organization. Addressing modes. Instruction set: Data transfer, Arithmetic, Logical, Boolean and Branch instructions. 10 Lectures

Unit 2

Oscillator and Clock Circuit, Input / Output Ports, Timers, Serial Interface, Interrupts, External Interrupts. 8051 Programing 10 Lectures

Unit 3

8051 interfacing with Keyboard, display Units (LED, 7-segment display, LCD), ADC, DAC, Stepper motor. RS232 and RS485 driver interfacing. 10 Lectures

Unit 4

Introduction to RISC microcontrollers. Von-Neumann and Harvard architectures. Advance microcontroller features: Reset (Power ON, Watchdog, Brown-out, External), Power Saving and Sleep Modes, Timer modes (Input capture, output compare, PWM), SPI, USART, I²C and CAN bus 10 Lectures

Suggested Books:

INHP- 606: Instrumentation Practical – XI

Marks: 100

8 classes/week

Practical based on paper Statistical Quality Control using latest statistical software package
Analytical Instrumentation –II

1. Analysis of various compounds using atomic absorption system.
   a) Qualitative analysis
   b) Quantitative analysis

2. Study of NMR machine (optional)

3. Qualitative & quantitative analysis of drugs using mass spectrosopy (optional)

4. Experiment based on ion selective electrodes.

5. To analyze the given sample using external standard method using HPLC

6. To analyze quantitatively in the given sample using interval standard in GC

7. To analyze quantitatively given mixture of compound by comparing their retention time using HPLC

INHP- 606: Instrumentation Practical - XII

Marks: 100

Practical based on paper Microcontrollers and its applications

8 classes/week

1. Write a program to add N 8 bit unsigned integer numbers.

2. Write a program to multiply two 16 bit unsigned numbers.

3. Write a program to arrange the unsigned integer numbers in ascending/descending order.

4. Interface a display to the micro controller and display number sequentially in a regular interval.

5. Interface switches and LED’s. Write program to verify the switch condition and light the LED’s accordingly.

6. Generate a PWM waveform whose width can be increased/decreased using switches.

7. Convert the analog voltage to digital using ADC and store the data in memory.

8. Generate the given waveform using DAC.

9. Using display and keys write program to work as a stop clock.

10. Using display and keys write program to work as a counter.

11. Interface a matrix keyboard and display the key pressed.

12. On-OFF temperature controller.

13. RPM meter.