

SHIVAJI UNIVERSITY KOLHAPUR
SCHOOL OF NANOSCIENCE AND TECHNOLOGY

SEM III Physical sciences III

Unit 1

(10)

Review of atomic model, vector atom model, space quantization and electron spin, Stern and Gerlach experiments, Zeeman effect (normal and anomalous), De-Broglie's hypothesis, Davisson- Germer Experiment, Heisenberg's uncertainty principle.

Unit 2

(15)

Crystal structure (Elementary idea), lattice and basis, Unit cell, fundamental type of lattices, Miller indices, lattice planes, simple cubic, FCC and BCC lattices, reciprocal lattices, Bragg's law, powder method of X ray diffraction, analysis of cubic crystal structure.

Unit 3

(10)

Magnetic dipole, origin of magnetization, types of magnetic material, hysteresis, B-H curve, relations between B and H, magnetism in superconductor, Meissner effect, ferrites- synthesis and application.

Unit 4

(10)

Electromagnetic spectrum, plane electromagnetic wave, Derivation of Maxwell equation, Poynting vector, boundary condition for electromagnetic field vector, wave equation, concept of waveguide (Circular and Rectangular)

SHIVAJI UNIVERSITY KOLHAPUR
SCHOOL OF NANOSCIENCE AND TECHNOLOGY

SEMIV: Physical sciences IV

Unit 1

(15)

Michelson's interferometer and Fabry-Perot interferometer- Principle, construction and working, application of Michelson's interferometer as measurement of wavelength of light, superiority of F-P interferometer over Michelson's interferometer. Theory of Half period zones, Principle, construction and working of zone plate, Fresnel's diffraction at a straight edge.

Unit 2

(10)

Absorption, spontaneous and stimulated emission, Einstein coefficient, population inversion, optical and electrical pumping, properties of LASER, HE-NE LASER, semiconductor LASER, concept of Holography.

Fiber Optics- structure and types, numerical aperture, pulse dispersion in step index fiber, fiber optics communication system, application of optical fiber, transit time calculation in parabolic index slab.

Unit 3

(10)

Schrodinger time dependent and independent wave equation, general solution of Schrodinger equation, application- SHO, particle in 3D rigid box, step potential, Alpha decay.

Unit 4

(10)

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Basic concepts in Statistical Physics: Micro and macro states, micro canonical and canonical ensembles, phase space, accessible micro states, a priori probability, thermodynamic probability, probability distribution, entropy and probability. Maxwell-Boltzmann Statistics: M-B distribution law, evaluation of constants α and β molecular speeds, law of equipartition of energy.

Reference Books:

1. Physics volume I –Halliday&Resnick.
2. Elements of properties of matter by D.S.Mathur.
3. Properties of Matter-Newman &Searl
4. Schaumsoutline series- programming with C, second edition, Byron S.Doltfried (Tata McGraw-Hill.)
5. Programming with ANSI, C. Balgurswami.
6. Let us C, YashvantKanitkar(BPB Publication, New Delhi.)
7. Geometrical & Physical optics by D. S. Mathur.
8. A Text book of optics (New edition) by Subrahmanyam&Brijlal.
9. Fundamentals of optics by Jenkins and White.
10. Optics (second edition) by Ajay Ghatak.
11. Laser and Non liner optics by B.B. Laud.
12. Optics & Atomic Physics - SatyaPrakash.
13. Perspectives of modern Physics-Arthur Beiser.
14. Atomic and nuclear Physics by Gupta and Gosh, 2nd Edition.
15. Quantum Mechanics by sing, Bagade, Kamal Shing, Chand & Comp.
16. Introduction to Atomic and Nuclear Physics by H. Semat and Albrogth.
17. Atomic Physics by J.B. Rajam.
18. Concepts of modern Physics by S.L. Gupta and S. Gupta, Dhanpatrai and Son

B.Sc. Part II (List of Physics experiments) SEMESTER :3

- 1-Measurment of earth's magnetic field using Earth's inductor
- 2- Hysteresis by magnetometer method.
- 3- Determination of lattice constant using given XRD powder pattern.
- 4- IV characteristics of solar cell (In dark and In light) and verification of inverse square law.
- 5- Band gap energy using semiconductor diode.
- 6- Sensitivity of CRO and measurement of unknown frequency.
- 7- Constants of B.G.
- 8- Comparison of capacities by De Sauté's method.
- 9-Carry foster's bridge- Measurement of low resistance.
- 10- Study of line absorption spectrum and measurement of temperature of flame.

- 11 –C-Language fundamentals-I a)Determination of area of a circle.
b) Determination of area of a rectangle.
- 12- C-Language fundamentals-II a) Program for biprism experiment.
b) Determination of Stefan's Constant

SEMESTER: 4

- 1- A) To measure wavelength of given He-Ne laser source using diffraction grating.
B) To study of divergence of laser beam.
 - 2- Biprism- determination of wavelength.
 - 3-Band absorption spectrum of liquid (KMnO₄ solution)
 - 4- R.P. of telescope.
 - 5- Study of scattering of light (diameter of lycopodium powder).
 - 6- Measurement and identification of spectral lines.
 - 7- Michelson's Interferometer to measure wavelength.
 - 8-Searl's goniometer.
 - 9- γ and η using flat spiral spring.
 - 10- Velocity of sound using CRO and microphone.
 - 11- Viscosity of liquid by Searle's viscometer.
 - 12- S.T. by ripples method.
- Note:** 1. Study tour may be arranged for B. Sc. II class Physics students.
2. At least eighty percent practical should be performed by the student.

SNST, P-302, Chemical Science – III

Unit – I, Alcohols and Phenols.

(15)

1) Dihydric alcohols : Nomenclature, methods of formation of (a) Ethylene glycol – from ethylene, ethylene dibromide and ethylene oxide. Physical properties. Chemical reactions of ethylene glycol – acidic nature, reaction with hydrogen halide, Oxidation – Lead tetraacetate, HIO₄ and Nitric acid. Uses of ethylene glycol. (b) Pinacol formation, Pinacol – pinacolone rearrangement and its mechanism.

2) Trihydric alcohols : Nomenclature, methods of formation of glycerol – from fats and oils. Synthesis from elements carbon and hydrogen. Physical properties. Chemical reactions of glycerol – reaction with electropositive metals, reaction with hydrogen halides (HCl & HI) Reaction with conc. Nitric acid in presence of conc. Sulphuric acid. Reactions with potassium hydrogen sulphate, Esterification and oxidation with Fenton's reagent. Uses of glycerol.

Aliphatic and Aromatic amines.

a) Structure b) Classification c) nomenclature d) physical Properties – salt of amine e) preparation of amine from – reduction of nitro compounds, reductive amination, reduction of nitriles, Hoffmann degradation of amides f) Reactions of amines - basicity, salt formation, alkylation, conversion into amides, ring substitution in aromatic amines, Hoffmann elimination reactions with nitrous acid g) Diazonium salts – preparation and reactions h) Sandmeyer reaction i) Replacement of nuclear 'H' by – I, -OH and H- j) Analysis of amines.

Application of alcohols and amines with special emphasis on synthesis of Nano particles

Unit – II, Chemistry of Transition metals and their co-ordination complexes. (10)

General characteristic properties of transition elements, variable oxidation states, absorption spectra and magnetic properties, co-ordination compounds of transition elements, Werners theory of co-ordination compounds, nomenclature of co-ordination compounds, co-ordination theory, co-ordination theory number and stereochemistry theories of compounds, splitting of d-orbital in octahedral and tetrahedral ligand field.

Unit – III, Physical Properties of Liquids and Solutions. (10)

Physical Properties: Types (additive, constitutive and colligative properties), characteristics of liquid state in terms of intermolecular forces, properties of liquids, vapour pressure, Surface tension and Viscosity.

Vapour pressure of liquid and its dependence on temperature, Clapeyron equation, Clausius-Clayperon equation, measurement of vapour pressure, Viscosity and viscosity coefficient, measurement of viscosity, Ostwald's viscometer method, Fluidity of liquids and viscosity, Surface tension, unit of surface tension, capillary rise and drop weight method of measurement of surface tension,

Solution: Methods of expression of composition of solution, effect of concentration of solute on surface tension of liquid, surface active materials, Parachor, Numerical problems.

Unit- IV, A) Gravimetric methods. (10)

Mechanism of precipitate formation, Aging of precipitate, precipitation from homogeneous solutions, coprecipitation, postprecipitation, washing, drying and ignition of precipitates, use of organic reagents in gravimetry.

B) Volumetric methods.

Theories of indicators, types of titrations, Acid-base, Redox, Precipitation, Complexometric, Iodometric.

Reference Books,

- 1) Coordination Chemistry 2nd Edition: D. Banerjee.
- 2) Concise Coordination Chemistry: R. Gopalan, V. Ramalingam.
- 3) Advanced Inorganic Chemistry: Gurdeep Raj.
- 4) Analytical Chemistry 6th Edition: Gary D. Christian.
- 5) Undergraduate Physical Chemistry Vol. 1: Gurtu and Gurtu.
- 6) Physical Chemistry Vol. 2: Gurtu and Gurtu.
- 7) Physical Chemistry: K. L. Kapoor.
- 8) A text Book of Physical Chemistry: K. L. Kapoor.
- 9) Advanced Physical Chemistry: Gurdeep Raj.

Experiments,

- a) Organic estimations:
 - i) Saponification value of oil.
 - ii) Estimation of aspirin from aspirin tablets.
- b) Inorganic Preparations:
 - i) Preparation of tetrammine copper (II) sulphate.
 - ii) Preparation of Ferrous ammonium sulphate.
- c) Determination of percentage of Copper in Brass sample.

- d) Determination of Strength of strong acid by titrating it against strong base conductometrically.
- e) Determination of Strength of weak acid by titrating it against weak base conductometrically.

SNST, P-404, Chemical Science – IV

Unit- I, Ethers and Epoxides.

(15)

Ethers: Introduction, Nomenclature, methods of formation of anisole by Williamson's synthesis and from diazomethane, chemical reactions of anisole, Gravimetric estimation of $-\text{OCH}_3$ group by Ziesel's method (Related problems are expected based on % of $-\text{OCH}_3$ and no. of $-\text{OCH}_3$ groups).

Crown ethers: Introduction, Nomenclature, Synthesis and applications

Epoxides : Introduction, Nomenclature, commercial method of preparation of Styrene oxide, ethylene oxide. Acid and Base catalysed ring opening of epoxides. Reactions of epoxide with Grignard and organolithium reagents.

Reduction: Wolf –kishner , clemmenson ,metal hydride reduction(LiAlH_4 , NaBH_4), Raney Nickel, MPV-reduction,

Unit- II, Chemistry of Inner transition Elements.

(10)

General properties of lanthanides, variable oxidation states, absorption spectra, magnetic properties, stereochemistry, lanthanide contraction, separation of individual lanthanides, industrial applications of lanthanides, General properties of actinides, electronic configuration, synthesis of actinides, applications of actinides.

Unit- III, A) Thermodynamics,

(10)

Introduction, reversible process, Carnot cycle, entropy, maximum work done in isothermal expansion of gas, physical significance of entropy, entropy and probability, Numerical problems.

B) Colloidal State,

Introduction, colloidal solution, comparison with true solution, classification of colloidal system, preparation of colloidal solutions, sols and its types, dispersion method, condensation method for preparation of sol, optical and kinetic properties of colloidal solution, purification of sols.

Unit - IV, A) Chromatography.

(10)

Introduction, General principles, Classification. Paper chromatography, Column chromatography, Thin layer chromatography, Gas chromatography

B) Introduction to Spectroscopy.

Meaning of spectroscopy, Nature of electromagnetic radiation -wave length, frequency, energy, amplitude, wave number, and their relationship, different units of measurement of wavelength frequency, different regions of electromagnetic radiations

Regions of electromagnetic radiation. Interaction of radiation with matter- absorption, emission, florescence and scattering, Types of spectroscopy and

advantages of spectroscopic methods. Energy types and energy levels of atoms and molecules

Experiments,

Organic Preparations:

- i) Multicomponent reaction - Preparation of Dihydropyrimidone.
- ii) Radical coupling reaction - Preparation of 1,1,2 bis-2 naphthol.
- iii) Base catalysed Aldol condensation- Preparation of Dibenzalpropanone.
- iv) Diels Alder reaction- Reaction between Furan and Maleic acid.
- v) Determination of refractive index of given liquid using Abbe's refractometer.
- vi) Qualitative analysis of organic mixture (any three)
- vii) Determination of given fertilizer sample.
- viii) Estimation of Iron ore.

Reference Books,

- 1) Concise Inorganic Chemistry: J. D. Lee.
- 2) Principles of Inorganic Chemistry: Puri, Sharma, Kalia.
- 3) Advanced Inorganic Chemistry: Agarwal, Keemti Lal.
- 4) Undergraduate Physical Chemistry Vol. 1: Gurtu and Gurtu.
- 5) Physical Chemistry Vol. 2: Gurtu and Gurtu.
- 6) Physical Chemistry: K. L. Kapoor.
- 7) A text Book of Physical Chemistry: K. L. Kapoor.
- 8) Advanced Physical Chemistry: Gurdeep Raj.

SHIVAJI UNIVERSITY, KOLHAPUR
School of Nanoscience and Technology
(5 year integrated multidisciplinary 10 semester course)
Semester-III
SYLLABUS
Title of the paper: Life Sciences-III

Introductory Biology

Topic Number	Credits: 3	Lectures 45
1	<p style="text-align: center;">UNIT – I</p> <p>Chemical basis of life:- Water:- Physical properties of water, structure of water molecule, weak interaction in aqueous solution, Vander Waals interaction, interaction between water and non polar solvent. pH and Buffer:- pH, Henderson–Hasselbalch equation, ionic product of water, Buffer:- Acidic buffer, basic buffer, biological buffer system. Biomolecular Interaction:- Van der Waals interactions, hydrogen bonds, ionic interactions and hydrophobic interactions Thermodynamics of Biological Systems:- The effect of pH on standard-state free energies, the important effect of concentration on net free energy changes, the importance of coupled processes in living things, the high-energy biomolecules.</p>	10
2	<p style="text-align: center;">UNIT- II</p> <p>Ecology and Evolution :- Ecology :- Definition of ecology, kinds of ecosystem, abiotic and biotic component, food chain food web, ecological pyramids. bio-geo chemical cycle :- carbon, nitrogen, phosphorous, sulfur cycle Natural resources conservation and Management :- Water and forest resource management. Community ecology:- Characteristics of communities, classification of communities, ecotone and edge effect, Ecological indicator. Evolution:- Fact of evolution, theories of evolution:-Lamarckism, Darwinism, Modern synthetic theory, germplasm theory, mutational theory. adaptive radiation and microevolution.</p>	11
3	<p style="text-align: center;">UNIT –III</p> <p>Mendel's law of Inheritance:- principle of segregation, independent assortment, Dominance, Mendelian genetics in humans, Variety of gene expression – modifiers, suppressors, pleiotropic</p>	12

3	<p style="text-align: center;">UNIT –III</p> <p>Mendel's law of Inheritance:- principle of segregation, independent assortment, Dominance, Mendelian genetics in humans, Variety of gene expression – modifiers, suppressors, pleiotropic gene, multiple allele, interaction of gene- epistasis, complementary gene, duplicate gene. Linkage - Definition, coupling and repulsion hypothesis, linkage Groups.</p>	12
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	<p>Crossing over – Mechanism and theory, structural and numerical changes in chromosomes.</p> <p>Population genetics :- Mendelian population, gene pool, gene frequency, hardy-weinberg law.</p>	
4	<p style="text-align: center;">UNIT IV</p> <p>Microbial growth:- Growth phases, measurement of growth, continuous growth, synchronous growth and diauxic growth, effect of environmental factors on microbial growth (temperature , pH, osmotic pressure, heavy metal). batch cultures, continuous cultures and fed batch cultures. General principle of microbial nutrition, classification based on microbial nutrition. Fermentation:-Definition, basic concepts of fermentation traditional fermentations (wine, beer), contemporary fermentations (vinegar and citric acid, antibiotics).</p>	12

REFERENCES -

1. Fundamentals of ecology ; E.P Odum.
2. Concept of ecology ; Dash.
3. Enviornmental Biology,Verma Agerwal
4. Enviornmental Science., Saigo, Canninhham
5. General ecology., H.D.Kumar
6. Strickberger “Genetics”
7. Freifelder “Genetics”
8. Stanier “General Microbiology”
9. P.K.Gupta “Genetics”
10. C. Sarin “Genetics”
11. Larry Snyder Wendy Champness “Molecular Genetics of Bacteria”
12. Biochemistry- Lubert Stryer
13. 13.Biochemistry- Nelson and Cox
14. Biochemistry - Garrett & Grisham
15. 14.Practical Biochemistry- Wilson and Walker
16. Fundamentals of Biochemistry – J. L. Jain
17. Principals of Biochemistry- Voet and Voet
18. Fundamentals of Plant Physiology- V. K.Jain
19. General Microbiology – R. Y. Stanier and others. Macmillan Press Ltd.
20. Principles of Fermentation Technology – Stanbury and Whitaker. Pergamon Press.
21. Industrial Microbiology – L. E. Casida Jr. John Wiley and Sons.
22. Microbial Technology, Volumes I & II – H. J. Peppler. Academic Press
23. A Compendium of Good Practices in Biotechnology – Biotol Series

SHIVAJI UNIVERSITY, KOLHAPUR

School of Nanoscience and Technology

(5 year integrated multidisciplinary 10 semester course)

Semester-IV

SYLLABUS

Title of the paper: Life Sciences-IV

Basic Biochemistry

Topic Number	Credits: 3	Lectures
		45
1	<p style="text-align: center;">UNIT I</p> <p>Proteins:- Amino acids structure and general properties, alpha helix and beta</p>	11

	sheet, tertiary and quaternary structures. classification of proteins; based on size, shape, biological functions (enzyme, transport, storage, contractile, structural, defense and regulatory. structure of peptide bond, restricted rotation, cis-trans, bending, ramchandran plot, peptides, membrane proteins, techniques for studying primary structure of proteins.	
2	<p style="text-align: center;">UNIT II</p> <p>Carbohydrates:- Classification, monosaccharides, disaccharides, polysaccharides, epimers, isomers, anomers, chiral carbon atoms, chair and boat forms, glycolysis, gluconeogenesis, glycogenolysis, glycopyranose, fructopyranose.</p> <p>Lipids:- Definition and classification of lipids, fatty acids, general formula, nomenclature and chemical properties, structure function and properties of simple, complex, acylglycerols, phosphoglycerides, waxes, terpins, steroids and postaglandins.</p>	12
3	<p style="text-align: center;">UNIT III</p> <p>Hormones: - Definition, endocrine glands, hormones and their function, hormonal imbalance and associated diseases. hormones of pituitary gland and sex hormones</p> <p>Vitamins:- General characters, classification, source, role and deficiency</p> <p>Fat soluble vitamins: - A, D, E and K</p> <p>Water soluble vitamins:-B complex and C</p>	12
4	<p>Unit IV</p> <p>Nucleic acid:- Experimental Evidences for DNA as a genetic material: -Griffith's Exp., Avery, Macleod, McCarty Exp., Blender Exp. RNA As a genetic material .Gierer and Schram expt.,Bases, nucleosides and nucleotides, purines and pyrimidines, Watson-Crick model of DNA, A, B, & Z forms of DNA, chargaff's rule, Tm, Cot Curve, concept of gene, unit of gene (cistron, recon, muton), fine structure of gene, one gene one polypeptide hypothesis, interrupted gene</p> <p>Organization of genome: - viral (lambda, T4), bacteria (E.coli.), eukaryote, typical structure of chromosome (euchromatin & heterochromatin), packaging of DNA (nucleosome, solenoid model)</p>	10

REFERENCES:-

1. Lehninger's Principles of Biochemistry by Nelson, D. L. and Cox, M. M.
2. Biochemistry by Lubert Stryer.
3. Principles of Protein Structure by Shulz and Schimer.
4. Complex Carbohydrate by Nathan Sharon.
5. Molecular biology by Watson
6. Genetics by Strickberger
8. Biochemistry - Garrett & Grisham
9. Practical Biochemistry- Wilson and Walker
10. Fundamentals of Biochemistry – J. L. Jain

11. Principals of Biochemistry- Voet and Voet
12. Molecular Biology by Glickpasternack
13. Molecular biolage Gerald Karp
14. Gene By Benjamin Levin
15. Genome by T.A. Brown
16. Animal Physiology- Nelson (Cambridge).
17. General and Comparative Physiology – Hoar (Prentice Hall).

Theory- Course No. -SNST- 404T

Advanced Instrumentation

Unit 1: The nature of electromagnetic radiation, electromagnetic spectrum, atomics-molecular electronics-vibration- X ray energy levels, Raman Effect, nuclear and electron spin behavior, ultraviolet and visible spectrophotometry instrumentation, radiation sources, detectors, readout module, filters, monochromators and performance, grating system, instrument for absorption photometry, ultraviolet and visible absorption methods, fundamental laws of photometry, difference spectroscopy, derivative spectroscopy, spectra of solid, correlation of electronic absorption spectra with molecular structure.

Unit 2: Fluorescence and phosphorescence spectrophotometry, structural factors, photoluminescence intensity as related to concentration, instrumentation for phosphorescence measurement, flame emission and atomic absorption spectrometry, Nebulization, flames and flame temp., interferences, flames spectrometry techniques, atomic emission spectroscopy, spectroscopic sources, atomic emission spectrometer, photographic and photoelectric detection.

Unit 3: Infrared spectrophotometry, correlation of infrared spectra with molecular structure, instrumentation, sample handling, theory of Raman spectroscopy, instrumentation, sample handling and illumination, diagnostics structural analysis, polarization measurement, X-ray methods, production of X-rays and X-ray spectra, instrumental units, detectors for measurement of radiation, semiconductor detectors, direct X-ray methods, X-ray absorption methods, X-ray fluorescence methods, X-ray diffraction.

Unit 4: PH and ion selective potentiometer, glass membrane electrode, solid state sensors, liquid membrane electrode, gas sensing and enzyme electrode, glass electrode for PH measurement, electrometric measurement of PH and PI,

voltammetry paleography and related technique, current-voltage relationship, characteristics of dropping mercury electrode, the half wave potential, instrumentation, modern voltammetry techniques, NMR spectroscopy, basics principles, continuous wave NMR spectrometers, pulsed Fourier transforms NMR spectrometer, spectra and molecular structure, elucidation of proton NMR spectra, Electron spin resonance spectroscopy, electron behavior, ESR spectrometers, ESR spectra, interpretation of ESR spectra, ENDOR and ELDOR, principle and working of AFM, SEM and FESEM.

References:

1. Instrumental method of analysis, Lynne I. merritt jr., CBS publication, 1990
2. Instrumental method of analysis, Hobart Hurd Willard, Van Nostrand, 1981
3. Principles of instrumental analysis, Douglas A. Skoog, Donald M. West, 1980
4. Organic spectroscopy, William Kemp, Macmillan, 1987
5. Analytical Chemistry, 6th Ed., Gary D. Christian, John Wiley & Sons, 2007
6. Introduction to instrumental analysis, Robert D. Braun, McGraw-Hill Ryerson, Limited, 1987
7. Chemical instrumentation: a systematic approach, Howard A. Strobel, William R. Heineman, Wiley, 1989
8. Nanotechnology: An introduction to nanostructuring technique Michael Kohler, Wolfgang fritzsche, Wiley –VCH (2007)
9. Handbook of Nanotechnology, Bhusan (Editor), Springer, Berlin Heidelberg New York (2010)
10. W.R.Fahrner, "Nanotechnology and Nanoelectronics – Materials, Devices and Measurement Techniques" Springer, 2006

Lab- Course No. -SNST- 414P

1. Studies of optical absorption and transmission of thin film
2. XRD studies on composite/oxides
3. Studies on IR spectra of the material
4. Studies on SEM of different material
5. Studies on AFM of different material
6. Studies on Photoluminescence spectra of oxide semiconductor
7. Studies of PH conductivity of different material

Fundamental of Instrumentation

1. Principle of measurement:

Measurement and error: Definition, accuracy & precision, significant figure, type of error, statistical analysis, probability of error and limiting error

System of units of measurement: fundamental and derived units, system of units, electric and magnetic units, international system of units, other system of units and conversion of units.

Standard of measurements: classification of standard, standard for mass, length and volume, electrical standard, international standard and IEEE protocol and standards.

2. Transducers:

Classification of transducer, selecting of transducer, Electrical Transducers and their parameters; Types of Transducers, Electro acoustic transducers, Force/Pressure transducers, Temperature Transducers, Analytical sensors, Radiation sensors, fiber Optical sensors, Smart sensors, signal conditioner, Instrumentation Amplifier, Bridge amplifier, active filters, Thermocouple Amplifier.

3. Measurement techniques:

Impedence measurement: introduction, resistance measurement-Voltmeter-Ammeter method and ohmmeter, Whetstone Bridge, measurement of low and high resistance, Inductance measurement, capacitance measurement, frequency measurement, Q-meter, complex impedance measurement meters and digital LCR Q-meter.

Voltage and Current measurement: introduction, basic DC ammeter, basic DC voltmeter, digital voltmeter and digital multimeter.

4. Data Converter and Data Acquisition System:

Data converter: D/A converter: circuit, converter and specification, A/D Converter: A/D Converter circuit, Type: parallel comparator, successive approximation, dual slope, aliasing effect, folding and folding frequency.

Data Acquisition System: Block diagram of DAS, objective of DAS, single channel and multi channel Data Acquisition System, computer based data acquisition system and data loggers, linearization of signal, source of noise, conductive, inductive and capacitive coupling, grounding methods, isolation amplifier, classification of isolation and opto-isolator.

References:

1. Electronic Instruments – K.S.Kalsi, (Tata Mc-Graw Hill)

2. Electronics instrument and measurement techniques: W. D. Copper and A. D. Helfrick, third edition, PHI publication, 1993.
3. Sensor & transducers, D. Patranabis, 2nd edition, PHI
4. Instrument transducers, H.K.P. Neubert, Oxford University press.
5. Signal conditioner and data converter: S. S. Narkhede and G. K. Kharate, Technical Publication,.
6. Measurement systems: application & design, E.A.Doebelin, Mc Graw Hill.
7. Instrumentation, Measurements and Analysis -B.S. Nakara and VSV Mani(TMh)
8. Instruments and Instrumentation Technology – M.M.S. Anand (PHI)
9. A Treatise on Sensor Interfacing- Tukaram Dongale and Dr. R. K. Kamat, LAP LAMBERT Academic Publishing House, Germany

Lab- Course No. - SNST- 314P

List of Practical

1. characteristics Study of thermocouple
2. characteristics Study of thermistor
3. characteristics Study of Instrumentation Amplifier
4. Measurement of Strain Gauge- using Bridge Amplifier
5. Study of ON/OFF Temperature Controller
6. characteristics Study of Load cell
7. Study of Photo Diodes and LDR
8. Displacement measurement by Linear Variable Displacement Transducers
9. MATLAB Simulation of 2nd order Active filters in MATLAB

Shivaji University , Kolhapur
School of Nanoscience and Technology (SNST)
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Semester-III
Syllabus

Title of the paper : Computational Methods I

Paper No: SNST-

305T

Total Marks: 100
(80+20)

Topic No.	Credit : 3 Name of Unit	Lectures 45
1	UNIT I Numerical Differentiation 1.1 Introduction, Definition 1.2 Numerical differentiation using Newton's forward difference interpolation formula, 1.3 Newton's backward difference interpolation formula,	(10)
2	1.4 Sterling's Central difference interpolation formula , 1.5 Newton's divided difference formula	(10)
3	UNIT II Numerical Solution of Ordinary Differential Equations of first order and first degree : 2.1 Introduction 2.2 Numerical Methods of solving first order first degree D.E. 2.3 Solution by Picard's methods , 2.4 Taylor's series method ,	(12)
	2.5 Euler's methods , 2.6 Modified Euler's method, 2.7 Runge-Kutta second and fourth order Method. UNIT III Partial Differentiation 3.1 Introduction, 3.2 Composite function, 3.3 Chain Rule and Total derivative , 3.4 Euler's theorem on homogeneous function of two variables . 3.5 Application of Partial Differentiation : 3.5.1 Jacobian, 3.5.2 Properties of Jacobian, 3.5.3 Jacobian of Implicit function, 3.5.4 Partial derivatives of Implicit function using Jacobian, 3.5.6 Errors and Approximation. Maxima and Minima of functions of two variables. Partial Differential Equation 3.1 Introduction, Order and degree, 3.2 Method of forming Partial differential equation, 3.3 Solution of Equation by Direct method , Lagranges Equation, 3.4 Charpits method, 3.5 Linear Homogeneous Partial Differential Equation, 3.6 Rules for finding the C.F and P.I.	(13)
	UNIT IV A. Vector Analysis 4.1 Introduction –Representation of Vectors in space , Scaler product and vector product, 4.2 Derivative, Derivative of Triple Product and composite functions 4.3 Directional Derivative. 4.4 Vector differential operator DEL, Gradient 4.5 Geometrical Interpretation of DEL 4.6 Divergence, Curl, Gauss, Stoke's, Green's Theorem. B. Transform Analysis Laplace Transform 5.1 Definition, Transforms of elementary functions, 5.2 Properties of Laplace transforms, transforms of derivatives, 5.3 transforms of	

BOOKS :

1. Introductory Methods of Numerical Analysis, S.S. Sastry, 3rd edition, Prentice Hall of India, 1999.

2.. Finite differences and Numerical Analysis, H.C. Saxena , S.Chand and Company.

3. J. N. Wartikar - A text book of Applied Mathematics Vol-I and II Pune Vidyarthi Griha Prakashan.

4. P. N. and J. N. Wartikar , Elements of Applied Mathematics.

5. B.S. Phadatare, U.H. Naik, P.V. Koparde, P.D .Sutar, P.D .Suryvanshi, M.C. Manglurkar, A Text Book Of Advanced Calculus Published by Shivaji University Mathematics Society (SUMS), 2005.

6. S.B. Kalyanshetti, S.D. Thikane, S.R .Patil, N. I. Dhanashetti, A Text Book Of Mathematics -Advanced Calculus Published by Sheth Publishers Pvt. Ltd. Mumbai

7. Dr. B. S. Grewal - Higher Engineering Mathematics, Khanna Publishers, Delhi.

7.G.V.Kumbhojkar, Engineering Mathematics II, C.Jamnadas and Co.

8. H. K. Dass - Advanced Engineering Mathematics.

9.M.R.Spiegel Advanced Calculus-Schaum Series

Shivaji University, Kolhapur
School of Nanoscience and Technology (SNST)
(5 year integrated multidisciplinary 10 semester course)

Semester-III
Laboratory course (Credit 2)

Title of the paper : Computational Methods I

Paper No: SNST-304T
Marks : 25

Sr.NO	Topic	No.Of Practicales
1	Numerical Diffrentiation	1
2	Numerical Methods for solution of Linear Equations: (Using Calculators) a) Gaussian Elimination Method b) Gauss – Jordan (Direct)Method c) Gauss Seidel (Iterative)Method.	1
3	Jacobian and Extreme values for two variables , Error and Approximation	2
4	Divergence , Curl & Gradient (examples)	1

5	Application of Laplace Transform	1
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BOOKS:

1. J. N. Wartikar - A text book of Applied Mathematics Vol-I and II
Pune Vidyarthi Griha Prakashan.
2. P. N. and J. N. Wartikar , Elements of Applied Mathematics.
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Shivaji University, Kolhapur.

School of Nanoscience and Technology (SNST)

(5 year integrated multidisciplinary 10 semester course.)

Semester –IV

Syllabus

Title of the paper : Computational Methods II

Paper No: SNST - 405T

Total Marks: 100

(80+20).

Unit – 1 Multiple Linear Regression (for trivariate data only):

- 1.1 Concept of multiple linear regression, Plane of regression, Yule's notation.
- 1.2 Fitting of regression plane by method of least squares, definition of partial regression coefficients and their interpretation.
- 1.3 Residual : definition, order, properties, derivation of mean and variance, Covariance between residuals.

Multiple and Partial Correlation (for trivariate data only):

- 1.4 Concept of multiple correlation. Definition of multiple correlation coefficient

$$R_{i,jk}$$

derivation of formula for multiple correlation coefficient.

- 1.5 Properties of multiple correlation coefficient;

$$(i) 0 \leq R_{i(d,jk)} \leq 1, (ii) R_{i(d,jk)} > |r_{ij}|, \quad (iii) R_{i(d,jk)} > |r_{ik}|, \quad i = j = k = 1, 2, 3, i \neq j, k$$

- 1.6 Interpretation of $R_{i,jk} = 1$, $R_{i,jk} = 0$.

- 1.7 Concept of partial correlation. Definition of partial correlation coefficient $r_{ij.k}$
derivation of formula for $r_{ij.k}$.

- 1.8 Properties of partial correlation coefficient
(i) $-1 \leq r_{ij.k} \leq 1$, (ii) $b_{ij.k}, b_{jk.k} = r_{ij.k}^2$.

Unit – 2 Exact sampling distributions:

- 2.1 Concept of sampling for finite population: SRS, SRSWR, SRSWOR, Stratified, systematic Sampling, Sampling error.
- 2.2 Chi-square distribution: definition, chi-square variate as the sum of square of n i.i.d.S.N.V., statement of p.d.f., mean, variance, additive property, normal approximation and examples.

- 2.3 Students t distribution: definition, nature of probability curve, statement of mean and variance, normal approximation, examples.
- 2.4 F – distribution: definition, inter-relationships between normal, chi-square, t and F distribution, examples.

Unit – 3 Test of Hypotheses:

- 3.1 Notion of random sample from probability distributions, statistic, sampling distribution of statistic.
Critical region, idea of one & two tailed test, type I and II errors, level of significance, p – value.
- 3.2 Large sample tests : Statement of Central Limit Theorem (CLT) for i.i.d. r.v.s, construction of test statistic and identification of its probability distribution
- (a) Test for proportion : i) $H_0: P = P_0$ ii) $H_0: P_1 = P_2$
- (b) Tests for means : i) $H_0: \mu = \mu_0$ ii) $H_0: \mu_1 = \mu_2$.
- 3.3 Small sample tests : If X_1, X_2, \dots, X_n is a r.s. from (μ, σ^2) then \bar{X} and S^2 are Independently distributed (without proof), construction of test statistic and identification of distribution of test statistic.
- (a) t-tests for means: i)
- $H_0: \mu = \mu_0$ (σ unknown), ii) $H_0: \mu = \mu_0$ ($\sigma_1 = \sigma_2$ unknown)
- unpaired t test.
- iii) $H_0: \mu_1 = \mu_2$ (paired t test), iv) $H_0: \rho = 0$

Unit – 4 Simulation

- 4.1 Introduction to simulation, merits and demerits.
- 4.2 Pseudo-random number generator, model sampling from Binomial, Poisson, Geometric uniform and exponential distribution as simulation technique.
- 4.3 Model sampling from normal distribution using Box-Muller transformation.
- 4.4 Examples

Practicals :

1. Multiple Regression
2. Partial and multiple correlation
3. Sampling for finite – population
4. Large sample tests

5. Small sample tests
6. Simulation.

Reference books :

Rohatgi V.K.,Saleh A. K. and Md. Ehsan. Introduction to probability theory and Mathematical Statistics.

Kale B. K. A first course on parametric inference.

Cochran W. G. Sampling techniques.

Murthy M. N. Sampling Theory and Methods.

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Fundamentals of Mathematical Statistics.

Morgan B. J. Elements of Simulation.