

NOTIFICATION

No. 39 / 2018

Date: 7 / 6 / 2018

Subject : Introduction of new syllabi for M.Sc. (Chemistry) Part-II (Sem. III & IV), which to be implemented from the academic session 2018-19.

- 1) It is notified for general information of all concerned that the authorities of the University has introduced new syllabi for M.Sc.(Chemistry) Part-II (Sem. III & IV), which to be implemented from the academic session 2018-19. Hence the page Nos. 26 to 91, appearing in prospectus No. 2015125 be substituted respectively by the "**APPENDIX**", which is appended with this notification.
- 2) The authorities further provided two additional chances for the failure students of M.Sc.(Chemistry) Part-II (Sem.III & IV) after implementation of the aforesaid new syllabi.

Sd/-
(Dr.A.P.Deshmukh)
Registrar,
Sant Gadge Baba Amravati University

APPENDIX

**SEMESTER –III
Paper IX SPECTROSCOPY-I**

Total Lectures: 60Hrs, 4 Hrs per week, 12 Hrs/unit

Total Marks-80

- Unit-I :** **12L**
- A) Unifying principle:** Electromagnetic radiation, interaction of electromagnetic radiation with matter-absorbance emission, transmission, reflection, refraction, dispersion, polarization and scattering, Diffuse Reflectance (DRIFT), reflection absorption (RAIRS), multiple internal reflection (MIR) Uncertainty relation and natural line width and line broadening, transition probabilities, transition moment, selection rule, intensity of spectral lines. rotational, vibrational and electronic energy level. Fourier Transform spectroscopy.
- B) Microwave spectroscopy:** Classification of molecules, rigid rotor model, Rotation and Vibration of Diatomic Molecules: effect of isotopic substitution on the transition frequencies, intensities, non rigid rotor, nuclear and electron spin interaction and effect of external field, energy eigenvalues and Eigen states Classification of polyatomic rotors and the non-rigid rotor, Electronic transitions, Franck-Condon principle. Fluorescence and phosphorescence.
- C) Reactivity and Characteristics of Nanoparticles:** Increased reactivity of nanoscale materials, reasons for high reactivity, effect of size and shape of nanocrystals on reactivity, comparison of nanocrystalline versus macro-crystalline materials in terms of reactivity
- Unit-II** **12L**
- A) Ultraviolet and visible spectroscopy :** Various electronic transition (185-800nm), Beer-Lambert law, effect of solvent on electronic transition, UV band for carbonyl compounds, unsaturated carbonyl compound, diene, conjugated polyenes. Fisher-Woodward rules for conjugated dienes and carbonyl compounds, UV spectra of aromatic and heterocyclic compounds. Fieser-Kuhn rules for polyenes, Steric effects in biphenyls.
- B) Infrared spectroscopy :** Review of linear harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant and bond strength, unharmonicity, Morse potential energy diagram, vibration of polyatomic molecules, selection rules, normal modes of vibration, group frequencies, overtone band, factors effecting the band position and intensities, far IR region, metal ligand vibrations, Instrumentation and sample handling characteristics. Vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, amines. Detail study of vibrational frequencies of carbonyl compounds, (ketones, aldehydes, esters, amides, acids, acid chlorides and anhydrides, lactones, lactams and conjugated carbonyl compounds). Effect of hydrogen bonding and solvent on vibrational frequencies, overtones, combination bands and Fermi resonance. FT-IR, IR of gaseous solids and polyatomic materials. applications of vibrational spectroscopy in investigating (i) symmetry and shapes of simple AB₂, AB₃ and AB₄ molecules on the basis of spectral data, (ii) mode of bonding of ambidentate ligands (thiocyanate, nitrate, sulphate and urea). mode of bonding of ambidentate ligands, Cyanides, Ethylenediamine and Diketone complexes.
- Unit-III :** **12L**
- Mass spectrometry:** Introduction, theory, measurement techniques (EI, CI, FD, FAB) recording of mass spectrum. types of ions, isotopic contribution, fragmentation process, factors affecting fragmentation, ion analysis, ion abundance. Mass spectral fragmentation of organic compounds of various types, common functional groups, molecular ion, metastable ions, McLafferty rearrangement. Retro-Diels Alder fragmentation, nitrogen rule. High resolution mass spectrometry. Examples of mass spectral fragmentation of organic compounds with respect to their structural determination. studies of inorganic/coordination and organometallic representative compounds Fingerprint applications and the interpretation of Mass spectra Elementary study of GCMS, FTMS, high resolution MS, ESI-MS, MALDI-MS, examples from macromolecules and supramolecules, study of in-organic co-ordination & organometallic compounds.

Unit-IV

12L

A) Nuclear Magnetic Resonance Spectroscopy: General introduction and definition of nuclear spin, nuclear resonance shielding of magnetic nuclei, chemical shift, factors influencing chemical shift, shielding and deshielding, chemical shift values and correlation for protons bonded to carbons (aliphatic, olefinic, aldehydic, aromatic) and other nuclei (alcohols, phenols, enols, acids, amides, and mercaptans), basic idea about instrument, mechanics of measurement, chemical exchange, effect of deuteration, spin spin coupling (n²) rule, complex spin spin interaction between two, three, four, and five nuclei (first order spectra) factors effecting coupling constant classification of spin system like A, A², AB, AM, ABC, A²B² etc. Stereochemistry, hindered rotation Karplus curve-variation of with dihedral angle.

B) Carbon¹³ NMR spectroscopy : General consideration, chemical shift (aliphatic, olefinic, alkyne, aromatic, heteroaromatic and carbonyl), coupling constants, proton decoupled off resonance.

Unit-V :

12L

Characterization of Organic Molecules: General idea about two dimensional NMR spectroscopy C¹³S, N¹⁵ES, HETCOR- DEPT techniques, INPET, APT, INADEQUATE SM-4: simplification of complex spectra, nuclear magnetic double resonance, contact shift reagent, solvent effects, nuclear over hauser effect (NOE). Spin-spin, spin-lattice relaxations. Off resonance decoupling Lanthanide shift reagents, Aromatic induced shifts, deuterium exchange, spectra at higher fields.. NMR Spectroscopy (Inorganic) solid state NMR. Study of dynamic processes by VT NMR, restricted rotation (DMF, DMA, biphenyls, annulenes), cyclohexane ring inversion, degenerate rearrangements (bullvalene and related systems). Multinuclear NMR of B, Al, Si, F and P nuclei structure and dynamics of representative inorganic molecules, deriving activation and thermodynamic parameters application of NMR to magnetism and magnetic susceptibility measurements of paramagnetic metal complexes. Quantitative applications of NMR: Drug Analysis **Magnetic Resonance Imaging (MRI):** Introduction to Magnetic Resonance - Principles of Spatial encoding in Magnetic Resonance.

Books Suggested:

1. E. A. V. Ebsworth, D. W. H. Rankin and S. Craddock, Structural Methods in Inorganic Chemistry, 1st Edn.(1987), Blackwell Scientific Publications, Oxford, London.
2. R. S. Drago, Physical Methods for Chemists, (1992), Saunders College Publishing, Philadelphia. (30)
3. R. S. Drago, Physical Methods in Inorganic Chemistry, 1st Edn.(1971), Affiliated East-West Press, New Delhi.
4. K. Nakamoto, Infrared and Raman Spectra of Inorganic and Coordination Compounds, 4th Edn. (1986), John Wiley & Sons, New York.
5. W. Kemp, Organic Spectroscopy, 3rd Edn. (1991), MacMillan, London.
6. G. Aruldas, Molecular Structure and spectroscopy, (2001) Prentice Hall of India Pvt. Ltd., New Delhi. Organic Chemistry Specialization MC

Semester III

Paper X Analytical Chemistry-I Thermal & Electroanalytical Methods

Total Lectures: 60Hours, 4Hours per week, 12Hours/unit

Total Marks: 80

Unit-I

: Thermal methods of analysis and thermometric titrations:

12L

Introduction to thermal analysis: Thermogravimetric analysis (TGA), Differential thermogravimetric analysis (DTG), Differential thermal analysis (DTA) Principles and methods, presentation of thermal data. Implication of combinational TG-DTA technique. Differential Scanning Calorimetry (DSC): a brief outline and a comparative discussion of DSC with DTA. Instrumentation TG-deflection and null point balances, recording devices, design principles of the instrument DTA-Schematic diagram and methodology of the instrument DSC Schematic diagram and methodology of the instrument. Factors affecting the results of thermal analysis. Applications, Solid state reaction - decomposition of inorganic and organic compounds. Desolvation/deauration of inorganic compounds, automatic thermogravimetric analysis single, binary, ternary systems. Quantitative DTA, peak area and its equations. Development of Gravimetric analytical procedures, discovery of new chemical compounds. Evaluation of reaction kinetics (dynamic or Non-isothermal) parameters by thermal methods. Special applications of DSC glass transition of polymers, determination of purity and crystallinity of sample. Problems.

Thermometric titrations: Principles, method, apparatus, applications very weak acid, mixtures of weak and strong acid, complexometric and redox titration

Unit-II : Electroanalytical Methods

12L

High frequency titrations: Principle, Instrumentation- Cells, oscillator circuit and high frequency titrimeters, theory, correlation of high frequency titration curves with low frequency titration curves. Applications- acid base, complexometric, measurement of dielectric constant and analysis of mixture of organic compounds. Advantages and disadvantages of high frequency methods.

Electrogravimetry: Theory, Principle and types of electrogravimetry, electrode reactions, over voltage, characteristics of deposits and completion of deposition, separation of metals and applications.

Coulometry : Principal, coulometry at constant current, coulometry at constant potential coulometric method of analysis, instrumentation, coulometric titrations, Advantages of coulometric titrations, Applications of coulometric titrations, problems.

Unit-III : Chemical, biochemical and biosensors: 12L

Chemical Sensors, Chemical Sensor Characteristics, Electrochemical Sensor, Potentiometric Sensors, Conductometric Sensors, Amperometric Sensors, Chronoamperometry and Chronopotentiometry, Acoustic Wave Devices, Electrochemical Impedance Spectroscopy, Chemical and Biological Recognition, Application of Chemical Sensors in the Food Industry, Agriculture and Biotechnology, Biosensors and Their Principles, Types of Biosensors, Amperometric Immunosensors, Cholesterol Biosensor, Electrochemical Glucose Biosensors, Electrochemical biosensors, Drug Delivery Systems, Microbial Biosensors for Environmental Applications
Ion-selective electrode, Principle of ion-selective electrode, Types of ion-selective electrode Advantages and limitations of ion-selective electrode, The glass electrode, glass electrodes for pH measurement, Solid-state electrode, Liquid-based electrode, Selectivity coefficients, Biopotential Electrodes, Uses of ion-selective electrode, Applications of ion selective electrode in determination of some toxic metals and some anions (F^- , Cl^- , Br^- , I^- and N_3^-), Biomedical Applications

Unit-IV : Electroanalytical Techniques: 12L

Polarography: Theory, Basics of polarography, apparatus: Dropping mercury electrode. Supporting electrolytes. Effect of supporting electrolyte on the limiting current. Diffusion coefficient and its evaluation. Ilković equation, its derivation and applications Ilkovic equation-diffusion current constant and capillary characteristics determination. Half wave potential. Polarographic maxima. Interpretation of a polarographic curve. Role of temperature on diffusion current. Reversible, quasi reversible and irreversible electrode reactions and evaluation of parameters using various reactions derivative polarography, modified polarographic techniques, AC polarography, Limitations of polarography, pulse polarography. Methods of quantitative analysis: absolute, comparative, the PIL/TIN and kinetic methods

Voltammetry: Basic principles, Instrumentation, Cyclic voltammetry- Principle, Instrumentation and applications, Voltammograms, Stripping Technique: Anodic and cathodic stripping voltammetry and their applications in the trace determination of metal ions and biologically important compounds. Enzyme catalyzed reactions and applications of voltammetry in monitoring such reactions.

Related Techniques : Amperometric titrations and chronopotentiometry, Principle, methodology and their application in qualitative and quantitative analysis.

Unit V : Bio-analytical chemistry: 12L

Application of spectrophotometry in the quantitative estimation of biological macromolecules. Application of spectrofluorimetry in detection and estimation of biomolecules (both fluorescent and non-fluorescent). Assay of very low quantity of vitamin B₁ in food stuffs, NADH, hormones, drugs, pesticides, cholesterol, porphyrin in biological samples and preparation of the sample for performing the above experiments.

Ultracentrifugation: principles of sedimentation, preparative ultracentrifugation and analytical ultracentrifugation. Application of ultracentrifugation in separating bio-molecules and determining their mass.

Gel electrophoresis: principles, nature of various types of gels, their applications in separating bio-macromolecules and determining their mass. 2D gel electrophoresis and its applications. Toxicology: introduction, chemical structure-toxicity relationships, heavy metals induced toxicity and its remedy.

Books Suggested :

1. Day and Underwood: Quantitative Analysis
2. A. I. Vogel: A text book of quantitative analysis.
3. Flaschka: EDTA Titration
4. Meites and Thomas: Advanced Analytical Chemistry.
5. G. W. Ewing: Instrumental Methods of Chemical Analysis.
6. R. S. Draga: Physical Methods in Inorganic Chemistry
7. G. D. Christian: Analytical Chemistry
8. S. M. Khopkar: Basic Concept of Analytical Chemistry.
9. Kolltath and Ligane: Polarography
10. Braun: Instrumental methods of chemical Analysis
11. Willard, Merritt and Dean: Instrumental methods of Analysis
12. Strouts, Crifillan and Wison: Analytical Chemistry.
13. W. T. Spinks and R. Woods: Introduction to Radiation Chemistry.
14. S. A. Skoog and D. W. West: Fundamental Of Analytical Chemistry
15. R. V. Dilts: Analytical Chemistry

Semester III
Paper XI
Special Paper-I
Inorganic Chemistry (Bio-inorganic Chemistry)

Total Lectures: 60Hrs, 4 Hrs per week, 12 Hrs/unit

Total Marks-80

- Unit-I :** **12L**
A) Essential trace elements in biological systems: Perspective of essential trace elements, Influence of excess and deficiency of V, Cr, Mn, Fe, Co, Cu & Zn. Genetic defects in the absorption of trace elements. Regulation and storage of trace elements. Role of minerals. Toxic effects of metals, biological ligands for metal ions. Coordination by proteins, Tetrapyrrole ligands and other macrocycle. Biological functions of alkali cations and ligands for alkali cations, metal storage, transport and biomineralization with respect to ferritin, transferrin and siderophores, Na⁺/K⁺ pump. Role of calcium in transport and regulation in living cells.
- Unit II :** **12L**
A) Transport & Storage of Dioxygen: Heme proteins & oxygen uptake, structure and functions of haemoglobin, myoglobin, hemocyanins & hemerythrin. Perutz mechanism showing structural changes in porphyrin ring system. Oxygenation and deoxygenation. Model compounds. Cyanide poisoning and treatment. Vanadium storage and transport.
B) Transport of Oxygen, Electrons and Metal Ions: Transport of Electrons: Iron-Sulphur Proteins: Rubredoxins and Ferredoxins (2Fe, 3Fe, 4Fe, 8Fe Proteins) - High Potential Iron-Sulphur Proteins. Structural and Spectral features of Iron-Sulphur Proteins - Electron-transport by Cytochromes, Azurin and Plastocyanin - Importance of Structures of Azurin and Plastocyanin in facilitating Rapid Electron Transport. Transport and Storage of Metal Ions: Iron-Transport by Transferrin and Siderophores-Ferritin in Iron Storage - Transport of Na⁺ and K⁺ across Cell Membranes by Na⁺-K⁺ ATPase-Transport of Calcium across Sarcoplasmic Reticulum by Ca²⁺-ATPase.
- Unit-III :** **12L**
A) Bio-energetics and ATP cycle: DNA polymerization, metal complexes in transmission of energy, chlorophylls, photosystem I and photosystem II in cleavage of water, Model systems.
B) Electron transfer in Biology: Structure and functions of metalloproteins in electron transfer proteins, cytochromes & Fe-S proteins, Non-heme iron proteins. Rubredoxins, Synthetic models. Biological Nitrogen fixation (in vitro and in vivo)
- Unit IV :** Metallo enzymes :
 Apoenzymes, Holoenzyme & Coenzyme. The principle involved and role of various metals in-
 i) Zn-enzyme:- Carboxyl peptidase & Carbonic anhydrase.
 ii) Fe-enzyme:-Catalase Peroxidase & Cytochrome P-450
 iii) Cu-enzyme:-Super oxide dismutase
 iv) Molybdenum:-xanthine transferase enzymes, xanthine oxidase, Co-enzyme Vit. B₁₂, Structure of vitamin B₁₂ Co-C bond cleavage, Methylase activity of co- Enzyme B-12, Alkylation reactions of Methyl Cobalamin. Synthetic model of enzyme action, stability and ageing of enzyme.
 v) Nickel Enzyme: Urease, Hydrogenase and Factor F430: Reactions Catalysed, Mechanistic Aspects
- Unit V :** **Chelate therapy and metallothrapy:** **12L**
 A brief introduction to chelate therapy and its types, Therapeutic spectra of different chelating drugs in metal ion detoxification: chelating drugs containing sulphhydryl group, the polyaminocarboxylic acids, polyethyleneamines, desferrioxamines. Radioprotective chelating drugs, limitations and hazards in chelation therapy.
 Medicinal use of metal complexes as antibacterial and anticancer, anticancer activity of platinum(II) and platinum(IV) complexes, mechanism of the anticancer activity of platinum complexes, anticancer activities of rhodium, gold, copper and cobalt complexes. Antibacterial and antiviral activities of metal complexes. Gold therapy in rheumatoid arthritis.

Books:

1. Das A. K. : A Text Book on Medicinal Aspects of Bio-inorganic Chemistry.
2. Akhmetov, N.: General and Inorganic Chemistry.
3. Aylett, B. and Smith, B.: Problems in Inorganic Chemistry, (English University Press)
4. Bertini, et al: Bioinorganic Chemistry (Viva)
5. Charlott, G and Bezier, D.: Quantitative Inorganic Analysis (John Wiley).
6. Douglas, B. E. McDaniel, D. H. et al: Concept and Models of Inorganic Chemistry (4th ed.) Wiley
7. Dutt P. K.: General and Inorganic Chemistry. (Sarat Books House)
8. Fenton, David E.: Biocoordination chemistry, Oxford
9. Colly, W. L. : Inorganic Chemistry (4th edn.) Addison-Wesley.
10. Katakis, D. and Gordon, G.: Mechanism of Inorganic Reactions. (Wiley).
11. Leigh, G. : IUPAC Nomenclature of Inorganic Chemistry (1990 Main-Interscience)
12. Massey, A. G.: Main Group Chemistry.
13. Porterfield, W. W.: Inorganic Chemistry-A unified approach (Holt Saunders)
14. Banerjee, D.: Coordination Chemistry, TMH
15. Lee D.: Concise Inorganic Chemistry, ELBS
16. Lippard S. and Berg, M.: Principles of Bioinorganic Chemistry, University Sci. Book., Mill Valley
17. Hay R. W.: Bioinorganic Chemistry, Ellis Horwood, Chichester and N
18. Das A.K.: Text Book of Medicinal Aspects of Bioinorganic Chemistry, CBS
19. Sigel H.: Metal ions in Biological systems, Marcell Dekker, N (Vol. 1-31)
20. Reddy K.H., Bioinorganic Chemistry, New Age Int. Pub.
21. Kaim W. and Schwederski B.: Bioinorganic Chemistry: Inorganic elements in the Chemistry of Life, John Wiley & Sons.
22. Medicinal Inorganic Chemistry, Edited by Jonathan L. Sessler, Oxford University Press.

Semester III
Paper XII
Special Paper-II
Inorganic Chemistry (Solid state Chemistry)

Total Lectures:60 Hours,4Hours/week, 12Hours/unit Total Marks-80

- Unit-I : Crystal Structure of Some Simple Compounds: 12L**
- i) Ionic Crystals & Their structures, radius ratio rule, effect of polarization on crystals.
 ii) Covalent structure type-Diamond, Sphalerite & Wurtzite.
 iii) Geometry of simple crystal AB type: NaCl, CsCl & NiAs & Wurtzite, reasons for preference for a particular structure in above AB type of compounds.
 iv) AB₂ type: Fluorite, antiferites, Rutile structures. Li₂O, Na₂O, etc. CdCl₂, CdI₂ structures, difference between them. AB₂ type: ReO₃, BiI₃, CrCl₃, A₂B₃ type: Fe₂O₃, Corundum Al₂O₃, Mn₂O₃.
 v) Ternary Compounds AB₂O₃ type: Perovskite, Barium titanate, lead titanate, CaTiO₃ Tolerance factor, charge neutrality & deviation structures. FeTiO₃.
 vi) AB₂O₄ type compounds- Spinel, Normal & inverse, 2-3 and 4-2 spinel, packing of oxygen in tetrahedral & octahedral sites, sites occupancy number of site surrounding each oxygen, application of charge neutrality principles, site preferences in spinel, distorted spinel. Hausmannite (Jahn-Teller distortions), Factors causing distortion in spinel.
- Unit-II : 12L**
- Lattice Defects:** Perfect & Imperfect crystals, point defects, Interstitial, Schottky defect, Frenkel defect, line defect & other entities, thermodynamics of Schottky & Frankel defects. Dislocation, theory of dislocation, plane defects-Lineage boundary, grain boundary, stacking fault, 3D defects. Defects & their concentrations, ionic conductivity in solids, Non stoichiometric compounds. Electronic properties of Non-stoichiometric oxides, pyknetric & electrical conductivity methods of study of defects, radiation effects on solid nature and properties, photography, colour centers, order-disorder changes, imperfection equilibrium, solid electrolytes, atom movements, and defect interactions.
- Unit-III : 12L**
- Electronic Properties of materials:** Metals, Insulators and Semiconductors, Electronic structure of solid, band theory, band structure of metals, insulators and semiconductors, Intrinsic and extrinsic semiconductors, doping of semiconductors and conduction mechanism, the band gap, temperature dependence of conductivity, Seebeck effect and Hall effect, carrier density and carrier mobility in semiconductors, synthesis and purification of semiconducting materials, single crystal growth, zone refining, fractional crystallization, photoconductors, photovoltaic cells, solar batteries. Types of ionic conductors, mechanism of ionic conduction, diffusion, superionic conductors, phase-transitions & mechanism of conduction in super ionic conductors, applications of ionic conductors, Metal complexes as semiconductors.
- Dielectric polarization:** Introduction, Piezo-electricity, pyroelectricity, ferrielectricity, antiferroelectricity, ferroelectricity & their applications
- Unit IV : 12L**
- Superconductivity:** Introduction, discovery magnetic properties of super conductor, theory of super conductivity, Meissner effect, type I & II superconductors, Josephson effects, He-temperature superconductor, crystal structure of high temperature semiconductors, & their applications.
- Magnetic Properties of Materials:** Introduction, Magnetization, Electronic Spin and Magnetic Moment, Classification of materials, magnetic susceptibility, paramagnetism in metal complexes, diamagnetism, ferromagnetic metals, ferromagnetic compounds (CrO₂), Antiferromagnetism- transition metal monoxides, ferrimagnetisms (ferrites), magnetic anisotropy, magnetostriction, cooperative phenomena- magnetic domains, Domain Theory, hysteresis loops (hard & soft magnets) magnetic storage & applications of magnetic materials. Spin glasses
- Unit V : Lasers in Chemistry: 12L**
- General principles of laser action. Stimulated emission. Rates of absorption and emission. Einstein coefficients. Population inversion. Three-level and four-level laser systems. Pumping. Laser cavity & resonant modes. Characteristics of laser light. Laser pulses and their characteristics. Pulse production, Q-switching. Pulse modification, mode-locking. Practical lasers. Solid-state lasers, gas lasers, chemical and excimer lasers. Examples. Applications of lasers in chemistry. Femtochemistry. The pump-probe technique. Time-resolved spectroscopy. Photodissociation of ICN. Formation and dissociation of CO-hemoglobin complex. Conversion of ethylene to cyclobutane. Bond selectivity in chemical reactions & the reaction between hydrogen atoms and vibrationally excited HD molecules.
- Lasers and multiphoton spectroscopy & underlying principles. Two-photon spectra of diphenyl octatetraene. Lasers in fluorescence spectroscopy and Raman spectroscopy. 12L

Books:

1. Azaroff L.V., Introduction to Solids, TMH
2. West A.R., Solid state Chemistry and its Applications, Plenum
3. Rao C.N.R., Solid State chemistry, Dekkar
4. Hagenmuller, Preparative methods in solid state chemistry
5. Keer H.V., Principles of the Solid state, Wiley Eastern.
6. Hannay N.B., Solid state chemistry
7. Chakrabarty D.K., Solid state chemistry, New Age Int.
8. West A.R., Solid state Chemistry, John Wiley
9. Pillai S., Solid state Physics, Academic press
10. Rey T., The Defects Solid state, Interscience
11. Azaroff L.V., Brophy, Electronic Process in Materials, McGraw Hills
12. Anderson and Leaver, Materials Science
13. Kirkendall, Analytical Methods of Materials Investigations
14. Greenwood N.N. Ionic Crystals, Lattice Defects and Nonstoichiometry, Butter worth
15. Kroger Chemistry of imperfect crystals, Holland
16. Callister W.D., Material Science and Engineering An Introduction, Wiley India
17. Van Bueren H.G., Imperfection in Crystals, Wiley-Interscience
18. Brandon D and Kaplan W.D. Microstructural Characterization of Materials, Wiley N.
19. Hummel R.E. Electronic Properties of Materials, Springer-Verlag
20. Solymar L. and Walsh D., Electrical properties of Materials, Oxford University Press
21. Giles D., Introduction to Magnetism and Magnetic Materials, Nelson Thornes, Cheltenham
22. Kotz, Treichel, P. Chemistry AND chemical Reactivity, Saunders
23. Masterton W.L. and Hurley C.N. chemistry, Principles and Reactions, Harcourt

SEMESTER III

Paper XI

Special Paper-I

Organic Chemistry (Organic Synthesis-I)

Total Lectures: 60Hrs, 4 Hrs per week, 12 Hrs/unit

Total Marks-80

Unit-I : Oxidation-Reduction

12L

I) Oxidation: oxidation of Hydrocarbons, Epoxidation, Shi Epoxidation, Jacobsen Epoxidation perhydroxylation by KMnO_4 and OsO_4 , ozonolysis, oxidative cleavage by Lemieux reagent, formation of ketones by Wacker process, oxidation of aromatic ring by chromic oxide, oxidation of alcohols (PCC, PDC, Chromic acid, Swern oxidation, Silver carbonate, Manganese dioxide, Oppenauer oxidation, CAN) oxidation of 1,2-Diols (Lead tetra-acetate, CAN, Periodates), Selective oxidation of alkyl side chain in aromatic compounds, alcohols and acid using Cr (IV and VI),

II) Reduction: Selectivity in reduction, Hydrogenation of aromatic rings, Noyori asymmetric hydrogenation, reduction of nitro and nitroso compounds, dissolving metal reduction, Metal based reductions using Li/Na/Ca in liquid ammonia, Hydride transfer reagents from Group III and Group IV in reductions, reduction of aldehydes, ketones to alcohols, reduction of carbonyl group to methylene, reduction of alkene to alkane (diimide), **Non-Metallic Reduction:** Wolf-Kishner & diimide reduction, Metal Hydride reduction using LiAlH_4 , NaBH_4 , BH_3 , Birch Reduction, Enzyme Catalyzed Reduction, Stereo/enantioselective reductions (Chiral Boranes, Corey-Bakshi-Shibata)

Unit-II :

12L

A) Polynuclear Hydrocarbons: Introduction, Comparative study of the aromatic character of linear and nonlinear ortho fused Polynuclear Hydrocarbon. General synthetic routes, reactivity, utilities and wherever possible spectral analysis of fluorine, anthracene and phenanthrene. carcinogenic polycyclic hydrocarbons

B) Construction of Ring Systems: Different approaches towards the synthesis of three, four, five and six-membered rings ketene cycloaddition (inter- and intramolecular), Pauson-Khand reaction, Bergman cyclization, Nazarov cyclization, cation-olefin cyclization and radical-olefin cyclization, inter-conversion of ring systems (contraction and expansion) construction of macrocyclic rings, ring closing metathesis

C) Non Aromatic Heterocycles: Synthesis reactivity and importance of Azirines, Oxiranes and Thiaziranes.

Unit-III :

12L

Formation of C-C bond Principle, disconnection synthons, electrophilic and nucleophilic carbon species, use of following reaction in carbon carbon bond formation, base catalysed condensation including Claisen, Dieckmann reaction, Perkin, Stobbes, Knoevenagel use of malonic and acetoacetic esters., Darzens reaction, Prins reaction, use of acetylides, acid catalysed condensation of olefins, Fries reaction, Fries reaction and diels alder reaction.

Unit-IV :

12L

A) Umpolung concept: Dipole inversion, generation of acyl anion, use of 1,3-dithiane, ethyl ethylthio methylsulphoxide bisPhenylthiomethane. metallated enol ethers, alkylidene dithiane. ketene thioacetals, 2-propenethiobismethyl thioallyl anion.

B) Phosphours, and sulphur ylide: Preparation and their synthetic applications with stereochemistry, Petersons olefination.

C) Enamines : Chemistry of enamines and their synthetic applications, Stark-Enamine reaction.

- Unit-V :** **12L**
A) Selective Organic Name Reaction Favorski reaction, Mannich reaction, Sharpless asymmetric epoxidation, Baeyer-Villiger reaction, Barton and Shapiro reaction Bamford-Stevens, Hoffmann-Löffler-Freytag,
B) Modern Synthetic Methods: Suzuki, Stille, Sonogishira cross coupling, Buchwald-Hartwig and Negishi-Kumada coupling reactions. Nef reaction, Julia-Lythgoe olefination, Ugi, Biginelli, Brook rearrangement, Pausan-Khand reaction, Bergman cyclisation, Sharpless azides cycloadditions. Baylis-Hilman reaction, Eschenmo Ullmann coupling reactions,

Books Suggested:

- 1) Principle of organic synthesis. R.C Norman & M Coxon
- 2) Modern synthetic reaction. H. House W.A. Benjamin
- 3) Organic synthesis, The disconnection approach-S. Warren
- 4) Designing organic synthesis-S. Warren
- 5) Some modern methods of organic synthesis-W. Carruthers,
- 6) Advance organic reaction. Mechanism & structure-Ferry march
- 7) Advance organic chemistry Part-B-F.A. Carey & R
- 8) Sundberg, Plenum P.
- 9) Organic reaction and their mechanism-PS Kalsi
- 10) Protective group in organic synthesis-TW Greene, & PGM
- 11) The chemistry of organo phosphorous-A Kirby, & SG Warren
- 12) Organic silicon compound-C. Eabon
- 13) Organic synthesis via Boranes-HC. Brown
- 14) Organic borane chemistry-TP Onak
- 15) Organic chemistry of boron-W. Gerrard
- 16) Organic Chemistry: Clayden, Greeves, Warren and Wothers
- 17) Organic Synthesis: Agdamba Singh And Adav
- 18) Organic Chemistry Reactions: Mundy

SEMESTER III

Paper XII

Special Paper-II Organic Chemistry (Natural Products)

Total Lectures: 60Hrs, 4 Hrs per week, 12 Hrs/unit Total Marks-80

- Unit-I :** **12L**
A) Carbohydrates : Types of naturally occurring sugars, deoxy sugars, amino sugars, branched chain sugars, methyl ethers and acid derivatives of sugars, general methods of structure and ring size determination with reference to maltose, lactose, sucrose, starch and cellulose
B) Lipids: Fatty acids, essential fatty acids, structures and function of triglycerides, glycerophospholipids, sphingolipids, cholesterol, bile acids, prostaglandins. Lipoproteins composition and function, role.

- Unit-II:** **12L**
A) Amino acids, proteins and peptides Amino acids, protein and peptides. Amino acids, structural characteristics, acid base property, stereochemistry of amino acids, optical resolution, Stecker synthesis, peptide and proteins. Structure of peptide and protein, primary, secondary, tertiary and quaternary structure. Reaction of polypeptide, structure determination of polypeptide, end group analysis, purines and nucleic acids, chemistry, structure and functional relation to gene of DNA and RNA. Biosynthesis of amino acids (Lysine and phenyl alanine).
B) Enzymes: and identification of active sites by the use of inhibitors, mechanism of enzyme action, orientation and steric effect (ribonuclease and carboxypeptidase) Enzyme catalysed reactions (carboxylation, decarboxylation, rearrangement and isomerization)

- Unit-III :** **Alkaloids and Terpenoids :** **12L**
 Classification, Nomenclature, occurrence, isolation, isoprene rule general methods of structure determination of the following-
 A) Alkaloids: Papaverine, Morphine, Reserpine, Nicotine.
 B) Terpenoids: Camphor, Geraniol, Abietic acid, Squalene.
 C) Biosynthesis of Terpenes, alkaloids

- Unit-IV :** **12L**
A) Steroids and Hormones : occurrence, Nomenclature, Basic skeleton, Diels-Alder Hydrocarbon and stereochemistry. Biosynthesis of steroids. Structure determination and synthesis of Cholesterol, Testosterone, progesterone, Estrone and Cortison
B) Prostaglandins, pyrethroids, rotenones and pheromones
 occurrence, classification. Biogenesis, physiological effects and synthesis of PGE₂ and PGE_{2a}. Natural and synthetic pyrethroids, rotenones and pheromones

- Unit-V :** **Vitamins and Natural Pigments** **12L**
Vitamins: A) Classification, occurrence, Chemistry of vitamins A, C, D, E and K. biotin and vitamin B2, synthesis of vitamin B1, biological functions of B6, B12, folic acid and thiamin. Structure elucidation and synthesis, deficiency syndromes, etc.
B) Natural Pigments: Chemistry of Carotenes, anthocyanines, general study of porphyrins, structure and synthesis of Haemoglobin and Chlorophyll.

Books suggested :

- 1) Chemistry of alkaloids-SW Pelletier.
- 2) Chemistry of steroids-LF fisher & M fisher.
- 3) The molecules of nature-□B hendricson.
- 4) Biogenesis of natural compound-benfield
- 5) Natural product chemistry & biological significance, □Mann,RS Devison, □B hobbs,DV Banthripde & □B horborne.
- 6) Introduction to flavonoids-BA Bohm, Harwood
- 7) Chemistry of naturally occurring quinines-RH Thomson
- 8) The systematic identification of flavonoids-marby, markham, &thomos
- 9) Text book of organic medicinal chemistry-wilson,geswold
- 10) Medicinal chemistry Vil I &II-Burger
- 11) Synthetic organic chemistry-Gurudeep chatwal.
- 12) □rganic chemistry of natural products Vol I &II-□P agrawal
- 13) Vitamins and Co enzymes: Woguer
- 14) The total synthesis of natural products: Apsimon
- 15) Chemistry of Terpenes: A.A. Newmen
- 16) □rganic chemistry Vol. II and I: Finar
- 17) Principles of Biochemistry, A. L. Lehinger, Worth Publications.
- 18) Biochemistry, L. Stryer, W. H. Freeman

Semester III
Physical Chemistry Special Paper I
Paper XI

60 Hours (4-Hours/week)

80 Marks

12 hours/Unit

Unit-I : Solid-state chemistry:

- A) Solid state reactions: General principles, experimental procedures, co-precipitation as a precursor to solid state reactions, other precursor methods, kinetics of solid state reactions. 6L.
- B) Crystal Defects & Non-Stoichiometry: Intrinsic and extrinsic defects- point defects, line and plane defects, vacancies- Schotcky defects and Frenkel defects. Thermodynamics of Schotcky and Frenkel defect formation, color centers. Non- Stoichiometry and defects. Numericals. 6L.

Unit-II : Electronic properties and Band Theory:

- A) Metals, insulators and semiconductors, electronic structure of solids- band theory, band structure of metals, insulators and semiconductors. Intrinsic and extrinsic semiconductors, doping semiconductors, semiconductor p-n junctions. Color in inorganic solids, 6L.
- B) Magnetic properties- Behavior of substances in magnetic field. Effect of temperature: Curie and Curie-Weiss Laws. Calculation of magnetic moments, magnetic materials, their structures and properties. Applications: structure / property relations. Numericals. 6L.

Unit-III : Glass, Ceramics and Multiphase materials:

- A) Factors influencing glass formation, kinetics and thermodynamics of glass formation, electrical (ionic) Conductivity of glasses, metallic glasses. Composition, properties and applications of glass-ceramics. 6L.
- B) Properties and applications of ferrous and non-ferrous alloys. Phase diagram of iron-carbon system. Ceramic Matrix composites, carbon and hybrid composites. 6L.

Unit-IV : Photochemistry:

- A) □Photophysical phenomenon: Introduction, prompt fluorescence, delayed fluorescence, and phosphorescence, fluorescence quenching: concentration quenching, quenching by excimer and exciplex emission, fluorescence resonance energy transfer between photoexcited donor and acceptor systems. Stern- Volmer relation, critical energy transfer distances, energy transfer efficiency, examples and analytical significance, bimolecular collisions, quenching and Stern-Volmer equation. 6L
- B) □Photochemical reactions: photoreduction, photooxidation, photodimerization, photochemical substitution, photoisomerization, photosensitisation, chemiluminescence, photochemistry of environment, Green house effect. 6L.

Unit-V : Superconductivity:

- A) High T_c Materials: Superconductivity in cuprates, preparation and characterization of 1-2-3 and 2-1-4 materials. Normal and Superconducting state of cuprates. The BCS theory. Applications of Low-temperature and Hightemperature Superconductors. 6L.
- B) Thin Films: Preparation techniques: evaporation/sputtering, chemical processes, M□CVD, sol-gel etc. Growth techniques, properties and applications of thin films. 6L.

Books Suggested:

- 1) Physical chemistry by P.W. Atkins & dePaula 7Th Edition
- 2) Industrial Chemistry by. B.K.Sharma, Goel Publication House.
- 3) Physical Chemistry of Surface, by A.W. Admsom, □ohn Wiley and Sons 1990.
- 4) Electronic structure and Chemistry of Solids by P.A.Cox , □xford University Press. 1991.
- 5) Solid State Chemistry by D.K.Chakraborti, New Edge Internation Publication 1996.
- 6) Principles of Solid State by. H.V.Kirr, Wiley Estern Publication.
- 7) Material Science & Engineering an Introduction, by W.D. Callister
- 8) Material Science by □C. Anderson, K.K.Leaver, □M. Alexander & R.D. Rawlings. ELBS.
- 9) Solid state physica by N A Wahab, Narosa Publications.
- 10) Fundamentals of Photochemistry by K K Rohatagi and Mukherjee.

Semester III
Physical Chemistry Special Paper II
Paper XII

60 Hours (4-Hours/week)

80 Marks

12 hours/Unit

Unit-I : Polymers:

A) Basic concepts: Monomers, repeat unit, degree of polymerization, linear branch, and network polymers, classification polymers, Polymerization: condensation, addition, radical chain ionic and coordination and copolymerisation. polymerization condition and polymer reaction, polymerization in homogeneous and heterogeneous system. 6L

B) Polymer processing: Plastic, elastomer and fibers. Compounding, processing technique: Calendaring, die casting, rotational casting, film casting, injection molding, glow molding, extrusion molding, thermoforming, foaming, reinforcing and fibers spinning. 6L

Unit-II : Polymer characterization:

A) Polydispersion, average molecular weight concept. Number, weight and viscosity average molecular weight. Polydispersity and molecular weight distribution. The practical significance of molecular weight. Measurement of molecular weight. End group, viscosity, light scattering, osmotic and ultra centrifugation method. 6L

B) Analysis and testing of polymers: chemical analysis of polymer, X-ray diffraction study, microscopy. Thermal analysis and physical testing-tensile strength. Fatigue impact. Tear resistance. Hardness and abrasion resistance. 6L

Unit-III : Structure and properties of Polymers:

A) Morphology and order in crystalline polymers, configuration of polymers chains. Crystal structure of polymers. Morphology of crystalline polymers, strain induced morphology, crystallization and melting. 6L

B) Properties and structure: Physical properties, crystalline melting point, T_m-melting point of homogeneous serious, effect of chain flexibility and other steric factors. Entropy and heat of fusion, the glass transition temperature, the relation between T_g and T_m. Effect of molecular weight, diluents, chemical structures, chain topology, branching and crossing linking. Property requirements and polymer utilization. Numericals. 6L

Unit-IV : A) Polymer composites: Polymer matrix material, reinforcement, properties of composite and composit system. Fabrication of polymer composite, processing science and quality assurance of composites, environmental effect on composites, Smart composites. 6L

B) Polyethylene, polyvinyl chloride, polyamide, polyester, phenolic resin, epoxy resin and silicon polymer, Functional polymer: electrically conducting polymer. 6L

Unit-V : A) Polymer degradation: Definition, Types: thermal, mechanical, degradation by ultrasonic waves, photo degradation, degradation by high-energy radiations, oxidative and hydrolytic degradation. 6L

B) Polymer reactions: Hydrolysis, acetolysis, aminolysis, hydrogenation, addition and substitution reaction, reaction of various specific groups, cyclation reaction and cross linked reactions, reaction leading to graft and block copolymers, miscellaneous reactions. 6L

Books Suggested:

- 1) A Text Book of Polymer Science by Billmeyer, J. Wiley
- 2) Polymer Science by V.R.Gowarikar, N. V. Vishwanathan & Sreedhar, Wiley Estern.
- 3) Physical Chemistry Polymers by D.D. Deshapande, Tata McGraw Hill
- 4) Principles of Physical Chemistry by P. Flory, Cornal University Press
- 5) Introduction to Polymer Chemistry by R.B. Seymour, McGraw Hill.
- 6) A Practical Course in Polymer Chemistry by S. Pnnea, Program press.
- 7) Polymer Composite by M.C. Gupta & A.P. Gupta. New Age International Publication.

Semester III
Paper XI
Special Paper I

Industrial Chemistry (Heat Transfer, Mass Transfer and Unit Processes)

60 Hours (4-Hours/week)

80 Marks

12 hours/Unit

Unit – I :

12 L

A) Fundamentals of Heat transfer: Methods of heat transfer, Fourier's law, Newton's law, heat transfer by conductance, by convection and by radiation. Heat exchanger, types of heat exchanger, overall heat transfer co-efficient, double pipe heat exchanger, Shell & tube type etc.

B) Fluid flow : Fluid flow phenomenon, introduction, Laminar flow, Turbulant flow, Reynolds number, Bernoulli equation, fans, blowers, compressors, pumps etc.

Unit – II :

12 L

A) Distillation: Flash distillation, differential distillation, rectification, plate columns, packed columns.

B) Gas Absorption: Introduction, equipments, packed columns, spray column mechanically agitated contactors.

- C) **Evaporation:** Introduction, short tube evaporator, forced circulation evaporator, falling film, climbing film, agitated evaporators.
 D) **Filtration:** Introduction, Filter media, filter aids, equipments sparkler filter, sand filters, bag filters, rotary drum filter.
 E) **Crystallization:** Introduction, solubility, super-saturation, nucleation, crystal growth, equipments tank crystallizer, Swenson-Walker crystallizer, \square slow crystallizer.
 F) **Drying:** Introduction, free moisture, bound moisture, drying curve, equipments: tray dryer, fluid bed dryer, drum dryer, spray dryer.
 G) **Extraction:** Introduction, selection of solvent, single stage and multistage extraction, spray column, packed column, mixer settler, centrifugal extractor

Unit-III : Material Balances: 12 L
 Material balance without chemical reactions, flow diagram, without recycle or by-pass for above processes. Problems based on above.
 Material balances involving chemical reactions, Concept of limiting reactant, excess reactant, yield and selectivity, stoichiometric coefficient and stoichiometric equation conversion, purge operation and Problems.

Unit – IV : 12 L
 A) **Nitration:** Introduction, nitrating agents, equipment for nitration, manufacturing and mechanism of nitrobenzene, \square ortho and para nitrochlorobenzene
 B) **Amination by reduction:** Introduction, methods of reduction, metal & acid, sulphide reduction, metal & alkali reduction, manufacturing and mechanism of aniline, meta nitro aniline.
 C) **Halogenation:** introduction, reagents of halogenation, aromatic halogenation, manufacturing and mechanism of chlorobenzene, dichlorofluoromethane

Unit – V : 12 L
 A) **Sulphonation:** Introduction, sulphonating agents, factors affecting sulphonation, equipment, manufacturing and mechanism of benzene sulphonic acid, sulphonation of anthraquinone
 B) **Oxidation:** introduction, oxidizing agents, vapour & liquid phase oxidation, manufacturing and mechanism of acetic acid, acetaldehyde, benzoic acid
 C) **Alkylation:** Introduction, alkylating agents, factors affecting alkylation, manufacturing and mechanism of ethyl benzene, phenyl ethyl alcohol

Books Suggested:

- 1) Heat transfer By Arora and Damkondwar, Pune
- 2) Heat and Mass transfer by A, G. Gavane, Nirali Prakashan. Pune Vol I & II.
- 3) McCabe and Smith, Unit operations of Chemical Engineering, McGraw Hill.
- 4) Budger and Bancharo, Introduction to Chemical Engineering McGraw Hill.
- 5) Text Book of Industrial Chemistry Pragti Agencies Pune.
- 6) Engineering Chemistry By Dr. S. S. Dara.
- 7) Unit Process in Organic Synthesis, by P. H. Groves.
- 8) Shreve's Chemical Process Industries edited by Austin, McGraw-Hill.
- 9) Dryden's outlines of Chemical Technology, edited by M.Gopal Rao and M.Sittig,
- 10) Industrial Chemistry by B.K.Sharma
- 11) Hand book of industrial chemistry Vol I & II K. H. Davis & F.S. Berner Edited by S.C. Bhatia, CBS publishers

Semester III Paper XII

Special Paper II

Industrial Chemistry (Fuels and Heavy Chemicals)

60 Hours (4-Hours/week)

80 Marks

12 hours/Unit

Unit – I : 12 L
Fuels: Introduction, History of Fuels, History of solid fuel, Definitions and properties of solid fuels, classification of Fuels on the basis of occurrence, physical state, Formation of coal. Coal mining, proximate and ultimate analysis of coal, determination of calorific value by using Bomb calorimeter, Coal tar distillation, problems on calculation of calorific value. ecofriendly fuels, environment aspects.

Unit – II : 12 L
Petroleum oils: Introduction, occurrence, composition of petroleum, processing of petroleum, thermal cracking, catalytic cracking, visbreaking, octane rating (octane number), cetane number, knocking, antiknock compounds, flash point, and aniline point, petrochemicals applications, synthetic petroleum,
Lubrication oils:- Properties and uses of refrigeration oils, transformer oils and gear oil. Additives for lubrication oils antioxidant \square passivators, pour point depressants, detergents, adhesives and emulsifiers.

Unit – III: Manufacture of Heavy Chemicals : 12 L
 Chemical processes for the manufacture of Heavy chemicals like- soda ash, bicarbonates, chlorine, caustic soda, bleaching power, calcium carbides, Silicon Carbide, Lime and acids like H_2SO_4 , HCl, HN_3 , H_3PO_4 and their applications.

Unit-IV :

12 L

- A) Cement:** Types of cement, manufacture- processes (Wet and Dry), setting and Hardening of cement, cement additives.
B) Glass: Types, their composition & properties, manufacture of glass, optical glass, coloured glasses, lead glass and neutron absorbing glass.
C) Ceramics: Introduction, types, manufacturing process, applications & refractories.

Unit –V : Sugar Industries

12 L

Manufacturing of sugar from sugarcane: Introduction, agriculture, harvesting, preparation of cane for mealing, juice extraction, diffusion, juice purification, evaporation, crystallization (production of raw sugar), centrifugation, sugar refining, decolouring, purification, filtration, crystallization grade analysis. Analysis of bagasse and molasses, byproducts of sugar industries.

Books Suggested:

1. Engineering Chemistry By Dr. S. S. Dara.
2. Modern Petroleum Technology by G. D. Hobson and W. Pohl.
3. Petroleum refining and engineering by W. L. Nelson.
4. Petroleum refining technology and economics by □ H. Gary and G. E. Hardwork.
5. The Petroleum chemical industry by Goldsteim and Waddams.
6. Petroleum processing handbook by W. E. Bland and R. L. Davidson.
7. The Text book on Petrochemical by Dr. B. K. Bhaskar Rao, Khanna Publishers NewDelhi.
8. Modern Petroleum refining Processes by Dr. B. K. Bhaskar Rao, □xford, IBH, 1984
9. Petroleum product handbook.
10. Charles E. Dryden, □utline of Chemical Technology Edited by M. Gopal Rao and
11. Marshall Siting, East West press 2nd Edition 1973.
12. Chemical Process Industries by R. N. Shreves and M. □ A. Brink. McGraw Hill Ltd. 4th Edition.
13. Manual of Chemical Technology V□L I & II by Venketesharul Educational Development Center. IIT Madras, 1977.
14. Material science, □. P. Khanna, Khanna Publishers, Delhi

**Semester III
Practical V
Inorganic Chemistry Practical**

Total Hours: 90 hrs. (9 Hours per week) (26 Laboratory Session)

Total Marks: 100

Quantitative Inorganic Analysis:

- 1) Detection and determination of Ascorbic acid from biological sample.
- 2) Determination of Phosphates from plant samples by spectrophotometry.
- 3) Determination of iron from pharmaceutical samples and coordination compounds.
- 4) Determination of Calcium from given drug sample by complexometry.
- 5) Determination of Iron, Calcium and Phosphorus from milk powder.
- 6) Drug Analysis: Aspirin, benzyl benzoate etc.
- 7) Practicals based on food analysis: honey, oil, tea-leaves, turmeric powder etc.
- 8) Analysis of stainless steel (Cr/Ni)
- 9) Determination of Ca content in chalk / milk powder as Ca-oxalate by permagnetometry
- 10) Simultaneous Spectrophotometric determination of-
 - i) Chromium and Manganese
 - ii) Titanium and Vanadium.
 - iii) Cobalt and Chromium
- 11) To determine the stability constant and stoichiometry of Ferric-thiocyanate complex by spectrophotometrically.
- 12) To study the stoichiometry and stability of Fe^{3+} salicylate complex by job's and mole ratio method spectrophotometrically.
- 13) Estimate the amount of copper (II) with EDTA photometric titration
- 14) Determination of capacity of anion and cation exchange resin by column method.
- 15) To estimate the amount of magnesium and zinc in the given sample solution by ion exchange chromatography method.**
- 16) Separation and estimation of Fe^{2+} , Co^{2+} and Ni^{2+} by anion exchanger.
- 17) Separation and estimation of Halide by anion exchanger.
- 18) Separation and estimation of-
 - i) Cobalt and nickel
 - ii) Calcium and □inc and
 - iii) □inc and Magnesium by anion exchange.
- 19) Separation and estimation of Fe^{3+} and Mg^{2+} by solvent extraction
- 20) Solvent extraction by binary mixtures i. e. Al/Mg, Mg/ UO_2 , Cu/Ni, Cu/Co etc. and quantitative determination by spectrophotometry.
- 21) Nickel / Molybdenum / tungston/vanadium / Uranium etc by extractive spectrometric method.

- 22) Separation, identification and quantitative determination of metal ions by paper chromatography.
- 23) Separation and identification of sugars/ honey/halides by paper chromatography and determination of Rf values
- 24) Thin layer chromatographic separation, identification and determination of Rf values □
 - a. Metal ions (Mn, Co, Ni, Cu, □n, Cd, Pb, alkali metals etc)
 - b. Amino acids/ □rganic compounds
 - c. Sulpha drugs in tablets and ointments.
- 25) Estimation of zinc/metals by fluorimetrically.
- 26) Nephelometric determinations of sulphate, phosphate, silver.
- 24) Potentiometric determination of the percentage of sodium carbonate in commercial washing soda.
- 25) Water analysis:
 1. Determination of sodium and potassium by flame photometry.
 2. Determination of hardness, alkalinity, salinity, Chloride, Fluoride, Nitrite, Nitrate, phosphate and Sulphate.
 3. Determination of D□, C□D and B□D.
 4. Determination of toxic metals viz As, Cd, Pb, Hg, and Ni in water and wastewater by suitable method.

The Practical examination will be based on the Inorganic Chemistry.

Time: 6-8 hours (one day examination)

Marks: 100

- | | |
|---|------------|
| I) Exercise -1 (Based on Instrumental) | - 40 Marks |
| II) Exercise-2 (Based on Separation Method) | - 40 Marks |
| III) Record | - 10 Marks |
| IV) Viva- Voce | - 10 Marks |

Total **- 100 Marks**

List of Books-

1. Day and Underwood: □uantitative Analysis
2. Vogel A.I: A textbook of quantitative Inorganic analysis, Longman.
3. Flaschka: EDTA Titration
4. Meites and Thomas: Advanced Analytical Chemistry.
5. Ewing, G.W.: Instrumental Methods of Chemical Analysis, McGraw-Hill
6. Drago, R.S: Physical Methods in Inorganic Chemistry
7. Christian G.D.: Analytical Chemistry
8. Khopkar S.M.: Basic Concept of Analytical Chemistry.
9. Kolltath and Ligane: Polarography
10. Braun: Instrumental methods of chemical Analysis
11. Willard, Merritt and Dean: Instrumental methods of Chemical Analysis, Van Nostrand
12. Strouts, Crifillan and Wison: Analytical Chemistry.
13. Skoog S.A. and West D.W.: Fundamental of Analytical Chemistry
14. Dilts R.V.: Analytical Chemistry
15. □ahagirdar D.V.- Experiments in Chemistry
16. Chondhekar T.K.- Systematic Experiments in Physical Chemistry, Rajbog S.W., Anjali Pubn.
17. Wlehov G. □- Standard methods of Chemical analysis, 6th Ed.
18. Ramesh R & Anbu M, Chemical Methods for Environmental Analyss: Water & Sedient, Macmillion India.

SEMESER III

Organic Chemistry Practical - VI

Total Hours: 90 hrs. (9 Hours per week)

Marks: 100

A- Multistage Preparations. (Total Laboratory Session 14) (45 marks)

- i) Preparation of p-nitroaniline from aniline
- ii) preparation of p-bromo aniline from aniline
- iii) Benzaldehyde → chalcone → chalcone epoxide
- iv) Flavnone
- v) Coumarine
- vi) Fisher Indol Synthesis
- vii) Skrup-□uinoline synthesis
- viii) Synthesis of Carbohydrates (any one)
- ix) Hippuric acid → Azalactone → 4-Benzylidene 2-phenyl oxazol-5-one
- x) Benzophenone → benzopinacol → benzopinacolone
- xi) Benzoin → benzil → benzilic acid (By Green Synthesis)
- xii) Acridone from anthranilic acid

Note: 1. Synthesis is carried out in molar quantities (Less than 2 gm). 2. Reaction with possible mechanism. 3. Calculate Theoretical and practical □ yield. 4. Product conformation by Physical constant and TLC. 5. Give expected spectral data (IR and NMR) of starting material, intermediate and final product (Theoretically differences). 6. All the prepared organic compounds should be stored as a sample and present at the time of University examination.

Scheme of Marking:

- | | |
|---|----|
| i) Synthesis of products of. (each steps) | 09 |
| ii) □ield of the crude product (each steps) | 09 |
| iii) MP of the recrystallized product (each steps) | 09 |
| iv) TLC of the recrystallized product (each steps) | 09 |
| v) Prediction of Spectral data for product of each step | 09 |

B- Estimations: (07 Laboratory Session)

(20 Marks)

- i) Nitrogen
- ii) Halogen
- iii) Sulphur
- iv) Soxhlet extraction of oil from oil seeds and determination of saponification value, iodine value of the same oil
- v) Soxhlet extraction of piperine from black pepper
- vi) Spectrophotometric/UV estimations of Caffeine.
- vii) Spectrophotometric/UV estimations of Cholesterol.
- viii) Analysis of Lindane in BHC powder
- ix) Analysis of some common pesticides, insecticides, plastics and detergents.

C- Purification of Solvents

(Total Laboratory Session 5)

(15 marks)

**Practical-VI
Organic Chemistry**

Time : 6-8 Hrs. (One day Examination) Marks : 100

- | | |
|---|----------|
| (1) Exercise-1 (Organic Synthesis) - | 45 Marks |
| (2) Exercise-2 (Qualitative Analysis) - | 20 Marks |
| (3) Exercise-3 (Qualitative Analysis) - | 15 Marks |
| (4) Record - | 10 Marks |
| (5) Viva-Voce - | 10 Marks |

Total - 100 Marks

Books Suggested:

- 1) Modern Experimental Organic Chemistry-Royston M. Robert, John C. Gilbert, Lyu B. Rodewald, S.
- 2) Experimental Organic Chemistry- L. M. Harwood, C. I. Moody
- 3) Semi-microqualitative Organic analysis-N. D. Cheronis, B. Entrikin, E.M. Wodnett.
- 4) The Systematic identification of Organic compounds-R.L. Shrine, D. Curtin.
- 5) Quantitative Chemical analysis A.I. Vogel.
- 6) Vogel's textbook of quantitative analysis (Revised)-Bassett, R.C. Denney, G.H. Jeffery and
- 7) Experiment and technique in Organic chemistry-D. Pasto, C. Johnson and M. Miller.
- 8) Hand book of organic analysis qualitative and quantitative-H. Clark, Edward Arnold.

SEMESTER-IV

Paper XIII SPECTROSCOPY-II

Total Lectures: 60Hrs, 4 Hrs per week, 12 Hrs/unit

Total Marks-80

Unit-I : 12L

A) Raman spectroscopy: Classical and quantum theories of Raman effects, Normal, Resonance and Laser Raman spectroscopies, Pure rotational and vibrational and vibrational rotational Raman spectra, selection rules, mutual exclusion Raman spectroscopy, coherent anti-Stokes Raman spectroscopy (CARS). Applications for the study of active sites of metalloproteins. Structure determination by symmetry selection rules (Normal Coordinate analysis), Rotational Raman- spectra, Vibrational Raman Spectra, polarization of light and Raman effect, structure elucidation from combined Raman and IR spectroscopy, applications in structure elucidation, Application of Raman spectroscopy to structural chemistry.

B) Photoelectron spectroscopy: Basic principle, classification of electron microscopy methods, photoelectric effect, ionization process, Koopmans theorem PES and X-PES, PES spectra of simple molecule, ESCA, chemical information from ESCA. Auger electron spectroscopy-basic idea. Scanning electron microscopy, working of SEM instrument surface characterization by spectroscopy and microscopy, (SEM/TEM). atomic force microscopy (AFM), application AFM, comparison of electron microscopy with electron Inversion photo emission, multi photo ionization, spin resolved photoionization.

Unit-II : 12L

A) X-ray diffraction: Interaction of x-ray with matter, scattering and diffraction. Bragg method Debye-Sherrer method of X-ray structural analysis of crystals, index reflection, identification of unit cell from systematic absence in diffraction pattern structure of simple lattice and x-ray intensities structure factor, its relation to intensity of electron density procedure for x-ray structure analysis.

B) Electron diffraction: Scattering intensity Vs scattering angle, Wierl equation, measurement techniques, elucidation of structure of simple gas phase molecules. Low energy electron diffraction and structure of surface.

C) Neutron diffraction: Scattering of neutrons by solids and liquids magnetic scattering, measurement techniques. Elucidation of structure of magnetically ordered unit cell.

Unit-III : 12L

Electron Spin Resonance Spectroscopy: Introduction, basic principle. zero field splitting and Kramer's degeneracy, factors effecting the g values, hyperfine splitting, hyperfine and super hyperfine coupling constants, determination of g values. Instrumentation, working of instruments, sensitivity, concentration, choice of solvent. presentation of ESR spectra, application of ESR to study the free radicals, structure determination, reaction velocities, McConnell relation, application to inorganic compounds including biological system and to inorganic free radicals such as PH_4^- , F_2^- , BH_3 , determination of oxidation state of metals, EPR and EPR techniques The EPR of triplet states Structural applications to transition metal complexes. ESR spectrum when one electron is influenced by a single proton and one electron delocalized over two equivalent protons, difference between ESR and NMR

- Unit-IV :** **12L**
Mossbauer spectroscopy: Basic principle, spectral parameters and spectrum display. Doppler shift. recoilless emission of radiation. The Mossbauer effect, isomer shift, quadrupole splitting, Nuclear quadrupole moment and EFG tensors, quadrupole coupling constants and asymmetry parameters, magnetic hyperfine splitting. Application of the techniques to the studies of 1. Bonding and structure of Fe²⁺ and Fe³⁺ compounds including those of intermediate spin (2) Sn²⁺ and Sn⁴⁺ compounds - Nature of M-L bond, coordination number, Structure and Detection of oxidation state and in equivalent MB atoms. Elucidation of structure of I₂Br₂Cl₄, I₂Cl₆, Structural problems, Mossbauer spectroscopy of Biological Systems. pure NMR and Zeeman spectra of spin 1 and spin 3/2 systems the Towners-Dailey theory and interpretation of NMR in terms of bond characteristics. NMR ⁵⁷Fe spectra of complexes, other Mossbauer nuclei, applications.
- Unit-V :** **12L**
 Determination of Structures of Complex Organic Molecules by Spectroscopic Means: Problems based on IR, Mass, UV, PMR, ¹H NMR, ¹³C NMR data and structure determination of organic molecules / inorganic compounds.

Books suggested

- 1) Spectroscopic identification of organic compound-RM Silverstein,GC Bassler and TC Morrill, John Wally
- 2) Introduction to NMR spectroscopy-R.Abrahm, Fisher and P loftus Wiely
- 3) Application of spectroscopy to organic compound-IR Dyer,Printice Hall
- 4) Organic spectroscopy-William kemp,ELB with McMillan
- 5) Spectroscopy of organic molecule-PS Kalsi,Wiley,Esterna,New Delhi
- 6) Organic spectroscopy-RT Morrison,and RN Boyd
- 7) Practical NMR spectroscopy-ML Martin, Delpench, and D.Martyin
- 8) Spectroscopic methods in organic chemistry-DH Willson,I Fleming
- 9) Fundamentals of molecular spectroscopy-CN Banwell
- 10) Spectroscopy in organic chemistry-CNR Rao and R Ferraro
- 11) Photoelectron spectroscopy-Baber and Betteridge
- 12) Electron spin resonance spectroscopy-Wertz and R Bolten
- 13) NMR Basic principle and application-H Guntur
- 14) Interpretation of NMR spectra-Roy H Bible
- 15) Interpretation of IR spectra-NB Coulthop
- 16) Electron spin resonance theory and applications-W gordy
- 17) Mass spectrometry organic chemical applications ,H Banyon

Semester IV
Paper XIV
General Analytical Chemistry

Total Lectures: 60Hours, 4Hours per week, 12Hours/unit

Total Marks: 80

- Unit-I : Radiochemical methods of analysis:** **12L**
- (A) Radiation detection and measurement : principle and working of ionization chemicals. multiplicative ion collection. reasons of multiplicative operation. proportional counters and Geiger Muller (GM) counters. principle and working of scintillation counters. semiconductor detectors (eg. HPGe). Gamma ray spectrometer.
- (B) neutron activation analysis : principle and methodology of neutron activation analysis, application of NAA in following branches of science.
- (i) Material science,(ii) Geochemistry(iii) Archacology(iv) Life sciences / Biomedical science(v) Food and Nutrition(vi) Environmental science(Vii) Forensic science(viii) Cosmochemistry advantages of NAA. Sources of errors and limitations of NAA.
- (C) isotopic dilution analysis (IDA) : principle and method of isotope dilution analysis (IDA). substoichio metric IDA. comparision of IDA with NAA. Applications of IDA for the measurement of trace quantatites of organic and inorganic components in a given complex mixture. sources of errors and limitations of IDA.
- (D) Radiometric titrations : principle and method of radiometric titrations. types of radiometric titrations. applications of radiometric titrations.source of errors and limitations of radiometric titrations. Radioactivity tracers- Principal and applications

Unit II :

Molecular photofluorescence and phosphorescence spectrometry: 12L

Basic theory, instruments, different photonic and deactivation process (interval conversion, vibration, relaxation, intersystem crossing fluorescence, phosphorescence, external conversion etc.), their inter-relationships and differences □ energy level diagram, Morse curve □ principal types of electronic transitions, principal types of linkages in fluorimetric reagents, reagents, effect of substitution (on aromatics) upon photoluminescence, structural and environmental effects on photoluminescence, quenching and non-quenching extinction of fluorescence and probable mechanism for quenching, characteristics of π - π states, spectra, mirror image rule, its violation and causes of violation delayed fluorescence, charge transfer process, structural factor favourable for fluorogenic reagents, fluorescence, immunoassay and its advantage over Radio-immunoassay, cations favouring fluorescent metal chelate formations. Fields of applications, merits and demerits of fluorometry, assessment as an ultratrace analysis technique. Principal types of reactions used in fluorimetric analysis. Analytical Applications. Phosphorimetry: Low temperature phosphorescence, Room temperature phosphorescence (RTP). Advantages and disadvantages. Applications. Chemiluminescence: Theory, measurement of chemiluminescence, mechanisms in analytical applications.

Unit III : Optical Methods & Flow Injection Analysis : 12L

□RF: Basic principle, instruments, excitation sources, energy dispersive and wavelength dispersive □RF techniques □ their advantages and disadvantages, matrix effects and their suppression, health hazards and safety. Applications.

Inductively Coupled Plasma Atomic Emission Spectroscopy (ICPAES): Principles, atomization and excitation, ICP-source, Instrumentation and applications

Flow Injection Analysis: Introduction, principal, theoretical aspects of FIA, techniques, pretreatment of sample in packed reactors, components of FIA apparatus, Factors affecting FIA and applications.

Unit-IV : Food and Cosmetic Analysis: 12L

A) The chemical analysis of food: Importance of food analysis, Determination of approximate composition: Moisture, fat, protein, fiber, carbohydrate, etc. □ quantitative analysis for food quality and safety - Determination of minerals, vitamins, anti-oxidants, toxins and preservatives. General idea of the properties of drugs for their characterization and quantification. □ quantitative methods of analysis - Gravimetric and volumetric analysis, potentiometry, coulometry and amperometry titrations, colorimetry, fluorimetry and polarimetry methods, Analysis of artificial sweeteners in food and colouring agents.

B) Analysis of Cosmetics-Composition of creams and lotions- determination of water, propylene glycol, non-volatile matter and ash content. Determination of borates, carbonates, sulphates, Phosphates, chlorides, titanium and zinc oxides.

Analysis of face powder- estimation of boric acid, Mg, Ca, Zn, Fe, Al and Ba.

Analysis of deodorants and antiperspirants-composition, analysis of fats and fatty acids, boric acid, magnesium, calcium, zinc, iron, titanium, aluminium, phenol, hexachlorophenone, methanamine, sulphonates and urea

Unit V : Forensic & Fuel analysis: 12L

Forensic Analysis: Special features of forensic analysis, sampling, sample storage, sample dissolution, classification of poisons, lethal dose, significance of LD-50 and LC-50. general discussion of poisons with special reference to mode of action of cyanide, organophosphate and snake venom. Estimation of poisonous materials such as lead, mercury and arsenic in biological samples.

Fuel analysis : Solid, Liquid and gaseous fuels. Characteristics of ideal fuels. Ultimate and proximate analysis of coal, heating values, grading of coal, liquid fuels-flash point, aniline point, knocking, antiknock compounds, octane number, cetane number and carbon residue. Gaseous fuels, producer gas and water gas, determination of calorific value. Analysis of fuel Gas. Numerical problems.

Books Suggested:

1. Day and Underwood: Quantitative Analysis
2. A. I. Vogel: A text book of quantitative Inorganic analysis.
3. Flaschka: EDTA Titration
4. Meites and Thomas: Advanced Analytical Chemistry.
5. G. W. Ewing: Instrumental Methods of Chemical Analysis.

6. R. S. Drago: Physical Methods in Inorganic Chemistry
7. G. D. Christian: Analytical Chemistry
8. S. M. Khopkar: Basic Concept of Analytical Chemistry.
9. Kolltath and Ligane: Polarography
10. R.D.Braun: Instrumental methods of chemical Analysis
11. Willard, Merritt and Dean: Instrumental methods of Analysis
12. Strouts, Crifillan and Wison: Analytical Chemistry.
13. □ W. T. Spinks and R. □ Woods: Introduction to Radiation Chemistry.
14. S. A. Skoog and D. W. West: Fundamental Of Analytical Chemistry
15. R. V. Dilts: Analytical Chemistry
16. Nuclear and radiochemistry by Friedlander, Kennedy and Miller.
17. **Essentials of nuclear chemistry by H. J. Arnikar**

Semister IV

Paper-XV

Special Paper-III

Inorganic Chemistry (Photoinorganic & Organometallic Chemistry)

Total Lectures: 60Hrs, 4 Hrs per week, 12 Hrs/unit

Total Marks-80

- Unit-I : 12L**
A) Basics of Photochemistry: Absorption, excitation, photochemical laws, quantum yield, electronically excited states-life times-measurements of the times. Flash photolysis, stopped flow techniques, Energy dissipation by radiative and no-radiative processes, absorption spectra, Frank-Condon principles □ photochemical stages-primary & secondary processes.
B) Properties of excited states: Photochemical kinetics, Calculation of rates of radiative processes.
- Unit-II : 12L**
A) Ligand field photo chemistry of transition metal complexes.. Electronically ligand field excited states of metal complexes containing d^1 to d^{10} configuration , , charge transfer spectra, charge transfer excitations, metods for obtaining charge transfer spectra Photochemistry Cr(III) of complexes : Photo-substitutions, properties of ligand field excited states ,Photo aquation reactions, photolysis rule , photoisomerization , photo recimization, photoanation reactions, Sensitizer, Types of sensitizer molecules, energy transfer process, Mechanism of photo sensitization, photo reactive excited state, The Doublet hypothesis, Role of quartet excited states, Photochemistry of Co(III) complexes : Introduction, energy level diagram, Photoaquations in Co(III) amine, Co(III) cynide complexes, Fe(II) low spin complexes., Ru(II) ammine derivative complexes, Photo redox properties of (Ru(III) complexes, Ce(III) and Ce(IV) complexes. Application of redox processes of electronically excited states for catalytic purposes, transformation of low energy reactants in to high-energy products, chemical energy in to light.
- Unit III : 12L**
Photochemical reaction on solid surface: Introduction,Basic principle of Photocatalysis, Photocatalysts, Phoreactive oxides, relation between solar spectrum & band gap, acceptor and donor level of photocatalyst, generation of electron □holepair, Needs of modification of photo catalysts, semiconductor supported metal oxide systems, synthesis methods, Characterization ,water photolysis, application of photocatalytic materials for degradation of organic pollutants, end product of organic pollutants with suitable examples.Nnitrogen fixation & carbon dioxide reduction.
- Unit-IV : 12L**
Organotransition metal chemistry: σ -Bonded transition metal-alkyls, - aryls, -alkenyls(vinyls), -alkynyls(acetylides). reactions in σ □organyls - homolytic cleavage, reductive elimination, electrophilic cleavage, insertion, β -metal hydrogen elimination. α -abstraction or α -elimination
Transition metal organyls with metal-carbon multiple bonding: Transition metal-carbenes, - carbynes, -bridging carbenes and -carbynes, reactions of carbene/ and carbyne complexes □ ligand substitution, nucleophilic, electrophilic attack, dismutation, ligand coupling reactions
Organotransition compounds with multicenter bonds (non-classically bonded): Concept of hapticity, transition metal complexes of alkenes, □iese salt, allenes, alkynes, allyls, butadienes□ cyclic π -metal complexes of cyclobutadienes, cyclopentadienyls, arenes, cycloheptatrienyls and cyclooctatetraenes□ reactions and bonding in ferrocene□ stereochemical non-rigidity in organometallic compounds and fluxional compounds, bimetallic and cluster complexes.
- Unit-V : 12L**
Transition Metal Pi -Complexes-Carbon multiple bonds: Transition metal complexes with unsaturated organic molecules like alkenes, alkynes, allyl, diene, dienyl, arene & trienyl complexes: Preparations,properties,nature of bonding and structural features.Important reactions relating to nucleophilic & electrophilic attack on ligands to organic synthesis.
Organometallics as catalysts: Bonding and structure transition metal complexes, applications in reactions such as hydrogenation, Hydrognation by Willkinsons catalyst, synthesis of chiral pharmaceuticals, □lefin metathesis, heterogeneous catalysis: □iegler Natta Polymerization, Water gas reduction ,carbonylation, coupling reactions - Suzuki coupling, Heck coupling and related cross coupling reactions. Alkene oligomerization and metathesis. Catalytic oxidations and reductions, epoxidation, dihydroxylations, decarbonylation, olefin isomerization, arylation, polymerization, asymmetric synthesis, heterogenised homogeneous catalysts, phase transfer catalysis, atalysis in green chemistry

Books:

1. Elschenbroich Ch. and Salzer A.: Organometallics, VCH, Weinheim, N.
2. Balzani V. and Cavassiti V.: Photochemistry of Coordination compounds, AP, London
3. Purcell K.F. and Kotz C., An Introduction to Inorganic Chemistry, Holt Sounder, Japan.
4. Rohtagi K.K. and Mukharjee, Fundamentals of Photochemistry, Wiley eastern
5. Calverts G. and Pitts N., Photochemicals of Photochemistry, John Wiley
6. Wells, Introduction of Photochemistry
7. Paulson, Organometallic Chemistry, Arnold
8. Rochow, Organometallic Chemistry, Reinhold
9. Weiss, Organometallic Chemistry, Reinhold
10. Gilbert A. and Baggott, Essential of Molecular Photochemistry, Blackwell Sci. Pub.
11. Turro N. and Benjamin W.A., Molecular Photochemistry
12. Cox A. and Camp, T.P. Introductory Photochemistry, McGraw-Hill
13. Kundall R.P. and Gilbert A., Photochemistry, Thomson Nelson Coxon and Halton B., Organic Photochemistry, Cambridge University Press.

Semester IV

Paper-XVI

Special Paper-IV

Inorganic Chemistry (Materials Chemistry)

Total Lectures: 60Hrs, 4 Hrs per week, 12 Hrs/unit

Total Marks-80

- Unit-I : Glasses, Ceramics & Composite materials: 12L**
Glass: Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Glassy state, glass formers and glass modifiers.
Ceramics: Ceramic structure. Mechanical properties. High technology ceramics and their applications.
Clays and refractory materials: Classification, structure and modifications of clays. Properties and applications of clays.
Refractories: Classification, properties and applications. Microscopic composites.
Composite materials: Definition, glass transition temperature, fibres, concrete and asphalt materials, polymer composites, application
Ceramic & Refractory: Introduction, classification, properties, raw materials, manufacturing and applications.
- Unit II : 12L**
A) Liquid Crystals: Mesomorphic behaviour, thermotropic liquid crystals, positional order, bond orientational order, nematics & smectic mesophases, smectic-Nematic transition clearing temperature-homeotropic, planer & schlieren textures twisted nematics, chiral nematics, molecular arrangement in smectic A & smectic C phases, optical properties of liquid crystals. Dielectric susceptibility & dielectric constants. Lyotropic phases & their description of ordering in liquid crystals.
B) Bio-materials: Biomineralisation, controlled formation of biological composites, bone & other mineralised tissues, materials of construction, applications (General aspect only).
- Unit-III : Nano Chemistry: 12L**
Introduction: Definition of nanoscale materials, different types, different physical and chemical synthetic routes, characterization of nanoscale materials by modern instrumental techniques.
Physical and Chemical Properties of Nanoscale Materials: Electrical properties, magnetic properties, optical extinction properties, unique optical signatures of various nanostructures, fluorescence, chemical reactivity, self-assembly of various nanostructures and its importance.
Catalytic Aspects of Nanoscale Materials: Catalysis using nanoparticles of metals and metal oxides with different sizes and shapes, useful chemical conversions using nanoparticles.
Nanoscale Materials in Emerging Technologies: Useful properties that can be exploited for applications, applications in the areas such as environmental remediation, adsorption, drug delivery, medical imaging, future prospects, precautions in using nanoparticles.
- Unit IV : Nanoporous Materials: 12L**
 Introduction, zeolites & molecular sieves, Classifications, fundamental properties of zeolites, qualitative & quantitative determination of surface acidity, Hydrothermal synthesis of zeolites, factors affecting the zeolite preparations, modification, methods of characterizations, & catalytic applications.
 Catalysis: Basic principles, types, industrial requirements, classification, theories of catalysis, Types of homogeneous and heterogeneous catalysts, Advantages and disadvantages, thermodynamic and kinetic aspects. Essential properties of catalysts. Characterization of catalysts
Solid State Reactions: Types, sintering, nucleation, Factors influencing the reactivity of solids, Precursors to solid state reactions, Tammann and Hedvall mechanism, Wagner's diffusion theory of reaction, Material transport in solid state reaction, counter diffusion, Kirkendall effect, Huttig's mechanism, Kinetic model: Reaction in powder compact, parabolic rate law, Fick's rate equation.

Unit V : 12L

A) **Fertilizers:** Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates, polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate
 B) **Coordination Polymers:** Homo and heterocatenated inorganic polymers. Polyphosphazenes: synthetic routes and bonding features, polymerization of organo/organometallic substituted phosphazenes and their applications. Polysilanes: sigma bond delocalization in polysilanes and its implications, synthesis and characterization of polysilanes. Polysiloxanes: synthetic routes via anionic and cationic polymerization, properties and environmental aspects. Dendritic macromolecules based on inorganic elements. Coordination polymers. Polymers based on Boron, Borazine, polymeric compounds of sulphur, polythiazoles, silicates with reference to preparation, properties, structures, bonding and applications. Natural polymers and reactions yielding coordination polymers. Synthesis of coordination polymers.

Books Suggested:

1. Barsoum, M.W., Fundamentals of Ceramics, McGraw Hill, New Delhi
2. Ashcroft, N.W. and Mermin, N.D., Solid State Physics, Saunders College
3. Callister W.D., Material Science and Engineering, An Introduction, Wiley
4. Keer, H.H., Principles of Solid State, Wiley Eastern
5. Anderson, C., Lever K.D., Alexander, M and Rawlings, R.D., ELBS
6. Gray G.W. Ed. Thermotropic Liquid Crystals, John Wiley
7. Kelkar and Hatz Handbook of Liquid Crystals, Chemie Verlag.
8. Kalbunde K.I., Nanoscale Materials in Chemistry, John Wiley, N.
9. Shull R.D., McMichael R.D. and Swartzendrub L., Studies of Magnetic Properties of Fine particles and their relevance to Materials Science, Elsevier Pub. Amsterdam
10. Breck D.W., Zeolite Molecular Sieves: Structure Chemistry and Use, Wiley Chichester, Eng.
11. Morrish A.H., Haneda K., In Nanophase Materials: synthesis, properties, applications, Kulwer, London.
12. Shriver & Atkins. Inorganic Chemistry, Peter Atkins, Tina Overton, Jonathan Rourke, Mark Weller and Fraser Armstrong, 5th Edition, Oxford University Press (2011-2012)
13. Adam, D.M. Inorganic Solids: An introduction to concepts in solid-state structural chemistry. John Wiley & Sons, 1974.
14. Poole, C.P. & Owens, F. Introduction to Nanotechnology John Wiley & Sons, 2003.
15. Rodger, G.E. Inorganic and Solid State Chemistry, Cengage Learning India Edition, 2002.

Semester IV

Paper XV

Special Paper-III Organic Chemistry (Organic Synthesis: II)

Total Lectures: 60Hrs, 4 Hrs per week, 12 Hrs/unit

Total Marks-80

Unit-I : 12L

Application of organometallics in organic synthesis

A) **Organometallic Reagents** Organo Lithium, Magnesium, Mercury, zinc and copper reagents, preparation using transmetallation, functionalized zinc and copper reagents, synthetic applications And Cram rule. Organo tin reagents, hydrostannation reaction and synthetic utility Organo boron and aluminium reagents, alkyl and aryl derivatives, synthesis and examples of applications in C-C bond forming reactions.

B) **Organo transition metal reagents:** Metal (Fe, Cr, Mo, Ni, Co, Rh) carbonyl compounds in organic synthesis. Metal (Cr, Fe, Ru) arene complexes, synthesis and structure. Activation of arene nucleus and side chain. Nucleophilic substitution and addition of arene.

Metal (Fe, Pd) ene, diene and dienyl complexes, metal complexes as protecting groups, activation towards nucleophilic addition reaction synthetic utility. π -allyl palladium, nickel and iron complexes, synthesis and their synthetic utility.

Metal Cobalt alkyne complexes, protection of triple bond, Metal (Rh, Ir) catalyzed C-H activation reactions and their synthetic utility.

C) **Metalloenes:** Introduction, Synthesis and Chemical Reactivity of Ferrocene, Cobaltocene, Nickelocene, Copper and Rhodium Based Carbene & Nitrene Complexes

Unit-II : 12L

Designing the synthesis based on retrosynthetic analysis

A disconnection approach to the synthesis of organic compound. Different consideration in designing target molecule, concept of synthon, FGI, Chemoselectivity, regioselectivity, specificity, stereoselectivity, general strategy choosing a disconnection. Types of bond disconnection, some of the applications of these concepts in designing the synthesis of common important class of the compounds.

Ring synthesis: Saturated heterocycles, synthesis of 3, 4, 5 and 6- membered rings. b) Synthesis of some complex molecules by Retrosynthetic analysis of following compounds: Camphor, Reserpine, and Vitamin-D2.

- Unit-III :** **12L**
A) Protection and Deprotection of functional groups Protection and deprotection of functional groups like, hydroxyl, amino, carbonyl and carboxylic acids groups, techniques employed for these.
B) Phase Transfer Catalysis: Quaternary ammonium and phosphonium salts, Crown ethers. Their methods of preparation and application in Organic Synthesis, Mechanism of Phase transfer reaction. ozone phase transfer catalyst,
- Unit-IV :** **12L**
Reagents in Organic Synthesis: Use of following reagents in Synthesis and functional group transformations such as complex metal hydrides, Gilman reagents, Lithium dialkyl cuprate LDA, DCC, Trimethyl silyl Iodide, Tributyl Tin hydride, Woodward and Prevost Hydroxylation, DDQ, Chloranil, Peterson Synthesis, Becker Reagent. Periodic Acid and periodate, Diazomethane, Selenium Dioxide, RuCl₄, IBX, DMP, Heck Reaction, Mukaiyama Reaction
- Unit-V :** **12L**
Heterocyclic Compounds: Nomenclature and familiarity with the heterocyclic ring (3- 7 members containing up to 3 heteroatoms). Detailed chemistry of Pyrazole, imidazole, oxazole, thiazole, thiazine, diazines, triazines pyrimidines, pyrazines and zepines, oxepines, Indoles, Benzofurans, Quinolines Flavones, Chromones, Coumarines, Phenothiazines, Azetidines

Books suggested :

- 1) Principle of organic synthesis. R.C Norman & M Coxon
- 2) Modern synthetic reaction. H.C.House W.A.Benjamin
- 3) Organic synthesis, The disconnection approach-S. Warren
- 4) Designing organic synthesis-S. Warren
- 5) Some modern methods of organic synthesis-W. Carruthers,
- 6) Advance organic reaction. Mechanism & structure- Jerry March
- 7) Advance organic chemistry Part-B-F.A. Carey & R. Sundberg, Plenum P.
- 8) Organic reaction and their mechanism-PS Kalsi
- 9) Protective group in organic synthesis-TW Greene, & PGM
- 10) The chemistry of organo phosphorous-A. Kirby, & SG Warren
- 11) Organic silicon compound-C. Eabon
- 12) Organic synthesis via Boranes-HC. Brown
- 13) Organic borane chemistry-TP Onak
- 14) Organic chemistry of boron-W. Gerrard
- 15) Organic Chemistry Reaction: Moondy
- 16) Heterocyclic chemistry : Coule & Smith (Van Nostrand).
- 17) Heterocyclic chemistry : R. K. Bansal: (Wiley E).
- 18) Principals of modern heterocyclic chemistry : L. A. Paquette
- 19) The structure and reactions of heterocyclic compounds : M. H. Palmer.
- 20) Advances in Heterocyclic chemistry : A. R. Katritzky:
- 21) Organic Chemistry: Clayden, Greeves, Warren & Wothers

SEMESTER –IV

Paper XVI

Special Paper-IV : ORGANIC CHEMISTRY (Applied and Medicinal Chemistry)

Total Lectures: 60Hrs, 4 Hrs per week, 12 Hrs/unit

Total Marks-80

- Unit-I :** **Polymers, Dyes and Agrochemicals:** **12L**
A) Mechanism of polymerization, study of polyesters, polyamides, PVC, polystyrene, Polyvinyl acetate and polyvinyl alcohol, polythene, viscous rayon. Synthesis of polyethylene, polypropylene.
 Synthetic Rubber: Styrene-butadiene, Butyl polyisoprene, polyurethane Vulcanization mechanism, phenol formaldehyde resin, stereo regulated polymers. Atactic, Isotactic and Syndiotactic polymers. Plasticizers, Foaming agents. Antioxidants for polymers,
B) DYES: General Introduction, optical brighteners, thermal sensitive dyes, disperse dyes. Fiber swelling in dyeing. Use of carriers in dyeing. Use of heat energy in dyeing, study of quinoline yellow, cyanine dye, ethyl red, methylene blue, Alizarin, cyanine-green, fluorescein, eosin, erythrosine, Rhodamine and Indigo
C) Agrochemicals:
 i) **Carbamate pesticides:** Introduction, Carbaryl, Bayon, Pirim.
 ii) **Organophosphorous pesticides:** Malathion, Monocrotophos, Dimethoate.
 iii) **Plant growth regulators:** General survey synthesis of simple compounds.
- Unit-II :** **12L**
General aspects of drug: Historical, Definitions used in drug chemistry-pharmacy, pharmacology, pharmacodynamics, pharmacodynamic agents, metabolite and antimetabolites, gram positive and gram negative Bacteria, Virus, Actinomycetes, Mutation, Chemotherapy, Nomenclature of medicinal compounds. Classification of drugs on basis of their Therapeutic actions. Chemotherapeutic agents Cancer chemotherapy, Synthesis of mechloaethamine, cyclophosphamide, Mephalan, uracils, mustards. Recent development in cancer chemotherapy. Pharmacodynamic agents Mechanism of Chemotherapeutic action: Biological defences. Chemical defences, Surface active agents, Metabolic Antagonism Assay of Drugs: Chemical assay, Biological assay, Immunological assay

- Unit-III** **12L**
DRUGS DESIGN: Classification of Drugs, procedures followed in drug design. Concept of lead compound and modification concept of Prodrugs and Softdrugs structure activity relationship (SAR) Factors affecting bioactivity resonance, inductive effect, isosterism, Biosterism, Spatial consideration, theories of drug activity occupancy theory, Rate theory induced tit theory, Quantitative structure activity relationship. History and development of QSAR, Concept of drug receptor interaction, Physico-Chemical parameter. Lipophilicity, Partition coefficient Electronic ionization constants, Steric Shelton and surface activity parameters and redox potential. Free Wilson analysis, Hansch analysis LD-50, ED-50 (Mathematical derivatives of equations included) Ligand-Based Drug Design, Diversity-Oriented Synthesis for Drug Design, Structure-Based Drug Design, Fragment-Based Drug Design, Natural Products-Based Drug Discovery, Diversity-Oriented Synthesis in Drug Discovery, Virtual Screening
- Unit-IV : Classification of Drugs- I** **12L**
 Synthesis, mode of actions, Pharmacokinetics, pharmacodynamic data and secondary metabolism of following Drugs
A) Antibiotics: Introduction, Penicillin V And G, Streptomycin, Chloramphenicol, Tetracyclins.
B) Antimalarial : Chemotherapy of malaria, Aminoquinolines, pamaquine, chloroquine and sulphones.
C) Antipyretic and Analgesic: Aspirin, salol, phenacetin, antipyrin:
D) Anti-inflammatory: Ibuprofen, Oxycodone, Diclofenac, Indomethacin.
E) Sedatives & Hypnotics: Barbiturates, mode of action, diazepam, caffeine, Mescaline, hermine
- Unit-V : Classification of Drugs- II** **12L**
 Synthesis, mode of actions, Pharmacokinetics, pharmacodynamic data and secondary metabolism of following Drugs
A) Antitubercular & antileprotic : Ethambutol, Isoniazide & Dapsone
B) Anaesthetics : Lidocaine, Thiopental.
C) Antihistamines: Phenobarbital, Diphenylhydramine.
D) Tranquilizers: Diazepam, Trimeprazine.
E) Cardiovascular: Synthesis of diltiazem, quinidine, methyl dopa

Books Suggested:

- 1) Pesticides: R. Cleymlin
- 2) Chemistry of Pesticides: K. H. Buchel
- 3) The Chemistry of Pesticides and formulations: N. N. Melikov
- 4) Chemistry of Synthetic Dyes Vol- 1 to 7: K. Venkataraman
- 5) Colour Chemistry: Allan
- 6) Text book of organic medical and pharmaceutical
- 7) chemistry: Wilson, Gisvold & Dorque
- 8) Strategies for Organic Drug synthesis and Design, D. Lednicer, Wiley
- 9) Medicinal Chemistry: A. Kar
- 10) Text book of organic medicinal chemistry-wilson, gesvold
- 11) Medicinal chemistry Vol I & II-Burger
- 12) Synthetic organic chemistry-Gurudeep chatwal.
- 13) A textbook of pharmaceutical chemistry-Layshree Ghosh
- 14) Synthetic dyes series-venkataraman
- 15) Chemistry process industries-shreve & brink paquette
- 16) Introduction to medicinal chemistry-A Gringuadge
- 17) The Organic Chemistry of Drug design and Drug action, R. B. Silverman Academic press.
- 18) Text book of Polymer Science: F. W. Billmeyer
- 19) An introduction to drug design-SS pandey, & R demmock
- 20) Goodman and Gilman's pharmacological basis of therapeutics-
- 21) Strategies for organic drug synthesis & design-D lednicer
- 22) Polymer science-v govarikar
- 23) Principle of polymer chemistry-P. Flory
- 24) An outline of polymer chemistry-james q.allen
- 25) Organic polymer chemistry-K. Saunders

Semester IV
Physical Chemistry Special Paper III
Paper XV

60 Hours (4-Hours/week) **80 Marks** **12 hours/Unit**

- Unit-I : Liquid Crystals:** **12L**
A) Liquid State: The vacancy theory of liquids, free volume of liquid, physical properties of liquids, Kelvin equation for Volume Pressure of droplet, Laplace equation and Young Laplace equation. Viscosity, effect of Temperature on viscosity and Reynolds number. **6L**
B) Liquid Crystal, VPT diagram, thermography, LCD and seven segment cell, classification of thermotropic crystals: Smectic, Nematic, Cholesteric, Disc shaped and polymer liquid crystal. Polymorphism in thermotropic liquid crystal, Pressure induced mesomorphism. **6L**

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| Unit-II | : Phase Equilibria: | 12L |
| | Phase rule, derivation of Gibbs phase rule, Liquid Helium system(one component), Two component system- Type A- simple eutectic system, Lead-silver, Bismuth-Cadmium system, potassium iodide water system. Type B- formation of compounds with congruent melting point, Ferric chloride water system, formation of compound with incongruent melting point, calculation of eutectic point and eutectic composition, Three component solid liquid system- Acetic acid chloroform water system and system containing two salt and water. | |
| Unit-III | : Kinetics in Liquid solutions: | 12L |
| | Introduction, Theory of Absolute Reaction rates in ideal solutions, theory of reaction rates for ions in solution, Linear Free energy relationship, Mechanistic Deductions used in Hammett Equation, Relaxation Time for simple reaction in solution, Kinetic Isotope effect, Diffusion controlled reaction, Full macroscopic and partial macroscopic diffusion controlled and ionic reaction. | |
| Unit-IV | : Chemical kinetic methods: | 12L |
| | A) Bioelectrochemistry: Membrane Phenomena Applications of Donnan's Membrane equilibria, Bioelectrodes, Electrocardiogram, Membrane Potentials. | 6L |
| | B) Electrocatalysis: Introduction, Electropower of electrolysis, Mechanism of Electrocatalysis, Bioelectrocatalysis, immobilization. | 6L |
| Unit-V | : Photochemical Reaction Dynamics: | |
| | Reaction Kinetics of thermal hydrogen-bromine reaction, reaction kinetics of photochemical hydrogen-bromine reaction and hydrogen chlorine reaction, reaction kinetics of decomposition of ethane, reaction kinetics of pyrolysis of acetaldehyde. Oscillatory reactions, Homogeneous catalysis, Acid base catalysis, Enzyme catalysis. | 12L |

Books Suggested:

- 1) Physical chemistry by P.W. Atkins & dePaula 7Th Edition
- 2) Chemical Kinetics by K. Laidler. 3rd Edition. Pearson Education.
- 3) Liquid State by A. Pryde.
- 4) Theotropic Liquid Crystals by G.W. Gray, Wiley
- 5) Hand Book of Liquid Crystals by Kelkar & Hatz, Chemie Verlag.
- 6) A Dynamic Liquid State, A. F.M. Barton, Longman.
- 7) Chemical Kinetics & Dynamics by I. Steinfeld, S. Francisco & W.L. Hase. Printice Hall. 1989.
- 8) Kinetic & Mechanism of Chemical Transformation by Rajaram & Kuriacose, McMillion.
- 9) Advanced Physical Chemistry by Gurdeep Raj, Goel Publications.
- 10) Physical Chemistry by Puri Sharma Pathania

**Semester IV
Paper- XVI
Special Paper-IV
Physical Chemistry**

60 Hours (4-Hours/week)

80 Marks 12 hours/Unit

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|-----------------|--|-----|
| Unit-I | : Nuclear reactions: | 12L |
| | Bath's notation, types of nuclear reactions, conservation in nuclear reaction, reaction cross section, compound nucleus theory, Experiments of Ghoshal, of Alexander and Simonoff specific nuclear reactions, trans uraniens, photonuclear reactions, thermonuclear reaction, fusion reactors | |
| Unit-II | : Nuclear fission: Process of nuclear fission, fission fragments and their mass and charge distribution. Fission energy, fission cross-section and threshold. Theory of nuclear fission, fission neutrons, other types of fissions. | 12L |
| Unit III | : Nuclear Reactors | |
| | The fission energy, natural uranium reactor, the classification reactor, critical size of thermal reactor the breeder reactor, reprocessing of spent fuel, nuclear waste management, Nature's nuclear reactors. | 12L |
| Unit-IV | : Radiation Chemistry : Radiation chemistry, interaction of radiation with matter, passage of neutron through matter, interaction of gamma radiation with matter, unit of measuring radiation absorption, radiation dosimetry, and free radicals in water, radiolysis, and radiation induced colour centers in crystals. | 12L |
| Unit-V | Applications of radioactivity and Dosimetry: Probing by isotope typical reactions involved in preparation of radioisotopes, the Szillard Chalmer's reaction, cow and Milk system, Radiochemical principles in the use of tracers, typical applications of radioisotopes as a tracer, uses of nuclear reaction, radioisotopes as a source of energy. | 12L |

Books Suggested:

- 1) Introduction to radiation chemistry by W.T. Spinks and R. Woods.
- 2) Essentials of Nuclear chemistry by H. Arnikaar.
- 3) A Dynamic Liquid State, A. F.M. Barton, Longman.
- 4) Chemical Kinetics & Dynamics by I. Steinfeld, S. Francisco & W.L. Hase. Printice Hall. 1989.
- 5) Kinetic & Mechanism of Chemical Transformation by Rajaram & Kuriacose, McMillion.
- 6) Advanced Physical Chemistry by Gurdeep Raj, Goel Publications.
- 7) Physical Chemistry by Puri Sharma Pathania

**Semester IV Paper XV
Special Paper III
Industrial Chemistry (Polymers, Dyes and Paints)**

60 Hours (4-Hours/week)

80 Marks 12 hours/Unit

- Unit – I :** 12L
Polymer Chemistry: Basic concepts, nomenclature, degree of polymerization, classification of polymerization reactions, thermodynamic. Types of polymerization: dendrimer, copolymerization, block copolymerization, graft copolymerization, stereo isomers, isotactic and syndiotactic polymers. Mechanism of polymerization: Free radical and ionic □ characterization and rheology of polymers, heterogeneous polymerization, □iegler-Natta catalysis.
- Unit – II :** 12L
A) Commercial polymers:- Manufacturing process, properties and uses of nylon-66, polyethylene, polypropene, polyvinylchloride, polystyrene, teflon and polybutene. Effect of stereochemistry on the structure and properties of polymers.
B) Degradation of polymers: □ oxidation, thermal, photo and hydrolytic degradation methods.
- Unit – III :** 12L
Dyes: Introduction, classification of dye on the basis of mode of application and structure dye intermediates, preparation of dye intermediates, structural features of a dye □ preparation and applications of picric acid, methyl orange, fluorescence, methyl red, indigo phthalenes, xanthenes, cyanine, anthraquinone.
- Unit - IV:** 12L
Paper and Pulp: Raw materials, classification, methods of pulping, production of sulphate and sulphite pulp, general principles of some mechanical and chemical pulping kinetics. **Paper industry:** Production of paper, wet process, paper properties testing, process instrumentation □ Emission: Solid and gas waste □ Applied processes and techniques: Sizing, coating, dyeing, addition of chemicals, and calendering □ Fibre recovery: Broke system
- Unit - V:** 12L
A) Paints and Pigments: Introduction of paints, ingredients and classification, new technologies □ properties of coatings □ solvents, plasticizers, dyes and bioactive additives □ paint formulations, testing and evaluation. Pigments: Introduction, classification and general physical properties.
B) Corrosion:- 12L
 Introduction, Principle of corrosion, Types of corrosion relevant to chemical industries, Mechanism of electrochemical corrosion, Factor influencing corrosion, Corrosion testing methods - Weight loss method, electrochemical approach, corrosion rate at short time intervals. Mechanism of corrosion and Corrosion prevention Methods- Galvanizing, tinning and electroplating. Corrosion Hazards and its industrial implications.

Books Suggested-

- 1) Textbook of polymer science by F. Bill Mayer, Wiley Inter Science.
- 2) Polymer Science by V. Govarikar, N. Viswanathan and □ Sreedhar, New Age International (P) Ltd. Publishers New Delhi.
- 3) Plastic materials, □A. Brydson, Newnes-Butterwarths (London)
- 4) Polymer science, Bill meyer, F. W. □. □ohn Wiely & sons
- 5) Introduction to plastics, □H. Brison and C.C. Gosselin, Newnes, London
- 6) Polymeric Materials, C. C. Winding and G. D. Hiatt McGraw Hill Book Co. Polymer Science by Gowarikar
- 7) Physical chemistry of polymers by D. D. Deshpande, Tata McGraw Hill.
- 8) Principles of polymer chemistry By P. □ Flory, Cornell Univ. Press.
- 9) Introduction to polymer chemistry by R. B. Seymour McGraw Hill.
- 10) A Practical Course in polymer chemistry by S. □ Pnnea, Pergamon press.
- 11) Labortary preparation of macro chemistry by E. M. M. Effery McGraw Hill.
- 12) Synthetic dyes by Venkatram (V □ L I & II)
- 13) Fundamental processes of dye chemistry, by Fietz.
- 14) Dyes and Intermediates by Adrahaedt.
- 15) Paints, coatings and solvents by D. Staye
- 16) Paints and surface coating theory and practice by R. L. Lambourna
- 17) Pigments handbook by T. C. Patton
- 18) Coating technology handbook by D. Satas

**Semester IV Paper XVI
Special Paper IV**

Industrial Chemistry (Chemical Process Industries, Green Chemistry and Process Economics)

60 Hours (4-Hours/week)

80 Marks 12 hours/Unit

- Unit – I :** 12L
Agrochemicals : General introduction, synthesis, structure and application:
Insecticides: DDT, BHC, aldrin, endosulfon, malathion, parathion.
Herbicides: 2,4-dichloro phenoxy acetic acid, dalapon, paraquat, banalin, butacarb, alachlor, suphonyl ureas.
Fungicides: Boardeaux mixture, copper oxychloride, benomyl.
Rodenticides: Warfarin, sodium monofluoroacetate, zinc phosphide.
Pesticides: Endosulphan, methyl parathion.

- Unit – II :** **12L**
A) Industrial Gases: Heavy chemicals and production of gases. Chemistry, manufacture, storage, hazards & uses.- Hydrogen, Oxygen, nitrogen, carbon dioxide, chlorine, fluorine, SO₂, phosgene, acetylene, argon, neon & helium.
B) Fertilizers: Fertilizer industries in India, Manufacture, uses and major engineering problems of Ammonium sulphate, Urea, Ammonium nitrates, Ammonia, Nitrogenous fertilizers, Ammonium Phosphate, superphosphates, complex fertilizers.
- Unit – III :** **12L**
Pharmaceuticals : Product profile study of the following drugs and intermediates with particular stress on the manufacturing process engineering problems involved, quality control and equipment
 i) Sulpha drugs:- Sulphaguanidine, sulphamethoxazole.
 ii) Antimicrobial:- chloramphenicol, streptomycin, Tetracyclines. Amoxiciline, Erythromycine
 iii) Analgesic:- anti inflammatory, Acetyl Salicyclic acid, Ibuprofen, paracetamol.
 iv) Vitamin Vit. A, Vit. B₆, Vit. C
 v) Barbiturates:- Pentobarbital
 vi) Cardiovascular gent:- Methyl dopa
 vii) Antidepressants Resperidone, sertraline.
- Unit – IV :** **12L**
Principles and Concepts of Green Chemistry : Introduction.
 (a) Atom economic reactions - Rearrangement reactions, Addition reactions.
 (b) Atom un-economic reactions - Substitutions reactions, Elimination reactions, Witting reaction
 (c) Reducing toxicity - Measuring toxicity.
 Synthesis involving basic principle of Green Chemistry - Introduction, Synthesis of Styrene, Adipic acid, Urethane, Aromatic amine, Selective alkylation of active methylene group, Synthesis of Acetaldehyde, Furfural from biomass, Synthesis of s-metalochlore (herbicide), Ibuprofane, Paracetamol.
- Unit – V :** **12L**
A) Chemical Process Economics : Cash flow for Industrial operation, factors affecting project cost and investment, cumulative cash position, salvage value, estimation methods employed for the estimation of capital investment. Interest, Methods of determining depreciation: Straight Line Method, Declining Balance Method and Sum of Years digit Method. Economics of selecting alternatives. Break even point, production scheduling.
B) Safety: General occupational safety, flammable materials, Handling, fuel fighting equipments, control measures for Toxic chemicals. Safety with chemical engineering operations, hazardous chemicals process. Safety in Laboratories and pilot plant. Safety in transportation & storage of chemicals, management of safety & loss prevention.

Books Suggested :

- 1) Pesticites-Color Publications,P. L. Bombay.
- 2) Elements of Plant Protection by L. L. Pyenson, John Wiley and sons.
- 3) Chemistry of Pesticides by N. N. Melnikov Springer-Verlag, New York.
- 4) Fungicites in Plant Disease control by G. L. Nines, Oxford and IBH Publishing company New Dehli.
- 5) Methods of Pesticides Analysis by Sree Ramuly, U. I. Oxford and IBH Publishers.
- 6) Chemical Process Industries by R. N. Shreves and M. A. Brink. McGraw Hill Ltd. 4th Edition.
- 7) Charles E. Dryden, Outline of Chemical Technology Edited by M. Gopal Rao and
- 8) Marshall Siting, East West press 2nd Edition 1973.
- 9) Indian Pharmacopoeia, 1985.
- 10) British pharamacopoeia, 1990.
- 11) Text book of Organic Medicinal and Pharmaceutical Chemistry by Willson, Eivold,
- 12) Dejjia, Lippinett Toppan.
- 13) Essentials of Medicinal Chemistry by Korolkovas and Burkhatler-Wiley-Inter science.
- 14) Pharmaceutical Dosage forms.
- 15) D. A. Crowl & F. Louvar, Chemical Process Safety (Fundamentals with applications), Prentice Hall
- 16) H. H. Fawcett and W. S. Wood, Safety and Accident Prevention in Chemical Operations, Wiley and sons.
- 17) Green Chemistry: Theory and Practice Paperback by Paul Anastas, John Warner.
- 18) Introduction to Green Chemistry, Editors: Ryan, M., Tinnesand, M.
- 19) Green Chemistry: Environmentally Benign Reactions, Second Edition V. K. Ahluwalia.

**Semester IV
 Practical-VII
 Inorganic Chemistry Special**

Pracitcal Workload 9 Hrs./week

Time: 6-8 hours

Marks: 100

Unit-I :

- 1) Extraction and absorption spectral study of chlorophylls from green leaves.
- 2) Determination of Phosphates from cold drink samples by spectrophotometry.
- 3) Analysis of talcum and nyclin powders (Mg-complexometry, Mn/H₃B₃)
- 4) Determination of iron in soap bar.
- 5) Analysis of N, P, K from fertilizer
- 6) Analysis of cement/paint/soil.

Unit II : Study of complex formation:

- 1) To determine the formula and formation of a complex by spectrophotometry (Mole/Slope ratio methods)
- 2) To determine stepwise proton-ligand and metal-ligand stability constant of complex by Irving-Rossotti method.
- 3) To determine the instability constant of complex by potentiometry (AgNH₃, Ag-thiosulphate)
- 4) To determine the composition and formation constant of a Fe-SSA complex by conductometry.
- 5) Determination of composition and stability constant of complex by polarography.
- 6) Cyclic Voltametric study of i) Potassium ferricyanide ii) Ferrocene

Unit-III : Inorganic reaction mechanism:

Kinetics and mechanism of following reactions:

- 1) Kinetics of Aquation/Isomerisation /Substitution reactions in octahedral complexes (Acid/Base hydrolysis)
- 2) Isomerization reaction of octahedral complexes.
- 3) Enzyme kinetics in presence of metal ions.
- 4) To determine the corrosion rate of metal strip.
- 5) To study the 1,10 phenanthroline as corrosion inhibitor for mild steel in sulphuric acid.
- 6) To study the adsorption and desorption of gases on heterogeneous catalyst.
- 7) Kinetics of substitution reaction of [Fe(Phen)₃]²⁺
- 8) Synthesis and photochemistry of K₃[Fe(C₂O₄)₃].3H₂O

Unit-IV : Solid State:

- 1) Synthesis of oxides and mixed oxides : Zinc Ferrite, MnMn₂O₄, NiO, Nickel Ferrite, CuMn₂O₄ Nano particles of MnO₂
- 2) Preparation of Gold Nanoparticles using Tea
- 3) Synthesis of nano size ZnO, its characterization by UV-Visible spectroscopy and removal of dye by ZnO-photocatalysis
- 4) Preparation of Silica and Alumina by sol-Gel technique.
- 5) To study the electrical conductivity and DRS of ferrites, Magnetites, doped oxides and pure samples and determine band gap.
- 6) Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II).

Unit-V : Two/Three steps synthesis and characterization:

Synthesis of metal complexes/Polymers and their structural characterizations by possible physical methods such as: elemental analysis (N, S, M etc.), m.p. Solubility, MW, molar conductance, magnetic moment, thermogravimetric analysis, IR and electronic spectral data, determination of crystal field parameters (minimum five)

- 1) Solvent free and one pot synthesis of Phthalocyanine complex of Copper (II).
- 2) Zinc(II) /Copper(II)/ Cobalt(II)/ Nickel(II) complexes of Schiff base derived from salicylaldehyde with aniline/ substituted aniline
- 3) Synthesis and characterization of coordination polymers of Zinc(II) /Copper(II)/ Cobalt(II)/ Nickel(II) .
- 4) Magnetic Susceptibility and Thermogravimetric studies (3 samples).
- 5) Solution state preparation of [Ni(en)₃][S₂O₃]₂, [Ni(H₂O)₆][Cl₂], [Ni(NH₃)₆][Cl₂]. Record absorption spectra in solution of all three complexes and analyse it. Arrange three ligands according to their increasing strength depending on your observations
- 6) Metal DNA interactions (Viscosity & spectrophotometry)

Book Suggested:

1. Synthesis and Characterization of Inorganic Compounds, W. L. Moly, Prentice Hall.
2. Inorganic Experiments, Derck Woollins, VCH.
3. Practical Inorganic Chemistry, G. Marrant, B. W. Rockett, Van Nostrand.
4. A Text Book of Quantitative Inorganic Analysis, A. I. Vogel, Longman.
5. EDTA Titrations. F. Laschka
6. Instrumental Methods of Analysis, Willard, Merit and Dean (CBS, Delhi).
7. Inorganic Synthesis, Moly
8. Instrumental Methods of Chemical Analysis, Melri Lalikov
9. Fundamental of Analytical Chemistry, Skoog D.A. & West D.M Holt Rinehart & Winston Inc.
10. Experimental Inorganic Chemistry, W.G.Palmer, Cambridge.
11. Solid state Chemistry, N.B.Hanney
12. Introduction to Thermal Analysis, Techniques & Applications, M.E.Brown, Springer
13. Preparation and Properties of solid state Materials, Wilcox, Vol. I&II, Dekker
14. The Structure and Properties of Materials Vol.IV, John Wulff, Wiley Eastern.

The Practical examination will be based on the Inorganic Chemistry.

Time: 6-8 hours (One day examination)

Marks: 100

| | |
|---------------------------------------|------------|
| I) Exercise -1 (Synthesis & Analysis) | - 40 Marks |
| II) Exercise-2 (Kinetics/complex) | - 40 Marks |
| III) Record | - 10 Marks |
| IV) Viva- Voce | - 10 Marks |

Total -100 Marks

**SEMESTER IV
Practical – VII
Organic Chemistry Special**

Total Hours: 90 hrs. (9 Hours per week) Marks: 100

A- Qualitative Organic Analysis: (40 Marks) (12 Laboratory Session) Separation, purification and identification of ternary (three component) mixtures. The water soluble solid/liquid should also be given. Student should submit the purified samples of the separated compounds and prepare a suitable derivative of the three compounds separated out.

Note : Analysis of at least ten mixtures should be carried out.

| | |
|--|-----------|
| Scheme of Marking: Type of the mixture | 10 |
| i). Analysis of the individual components: (10 Marks for each component) | |
| ii). Detection of Elements | 02 |
| iii). Detection of functional groups | 02 |
| iv). Determination of MP/BP | 02 |
| v). Preparation of the derivative | 02 |
| vi). Identification (Spotting) | 02 |

B- Spectral Interpretation and use of Chem draw software (Total Laboratory Session 6) (15 marks)

C: Miscellaneous Experiments (Mandatory) (Total Laboratory Session 8) (25 marks)

- (1) Reduction reaction of 3-nitroacetophenone (Stereo selective synthesis)
 - (i) Reduction with Tin and Hydrochloric Acid
 - (ii) Reduction with sodium borohydride
- (2) Grignard Reaction: Conversion of Benzophenone into triphenyl methanol.
- (3) Synthesis of 5,5-Diphenylhydantoin from benzil, as an anticonvulsant.
- (4) Extraction of Limonene (essential oil) from orange by steam Distillation.
- (5) Synthesis of anaesthetic drug Benzocaine.
- (6) Synthesis of anticancer drug 6-methyl uracil.
- (7) Synthesis of α -Acetylamino cinnamic acid from glycine.
- (8) Estimation of blood sugar, calcium, and total nitrogen and non-protein nitrogen in blood.

**Practical-VI
Organic Chemistry**

Time : 6-8 Hrs. (One day Examination) Marks : 100

| | |
|---|----------|
| (1) Exercise-1 (Organic Synthesis) - | 40 Marks |
| (2) Exercise-2 (Qualitative Analysis) - | 15 Marks |
| (3) Exercise-3 (Qualitative Analysis) - | 25 Marks |
| (4) Record - | 10 Marks |
| (5) Viva-Voce - | 10 Marks |

Total 100 Marks

Books Suggested:

1. Textbook of practical organic chemistry qualitative and quantitative analysis (Vol I & II)- A.I. Vogel.
2. Elementary practical organic chemistry small scale preparation (Langman)- A.I. Vogel.
3. A handbook of organic analysis.-H.T.Clark.
4. Systematic qualitative organic analysis H. Middleton.
5. Advanced practical organic chemistry-N. K. Vishnoi.
6. Small scale organic preparation-P. Hill
7. Practical organic chemistry-H. Dupont Durst & George W.Gokal.
8. Experimental organic chemistry Part I & II, P. R. Singh, D. S.Gupta & K.S. Bajpai.
9. Vogel's textbook of practical organic chemistry-A.R. Tatchell

Semester IV
Practical-VII
Physical Chemistry Special

Practical Workload 9 Hrs./week

Time: 6-8 hours

Marks: 100

USE OF COMPUTER PROGRAMES 5 TERMS OF PRACTICALS.

Treatment of experimental data, X-Y plots, programs with data preferably from physical chemistry practical. Students will operate two packages I) MS-Word and II) MS-Excel.

Part-A

- 1) To find out Energy of activation & Temperature coefficient of hydrolysis of methyl / ethyl acetate
- 2) To find out Energy of activation of the reaction between potassium persulphate & potassium iodide.
- 3) **Determination of partial molar volume of solute and solvent in binary mixture.**
- 4) **To study the variation of solubility of calcium sulphate with ionic strength and hence determine thermodynamic solubility product.**
- 5) **To study the adsorption of acetic acid on charcoal and prove the validity of Freundlich and Langmuir adsorption isotherm.**
- 6) To determine the critical micelle concentration of soap.
- 7) To determine the molecular weight of high polymer by viscosity measurement.
- 8) To find out partition coefficient of Iodine/Benzoic/Salicylic acid between benzene and water.

Part-B

- 1) Determination of Half Wave potential of metal ions by polarography.
- 2) Simultaneous determination of suitable of metal ion by polarography
- 3) Analysis of aspirin conductometrically and potentiometrically
- 4) Determination of sodium, potassium, lithium and calcium by Flame photometric individually and mixture.
- 5) Electronics measurement of resistance with multimeter and use of Wheatstone Bridge for accurate measurement of resistance.
- 6) Determine the dipole moment of given liquid.
- 7) Plot the current voltage curve for copper sulphate and sulphuric acid using bridge platinum electrode.
- 8) Determine the transport number of ions by moving boundary method.
- 9) Determine the composition of binary mixture spectrophotometrically

**Physical Chemistry Practical :
Distribution of marks:**

| | |
|---------------------------------|-----------|
| Two Days Examination - 6-8 Hrs. | 100 Marks |
| Unit A □ □ | 40 |
| Unit B □ □ □ | 40 |
| Record | 10 |
| Viva-voce | 10 |
| | |
| TOTAL | 100 |
| | |

**Semester IV
Practical-VII
Industrial Chemistry Special**

Practical Workload 9 Hrs./week

Time: 6-8 hours

Marks: 100

Multi step organic Synthesis (Minimum 20 practical should be performed):

1. Nitrobenzene - m-dinitrobenzene □ m-nitroaniline- m-nitrophenol.
Anthranilic acid □ phenylglycine orthocarboxylic acid □ indigo
2. Cyclohexanone □ cyclohexanone oxime □ caprolactum.
3. Preparation of p-bromoaniline from aniline.
4. Preparation of Synthetic zeolites.
5. Determination of %N and %P nitrogen and phosphorus containing fertilizer respectively by suitable methods.
6. Determination of Iron and Calcium from Cement by suitable methods.
7. Determination of Lead (Pb) from □al Glass by suitable methods.
8. Experiments based on distillation under reduced pressure, fractional and steam distillation.
9. Measurement of flash point, ignition point, kinematic viscosity by U-tube method.
10. Estimation of Copper from □fungicides.
11. Determination of pesticide contents in the soil.
12. Preparation of Methyl orange, Methyl red, orange II, Fluorescein, □quinoline, Anthraquinone.
13. Quantitative estimations of important commercially available drugs.
14. Qualitative analysis of commercial available drugs including chromatographic technique.
15. Preparation of simple drugs involving two or three steps.
16. Preparation of melamine □HCHO resin.
17. Determination of number average molecular weight (Mn) by end group analysis by conductometric method.
18. Determination of average molecular weight of polymer by viscometric method.
19. Determination of reducing sugar in cane juice.
20. Determination of moisture content and ash content of wood sample.
21. Experiments based on simple & fractional crystallization.
22. Analysis of nonfibrous materials used in pulp industries such as caustic soda as Na₂CO₃, Soda ash as Na₂CO₃, lime as CaO.
23. Extraction of essential oils from medicinal plants (Tikhadi).
24. Separation of Chromium (VI) & Chromium (III) by TLC in wastewater sample from electroplating industry.
25. Estimation of Manganese from Tea leaves-component
26. Preparation of selected pesticide formulations in the form of dusts, emulsions, sprays.
27. Preparation of biodiesel from vegetable/ waste cooking oil
28. Determination of calorific value of fuels.
29. Preparation and characterization of inorganic complexes containing Fe, Co, Ni, Cu, □n, with N, and P containing ligands. Applications of these complexes for □rganic coupling reactions like Heck, Suzuki, Stille and Sonogashira reactions

Distribution of marks:

The Practical examination will be based on the syllabus for Industrial Chemistry (Elective Paper).

Time: 6-8 hours (one day examination)

Marks: 100

| | |
|---|------------|
| I) Exercise -1 (Based on Synthesis) | - 40 Marks |
| II) Exercise-2 (Based on Quantitative Analysis) | - 40 Marks |
| III) Record | - 10Marks |
| IV) Viva- Voce | - 10 Marks |

| | |
|-------|------------|
| Total | -100 Marks |
|-------|------------|

List Of Books-

1. Practical Engineering by S. S. Dara.
2. Laboratory Preparation of Microchemistry by E. M. M. Effery, McGraw Hill.
3. Practical Course in Polymer Chemistry by S. P. Pnnea, Pargaman Press
4. Practical Pharmacognosy by T. B. Willis.
5. Practical Pharmacognosy by T. N. Vasudevan.
6. Indian Pharmacopea-1985, British Pharmacopea-1990.
7. Handbook of Drugs and Cosmetics by Mehrotra
8. Methods of Pesticide Analysis by Sree Ramuly U. I. Oxford and IBH Publishing Co.
9. Methods of testing for petroleum and petroleum products. IS 1448-1960 Part I to Part IV. Published by ISI New Delhi 1967
10. IP Stands for Petroleum and products Published Applied Service Publisher Ltd. London, 33rd Edition 1974.
11. American Stds. For testing Materials, New York 1967.
12. Textbook of Inorganic Chemistry by A. I. Vogel.
13. Instrumental Methods of Analysis by Willard, Merit and Dean
14. Industrial Chemicals, Faith et. al. Wiley Interscience New York
15. Textbook of Practical Organic Chemistry by I. C. Voley.
16. Industrial Organic Chemistry by K. Stille
17. Unit Operations by Kale
18. Reagents for Organic Synthesis Fisher and Fisher.
19. Technique of Organic Chemistry Vol I, Part I- IV A. Weishberger.

**SEMESTER IV
Practical – VII
Project Work**

Total Hours: 90 hrs. (9 Hours per week)

Marks: 100

The students will develop utilities such as analytical spectra, simulation programs that will supplement laboratory exercises in their subject of specialisation. Literature survey, Studies of reactions, synthesis, mechanism, isolation of natural products, standardization of reaction conditions, new methods etc. External and internal examiners will examine this jointly at the time of practical examination. (Students should present his/her work in power point presentation. Open Viva is compulsory. Soft Copy of presentation in CD should be submitted with dissertation.)

Study Tour:

Educational/Industrial tour is compulsory for M.Sc. Chemistry.

- (i) Semester I/II: Visit to local Industry/Institute.
- (ii) Semester III/IV: Education tour to visit the industry/Research laboratory (Long Tour).
Students should submit their tour report at the end of Semester II and Semester IV respectively with proof of visiting (Photo etc.).

List of equipments/apparatus required for the M.Sc. Chemistry Semester-I to IV Practicals.

| | |
|-----------------------------------|---------------|
| 1. Rotaevaporater | 01 no./batch |
| 2. Crycooler | 01 no./batch |
| 3. Sonicator bath | 01 no./batch |
| 4. Stirrer With Hot Plate | 04 nos./batch |
| 5. Eye Washer | 01 no./batch |
| 6. Chemdraw Software (version12) | 01 no./batch |
| 2. Conductivity meter | 03 nos./batch |
| 2. pH meter | 03 nos./batch |
| 3. Potentiometer | 03 nos./batch |
| 4. Polariometer | 02 nos./batch |
| 5. Centrifuge machine | 02 nos./batch |
| 6. Vaccum Pump | 01 no./batch |
| 7. Hot air oven | 01 no./batch |
| 8. Blower hot & cold | 03 nos./batch |
| 9. Stop watch | 10 nos./batch |
| 10. Weight box con.100 gm. | 10 nos./batch |
| 11. Analytical double pan balance | 10 nos./batch |
| 12. One pan electronic balance | 02 nos./batch |
| 13. Tripple beam balance | 02 nos./batch |
| 14. Melting point apparatus | 02 nos./batch |
| 15. Spectrophotometer | 02 nos./batch |
| 16. Water still | 01 no./lab |

| | |
|--|---------------|
| 17. Colorimeter | 02 nos./batch |
| 18. Thermostate | 01 no./batch |
| 19. Electrodes platinum | 03 nos./batch |
| Silver, □n, Cu | 03 nos./batch |
| Glass | 03 nos./batch |
| Reference | 03 nos./batch |
| 20. Heating mentle | 02 nos./batch |
| 21. Glass double distillation unit | 01 no./lab |
| 22. Flame Photometer | 01 no./batch |
| 23. High Resistivity meter | 01 no./lab |
| 24. Polarpraph with recorder | 01 no./lab |
| 25. U.V.visible spectrophotometer(Double beam) | 01 no./lab |
| 26. Infrared Spectrophotometer | 01/class |
| 26. Standard cell | 02 nos./batch |
| 27. Muffle furnace | 01 no./lab |
| 28. D.C.Voltmeter | 01 no./lab |
| 29. Infrared lamp | 05 nos./lab |
| 30. Refrigerator | 01 no./lab |
| 31. Magnetic stirrer 2 ml, 5 ml. | 02 nos./batch |
| 32. Dimmer state | 01 no./lab |
| 33. Abbe□ refractometer | 01 no./batch |
| 34. Sodium lamp for polarimeter | 02 nos./batch |
| 35. T.L.C. Kit | 01 no./lab |
| 36. Calorimeter | 01 no./lab |
| 37. Bomb Calorimeter | 02 nos./batch |
| 38. B□D analyser | 01 no./lab |
| 39. Water analysis kit | 01 no./lab |
| 40. Computer-386/486 | 01 no./lab |
| 41. U.V.Lamp | 02 no./lab |
| 42. Ice making machine | 01 no./lab |
| 43. LCR bridge(Four Probe Method) | 01 no./lab |
| 44. Gas Chromatograph | 01 no/course |
| 44. HPLC | 01 no/course |
| 45. Deioniser | 01 no./lab |
| 46. Ion exchange column□ | 04 no./lab |
| 47. Turbidity meter | 01 no./lab |
| 48. □optical densitometer | 01 no./lab |
| 49. □rsat apparatus (gas analysis) | 01 no./lab |
| 50. Interferometer (ultrasound) | 01 no./batch |
| 51. Magnetic Susceptibility balance | 01 no./lab |
| 52. Hydraulic press | 01 no./lab |
| 53. TGA, D.T.A. Apparatus | 01 no./course |
| 53. Shaking machine | 01 no./lab |
| 54. G.M.Counter | 01 no./lab |
| 55. Electrophorasis apparatus | 01 no./lab |
| 56. Karl-Fisher Titration apparatus | 01 no./lab |
| 57. Power supply (regulator) | 01 no./batch |
| 58. Regulated furnace | 01 no./lab |
| 59. Thermocouple | 01 no./lab |
| 60. Vaccum oven | 01 no./lab |
| 61. Top pan balance | 01 no./lab |
| 62. UV Chamber | 01 nos/batch |
| 63. Fume Hude | 01 no/class |
| 64. Gaussian software(version 9) | 01 no/class |

List of glasswares (main) for M.Sc. Chemistry Semester-I to IV Practicals

| | |
|--------------------------|---------------|
| 1. Glass Column | 10 nos./batch |
| 2. Dean-Stark Apparatus | 02 nos./batch |
| 3. Addition funnel | 10 nos./batch |
| 4. Round bottomed flask | 10 nos./batch |
| 5. Sintered funnels | 03 no./batch |
| 6. Pressure bottle | 02 nos./batch |
| 7. Cannula | 01 no./batch |
| 8. Rubber septum | 10 nos./batch |
| 9. □-adaptor | 03 nos./batch |
| 10. Vacuum adaptor | 03 nos./batch |
| 11. Thermometer adaptor | 02 nos./batch |
| 12. Claisen adaptor | 02 nos./batch |
| 19. Flow control adaptor | 03 nos./batch |
| 13. Side-arm flask | 02 nos./batch |
| 14. Buchner funnel | 02 nos./batch |
| 15. Crystallizing dish | 04 nos./batch |

| | | |
|-----|---|---------------|
| 16. | Versatile clamp | 02 nos./batch |
| 17. | 3-Prolonged clamp | 02 nos./batch |
| 18. | Ring clamp | 05 nos./batch |
| 19. | Soxhlet set | 02nos/batch |
| 20. | Kjeldahl's apparatus set (for Nitrogen element estimation) | 02 nos./batch |
| 21. | Distillation unit | 04 nos./batch |
| 22. | Separating funnel | 10 no./batch |
| 23. | Steam distillation unit | 02 nos./batch |
| 24. | Vaccum desicator | 01 no./batch |
| 25. | Paper chromatography chamber | 03 nos./batch |
| 26. | TLC chamber | 05 nos./batch |
| 27. | Silica crucibles | 20 nos./batch |
| 28. | Sintered glass crucibles g4/g5 | 20 nos./batch |
| 29. | Spot test plates | 10 nos./batch |
| 30. | Wash bottles | 10 nos./batch |
| 31. | Density bottles | 10 nos./batch |
| 32. | Viscometer | 10 nos./batch |
| 33. | Kipp's apparatus | 01 nos./batch |
| 34. | Beakers, capacity :50 ml, 100 ml, 250 ml, 400 ml, 500 ml, 1000ml | 10 nos/batch |
| 35. | Conical flask : 100 ml, 250 ml | 10nos /batch |
| 36. | Burettes with stop cock, capacity : 2ml, 5 ml, 10ml, 25 ml. | 10nos/batch |
| 37. | Lambda pipette | 02 nos./batch |
| 38. | Voumetric flasks, capacity : 10 ml, 25 ml, 50 ml, 100 ml, 250 ml, 500 ml, 1000ml. | 10nos /batch |
| 39. | Measuring cylinder, capacity : 10 ml, 25 ml 50 ml, 100 ml, 500 ml, 1000 ml | 10nos/batch |
| 40. | Pipette, capacity : 1 ml, 2 ml, 5 ml, 10 ml, 25 ml. | 10nos/batch |
| 41. | Stalagmeter | 10 nos./batch |
| 42. | Thermometer (b-24) 0 to 360 ⁰ C (quick fit) | 05 nos./batch |
| 43. | Water suction pump (glass) | 05 nos./batch |
| 44. | Filtration flasks with buckner funnels 50 ml ,100ml,250ml,500ml | 10 nos./batch |
| 45. | China dishes | 10 nos./batch |
| 46. | Dessicators | 10 nos./batch |
| 47. | Platinum/Nickel Crusible | 02 nos./batch |
| 47. | Thiel's tube for melting point | 10pkt./batch |
| 48. | Quick fit water condensers b-19, b-24 | 10 nos./batch |
| 49. | Quick fit flasks, Capacity 50 ml, 100 ml, 250 ml, 500 ml, 1000 ml. | 10 nos./batch |
| 50. | Microanalysis Kit | 10 nos/batch |

M.Sc. Sem. I to Sem. IV
(Microbiology)

Prospectus No. 2017128

संत गाडगे बाबा अमरावती विद्यापीठ

SANT GADGE BABA AMRAVATI UNIVERSITY

विज्ञान विद्याशाखा
(FACULTY OF SCIENCE)

अभ्यासक्रमिका
विज्ञान पारंगत परिक्षा (सुक्ष्मजीवशास्त्र)
सत्र-१ ते सत्र-४

PROSPECTUS
OF
MASTER OF SCIENCE EXAMINATION
IN MICROBIOLOGY
Semester - I & Semester III Winter 2016
Semester - II & Semester IV Summer 2017



2016

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SANT GADGE BABA AMRAVATI UNIVERSITY
SPECIAL NOTE FOR INFORMATION OF THE STUDENTS

- (1) Notwithstanding anything to the contrary, it is notified for general information and guidance of all concerned that a person, who has passed the qualifying examination and is eligible for admission only to the corresponding next higher examination as an ex-student or an external candidate, shall be examined in accordance with the syllabus of such next higher examination in force at the time of such examination in such subjects papers or combination of papers in which students from University Departments or Colleges are to be examined by the University.
- (2) Be it known to all the students desirous to take examination/s for which this prospectus has been prescribed should, if found necessary for any other information regarding examinations etc., refer the University Ordinance Booklet the various conditions/provisions pertaining to examination as prescribed in the following Ordinances.

- Ordinance No. 1 : Enrolment of Students.
- Ordinance No. 2 : Admission of Students
- Ordinance No. 4 : National cadet corps
- Ordinance No. 6 : Examinations in General (relevent extracts)
- Ordinance No. 18/2001 : An Ordinance to provide grace marks for passing in a Head of passing and Improvement of Division (Higher Class) and getting Distinction in the subject and condonation of defficiency of marks in a subject in all the faculties prescribed by the Statute NO.18, Ordinance 2001.
- Ordinance No. 9 : Conduct of Examinations (relevent extracts)
- Ordinance No. 10 : Providing for Exemptions and Compartments
- Ordinance No. 19 : Admission of Candidates to Degrees.
- Ordinance No. 109 : Recording of a change of name of a University student in the records of the University.

Ordinance No.19/2001 : An Ordinance for Central Assessment Programme, Scheme of Evaluation and Moderation of answerbooks and preparation of results of the examinations, conducted by the University, Ordinance 2001.

Dr. Ajay P. Deshmukh
 Registrar
 Sant Gadge Baba Amravati University.

PATTERN OF QUESTION PAPER ON THE UNIT SYSTEM.

The pattern of question paper as per unit system will be broadly based on the following pattern

- (1) Syllabus has been divided into units equal to the number of question to be answered in the paper. On each unit there will be a question either a long answer type or a short answer type.
- (2) Number of question will be in accordance with the unit prescribed in the syllabi for each paper i.e. there will be one question on each unit.
- (3) For every question long answer type or short answer type there will be an alternative choice from the same unit. However, there will be no internal choice in a question.
- (4) Division of marks between long answer and short answer type question will be in the ratio of 40 and 60
- (5) Each short answer type question shall contain 4 to 8 short sub question with no internal choice.

%ORDINANCE NO. 4 of 2008

Examinations leading to the Degree of विज्ञान पारंगत (Master of Science)(Four Semesters Degree Course), Ordinance, 2008.

Whereas it is expedient to provide an Ordinance regarding Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semesters Degree Course), in the faculty of Science. The Management Council is hereby pleased to make the following Ordinance.

1. This Ordinance may be Called, "Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semesters Degree Course), Ordinance, 2008".
2. This Ordinance shall come into force w.e.f. the date of its approval by the Management Council.
3. The duration of the course shall be two academic years,
 - (a) M.Sc. Course is divided into Semester-I, Semester-II, Semester-III & Semester-IV.
 - (b) University shall hold examinations in Winter and in Summer every year for all semesters.
 - (c) The main examination of odd semesters shall be held in Winter and the main examination of even semesters shall be held in Summer every year. The supplementary examination for odd semesters shall be held in Summer and the supplementary examination for even semesters shall be held in Winter every year.
4. The period of Academic Session/Term shall be such as may be notified by the University and the Examination shall be held at such places and on such dates as may be fixed by the Board of Examinations.
5. Subject to their compliance with the provisions of this Ordinance and of other Ordinances in force from time to time, the following persons shall be eligible for admission to the examinations, namely:-
 - (A)For विज्ञान पारंगत भाग-१ प्रथम सत्र M.Sc.Part-I:-
 - (a) A collegiate candidate admitted to the Degree of Bachelor of Science who has prosecuted a regular course of study in a college or a University Department.
 - (b) a teacher admitted to the Degree of Bachelor of Science and eligible under Ordinance No. 18;
 - (c) a woman candidate admitted to the Degree of Bachelor of Science, who has not pursued a course of study in the University or a College;

% As approved by Management Council on dated 30.5.2008, Vide Item No. 196, and latest amended vide Ordinance No. 14 of 2009 (M.C. dated 25.5.09)

Provided that, applicants eligible under clauses (b) and (c) above shall, if laboratory work is prescribed in the subject which they offer for examination, attend the full course of laboratory instruction in the University Department or a College or a recognised Institution imparting instruction upto the standard of the examination;

Provided further, that in the case of applicants under clauses(b) and (c) above, not less than one academic year shall have elapsed since the date of their passing the examination for the Degree of विज्ञान स्नातक (Bachelor of Science);

- (d) Candidate who has passed B.Sc.Examination of Sant Gadge Baba Amravati University with Chemistry as one of the optional subjects and has also passed the Diploma of Associateship of Institution of Chemists (India) Calcutta and is working as Jr/Sr.Laboratory Asstt. in National Environmental Engineering Research Institute, Nagpur (NEERI) or Council of Scientific and Industrial Research (CSIR), Nagpur or Indian Bureau of Mines (IBM) will be eligible to appear at M.Sc.Semester-I in Chemistry only, without prosecuting a regular course of study in a College/ Department in the University.

Provided he produces certificate of completion of practical course prescribed for M.Sc. Part-I (Semester-I & Semester-II) Examination in Chemistry from his employer.

- (e) any other graduate in Science not eligible under clause (a) (b) or (c) above, shall be eligible for admission to the examination in Mathematics only, after a lapse of not less than one academic year since the date of his passing the examination for the Degree of विज्ञान स्नातक (Bachelor of Science):
- (f) an applicant holding the भेषजी स्नातक (B.Pharm) or the विज्ञान स्नातक कृषी (B.Sc.Agri.) Degree shall be eligible for admission to the विज्ञान पारंगत (M.Sc.) Course in Biochemistry only; (Note: The विज्ञान स्नातक (B.Sc.) Degree referred to in clause (a) above, shall include the विज्ञान स्नातक (B.Sc.) Degree of the University or an equivalent Degree of any other Statutory University)

- (g) an applicant holding the B.Sc. (Ind.Chem.) Degree of the Banaras Hindu University;
- (h) an applicant holding B.A./B.Sc. with Mathematics/ Statistics or Bachelor of Computer Science Degree for admission to M.Sc. Course in Statistics or Mathematics ;
- (i) i) for admission to M.Sc. Microbiology a candidate shall have offered Microbiology or Industrial Microbiology or Biochemistry as a subject of study and examination at the B.Sc. degree.
- ii) for admission to M.Sc. Biochemistry a candidate shall have offered Microbiology or Industrial Microbiology or Biochemistry as a subject of study and examination at the B.Sc. degree.
- For admission to M.Sc.Biochemistry, in case of vacancies, a students offering Chemistry alongwith Biological Science shall be admitted.
- (j) i) for admission to M.Sc. Electronics (Instrumentation) a candidate shall have offered Physics or Electronics (Instrumentation) or Electronics or Electronics Science or Computer Maintenance as subjects of study and examination at the B.Sc. level and B.C.S. degree of this University or any other equivalent Degree of Statutory University.
- ii) a person passing B.E. (Electronics & Telecommunication or Industrial Electronics) Examination of Sant Gadge Baba Amravati University is eligible to take admission directly at second year of M.Sc. Electronics (Instrumentation). Such a student who is admitted to second year of M.Sc. Electronics (Instrumentation) shall be awarded M.Sc. degree on the basis of his performance at M.Sc. Part-II only.
- (k) for admission to (M.Sc.) Geography a candidate shall have offered Geography as a subject to study and examination at the B.Sc. Degree.

- (l) for admission to (M.Sc.) Petrochemical Science, a candidate shall have offered Petrochemical Science subject to study and examination at the B.Sc. Degree.
- (m) i) for admission to M.Sc. Part-I (Environmental Science) a candidate shall have offered one of the optional subject as Environmental Science or Botany or Zoology or Life Sciences or Microbiology or Biochemistry or Biotechnology at B.Sc. degree,
- ii) Sixty percent seats of the total intake shall be reserved for students who have passed B.Sc. with Environmental Science. If students having Environmental Science as an optional subject are not available then students having other optional subjects be considered.
- (n) for admission to M.Sc. Geoinformatics or Remote Sensing and GIS, a candidate shall have passed B.Sc. in any discipline of Life Sciences. Preference shall be given to graduates having offered Geology at undergraduate level.
- (o) for admission to M.Sc. Bioinformatics a candidate shall have passed B.Sc. in any discipline of Life Sciences, Bio Sciences or Bachelor Degree in Agriculture, Veterinary and Fishery Sciences, Pharmacy, or Medical Sciences - Bachelor of Medicine and Bachelor of Surgery, Bachelor of Dental Surgery, B.A.M.S., B.H.M.S. or any equivalent examination recognised by Sant Gadge Baba Amravati University.
- (B) For विज्ञान पारंगत भाग-२ (M.Sc. Part-II) Examination:-
- (a) a student who has been admitted to the Degree of विज्ञान स्नातक (Bachelor of Science) and who has since passing the M.Sc.Part-I (Semester-I & II) Examinations, prosecuted a regular course of study for not less than one academic year in the University or in the College in the subject in which he offers himself for the M.Sc.Part-II Examinations;
- (b) a teacher admitted to the Degree of विज्ञान स्नातक (Bachelor of Science) and eligible under Ordinance

No. 18 and who has not less than one academic year previously, passed the M.Sc.Part-I Examination in the subject in which he offers himself for M.Sc.Part-II Examinations;

- (c) a woman candidate admitted for the Degree of विज्ञान स्नातक (Bachelor of Science) and who has not less than one academic year previously, passed the M.Sc. Part-I Examination in that subject in which she offers herself for the M.Sc. Part-II Examinations;
- (d) a candidate who has been admitted under Para 3 (A) (d) above and who has not less than one academic year previously, passed M.Sc. Part-I Examination in the subject Chemistry in which he offers himself for the M.Sc.Part-II Examination.
- Provided he produces a certificate of completing of practical course prescribed for M.Sc. Part-II Examination in Chemistry from his employer;
- (e) any other Graduate in Science not eligible under clause (a) (b) or (c) who has not less than one academic year previously, passed the M.Sc. Part-I (Semester-I & Semester-II) Examinations in the subject which he offers himself for the Part-II Examination;
6. Subject to his / her compliance with the provisions of this Ordinance and other Ordinances (Pertaining to Examination in General) in force from time to time, the applicant for admission, at the end of the course of study of a particular term shall be eligible to appear at it, if,
- He / She satisfied the conditions in the table and the provisions thereunder.
 - He / She has prosecuted a regular course of study in the university / college affiliated to the university.
 - He / She has in the opinion of the Head of the Department / Principal shown satisfactory progress in his / her study.

| Name of Exam. | The student should have passed the Examination of satisfactory | The student should have completed the session/semester |
|-----------------------------|--|--|
| M.Sc.Part-I(Semester-I) | The qualifying examination mentioned in para 5 | M.Sc.Part-I (Semester-I) |
| M.Sc.Part-I (Semester-II) | | M.Sc.Part-I (Semester-I & II) |
| M.Sc.Part-II (Semester-III) | Semester-I | M.Sc.Part-II (Semester-III) |
| M.Sc.Part-II (Semester-IV) | Semester-I | M.Sc.Part-II (Semester-III & IV) |

7. Without prejudice to the provisions of Ordinance No.6 relating to the Examinations in General, the provisions of Paragraphs 8,10, and 31 of the said Ordinance shall apply to every collegiate candidate.
8. The fee for each Semester Examination shall be as prescribed by the University time to time.
- Provided that a non-collegiate candidate, other than an ex-student shall also pay a registration fee as prescribed by the University time to time.
9. Every candidate for admission to the examination shall offer one of the following subjects for his examination, namely-
- Mathematics,
 - Physics,
 - Chemistry,
 - Botany,
 - Zoology,
 - Geology,
 - Statistics,
 - Biochemistry,
 - Microbiology,
 - Electronics (Instrumentation),
 - Geography,
 - Geoinformatics,
 - Remote Sensing & GIS,
 - Environmental Science, and
 - Bioinformatics.

Provided firstly, that an examinee who has passed Part-II Examination in one of the subjects listed above from 1 to 15 and is desirous of appearing.

- (a) in any other subject, or
- (b) in a new paper or a combination of papers in the subject in which he has passed, may, without prosecuting a regular course of study present himself in any subsequent academic year for Part-I of the Examination in that other subject or that new paper or new combination of papers, and after not less than one academic year after passing the said Part-I Examination, for Part-II Examination in the said new paper or the said new combination of papers.

Provided secondly, that a candidate eligible for appearing at an examination under the first proviso shall, in the subject or a new paper or the new combination of papers which he is offering for the examination, attend the full course of practical Training, wherever such training is prescribed in the University Department or a College or a recognised Institution imparting instruction upon the standard of the Examination.

Provided thirdly, that an examination successful under clause (b) of the first proviso shall not be awarded division nor shall he be eligible for any scholarship, medal or prize of the University.

10. An examinee at the M.Sc. Part-I or the M.Sc. Part-II Examination shall have the option of not being declared successful at the examination in case he does not secure a minimum of Second Division marks /Higher Second Division marks fifty five percent marks (55%) at the Examination. The option will have to be exercised everytime an application is submitted to any of the three examinations and shall be on the proforma printed on the application form itself. Once exercised the option shall be binding upon the examinee, and shall not be revoked under any circumstances.
11. Any person who has obtained a Third Division at the M.Sc. Examination of this University shall be eligible to take the examination again under this Ordinance in the same subject or group of subjects as the case may be for improving his division. In such a case the provisions of Ordinance No.138 relating to Improvement of Division shall apply.
12. (1) The scope of the subject shall be as indicated in the syllabus.
(2) The medium of instruction and examination shall be English.
13. The number of papers and marks allotted to each subject and the minimum marks which an examinee must obtain in order to pass the examination shall be as indicated in Appendix--Aø

14. Examinees who are successful in the M.Sc. Semester-I, II, III & IV Examination and have obtained not less than 60% marks in the aggregate of the M.Sc. Semester-I, II, III & IV Examinations taken together shall be placed in the First Division, those obtained less than 60% but not less than 55% marks, in the Higher Second Division, those obtained less than 55% but not less than 48% marks, in the Second Division, and all other successful examinees, in the Third Division.
15. Provision of Ordinance No. 18 of 2001 relating to the an Ordinance to provide grace marks for passing in a Head of passing and improvement of division (higher class) and getting distinction in the subject and Condonation of Deficiency of Marks in a subject in all the faculty prescribed by the Statute No.18, Ordinance, 2001, shall apply to the examinations under this ordinance.
16. As soon as possible after the examination, but not later than 30th, June next following, the Management Council shall publish a list of successful examinees arranged in Three Divisions. The names of examinees passing the examination as a whole in the minimum prescribed period and obtaining the prescribed number of places in each subject in the First or Second Division, shall be arranged in Order of Merit as provided in the Examinations in General Ordinance No.6.
17. Save as provided in Paragraph 11 of this ordinance, no person shall be admitted to an examination under this ordinance, if he has already passed the same examination of this University or an equivalent examination in M.Sc. Part-I (Semester-I & II), and M.Sc. Part-II (Semester-III & IV) of any other Statutory University.
18. Examinees successful at the M.Sc. Part-I (Semester-I & II), and M.Sc. Part-II (Semester-III & IV) shall on payment of the prescribed fees, be entitled for the award of the respective Degree in the prescribed form, signed by the Vice-Chancellor.

(Note : - " P.G. Workload in the faculty shall be as per Ordinance No. 131.")

APPENDIX-A
SCHEME OF EXAMINATION FOR M.Sc. PART-I & II.
(FOR ALL SUBJECTS)

| | | | | | | |
|-------------------------------|------------|---|----------|---------------------|---|----------|
| i) M.Sc. Part-I Semester-I | Paper-I | - | 50 Marks | Practical-I | - | 40 Marks |
| | Paper-II | - | 50 Marks | Internal Assessment | - | 10 Marks |
| | Paper-III | - | 50 Marks | Practical-II | - | 40 Marks |
| | Paper-IV | - | 50 Marks | Internal Assessment | - | 10 Marks |
| M.Sc. Part-I Semester-II | Paper-V | - | 50 Marks | Practical-III | - | 40 Marks |
| | Paper-VI | - | 50 Marks | Internal Assessment | - | 10 Marks |
| | Paper-VII | - | 50 Marks | Practical-IV | - | 40 Marks |
| | Paper-VIII | - | 50 Marks | Internal Assessment | - | 10 Marks |
| M.Sc. Part-II Semester-III | Paper-IX | - | 50 Marks | Practical-V | - | 40 Marks |
| | Paper-X | - | 50 Marks | Internal Assessment | - | 10 Marks |
| | Paper-XI | - | 50 Marks | Practical-VI | - | 40 Marks |
| | Paper-XII | - | 50 Marks | Internal Assessment | - | 10 Marks |
| M.Sc. Part-II Semester-IV | Paper-XIII | - | 50 Marks | Practical-VII | - | 40 Marks |
| | Paper-XIV | - | 50 Marks | Internal Assessment | - | 10 Marks |
| | Paper-XV | - | 50 Marks | Project Work | - | 40 Marks |
| | Paper-XVI | - | 50 Marks | Internal Assessment | - | 10 Marks |

ii) For the subject Mathematics, there shall be five theory papers of sixty marks for each semester.

- Notes:-**(1) Minimum pass marks for theory and practical examination including internal assessment shall be 36% separately.
- (2) (a) Topic of project work shall be given by concerned supervisor with prior approval of Head of Department.
There shall be no duplication of the topic of the project work. Project shall be based on research in the laboratory and / or field work. Project work shall be allotted at the beginning of third semester and the student shall have to submit it atleast 15 days before commencement of practical examination of the fourth semester. Project work will be evaluated by external and internal examiners.
- (b) There should be atleast 2 to 3 external examiner for a batch of 10 students or 3 to 5 external examiner for a batch more than 10 students.
- (3) There shall be separate exemption in theory and / or practical on getting minimum pass marks.
- (4) Internal Assessment marks for all semesters shall be granted on the basis of - performance of students in any of the following activities:-
(i) Study tour, (ii) Seminar, (iii) field visits, (iv) Industrial visits, (v) visit to research institute / organisation.
(vi) Assignments, (vii) Unit test and any other co-curricular activities.
- (5) The concerned Department or College shall have to maintain the record of award of internal assessment marks.

DIRECTION

No. : 14 / 2009

Date : 29.6.2009

Subject : Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semester Degree Course), Direction, 2009.

Whereas, Ordinance No.4 of 2008 in respect of Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semester Degree Course) Ordinance, 2008 is in existence in the University.

AND

Whereas, the Board of Studies in Computer Science (including Computer Application and Computer Science (Computer Software)) in the faculty of Science in its meeting held on 5.6.2009 has resolved to accept revised syllabi of M.Sc. Semester-I to IV Computer Software, eligibility criteria and other details.

AND

Whereas, the Board of Studies further recommended that the scheme of examination will be applicable as per Ordinance No.4 of 2008 to M.Sc. Computer Software, as it is, and the revised syllabi shall be implemented from the academic session 2009-10 expeditiously in the light of advancement of knowledge in the subject.

AND

Whereas the Honorable Vice-Chancellor has accepted the revised syllabi of M.Sc. Computer Software, Eligibility criteria, Scheme of examinations and other details under section 14(7) of the Maharashtra Universities Act, 1994 on behalf of the faculty of Science and Academic Council.

AND

Whereas, Original Ordinance No.4 of 2008 is required to be amended for inclusion of the above said course.

AND

Whereas, the matter for the admission to student at the examination of above said course is required to be regulated by an Ordinance, and making amendments in Ordinance is time consuming process.

AND

Now, therefore, I, Dr. Kamal Singh, Vice Chancellor of Sant Gadge Baba Amravati University, in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Universities Act., 1994, do hereby direct as under:

1. This Direction may be called "Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semester Degree Course), Direction, 2009".
2. This direction shall come into force from the date of its issuance.
3. Eligibility criteria for admission to M.Sc. Computer Software shall be as given below.
"A person who has passed the Degree of Bachelor of Science with Computer Science/Vocational Computer Application Subjects
OR
A person who has passed the Degree of Bachelor of Science with Post Graduate Diploma in Computer Science of this University
OR
An Examination Recognised as an equivalent of this University or of any other statutory University."
4. The Scheme of Examination for M.Sc. Computer Software shall be as per Ordinance No.4 of 2008 as other Science subjects, as it is.

Amravati
Date : 29/6/2009

Sd/
(Dr.Kamal Singh)
Vice-Chancellor

DIRECTION

No. : 26 / 2010

Date : 24/06/2010

Subject : Scheme for Choice Based Credit System (CBCS) and Awarding Grades to the Post Graduate Students in the Faculty of Science, Direction, 2010.

Whereas, University Grants Commission, New Delhi vide D.O.No.F-2/2008/(XI Plan), Dtd.31 Jan.2008 regarding new initiatives under the 11th Plan of Academic Reforms in the University has suggested for improving quality of higher education and to initiate the Academic Reform at the earliest.

AND

Whereas, the Academic Council while considering the above letter in its meeting held on 30.4.2008, vide item No.55 has resolved to refer the same to Dean's Committee, and the Dean's Committee in its meeting held on 19.07.2008 has decided to refer the matter to all Board of Studies.

AND

Whereas, the recommendations of various Board of Studies in the faculty of Science regarding Upgradation and Revision of various syllabi and introduction of choice based credit pattern Examination System at post graduate level was considered by the faculty of Science in its meeting held on 7.12.2009 and constituted a Committee of all Chairmen of Board of Studies and one member nominated by Chairmen of respective B.O.S. under the Chairmanship of Dean of faculty to decide the policy decision regarding choice based credit system examination pattern at P.G. level.

AND

Whereas, the faculty of Science in its emergent meeting held on 11th May, 2010 vide item No.27, has considered, accepted and recommended to Academic Council, the policy decision regarding introduction of Scheme for Choice Based Credit System (CBCS) and Awarding Grades to the Post Graduate Students in the Faculty of Science under ordinance No.4 of 2008. The recommendations of the faculty was approved by the Academic Council in its emergent meeting held on 28.5.2010, vide item No.36.

AND

Whereas, Ordinance No.4 of 2008 in respect of Examinations leading to the Degree of विज्ञान स्नातक (Bachelor of Science) is in existence in the University as per semester pattern examination system.

AND

Whereas, it is necessary to frame the Regulation regarding the Scheme for Choice Based Credit System (CBCS) and Awarding Grades to the Post Graduate Students in the Faculty of Science which is to be implemented from the Academic Session 2010-11 of M.Sc.Semester-I & onwards to all subjects in the faculty of Science and framing of Regulation for the above examination is likely to take some time.

AND

Whereas, the admission of students in the above pattern at M.Sc. Part-I (Semester-I) of all subjects in the faculty of Science are to be made in the Academic Session 2010-11.

Now, therefore, I, Dr. Kamal Singh, Vice Chancellor of Sant Gadge Baba Amravati University, in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Universities Act., 1994, do hereby direct as under:

1. This Direction may be called "Scheme for Choice Based Credit System (CBCS) and Awarding Grades to the Post Graduate Students in the Faculty of Science, Direction, 2010.
2. This Direction shall come into force with effect from the examination as shown below for all subjects for the Examinations leading to the Degree of Master of Science in the faculty of Science-
 - (i) Winter 2010 examination for M.Sc. Part-I, Semester-I,
 - (ii) Summer-2011 examination for M.Sc. Part-I, Semester-II,
 - (iii) Winter-2011 examination for M.Sc. Part-II, Semester-III,
 - (iv) Summer-2012 examination for M.Sc. Part-II, Semester-IV.
3. The detailed Scheme for Choice Based Credit System (CBCS) and Awarding Grades to the Post Graduate students in the Faculty of Science is as given below-

I. The CBCS System

All Programmes (named after the Core subject) mentioned in para 9 of Ordinance No.4 of 2008 shall be run on Choice Based Credit System (CBCS) and the grades in 7 point scale will be awarded to the students. It is an instructional package developed to suit the needs of students to keep pace with the developments in higher education and the quality assurance expected of it in the light of liberalization and globalization in higher education.

II. Credits and Degrees

- i) A candidate who has successfully completed all the core courses Compulsory, Elective/ Specialised courses and project prescribed and optional approved by the University for the programme

and accumulated not less than 72 (52 core and elective) Credits and who has put in the minimum residence time shall be eligible to receive the degree.

- ii) One Credit shall mean one teaching period per week for one semester (of 16 weeks) for theory courses and one laboratory session of two periods / week for one semester. One teaching period shall be of 60 minutes duration including 10 minutes for discussion / movement.

III. Courses

- (i) **Core Course :-** A core course is a course that a student admitted to a particular programme must successfully complete to receive the degree. There may be two kinds of core courses: The **hard-core** courses which cannot be substituted by any other course and which must be successfully completed and **soft-core** courses which may be substituted by equivalent courses from the same department. In all P.G. programmes a project with 03 credits shall be included. The project may include a viva-voce examination with a credit of 1, Normally no theory course shall have more than 4 credits.
- (ii) **Elective Course :** Means an optional course from the basic subject or specialization.

The core credits for any P.G. programme (inclusive of hard-core, soft-core and project) shall not exceed 60 credits and shall not be less than 48 credits. Each Board of Studies shall specify the core-credit load for their respective programme apart from approving syllabi, for all the courses offered by the department.

(iii) General Interest Course (GIC)

The General Interest Course shall be the choice of student. The student who chooses the GIC shall have to register for it on payment of fees as prescribed by the University.

The Departmental Committee shall follow a selection procedure on a first come first served basis, fixing the maximum number of students, after counselling to the students etc. to avoid overcrowding to particular course(s) at the expense of some other courses.

- (iv) Each **Course** is designed such that it includes lectures / tutorials / laboratory or field work / Seminar / Practical training / Assignments / Term paper / Report writing or review of literature and any other innovative practice etc., to meet effective teaching and learning needs.

- (v) **Attendance :-** Students must have 75% of attendance in each Core and Elective course for appearing the examination. However student having attendance less than 75% may apply to the H.O.D. for condonation of attendance upto 15% under the provision of para 6-A (i) of Ordinance No.6.

IV. Registration for General Interest Course :-

- i) Each student, on admission shall be assigned to a faculty advisor who shall advise the student about the academic programme and counsel him on the choice of courses listed in Appendix-Q depending on his general interest, academic background and objective.
- ii) With the advice and consent of the faculty advisor the student shall register for courses he plans to take for the semester before classes start. No student shall be permitted to register for courses exceeding 30 credits per semester including those of repeat courses nor shall any student be permitted to register for any course without satisfactorily completing the prerequisites for the course except with the permission of the concerned teacher in the prescribed format.
- iii) If the student feels he has registered for more courses than he can handle, he shall have the option of dropping one or more of the courses he has registered for, with the consent of his advisor before the end of 3rd week of the semester. However, a student, to retain his status, should have registered at least for core course and elective course of that semester.
- iv) Students, other than those freshly admitted, shall register for the courses of their choice in the preceding semester by filling in the prescribed forms.
- v) The University shall prescribe the maximum number of students in each General Interest Course taking into account the teachers and Physical facilities available in the Department.
- vi) The University may make available to all students a listing of all the courses offered in every semester specifying the credits, the prerequisites, a brief description or list of topics the course intends to cover, the instructor who is giving the courses, the time and place of the classes for the course. This information shall be made available on the University website.
- vii) Normally no course shall be offered unless a minimum of 10 students are registered.

- viii) The student shall have to pay the prescribed fee per course for the registration.

V. Programme Committee :-

There shall be the programme committee at the University level constituted as under-

- i) Dean of the faculty (Chairman)
- ii) Heads of all the Departments ó (Member)
- iii) Three teachers from the affiliated colleges having post graduate courses other than University Department ó nominated by the Vice-Chancellor. (Member)
- iv) Deputy Registrar (Acad) ó (Secretary)

Duties and responsibilities of the Programme Committee shall be as under-

- i) To identify the General Interest Courses (GIC) as per the need of the student and availability of teachers in the Departments.
- ii) To approve the time table of GIC and make it available to the students before the commencement of respective semester. This time table also be made available on the University website.
- iii) To consider and approve the report of grivence redresal committee.
- iv) To remove the difficulties if any faced during implementation of the CBCS and report it to Honøble Vice-Chancellor for further action.
- v) Any other matter as it think fit for the effective implementation of CBCS.

VI. Departmental Committee

1. Every P.G. programme of the University/College shall be monitored by a committee constituted for this purpose by the Department.
The Committee shall consist of H.O.D. as a Chairman and all the teachers of the Deptt. of its members including one student members per class. There shall be atleast one student member on the committee.

VII. Grievances Redressal Committee

The University or College shall form a Grievance Redressal Committee for each course in each department with the Course Teacher and the HOD. This Committee shall solve all grievances relating to the Internal Assessment marks of the students.

VIII. Total credits per semester :-

Table-I
For all subjects other than Mathematics,
Biotechnology & Computer Science

| Course | Credits | | | | Total |
|-------------|---------|----------|----------|----------|-------|
| | Sem-I | Sem-II | Sem-III | Sem-IV | |
| Core | 12 | 12 | 12 | 12 | 48 |
| Elective | 04 | 04 | 04 | 04 | 16 |
| GIC | 00 | 04 | 04 | 04 | 12 |
| Lab. Course | 06 | 06 | 06 | 03 | 21 |
| I.A. | 04 | 04 | 04 | 04 | 16 |
| Project | 00 | 00 | 00 | 03 | 03 |
| Total | 26 | 26 or 30 | 26 or 30 | 26 or 30 | 116 |

Table-II
For Mathematics

| Course | Credits | | | | Total |
|---------------------|---------|----------|----------|----------|-------|
| | Sem-I | Sem-II | Sem-III | Sem-IV | |
| Core courses | 12 | 12 | 12 | 12 | 48 |
| Elective Courses | 08 | 08 | 08 | 08 | 32 |
| GIC | 06 | 04 | 04 | 04 | 12 |
| Internal Assessment | 05 | 05 | 05 | 05 | 20 |
| Project | 06 | 06 | 06 | 04 | 04 |
| Total | 25 | 25 or 29 | 25 or 29 | 25 or 33 | 116 |

Table-III
For Biotechnology

| Course | Credits | | | | Total |
|---------------------|---------|--------|---------|--------|-------|
| | Sem-I | Sem-II | Sem-III | Sem-IV | |
| Core courses | 16 | 12 | 12 | 08 | 48 |
| Elective Courses | 06 | 9 | 06 | 9 | 18 |
| Lab courses | 24 | 18 | 18 | 12 | 72 |
| Seminar | 06 | 01 | 01 | 06 | 02 |
| Project | | | | 06 | 06 |
| Assignment | | | 02 | | 02 |
| Internal Assessment | | | 02 | | 02 |
| Total | 40 | 40 | 35 | 35 | 150 |

Table-IV
For Computer Science

| Course | Credits | | | | Total |
|-------------|---------|--------|---------|--------|-------|
| | Sem-I | Sem-II | Sem-III | Sem-IV | |
| Core | 25 | 20 | 15 | 10 | 70 |
| Elective | - | 05 | 05 | 05 | 15 |
| GIC | - | - | 05 | - | 05 |
| Lab. Course | 06 | 06 | 06 | 03 | 22 |
| I.A. | - | - | - | 02 | 02 |
| Project | - | - | - | 04/02 | 06 |
| Total | 31 | 31 | 31 | 26 | 119 |

IX. Grade Awards :-

- (i) A seven point rating scale is used for the evaluation of the performance of the student to provide letter grade for each course and overall grade for the Master's Programme. Grade points are based on the total number of marks obtained by him/her in all the heads of examination of the course. These grade points and their equivalent range of marks are shown separately in Table-I. The performance of the student in theory, practical, internal assessment, subjects shall be evaluated in accordance with following Table-I.

TABLE -I

| Grade | Range of Marks obtained out of 100 or Equivalent fraction | Grade Points | Remarks (Not to be displayed On transcripts) |
|-----------|---|--------------|---|
| O | 90-100 | 10 | Outstanding |
| A+ | 80-89 | 9 | Excellent |
| A | 70-79 | 8 | Very Good |
| B+ | 60-69 | 7 | Good |
| B | 55-59 | 6 | Fair |
| C+ | 50-54 | 5 | Average |
| C | 40-49 | 4 | Below Average |
| F | Below 40 | 0 | Fail |

TABLE-II: Final Grade Points for SGPA and CGPA

| Grade Points | Final Grade | Remarks (Not to be displayed On transcripts) |
|--------------|-------------|--|
| 9.00-10.00 | O | Outstanding |
| 8.00 – 8.99 | A+ | Excellent |
| 7.00-7.99 | A | Very Good |
| 6.00-6.99 | B+ | Good |
| 5.50 – 5.99 | B | Fair |
| 5.00 – 5.49 | C+ | Average |
| 4.00 – 4.99 | C | Below Average |

Equivalence of the conventional division/class with the CGPA is in accordance with the following table no. 4.

Table III. Equivalence of Class/Division to CGPA

| Sr.No. | CGPA | Class/Division |
|--------|---------------------------------|------------------------------|
| 1 | 8.00 or more | First Class & Exemplary |
| 2 | 7.50 or more but less than 8.00 | First Class with Distinction |
| 3 | 6.00 or more but less than 7.49 | First Class |
| 4 | 5.50 or more but less than 5.99 | Higher Second Class |
| 5 | 4.00 or more but less than 5.49 | Second Class |
| 6 | Less than 4.00 | Fail |

The overall performance of a student is evaluated by assigning appropriate weightage to all the **four** semesters in order to maintain the quality of education. A student is permitted to appear for the semester examination subject to he or she has a minimum attendance of 75% in theory and practical classes, completes all his/her internal/ sessional assignments and clears all his/her dues. Non appearance in any examination is treated as the student having secured zero mark in that subject examination.

The evaluation is based on an average weightage system. Every subject has credit points based on the hours of study required. Every student is assessed in a subject with appropriate weightage to internal/ sessional work and semester examination, thereby making the students study regularly. Every student is awarded Grade points out of maximum 10 points in each subject (based on 7 Points Scale). Based on the Grade points obtained in each subject, Semester Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) are computed.

X. Computation of SGPA & CGPA

Every student will be awarded points out of maximum 10 points in each subject. (based on 7 Points Scale). Based on the Grade points obtained in each subject the Semester Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) are computed. The computation of SGPA & CGPA, is as under:

Semester Grade Point Average (SGPA) is the weighted average of points obtained by a student in a semester and is computed as follows:

$$SGPA = \frac{U1 \times M1 + U2 \times M2 + \dots + Un + Mn}{U1 + U2 + \dots + Un}$$

Where U1, U2, í .. are subject credit of the respective course and M1, M2, í .. are the Grade Points obtained in the respective subject (out of 10)

The Semester Grade Point Average (SGPA) for all the four semesters is also mentioned at the end of every semester.

The Cumulative Grade Point Average (CGPA) is used to describe the overall performance of a student in the course and is computed as under:

$$CGPA = \frac{\sum_{n=1}^4 SGPA(n)C_n}{\sum_{n=1}^4 C_n}$$

Where SGPA (n) is the nth Semester SGPA of the student and C_n is the nth Semester total credit. The SGPA and CGPA are rounded off to the second place of decimal.

XI. Internal Evaluation Method :-

- (i) At the beginning of each course, every teacher shall inform his/her students unambiguously the method he/she proposes to adopt for the continuous assessment. Normally the teacher concerned may conduct three written sessional examinations spread periodically during the semester and select best two for contributing to the final marks.
- (ii) At the end of each semester the Departmental Committee shall assign grades to the students.
- (iii) The Departmental Committee shall prepare the copies of the result sheet in duplicate.

- (iv) Every student shall have the right to scrutinize answer scripts of sessional/end-semester examinations and seek clarifications from the teacher regarding evaluation of the scripts immediately thereafter or within 3 days of receiving the evaluated scripts.
- (v) The Department shall display the grade points and grades for the notice of students.
- (vi) The department shall send all records of evaluation, including sessional evaluation, for safekeeping to the Controller of Examinations as soon as all the formalities are over.

XII. Grade Card

The University shall issue at the beginning of each semester a grade card for the student, containing the grades obtained by the student in the previous semester and his Semester Grade Point Average (SGPA).

The grade card shall list:

- (a) the title of the courses along with code taken by the student
- (b) the credits associated with the course,
- (c) the grade and grade points secured by the student,
- (d) the total credits earned by the student in that semester.
- (e) the SGPA of the student,
- (f) the total credits earned by the students till that semester and
- (g) the CGPA of the student (At the end of the IVth Semester)

XIII. At the end of the IVth semester, the University shall issue the statement of marks to the Students showing details of marks obtained by the student in each Head in each semester along with grade total marks.

XIV. Power to modify and remove difficulties :-

1. Notwithstanding anything contained in the foregoing, Honøble V.C. in consultation with the Dean of the faculty shall have the power to issue directions or orders to remove any difficulty,
2. Nothing in the foregoing may be construed as limiting the power of the University to amend, modify or repeal any all of the above.

sd/-

Amravati
Date : 2/6/2010

(Dr.Kamal Singh)
Vice-Chancellor

**Examination Scheme under C.B.C.S. for the subject other than
Mathematics, Biotechnology and Computer Science in the
faculty of Science
M.Sc. Part-I
Semester-I**

SA-Subject abbreviation; C-Core; E- Elective

| Sr.No. | Paper / Code | Course | Theory | | | | Practical | | |
|--------|--------------|--------|----------------------|---------------------------------|---------------------|----------------------------------|--|---------------------|-------------------------------------|
| | | | Max. Marks (Credits) | Min Pass Marks (Min. Grade Pt.) | Int. Ass. (Credits) | Min. Pass Marks (Min. Grade Pt.) | Th + Int. Ass. Min. Pass Mar (Grade Pt.) | Max. Marks (Credit) | Min. Marks marks (Min. Grade Point) |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | ISA-1 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) | ø | ø |
| 2 | ISA-2 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) | ø | ø |
| 3 | ISA-3 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) | ø | ø |
| 4 | ISA-4 | E | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) | ø | ø |
| 5 | ISA-5 | Lab-I | ø | ø | ø | ø | ø | 100 (03) | 40 (04) |
| 6 | ISA-6 | Lab-II | ø | ø | ø | ø | ø | 100 (03) | 40 (04) |

Total Marks : 600; Minimum Total Credits : 26

- Note :-** (1) If the student has scored minimum marks or minimum grade points mentioned in Column No.8 out of the sum of total marks of theory and internal assessment taken together then he/she will be declared to have cleared with (04+01) 05 credits.
- (2) If the student has scored minimum marks or minimum grade points in either theory or in internal assessment then he/she will be declared to have cleared in that particular head.

**Examination Scheme under C.B.C.S. for the subject other than
Mathematics, Biotechnology and Computer Science in the faculty
of Science**

M.Sc. Part-I

Semester-II

SA-Subject abbreviation; C-Core; E-Elective; GIC-General Interest Course

| Sr.No. | Paper / Code | Course | Theory | | | | Practical | | |
|--------|-----------------------|--------------------|----------------------|---------------------------------|---------------------|----------------------------------|---|---------------------|-------------------------------------|
| | | | Max. Marks (Credits) | Min Pass Marks (Min. Grade Pt.) | Int. Ass. (Credits) | Min. Pass Marks (Min. Grade Pt.) | Th + Int. Ass. Min.Pass Mar (Grade Pt.) | Max. Marks (Credit) | Min. Marks marks (Min. Grade Point) |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 2SA-1 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) | 0 | 0 |
| 2 | 2SA-2 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) | 0 | 0 |
| 3 | 2SA-3 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) | 0 | 0 |
| 4 | 2SA-4 Or 2GIC-X | E and/or GIC | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) | 0 | 0 |
| 5 | 2SA-5 | Lab-III | 0 | 0 | 0 | 0 | 0 | 100 (03) | 40 (04) |
| 6 | 2SA-6 | Lab-IV | 0 | 0 | 0 | 0 | 0 | 100 (03) | 40 (04) |

Total Marks : 600; Minimum Total Credits : 26

- Note :-** (1) If the student has scored minimum marks or minimum grade points mentioned in Column No.8 out of the sum of total marks of theory and internal assessment taken together then he/she will be declared to have cleared with (04+01) 05 credits.
- (2) If the student has scored minimum marks or minimum grade points in either theory or in internal assessment then he/she will be declared to have cleared in that particular head.

**Examination Scheme under C.B.C.S. for the subject other than
Mathematics, Biotechnology and Computer Science
in the faculty of Science**

M.Sc. Part-II

Semester-III

SA-Subject abbreviation; C-Core; E-Elective; GIC-General Interest Course

| Sr.No. | Paper / Code | Course | Theory | | | | Practical | | |
|--------|-----------------------|--------------------|----------------------|---------------------------------|---------------------|----------------------------------|---|---------------------|-------------------------------------|
| | | | Max. Marks (Credits) | Min Pass Marks (Min. Grade Pt.) | Int. Ass. (Credits) | Min. Pass Marks (Min. Grade Pt.) | Th + Int. Ass. Min.Pass Mar (Grade Pt.) | Max. Marks (Credit) | Min. Marks marks (Min. Grade Point) |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 3SA-1 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) | 0 | 0 |
| 2 | 3SA-2 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) | 0 | 0 |
| 3 | 3SA-3 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) | 0 | 0 |
| 4 | 3SA-4 Or 3GIC-Y | E and/or GIC | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) | 0 | 0 |
| 5 | 3SA-5 | Lab-V | 0 | 0 | 0 | 0 | 0 | 100 (03) | 40 (04) |
| 6 | 3SA-6 | Lab-VI | 0 | 0 | 0 | 0 | 0 | 100 (03) | 40 (04) |

Total Marks : 600; Minimum Total Credits : 26

- Note :-** (1) If the student has scored minimum marks or minimum grade points mentioned in Column No.8 out of the sum of total marks of theory and internal assessment taken together then he/she will be declared to have cleared with (04+01) 05 credits.
- (2) If the student has scored minimum marks or minimum grade points in either theory or in internal assessment then he/she will be declared to have cleared in that particular head.

Appendix-D

**Examination Scheme under C.B.C.S. for the subject other than
Mathematics, Biotechnology and Computer Science
in the faculty of Science**

**M.Sc. Part-II
Semester-IV**

SA-Subject abbreviation; C-Core; E-Elective; GIC-General Interest Course

| Sr.No. | Paper / Code | Course | Theory | | | | Practical | | |
|--------|-----------------------|--------------------|----------------------|---------------------------------|---------------------|----------------------------------|---|---------------------|-------------------------------------|
| | | | Max. Marks (Credits) | Min Pass Marks (Min. Grade Pt.) | Int. Ass. (Credits) | Min. Pass Marks (Min. Grade Pt.) | Th + Int. Ass. Min.Pass Mar (Grade Pt.) | Max. Marks (Credit) | Min. Marks marks (Min. Grade Point) |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 1 | 4SA-1 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) | 0 | 0 |
| 2 | 4SA-2 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) | 0 | 0 |
| 3 | 4SA-3 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) | 0 | 0 |
| 4 | 4SA-4 Or 4GIC-Z | E and/or GIC | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) | 0 | 0 |
| 5 | 4SA-5 | Lab-V | 0 | 0 | 0 | 0 | 0 | 100 (03) | 40 (04) |
| 6 | 4SA-6 | Project | 0 | 0 | 0 | 0 | 0 | 100 (03) | 40 (04) |

Total Marks : 600; Minimum Total Credits : 26

- Note :-** (1) If the student score Minimum Marks or Minimum Grade Points mentioned in Column No.8 out of the sum total marks of theory and internal assessment taken together then he/she will be declared to have clear (04+01) 05 credits.
- (2) If the student score Minimum Marks or Minimum Grade Points in either theory or in internal assessment then he/she will be declared to have clear in that Particular Head.

Appendix-E

**Examination Scheme under C.B.C.S. for the subject
Mathematics in the faculty of Science**

**M.Sc. Part-I
Semester-I**

| Sr.No. | Paper / Code | Course | Theory | | | | |
|--------|--------------|--------|----------------------|---------------------------------|---------------------|----------------------------------|---|
| | | | Max. Marks (Credits) | Min Pass Marks (Min. Grade Pt.) | Int. Ass. (Credits) | Min. Pass Marks (Min. Grade Pt.) | Th + Int. Ass. Min.Pass Mar (Grade Pt.) |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | 1MTH-1 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) |
| 2 | 1MTH-2 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) |
| 3 | 1MTH-3 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) |
| 4 | 1MTH-4 | E | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) |
| 5 | 1MTH-5 | E | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) |
| | | | 400 (20) | | 100 (05) | | |

Total Marks : 500; Total Credits : 25

- Note :-** (1) If the student score Minimum Marks or Minimum Grade Points mentioned in Column No.8 out of the sum total marks of theory and internal assessment taken together then he/she will be declared to have clear (04+01) 05 credits.
- (2) If the student score Minimum Marks or Minimum Grade Points in either theory or internal assessment then he/she will be declared to have clear either of the head.

**Examination Scheme under C.B.C.S. for the subject
Mathematics in the faculty of Science**

**M.Sc. Part-I
Semester-II**

| Sr.No. | Paper / Code | Course | Theory | | | | |
|--------|----------------------------|--------------------|----------------------|---------------------------------|---------------------|----------------------------------|--|
| | | | Max. Marks (Credits) | Min Pass Marks (Min. Grade Pt.) | Int. Ass. (Credits) | Min. Pass Marks (Min. Grade Pt.) | Th + Int. Ass. Min. Pass Mar (Grade Pt.) |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | 2MTH-1 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) |
| 2 | 2MTH-2 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) |
| 3 | 2MTH-3 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) |
| 4 | 2MTH-4 | E | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) |
| 5 | 2MTH-5 and/or 2GIC-X | E and/or GIC | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) |
| | | | 400 (20) | | 100 (05) | | |

Total Marks : 500; Total Credits : 25

- Note :-** (1) If the student score Minimum Marks or Minimum Grade Points mentioned in Column No.8 out of the sum total marks of theory and internal assessment taken together then he/she will be declared to have clear (04+01) 05 credits.
- (2) If the student score Minimum Marks or Minimum Grade Points in either theory or internal assessment then he/she will be declared to have clear either of the head.

**Examination Scheme under C.B.C.S. for the subject
Mathematics in the faculty of Science**

**M.Sc. Part-II
Semester-III**

| Sr.No. | Paper / Code | Course | Theory | | | | |
|--------|----------------------------|--------------------|----------------------|---------------------------------|---------------------|----------------------------------|--|
| | | | Max. Marks (Credits) | Min Pass Marks (Min. Grade Pt.) | Int. Ass. (Credits) | Min. Pass Marks (Min. Grade Pt.) | Th + Int. Ass. Min. Pass Mar (Grade Pt.) |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | 3MTH-1 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) |
| 2 | 3MTH-2 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) |
| 3 | 3MTH-3 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) |
| 4 | 3MTH-4 | E | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) |
| 5 | 3MTH-5 and/or 3GIC-Y | E and/or GIC | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) |
| | | | 400 (20) | | 100 (05) | | |

Total Marks : 500; Min.Total Credits : 25

- Note :-** (1) If the student score Minimum Marks or Minimum Grade Points mentioned in Column No.8 out of the sum total marks of theory and internal assessment taken together then he/she will be declared to have clear (04+01) 05 credits.
- (2) If the student score Minimum Marks or Minimum Grade Points in either theory or internal assessment then he/she will be declared to have clear either of the head.

**Examination Scheme under C.B.C.S. for the subject
Mathematics in the faculty of Science**

**M.Sc. Part-I
Semester-IV**

| Sr.No. | Paper / Code | Course | Theory | | | | |
|--------|---|---|----------------------|---------------------------------|---------------------|----------------------------------|---|
| | | | Max. Marks (Credits) | Min Pass Marks (Min. Grade Pt.) | Int. Ass. (Credits) | Min. Pass Marks (Min. Grade Pt.) | Th + Int. Ass. Min.Pass Mar (Grade Pt.) |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | 4MTH-1 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) |
| 2 | 4MTH-2 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) |
| 3 | 4MTH-3 | C | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) |
| 4 | 4MTH-4 | E | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) |
| 5 | 4MTH-5 and/or 4GIC-Z and/or Project | E and/or GIC and/or Project | 80 (04) | 32 (04) | 20 (01) | 08 (04) | 40 (04) |
| | | | 400 (20) | | 100 (05) | | |

Total Marks : 500; Min.Total Credits : 25

- Note** :- (1) If the student score Minimum Marks or Minimum Grade Points mentioned in Column No.8 out of the sum total marks of theory and internal assessment taken together then he/she will be declared to have clear (04+01) 05 credits.
- (2) If the student score Minimum Marks or Minimum Grade Points in either theory or internal assessment then he/she will be declared to have clear either of the head.

Scheme of Teaching and Examination under C.B.C.S. for the Subject Biotechnology

M.Sc. (Biotechnology) SEMESTER PATTERN

M.Sc.Part-I (SEMESTER-I)

T: Lectures, P: Practical, TU: Tutorial/Assignment; G.I.C. – General Interest Course

| S N | Subject Code | Paper | Course | Hrs/ Week | | Credits | | Examination Scheme | | | | | | | | |
|--------|-----------------|--------|--------|--------------|----------|---------|--------|--------------------|---------------------------|--------------------------|-------|--------------------------------|---------------------------|-----------------------------|-------|-----------------------------------|
| | | | | | | | | Theory | | | | Practical | | | | |
| | | | | T | P/ TU | Theory | Pract. | Paper Hrs | Max External; Marks | Max Internal Marks | Total | Min Passing Grade Points | Max Marks Practical | Max Marks Int. Ass | Total | Min Passing Grade Points |
| 1 | 1BTB-1 | I | C | 04 | 06 | 04 | | 3 | 100 | | 100 | 4 | -- | -- | -- | -- |
| 2 | 1BTB-2 | II | C | 04 | 06 | 04 | | 3 | 100 | | 100 | 4 | -- | -- | -- | -- |
| 3 | 1BTB-3 | III | C | 04 | 06 | 04 | | 3 | 100 | | 100 | 4 | -- | -- | -- | -- |
| 4 | 1BTB-4 | IV | C | 04 | 06 | 04 | | 3 | 100 | | 100 | 4 | -- | -- | -- | -- |
| 5 | 1BTB-5 | Lab-I | | -- | P 01 | | 12 | -- | -- | -- | -- | - | 80 | 20 | 100 | 5 |
| 6 | 1BTB-6 | Lab-II | | -- | P 02 | | 12 | -- | -- | -- | -- | -- | 80 | 20 | 100 | 5 |
| | | | | 16 | 24 | 16 | 24 | | | | 400 | | | | 200 | |

Total Credits: 40

Scheme of Teaching and Examination under C.B.C.S. for the Subject Biotechnology

M.Sc. (Biotechnology) SEMESTER PATTERN

M.Sc.Part-I (SEMESTER-II)

T: Lectures, P: Practical, TU: Tutorial/Assignment; G.I.C. – General Interest Course

| S N | Subject Code | Paper | Course | Hrs/ Week | | Credits | | Examination Scheme | | | | | | | | |
|--------|----------------------------|---------|--------------------|--------------|----------|---------|-----------|--------------------|---------------|-----------------|-------|--------------------------------|---------------------------|-----------------------------|-------|-----------------------------------|
| | | | | | | | | Theory | | | | Practical | | | | |
| | | | | T | P/ TU | Theory | Practical | Paper Hrs | Max Theory | Max Internal | Total | Min Passing Grade Points | Max Marks Practical | Max Marks Int. Ass | Total | Min Passing Grade Points |
| 1 | 2BTB-1 | V | C | 04 | 06 | 4 | | 3 | 100 | | 100 | 4 | -- | -- | -- | -- |
| 2 | 2BTB-2 | VI | C | 04 | 06 | 4 | | 3 | 100 | | 100 | 4 | -- | -- | -- | -- |
| 3 | 2BTB-3 | VII | C | 04 | 06 | 4 | | 3 | 100 | | 100 | 4 | -- | -- | -- | -- |
| 4 | 2BTB-4 and/or 2GIC-X | VIII | E and/or GIC | 04 | 06 | 4 | | 3 | | 100 | 100 | 4 | -- | -- | -- | -- |
| 5 | 2BTB-5 | Lab-III | | | P 02 | | 12 | -- | -- | -- | -- | -- | 80 | 20 | 100 | 5 |
| 6 | 2BTB-6 | Lab-IV | | | P 02 | | 12 | -- | -- | -- | -- | -- | 80 | 20 | 100 | 5 |
| | | Total | | 16 | 25 | 16 | 24 | | | | 400 | | | | 200 | |

Total Credits: 40

Scheme of Teaching and Examination under C.B.C.S. for the Subject Biotechnology
M.Sc. (Biotechnology) SEMESTER PATTERN
M.Sc.Part-II (SEMESTER-III)

T: Lectures, P: Practical, TU: Tutorial/Assignment; G.I.C. – General Interest Course

| S N | Subject Code | Paper | Course | Hrs/ Week | | Credits | | Examination Scheme | | | | | | | | |
|--------|-----------------|------------------------|-----------------|--------------|----------|---------|--------|--------------------|---------------|-----------------|-------|--------------------------------|---------------------------|-----------------------------|-------|-----------------------------------|
| | | | | | | | | Theory | | | | Practical | | | | |
| | | | | T | P/ TU | Theory | Pract. | Paper Hrs. | Max Theory | Max Internal | Total | Min Passing Grade Points | Max Marks Practical | Max Marks Int. Ass | Total | Min Passing Grade Points |
| 1 | 3BTB-1 | IX | C | 04 | 06 | 04 | | 3 | 100 | -- | 100 | 4 | -- | -- | -- | -- |
| 2 | 3BTB-2 | X | C | 04 | 06 | 04 | | 3 | 100 | -- | 100 | 4 | -- | -- | -- | -- |
| 3 | 3BTB-3 | XI and 3GIC-Y | C and GIC | 04 | 06 | 04 | | 3 | 100 | -- | 100 | 4 | -- | -- | -- | -- |
| 4 | 3BTB-4 | Lab-V | | | P 02 | | 18 | -- | -- | -- | -- | -- | 80 | 20 | 100 | 5 |
| 5 | 3BTB-5 | Internal Assessment | | | 01 | | 02 | | -- | -- | -- | -- | -- | 75 | 75 | 5 |
| 6 | 3BTB-6 | Assignment | | | | | 02 | | -- | -- | -- | -- | -- | 50 | 50 | 5 |
| 7 | | Seminar | | | 01 | 1 | | - | -- | -- | -- | -- | -- | 75 | 75 | 5 |
| | | Total | | 12 | 20 | 13 | 22 | - | -- | -- | 300 | -- | -- | -- | 300 | -- |

Total Credits: 35

Scheme of Teaching and Examination under C.B.C.S. for the Subject Biotechnology
M.Sc. (Biotechnology) SEMESTER PATTERN
M.Sc.Part-II (SEMESTER-IV)

T: Lectures, P: Practical, TU: Tutorial/Assignment; G.I.C. – General Interest Course

| S N | Subject Code | Paper | Course | Hrs/ Week | | Credits | | Examination Scheme | | | | | | | | |
|--------|----------------------------|---------|--------------------|--------------|----------|---------|--------|--------------------|---------------|-----------------|-------|--------------------------------|---------------------------|-----------------------------|-------|-----------------------------------|
| | | | | | | | | Theory | | | | Practical | | | | |
| | | | | T | P/ TU | Theory | Pract. | Paper Hrs. | Max Theory | Max Internal | Total | Min Passing Grade Points | Max Marks Practical | Max Marks Int. Ass | Total | Min Passing Grade Points |
| 1 | 4BTB-1 | XII | C | 04 | 06 | 04 | | 3 | 100 | -- | 100 | 4 | -- | -- | -- | -- |
| 2 | 4BTB-2 | XIII | C | 04 | 06 | 04 | | 3 | 100 | -- | 100 | 4 | -- | -- | -- | -- |
| 3 | 4BTB-3 and/or 4GIC-Z | XIV | E and/or GIC | 04 | 06 | 04 | | 3 | | 100 | 100 | 4 | -- | -- | -- | -- |
| 4 | 4BTB-4 | Lab-VI | | | | | 18 | | | | | | 80 | 20 | 100 | 5 |
| 5 | 4BTB-5 | Project | | | 06 | | 06 | | | | | | 200 | -- | 200 | 5 |
| | | Total | | 12 | 24 | 12 | 24 | - | -- | -- | 300 | -- | -- | -- | 300 | -- |

Total Credits: 35

Scheme of Teaching and Examination under C.B.C.S. for the subject Computer Science
M.Sc. (Computer) SEMESTER PATTERN
M.Sc.Part-I (SEMESTER-I)

T: Lectures, P: Practical, TU: Tutorial/Assignment; G.I.C. – General Interest Course, C-Core

| S N | Subject Code | Paper | Course | Hrs/ Week | | Credits | | Examination Scheme | | | | | | | | | |
|--------|-----------------|--------|--------|--------------|----------|---------|-----------|--------------------|---------------------------|--------------------------|-------|--------------------------------|---------------------------|-----------------------------|-------|-----------------------------------|--------|
| | | | | | | | | Theory | | | | Practical | | | | | |
| | | | | T | P/ TU | Theory | Practical | Paper Hrs | Max External; Marks | Max Internal Marks | Total | Min Passing Grade Points | Max Marks Practical | Max Marks Int. Ass | Total | Min Passing Grade Points | |
| 1 | 1MCS-1 | I | C | 5 | - | 5 | - | 3 Hrs | 100 | - | 100 | 40 | 4.00 | | | | |
| 2 | 1MCS-2 | II | C | 5 | - | 5 | - | 3 Hrs | 100 | - | 100 | 40 | 4.00 | | | | |
| 3 | 1MCS-3 | III | C | 5 | - | 5 | - | 3 Hrs | 100 | - | 100 | 40 | 4.00 | | | | |
| 4 | 1MCS-4 | IV | C | 5 | - | 5 | - | 3 Hrs | 100 | - | 100 | 40 | 4.00 | | | | |
| 5 | 1MCS-5 | V | C | 5 | - | 5 | - | 3 Hrs | 100 | - | 100 | 40 | 4.00 | | | | |
| 6 | 1MCS-6 | Lab-I | - | - | 7 | - | 03 | | | | | | | | | | |
| 7 | 1MCS-7 | Lab-II | - | - | 7 | - | 03 | | | | | | | 100 | - | 100 | 40 4.0 |
| | | Total | | 25 | 14 | 25 | 06 | | | | | | | 100 | - | 100 | 40 4.0 |

Total Credits: 40

Scheme of Teaching and Examination under C.B.C.S. for the subject Computer Science
M.Sc. (Computer) SEMESTER PATTERN
M.Sc.Part-I (SEMESTER-II)

T: Lectures, P: Practical, TU: Tutorial/Assignment; G.I.C. – General Interest Course, C-Core

| S N | Subject Code | Paper | Course | Hrs/ Week | | Credits | | Examination Scheme | | | | | | | | | |
|--------|------------------------|---------|-------------|--------------|----------|---------|-----------|--------------------|---------------|-----------------|-------|--------------------------------|---------------------------|-----------------------------|-------|-----------------------------------|--------|
| | | | | | | | | Theory | | | | Practical | | | | | |
| | | | | T | P/ TU | Theory | Practical | Paper Hrs | Max Theory | Max Internal | Total | Min Passing Grade Points | Max Marks Practical | Max Marks Int. Ass | Total | Min Passing Grade Points | |
| 1 | 2MCS-1 | VI | C | 5 | - | 5 | - | 3 Hrs | 100 | - | 100 | 40 | 4.00 | | | | |
| 2 | 2MCS-2 | VII | C | 5 | - | 5 | - | 3 Hrs | 100 | - | 100 | 40 | 4.00 | | | | |
| 3 | 2MCS-3 | VIII | C | 5 | - | 5 | - | 3 Hrs | 100 | - | 100 | 40 | 4.00 | | | | |
| 4 | 2MCS-4 | IX | C | 5 | - | 5 | - | 3 Hrs | 100 | - | 100 | 40 | 4.00 | | | | |
| 5 | 2MCS-5 Or 2GIC-X | X | E or GIC | 5 | - | 5 | - | 3 Hrs | 100 | - | 100 | 40 | 4.00 | | | | |
| 6 | 2MCS-6 | Lab-III | - | - | 7 | - | 03 | - | - | - | - | | | | | | |
| 7 | 2MCS-7 | Lab-IV | - | - | 7 | - | 03 | - | - | - | - | | | 100 | - | 100 | 40 4.0 |
| | | | | 25 | 14 | 25 | 06 | | | | | | | 100 | - | 100 | 40 4.0 |

Total Credits: 40

Scheme of Teaching and Examination under C.B.C.S. for the subject Computer Science

M.Sc. (Computer) SEMESTER PATTERN

M.Sc.Part-II (SEMESTER-III)

Appendix-O

T: Lectures, P: Practical, TU: Tutorial/Assignment; G.I.C. – General Interest Course

| S N | Subject Code | Paper | Course | Hrs/ Week | | Credits | | Examination Scheme | | | | | | | | | |
|--------|------------------------|--------|-------------|--------------|----|---------|----|--------------------|---------------|-----------------|-------|--------------------------------|---------------------------|-----------------------------|-------|-----------------------------------|--------|
| | | | | | | | | Theory | | | | Practical | | | | | |
| | | | | | | | | Paper Hrs. | Max Theory | Max Internal | Total | Min Passing Grade Points | Max Marks Practical | Max Marks Int. Ass | Total | Min Passing Grade Points | |
| T | P/ TU | Theory | Pract. | | | | | | | | | | | | | | |
| 1 | 3MCS-1 | XI | C | 5 | - | 5 | - | 3 Hrs | 100 | - | 100 | 40 | 4.00 | | | | |
| 2 | 3MCS-2 | XII | C | 5 | - | 5 | - | 3 Hrs | 100 | - | 100 | 40 | 4.00 | | | | |
| 3 | 3MCS-3 | XIII | C | 5 | - | 5 | - | 3 Hrs | 100 | - | 100 | 40 | 4.00 | | | | |
| 4 | 3MCS-4 | XIV | E | 5 | - | 5 | - | 3 Hrs | 100 | - | 100 | 40 | 4.00 | | | | |
| 5 | 3MCS-5 Or 3GIC-Y | XV | E or GIC | 5 | - | 5 | - | 3 Hrs | 100 | - | 100 | 40 | 4.00 | | | | |
| 6 | 3MCS-6 | Lab-V | - | - | 7 | - | 03 | | | - | | | | | | | |
| 7 | 3MCS-7 | Lab-VI | - | - | 7 | - | 03 | | | - | | | | 100 | - | 100 | 40 4.0 |
| | | Total | | 25 | 14 | 25 | 06 | | | | | | | 100 | - | 100 | 40 4.0 |

Total Credits: 35

Scheme of Teaching and Examination under C.B.C.S. for the subject Computer Science

M.Sc. (Computer) SEMESTER PATTERN

M.Sc.Part-II (SEMESTER-IV)

Appendix-P

T: Lectures, P: Practical, TU: Tutorial/Assignment; G.I.C. – General Interest Course

| S N | Subject Code | Paper | Course | Hrs/ Week | | Credits | | Examination Scheme | | | | | | | | | |
|--------|------------------------|-----------------------|-------------|--------------|----|---------|------|--------------------|---------------|-----------------|-------|--------------------------------|---------------------------|-----------------------------|-------|-----------------------------------|-------|
| | | | | | | | | Theory | | | | Practical | | | | | |
| | | | | | | | | Paper Hrs. | Max Theory | Max Internal | Total | Min Passing Grade Points | Max Marks Practical | Max Marks Int. Ass | Total | Min Passing Grade Points | |
| T | P/ TU | Theory | Pract. | | | | | | | | | | | | | | |
| 1 | 4MCS-1 | XVI | C | 5 | - | 5 | - | 3 Hrs | 100 | - | 100 | 40 | 4.00 | | | | |
| 2 | 4MCS-2 | XVII | C | 5 | - | 5 | - | 3 Hrs | 100 | - | 100 | 40 | 4.00 | | | | |
| 3 | 4MCS-3 Or 4GIC-Z | XVIII | E or GIC | 5 | - | 5 | - | 3 Hrs | 100 | - | 100 | 40 | 4.00 | | | | |
| 4 | 4MCS-4 | Lab-VII | - | - | 7 | - | 03 | 4 Hrs | - | - | - | - | - | 100 | | 100 | 40 04 |
| 5 | 4MCS-5 | Project | - | - | 7 | - | 03+1 | | | - | - | - | - | 100 | 50 | 100 | 40 04 |
| 6 | 4MCS-6 | Seminar | - | 02 | - | - | 01+1 | | | - | - | - | - | 100 | 50 | 150 | 60 04 |
| 7 | 4MCS-7 | Internal Assesment | - | 06 | - | - | 02 | | | - | - | 40 | 4.00 | | 50 | 50 | 20 04 |
| | | Total | | 23 | 14 | 15 | 11 | | | | | | | | | | |

Total Credits: 35

**List of General Interest Courses (GIC) to be opted
by the student/s in Semester-II**

| Sr.No. | Subject | Subject Code Elective | Equivalent General Interest Course Code |
|--------|--------------------------|-----------------------|---|
| 1 | 2 | 3 | 4 |
| 1 | Chemistry | 2CHE3 | 2GIC-1 |
| | | 2CHE4 | 2GIC-2 |
| 2 | Physics | 2PHY3 | 2GIC3 |
| | | 2PHY4 | 2GIC4 |
| 3 | Mathematics | 2MTH4 | 2GIC5 |
| | | 2MTH5 | 2GIC6 |
| 4 | Zoology | 2ZOO3 | 2GIC7 |
| | | 2ZOO4 | 2GIC8 |
| 5 | Botany | 2BOT3 | 2GIC9 |
| | | 2BOT4 | 2GIC-A |
| 6 | Statistics | 2SCA3 | 2GIC-B |
| | | 2SCA4 | 2GIC-C |
| 7 | Biotechnology | 2BTB3 | 2GIC-D |
| | | 2BTB4 | 2GIC-E |
| 8 | Computer Science | 2CMS3 | 2GIC-F |
| | | 2CMS4 | 2GIC-G |
| 9 | Microbiology | 2MCB3 | 2GIC-H |
| | | 2MCB4 | 2GIC-I |
| 10 | Electronics | 2ELE3 | 2GIC-J |
| | | 2ELE4 | 2GIC-K |
| 11 | Biochemistry | 2BMC3 | 2GIC-L |
| | | 2BMC4 | 2GIC-M |
| 12 | Geology | 2GEO3 | 2GIC-N |
| | | 2GEO4 | 2GIC-O |
| 13 | Bioinformatics | 2BIT3 | 2GIC-P |
| | | 2BIT4 | 2GIC-Q |
| 14 | Environmental Science | 2ENV3 | 2GIC-R |
| | | 2ENV4 | 2GIC-S |
| 15 | Geoinformatics | 2GIT3 | 2GIC-U |
| | | 2GIT4 | 2GIC-V |
| 16 | Computer Software | 2CSW3 | 2GIC-W |
| | | 2CSW4 | 2GIC-1A |
| 17 | Remote Sensing and GIS | 2RSG3 | 2GIC-1B |
| | | 2RSG4 | 2GIC-1C |
| 18 | Pharmaceutical Chemistry | 2PCH3 | 2GIC-1D |
| | | 2PCH4 | 2GIC-1E |

Note : Title of the paper shall prescribed in the respective prospectuses.

No. : 27 / 2010

Date : 24.6.2010

Subject : Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semester Degree Course), Direction, 2010.

Whereas, Ordinance No.4 of 2008 in respect of Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semester Degree Course) Ordinance, 2008 is in existence in the University.

AND

Whereas, the Academic Council in its meeting held on 28.5.2010 vide item No.36 has approved the policy decision regarding introduction of Scheme for Choice Based Credit System (CBCS) and Awarding Grades to the Post Graduate Students in the Faculty of Science, for all subjects along with Draft Regulation in this behalf.

AND

Whereas, due to implementation of Scheme for Choice Based Credit System (CBCS) and Awarding Grades to the Post Graduate Students in the Faculty of Science, the provision under Ordinance No.4 of 2008 need to be revised accordingly.

AND

Whereas, admission to students for M.Sc. Part-I (Semester-I) for all subjects in the faculty of Science are to be made in the Academic Session 2010-11 in choice based credit system (C.B.C.S.).

AND

Whereas, making amendments in Original Ordinance No.4 of 2008 is likely to take some time.

Now, therefore, I, Dr. Kamal Singh, Vice Chancellor of Sant Gadge Baba Amravati University, in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Universities Act., 1994, do hereby direct as under:

1. This Direction may be called "Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semester Degree Course), Direction, 2010".
2. This direction shall come into force from the date of its issuance.
3. The word "Biochemistry" in clause i) of sub-para (i) of para 5 shall be deleted.
4. The title of the subject "Electronics (Instrumentation)" be substituted as "Electronics" wherever occur in the Ordinance.
5. Following shall be the eligibility criteria for admission to M.Sc. Part-I Semester-I for the subjects (i) Pharmaceutical Chemistry, (ii) Biotechnology, (iii) Computer Science.

- (a) for admission to M.Sc. Pharmaceutical Chemistry a candidate shall have offered Chemistry or Industrial Chemistry or Biochemistry as a subject of study and examination at the B.Sc. Degree.
- (b) following shall be the eligibility for admission to M.Sc. Semester-I (Biotechnology) -
- (i) B.Sc. in any discipline of Life Sciences, Bio Sciences or Bachelor's Degree in Agriculture, Veterinary and fishery Sciences, Pharmacy, or Bachelor of Medicine and Bachelor of Surgery (M.B.B.S.) or Bachelor of Dental Surgery or equivalent examination recognized by Sant Gadge Baba Amravati University are eligible to appear in entrance test as given in para (iii) below.
 - (ii) The student should have minimum 50% marks as aggregate in the degree course.
 - (iii) The student will have to pass entrance examination for admission in M.Sc. Semester-I (Biotechnology) as per the Sant Gadge Baba Amravati University rules.
- (c) following shall be the eligibility for admission to M.Sc. Semester-I (Computer Science) -
- i. A person who has passed the Degree of Bachelor of Science of this university with Computer Science / Computer Application (Vocational) as on the subjects.
OR
 - ii. A person who has passed B.A. / B.Sc. with Mathematics plus Post Graduate Diploma in Computer Science of this University.
OR
 - iii. A person who has passed a Degree of Bachelor of Computer Science.
6. The following subject be inserted in para 9) of the Ordinance after Sr.No. 15. Bioinformatics.
16. Computer Software,
 17. Computer Science
 18. Biotechnology, and
 19. Pharmaceutical Chemistry.
7. A person who desire to improve the division obtained by him/her at M.Sc. examination shall be eligible for improvement of division under the provision of Ordinance No.6 of 2008. However, for improvement of division he/she shall have to offer the core courses only. In no case he/she shall be allowed for improvement of division/grade/CGPA by offering General Interest Course.

8. The number of papers and marks allotted to each subject and the minimum marks which an examinee must obtained in order to pass the examination shall be as indicated in Appendices, appended with the Regulation.
9. The classification in reference to the class/division/grade to be awarded to the examinee shall be as per the Table-III (Equivalence to Class / Division to CGPA) of para No.IX, appended to the Regulation.
10. As soon as possible after the examination, but not later than 30th, June following, the B.O.E. shall publish a list of successful examinees arranged in Division as mentioned in Table-III (Equivalence to Class / Division to CGPA) of para No.IX, appended to the Regulation. The names of examinees passing the examination as a whole in the minimum prescribed period and obtaining the prescribed number of places in each subject in the division as per Table-III of the Regulation shall be arranged in order of merit as provided in the Examinations in General Ordinance No.6.

Amravati
Date : 21/6/2010

Sd/-
(Dr.Kamal Singh)
Vice-Chancellor

DIRECTION

No. :39/ 2011

Date :23.8.2011

Subject : Corrigendum to Direction No. 26/2010

Whereas, the Direction No.26 of 2010 in respect of Scheme of Choice Based Credit System (CBCS) and awarding Grades to the Post Graduate students in the faculty of Science is in existence.

AND

Whereas, the Academic Council in its emergent meeting held on 28.5.2010 vide item No.36 has approved the decision regarding introduction of scheme for C.B.C.S. and Awarding grades to the P.G. students in the faculty of Science under Ordinance No.4 of 2008..

AND

Whereas, in sub-para V of para 3, under Direction No.26 of 2010, there shall be Programme Committee and the duties of the Programme Committee shall be to remove the difficulties if any faced during implementation of C.B.C.S. and report it to Honorable Vice-Chancellor for further action and any other matter as it think fit for the effective implementation of C.B.C.S.

AND

Whereas, the Programme Committee in its meetings held on 14.7.2011, 20.7.2011, 30.7.2011 & 9.8.2011 has recommended necessary corrections in the above Direction which will be effective from the academic session 2011-12. The minutes of the Programme Committee was accepted by Honorable Vice-Chancellor on dated 22.8.2011.

AND

Whereas, it is necessary to carry out the corrections in the above said Direction immediately.

Now, therefore, I, Dr.Mohan K.Khedkar, Vice Chancellor of Sant Gadge Baba Amravati University, in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Universities Act., 1994, do hereby direct as under:

1. This Direction may be called "Corrigendum to Direction No.26/2010.
2. This direction shall come into force from the date of its issuance.
3. (A) In Direction No.26/2010 in respect of Scheme of Choice Based Credit System (CBCS) and awarding Grades to the Post Graduate students in the faculty of Science following paras be corrected as follows :

- i) In para II, sub para (i) of para 3 in the fifth line after the words "less than" the figure, sign, and words "72 (52 core and elective)" be substituted by the figures, sign, and words "88(64 core and elective)"
- ii) In para VI: the title "Departmental Committee" be replaced as "Programme Monitoring" and Para 1 be completely deleted. Instead of this, the new para should be "Every P.G. programme of the University/College shall be monitored by the Head of the Department of the University/College of the concerned subject."
- iii) The para VII shall be substituted as given below -
"VII. Grievance Redressal
All the grievances regarding Internal Assessment shall be settled by H.O.D. or the teacher of the department nominated by H.O.D. / Principal."
- iv) In para IX : Table I: the grades in column No.2 shall be substituted as under -

| | | |
|----------------|----|-----|
| "O | by | AA |
| A ⁺ | by | AB |
| A | by | BB |
| B ⁺ | by | BC |
| B | by | CC |
| C ⁺ | by | CD |
| C | by | DD" |
- v) **In para X :**
 - i) In the first line the word "Grade" be added after the word "awarded" and before the word "points"
 - ii) In third line the words "obtained in each subject" be substituted by the words "obtained in Core and Elective courses of the subject"
- vi) **In para XI :**
 - In sub para (i) in the first line the word "Head of the Department" be inserted after the words "& sign" each course," and before the words "every teacher."
 - The sentence "Normally the teacher concerned may conduct three written sessional examinations spread periodically during the semester and select best two for contributing to the final marks" shall be deleted.
 - Sub para (ii) & (iii) be deleted completely.

- Sub para (iv) be renumbered as sub para (ii) and the word "teacher" in the second line of the original sub para (iv) be substituted by the words "Head of Departments".
 - Sub para (v) be renumbered as sub para (iii). In original sub para (v) the words "grade points and grades" be deleted.
 - Sub para (vi) be deleted completely.
- vii) The word "Minimum" printed below the table in Appendix A, B, C, D, G, and H, shall be deleted.
- viii) Following special explanatory Note be added below the table in Appendix-D, H, L, and P respectively.
- Special Explanatory Note :-** At the end of IVth semester, the students/examinee who accumulated atleast 88 credits (out of these 88 credits, 64 credits must be on core and elective course) and who has put in the minimum residence time shall be eligible to receive the degree in the subject he/she has admitted.
- (B) The students should have accumulated 28 credits of M.Sc. Part-I, Sem-I & II taken together for admission to III Semester and should have completed the term of M.Sc. Part-I (Semester-I & II) satisfactorily.

Amravati
Date : 22/8/2011

Sd/-
(Mohan K.Khedkar)
Vice-Chancellor

DIRECTION

No. : 25 / 2012

Date : 29/6/2012

Subject : Corrigendum to Direction No.26/2010 and 39/2011

Whereas, the Direction No.26 of 2010 in respect of Scheme of Choice Based System (CBCS) and awarding Grades to the Post Graduate Students in the faculty of Science is in existence.

AND

Whereas, University has issued corrigendum to Direction No.26 of 2010 vide Direction No.39 of 2011 on dated 23.8.2011.

AND

Whereas, in sub-para V of para 3, under Direction No.26 of 2010, there shall be Programme Committee and the duties of the Programme Committee shall be to remove the difficulties if any faced during implementation of C.B.C.S. and report it to Hon'ble Vice-Chancellor for further action and any other matter as it think fit for the effective implementation of C.B.C.S.

AND

Whereas, the Programme Committee in its meeting held on 1st March, 2012 and 18th April 2012 has recommended necessary corrections in the above said Directions which shall be effective for 2011-12 session and the minutes of the Programme Committee was accepted by the Hon'ble Vice-Chancellor.

AND

Whereas, the Academic Council in its meeting held on 13.1.2012, vide item No.14(5) F) R-3, I) R-2 & R6 has accepted additional eligibility criteria for Admission to M.Sc. (Zoology), Direct admission to M.Sc. Part-II (Computer Science) for the students who have passed the degree of M.Sc. (Computer Software), and revised syllabi of M.Sc. (Computer Science), which is to be implemented from the Academic Session 2012-13.

AND

Whereas, it is necessary for carryout the corrections in the above said Direction immediately.

Now, therefore, I, Dr.Mohan K.Khedkar, Vice Chancellor of Sant Gadge Baba Amravati University, in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Universities Act., 1994, do hereby direct as under:

1. This Direction may be called "Corrigendum to Direction No.26/2010 and 39/2011".
2. This direction shall come into force from the date of its issuance.

3. In Direction No.26/2010 in respect of Scheme of Choice Based System (CBCS) and awarding Grades to the Post Graduate Students in the faculty of Science, following corrections shall be carried out-

- A) i) In para 5th, the words and brackets 'Degree of विज्ञान स्नातक (Bachelor of Science)' shall be substituted as 'Degree of विज्ञान पारंगत (Master of Science)'
 ii) The clause (i), of sub-para (II) of para 3 shall be deleted.
 iii) The clause (i), of sub-para (II) of para 3 shall be renumbered as para (i) and new para (ii) shall be added as follows.

Minimum total credits that students shall have to accumulate in all four semesters for receiving the M.Sc. degree core subject shall be as shown in the table given as under

| Subject/s | Minimum total credits (Core Elective and GIC) |
|--|--|
| All subjects other than Mathematics, Computer Science & Biotechnology | 104 |
| Computer Science | 119 |
| Biotechnology | 150 |
| Mathematics | 100 |

- B) i) Under Table-III (Equivalence of Class/Division of CGPA) of Para IX,
 (a) the figures shown 7.49, 5.99 and 5.49 against Sr.Nos.3, 4 & 5 in Column No.2 (CGPA) be substituted by the figures 7.50, 6.00 and 5.50 respectively.
 (b) Following sub-para be added before the para X
Declaration of Merit List :- Merit list of M.Sc. (C.B.C.S.) examination shall be prepared from the examinee who have successively cleared minimum total credits including GIC as shown in the table assigned in the first attempt.

- ii) Special Explanatory note shown under Appendix-D, H, I, L and P shall be deleted.
 The note No.(2) printed under Appendix-A, B, C, D, E, F & H shall be substituted as follows-
 If the student has not scored minimum marks or minimum grade points mentioned in column No. 8 and if the student scores minimum marks or minimum grade points in either theory or internal assessment then he/she will be declared to have cleared either of the head.

4. In Direction No.39 of 2011, under para IX), in Table-I & II, under column No.2, i.e. 'Grade Points' and 'Final Grade' shall be substituted respectively as under.

| | | |
|----|----|----|
| O | by | AA |
| A+ | by | AB |
| A | by | BB |
| B+ | by | BC |
| B | by | CC |
| C+ | by | CD |
| C | by | DD |

5. As the revised syllabi has been accepted by the Academic Council, for the subject Computer Science of four theory papers to each semester therefore the Scheme of Examination for M.Sc. Semester-I to IV shall be as per Appendices-A, B, C & D appended to Direction No.26 of 2010, which is to be implemented for Semester-I from Winter-2012, Semester-II from Summer-2013, Semester-III from Winter-2013 & Semester-IV from Summer-2014 respectively.
 6. The students passing B.Sc. Agriculture with specialization Antomology and Fisheries shall be eligible for admission to M.Sc. Zoology with specialization Antomology and Fisheries respectively.
 7. The student having Degree of M.Sc. (Computer Software) shall be eligible for directly admission to M.Sc. Part II (Semester III) (Computer Science) in the faculty of science within the jurisdiction of sant Gadge Baba Amravati University, Amravati. The average percentage of Marks of M.Sc. (Computer software) and percentage of marks of M.Sc. (Computer Science) shall be considered to award class / Grade for awarding the degree of M.Sc. (Computer Science).

Amravati
 Date : 28/6/2012

Sd/-
 (Mohan K.Khedkar)
 Vice-Chancellor

**SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI
DIRECTION**

No. : 7 of 2014

Date: 07/05/2014

Subject : Corrigendum to Direction No.25 of 2012

Whereas, Direction No.25 of 2012 in respect of Corrigendum to Direction No.26/2010 and 39/2011 in the Faculty of Science is in existence in the University.

AND

Whereas, the Academic Council in its meeting held on 17.2.2014 vide item No.22 2) E) R-2 while considering the recommendations of Faculty of Science has approved the recommendation regarding award of M.Sc. (Computer Science) degree.

AND

Whereas, the matter is required to be regulated by framing the Ordinance and making of an Ordinance may likely to take some time.

AND

Whereas, the changes are to be made applicable from the Academic Session 2014-15.

Now, therefore, I, Dr.J.A.Tidke, Vice-Chancellor of Sant Gadge Baba Amravati University, Amravati in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Universities Act, 1994, do hereby direct as under:

- 1) This Direction may be called, "Corrigendum to Direction No.25 of 2012, Direction, 2014"
- 2) This Direction shall come into force w.e.f. the date of its issuance.
- 3) In Direction No.25 of 2012, in Para 7., the lines "The average percentage of Marks of M.Sc. (Computer software) and percentage of marks of M.Sc. (Computer Science) shall be considered to award class / Grade for awarding the degree of M.Sc. (Computer Science)" be substituted by the lines "**The class / Grade for awarding the degree of M.Sc. (Computer Science) shall be awarded on the basis of performance at M.Sc. Part-II (Computer Science) only.**"

Date : 3/5/2014

Sd/-
(Dr.J.A.Tidke)
Vice-Chancellor
Sant Gadge Baba Amravati University

**SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI
DIRECTION**

No. : 8 of 2014

Date : 07/05/2014

Subject :Corrigendum to Direction No. 14 of 2009 in respect of Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semester Degree Course).

Whereas, Ordinance No.4/2008 in respect of Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semester Degree Course), Ordinance, 2008, in the Faculty of Science is in existence in the University.

AND

Whereas, Direction No. 14 of 2009 in respect of Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semester Degree Course) in the Faculty of Science is in existence in the University.

AND

Whereas, the Academic Council in its meeting held on 17.2.2014 vide item No.22 2) E) R-1 while considering the recommendations of Faculty of Science has approved the B.C.A. degree holders of this University are eligible for admission to M.Sc. (Computer Software) course.

AND

Whereas, the matter is required to be regulated by framing the Ordinance and making of an Ordinance may likely to take some time.

AND

Whereas, the changes are to be made applicable from the Academic Session 2014-15.

Now, therefore, I, Dr.J.A.Tidke, Vice-Chancellor of Sant Gadge Baba Amravati University, Amravati in exercise of powers conferred upon me under sub-section (8) of section 14 of the Maharashtra Universities Act, 1994, do hereby direct as under:

- 1) This Direction may be called, "Corrigendum to Direction No. 14 of 2009 in respect of Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semester Degree Course) Direction 2014."
- 2) This Direction shall come into force w.e.f. the date of its issuance.

- 3) In Direction No. 14 of 2009 in respect of Examinations leading to the Degree of विज्ञान पारंगत (Master of Science) (Four Semester Degree Course), in para 3., after the lines "A person who has passed the Degree of Bachelor of Science with Post Graduate Diploma in Computer Science of this University OR" following lines be inserted

"The Candidates having B.C.A. degree of this University shall be eligible to take admission to M.Sc. Part-I (Computer Software) course OR"

Date : 3/5/2014

Sd/-
(Dr.J.A.Tidke)
Vice-Chancellor
Sant Gadge Baba Amravati University

**Syllabus Prescribed for
M.Sc Part I Microbiology (Semester I)**

THEORY

| | | |
|-----------|--|----------------------|
| Paper I | Microbial Techniques | 100 (80 + 20*) Marks |
| Paper II | Microbial Enzymology | 100 (80 + 20*) Marks |
| Paper III | Microbial Physiology and Photosynthesis | 100 (80 + 20*) Marks |
| Paper IV | Environmental Microbiology | 100 (80 + 20*) Marks |

PRACTICAL

| | | |
|--------------|--|-----------|
| Practical I | Soil Microbiology | 100 Marks |
| Practical II | Analytical Biochemistry and Instrumentation | 100 Marks |

M. Sc Part I Microbiology (Semester II)

THEORY

| | | |
|------------|--|----------------------|
| Paper V | Biostatistics, Bioinformatics and Computer Applications | 100 (80 + 20*) Marks |
| Paper VI | Enzyme Technology | 100 (80 + 20*) Marks |
| Paper VII | Microbial Metabolism | 100 (80 + 20*) Marks |
| Paper VIII | Environmental Microbiology and Extremophiles | 100 (80 + 20*) Marks |

PRACTICAL

| | | |
|---------------|--|-----------|
| Practical III | Environmental Microbiology and Biodiversity | 100 Marks |
| Practical IV | Microbial Enzymology, Biostatistics and Computer Applications | 100 Marks |

M. Sc Part II Microbiology (Semester III)

THEORY

| | | |
|-----------|-------------------------|----------------------|
| Paper IX | Molecular Biology | 100 (80 + 20*) Marks |
| Paper X | Virology | 100 (80 + 20*) Marks |
| Paper XI | Fermentation Technology | 100 (80 + 20*) Marks |
| Paper XII | Immunology | 100 (80 + 20*) Marks |

PRACTICAL

| | | |
|--------------|-------------------------------------|-----------|
| Practical V | Fermentation Technology | 100 Marks |
| Practical VI | Immunology and Medical Microbiology | 100 Marks |

M. Sc Part II Microbiology (Semester IV)

THEORY

| | | |
|------------|-------------------|----------------------|
| Paper XIII | Biotechnology | 100 (80 + 20*) Marks |
| Paper XIV | Clinical Virology | 100 (80 + 20*) Marks |

| | | |
|-----------|----------------------|----------------------|
| Paper XV | Microbial Technology | 100 (80 + 20*) Marks |
| Paper XVI | Medical Microbiology | 100 (80 + 20*) Marks |

PRACTICAL

| | | |
|---------------|---|-----------|
| Practical VII | Applied Microbiology and Biotechnology | 100 Marks |
| Project | Project Work | 100 Marks |

*** Internal assessment marks for theory Paper**

Notes:

The practical schedule of M.Sc. (Microbiology) should be as follows:

- Each practical in M.Sc. Part I should be of 8 hours duration per week (4 hrs /day for two consecutive days).
- Each practical in M.Sc. Part II (Practical II, project work & I) should be of 8 hours duration per week (8 hrs/days) for two days).
- Atleast 70% practicals should be performing during each semester.
- Examination of each practical should be at least for 10 Hr. (Split over two days)

M.Sc. Part I (Semester I) (MICROBIOLOGY) EXAMINATION

PAPER-I

MICROBIAL TECHNIQUES

- Unit-I : **Biological Relevance of pH and Buffers:-** The pH depends ionization of amino acids and proteins. Isoionic and isoelectric points. Effects of the pH change on non-protein protoplasmic components. The pH and metabolic reactions involving proton.
- Unit-II : **Absorption and Emission of Radiation:** Principles laws of absorption of radiation, visible ultraviolet and infrared Spectrophotometry. Absorption spectra, fluorescence, fluorometry, flame photometry, NMR, ESR.
- Unit III : **Isotopic Tracers techniques in Biology:-** Stable and radioactive isotopes, preparation, labeling, detection and measurement of isotopes. Dilution technique, Kinetics of radioactive disintegration.
- Unit-IV : **Chromatography:** Paper, Column, thin layer, Gas, Ion exchange and affinity chromatography, Gel filtration.
- Unit-V : **Electrophoresis:** Moving boundary, Zone (paper, gel etc.) electrophoresis. Immunoelectrophoresis, Isoelectric focussing.

PAPER-II
MICROBIAL ENZYMOLOGY

Unit-I : GENERAL INTRODUCTION :

- a) Introduction of Enzymology, Various terminologies, Properties of enzymes.
- b) Enzymes as catalyst.
- c) Enzyme activity units.

- Unit II:**
- a) Enzyme isolation and purification - Importance of purification, Methods of Purification and fractionation.
 - b) Criteria of purity of enzymes - Tests of homogeneity.
 - c) Classification, of enzymes - IUB nomenclature.
 - d) Constitutive, Inducible and marker enzymes.

Unit-III: ENZYME KINETICS:

- a) Importance of Kinetic Study
- b) Effect of Enzyme concentration on progress curves.
- c) Effect of pH and Temperature.
- d) Effect of Substrate concentration - Concepts of ES complex, Steady state and Rapid state equilibrium kinetics, Derivation of Henry - Michaelis - Menten equation of rectangular hyperbola, Significance of Vmax and Km, Transformation of H.M.M. equation to a straight line equation, Construction of Lineweaver - Burk Plot, Single and Double reciprocal plots, Limitations of H.M.M. equation, Sigmoidal saturation kinetics, Co-operatively of an enzyme, Hill's equation, steady kinetics (Haldane and Briggs equation).
- e) Bisubstrate enzyme kinetics.

- Unit- IV**
- a) Types of inhibitors (reversible and irreversible), Kinetics of enzyme inhibition (competitive, non-competitive, uncompetitive and mixed inhibitors), Graphical presentation of inhibition effects.
 - b) Kinetics of reversible reactions (Haldane's relationship)
 - c) Mechanism of action of lysozyme.
 - d) Enzyme activators, Co-enzymes and Co-factors in enzymatic catalysis.

Unit-V: MECHANISM OF ENZYME ACTION :

- a) Concept of enzyme and substrate specificity.
- b) Chemistry of active Centre, chemical modification by active site directed reagents.
- c) Factors affecting catalytic efficiency of enzymes-covalent proximate, orientation, distortion or strain, acid-base and nucleophilic effects.

- d) Various theories of mechanism of enzyme action.
- e) Mechanism of action of lysozyme.

PAPER-III
MICROBIAL PHYSIOLOGY AND PHOTOSYNTHESIS

- Unit-I : Membrane Transport :** Structure and organization of biological membranes. Types of cellular transport, Passive, facilitated, Active, Group translocation, membrane bound and binding protein transport systems. Carrier models. Liposomes. Ion transduction NaK⁺, ATPase.

- Unit II: Energy metabolism:** ATP cycle, Free energy, standard free energy change, conventions in biochemical energetic, Calculation of DG. Standard free energy of hydrolysis of phosphate, compounds, Reservoirs of high-energy phosphate groups, Energy rich bonds, Biological energy transducer.

- Unit-III : Bacterial and Mitochondrial respiration:** Respiratory chain in mitochondria and bacteria, Oxidation-reduction enzymes. Respiration linked proton translocation.

- Unit- IV : Oxidative phosphorylation:** Coupling of oxidative phosphorylation to electron transport. Uncouplers, inhibitors, Reactions of oxidative phosphorylation, Mechanisms of oxidative phosphorylation. Chemical coupling, Conformational coupling and chemiosmotic coupling mechanism

- Unit -V : Microbial photosynthesis:** Structure of photosynthetic pigments, Primary photochemistry PS I & PS II and electron transport. CO₂ fixation in bacterial photosynthesis, Anoxygenic and oxygenic photosynthesis, Halobacterial photosynthesis

PAPER-IV
ENVIRONMENTAL MICROBIOLOGY

- Unit-I : An Introduction :** Definition of environment, Interaction between environment and biota, Concept of the habitat in biosphere, Food Chain, Ecosystem, Community, homeostasis and ecosystem management.

Concept of sustainable development of ecosystem: Definition and Need of Sustainable developments. Role of bacterial technology in achieving sustainable development. Improvement and restoration of barren/degraded land. Pollution control, Renewable source of energy and fuel using microorganisms, biodiversity and its conservation

- Unit-II : **Advancement in Biogeochemical cycles :**
Nitrogen cycle : Symbiotic and non-symbiotic N_2 fixation, Mechanism of nitrogenase, cross inoculation group and host specificity, energy input/output ratio of N_2 fixation process in crop production, Biochemistry of Nitrate reduction.
- Unit -III : **Phosphorus cycle :** Significance of P element, Occurrence and solubilization in nature, role of phosphobacter and mycorrhizae in crop production.
Carbon cycle - General aspects, generation and decay of detritus C compounds, features of plant cell wall polysaccharides, cellulose & lignin degrading microorganisms, mechanism of enzymes and its products. Carbonic anhydrase and its role in carbon cycle.
Sulphur cycle - Significance of S compound, microbial sulphur metabolism, sulphur oxidizing bacteria and mechanism, distribution of sulphur bacteria in nature, Biochemistry of sulphate reduction.
Selenium cycle - Significance and occurrence, metabolism, deficiency and toxicity.
- UNIT-IV : **Biochemistry and Microbiology of acid mine drainage:** Process of biochemistry, Iron oxidizing bacteria, Microbiology and Biochemistry of Metal and Metalloid transformation-ecological succession and control. Transformation of mercury, arsenic lead and tellurium. Biotransformation of pesticides.
- Unit V **Biodeterioration :** Concept of biodeterioration. Biodeterioration of Wood, Metal, pharmaceutical products and Stone Work.
Bioleaching: Introduction, application of bacterial leaching, leaching techniques, prospective of bioleaching.

PRACTICAL-I

Soil Microbiology

- Study of antagonism in microorganism from soil.
- Isolation of soil microorganisms.
- Isolation, Identification, Enumeration of Nitrogen fixing microorganism from soil, rhizosphere, phyllosphere and root nodule.
 - Isolation of *Azotobacter* spp and *Azospirillum*
 - Isolation and cultivation of *Rhizobium* from soil and roots nodules.
 - Nodulation of legume roots - Leonard jar experiment.
 - Isolation of cyanobacteria
 - Isolation of phosphobacteria from soil.

- Estimation of nitrogen by kjeldhal method.
- Preparation of biofertilizer/Biopesticides, enumeration of titer inoculum
- Application of bioinoculant through seed, seedling and soil test under pot condition.
- Isolation and microscopic examination of iron and sulphur bacteria.

PRACTICAL-II

ANALYTICAL BIOCHEMISTRY AND INSTRUMENTATION

- Estimation of sucrose in presence of glucose.
- Determination of pK_a of amino acids.
- Estimation of proteins by biuret method.
- Estimation of protein by Folin-Ciocalteu method.
- Ultraviolet spectroscopy of proteins.
- Absorption spectrum of p-nitro phenol
- Paper chromatography of amino acids.
- Paper chromatography of sugars.
- Paper chromatography of purine and pyrimidine bases.
- Separation of proteins by paper electrophoresis.
- Separation of protein by gel electrophoresis.
- Separation of pigments by adsorption chromatography.
- Thin layer chromatography.
- Estimation of DNA.
- Estimation of RNA.

Distribution of marks in University Practical Examination:

| | | |
|--------------------------|---|-----------|
| 1. Long Experiments | - | 15 marks. |
| 2. Short Experiment | - | 10 marks |
| 3. Viva-voce examination | - | 05 marks |
| 4. Spotting | - | 05 marks |
| 5. Practical record book | - | 05 marks |
| 6. Internal Assessment | - | 10 marks |

Total - **50 marks**

M.Sc PART I (MICROBIOLOGY) EXAMINATION

(Semester –II)

PAPER-V

BIostatISTICS, BIOINFORMATICS AND COMPUTER APPLICATIONS.

UNIT-I : Biostatistics :

- Introduction:** Definition of Statistics, Statistical application in Biology, Types of statistics used in biology, sample statistics, test statistics, parametric Vs non-parametric

- b) **Sample and Sampling:** Introduction, selection of sample or sampling, theory-qualitative sample, random sample, non-random sample.
- c) **Graphical distribution of data:** Collection of data, classification of data, tabulation of data, graphic representation of data, diagrammatic representation of data
- d) **Measures of Central tendency:** Measures of central tendency, Mathematical averages, - arithmetic mean, Geometric mean, Harmonic mean, Average mean- Median and Mode.
- e) **Measures of Dispersion:** Definition, Range, Mean deviation, standard deviation, Standard error, Coefficients of variability, degree of freedom, confidence limit.

- Unit II:**
- a) **Test of Significance:** Standard error of mean, standard error of standard deviation, student's t-test, chi-square test.
 - b) **Probability:** Definitions, types of probabilities, Rule of probabilities, Random variable, probability distributions, theoretical probability distributions.
 - c) **Correlation:** Meaning of correlation, Definition, Kinds, properties of coefficient of correlation, method of studying.
 - d) **Regression:** Introduction. Difference between correlation and regression, objects of regression analysis, kinds of regression analysis, linear regression, regression equation, coefficient
 - e) **Vital statistics:** Introduction, definition, methods of obtaining vital statistics, principles, measurements of population, measures of vital statistics, measurements of Mortality, life table.

UNIT-III : Computer Fundamentals:

Basics of Computers, In-put and Out-put devices. Computer graphics. PC based software packages, Computer application in Microbiology/ Biology. Computer's role, Modern computers, personal computers, hardware, and software, Internet, Modem, freeware, Usenet, file transfer protocol, HTML, Browsers, Home page, URL, Search Engine, IP address.

UNIT IV: Bioinformatics :

- a) Introduction, Definition, Importance, Analytical Approach, Application, Bioinformatics as tool, Role of bio and Cheminformatics in drug designs, Bioinformatics in life sciences, Studying bimolecular structures.
- b) Biological Data base: Sequence database, Nucleic acid database, gene bank, proteins sequence data base, Swiss port, searching sequence data base, non reductant data base, Low annotation data base, specialized sequence data base, structure

data base, motif database, proteome data base, Other data base

- c) Sequence analysis:

Unit V : Bioinformatics Tools and Application

- a) Tools for Bioinformatics: Pair wise alignment, Dotplots, scoring matrices, Blosum Matrices, PAM matrix, Gap penalty, Alignment Algorithms EMBOSS,
- b) Proteins structure predictions: Secondary structure predictions, Tertiary structure Prediction, comparative modeling, folds recognition, Ab-initio prediction, Modeler, RASMOL.
- c) Software in Bioinformatics: C/C, BioPerl, Biojava, BIOXML, BioCorba, BioPython, BioDas, BioML, Oracle.
- d) Emerging areas in Bioinformatics: DNA microarrays, Functional Genomics, Comparative Genomics, Pharmacogenomics, cheminformatics, Medical informatics, Neural networks, phylogeny, whole cell stimulation, Human genome project.

PAPER-VI

ENZYME TECHNOLOGY

Unit-I : MECHANISM OF ENZYME ACTION :

- a) Enzyme activators, Co-enzymes and Co-factors in enzymatic catalysis.
- b) Concept of enzyme and substrate specificity.
- c) Mechanism of action of lysozyme.

Unit-II : CONTROL OF ENZYME ACTION :

- a) Regulation of enzyme activity-Feed-back control, enzyme introduction and repression, covalent modification.
- b) Multienzyme complexes and their significance in metabolic control.
- c) Membrane bound enzyme in metabolic regulation.

Unit III:

- d) Isoenzymes and their metabolic significance.
- e) Allosterism - allosteric enzymes and Co-operativity.
- f) Covalently modulated regulatory enzymes.

Unit IV: COMPARTMENTATION AND IMMOBILIZATION OF ENZYMES:

- a) Compartmentation of enzyme and substrate and its significance, Shuttle systems.
- b) Naturally occurring Activators, Inhibitors and Co-enzymes.
- c) Methods of enzyme immobilization, Industrial advantages. Immobilized multi-enzyme system.
- d) Kinetics of immobilized enzymes.
- e) Enzyme probes.

Unit V: ENZYME TECHNOLOGY:

- a) **Immobilization of Microbial enzymes:** Methods viz, adsorption, covalent bonding, entrapments and membrane confinement and their analytical, therapeutic and industrial application, Properties of immobilized enzymes.
- b) **Enzyme engineering:** Chemical modification and site directed mutagenesis to study the structure, function relationship of industrially important enzymes.
- c) **Application of microbial enzymes:** Microbial enzymes in textile, leather, wood industries and detergents, enzyme in clinical diagnostics, Enzyme sensor for clinical processes and environmental analyses, Enzymes as therapeutic agents.

PAPER-VII**MICROBIAL METABOLISM**

UNIT-I : Carbohydrate metabolism : EMP, ED, HMP, and phosphoketolase pathways in different microorganism. Fate of pyruvate. Gluconeogenesis.

Tricarboxylic acid cycle: Discovery, Intracellular location, Reactions of the cycle. Amphibolic nature. Anaplerotic reactions, Glyoxylate pathway.

UNIT II : Aerobic metabolism of C1 Compounds: Oxidation of methane, methanol, formaldehyde and formate. Ribulose pathways, Serine pathway, Xylulose monophosphate pathway.

UNIT-III : Nucleotide metabolism: Biosynthesis of purine and pyrimidine nucleotides, biosynthesis of deoxyribonucleotides, Regulation of nucleotide synthesis. Catabolism of nucleotides. Formation of coenzyme nucleotides. Inhibitors of nucleotide synthesis.

UNIT IV Microbial metabolism of aromatic compounds: Ortho cleavage pathway, meta cleavage pathway, Gentisate pathway, reductive catabolism.

Catabolism of aromatic amino acids : Tyrosine, Tryptophan, phenylalanine

Lipid metabolism : Biosynthesis of fatty acids, triacylglycerol, phosphoglyceride, sphingomyeline and sphingolipids. Oxidation of saturated and unsaturated fatty acids.

UNIT-V : Protein metabolism: Assimilation of inorganic nitrogen, **Biosynthesis of amino acids:** Branched chain amino acids, Aromatic amino acids, Sulphur containing amino acids, Basic amino acids.

Catabolism of amino acids: Glutamine, glutamate,

Aspartate, Asparagine, L-alanine, D-alanine, proline, Serine, Glycine, Arginine, polyamines, Valine, Leucine and Isoleucine, Threonine, Lysine, Methionine, Cysteine.

PAPER-VIII**ENVIRONMENTAL MICROBIOLOGY AND EXTREMOPHILES**

UNIT-I : Recalcitrant organic compounds and concept of biomagnification: Definition of recalcitrant organic compounds and their presence in natural ecosystem, concept and consequences of biomagnification, biomagnification of chlorinated hydrocarbons and pesticides. Biodegradation of recalcitrant and toxic chemicals.

UNIT II : Eutrophication, and its management: Eutrophication, Microbial changes induced by organic and inorganic pollutants, role of phosphorus and nitrogen in eutrophication, process and control of eutrophication.

UNIT III : Extremophiles - acidophilic, alkalophilic thermophilic, barophilic and osmophilic microbes - mechanisms and adoption. Halophiles - membrane variation - electron transport - application of thermophiles and extremophiles.

UNIT-IV : Water Microbiology

a) **Water treatment Process,** Disinfections, kinetics of disinfections, factors affecting disinfecting drinking water, Halogens, (Chlorine, Chloramines, Chlorine di-oxide, Bromine and iodine) ozones, metal ions, Ultraviolet disinfections,

b) **Water distribution systems,**

c) **Concept of indicator organisms,** Total coliform, MTD, MPN, MFT, P-A test, TTC, Fecal coliform, Fecal streptococci, Clostridium perfringens, Heterotrophic plate count, Bacteriophages, other indicator organisms, Standards and Criteria for indicators

UNIT V Waste water Management: Introduction to primary, secondary and tertiary treatment, activated sludge process, trickling filters, principles of anaerobic digestion, Methane formation with respect to waste treatment, Oxidation pond and stabilization pond, application of sewage, Aerated lagoons. Biochemistry of nitrate and sulphate reduction with a special reference to waste treatment.

PRACTICAL-III**ENVIRONMENTAL MICROBIOLOGY AND BIODIVERSITY**

- 1 Isolation of *Salmonella* from polluted water.
2. Isolation of phage from sewage water.

3. Assay of bacteriophages.
4. Demonstration of human enteric viruses.
5. Enumeration of coliform and faecal *Streptococci* by MF/MPN technique.
6. Examination and estimation of water for:
 - a) Ammonical nitrogen
 - b) nitrate
 - c) nitrite
 - d) dissolved oxygen
 - e) chlorides
 - f) sulphates
 - g) Chemical oxygen demand
 - h) biochemical oxygen demand
 - i) phosphates
 - j) calcium
 - k) magnesium
 - l) hardness
 - m) Alkalinity
 - n) solids-total dissolved & suspended
7. Enrichment of chemolithotrophs, methylotrophs, thermophiles, halophiles and acidophiles.
8. Enrichment and isolation of aliphatic hydrocarbon, phenol and parathion degraders
9. Study/Educational tour and submission of report.

PRACTICAL-IV

MICROBIAL ENZYMOLOGY, BIostatISTICS AND COMPUTER APPLICATION

1. Assay of following microbial enzymes.
a) Amylase b) Lipase c) Protease d) Invertase
2. Isolation and purification of certain microbial enzymes such as: protease, amylase, invertase by salt fractionation, dialysis, ion exchange.
3. Evaluation of kinetic constants of the purified enzymes.
4. Effect of different parameters on enzymes activity such as:
a) pH b) temperature c) time d) Enzyme concentration.
5. Effect of inhibitors on enzyme activity.
6. Fluidized bed column reactor using immobilized whole cell to study catabolism.
7. Immobilization of enzymes.
8. Students seminar and submission of report.
- b) BIostatISTICS:**
9. Organisation of data - frequency distribution.
10. Summarization of data -p describing a sample :
Measures of central tendency - arithmetic mean, mode, median.(for grouped data)
Measures of dispersion - variance and standard deviation.
11. Estimation of confidence interval for a normally distributed population.

12. Hypothesis testing - t-test, chi -square test, F-test.
13. Histograms.

D) COMPUTER SCIENCE AND BIOINFORMATICS :

- 14) Computer operations getting acquainted with different parts of computers.
Handling WINDOWS and Internet, E-mail and Internet. Use of CD ROM for literature search.
- 15) Accessign databases for nucleic acids and proteins.

Distribution of marks in University Practical Examination:

| | | | |
|--------------|-----------------------|----------|-----------------|
| 1. | Long Experiments | - | 15 marks. |
| 2. | Short Experiments | - | 10 marks |
| 3. | Viva-voce examination | - | 05 marks |
| 4. | Spotting | - | 05 marks |
| 5. | Practical record book | - | 05 marks |
| 6. | Internal Assessment | - | 10 marks |
| Total | | - | 50 marks |

M.Sc PART II (MICROBIOLOGY) EXAMINATION

(Semester –III)

paper-IX

Molecular biology

- Unit-I : Nucleic Acids :** Importance of nucleic acid in living systems, general composition of nucleic acids, purine and pyrimidine bases, tautomeric forms of bases, reactions of purines and pyrimidines, structure of nucleosides and nucleotides, deoxynucleotides, cyclic nucleotides and polynucleotides. Watson and Crick model for DNA. Different types of DNA and RNA
- Unit- II DNA Replication:**
- i) Enzymes of DNA replication in prokaryotes and eukaryotes, replication mechanisms in prokaryotes, eukaryotes, and phages.
 - ii) DNA repair mechanism
- Unit-III: a) Genetic recombination:** Mechanism of genetic recombination, Transformation, Transduction, Conjugation and Transposable elements
- b) Genetics and Molecular organization:** Genes concept, genome, Multigene families, Pseudogenes, split genes, overlapping genes, genetic code

- d) **Gene mutation:** Insertion deletion, frame shift and suppressor mutation, chemical and physical agents

Unit-IV: Protein Synthesis:

- a) **Transcription:** RNA polymerases in prokaryotes and eukaryotes, process of transcription, concept of promoters and promoters types, enhancers and silencers and other regulatory elements, post transcriptional processing of tRNA, mRNA and tRNA, transcripts. Post transcriptional modification, spliceosome assisted and self-splicing of RNA transcripts. RNA dependent synthesis of RNA and DNA.
- b) **Translation:** Protein synthesis, Translational process and control of translation, post-translational modification (covalent modification, phosphorylation, glycosylation, mythelation etc. protein targeting and degradation, non-ribosomal polypeptic synthesis Processing of RNA.

Unit-V : Regulation of gene expression: Gene regulation in prokaryotes - operon concepts (Lac operon and trp, arabinose operon), Negative & Positive Control, Sigma factor, Post translational regulation, etc.

Gene regulation in eukaryotes- Regulation at transcriptional and translational level, by gene rearrangement

**PAPER-X
VIROLOGY**

- Unit-I :**
- a) **Introduction to Virology:** Historical aspects: nature of viruses; origin and evolution of viruses, terminology, differentiation with other microorganisms.
- b) **General properties of Viruses:** Morphology, size, host specificity, viral structure, shape, Chemical properties, Susceptibility to physical and chemical agents, Viral Haemagglutination,
- c) **Replication:** Mechanism of virus adsorption and entry into host cell including genome replication, and m-RNA production by animal virus, mechanism of RNA synthesis, mechanism of DNA synthesis, transcription mechanism and post transcriptional processing, translation of virus, protein s, assembly, exit and maturation of progeny virions, multiplication of Bacteriophages.
- d) Viral assay, viral genetics, Nomenclature of viruses.

Unit- II : Virus-host Interaction: Epidemiology, pathogenesis, Host response to virus Infections, Laboratory diagnosis of viral infection, Immunoprophylaxis, chemophylaxis and chemotherapy of viral diseases.

Interferons and Antiviral Agents: Definition, types of interferons; Nomenclature and classification of interferon. Types of inducer, induction of interferon. Antiviral effect of interferon; Molecular basis of antiviral state: Antiviral protein(s) (AVPS): ds RNA dependent pathways and ds RNA independent pathways. Interference not mediated by interferon (intrinsic factors).

UNIT III : Laboratory Diagnosis of Viral Infections: Microscopy, Cultivation of Viruses: Animal inoculation, chick embryo and tissue-cultures (MKC, Human Embrogenic Kidney cell culture, Human Amnion cell culture). Serology, detection of viral proteins and genetics material

UNIT IV : Structure, Pathogenesis, Laboratory Diagnosis & immunology of viruses: Pox virus, Herpes viruses, Adenoviruses Picorna viruses,

UNIT V : Structure, Pathogenesis, Laboratory Diagnosis & immunology of viruses: Orthomyxoviruse, Paramyxoviruses, Arboviruses, Rubella, Arenaviruses, Rabdoviruses, Hepatitis virus. Miscellaneous virus

PAPER-XI

FERMENTATION TECHNOLOGY

UNIT-I : Bioreactors: Design and type of fermentors, unit operation and techniques, batch and continuous fermentations, evolution of bio-kinetics constants. Significance of bio-kinetic constants, Computer control of fermentation process.

UNIT II :a) Industrial production: Penicillin, streptomycin, and tetracycline.

- b) **Anticancer drug:** interferons, anthracycline, L-apspariginas es. Biotechnological application for the production of rare biological molecules, antibiotics, vaccines, steroids, hormones and diagnostic kits

Unit-III : Food and beverage production.

- a) Cottage & cheddar cheese, Yoghurt and *Dahi*
- b) Mycotoxin production
- c) Oriental food fermentations: 1) Koji 2) Soya Sauce 3) Miso,
- d) Single cell proteins, mycoproteins.
- e) Types of different alcoholic beverages and production of whisky.

UNIT IV: Food Technology:

- a) Starter culture for food industries,

- b) Production and preservation of following fermented foods:
 - i. Soya souse fermentation by moulds,
 - ii. Fermented vegetables ó Sauerkraut
 - iii. Fermented Meat ó Sausages
 - iv. Production and application of Bakers Yeast
 - v. Application of microbial enzymes in food industries.
- c) Food borne infection and intoxications, bacterial with examples of infective and toxic types: *Clostridium*, *Salmonella*, *Shigella*, *Staphylococcus*, *Compylobacter*, *Listeria*.
- d) **Quality assurance:** Microbiological quality of standard of food, Government regulatory practices and policies. FDA, EPA, HACCP, ISI.

Unit-IV: A) Biomass Production :

- i) **Bacterial biomass- production:** a) *Bacillus megatherium* b) *Acinebacter cerificans*.
 - ii) **Fungal biomass production:** *Paecilomyces varioti* by Pekilo process & *Candida utilis* from hydrocarbon.
- B) Prebiotics and probiotics**
- a) Importance of probiotics
 - b) Sources of Prebiotics
 - c) Probiotics organisms
 - d) Desirable characteristics
 - e) Benefits of probiotics consumption

**PAPER-XII
IMMUNOLOGY**

- Unit-I :** **Basic Immunology-** Anatomic organization of the immune system cell types and organs. Effect of mechanisms involved in specific and nonspecific immune mechanisms. characters. Immune Response- primary, Secondary, Immunological memory.
- Unit- II** **Antigens, and Immunogenicity,** variation in antigenic Antibody and Immunoglobulins- Structure and functions of IgG, IgA, IgM, IgD, & Ig E., Antigen-Antibody reactions.
- Unit-III :** **Clinical Immunology** - Complement system; classic and alternate pathways and functions,. Cell mediated immunity. Immunological tolerance and Immunosuppression. Tumors Immunological. Autoimmunity and Autoimmune diseases,
- Unit- IV :A)** Hypersensitivity, Immune deficiency diseases, MHC class Molecules.

- B) Conventional vaccines, peptide vaccine, subunit vaccine, genetically engineered vaccines, production and application of lymphokines. Antibody diversity, Immunogenetics.

Unit-V : Immunobiotechnology & Hybridoma Technology:

Immuni zation of animals, isolation of stimulated spleen cells, myeloma cell lines used as fusion partners, fusion method, detection and application of monoclonal antibodies,

**PRACTICAL-V
APPLIED MICROBIOLOGY**

a) Applied microbiology

- 1) Isolation of antibiotic producing organism from soil.
- 2) Microbiological assay of antibiotics and purification by ion-exchange resin.
- 3) Determination of k_{la} for fermenter.
- 4) Preparation of yoghurt, koji, cheese. Idli
- 5) Preparation of Flavor and aroma.
- 6) Solid state fermentation of some product.
- 7) Microbiological assay of amino acids .
- 8) Microbiological assay of vitamins.

b) Plant tissue culture:

- 9) Preparation of media for plant cell culture.
- 10) Callus from explants.
- 11) Haploid cell culture.
- 12) Proto-plast culture.
- 13) Educational tour and submission of report.

**PRACTICAL-II
IMMUNOLOGY AND CLINICAL MICROBIOLOGY**

1. Diagnostic methods for isolation and Identification of pathogenic microorganisms from the following specimens:
 - (a) Blood (b) Urine (c) Cerebrospinal fluid (d) Throat (Swabs)
 - (e) Sputum (f) faeces (g) Pus and wound (infection) fluid.
2. **Isolation and identification of following pathogenic bacteria:**
 - (a) *Staphylococcus aureus* (b) *Streptococcus pyogenic*
 - (c) *Streptococcus pneumonia* (d) *Salmonella typhi* and *paratyphi* A.B.C. (e) *Shigella* Species (f) *Escherichia coli* (g) *Proteus vulgaris*
 - (h) *Pseudomonas aeruginosa* (i) *Vibrio cholera* (j) *Mycobacterium tuberculosis* (k) *Clostridium titanicae*
3. **Serology:**
 - a) VDRL Test b) RPR test c) Kahn test d) Widal test
 - e) C-Reactive protein f) Anti streptomycin-o g) R.A. Factor

- h) ELISA test i) Surface visual B-96 test (ELISA)
j) Latex agglutination test (pregnancy test)
- 4. Diagnostic Immunology:**
- Double diffusion methods of ouchterolony
 - immunoelectrophoresis
 - Quantitative determination of plasma protein by immunoelectrophoresis.
 - Single radial immunodiffusion.
 - Estimation of antigen-antibody response by immunodiffusion technique.
 - Estimation of antigen- antibody response by immunoelectrophoresis.
- 5. Preparation of monoclonal antibodies.**
- 6. Hematology:**
- Estimation of HB, b) PCV c) Blood cell counts W.B.C. & R.B.C.
 - ESR e) blood smear examination f) bleeding time g) clotting time
 - prothrombin time i) prothrombin determination j) Lab. diagnosis of leukaemias.
- 7. Study of medical Parasitology:**
- E. histolytica* b) *Trypanosomes*
 - Leishmania and d) Plasmodium
- 8. Stool Examination for:**
- Ova, cysts of intestinal parasite blood cell and pus cells b) Occult blood, c) Characteristics of the stool in amoebic and bacillary dysentery.
- 9. Antibiotic and chemotherapeutic agents:**
- Antibiotic sensitivity test.
 - Assay of antibiotic level in the body fluids.
- 11. Routine examination of urine.**
- 12. Student seminar and submission of report.**

Distribution of marks in University Practical Examination:

| | | |
|------------------------------------|---|-----------------|
| 1. Long Experiments (At least two) | - | 15 marks. |
| 2. Short Experiments | - | 10 marks |
| 3. Viva-voce examination | - | 05 marks |
| 4. Spotting | - | 05 marks |
| 5. Practical record book | - | 05 marks |
| 6. Internal Assessment | - | 10 marks |
| Total | - | 50 marks |

M.Sc Part II (Semester IV)
Paper XIII
BIOTECHNOLOGY

Unit-I : Genetic Engineering

- Enzymes used in recombinant DNA technology:** Endonucleases, ligases, Enzymes to modify DNA molecules.
- Vectors:** Plasmids, plant vector, bacteriophages, cosmids, phagmides, animal viruses, plants viruses, special vectors.

UNIT II : Genes cloning in prokaryotes & Eukaryotes: Isolation of gene, Methods of gene transfer, Selection and screening of recombinant DNA, nucleic acid hybridization and dot curves, southern, northern and western blotting techniques, dot and slot blots, colony hybridization.

UNI III : Cloning strategies:

- Cloning from m-RNA and genomic DNA, synthesis of gene, gene probes, gene banks, gene libraries, mapping of gene, DNA sequencing, RFLP, DNA finger printing, site direct mutagenesis.
- Polymerase chain reaction & gene amplification.

Unit-IV : Plant Biotechnology:

- Culture media and plant cell culture
- Tissue culture, micropropagation and somaclonal variation
- Production and use of haploid cell culture
- Protoplast culture, regeneration and somatic hybridization
- Gene transfer method in plants, transgenic plants and animals.

Unit-V : Application of Biotechnology:

- Application in agriculture, plants and animal improvement.
- Enzyme biotechnology
- Protein engineering, immunotoxins and drug designing
- Metabolic engineering for over production of metabolites.
- Use of microbes in industry and agriculture
- Application to medical sciences, gene therapy, genetic counseling, diagnosis of diseases and phenomenon of ageing.
- Control of environmental pollution, recovery of minerals and restoration of degraded lands

PAPER-XIV

CLINICAL VIROLOGY

- Unit-I :** **Plant Viruses:** Classification, life cycle and replication of tobacco mosaic virus (TMV), PVX, PVY, CMV, TSWV, CaMV, Cynophages, Mycoviruses
- Unit-II :** **Bacterial Viruses:** Life cycle, Structure and replication of following RNA and DNA phages: Ox 174 phage, T4 phage; Lambda phage. (Lyric and glycogenic Cycle); Ft phage; MS2, f2, QB phages and Mud phage and O6 phage.
- Unit- III :** a) **Oncogenic Viruses (Tumor Viruses) :** Classification of viruses characteristics of virus transformed cell or tumor cell.
i) DNA - Containing Tumor Viruses :
ii) RNA - Containing Tumor Viruses : Retroviruses (oncornaviruses) .
- Unit- IV :** a) **AIDS viruses: Retro viruses, HIV**
- Unit- V :** **Viroids and Prions.**

PAPER-XV

MICROBIAL TECHNOLOGY

- Unit - I :** Isolation and screening of microorganisms, maintains of isolates/ strains, Inoculum developments, sterilization, strain improvement, process development, Downstream processing, In situ recovery of products. General scale up procedure
Solid-state fermentations
Manufacturing cost estimation
Principal and general consideration in down stream processing.
- Unit-II:** a) **Fermentation of acids:** Aspartic acid, L glutamic acid and Gluconic acid.
b) **Modern trends in Microbial Productions:** Bioplastic (PHB, PHA) Biopolymer (Dextran, alginates, xanthan, Pullulan)
- Unit- II** **Fermentation Of enzymes and Amino acids:** Amylase, Protease. Riboflavin, cyanocobalamine,
- Unit- III :** **Enzyme biotechnology:** Immobilization of enzymes - (glucose -isomerase) Methods, bioreactors and application in industry. Enzyme electro catalysis. Biosensors- Bioelectodes, Optrons, Immunological biosensors.
- Unit-IV :** **Fuel Biotechnology:** Biofuels, Energy crops, Biogas, Bioethanol, Biobutanol, Biodiesel, Biohydrogen.

Unit- V : Biofertilizers and Biopesticides.

- a) Basic concept: PSM, N₂ Fixer, S-solubilizers etc, K-solubilizers
b) Biomass production
c) Formulation (Carrier based, dried, liquid, and mixed inoculum)
d) Application methods
e) Inoculation quantity concept.
f) Biopesticides: Bacterial, fungal, viral etc.
g) Biocontrol mechanism,
h) Preparation and application of Biopesticides

PAPER-XVI

MEDICAL MICROBIOLOGY

- Unit-I :** **Pathogenic bacteria and laboratory diagnosis:**
Staphylococci, Streptococci including pneumococci, Mycobacterium tuberculosis and M. leprea
- Unit-II** **Pathogenic bacteria and laboratory diagnosis:**
Escherichia, Klebsiella, Proteus, Salmonella, Shigella, Pseudomonas, Bordetella, Heamophilus, Vibrio, Camphylobacter, Treponema, Borrelia, Leptospira, Corynebacteria, Mycoplasma and Rickettsia.
- Unit-III** **Pathogenic fungi and their laboratory diagnosis:**
Microsporium, Trichophyton, Epidermophyton, Candida albican, Cryptococcus neoformans, Blastomyces dermatitidis and Histoplasma capsulatum.
- Unit- IV** **Parasites and their laboratory diagnosis:**
Entamoeba histolytica, Leishmania donovani, Trypanosoma spp., Plasmodia species, Taenia saginata, Taenia solium Echinococcus granulosus, Hymenolepsis nana, Ascaris lumbricoides, Enterobius vermicular and Wuchereria bancrofti.
- Unit V :** **Clinical Microbiology:** Normal microbial flora of human body, sore throat and pneumonia, UTI, Diarrahaial diseases, Meningitis, Bacterimia, septicimia, Infective Endocarditis, PUO, STD, Hospital acquired infections, , Prophalaytic imuunization, antimicrobial therapy, Antimicrobial sensitivity testuing, Hospital waste management, Vechicals and vectors.

PRACTICAL-VII
APPLIED MICROBIOLOGY AND BIOTECHNOLOGY
RECOMBINANT DNA TECHNOLOGY

- 1) Agarose gel Electrophoresis
- 2) Restriction Digestion of DNA
- 3) DNA Ligation
- 4) DNA Molecular size Determination
- 5) DNA Fingerprinting
- 6) Southern hybridization
- 7) Restriction Mapping
- 8) In vitro Transcription
- 9) Southern Blotting
- 10) Northern Blotting
- 11) Plasmid preparation
- 12) Genomic DNA isolation.
- 13) Gene Cloning
- 14) Bacterial Gene expression.
- 15) Bacterial Transformation
- 16) Bacterial Conjugation
- 17) Bacterial Transduction
- 18) Whole Blood DNA extraction.
- 19) Educational tour and submission of report.

Project work (Marks 50)

Distribution of marks in University Practical Examination:

| | | |
|------------------------------------|---|-----------------|
| 1. Long Experiments (At least two) | - | 15 marks. |
| 2. Short Experiments | - | 10 marks. |
| 3. Viva-voce examination | - | 05 marks |
| 4. Spotting | - | 05 marks |
| 5. Practical record book | - | 05 marks |
| 6. Internal Assessment | - | 10 marks |
| Total | | 50 marks |

Distribution of marks in Project work Examination:

| | | |
|------------------------|---|-----------------|
| 1. Valuation project | - | 40 marks |
| 1. Internal Assessment | - | 10 marks |
| Total | | 50 marks |

Project Work -

Examination of Project Work :

1. The examination should be held at the centres of practical examination.
2. There shall be panel of examiners including Head of the department and the Supervisor of the Student.
3. There should be at least 2 to 3 external examiners for a batch of up to 10 Students or 3 to 5 external examiners for a batch of more than 10 Students.
4. The Students should submit the project reporty within 20 days after the last/final theory paper in University examination.
5. The date of Viva-voce examination on project work should be within the 30 days after the completion of theory examination

Distribution of marks in Project work examination:

| | | |
|---|--|-----------------|
| 1. Evaluation of Project | | 20 marks |
| 2. Viva--voce (Jointely by internal and external examiners) | | 20 martks |
| 3. Internal Assessment | | 10 marks |
| Total : | | 50 marks |

Books recommended for M.Sc. Part-I & Part-II (Microbiology)

1. Biophysical Chemistry - Upadhyay & Nath (Himalaya Pub.)
2. Practical Biochemistry - Plummer (TMH Pub.)
3. Principal of Biochemistry - Lehninger (CBS Pub.)
4. Practical Biochemistry - Jayraman (Wiley Estern Pub.)
5. Physical Biochemistry - Morrison (Oxford)
6. Enzyme - Dixon & Webb
7. Fundamentals of Enzymology - Lewis (Oxford)
8. Bacterial metabolism - A.H. Rose
9. Biochemistry - West & Toad
10. Out line of Biochemistry - Corn & Stump. (Wiley Eastern Pub.)
11. Soil Microbiology - Alexander (Wiley Eastern Pub.)
12. Genes VIII - Lewin (Oxford)
13. Element of Biotechnology - P.K. Gupta. (Rastogi Pub.)
14. Fundamentals of Biotechnology - Purohit & Mathur (Agro Bot. Pub.)
15. Essentials of molecular biology - Freifelder D. (Narosa Pub.)
16. A textbook of biotechnology - Duby (S. Chand Pub.)
17. Molecular Biology - Freifelder D. (Narosa Pub.)
18. Microbial Genetics - Freifelder D. (Narosa Pub.)

19. Text Book of Molecular Biology - Shastry & Other (Macmillan)
20. Hand Book of Tissue Culture (ICAR Pub.)
21. A textbook of Biotechnology - H.D. Kumar (E.W. pub.)
22. Basic Biotechnology Rev. Iganacimuthu (TMH Pub.)
23. Plant viruses - Mandahar (S. Chand & Co.)
24. Microbiology Lewis. (Harper)
25. Microbiology - Fundamentals & Application - Purohit. (Agro Botanical Pub.)
26. Industrial Microbiology - Casida (Wiley Eastern pub.)
27. Press Scott and Dunnø Industrial Microbiology.
28. Microbiology - Anantnarayan & Panikar (Orient Longman)
29. A text book of Microbiology, ô P. Chakraborty (Central Pub.)
30. Medical Microbiology - Ichhapunani & Bhatia (J.P. Brothers)
31. Essential of Medical Mycology - Evans & Genitals (Churchill and Livingston)
32. Genetics by Strickbeger (Prentice Hall)
33. A short textbook of recombinant DNA technology Watson. (Black Well)
34. Molecular Biotechnology - Prime Rose - (Black Well.)
35. Immunology by Shetty - (Wiley Eastern Pub.)
36. Molecular biology of genes. Watson - (Begamin Cumming))
37. Recombinant DNA technology - Rodriguez (Begamin Cumming)
38. Advances in molecular genetics. Puhlar. (Begamin Cumming)
39. Molecular cloning - A lab manual. (Cold spring harbor lab pub.)
40. Concept of molecular biology - Rastogi (Wiley Eastern Pub.)
41. Genetic Engineering - Sandhy Mitra (Macmillan)
42. Elementary Microbiology Vol. I Vol. II (Fundamental of microbiology and microbial world) Ed. by H.A. Modi. (Akta Prakashan)
43. Applied microbiology. Ed. by H.A. Modi. (Akta Prakashan)
44. Environmental Microbiology. Ed. by H.A. Modi (Akta Prakashan)
45. Fundamentals of Dairy Microbiology by J.B. Prajapati (Akta Prakashan)
46. Bio-Fertilizer. By Vyas & Modi (Akta Prakashan)
47. Biochemistry. By D. Das (Academic Pub.)
48. Biophysics & Biophysical Chemistry. By D. Das. (Academic Pub.)
49. Modern Immunology. By A. Das Gupta (Jaypee Pub.)
50. A textbook of microbiology by P. Chakraborty (New Central Book Agency)
51. Principal of gene manipulation by Old & Prim Rose (black well pub.)
52. Agricultural microbiology by Rangaswami & Bagyaraj (PHI)

53. An introduction to recombinant DNA by A.E.H. Emery (ELBS)
54. Concepts in Biotechnology by D. Bakasubramuniam and other (University Press.)
55. Introduction to genetics Engineering by D.S.T Nicholl (Cambridge)
56. Genetics by P.K. Gupta (Rastogi Pub.)
57. Genetics by Sandhya Mitra (TMH)
58. Applied plant biotechnology by Iganacimuthu (TMH)
59. Immunodiagonostics S.C. Rastogi (Wiley Eastern Pub.)
60. Immunology by Roitt. (Black well)
61. A textbook of Microbiology. R.C.Dubey and D.K.Maheshewari. (S.Chand & Company)
62. Genetics - A.V.S.S. Sambamurty (Narosa Pub.)
63. Concept of Molecular Biology. P.S. Varma & V.K. Agrawal. (S.Chand & Company)
64. General Microbiology S.B. Sullia and S. Shantharam. (Oxford & IBH)
65. Modern Concept of Biotechnology. H.D.Kumar (Vikas Pub.)
66. Fundamentals of Enzymology - Price and Steven (Oxford Sci.Pub.)
67. Gene VII - Lewis (Oxford Science Publication)
68. Molecular Cell Biology, Berk, Lipursky, Baltimore, Darnell and Matsudaira (W.H. Freeman and Company)
69. Biotechnology - Rhem and Reead
70. Standard method s of Biochemical analysis - S.R. Thimmaiah (Kalyani Publisher).
71. Laboratory Manual of Bacterial Genetics - Institute of Microbial Technology - Chandigarh.
72. A textbook of Industrial Microbiology - Wulf Crueger and Annekiese Cruger (Panima Publishing Corporation)
73. An Introduction to electrophoresis - K. Anbalgan (The Electrophoresis Institute, Salem Dist.S. India.)
74. Waste water microbiology - Gabrian Bitton (John Wiley & Sons)
75. Environmental Microbiology - Ralph Mitchell (John Wiley and Sons).
76. Microbial Biotechnology - Fundamentals of applied Microbiology - Alexander N. Glazer, and Hiroshi Nikoidu (W.H. Freeman and Company)
77. Gene structure and expression - John D. Hawkins (Cambridge University Press)
78. Biotechnology - John G. Smith, (Cambridge University Press)
79. Plant Biotechnology - S. Ignacimuthu S.J. (Oxford and IBH, New Delhi)
80. Advanced molecular biology - R.M.Twyman (Viva book Pvt.Ltd.)

81. Introductory Microbiology - J.Heritage, E.G.V. Evans and R.A.Killington (Cambridge University Press)
82. General Microbiology - Schiegel (Cambridge University Press)
83. Gene Structure - Hawkins (Cambridge University Press)
84. Modern Concepts of Biotechnology - H.D.Kumar, (Vikas Publishing Pvt.Ltd.)
85. A textbook of Microbiology - R.C.Dubey and D.K.Maheshewari (S.Chand & Company)
86. Biotechnology - Applications and Research - Edited by Paul Cheremisinoff and Robert Ouellete (Technomic Pub.Co.Inc.)
87. Basic and Clinical Immunology - Daniel Stites, Abba Terr & Tristram Parslow (Prentice Hall International INC)
88. A Text Book of Biochemistry with Clinical correlation - Edited by Thomas Devlin (John Wiley and Sons, INC).
89. Microbiology Laboratory - Fundamentals and Application, George Wistreich (Prentice Hall)
90. Microbiology - A Laboratory Manual - James Cappucino and Natalic Sherman (The Benjamin / Cummings Pub.Co.Inc.)
91. Foundations in Microbiology - Kathleen Talaro & Arthur Talaro (Wm.C. Brown Publishers)
92. Principles of Microbiology - Ronald Atlas Mosby.
93. Fundamentals of Microbiology - Alcamo (Benjamin / Cummings Pub.Co.Inc.)
94. Sale and Molecular Biology - Concepts and experiments - Gerald Karp (John Wiley and Sons, INC).
95. Cellular and Molecular Immunology - Abul Abbas, Andrew Lichman & Jordan Pober (W.B.Saunders Co.)
96. Biochemistry-Zubay (Wm C.Brown Publishers)
97. Life-An Introduction to Biology - Beck, Liem & Simpson (Harper Collins Publishers)
98. Genetics - A. V.S.S. Sambamurthy (Narosa Publication)
99. Water Pollution - V.P.Kudesia, (Pragati Prakashan Meerut)
100. Physicochemical Examination of Water, Sewage and Industrial waste - N. Maniwasakam (Pragati Prakashan, Meerut)
101. Textbook of Biochemistry - O.P.Agrawal, G.R.Agrawal (Goel Publishing House, Meerut)
102. Textbook of Medical Mycology - Jagdish Chander (Interprint, New Delhi)
103. An introduction to Plant tissue and Cell culture - N.C.Kumar (Emkay Publication Delhi)
104. Short Protocols in Molecular Biology - Edited by Ausubel, Brent, Kingston, Moore, Seidman, Smith and Struhl (John Wiley and Sons)

105. Molecular Cell Biology - Darnell, Lodish and Baltimore, (Scientific American Books)
106. Technological Applications of Biocatalysts - Published on behalf of Open University and University of Greenwich (Butterworth-Heinemann).
107. Microbiology-Principle and Explorations - J.G.Black (John Wiley and Sons)
108. Techniques for engineering Genes - Published on behalf of Open University and University of Greenwich (Butterworth-Heinemann).
109. Biotechnological Innovations in Energy and Environmental management - Published on behalf of Open University and University of Greenwich (Butterworth-Heinemann).
110. Medical Microbiology- Mims, Playfair, Roitt, Wakelin and Williams (Mosby)
111. Principles of Enzymology for the Food Sciences (John Whitaker, Marcel Dekker, Inc.)
112. Biostatistics - A Foundation for analysis in Health Sciences - W.D.Daniels, John Wiley and Sons.
113. Basic Statistics - C, Dunn
114. How Computers Works - Ron White, Techmedia.
115. How the Internet works - Preston Gralla, Techmedia.
116. Bioinformatics - 1998 - Baxevanis
117. Bioinformatics - 2000 - Haggins & Taylor OUP.
118. Fundamentals Biostatistics- Sadguru Prakash, Emkay Publication, New Delhi.
119. Bioinformatics for Beginners - Dr.K.Mani & N. Vijayraj (Kalai Kathir Achchagani Pub. Coimbatore)
120. Instant Notes - Bioinformatics - West head, Parish and Twyman (Viva Publication) New Delhi.
121. Schaum's Outlines - Biochemistry, Kuchel & Ralston (TMH Edition)
122. Schaum's outlines - Microbiology (TMH Edition)
123. Schaum's outlines - Molecular and cell Biology (TMH Edition)
124. Principles of Genetics - R.H.Tamarin (TMH Edition)
125. Biotechnology DNA - Protein A Laboratory project in molecular Biology. Thiel, Bissen & Lyons (TMH Edition)
126. General Enzymology, Kulkarni and Deshpande, Himalaya Publishing House.
127. Modern Approaches to Soil and Agriculture and Environmental Microbiology, Shiva Aithal and Nikhilesh Kulkarni, Himalaya Publishing House.

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SYLLABUS PRESCRIBED FOR CERTIFICATE COURSE IN
CLINICAL LABORATORY TECHNOLOGY.
THEORY

B.Sc I

CCLT
CCLT

Anatomy

Anatomical structure and location/distribution of different part of human body with anatomical terms and planes.

- Gastro intestinal tract.
- Salivary glands, stomach, intestine.
- Liver, Gall bladder, spleen, pancreas
- Respiratory system
- Kidneys, Ureter, Bladder.
- Testes (male genital organ)
- Ovaries, Uterus, Vagina, Urethra.

II: Physiology

- Blood composition and function.
- Normal counts of blood cells and their function.
- Steps of coagulation, anticoagulants
- CSF
- Blood grouping, ABO and Rh typing.

Cardiovascular system,

- Heart structure and function.
- Blood vessels.
- Circulation
- Pulse, Blood pressure, Electrocardiogram.

Respiratory system:

- Organs of Respiration.
- Transport of O₂ and CO₂ in the blood.

Excretory System:

- Functions of Kidneys.
- Functions of Glomerular tubules.
- Composition of normal and abnormal urine.

Digestive System :

- Function of stomach, saliva, gastric juice, pancreatic juice.

Endocrine Glands :

- Definition of endocrine glands, name and Hormones secreted.
- Action of hormones.

Reproductive System :

- Sex organs, male and female.
- Testes and ovaries.
- Contraceptives.

Unit III : Elementary Clinical Biochemistry

- Elementary knowledge, handling, maintenance, and care of analytical instruments.
- a) Centrifuge
- b) Balance
- c) Colorimeter.
- d) Definition, classification and examples of carbohydrates, proteins, and lipids.

Unit IV : Microbiology

1. Introduction to Microbiology, Morphological classification of Bacteria.
2. Cultivation of bacteria aerobic and anaerobic.
3. Culture media, types of media, special media.
4. Sterilization and Disinfection (Physical and Chemical methods)
5. Morphology and Pathogenicity of Staphylococci, Streptococci, Salmonella, Shigella and Vibrio.
6. Morphology, Pathogenicity and methods of isolation of Mycobacterium tuberculosis and Mycobacterium leprae.
7. Antimicrobial susceptibility test.
8. Preservation of stock cultures.

Unit V : Haematology and clinical pathology.

1. Introduction to Haematology.
2. Collection of blood - ways of collection.
3. Anticoagulants.
4. Red cell count - Haemocytometry.
5. White cell count - TLC
6. Differential white cell count. (DLC)
7. Absolute Eosinophil count.
8. ESR
9. Haematocrit - Packed cell volume (PCV)
10. Haemoglobin estimation.
11. Red cell indices MCV, MCH, MCHC.
12. Reticulocyte count.
13. Sickel cell preparation.
14. Osmotic Fragility test.

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15. Preparation of Bone Marrow.
16. Morphology of Normal and Abnormal cells.
17. Coagulation test.
18. Bleeding time, clotting time.
19. Urine analysis (Normal constituents, Physical examination, chemical examination & Microscopic examination.)
20. Stool Examination (Normal and Abnormal constituents)
21. C.S.F. Examination (Normal and Abnormal Cell counts and different counts.)
22. Semen Analysis : (Physical examination, Mortality and Morphology)
23. Blood grouping and Blood Banking.

PRACTICALS

Anatomy :

1. Study of permanent slides of cells and tissues.
2. Surface marking of body
3. Skeletal system, bones and joints.

Physiology :

1. Microscope, usage, maintenance, cleaning and minor repair.
2. Osmotic fragility test.
3. Identification of RBC under microscope.
4. DLC, Platelets, Reticulocytes.
5. To obtain sample of plasma and serum.
6. Preparation of oxalate, citrate, fluoride and EDTA anti coagulant Bulbs.
7. Haematocrit (PCV)
8. Neubour's chamber, pipettes (RBC/WBC), western green pipettes.
9. Haemoglobin estimation (By Sahli's method)
10. Blood pressure and pulse
11. Examination of urine glucose and protein.
12. Record/Report writing.

Clinical Biochemistry :

1. Cleaning of Glassware.
2. Maintenance of laboratory instruments and cleaning.
 - i. Centrifuge.
 - ii. Colorimeter.
 - iii. Spectrophotometer.
 - iv. Microscope.
3. Estimation of serum Bilirubin, Blood Sugar, Blood Urea, Serum Creatinine, Uric acid, Cholesterol. Serum Acid phosphatase, Alkaline phosphatase, SGOT, SGPT, Serum Sodium/Potassium.
4. Qualitative and Quantitative estimation of urine sugar and protein.
5. C.S.F. protein, and sugar.

Microbiology

1. Gram staining technique.
2. Acid fast staining (Z-N)
3. Motility by hanging drop method.
4. Cultivation of UTI isolates.
5. Culture and sensitivity test (Kirby-Bauer method)
6. Biochemical test (Glucose, Lactose, Mannitol, Indole, MR, V.P.Citrate)

Haematology and Clinical Pathology.

1. Haemoglobin estimation by Sahli's method.
2. R.B.C. count.
3. TLC
4. DLC
5. Platelet count
6. Reticulocyte count.
7. Bleeding time, clotting time.
8. Examination of blood smear (Peripheral smear)
9. Eosinophil count: LE cell test, E.S.R. sickle cell test.
10. Stool examination for ova, cyst, Amoeba, Exudate, fat globule.
11. Routine Urine analysis
12. Sputum Analysis.
13. Semen Analysis.
14. C.S.F. examination.
15. Bone Marrow smear Preparation.
16. Blood group: ABO and Rhfactor.

Field work / Project work : Project work : field work involving 90 hrs. minimum laboratory work and based on critical st of any one of the topics included in theory or practical should be completed for Certificate course. Project report of ab 30 pages be submitted.

The B.G.E. Society's

SHRI R. L. T. COLLEGE OF SCIENCE, AKOLA

Re-accredited with 'A' Grade by NAAC with CGPA 3.12



**DEPARTMENT OF PHYSICS &
INTERNAL QUALITY ASSURANCE CELL (IQAC)**



Conducting
"DIPLOMA COURSE IN ASTRONOMY"

Accredited by
**Department of Lifelong Learning & Extension
Sant Gadge Baba Amravati University, Amravati.**

**Registration Start
23rd November 2020**

**Last Date of Registration and Payment
30th November 2020**

**Course Fees
₹ 1500**

- **Course Duration : 6 Months**
- **Accessibility: Min. 20 Students**
- **Eligibility: 12th Pass**

Course Examination:

- **Theory Exam (40 marks) will be conducted by university.**
- **Practical Exam (60 marks) will be conducted by college.**

ORGANISERS

Shri S. R. Jaiswal
Course Coordinator

Dr. V. D. Nanoty
Principal/ Chairman

For More Details Contact to:

Shri Shailesh R. Jaiswal

(Coordinator)

Asst. Professor,

Department of Physics

Shri R. L. T. College of Science, Akola

(Mail ID: srjaiswal07@gmail.com)

Mob. No.: 8806070156

Note:

- 1. The Course will be start from 1st December 2020 (Online/Offline)**
- 2. For Admission Contact to Coordinator in Physics Department.**
- 3. Certificate will be provided by University after successfully completion of the course.**

Objective of the course:

- To develop interest in the field of astronomical science among students.
- To cultivate public awareness and appreciation of astronomy as a hobby and science.
- To motivate students for scientific study for higher education in the field of space and astronomy by performing simple projects.
- To developed the skill how to designed optical instruments so that students enable to start business/projects of astronomical instruments.

Details of the Physical Infrastructure to be provided for the course:

i) Classroom: Sufficient class rooms are available in the college for online and offline classes.

ii) Library: Books of Astronomy are available in our library

iii) Practical set:-

- A telescope “Sky watcher-8 inch flex Dobsonians (Newtonian reflecting telescope).
- Refractor Telescope
- Sextant
- Two Binoculars (7 X 50 and 7 X 35).
- Star Dials (English & Marathi).
- Green Laser Beam.
- Astronomical Model.
- Celestial Glob.

Course Details:-

| Sr. No. | Course/subject/Units | Type of Theory/ Practical | Credits | Total Marks |
|---------|--|---|---------|-------------|
| 1 | History of Astronomy | PPT, VIDEOS Lectures | - | 10 |
| 2 | Sky and Coordinate system in Astronomy | PPT, VIDEOS Lectures | - | 10 |
| 3 | Sky observations at night | PPT, VIDEOS Lectures | - | 10 |
| 4 | Astronomical Instruments | PPT, VIDEOS Lectures | - | 10 |
| 5 | Practical | Field work/Project work/ Assignment/ Seminars | - | 60 |
| | Total | | - | 100 |

Draft Syllabus

Unit I: History of Astronomy

(10 Marks)

- Pre historic astronomy
- Early ideas of heavens
- Astronomy as tool in everyday life and basis for religion.
- Contributions by ancient Hindu, Arabic and Greek astronomers or thinkers like Ptolemy, Aryabhata, Varahmir, Nicolas Copernicus, Johannes Kepler, Galileo Galili, Tycho Brahe, Issac Newton etc.

Unit II: Sky and Coordinate system in Astronomy (10 Marks)

- Aspect of sky at a given place
- Sky conditions for astronomical observations
- Identification of some prominent stars in the night sky
- Spherical coordinate system.
- Latitude and longitude at a place on the earth.
- Celestial coordinate system (RA and Dec).
- Concept of celestial equator, elliptic and equinoxes.
- Precession of equinoxes.
- Astronomical definition of time.
- Visual magnitude system for stars and planets.

Unit III: Sky observations at night

(10 Marks)

- Ideal sky for astronomical observations.
- Constellation including Zodiac belt.
- Sky charts.
- Motion of moon.
- Apparent motion of sun.
- Motion of planets.

Unit IV: Astronomical Instruments

(10 Marks)

- Sextant: Principle of working and its application for measurement of coordinates of stars and planets.
- Introductions about lenses and mirrors.
- Types of Telescope, Constructions & Working, Handling the Telescope, Binocular, Telescope with mobile camera.

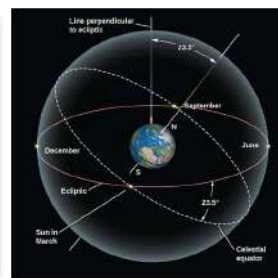
Practical Work :(60 marks)

The distribution of marks for practical examination will be as follows:

- Students must be performing **Astronomical Related Projects**. (15 marks)
- Students must be Submitted **project report**. (In project report, every student should be asked to submit the detailed report on one of project he or she has performed.) (05 marks)
- Students must be Submitted **visit report**. (Planetarium or any other astronomical related place/ institutions) (10 marks)
- Students give Seminars **any topics related to syllabus**(10 marks)
- Students must be Submitted detailed report on **Night Sky Observations** in every lecture during the whole Course. (20 marks)

Tentative Project List:

- Phases of the Moon
- Measuring the Diameter of the Sun
- Planets and Planetary Systems
- Nebulas and Galaxy
- Mechanism of the Seasons
- Constellation including Zodiac belt
- Solar & Lunar eclipse
- Telescope Making
- Spacecraft
- Rocket Launcher
- Artificial Satellite





The B.G.E. Society's

SHRI R. L. T. COLLEGE OF SCIENCE, AKOLA

Re-accredited with 'A' Grade by NAAC with CGPA 3.12

Department of Zoology & I.Q.A.C.

Conducting

“DIPLOMA COURSE IN SERICULTURE”

Accredited by

Department of Lifelong Learning & Extension

Sant Gadge Baba Amravati University, Amravati.

**Registration from
23rd November 2020**

**Last date of Registration
30th November 2020**

**Course Fees
Rs. 1500/-**

Organizers

Dr. Rashmi Joshi Sawalkar

Course Co-ordinator

Dr. V.D. Nanoty

Principal / Chairman

For More Details Contact:

Dr. Rashmi Joshi Sawalkar

(Coordinator)

Asst. Professor,

Department of Zoology

Shri R. L. T. College of Science, Akola

Mail ID: rashmisawalkar75@gmail.com

Mob.no. 9923074666

Note:

1. The list of selected students will be displayed on 1st December 2020.
2. For Admission Contact to the Coordinator in Department of Zoology.
3. Regular classes will start from first week of December 2020.
4. Certificate will be provided by University after completion of the course.

Objective of the course:

- To develop interest in the field of Agriculture science & Entrepreneurship.
- To Develop public awareness about Sericulture.
- To motivate students for scientific study in the field of Agro-based Industry by performing simple projects and field visits.
- To developed the skill, how to develop and earn regular incomes through sericulture.
- Government Subsidies' and Schemes are provided for the motivation for Sericulture.
- Entrepreneurship can be developed with Minimum Finance and few labours.

1)Infrastructure available:

a) Classroom: 3 digital Class Rooms

b) Lab: - Laboratory and silkworm rearing house

2) Details of course wise teaching aids':-

- i) Books and Notes with library facility.
- ii) Lectures by Guest and resource persons.
- iii) e-Resources

3) Practical Set:-

- Mulberry plantation
- DFL's (Disease free Laying's)
- A rearing house and rearing Trays
- Chandrika nets for cocoon production
- Disinfectants and Equipment's.
- Thermometer's and Hygrometer's
- Cocoon Harvesting trays n bags
- Videos and Presentation

4) Workbooks / manuals (which are designed by the college): for Project work submission and practical manuals.

5) Objective of the proposed course (at list 5 objectives):

- To develop interest in the field of Agriculture science among students.
- To cultivate public awareness and appreciation for Sericulture as a hobby and science.
- To motivate students for scientific study in the field of Agro-based Industry by performing simple projects and field visits.

- To developed the skill, how to develop and earn regular incomes through sericulture in the Vidarbha area dependent on Monsoon.
- Many Government Subsidies' and facilities are provided for the motivation of poor farmers.
- Non Dependency on monsoon and can be developed with few labours and very little finance.
- Utility of the proposed course:- 1. Skills development 2. Entrepreneur

Total Credits for the Course:-

| Sr. No. | Course/subject/Units | Type of theory/ Practical | Credits | Total Marks |
|----------------|-------------------------------------|---|----------------|--------------------|
| 1 | History and types of Sericulture | PPT, VIDEOS | - | 10 |
| 2 | Rearing of silkworms. | PPT, VIDEOS | - | 10 |
| 3 | Harvesting of cocoons | PPT, VIDEOS | - | 10 |
| 4 | Diseases n Preventions | PPT, VIDEOS | - | 10 |
| 5 | Field work /Project work/ Visits to | Field work/Project work/ Assignment/ Seminars | - | 60 |
| | Total | | - | 100 |

.....

Syllabus: Theory

Diploma Course in Sericulture (Marks :40 M)

UNIT I: History of Sericulture **(08 Marks)**

- 1.1 Introduction to sericulture:
- 1.2 Cultivation of food plants.
- 1.3 Bioecology of mulberry silkworms.

Unit II: Rearing of silkworms **(08 Marks)**

- 2.1 Rearing of silkworms.
- 2.2 Equipment's or requirements for rearing.
- 2.3 Favourable Climatic conditions for rearing.

Unit III: Harvesting **(08 Marks)**

- 3.1 Harvesting and processing of cocoons.
- 3.2 Stifling and reeling of cocoons

3.2.1. Reeling's selling to Textile mills through Government sanctioned rates.

3.2.2. Government Subsidies and Schemes for Sericulture farming.

3.3 Reeling appliances

Unit IV: Diseases n Preventions

(08 Marks)

4.1 Diseases of Bombyx mori

4.2 Preventive measures for disease free cocoon production.

4.2 Predators and parasitoids of silkworm and their management

UNIT V: 4. Non-Mulberry sericulture:

(08 Marks)

4.1 Tasar sericulture:

4.2 Muga sericulture;

4.3 Eri sericulture:

.....

Practical Work:

(60 marks)

The distribution of marks for practical examination will be as follows:

- **Sericulture Related Projects submission by students.** **(15 marks)**
- Students must be Submitted **project reports as Project assignments.** **(05 marks)**
- Students must be Submitted **Field visit report.** (Visits to different sericulture rearing centers and farms also visiting the Reeling centers and textile mills.) **(10 marks)**
- Students give Seminars **any topics related to syllabus** **(10 marks)**
- Students have to submit detail report on the following:
Rearing and Management of Sericulture / The technical part:
Reeling of silk, Stifling, Yarn making, Textile work etc. during the entire Course. **(20 marks)**

Project List:

- Introduction to sericulture:
- Bioecology of mulberry silkworms
- Rearing of silkworms.
- Equipment's or requirements for rearing of Silkworm.
- Diseases of Bombyx mori

- Predators and parasitoids of silkworm
- Prevention and Disease management
- Sericulture and the technical part of silk reeling, stifling and yarn making.
- Tasar sericulture: Life cycle
- Muga sericulture: Life cycle
- Eri sericulture: Life cycle





महाराष्ट्र शासन

जिल्हा रेशीम कार्यालय,

प्लॉट क्र. 8,9,10. एम.आय.डी.सी. फेस-1 शिवर, अकोला.

फोन क्र.0724-2259037, 2258036 email – akolareshim@gmail.com

जा.क्र.जिरेका/अकोला/MOU /2020-21/880

दिनांक- 30/07/2020

प्रति,

प्राचार्य

डॉ. विजय डी. नानोटी

श्री रा.ल.तो. विज्ञान महाविद्यालय, अकोला.

विषय: Certificate Course In Sericulture MOU करुन देण्याबाबत

संदर्भ:- श्री.रा.ल.तो विज्ञान महाविद्यालय.अकोला यांचे पत्र क्र. ३७० दिनांक २९/०७/२०२०

आपल्या महाविद्यालयातील प्राणीशास्त्र विभाग व संत गाडगे बाबा अमरावती विद्यापीठ, अमरावती ह्यांच्या संयुक्त विद्यमाने सत्र २०२०-२१ मध्ये जे "Certificate Course In Sericulture" राबविण्यात येणार आहे त्या करिता, रेशीम विकास विभाग, अकोला जिल्हा कडून जे सहकार्य करता येईल ते आम्ही पूर्ण करू व श्री रा.ल.तो. विज्ञान महाविद्यालया च्या प्राणीशास्त्र विभाग ह्यांच्या सोबत नियोजित कोर्स साठी MOU करण्याकरिता आम्ही स्वीकृती देत आहोत व हे पत्र सादर करित आहोत. कृपया आपण ह्याची नोंद घ्यावी हि विनंती.

श्री. अरविंद मोरे

रेशीम विकास अधिकारी

जिल्हा अकोला - ११

अकोला

The Berar General Education Society's, Akola
(Regd. No. F65 B'bay Public Trust Act.)



SHRI RADHAKISAN LAXMINARAYAN TOSHNIWAL COLLEGE OF SCIENCE, AKOLA

(R.L.T. COLLEGE OF SCIENCE)

CIVIL LINES, AKOLA - 444 001 (MAHARASHTRA)

: Recognized By :

Govt. of Maharashtra & Permanently Affiliated to S. G. B. Amravati University, Amravati.

Ph. No. 0724 - 2415480
Fax - (0724) - 2415650
Post Box No.60

**NAAC REACCREDITED
GRADE 'A'
WITH CGPA -3.12**

COLLEGE CODE - 210

Website : www.rltsc.org
E-mail: principal@rltsc.org
principal@rltsc.edu.in

L.No.: 370

Date: 29-07-2020

प्रति,
श्री अरविंद मोरे
रेशीम विकास अधिकारी,
अकोला जिल्हा

विषय :- "Certificate Course in Sericulture" MOU करण्याकरिता प्रस्ताव सादर करणेबाबत.

महोदय,

आमच्या महाविद्यालयातील प्राणीशास्त्र विभाग व संत गाडगे बाबा अमरावती विद्यापीठ, अमरावती ह्यांच्या संयुक्त विद्यमाने सत्र २०२०-२१ मध्ये "Certificate Course In Sericulture" राबविण्यात येणार आहे. त्या अनुषंगाने रेशीम विकास विभाग, अकोला जिल्हा व श्री रा.ल.तो. विज्ञान महाविद्यालय च्या प्राणीशास्त्र विभाग ह्यांच्या मध्ये MOU करण्याकरिता हे आवेदन पत्र सादर करित आहोत. कृपया आपण ह्याची नोंद घ्यावी व सहकार्य करावे हि विनंती.

कोर्स समन्वयक



प्राचार्य
Principal
Shri R.L.T. College of Science,
AKOLA

30.7.20
आवक/जावक लिपीक
अकोला, अकोला

MEMORANDUM OF UNDERSTANDING

Between

The B.G.E. Society's

SHRI R.L.T. COLLEGE OF SCIENCE, AKOLA (MS)

and

Dr. HEDGEWAR HOSPITAL AND RESEARCH CENTRE, AKOLA

This Memorandum of Understanding (MOU) sets for the terms and understanding between the Shri R.L.T. College of Science, Akola and the Dr. Hedgewar Hospital and Research Centre, Akola to exchange knowledge and provide training related to Microbiology and Pathology skills.

Background

Microbiology and Pathology skills are very important for health care professionals and Microbiology students. Health care industry and academia collaboration is needed for scientific concept to go with application-based products. Shri RLT College of science, Akola is known for its scientific contribution and knowledge sharing amongst young minds. Dr. Hedgewar Hospital and Research Centre, Akola is people centric charitable institution known for help to needy people. Both institutes collaboration will help students and society of region.

Purpose

This MOU will allow both parties for knowledge and resource sharing for propagation of scientific temperament amongst society.

Shri R.L.T. College of Science, Akola will provide

1. Student volunteers will be provided for any social cause organized by Dr. Hedgewar Hospital and Research Centre, Akola
2. College will encourage students for blood donations for camps organized by Dr. Hedgewar Hospital and Research Centre, Akola.
3. Allow use of scientific instruments for jointly organized training programs.

Dr. Hedgewar Hospital and Research Centre, Akola will provide

1. Training facility to students of Shri RLT College of Science, Akola
2. Pathology samples like blood, sputum, CSF and other for college practical.
3. Internship facility to M.Sc. Microbiology, CCLT and DCLT students

Reporting

Both parties may keep record of knowledge and resource sharing.

Funding

This MOU is not a commitment of funds and exchange of any physical assets within parties.

Duration

This MOU is at-will and may be modified by mutual consent of authorized officials from (list partners). This MOU shall become effective from Academic Session 2020-21 and will remain in effect until modified or terminated by any one of the partners by mutual consent. In the absence of mutual agreement by the authorized officials from (list partners) this MOU shall end on 30th April 2026.

Contact Information

Principal
Shri R.L.T. College of Science, Akola (MS)

Civil Lines Akola
Telephone (0724) 2414049
principal@rltsc.org

Managing Director
Dr. Hedgewar Hospital and Research
Centre, Akola
Mukharjee Bunglow Rautwadi Akola
Telephone 7499275095
hedgewarakola@gmail.com


Principal
Shri R.L.T. College of Science
Civil Lines, AKOLA (M.S.)
Shri R.L.T. College of Science, Akola





Official Signatory
Dr. Hedgewar Hospital and Research
Centre, Akola



MEMORANDUM OF UNDERSTANDING

Between



DEPARTMENT OF MICROBIOLOGY
SHRI R.L.T. COLLEGE OF SCIENCE, AKOLA (MS)



and

MICROBIOLOGIST'S SOCIETY INDIA

This Memorandum of Understanding (MOU) sets for the terms and understanding between the Department of Microbiology, Shri R.L.T. College of Science, Akola and the Microbiologist's society India to exchange knowledge and provide facilities and experts for creating awareness amongst society related to Microbiology and allied sciences.

Background

Microbiology and allied sciences are very important for creating awareness about health & hygiene in society. Scientific association and academia collaboration is needed for scientific concept to go with application-based products. Department of Microbiology, Shri RLT College of Science, Akola is known for its scientific contribution and knowledge sharing amongst young minds. Microbiologist's society India is people centric association of Microbiology professionals known for creating awareness about health & hygiene in society. Both institutes collaboration will help students and society of region.

Purpose

This MOU will allow both parties for knowledge and resource sharing for propagation of scientific temperament amongst society.

Department of Microbiology, Shri R.L.T. College of Science, Akola will provide

1. Student volunteers will be provided for any social cause organized by Microbiologist's society India
2. College will encourage students for participation in events organized by Microbiologist's society India.
3. Allow use of college facilities for any event jointly organized with college.

Microbiologist's society India will provide

1. Training facility to students of Shri RLT College of Science, Akola
2. Experts for scientific event organized by college
3. Internship/ Training facility to M.Sc. Microbiology students.

Reporting

Both parties may keep record of knowledge and resource sharing

Funding

This MOU is not a commitment of funds and exchange of any physical assets within parties.

Duration

This MOU is at-will and may be modified by mutual consent of authorized officials from (list partners). This MOU shall become effective from Academic Session 2020-21 and will remain in effect until modified or terminated by any one of the partners by mutual consent. In the absence of mutual agreement by the authorized officials from (list partners) this MOU shall end on 30th April 2026.

Contact Information

HoD, Department of Microbiology
Shri R.L.T. College of Science, Akola (MS)

Telephone (0724) 2414049
rltmicrobiology@gmail.com

President
Microbiologist's society India
C2/12 Parijatak apartment
Osmanbad(MS)

Telephone 9822079782
mbiosociety@gmail.com


30/6/21

Dr. H.S. Malpani
Head

Department of Microbiology Shri RLT. College of Science Akola
Shri R.L.T. College of Science, Akola


30/6/2021

Dr. V.D. Nanoty
Principal





Dr. A.M. Deshmukh
President
Microbiologist's society India

CERTIFICATE

This is to certify that the project work entitled "*Biofertilizers a key player in sustainable agricultural practices- A review*" submitted in partial fulfillment of the requirements for the degree of Master of Science in Microbiology of Sant Gadgebaba Amravati University at Post graduate Department of Microbiology, **Shri Radhakishan Lakshminarayan Toshniwal College of Science Akola** is a record of bonafide research work carried out by **Miss. Apoorva Deepak Kale** under the guidance and supervision in department of Microbiology.

Co-Guide



Mr. Sandeep A. Toshniwal

P. G. Department of Microbiology

Shri R. L. T. College of Science, Akola.

Guide

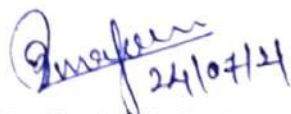


Dr. V. D. Nanoty

Principal

Shri R. L. T. College of Science, Akola.

Forwarded


24/07/24

Dr. Harish S. Malpani

Assistant Professor and Head (I C)

Department of Microbiology

Shri R. L. T College of Science, Akola

Date: 24-7-2024

Place: Akola

CERTIFICATE

This is to certify that the project work entitled "Role of vermicomposting in bioconversion of kitchen waste to manure- A review" submitted in partial fulfillment of the requirements for the degree of Master of Science in Microbiology of Sant Gadgebaba Amravati University at Post graduate Department of Microbiology. Shri Radhakishan Lakshminarayan Toshniwal College of Science Akola is a record of bonafide research work carried out by Ms. Pragati Suresh Abgad under the guidance and supervision in department of Microbiology.

Co-Guide



Mr. Sandeep A. Toshniwal

P. G. Department of Microbiology
Shri R. L. T. College of Science, Akola.

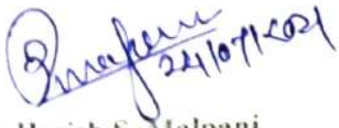
Guide



Dr. V. D. Nanoty

Principal
Shri R. L. T. College of Science, Akola.

Forwarded



Dr. Harish S. Malpani

Assistant Professor and Head (I.C)

Department of Microbiology

Shri R. L. T College of Science, Akola

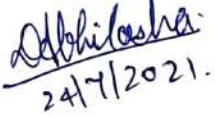
Date 24/7/2021

Place Akola

CERTIFICATE

This is to certify that the project work entitled "*Survey based study on the precautions taken by parents for their children aged 2-17 years during the COVID-19 pandemic.*" Submitted in partial fulfillment of the requirements for the degree of Master of Science in Microbiology of Sant Gadge baba Amravati University at Post graduate Department of Microbiology. **Shri Radhakishan Lakshminarayan Toshniwal College of Science, Akola** is a record of bonafide research work carried out by **Miss. Naseem Abid Ali** under my guidance and supervision in department of Microbiology.

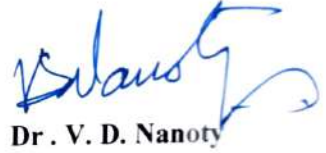
Co - guide


24/7/2021.

Miss Abhilasha A. Deshmukh

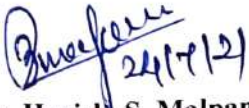
P. G. Dept. of Microbiology,
Shri R.L.T. College of Science,
Akola

Guide


Dr. V. D. Nanoty

Principal
Shri R.L.T. College of Science,
Akola

Forwarded


24/7/21

Dr. Harish S. Malpani

Head Dept. of Microbiology (I/C)
Shri R.L.T College of Science, Akola.

Date: 24/07/21

Place: Akola

CERTIFICATE

This is to certify that the project work entitled "Review on Antibiotics used in animal feed and its effect on human health" Submitted in partial fulfillment of the requirements for the degree of Master of Science in Microbiology of Sant Gadge Baba Amravati University at Post graduate Department of Microbiology, Shri Radhakishan Lakshminarayan Toshniwal College of Science Akola is a record of bonafide research work carried out by Miss. Swati Raju Bhise under my guidance and supervision in department of Microbiology.

Co-Guide

Abhilasha.
22/7/2021

Ms. Abhilasha A. Deshmukh

P.G. Dept. of Microbiology
Shri R.L.T. College of Science,
Akola

Guide

V. D. Nanoty

Dr. V. D. Nanoty

Principal
Shri R.L.T. College of Science,
Akola

Forwarded

Harish S. Malpani
22/7/2021

Dr. Harish S. Malpani


Head Dept. of Microbiology (I/C)
Shri R.L.T. College of Science, Akola

Date: *22/07/2021*

Place: **Akola**

CERTIFICATE

It is to certify that the survey work entitled "**Point Prevalence Survey on Urinary Tract Infections (UTIs) in Women: to analysis its Trend, Risk Factor & Outcome.**" Submitted in Partial fulfillment of the requirements for the degree of Master of Science in Microbiology, of Sant Gadge baba Amravati University at Post Graduate Department of Microbiology, **Shri Radhakishan Lakshminarayan Toshniwal College of Science, Akola** is a record of bonafide research work carried out by **Miss. Neha Sachin Phafat** under my guidance and supervision in the department of Microbiology.


24/7/21.
Co-Guide

Ms. Abhilasha A. Deshmukh

P.G. Dept. of Microbiology

Shri R.L.T. College of Science, Akola


24/07/2021
Guide

Ms. Sonali N. Gawande

Assistant Professor

Dept. of Microbiology

Shri R.L.T. College of Science, Akola


24/7/21
Forwarded

Dr. Harish S. Malpani

Head Dept. of Microbiology (I/C)

Shri R.L.T. College of Science, Akola

Date: 24/07/21

Place: AKOLA

"A review work on Biological control of Water Hyacinth."

CERTIFICATE

This is to certify that the project work entitled "**A review work on Biological control of Water Hyacinth**" Submitted in partial fulfillment of the requirements for the degree of Master of Science in Microbiology of Sant Gadgebaba Amravati University at Post graduate Department of Microbiology, **Shri Radhakishan Lakshminarayan Toshniwal College of Science Akola** is a record of bonafide research work carried out by **Miss. Nisha Ganesh kad** under my guidance and supervision in department of Microbiology.

Guide

S. Gawande
22/07/2021

Ms. Sonali N. Gawande

Assistant Professor

Department of Microbiology

Shri R.L.T. College of Science,

Akola

Forwarded

Dr. Harish S. Malpani
20/7/2021

Dr. Harish S. Malpani

Assistant Professor

Head (I/C) Dept. of Microbiology

Shri R. L. T. College of Science, Akola

Date: 24/07/2021

Place: Akola

CERTIFICATE

This is to certify that the project work entitled "**A review on identification on bacterial isolates from tooth decay**" Submitted in partial fulfilment of the requirements for the degree of Master of Science in Microbiology of Sant Gadgebaba Amravati University at Post graduate Department of Microbiology, **Shri Radhakishan Lakshminarayan Toshniwal College of Science, Akola** is a record of bonafide research work carried out by **Miss. Priyanka J.Sharma** under my guidance and supervision in department of Microbiology.


Guide

Ms. Sonali N. Gawande

Assistant professor,

Dept. of Microbiology

Shri R.L.T College of Science,
Akola


Forwarded

Dr. Harish S. Malpani

Assistant Professor & Head (I/C)

Dept. of Microbiology

Shri R.L.T. College of Science, Akola

Date: 22/07/2021

Place: Akola.

***A survey on healthy practices to maintain health during
COVID-19 pandemic***

CERTIFICATE

This is to certify that the project work entitled "**A survey on healthy practices to maintain health during COVID-19 pandemic**" Submitted in partial fulfilment of the requirements for the degree of Master of Science in Microbiology of Sant Gadgebaba Amravati University at Post graduate Department of Microbiology, **Shri Radhakishan Lakshminarayan Toshniwal College of Science Akola** is a record of bonafide research work carried out by **Ms. Pragati Ramdas Pakhare** under my guidance and supervision in department of Microbiology.

Guide

S. Gawande
22/07/2021

Ms. Sonali N. Gawande

Assistant Professor

Department of Microbiology

Shri R.L.T. College of Science,

Akola

Forwarded

Dr. Harish S. Malpani
22/07/2021

Dr. Harish S. Malpani

Assistant Professor

Head (I/C) Dept. of Microbiology


Shri R.L.T College of Science, Akola

Date 22/07/2021

Place: Akola

CERTIFICATE

It is to certify that the review work entitled "REVIEW WORK ON ORAL MICROBIAL BIOFILMS RELATED TO COVID-19 PANDEMIC." Submitted in partial fulfilment of the requirements for the degree of Master of Science in Microbiology, of **SANT GADGE BABA AMRAVATI UNIVERSITY AT POST GRADUATE DEPARTMENT OF MICROBIOLOGY, Shri R.L.T college of Science, Akola** is a record of bonafied research work carried out by Ms. Shweta Rajesh Rudrakar under my guidance and supervision.


22/07/2021
Guide


Ms. Sonali N. Gawande

Assistant Professor,

Dept. Of Microbiology

Shri R.L.T. College of Science, Akola

Forwarded


20/7/2021
Dr. Harish S. Malpani

Assistant Professor

Head (I/C) Department of Microbiology

Shri R.L.T. College of Science, Akola

Date - 22-07-2021

Certificate

It is to certify that the review work entitled “**Role of Hematological Parameter in the Stratification of Covid 19 Infection**” Submitted in partial fulfilment of the requirements for the degree of Master of Science in Microbiology, of Sant Gadgebaba Amravati University at Post Graduate Department of Microbiology, Shri R.L.T college of Science, Akola is a record of bonafied research /review work carried out by **Miss. Prajakta Anant Kulkarni** under my guidance and supervision.

Guide

23/7/2021

Dr. Harish S. Malpani

Assistant Professor & Head (I/C)

Department of Microbiology

Shri. R.L.T. College of Science, Akola

Date : 23/07/2021

Place : Akola

CERTIFICATE

It is to certify that the review work entitled **Review work on :
Antimicrobial and Antioxidant property of Moringa Oleifera**
submitted in partial fulfilment of the requirements for the degree of
Master of Science in Microbiology, of Sant Gadge baba Amravati
University at Post Graduate Department of Microbiology, Shri R.L.T
college of Science, Akola is a record of bonafied research work carried
out by Miss. Nisha Ganesh Taksalkar under my guidance and supervision.


22/07/2021

Guide

Dr. Harish S. Malpani

Assistant Professor & Head (I/C)
Department of Microbiology

Date: 22/07/2021

Place: Akola

CERTIFICATE

It is to certify that the review work entitled "Review studies on food allergies and hypersensitivity" submitted in partial fulfilment of the requirements for the degree of Master of Science in Microbiology, of Sant Gadge Baba Amravati University at Post Graduate Department of Microbiology, Shri R.L.T college of Science, Akola is a record of bonafied research work carried out by **Miss Pragati Ramdhan Shelke** under my guidance and supervision.

Guide  22/07/2021

Dr. Harish S. Malpani

Head of Department and Assistant Professor

Shri R.L.T. College of Science, Akola.

Date: 22-07-21

Place: Akola

"A review work on Bio diesel From Waste Cooking Oil."

CERTIFICATE

This is to certify that the project work entitled "A review work on Bio Diesel From Waste Cooking Oil" Submitted in partial fulfilment of the requirements for the degree of Master of Science in Microbiology of Sant Gadgebaba Amravati University at Post graduate Department of Microbiology, Shri Radhakishan Lakshminarayan Toshniwal College of Science Akola is a record of bonafide research work carried out by Miss. Nisha Ashokrao Rathod under my guidance and supervision in department of Microbiology.

Guide

Assistant Professor



22/07/2021

Dr. Harish S. Malpani

Assistant professor and head (I/C)

Shri R.L.T. College of Science,

Akola.

Forwarded

Dr. Harish S. Malpani

Dept. Of Microbiology (Incharge)

Shri R. L. T. College of Science, Akola

Date: 22/07/2021

Place: Akola

CERTIFICATE

It is to certify that the review work entitled "**Review studies on impact of drugs/antibiotics upon gut microbiome**" submitted in partial fulfilment of the requirements for the degree of Master of Science in Microbiology, of Sant Gadgebaba Amravati University at Post Graduate Department of Microbiology, Shri R.L.T college of Science, Akola is a record of bonafied research work carried out by Miss Leena Vishwanath Dange under my guidance and supervision.

Guide



Dr. Harish S. Malpani

Assistant Professor & Head (I/C)

Department of Microbiology

Shri R. L. T. College of Science Akola

Date: 20/07/2021

Place: Akola

Certificate

It is to certify that the review work entitled "**Studies On Mother Milk Bank**" - **Scope and Limitations** Submitted in partial fulfilment of the requirements for the degree of Master of Science in Microbiology, of Sant Gadgebaba Amravati University at Post Graduate Department of Microbiology, Shri R.L.T college of Science, Akola is a record of bonafied research /review work carried out by **Miss.Shraddha Madhukar Ganorkar** under my guidance and supervision.

Guide


20/07/2021

Dr.Harish S.Malpani

Assistant Professor & Head(I/C)

Department Of Microbiology

Shri. R.L.T College Of Science , Akola

Date - 20/07/2021

Place - Akola

CERTIFICATE

It is to certify that the review work entitled "**Review Work on Eating habits and food poisoning**" Submitted in partial fulfilment of the requirements for the degree of Master of Science in Microbiology, of Sant Gadge baba Amravati University at Post Graduate Department of Microbiology, Shri R.L.T college of Science, Akola is a record of bonafied research/review work carried out by Miss Gauri Ashok Walke under my guidance and supervision.

Guide



Dr. Harish S. Malpani

Date: 20/07/2021

Place: **Akola**

Assistant Professor & Head (I/C)

Department of Microbiology

Shri R.L.T. College of Science, Akola

CERTIFICATE

It is to certify that the review work entitled "**Review Work on Microorganism Mediated Bioremediation of Soil Contaminants.**" submitted in partial fulfillment of the requirements for the degree of Master of Science in Microbiology, of Sant Gadgebaba Amravati University at Post Graduate Department of Microbiology, Shri R.L.T college of Science, Akola is a record of bonafied research/review work carried out by **Mr. Akshay Shrikrushna Wakte** under my guidance and supervision.

Guide



Dr. Harish S. Malpani

Assistant Professor & Head (I/C)

Department of Microbiology

Shri R.L.T. College of Science, Akola.

Date : 20/07/2021

Place : Akola.

CERTIFICATE

This is to certify that the project work entitled "A review on bioremediation technique". Submitted in partial fulfillment of the requirements for the degree of Master of Science in Microbiology of Sant Gadge baba Amravati University at Post graduate Department of Microbiology, **Shri Radhakishan Lakshminarayan Toshniwal College of Science Akola** is a record of bonafide research work carried out by **Ms. Achal Rahul Shegaonkar** under my guidance and supervision in department of Microbiology.

Guide


Ms. Sonali N. Gawande

Assistant Professor

Department of Microbiology

Shri R.L.T. College of Science,

Akola.

Forwarded


Dr. Harish S. Malpani

Assistant Professor

Head (I/C) Department of Microbiology

Shri R.L.T College of Science, Akola

Date: 22.07.2021

Place: Akola



CERTIFICATE

This is to certify that the Project Work entitled " Review on Herbal Extract Mediated Green Synthesis of Silver Nanoparticles " submitted in partial fulfillment of the requirements for the degree of Master of Science in Microbiology of Sant Gadge Baba Amravati University, at Post Graduate Department of Microbiology, Shri R. L. T. College of Science, Akola is a record of bonafied research work carried out by Miss. Simran Anilkumar Sachdeo under my guidance and supervision.

Guide

Sonali N. Gawande
24/07/2021
Ms. Sonali N. Gawande

Assistant Professor

Department of Microbiology

Shri R.L.T. College of Science,

Akola.

Forwarded

Dr. H.S. Malpani
24/07/2021
Dr. H.S. Malpani

Assistant Professor

Head (I/C) Department of Microbiology

Shri R.L.T College of Science, Akola.

Date: 24/7/21

Place: Akola

CERTIFICATE

This is to certify that the project work entitled "**Probiotics and their health benefits: A review**" Submitted in partial fulfilment of the requirements for the degree of Master of Science in Microbiology of Sant Gadgebaba Amravati University at Post graduate Department of Microbiology, **Shri Radhakishan Lakshminarayan Toshniwal College of Science Akola** is a record of bonafide research work carried out by **Miss Rajeshwari Vijay Chavan** under my guidance and supervision in department of Microbiology.

Guide

Shilpa Lokhande

Dr. Shilpa Lokhande

Assistant Professor

P. G. Department of Microbiology

Shri R.L.T. College of Science,

Akola.

Forwarded

Harish S. Malpani
24/07/2021

Dr. Harish S. Malpani

Assistant Professor & Head (I/C)

Dept. of Microbiology

Date: 24/07/2021

Shri R.L.T College of Science, Akola

Place: Akola

CERTIFICATE

This is to certify that the project work entitled "**Bacterial colonization on human skin : A review**" Submitted in partial fulfillment of the requirements for the degree of Master of Science in Microbiology of Sant Gadge baba Amravati University at Post graduate Department of Microbiology, **Shri Radhakishan Lakshminarayan Toshniwal College of Science Akola** is a record of bonafide research work carried out by **Miss. Priya Digambar Pawar** under my guidance and supervision in department of Microbiology.

Guide

Shilpa Lokhande

Dr. Shilpa Lokhande

Assistant Professor

P. G. Department of Microbiology

Shri R.L.T. College of Science,

Akola.

Forwarded

Harish s. Malpani
24/11/2021

Dr. Harish s. Malpani

Assistant Professor & Head (I/C)

Dept. Of Microbiology.

Shri R.L.T College of Science, Akola.

Date: / /

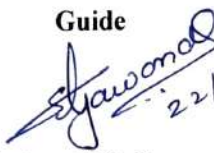
Place: Akola

***A survey on healthy practices to maintain health during
COVID-19 pandemic***

CERTIFICATE

This is to certify that the project work entitled “**A survey on healthy practices to maintain health during COVID-19 pandemic**” Submitted in partial fulfilment of the requirements for the degree of Master of Science in Microbiology of Sant Gadgebaba Amravati University at Post graduate Department of Microbiology, **Shri Radhakishan Lakshminarayan Toshniwal College of Science Akola** is a record of bonafide research work carried out by **Ms. Pragati Ramdas Pakhare** under my guidance and supervision in department of Microbiology.

Guide


22/07/2021

Ms. Sonali N. Gawande

Assistant Professor

Department of Microbiology

Shri R.L.T. College of Science,

Akola

Forwarded


Dr. Harish S. Malpani

Assistant Professor

Head (I/C) Dept. of Microbiology

Shri R.L.T College of Science, Akola

Date: 22/07 2021

Place: Akola

*Food preservation tradition and modern techniques : A
review*

CERTIFICATE

This is to certify that the project work entitled "**Food preservation traditional and modern techniques : A review**" Submitted in partial fulfilment of the requirements for the degree of Master of Science in Microbiology of Sant Gadgebaba Amravati University at Post graduate Department of Microbiology, **Shri Radhakishan Lakshminarayan Toshniwal College of Science Akola** is a record of bonafide research work carried out by **Ms. Kalyani Dilip Raut** under my guidance and supervision in department of Microbiology.


22/07/2021

Guide

Ms. Sonali N. Gawande

Assistant Professor

Department of Microbiology

Shri R.L.T. College of science,

Akola

Forwarded


22/07/2021

Dr. Harish S. Malpani

Assistant Professor

Head (I/C) Dept. of Microbiology


Shri R.L.T College of Science, Akola

Date: 22/07/2021

Place: **Akola**

CERTIFICATE

This is to certify that the survey work entitled "**Dandruff and fungal infections controlling shampoo.**"Submitted in partial fulfillment of the requirements for the degree of Master of Science in Microbiology of Sant Gadge baba Amravati University at Post graduate Department of Microbiology, **Shri Radhakishan Lakshminarayan Toshniwal College of Science, Akola** is a record of bonafide research work carried out by **Miss. Vaishnavi Raman Patil** under my guidance and supervision in department of Microbiology.


22/07/2021
Guide

Ms. Sohali N. Gawande

Assistant Professor

Department of Microbiology

Shri. R.L.T. College of Science, Akola

Forwarded


22/07/2021

Dr. Harish S. Malpani

Assistant Professor

Head (I/C) Dept. Of Microbiology

Shri R.L.T College of Science, Akola

Date: 22/07/21

Place: Akola

Sant Gadge Baba Amravati University, Amravati
 Shri R.L.T. College of Science, Akola
 Topics of Project

M.Sc.-II (Chemistry), Semester-IV
 Subject: Practical -Project (3008)
 Date: _____

Summer-2021
 Max Marks: 100
 Time: _____

| Sr. No. | Name of the Students | Roll. No. | Title of Project | Name of Project Guide |
|---------|------------------------|-----------|---|--|
| 1. | Ankita B. Potdukhe | | Review on synthesis, structural study Properties & Biological activity of 1,2,4-triazolidine Derivative | Dr. P. P. Deobole |
| 2. | Ankita P. Jaiswal | | Review on different method of Purification of Fungus Arsenol college Recquiring system in | Dr. V. D. Deobol |
| 3. | Ankita V. Bhad | | Synthesis & evaluation of herbal based hair dye | Prof. S. C. Zyate |
| 4. | Archana S. Paraskar | | | Dr. Kavita M. Heda |
| 5. | Dnyaneshvar S. Bhaskar | | Herbal Soap Making | Dr. P. P. Deobole |
| 6. | Komal B. Sewak | | Review on two decadal of synthesis, structural study & Biological potential of 1,3,4-oxadiazole sca field | Dr. V. D. Deobole |
| 7. | Komal S. Langote | | Liquide waste management in college | Dr. P. P. Deobole |
| 8. | Komal V. Ingle | | Review on pyridine catalyzed heterocyclic compound | Prof. S. C. Zyate |
| 9. | Komal V. Karale | | Evaluation of some chemical constituents of selected ENERGY DRINKS | Dr. P. R. Kavale |
| 10. | Nikita M. Wankhade | | Preparation of face mask from olive kernel | Dr. P. P. Deobole Dr. K. M. Heda |
| 11. | Pratiksha H. Mhatra | | Purification of lab water with microbial control | Dr. P. T. Agrawal |
| 12. | Priyanka A. Kahar | | Review on acid base catalysed pinct-spengler reaction | Prof. P. R. Kavale |
| 13. | Renuka V. Siraskar | | Synthesis of anti HIV agent & control of Rasf. P. R. Kavale | Dr. P. R. Kavale |
| 14. | Rushikesh R. Ekhe | | Analytical method and procedure used in soil test in laboratory | Dr. P. G. Sagar |

| | | | | |
|-----|---------------------|--|---|---------------------------------------|
| 15. | Shruti A. Panchbhai | | Review on Derivatives of Thiobarbituric Acid | De V D. Deotale |
| 16. | Shrutika V. Kadam | | Non hazardous chemical and Radioactive waste management in college campus | prof. S. C. Zyate |
| 17. | Sonali S. Wakode | | Review on Derivation of Barbituric acid. | Dev D. Deotale |
| 18. | Suhani S. Sharma | | method and chemical composition of home made manure. | pr. K.M. Hedra |
| 19. | Trupti G. Bhise | | Covid Analysis in Building | Pr. D. Deotale P.G. Saraf. |

Saraf

Head,

Department of Chemistry

Jhu. R.L.T. college of Science, Aclg

Shri R. L. T. College of Science Akola

Department of Microbiology/Biochemistry

CCLT Theory Examination 2020-21

Following Students of CCLT have completed project work on **Topic Basic pathology skills** in different pathology laboratories as a part of curriculum.

| Sr. No. | Roll No. | Name of the Student | Theory Marks | Practical Marks | Project Marks | Total Marks |
|---------|------------|----------------------------------|--------------|-----------------|---------------|--------------|
| | | | (out of 100) | (Out of 50) | (Out of 50) | (Out of 200) |
| 1 | C-20-21/01 | Almas Naaz Shakil Shah | 92 | 48 | 50 | 190 |
| 2 | C-20-21/02 | Anuja Ganesh Bhatkar | 100 | 48 | 50 | 198 |
| 3 | C-20-21/03 | Asma Anjum Fayaz Ahmed | 88 | 42 | 50 | 180 |
| 4 | C-20-21/04 | Harshada Bhaskar Nawkar | 100 | 46 | 50 | 196 |
| 5 | C-20-21/05 | Harshali. S. Jadhao | 94 | 50 | 50 | 194 |
| 6 | C-20-21/06 | Jagruti Navinchandra Banot | 86 | 50 | 50 | 186 |
| 7 | C-20-21/07 | Juhi Vinod Sarag | 100 | 46 | 50 | 196 |
| 8 | C-20-21/08 | Mahek parveen M. Irfan Jattawale | 80 | 50 | 50 | 180 |
| 9 | C-20-21/09 | Manojkumar Himmatrao Wadatkar | 86 | 48 | 50 | 184 |
| 10 | C-20-21/10 | Nadiya Firdous | 90 | 50 | 50 | 190 |
| 11 | C-20-21/11 | Neha kishor Gawai | 92 | 44 | 50 | 186 |
| 12 | C-20-21/12 | Nikita Rajendra Thete | 96 | 48 | 50 | 194 |
| 13 | C-20-21/13 | Pankajkumar Shivkumar Yadav | 100 | 48 | 50 | 198 |
| 14 | C-20-21/14 | Pratiksha Gajanan Deshmukh | 100 | 50 | 50 | 200 |
| 15 | C-20-21/15 | Rajvi Vijay Gawai | 88 | 44 | 50 | 182 |
| 16 | C-20-21/16 | Revati Pankaj Lahane | 100 | 50 | 50 | 200 |
| 17 | C-20-21/17 | Sakshi Anil Bhagat | 100 | 44 | 50 | 194 |
| 18 | C-20-21/18 | Sakshi Raju Raut | 84 | 50 | 50 | 184 |
| 19 | C-20-21/19 | Sana Firdous Mushtaque Khan | 98 | 50 | 50 | 198 |
| 20 | C-20-21/20 | Shantanu Sunilrao Wawage | 100 | 44 | 50 | 194 |
| 21 | C-20-21/21 | Shivani Ganesh Muley | 96 | 50 | 50 | 196 |
| 22 | C-20-21/22 | Shreya Nandakishor Sathe | 92 | 48 | 50 | 190 |
| 23 | C-20-21/23 | Sonal Bandu Gawande | 100 | 46 | 50 | 196 |
| 24 | C-20-21/24 | Vaibhavi Vinod Badarkhe | 98 | 50 | 50 | 198 |
| 25 | C-20-21/25 | Vaishnavi Anil Bagule | 96 | 44 | 50 | 190 |
| 26 | C-20-21/26 | Vaishnavi Chandrakant Hirudkar | 100 | 50 | 50 | 200 |

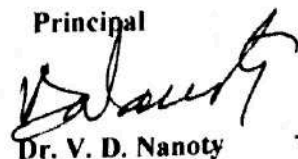


Dr. Harish S. Malpani

Assistant professor

Course co-ordinator (CCLT/DCLT/ADCLT)

Principal



Dr. V. D. Nanoty

Shri. R.L.T College of Science, Akola

Inward No. 698
Dated 09-10-2020

आजीवन अध्ययन व विस्तार विभाग
क्र.संगाबाअवि/DLL/426/142/2020
दिनांक :- 08/10/2020

प्रती,
श्री . राधाकीसन लक्ष्मीनारायण
तोशनीवाल विज्ञान महाविद्यालय,
अकोला

विषय :- अल्पकालीन प्रमाणपत्र/पदविका अभ्यासक्रम सुरु करण्यास मान्यता
देण्याबाबत.

संदर्भ :- पत्र क्र. 929, दि. 99/03/2020

महोदय,

उपरोक्त संदर्भाकित पत्रान्वये आपण मागणी केल्यानुसार खालील अल्पकालीन प्रमाणपत्र/पदविका अभ्यासक्रम सुरु करण्यास आजीवन अध्ययन व विस्तार मंडळ, संत गाडगेबाबा अमरावती विद्यापीठ यांनी खालील नमूद अटी व शर्तीचे अधिन राहून मान्यता प्रदान करण्यात येत आहे.

| अ. क्र. | अभ्यासक्रमाचे नांव | अभ्यासक्रमाचा कालावधी | अभ्यासक्रम सुरु करण्याचे वर्ष | प्रवेश क्षमता |
|---------|------------------------|-----------------------|-------------------------------|---------------|
| 1. | Diploma in Astronomy | 6 Month | 2020-21 | 20 |
| 2. | Diploma in Sericulture | 6 Month | 2020-21 | 20 |

अटी व शर्ती -

- अभ्यासक्रमिका, परिक्षा योजना विद्यापीठाने प्रसिध्द केल्यानुसार राहिल.
- अभ्यासक्रमाचे सर्व प्रकारचे शुल्क विद्यापीठाने निर्धारित केल्यानुसार राहिल. (सोबत जोडलेले परिशिष्ट पहावे.)
- अभ्यासक्रमासाठी लागणाऱ्या सर्व सोई-सुविधा संस्थेने/महाविद्यालयाने उपलब्ध करून घ्याव्यात.
- विद्यापीठाने मान्य केलेल्या प्रवेश क्षमतेपेक्षा जास्त विद्यार्थ्यांना प्रवेश देता येणार नाहीत.
- विद्यार्थ्यांची नोंदणी, परिक्षा, प्रात्यक्षिक व विद्यापीठ हिस्स्याची रक्कम विद्यापीठात Registrar, Sant Gadge Baba Amravati, University यांचे नावे काढलेले बँक Demand Draft द्वारे जमा करावी लागेल.
- सादर अभ्यासक्रम स्वयंनिर्वाही तत्त्वावर सुरु करावयाचा असल्याने सर्व प्रकारचा खर्च महाविद्यालयास करावा लागेल.
- प्रवेशित विद्यार्थ्यांची यादी प्रपत्रात भरून विहित मुदतीत संचालक आजीवन अध्ययन व विस्तार विभाग यांचेकडे सादर करावी लागेल.
- अभ्यासक्रमाचे परिक्षा आयोजन विद्यापीठ निदेश क्र. 89/2097 व 24/2098 मध्ये नमूद तरतुदीनुसार करण्यात येईल.
- अभ्यासक्रमासंबंधी वेळोवेळी प्रसिध्द अधिसूचना, विनियम, अध्यादेश, परिपत्रकांचे चलत कराले लागेल.

I/W

Dr. Jaishwal, Dr. Rohit Agrawal

Dr. Rashmi Joshi

to note

10/10/2020

आपला विश्वासु

(डॉ. श्रीकांत पाटील)

संचालक

आजीवन अध्ययन व विस्तार विभाग

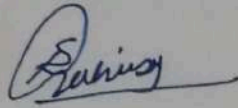
Shri R. L. T. College of Science, Akola
Department of Physics and Sky Observation Club
Diploma Course in Astronomy
Observatory Project List
Session: 2020-2021

| Sr. No. | Full Name of Candidate | Class | Name of the Project |
|----------------|-------------------------------|--------------|-------------------------------------|
| 1 | Anuradha Dharamkar | B. Sc.-I | Phases of Moon and Ursa Majar |
| 2 | Gayatri Ingle | B. Sc.-I | Phases of Moon and Ursa Majar |
| 3 | Meenakshi Ingle | B. Sc.-I | Phases of Moon and Ursa Majar |
| 4 | Purvin Bhalekar | B. Sc.-I | Phases of Moon and Ursa Majar |
| 5 | Tanvi Dubey | B. Sc.-I | |
| 6 | Yash hagone | B. Sc.-I | Phases of Moon and Ursa Majar |
| 7 | Bhushan Gondhachawar | B. Sc.-II | Phases of Moon and Ursa Majar |
| 8 | Nikita Tembhekar | B. Sc.-II | Phases of Moon |
| 9 | Pooja Hatgaonkar | B. Sc.-II | Ursa Majar & North Star |
| 10 | Ritika Wankhade | B. Sc.-II | Phases of Moon and Ursa Majar |
| 11 | Vaishnavi kadu | B. Sc.-II | Phases of Moon and Ursa Majar |
| 12 | Aakanksha Dongare | B. Sc.-III | Phases of Moon and Motion of Planet |
| 13 | Akhilesh Puranik | B. Sc.-III | Phases of Moon and Ursa Majar |
| 14 | Akshy Ingle | B. Sc.-III | Phases of Moon |
| 15 | Amisha Mishra | B. Sc.-III | Phases of Moon |
| 16 | Anuradha Mahajan | B. Sc.-III | Phases of Moon |
| 17 | Divyani Mulatkar | B. Sc.-III | Phases of Moon and Ursa Majar |
| 18 | Hrutuja Gopnarayan | B. Sc.-III | Phases of Moon and Ursa Majar |
| 19 | Kalyani Kanojiya | B. Sc.-III | Phases of Moon and Ursa Majar |

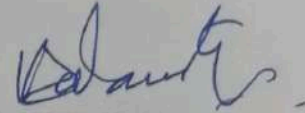
| | | | |
|----|-------------------|------------|-------------------------------|
| 20 | Prashant Rathi | B. Sc.-III | Phases of Moon |
| 21 | Samiksha Dongare | B. Sc.-III | Motion of Planets |
| 22 | Vaibhav Saraf | B. Sc.-III | Phases of Moon and Ursa Majar |
| 23 | Vaishnvi Mhaisane | B. Sc.-III | Phases of Moon and Ursa Majar |

Google Class Roo Code:- bxb4oo6

Students have been submitted the project reports in online/offline mode



Shri S. R. Jaiswal
Co-ordinator



Dr. V. D. Nanoty

Principal

(DR. VIJAY D. NANOTY)

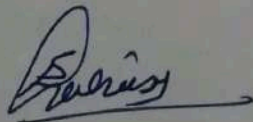
Principal

Shri Radhakishan Toshniwal College of Science,
(R. L. T. College of Science)
Civil Lines, AKOLA - 444001 (Maharashtra)

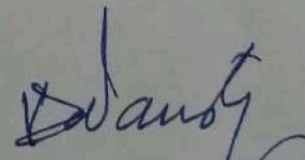
Shri R. L. T. College of Science, Akola
Department of Physics and Sky Observation Club
Diploma Course in Astronomy
Hands-on Project List
Session: 2020-2021

| Sr. No. | Full Name of Candidate | Class | Name of the Project |
|---------|------------------------|------------|---|
| 1 | Anuradha Dharamkar | B. Sc.-I | Constellation including Zodiac belt |
| 2 | Gayatri Ingle | B. Sc.-I | |
| 3 | Meenakshi Ingle | B. Sc.-I | |
| 4 | Purvin Bhalekar | B. Sc.-I | |
| 5 | Tanvi Dubey | B. Sc.-I | |
| 6 | Yash hagone | B. Sc.-I | |
| 7 | Bhushan Gondhachawar | B. Sc.-II | Mechanism of the Seasons |
| 8 | Nikita Tembhekar | B. Sc.-II | |
| 9 | Pooja Hatgaonkar | B. Sc.-II | |
| 10 | Ritika Wankhade | B. Sc.-II | |
| 11 | Vaishnavi kadu | B. Sc.-II | |
| 12 | Aakanksha Dongare | B. Sc.-III | Measuring the Diameter of the Sun and Simple Telescope Making |
| 13 | Akhilesh Puranik | B. Sc.-III | |
| 14 | Akshy Ingle | B. Sc.-III | |
| 15 | Amisha Mishra | B. Sc.-III | |
| 16 | Anuradha Mahajan | B. Sc.-III | |
| 17 | Divyani Mulatkar | B. Sc.-III | |
| 18 | Hrutuja Gopnarayan | B. Sc.-III | |
| 19 | Kalyani Kanojiya | B. Sc.-III | |
| 20 | Prashant Rathi | B. Sc.-III | |
| 21 | Samiksha Dongare | B. Sc.-III | |
| 22 | Vaibhav Saraf | B. Sc.-III | |
| 23 | Vaishnvi Mhaisane | B. Sc.-III | |

Very few students were able to preform the hands on project due to COVID-19 Pandemic



Shri S. R. Jaiswal
Co-ordinator

Dr. V. D. Nanoty
Principal

Shri R. L. T. College of Science,
R. L. T. College of Science,
Civil Lines, AKOLA

Shri R. L. T. College of Science, Akola

Department of Physics and Sky Observation Club

Diploma Course in Astronomy

Students Score Plan

Session: 2020-2021

| Sr. No. | Full Name of Candidate | Class | University Roll Number | University Theory Exam (MCQs) (40-Marks) | Project Report (Observatory + Hands-on) (20-Marks) | Visit Report (40-Marks) | Seminar (40-Marks) | Assignment/ Lecture Report on Each Chapter (20-Marks) | Total Marks -100 |
|---------|------------------------|-----------|------------------------|--|--|-------------------------|--------------------|---|------------------|
| 1 | Anuradha Dharamkar | B. Sc.-I | 8006 | | online | | | | |
| 2 | Gayatri Ingle | B. Sc.-I | 8009 | | online | | | | |
| 3 | Meenakshi Ingle | B. Sc.-I | 8012 | | online | | | | |
| 4 | Purvin Bhalekar | B. Sc.-I | 8016 | | Bhalekar | Bhalekar | Bhalekar | Bhalekar | |
| 5 | Tanvi Dubey | B. Sc.-I | 8019 | | online | Mark | Yash | Mark | |
| 6 | Yash hagone | B. Sc.-I | 8023 | | online | online | online | online | |
| 7 | Bhushan Gondhachawar | B. Sc.-II | 8007 | | online | | | | |
| 8 | Nikita Tembhekar | B. Sc.-II | 8013 | | online | | | | |
| 9 | Pooja Hatgaonkar | B. Sc.-II | 8014 | | Pooja | Pooja | Pooja | Pooja | |
| 10 | Ritika Wankhade | B. Sc.-II | 8017 | | Wankhade | Wankhade | Wankhade | Wankhade | |
| 11 | Vaishnavi kadu | B. Sc.-II | 8021 | | Wankhade | Wankhade | Wankhade | Wankhade | |

| Sr. No. | Full Name of Candidate | Class | University Roll Number | University Theory Exam (MCQs) (40 Marks) | Project Report (Observatory + Hands-on) (20 Marks) | Visit Report (10 Marks) | Seminar (10 Marks) | Assignment/ Lecture Report on Each Chapter (20 Marks) | Total Marks -100 |
|---------|------------------------|------------|------------------------|--|--|-------------------------|--------------------|---|------------------|
| 12 | Aakanksha Dongare | B. Sc.-III | 8001 | | <u>Bangare</u> | <u>Bangare</u> | <u>Bangare</u> | <u>Bangare</u> | |
| 13 | Akhilesh Puranik | B. Sc.-III | 8002 | | online | | | | |
| 14 | Akshy Ingle | B. Sc.-III | 8003 | | <u>Akshy</u> | <u>Akshy</u> | <u>Akshy</u> | <u>Akshy</u> | |
| 15 | Amisha Mishra | B. Sc.-III | 8004 | | online | | | | |
| 16 | Anuradha Mahajan | B. Sc.-III | 8005 | | <u>Anuradha</u> | <u>Anuradha</u> | <u>Anuradha</u> | <u>Anuradha</u> | |
| 17 | Divyani Mulatkar | B. Sc.-III | 8008 | | <u>Divyani</u> | <u>Divyani</u> | <u>Divyani</u> | <u>Divyani</u> | |
| 18 | Hrutuja Gopnarayan | B. Sc.-III | 8010 | | <u>Hrutuja</u> | <u>Hrutuja</u> | <u>Hrutuja</u> | <u>Hrutuja</u> | |
| 19 | Kalyani Kanojiva | B. Sc.-III | 8019 | | <u>Kalyani</u> | <u>Kalyani</u> | <u>Kalyani</u> | <u>Kalyani</u> | |
| 20 | Prashant Rathi | B. Sc.-III | 8005 | | online | | | | |
| 21 | Samiksha Dongare | B. Sc.-III | 8018 | | <u>Bangare</u> | <u>Bangare</u> | <u>Bangare</u> | <u>Bangare</u> | |
| 22 | Vaibhav Saraf | B. Sc.-III | 8010 | | online | | | | |
| 23 | Vaishnavi Mhaisane | B. Sc.-III | 8022 | | <u>Mhaisane</u> | <u>Mhaisane</u> | <u>Mhaisane</u> | <u>Mhaisane</u> | |

Course Code: 008

SANT GADGE BABA AMRAVATI UNIVERSITY, AMRAVATI
DIPLOMA COURSE IN ASTRONOMY

THEORY EXAM ATTENDANCE

Date: 30/11/2021

Time: 09 am to 10 am

Name of College: Shri R. L.T. College of Commerce, Akola
Science

College Code: 210

| Sr.No | Name Of Students | Roll Number | Signature |
|-------|--------------------------------|-------------|---------------------------|
| 1 | Aakanksha Shrikrushna Dongare | 8001 | <i>Dongare</i> |
| 2 | Akhilesh Ajay Puranik | 8002 | <i>Akhilesh Puranik</i> |
| 3 | Akshay Kailas Ingle | 8003 | <i>Akshay Ingle</i> |
| 4 | Amisha Sanjay Mishra | 8004 | <i>Amisha</i> |
| 5 | Anuradha Aniruddha Mahajan | 8005 | <i>Anuradha Mahajan</i> |
| 6 | Anuradha Vivek Dharamkar | 8006 | <i>Anuradha Dharamkar</i> |
| 7 | Bhushan Vishnu Gondachwar | 8007 | <i>Bhushan Gondachwar</i> |
| 8 | Divyani Ganesh Mulatkar | 8008 | <i>Divyani Mulatkar</i> |
| 9 | Gayatri Sarangdhar Ingle | 8009 | <i>Gayatri Ingle</i> |
| 10 | Hrutuja Bharat Gopnarayan | 8010 | <i>Hrutuja</i> |
| 11 | Kalyani Raju Kanojiya | 8011 | <i>Kalyani</i> |
| 12 | Meenakshi Nilkanth Ingle | 8012 | <i>Meenakshi Ingle</i> |
| 13 | Nikita Jayanand Tembhekar | 8013 | <i>Nikita</i> |
| 14 | Pooja Diliprao Hatgaonkar | 8014 | <i>Pooja</i> |
| 15 | Prashant Omprakash Rathi | 8015 | <i>Prashant Rathi</i> |
| 16 | Purvin Sunil Bhalekar | 8016 | <i>Purvin Bhalekar</i> |
| 17 | Ritika Chandrashekhar Wankhade | 8017 | <i>Ritika Wankhade</i> |
| 18 | Samiksha Shrikrushna Dongare | 8018 | <i>Samiksha Dongare</i> |
| 19 | Tanvi Suryakumar Dubey | 8019 | <i>Absent</i> |
| 20 | Vaibhav Balu Saraf | 8020 | <i>Vaibhav Saraf</i> |
| 21 | Vaishnavi Shrikrishna Kadu | 8021 | <i>Vaishnavi Kadu</i> |
| 22 | Vaishnvi Bhaskar Mhaisane | 8022 | <i>Vaishnvi Mhaisane</i> |
| 23 | Yash Sanjay Hagone | 8023 | <i>Yash Hagone</i> |

Present = 22
Absent = 01
Total = 23



V. D. Nanoty
DR. V. D. Nanoty
Principal
Shri R.L.T. College of Science
Civil Lines, AKOLA (M.S.)

S.R. Jaiswal
S.R. Jaiswal
30/11/2021



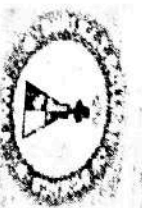
THE HIGHER SECONDARY

Shri R. L. T. College of Science, Akola
Diploma Courses in
Sericulture / Astronomy

with

Department of Lifelong Learning & Extension

Sant Gadge Baba Amravati University, Amravati.



List of Project/ Dissertation for Diploma in Sericulture (Session: 2020-2021)

| Sr. No. | Full Name of Candidate | Class/Batch | Group | Project Title | Marks out of 20 M | Sign |
|---------|-------------------------|-------------|---------|--|-------------------|------|
| 1. | Narayani D. Sonone | BSc I/ B5 | Group A | Cocoon Harvesting and Marketing | | |
| 2. | Prathamesh S. Honale | BSc I/ B5 | | | | |
| 3. | Rutuja S. Baidhe | BSc I/ B5 | | | | |
| 4. | Shweta V. Bharambhe | BSc I/ B3 | Group B | Infestation of Silkworm Pests and Control Measures | | |
| 5. | Tanvi S. Duhey | BSc I/ B2 | | | | |
| 6. | Yash Haggone | BSc I/ P4 | | | | |
| 7. | Bhushan Gondehwar | BSc II/ B5 | Group C | Infestation of Mulberry Pests and Control Measures | | |
| 8. | Saurabh P. Warkhade | BSc II/ B5 | | | | |
| 9. | Ujwal R. Patel | BSc II/ B5 | | | | |
| 10. | Harshal S. Giram | BSc II/ B5 | | | | |
| 11. | Vishal M. Andhale | BSc II/ B5 | | | | |
| 12. | Kalyani S. Puri | BSc II/ B6 | Group D | Bioecology of Mulberry Silkworm | | |
| 13. | Kunika H. Parmar | BSc II/ B3 | | | | |
| 14. | Pratiksha D. Chitliwant | BSc II/ P6 | | | | |
| 15. | Divya S. Paraskar | BSc II/ B2 | | | | |
| 16. | Raksha G. Sharma | BSc II/ B5 | Group E | Economy of Sericulture | | |
| 17. | Rutika R. Khundare | BSc II/ B5 | | | | |
| 18. | Rutuja S. Dandale | BSc II/ B5 | | | | |
| 19. | Vaishnavi B. Mahalle | BSc II/ B5 | | | | |
| 20. | Ankita R. Gajabhiye | BSc III/ B5 | Group F | | | |

| | | | | | | |
|-----|------------------------|-------------|---------|--|--|-------------------------|
| 21. | Shivani G. Gangannwar | BSc III/ B5 | | Scope of Entrepreneurship in Sericulture | | S. Gangannwar Shilpa |
| 22. | Vaishnavi S. Ingle | BSc III/ B5 | | Moriculture (Mulberry Plantation) | | V. Ingle |
| 23. | Vaishnavi B. Maisane | BSc III/ B5 | Group G | | | V. B. Maisane |
| 24. | Pragati S. Kalne | BSc III/ B1 | | | | Pragati |
| 25. | Priya C. Kholbure | BSc III/ B5 | | | | |
| 26. | Prajakta I. Parale | BSc III/ P3 | Group H | Non-Mulberry Sericulture in India | | P. Parale |
| 27. | Dhanashree M. Paddakhe | BSc III/ P3 | | | | D. Paddakhe |
| 28. | Janhavi Y. Ujwane | BSc III/ P3 | | | | J. Ujwane |
| 29. | Rushikesh R. Ghawar | BSc III/ P3 | | | | |
| 30. | Sagar Bandu Chechare | BSc III/ P5 | | | | S. Chechare |

Coordinator/In-charge Teacher



H.O.D.



Principal



Principal
Shri R.L.T. College of Science,
AKOLA

