

## JNU CBEE 2012 Syllabus for M.Tech (Biotechnology)

**Section I : Technology / Engineering Stream :**

**Part A : (Basic Engineering and Technology Pharmacology)**

**i) Basic Engineering and Technology :**

Basic concepts / principles in mechanical engineering, electrical and electronics engineering :

**Chemical Engineering :** Computer applications in chemical engineering- chemical process industries instrumentation methods of chemical analysis- thermodynamics- stoichiometry- fluid dynamics. mechanical operations- heat and mass transfer operations- chemical kinetics/reaction engineering- process instrumentation dynamics and control- process equipment design.

**Principles of Biochemical Engineering :** Enzyme catalysis (Michalis Menton Kinetics) and reactor design. Material & energy balances of fermentation processes. Kinetics of microbial growth and product formation (Monad model-Leudekins-Piert model). Nature of fermentation processes. Transport phenomena in biochemical reactors- Mass transfer in immobilized enzyme systems and Oxygen transfer in submerged fermentation process, examples of primary metabolites, secondary metabolites and enzymes.

Bioreactor operation and design, reactor sterilization. Batch, fed-batch and continuous culture process and cell recycle processes. Modelling of non-ideal behavior in bioreactors. Novel bioreactors, air-lift reactors, membrane bioreactors and fluidized bed reactors. Filtration and membrane based separations, centrifugation, extraction, absorption and chromatography.

**(ii) Pharmacology :**

Physiology, Pharmacology & Biochemistry: Basic physiology and biochemistry pertaining to all the systems in the body. Classification, mode of action, pharmacological effects, side effects, toxicity and posology of drugs acting on the CNS, ANS, CVS, gastrointestinal system, endocrine system. Principles of chemotherapy, chemotherapeutic agents, anticancer drugs, vitamins and minerals.

**Industrial Pharmacy :** Pharmaceutical processing – mixing, milling, drying, powder compression, clarification, filtration, Rheology, sterilization, sterility testing, disinfection, Pharmaceutical dosage forms: Formulation, manufacture and evaluation of solid, semisolid, liquid, aerosols and parenterals. Chemistry of natural products, SAR and Chemistry of analgesics, anticancer, CVS drugs, drugs acting on the CNS, GIT, chemotherapeutic agents, vitamins, hormones.classification, identification, extraction and isolation of active principles of commonly used medicinal plants. Immunological preparations, genetic engineering, fermentation. Biopharmaceutics, Pharmacokinetics-drug absorption, distribution, metabolism and elimination- general principles. Basic concepts of analysis of drugs.

**Section I : Technology / Engineering Stream**

**Part – B : (Physics, Chemistry and Mathematics)**

**Mathematics :**

Calculus – Differential Equation- Complex numbers- Complex integration- Power series- Three Dimensional Geometry-Algebra.

### **Physics :**

**Mechanics :** Kinematics – Newton’s laws – work and mechanical energy- dynamics of rotary motion- fundamentals of special theory of relativity- gravitation- motion in non-inertial frames.

**Thermodynamics :** Ideal gases- 1st law of thermodynamics – Kinetic theory of gases- 2nd law of thermodynamics -real gases.

**Electricity and Magnetism :** Electrostatics- Coulomb’s law- electric field potential- capacitance – dielectrics in an electric field- energy of an electric field- direct current- magnetic field of direct current- – electromagnetic induction.

**Waves and Optics :** Free harmonic oscillators – elastic waves- electromagnetic waves – interference, diffraction, scattering and polarisation of light – thermal radiation.

**Modern Physics :** Structure of matter and basic solid state physics – elementary nuclear physics – elementary quantum mechanics – structure of atom.

**Chemistry :** Inorganic chemistry: Electronic structure of atoms, periodic table and periodic properties. General characteristics, structure and reactions of non-transition elements and transition elements. Coordination compounds, structure, crystal field and ligand field theories, spectral and magnetic properties.

**Organic chemistry :** Synthesis, reactions and mechanisms of alkenes, alkynes, arenes, alcohols, phenols, aldehydes, ketones, carboxylic acids and their derivatives, halides, nitro compounds and amines. Structure and properties of biomolecules, carbohydrates, amino acids and proteins.

**Physical chemistry :** Chemical equilibrium, first law, thermochemistry, second law and entropy, free energy, properties of dilute solutions. chemical kinetics, rates of reactions and factors affecting rates of reactions. Spectroscopy, principles of UV- visible and IR spectroscopy.

### **Section I : Technology / Engineering Stream :**

#### **Part C : (Fundamentals of Life Sciences and Informatics)**

**Life Sciences :** Organization of unicellular organisms, invertebrates and vertebrates. Ultrastructure of plant and animal cells. Nucleic acids, protein synthesis, Mendelian genetics. Morphology of angiosperms. Biotechnology, Physiology.

**Information Technology :** Introduction to www.Networking : Basics-modem-hub-switch-commands to transfer files- remote login. Elements of languages used on the Internet JAVA- Perl. Elements of databases- Relational databases.

### **Section II : Science Stream :**

#### **Part A : Life Sciences :**

**Biochemistry** : Cell structure and function; protein synthesis; genetic code; DNA & RNA; carbohydrate, protein and lipid metabolism, clinical biochemistry; In born erros of metabolism; hormones and their function.

**Molecular biology & recombinant DNA Technology** : Properties of nucleic acids, chromosomes, DNA replication, damage and repair, gene manipulation, cloning vectors, gene libraries, screening of libraries, gene cloning, applications of recombinant DNA technology, PCR, RFLP, Western, Northern and Southern blotting.

**Immunology** : Cells of the immune system, lymphoid tissues, complement, antibodies, hybridoma technology, applications of monoclonal antibodies, antigen recognition, processing and presentation, cell mediated immunity, cytokines, hypersensitivity, vaccine technology, auto-immunity, transplantation, immune responses to various infections, Immunotechnology.

**Section II** : Science Stream :

**Part B** : (Physics and Chemistry)

**Physics** :

**Mechanics** : Kinematics- Newton's laws- work and mechanical energy- dynamics of rotary motion- fundamentals of special theory of relativity- gravitation- motion in non-inertial frames.

**Thermodynamics** : Ideal gases – 1st law of thermodynamics- Kinetic theory of gases- 2nd law of thermodynamics- real gases.

**Electricity and Magnetism** : Electrostatics- Coulomb's law – electric field potential- capacitance- dielectrics in an electric field – energy of an electric field- direct current- magnetic field of direct current- electromagnetic induction

**Waves and Optics** : Free harmonic oscillators- elastic waves- Electromagnetic waves- interference, diffraction, scattering and polarisation of light- thermal radiation.

**Modern Physics** : Structure of matter and basic solid state physics – elementary nuclear physics- elementary quantum mechanics- structure of atom.

**Chemistry** :

**Inorganic Chemistry** : Electronic structure of atoms, periodic table and periodic properties. General characteristics, structure and reactions of non – transition elements and transition elements. Coordination compounds, structure, crystal field and ligand field theories, spectral and magnetic properties.

**Organic Chemistry** : Synthesis, reactions and mechanisms of alkenes, alkynes, arenes, alcohols, phenols, aldehydes, ketones, carboxylic acids and their derivatives, halides, nitro compounds and amines. Structure and properties of boimolecules, carbohydrates, amino acids an proteins.

**Physical Chemistry** : Chemical equilibrium, first law, thermochemistry, second law and entropy, free energy, properties of dilute solutions. Chemical kinetics, rates of reactions and factors affecting rates of reactions. Spectroscopy, principles of UV-visible and IR spectroscopy.

**Section II** : Science Stream :

**Part C :** (Mathematics, Computer and Information Sciences)

**Mathematics :** Vectors- Trigonometry- Differentiation & Integration- Matrices

**Information Sciences :** Introduction to www. Networking: Basics-modem-hub-switch-commands to transfer files- remote login. Elements of languages used on the Internet JAVA- Perl. Elements of databases- Relational database.

**Computer Application :** Basics of computers – hardware – components of a computer. Operating systems – windows – linux – simple commands. Elementary Boolean arithmetic – subtraction – addition – multiplication. Applications – word processing – spread sheets. Elementary basic programming commands and syntax.