



**KONGUNADU ARTS AND SCIENCE COLLEGE (Autonomous)**  
COIMBATORE-641 029.

**B.Sc. BIOTECHNOLOGY**

**Curriculum & Scheme of Examination under CBCS**

*(Applicable to Students Admitted from the Academic Year 2017-2018 onwards)*

Semester	Part	Subject Code	Title of the Paper	Instruction hours/cycle	Exam. Marks			Duration of Exam (Hours)	Credits
					CIA	ESE	Total		
I	I	17TML101 <sup>@</sup>	Language	6	25	75	100	3	3
	II	17ENG101	English I	6	25	75	100	3	3
	III	17UBT101	C.P.1 - Cell Biology	6	25	75	100	3	5
		15UCH1A1	Allied - Paper I: Chemistry - I	5	20	55	75	3	4
		17UBT2CL	C.Pr.1 – Lab. in Cell Biology and Biochemistry	3	-	-	-	-	-
		15UCH1AL	Allied Pr.1 - Chemistry Practical	2	-	-	-	-	-
	IV	15EVS101	Environmental Studies*	2	-	50	50	3	2
II	I	17TML202 <sup>@</sup>	Language	6	25	75	100	3	3
	II	17ENG202	English II	6	25	75	100	3	3
	III	17UBT202	C.P.2 - Biochemistry	6	25	75	100	3	5
		15UCH2A2	Allied - Paper 2: Chemistry - II	5	20	55	75	3	4
		17UBT2CL	C.Pr.1- Lab. in Cell Biology and Biochemistry	3	40	60	100	4	3
		15UCH2AL	Allied Pr.1 - Chemistry Practical	2	20	30	50	3	2
	IV	15VED201	Value Education - Moral and Ethics*	2	-	50	50	3	2
III	I	17TML303 <sup>@</sup>	Language	6	25	75	100	3	3
	II	17ENG303	English III	6	25	75	100	3	3
	III	17UBT303	C.P.3 – Bioinstrumentation and Biophysics	4	25	75	100	3	4
		17UBT304	C.P.4 – Genetics	4	25	75	100	3	4
		15UBT3A3	Allied - Paper 3 : Basic Mathematics and Statistics	4	20	55	75	3	4
		17UBT4CM	C.Pr.2- Lab. in Bioinstrumentation, Genetics and Microbiology	2	-	-	-	-	-
	IV	17UGA3S1	Skill Based Subject: 1 General Awareness	2	25	75	100	3	3
		16UHR3N1*/16TBT301**/16TAT301*	Non Major Elective – I* Human Rights /Basic Tamil /Advanced Tamil	2	-	75	75	3	2
IV	I	17TML404 <sup>@</sup>	Language	6	25	75	100	3	3
	II	17ENG404	English IV	6	25	75	100	3	3
	III	17UBT405	C.P.5 – Microbiology	4	25	75	100	3	4
		17UBT4CM	C.Pr.2- Lab. in Bioinstrumentation, Genetics and Microbiology	3	40	60	100	4	3
		15UBT4A4	Allied - Paper 4 : C - Programming and Numerical Methods	5	20	55	75	3	4
		15UBT4AL	Allied Pr. 1 – Lab in C-Programming	2	20	30	50	3	2

	IV	17UBT4S2	Skill Based Subject: 2 – Human Anatomy and Physiology	2	25	75	100	3	3
		16UWR4N2* 16TBT401** 16TAT402*	Non Major Elective – II* - Women's Rights /Basic Tamil /Advanced Tamil	2	-	75	75	3	2
V	III	17UBT506	C.P.6- Immunology	4	25	75	100	3	4
		17UBT507	C.P.7- Molecular Biology	4	25	75	100	3	4
		17UBT508	C.P.8- Recombinant DNA Technology	5	25	75	100	3	4
		17UBT509	C.P.9 - Animal Biotechnology	5	25	75	100	3	4
		17UBT5CN	C.Pr.3 – Lab. in Immunology, Molecular biology, Recombinant DNA Technology and Animal Biotechnology	5	40	60	100	4	3
		17UBT5E1	Major Elective - I	5	25	75	100	3	5
	IV	16UBO5X1/ 17UBC5X1/ 16UZO5X1	Extra Departmental Course (EDC) - I	2	25	75	100	3	3
		17UBT5ST	Summer Training @@						
VI	III	17UBT610	C.P.10 - Bioprocess technology	5	25	75	100	3	4
		17UBT611	C.P.11 - Plant Biotechnology	5	25	75	100	3	4
		17UBT612	C. P. 12–Genomics, Proteomics and Bioinformatics	5	25	75	100	3	4
		17UBT6CO	C.Pr.4- Lab. in Bioprocess technology, Plant Biotechnology and Bioinformatics	5	40	60	100	4	3
		17UBT6Z1	Project***	3	20	80	100	3	3
		17UBT6E2	Major Elective - II	5	25	75	100	3	5
	IV	17UBT6S3	Skill Based Subject: 3 - Infectious Diseases, Diagnostics and Health Management	2	25	75	100	3	3
	V	17NSS101/ 17NCC101/ 17PYE101/ 17YRC101#	Extension Activities**	-	50	-	50	-	1
<b>Total</b>				<b>180</b>			<b>3800</b>		<b>140</b>

@ Hindi/Malayalam/French/Sanskrit-15HIN/MLM/FRN/SAN101 - 404

\*No Continuous Internal Assessment. Only End of Semester Examinations (ESE)

\*\* No End of Semester Examinations. Only Continuous Internal Assessment (CIA)

\*\*\* Project Report – 60 marks; Viva voce-20 marks; Internal – 20 marks; Group Project

CBCS – Choice Based Credit system; CIA – Continuous Internal Assessment; ESE – End of Semester Exam.

### Non - Major Elective subjects

1. Human Rights
2. Women's Rights

### Major Elective Subjects (2 subjects to be chosen from the following 4 papers)

1. Research Methodology and Biostatistics
2. Nanobiotechnology and Intellectual Property Rights
3. Biodiversity and Environmental Biotechnology
4. Medical Biotechnology

**Skill Based Subject**

1. General Awareness (On-line Examination)
2. Human Anatomy and Physiology
3. Infectious Diseases, Diagnostics and Health Management

**Extra Departmental Courses (EDC)**

S. No.	Subject code	Subject	Offering Department
1.	17UBC5X1	Diagnostic Biochemistry	Biochemistry
2.	16UBO5X1	Medicinal Botany	Botany
3.	16UZO5X1	Ornamental Fish Culture Technology	Zoology

**Note:** In core/allied subjects, number of papers both theory and practical are included wherever applicable. However, the total credits and marks for core/allied subjects remain the same as stated below.

**Tally Table:**

S. No.	Part	Subject	Marks	Credits
1.	I	Language – Tamil/ Hindi / Malayalam / French	400	12
2.	II	English	400	12
3.	III	Core – Theory / Practical / Project	1700	65
		Allied	400	20
		Electives	200	10
4.	IV	Basic Tamil /Advanced Tamil (OR) Non-Major elective	150	4
		Skill Based subject	300	9
		Extra Departmental Course	100	3
		Environmental Studies	50	2
		Value Education	50	2
5.	V	Extension Activities	50	1
<b>Total</b>			<b>3800</b>	<b>140</b>

**Note:**

25 % CIA is applicable to all theory subjects except JOC, COP and Diploma Courses, which are considered as extra credit courses.

**Job Oriented Courses (JOC)**

1. Medical Coding (17UBT0J1)
2. Applied Biotechnology – Biomass, Biofertilizer and Biocontrol agents (17UBT0J2)

**Note:** JOC which are offered at present will be applicable for the students admitted during the academic year 2017-2018 and will be considered as extra credit courses.

@@ The result of the summer training will be displayed in the V Semester's mark sheet as follows:

- 85-100 - Grade O
- 70-84 - Grade D
- 60-69 - Grade A
- 50-59 - Grade B
- 40-49 - Grade C

### 1. Break up Marks for CIA of Theory

CIA Exam	-	15
Assignment	-	5
Attendance	-	5
		<hr/>
Total		25
		<hr/>

### 2. Components of Practical:

#### Break up Marks for CIA of Practical

CIA Practical Exam	-	25
Observation Notebook	-	10
Attendance	-	5
		<hr/>
Total		40
		<hr/>

#### Break up Marks for ESE of Practical

Experiment	-	50
Record	-	10
		<hr/>
Total	-	60
		<hr/>

### 3. Component for Project:

CIA / ESE	Particulars	Project Out of 100 Marks (UG)
CIA	Project Review	15
	Attendance	5
	<b>Total Internal Marks</b>	<b>20</b>
*ESE	Project Report Presentation	60
	Viva Voce	20
	<b>Total External Marks</b>	<b>80</b>
<b>Total Marks (CIA+ESE)</b>		<b>100</b>

*\* Project report and Viva voce will be evaluated jointly by both the Project Supervisor (Faculty of the Department) and an External Examiner*

**C.P.1 - CELL BIOLOGY**

Total Credits: 6

Total Hours: 90

***Objective:***

*To understand the structural and functional aspects of the cell and foundation in the molecular mechanisms underlying cellular functions.*

**UNIT-I****(18 HRS)**

*Cell:* Discovery of cells - Cell Theory – Protoplasmic and organismal theory, Types of Cells – Prokaryotic, Eukaryotic and Virus with structure and example; Structure and Function of Plant and Animal cells. Animal cell types.

**UNIT-II****(18 HRS)**

*Cellular Organelles:* Plasma Membrane; Nuclear compartment, chromatin; Structure and Functions of Mitochondria, Plastids, Endoplasmic reticulum, Golgi apparatus, **Lysosomes\***, Microbodies, Peroxisomes, Microtubules and Plasmodesmata. Ribosomes, Cytoskeleton structures (Microtubules, Microfilaments and Intermediate filaments). Cilia, flagella-structure and function

**UNIT-III****(18 HRS)**

*Specialized cells:* Muscle and Nerve cells (Physiology and Function); Cell Cycle; Cell junctions and Cell-Cell interaction. Erythropoiesis- genetic and molecular basis of erythrocyte differentiation, morphological specialization of red blood cells.

**UNIT-IV****(18 HRS)**

*Cell division in prokaryotes and eukaryotes:* Mitosis and Meiosis, Cell Cycle and its regulation, Cell death. Cell Signaling-G protein coupled receptors, RTKs, Cytokine Receptors & NRTKs, **Enzyme linked receptors\***. Apoptosis, Stem cells, Prions. Cancer - Types, Characteristics and Treatment.

**UNIT-V****(18 HRS)**

*Tools of Cytology:* Microscopy - Resolving power, Light Microscope, Phase Contrast, Bright field Microscope and Fluorescent microscope. Specimen preparation for microscopy. Cell fractionation techniques - Physical, Chemical and Enzymatic methods.

**Text Book**

Verma, P.S. and V. K. Agarwal, 2003. Cytology. S. Chand and Co, New Delhi.

**References**

1. Alberts, B. 2002. Molecular Biology of the Cell, 4<sup>th</sup> Edition. Garland Publishing, Inc., New York.
2. De Robertis, E.D.P. and E.M.F. De Robertis. 1995. Cell and Molecular Biology, 8<sup>th</sup> Edition, B.I. Waverly Pvt. Ltd., New Delhi.
3. Lodish et al. 1995. Molecular Cell Biology, Scientific American Books.
4. Ekambranatha Ayyer, M. and T.N. Ananthakrishnan. 1982. Outlines of Zoology: Invertebrate. S. Viswanathan Printers and Publishers Pvt. Ltd.

*\* Self Study and Question for Examination must be taken from the self study portion also*

**C.P.2 – BIOCHEMISTRY**

Total Credits: 4

Total Hours: 90

**Objective:**

*On the successful completion of the subject, the student get an overall understanding of structure of atoms, molecules and chemical bonds, enzyme kinetics, biopolymers and metabolic reaction in the living systems.*

**UNIT-I****(18 HRS)**

*Water:* Structure of water, Hydrogen bonding and solubility, Physical properties, Cellular reactions of water, Ionization of water. pH and pKa: Definition, Henderson-Hasselbalch Equation, titration curve. Buffers: Principle and Types of buffers used in Biological science.

**UNIT-II****(18 HRS)**

*Carbohydrates:* Classification, structure and chemical properties (with two examples for each classification) of sugars. Glycolysis, TCA cycle, Electron transport chain and Oxidative phosphorylation. **Gluconeogenesis\***.

**UNIT-III****(18 HRS)**

*Amino acids:* Classification, structure and reactions of amino acids. Amino acid catabolism (Transamination, deamination and decarboxylation) Proteins: Classification and orders of protein structure. Protein sequencing – Introduction.

**UNIT-IV****(18 HRS)**

*Lipids:* Classification, **General Properties\*** and functions. Fatty acid - Biosynthesis and oxidation - beta oxidation. *Nucleic acids:* Nucleosides and Nucleotides. Structure of DNA and RNA. Synthesis of purines and pyrimidines. *Vitamins:* Classification, functions and its hypo, hyper manifestations. *Minerals:* sources, functions and manifestations of sodium, potassium, calcium and selenium

**UNIT-V****(18 HRS)**

*Enzymes:* Definition, IUB classification, Nomenclature and properties, Physical factors affecting enzyme activity. Enzyme kinetics: Michaelis-Menton Equation, Lineweaver-Burkeplot. Mechanism of Enzyme regulation. Enzyme inhibition. Co-enzyme and Co-factors.

**Text book**

1. Sathyanarayana O. U., 2014. Biochemistry. Books & Allied Pvt. Ltd., Kolkatta

**References**

1. Aroor.A.K.,2010. Medical Biochemistry, Japee brothers. Medical publications Pvt Ltd.
2. Chawla.R and Tarekh.H, 2014,1<sup>st</sup> Edition. A comprehensive Text book of Medical Biochemistry, Lippincott Williams and Wikins.
3. Voet.D and Voet.J., 2010. Biochemistry, Donald Voet, Judith G. Voet, Published by J. Wiley & Sons,Eds. 4.

*\* Self Study and Question for Examination must be taken from the self-study portion also*

**C. Pr. 1 – LAB. IN CELL BIOLOGY AND BIOCHEMISTRY**

Total Credits: 2

Total Hours: 45+45

***Objective:***

*To understand and to have a hands on experience in various basic aspects of cell biology and Biochemistry.*

**CELL BIOLOGY****(45 HRS)**

1. General Laboratory Instructions and Safety – Video / Power-point
2. Microscopy
3. Cell types – Microbial, Animal and Plant cells
4. Centrifuge – Ultra and Table top
5. Fraction of Cellular components
6. Cell Counting – RBC and WBC
7. Preparation of blood Smear.
8. Mitotic Preparation in Onion root tip
9. Differential leukocyte count by Leishmann's staining

**BIOCHEMISTRY****(45 HRS)**

1. Preparation of standard solutions (Molar, Normal, Molal and Percentage solutions)
2. Qualitative analysis of sugars (Glucose, lactose and starch)
3. Estimation of total sugars by Anthrone method
4. Qualitative tests for proteins
5. Estimation of Protein by Lowry's method
6. Estimation of total free amino acids by Ninhydrin method
7. Estimation of Lipids
8. Enzyme analysis – Amylase
9. Quantification of Vitamin C
10. Paper chromatography
11. Thin layer Chromatography

**C.P.3 – BIOINSTRUMENTATION AND BIOPHYSICS**

Total Credits: 4

Total Hours: 45

***Objective:***

*To make the student to understand the fundamental of biophysics and the basic principle of instruments used in biology.*

**UNIT-I****(09 HRS)**

pH meter; Electron microscopy- principles and methods; dialysis; Centrifuges: - Working principle, types and applications

**UNIT-II****(09 HRS)**

*Photometry: Colorimetry\**, UV- visible spectrophotometry, fluorimetry and flame photometry – working and applications, sonicator, ELISA reader: working and applications.

**UNIT-III****(09 HRS)**

*Chromatography:* Principle and types – **paper\***, TLC, column chromatography, ion exchange, molecular exclusion, affinity, HPLC and gas liquid chromatography, mass spectrometry and lyophilization.

**UNIT-IV****(09 HRS)**

*Electrophoresis:* Principles of AGE, PAGE, Immunoelectrophoresis, 2 D-gel electrophoresis and capillary electrophoresis, Geiger Muller and Scintillation counters. *PCR:* principle, types, instrumentation and applications.

**UNIT-V****(09 HRS)**

*Biophysics:* Properties of light-spectrum, bioenergetics and thermodynamic laws, determination of structure of nucleic acids and proteins by X-ray crystallography and nuclear magnetic resonance (NMR).

**Textbook**

1. Veerakumari, L. 2009. Bioinstrumentation. MJP Publishers, New Delhi, India.
2. Wilson, K. and J. Walker, 2000. Practical Biochemistry, 5<sup>th</sup> edition, Cambridge University Press, Cambridge.

**References**

1. Holme and Peck, 1998. Analytical Biochemistry, 3<sup>rd</sup> Edition, Longman Scientific.
2. Skoog and Leary, 1992. Principles of Instrumental analysis, 4<sup>th</sup> Edition. Saunder's College Publishing, New York.
3. Sharma, B.K., 1991. Instrumental Methods of Chemical analysis. Goel Publishing House, New Delhi.

*\* Self Study and Question for Examination must be taken from the self-study portion also*



**C.P.4 – GENETICS**

Total Credits: 5

Total Hours: 60

***Objective:***

*To make the students to understand the fundamentals, concept of gene and their behaviors like expression and regulation.*

**UNIT-I****(12 HRS)**

Mendelian Principles: **Segregation, Independent assortment\***, Non-Mendelian Inheritance, Dominance relations and Multiple alleles in diploid organisms: Incomplete Dominance, Overdominance, Codominance, complementation test.

**UNIT-II****(12 HRS)**

Gene Interaction, Epistasis. Chromosomal theory of inheritance, Linkage and crossing over, Sex determination and Sex linkage in diploids. Gene: Fine structure of gene, Cistron, Muton, Recon, Structure of eukaryotic and prokaryotic gene.

**UNIT-III****(12 HRS)**

Chromosome morphology, banding pattern, landmarks, FISH, Chromosomal aberrations. Karyotyping. Human Genetic Diseases - Down's syndrome, Turner's syndrome, Klinefelter's syndrome.

**UNIT-IV****(12 HRS)**

Gene Mutation - Classification of mutations, Suppressor and Reverse Mutations, DNA as a genetic material (Transformation, Conjugation and Transduction).

**UNIT-V****(12 HRS)**

Genetic Recombination (Homologous recombination-Holliday model). Modern concept of genes. Population genetics: Hardy –Weinberg law, Gene frequency, Gene pool, Inbreeding, Outbreeding. Genetic drift, Shift, Pedigree analysis and genetic counselling.

**Text Books**

1. Verma, P.S. and V. K. Agarwal, 2003. Genetics. S. Chand and Co, New Delhi.

**References**

1. Tamarin, R.H., 2002. Principles of Genetics, Tata McGraw-Hill Publishing Co. Pvt. Ltd., New Delhi (ISBN 9780070486676).
2. Gupta, P.K., 1996. Genetics. Rastogi Publications, Meerut.
3. Gardner, *et al.* 1991. Principles of Genetics. John Wiley and Sons Pvt. Ltd.
4. Genetics - Strickberger. Published by Prentice Hall of India Pvt. limited. 2006, Edition: 3.

*\* Self Study and Question for Examination must be taken from the self-study portion also*

**C.P.5 – MICROBIOLOGY**

Total Credits: 4

Total Hours: 60

**Objective:** To make the students to understand the basic concepts of the biology of microorganisms.

**UNIT-I****(12 HRS)**

History of Microbiology - Ultra structure and function of Prokaryotes (Bacteria). General classification: Bacteria (Bergey's classification and modern classification [16S rRNA-PCR]), fungi and virus (Baltimore Classification of virus). Classification of Algae.

**UNIT-II****(12 HRS)**

Culture media - Types and preparation. Sterilization methods - Dry heat, moist heat, radiation, filtration and chemicals. Culture methods - Isolation and maintenance of pure culture (spread plate, streak, and pour plate). Preservation methods, bacterial staining and fungal staining methods.

**UNIT-III****(12 HRS)**

Nutritional requirement of bacteria - Nutritional Types of Microorganisms. Microbial growth – growth curve; Measurement of microbial growth - dry weight, colony count, packed cell volume, turbidometry and haemocytometry.

**UNIT-IV****(12 HRS)**

Microbial interaction: Symbiosis, asymbiosis, ammensalism, synergism, mutualism, neutralism, **commensalisms\***. Microbiology of water – water pollution and water borne disease (Vibriosis). Bacteriological examination of water – Membrane filtration technique and MPN test.

**UNIT-V****(12 HRS)**

Microbial Diseases: Causative agents, pathogenesis, symptoms, diagnosis and prophylaxis of Typhoid, Staphylococcosis, Aspergillosis, Candidiasis, TMV, **HIV\***, Dengue fever, Influenza.

**Textbook**

1. Pelczar, Jr. 2004. Microbiology, 5<sup>th</sup> Edition, Tata McGraw-Hill Publishing Co. Ltd, New Delhi.

**References**

1. Prescott *et al.* 1997. Microbiology. Tata McGraw-Hill Publishing Co. Ltd, New Delhi.
2. Stainer, *et al.* 1992. General Microbiology, 5<sup>th</sup> edition. Macmillan Education Ltd., London.
3. Ronald M. Atlas and R. Bartha, 1998. Microbial Ecology – Fundamentals and Applications. Pearson Education, Asia.

*\* Self Study and Question for Examination must be taken from the self study portion also*

**C.Pr.2 – LAB. IN BIOINSTRUMENTATION, GENETICS AND MICROBIOLOGY**

Total Credits: 2

Total Hours 75

***Objective:****To have a practical experience in Instrumentations, Genetics and Microbiological techniques.***BIOINSTRUMENTATION**

1. pH meter
2. Colorimeter and Spectrophotometer
3. HPLC (Demo)
4. PCR (Demo)
5. ELISA READER (Demo)

**GENETICS****(45 HRS)**

1. Preparation of Buccal Smear.
2. Problem Solving in Mendelian Ratios.
3. Isolation of Giant chromosome from Drosophila
4. Extraction of Human DNA.
5. Sex chromatin (Buccal smear)
6. Estimation of DNA by Diphenylamine method.
7. Estimation of RNA by Orcinol method.
8. Estimation of DNA by UV-Spec method
9. Estimation of RNA by UV-Spec method

**MICROBIOLOGY**

1. Preparation of media for bacteria and fungi and sterilization methods
2. Preparation of agar slant and Stab
3. Pure culture techniques - Pour plate, spread plate and Streak Method
4. Motility test – Hanging Drop method
5. Staining of Bacteria - Simple, Gram's, Capsule, Endospore
6. Fungal Staining – LCB technique
7. Biochemical tests for identification of Bacteria
8. Enumeration of microorganisms from water, soil, air and spoiled food.
9. Bacterial growth curve – Spectrophotometry method.
10. Antibiotic sensitivity test – Kirby Bauer method

**C.P.7 - IMMUNOLOGY**

Total Credits: 4

Total Hours: 60

***Objective:***

*To make the student to understand the definition of immunity, how it discriminates self and nonself and its regulation.*

**UNIT-I****(12 HRS)**

*Types of Immunity:* Innate and Acquired immunity. Primary and Secondary immune responses. Cells and Organs of the Immune system (Primary lymphoid organ-Bone marrow, secondary lymphoid organ-lymph node). Humoral and Cell mediated immunity. Hematopoiesis and Development of B & T lymphocytes- clonal expansion, production of plasma and memory cells. T<sub>H</sub> and T<sub>C</sub> cells.

**UNIT-II****(12HRS)**

*Antigens:* Essential features of antigens, Epitopes, Haptens, Adjuvants, Cross reactivity, Synthetic antigens. MHC- structure and function, MHC restriction. HLA typing. *Antibody:* Structure, Types, properties and their biological functions. CD markers.

**UNIT-III****(12 HRS)**

*Complement biology:* Definition, Nomenclature, Activation pathways (classical and alternate). *Cytokines:* Interleukins and interferons and its biological functions. *Hypersensitivity reactions:* Type I to IV. Tolerance and Immunosuppression.

**UNIT-IV****(12 HRS)**

*Transplantation Immunology:* Types of grafts, transplantation reactions (graft versus host) Tumour Immunology: tumor antigens and its regulation. Autoimmunity. **General Immune response to infectious diseases (Bacteria and Viruses)\*.** Immunodeficiency diseases-types- X-Linked Agammaglobulinemia - AIDS.

**UNIT-V****(12 HRS)**

*Vaccine:* Definition, Types (Attenuated, sub-unit and DNA vaccines and anti-idiotypic vaccines). Immunotechnology: Monoclonal Antibodies production and applications, **agglutination\***, precipitation, complement fixation, Immunofluorescence, RIA and Immunoblotting. Immuno surveillance- mechanisms.

**Text Book**

1. Richard A. G., J. K. Thomas and A. O. Barbara, 2006. Kuby's Immunology, 6<sup>th</sup> Edition. W.H. Freeman and Company, New York.

**References**

1. Ashim K. Chakravarty, 2006. Immunology and Immunotechnology. Oxford University Press (India).
2. Tizard, I. R., 1995. Immunology: An Introduction, 4<sup>th</sup> edition. Prentice Hall, International.
3. Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt, 2016. Roitt's Essential Immunology, 13th edition. Wiley-Blackwell.
4. Khan, Fahim Halim, 2009. The elements of Immunology, Pearson Education (India) Pvt. Ltd.

*\* Self Study and Question for Examination must be taken from the self study portion also*

**C.P. 6 - MOLECULAR BIOLOGY**

Total Credits: 4

Total Hours: 60

***Objective:***

*To make the student understand the basics of molecular level cellular regulation and its mechanism.*

**UNIT-I****(12 HRS)**

Universal genetic code, Wobble hypothesis, Degeneracy; Replication: Mechanism in Prokaryotes and eukaryotes, Theta & rolling circle model, Enzymology of replication. Replication of RNA genome- replicase and reverse transcriptase

**UNIT-II****(12 HRS)**

Mutation: **Mutagenesis\***, Biochemical Basis of Mutations, Spontaneous and Conditional mutants, Ames test for mutation, Reversion and Suppression mutations. DNA damage and molecular mechanisms of repair (mismatch, excision and recombination)

**UNIT-III****(12 HRS)**

Gene expression in prokaryotes: Transcription, Translation; RNA processing and post-transcriptional modification, post-translational modifications and folding of newly assembled Polypeptides, translational regulations, signal sequences and protein export.

**UNIT-IV****(12 HRS)**

Gene regulatory elements (*cis*-regulatory elements (promoter, enhancer, silencer, response elements) and trans-regulatory elements (transcription factors), Gene regulation in prokaryotes-Operon concept – *trp* and *lac*; Transposons and insertion sequences, Prokaryotic and Eukaryotic Transposons.

**UNIT-V****(12 HRS)**

Recombination – Homologous and Non homologous – Holliday model, Recombinases - RecA, Cre. Lambda phage: genome, **lytic and lysogeny cycle\***, transcriptional switch genetics (*Cro* gene, *Cl* gene).

**Textbook**

1. Freidfelder's Essentials of Molecular Biology. 4<sup>th</sup> edition. Malacinski, G. M. Narosa Book Distributors Private Ltd (reprint 2008).

**References**

1. Lodish *et al.* 2001. Molecular Cell Biology. W.H. Freeman and Co., New York.
2. Watson, J. D. *et al.* 1998. Molecular Biology of the gene, 4<sup>th</sup> Edition., The Benjamin/Cummings Publ. Co., Inc., California.

*\* Self Study and Question for Examination must be taken from the self study portion also*

**C.P. 8 – RECOMBINANT DNA TECHNOLOGY**

Total Credits: 4

Total Hours: 75

***Objective:***

*To enable the students to learn the various molecular biology techniques, principle and application of genetic engineering which includes cloning strategies and its applications.*

**UNIT-I****(15 HRS)**

Basics of rDNA technology - Tools for rDNA technology and steps of gene cloning in prokaryotes, plasmids and hosts: characteristic features and problems. Manipulating Enzymes: Restriction Endonucleases, Exonucleases, Polymerases, DNA modifying enzymes and Ligases and restriction mapping.

**UNIT-II****(15 HRS)**

Cloning vectors: pBR322, pUC and their derivatives, pGEM vectors. Phage vectors -  $\lambda$  vectors, cosmids and phagemids. Single strand vectors (M13), Binary and Shuttle vectors.

**UNIT-III****(15 HRS)**

Specialized vectors: Yeast episomal plasmids, Yeast integrative plasmids, Yeast replicative plasmids, BAC and YAC. Animal vectors- Vaccinia virus and Baculo viral vectors. *Plant vectors - Ti plasmid as gene vector, Caulimoviruses, Gemma viruses.* Expression vectors (pET) for prokaryotes, cassettes and gene fusion. Problems encountered in expressing foreign gene in *E.coli*.

**UNIT-IV****(15 HRS)**

Genomic library, cDNA library - RT-PCR, Real time PCR. Methods of labeling, Southern and **Northern hybridization**\*- detection of cloned gene products, Selection of clones by hybridization probes - Plaque and colony hybridization. Antibody based screening.

**UNIT-V****(15 HRS)**

DNA sequencing- Sanger's and Maxam-Gilbert method, Pyrosequencing, Applications of sequencing. Marker Genes – *gus*, *GFP*, *lux* and *luc*. RNAi technology- siRNA, miRNA. DNA analysis in **forensics, medicine and Agriculture**\*

**Textbook**

1. Brown TA., 2010, Gene cloning and DNA analysis, An Introduction. John Wiley & Sons
2. Primrose, S.B., and Twyman. R ., 2009, Principles of gene manipulation and genomics, Wiley.com

**References**

1. Winnacker, E.L., 2003. From Genes to Clones. Panima Publishing Corporation, New Delhi.
2. Old *et al.* 2001. Principles of Gene Manipulation, 6<sup>th</sup> Edition. Blackwell Science, London.
3. Glick, B. R. and J.J. Pasternak.1998. Molecular Biotechnology, 2<sup>nd</sup> Edition, ASM Press, Washington.
4. Watson *et al.* 1992. Recombinant DNA, 2<sup>nd</sup> Edition. W.H. Freeman and Co., New York.

\* Self Study and Question for Examination must be taken from the self study portion also

**C.P.9 - ANIMAL BIOTECHNOLOGY**

Total Credits: 4

Total Hours: 75

***Objective:***

*To enable the students to understand and learn various culturing techniques of animal cells (in vitro) gene transferring methods and production of transgenic animals.*

**UNIT-I****(15 HRS)**

Molecular events during fertilization (mammals), **Types of eggs\***, Blastulation, Gastrulation, Embryonic induction (Spemann organizer) and Fate maps in amphibians; Drosophila- Genetics and pattern of development: Morphogens (Bicoid and Nanos), morphogenic gradient, Homeotic genes (Antennapedia and Bithorax).

**UNIT-II****(15 HRS)**

Culture media: Balanced salt solutions and simple growth media, functions of Physical and chemical constituents of culture medium, role of carbon dioxide, serum, growth factors, glutamine and other amino acids of cell culture medium. Serum and serum free media for cell lines. Contamination: source, types, monitoring and eradication.

**UNIT-III****(15 HRS)**

History of animal tissue culture, Primary and established cell culture, culture methods (plasma clot, agar gel raft, and grid) - cell strain - cell lines - cell separation - cell synchronization, cell counting (dye exclusion assay) Cytotoxicity (MTT Assay) – Culturing of embryos, cryopreservation, Semen banking, Micro manipulation of cells, Artificial insemination, IVF-PZD, SUZI.

**UNIT-IV****(15 HRS)**

Stem cells: Stem cells and their applications (Cell cloning: Therapeutic Cloning, Reproductive cloning (Dolly); Transformation of cells in culture - Animal viral vectors for transfection (Adeno and Retro), Gene targeting (knock out mouse), Gene silencing (RNAi) and their applications. Gene therapy and its application.

**UNIT-V****(15 HRS)**

Transgenic animals: Production (physical, chemical and biological methods), Application – Hormone - Insulin to Humulin, Cytokines, Interferons and **Human growth hormones**, Blood clotting factors (Plasminogen activators), Biopharming (Somatropin). (RTS, DSR and SRK).

**Textbook**

1. Satyanarayana, U. 2005. Biotechnology. McGraw Hill Publishing Co., Kolkata.
2. Ranga, M. M., 2004. Animal Biotechnology, 2<sup>nd</sup> Edition. Agrobios (India), Jodhpur.

**References**

1. Freshney, R. I., 2006. Culture of Animal cells: Manual of Basic technique, 5<sup>th</sup> edition. John Wiley Publications.
2. Masters, J. R. W., 2000. Animal Cell Culture: A practical approach series, 3<sup>rd</sup> Edition. Oxford University Press, London.
3. Bruce Carlson, 2006. Foundations of Embryology. Tata McGraw Hill Publications.

*\* Self Study and Question for Examination must be taken from the self study portion also*

**C. Pr. 3 – PRACTICALS – 3: IMMUNOLOGY, MOLECULAR BIOLOGY, rDNA  
TECHNOLOGY AND ANIMAL BIOTECHNOLOGY**

Total Credits: 3

***Objective:***

*To have hands on experience and learn the principles behind each technique.*

**IMMUNOLOGY**

1. ELISA
2. Immunoelectrophoresis
3. ABO blood grouping.
4. Radial immunodiffusion.
5. Ouchterlony Double immunodiffusion.
6. Preparation of serum from blood.
7. Immunoassay of particulate antigen.
8. WIDAL test

**MOLECULAR BIOLOGY**

1. Extraction of Genomic DNA (Bacteria, Animal and Human).
2. Extraction of Plasmid DNA.
3. Polyacrylamide Gel Electrophoresis
4. Bacterial Transformation

**RECOMBINANT DNA TECHNOLOGY**

1. Restriction Digestion and Ligation.
2. Amplification of a gene by Polymerase Chain Reaction
3. Southern Blotting

**ANIMAL BIOTECHNOLOGY**

1. Animal cell culture medium preparation
2. Primary cell culture and subculturing.



**C.P.10 - BIOPROCESS TECHNOLOGY**

Total Credits: 4

Total Hours: 75

***Objective:***

*To understand the basics of fermentation technology and to learn the concepts of screening, optimization and maintenance of cultures.*

**UNIT I****(15 HRS)**

*Bioprocess technology:* Basic principles, **scope and advantages of bioprocess technology\***. Fermentation systems and Kinetics: batch, fed batch and continuous.

**UNIT II****(15 HRS)**

*Bioreactor:* Components, design and functions. Types of bioreactors (CSTR, packed bed, batch, Air lift bioreactor). Isolation, screening and maintenance of industrially important microorganisms and strain improvement methods.

**UNIT III****(15 HRS)**

*Upstream Processing:* Media formulation. Media sterilization, Air and components of a bioreactor. Inocula development. Scale up and Scale down. Transport phenomena: - Mass, oxygen and heat transfer mechanism.

**UNIT IV****(15 HRS)**

*Downstream Processing:* Introduction, removal of microbial cells and solid matter, foam separation, membrane processes (microfiltration, Ultrafiltration, nanofiltration and reverse osmosis), precipitation (solvent precipitation and salting out), filtration, centrifugation, cell disruptions (Mechanical, enzymatic and chemical), liquid – liquid extraction chromatography, drying and crystallization.

**UNIT V****(15 HRS)**

*Industrial Biotechnology:* Alcoholic beverages (**beer and wine\***), organic acids (acetic and citric acid), Organic solvents (ethanol), enzymes (Amylase and Protease), antibiotics (Pencillin and Streptomycin), vitamin B12 and amino acids (glutamic acid).

**Textbook**

1. Stanbury, P. F. and A. Whitaker, 2003. Principles of Fermentation Technology. Pergamann Press, Oxford.
2. Sathyanarayana, U., 2007, Biotechnology, Books & Allied (P) Ltd.

**References**

1. Shuler, M. L. and F. Kargi, 2003. Bioprocess engineering: Basic Concepts. Prentice Hall, Engelwood Cliffs.
2. Cruger, W. and A. Cruger, 2003. A Textbook of Industrial Microbiology. Panima Publishing Corporation, New Delhi.
3. Casida, L.E., 1999. Industrial Microbiology. New Age International Pvt. Ltd., New Delhi.

*\* Self Study and Question for Examination must be taken from the self study portion also*

## UBT 14

### SEMESTER-VI

17UBT611

### C.P.11 - PLANT BIOTECHNOLOGY

Total Credits: 4

Total Hours: 75

#### **Objective:**

*To make the students understand the basics of the biology behind plant science.*

#### **UNIT – I**

**(15 HRS)**

Plant genome organization: Structural features of a plant genome, chloroplast and mitochondria, protein targeting: chloroplast and mitochondria, Model plant: Arabidopsis

#### **UNIT – II**

**(15 HRS)**

Plant breeding: Heterosis and male sterility, plant tissue culture: history, laboratory organization, **sterilization methods\***, types and composition of media and preparation, plant growth regulators.

#### **UNIT – III**

**(15 HRS)**

Propagation techniques: Micropropagation, Callus culture and its maintenance, cell culture, isolation of protoplast, fusion and culture, somatic embryogenesis and synthetic seed preparation, haploid production: Anther and pollen culture and somaclonal variation.

#### **UNIT – IV**

**(15 HRS)**

Biological N<sub>2</sub> fixation: Mechanism of *nif* and *nod* genes. Transformation: stable and transient gene expression, gene transformation methods: chemical and gene gun. Model Plants: Tobacco, *Agrobacterium* characteristics, Ti and Ri plasmids, mechanism of T-DNA transfer, plant viral vector-CaMV

#### **UNIT- V**

**(15 HRS)**

Transgenic plants: Chitinase gene based fungal resistance, coat protein mediated virus resistance, Insect resistance (Bt genes) and herbicide resistance, golden rice and Flavr Savr tomato, plantibodies, edible vaccines (interleukins and interferons) and biodegradable plastics, GM food and **biosafety issues\***.

#### **Textbook**

1. Chawla, H. S. 2002. Introduction to Plant Biotechnology. 2<sup>nd</sup> Edition, Science Publishers, Inc., Enfield, NH, USA.
2. Kalyan Kumar De. 2004. An Introduction to Plant Tissue Culture. 2008. New Central Book Agency, Kolkata.
3. Dubey, R.C., 2013. A text book of Biotechnology (Revised Edition), S. Chand & Company Ltd. New Delhi.
4. Razdan, M. K., 2003. Introduction to Plant Tissue Culture. 2<sup>nd</sup> Edition, Science Publishers, Inc., Enfield, NH, USA.

#### **References**

1. Slater, Scott and Fowler, 2008. Plant Biotechnology, 2<sup>nd</sup> Edition, Oxford University Press.
2. Primrose, S.B. and Twyman, R. 2006. Principles of Gene Manipulation and Genomics. 7<sup>th</sup> Edition, Blackwell Publishing, Malden, MA, USA.
3. Buchanan, Gruissem and Jones. 2000. Biochemistry and Molecular Biology of Plants. John Wiley & Sons, UK.

*\* Self Study and Question for Examination must be taken from the self study portion also*

## UBT 15

**C. P. 12 – GENOMICS, PROTEOMICS AND BIOINFORMATICS**

Total Credits: 4

Total Hours: 75

***Objective:***

*To understand the molecular characterization of genomes and proteomes leading to the design and development of novel drugs.*

**UNIT I****(15 HRS)**

Genomics: Genomes of bacteria and eukaryotes- topology, organization. Human Genome Project: Historical background; Human genome features-protein coding regions repetitive sequences and pseudogenes. **Ethical, legal, social implications of HGP\***.

**UNIT II****(15 HRS)**

Mapping and Sequencing: Molecular markers for genome analysis - RFLP and SNP, Genetic and Physical maps- Pedigree analysis, Restriction mapping, STS mapping with radiation hybrid panels; DNA and Genome sequencing- Automated sequencing of DNA, Shotgun sequencing; Contig assembly.

**UNIT III****(15 HRS)**

Proteomics: Structural proteomics- NMR, X-ray crystallography and Mass spectroscopy. Functional Proteomics - 2D analysis of cell proteins, Yeast two hybrid system, Protein micro arrays.

**UNIT IV****(15 HRS)**

*Bioinformatics:* Nucleic acid sequence databases: Genbank, Protein sequence databases - Swiss-Prot, PDB; Databank search: File formats - EMBL, **FASTA\***, GCG and ClustalW. BLAST: types, steps involved in use, interpretation of results, multiple sequence alignment, Phylogenetic Analysis.

**UNIT V****(15 HRS)**

*Emerging areas of Bioinformatics:* Gene expression analysis: DNA microarrays- concept and design, analysis, visualization of data, expression profiling using SAGE. Medical informatics, Disease genes identification and drug targets, Pharmacogenomics: Drug designing, Genetic tests. Bioperl programming – Introduction and application.

**Text Book**

1. Brown, T.A. 2017, *Genomes 4*, CRC Press is a member of Taylor & Francis Group.
1. Lesk, AM., 2002 Introduction to Bioinformatics, Oxford University Press, UK.

**References**

1. Sandy B. Primrose, Richard Twyman 2007, Principles of Gene Manipulation and Genomics, 7<sup>th</sup> edition, Willey-Blackwell.
2. Daniel. C. Liebler, 2002. Introduction to Proteomics. Humana Press.
3. Tsai, C.S. 2002. An Introduction To Computational Biochemistry, Wiley-Liss, Inc., NY.

*\* Self Study and Question for Examination must be taken from the self-study portion also*

**C.Pr.4 – PRACTICALS – 4: BIOPROCESS TECHNOLOGY, PLANT  
BIOTECHNOLOGY AND BIOINFORMATICS**

Total Credits: 3

***Objective:***

*To have hands on experience and learn the principles behind each technique.*

**BIOPROCESS TECHNOLOGY**

1. Study of the parts of a bioreactor.
2. Isolation of amylase producing bacteria
3. Optimization of conditions for bacterial growth and amylase production (media, pH & temperature)
4. Purification of bacterial amylase
  - Ammonium sulfate precipitation
  - Dialysis
  - Gel filtration chromatography
5. Wine production and analysis
6. Sauerkraut preparation for lactic acid fermentation and analysis.
7. Vermicompost preparation.
8. Immobilization of Enzymes

**PLANT TISSUE CULTURE**

1. Preparation of MS medium and sterilization.
2. *In vitro* seed germination
3. Artificial seed preparation and culture
4. Micropropagation - Nodal and shoot tip
5. Callus and suspension culture
6. Isolation of plant genomic DNA
7. Isolation of protoplast and viability check
8. Genetic Transformation (Demo)

**BIOINFORMATICS**

1. File Formats of Nucleic acid and aminoacid sequences
2. Sequence similarity searching using NCBI (BLAST)
3. Protein Data banks (SWISPROT and ExPASy)
4. Multiple sequence alignment (ClustalW)
5. Bioperl - Demo

**ALLIED - PAPER 1: CHEMISTRY - I***Total Credits: 4**Total Hours: 75***Objective:***To make the students understand the basic concepts of chemistry.***UNIT-I****(15 HRS)****Bioinorganic chemistry**

Porphyrin systems-Myoglobin and hemoglobin-Role of myoglobin and hemoglobin in biological systems – cooperativity effect – explanation of co-operativity effect in hemoglobin-metallo enzymes. Biological fixation of nitrogen.

**UNIT-II****(15 HRS)**

**Isomerism and stereochemistry** – Structural isomerism – Chain, position, functional isomerism, metamerism, Tautomerism. Stereomerism – Optical activity, plane polarized light, specific rotation, chiral carbon atom, optical isomerism in lactic acid and tartaric acid. Alkanes – Classification, structure, nomenclature. Preparation of alkanes from alkenes, alkynes, alkylhalides and carboxylic acid. Physical and Chemical properties.

**UNIT-III****(15 HRS)**

**Introduction to Chemical Kinetics** - Rate of chemical reaction - units of rate - Factors influencing rate of a reaction -rate equation - rate laws - Rate constant- unit of rate constant - Determination of rate constant of a reaction. Order of a reaction - integrated rate expression for first, second and zero order reactions - examples. Determination of order of reactions - Integrated method, Half - life method, Graphical method, Oswald's method. Molecularity of a reaction - Pseudo unimolecular reaction- Difference between order and molecularity of a reaction.

**UNIT – IV****(15 HRS)****Industrial Chemistry:**

**Fertilizers:** Role of the nutrient elements Nitrogen, Phosphorus and Potassium in plants. Qualities of good Fertilizer, Short accounts of Ammonium Sulphate, Urea, CAN, and Calcium super phosphate, Triple super phosphate and Potassium nitrate (manufacturing details not required).

**Fuels:** Introduction - composition of natural gas-composition of petroleum - Petroleum Mining -petroleum refining - cracking.

**UNIT-V****(15 HRS)****Environmental Chemistry**

Air pollution: *\*Definition, Greenhouse effect*, global warming, greenhouse gases and ozone hole. Water pollution – Types of water pollutants, effects of water pollution, Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD). Soil pollution - Sources – pesticides, pollution by heavy metals.

### ***Text Books***

1. Puri, B. R, Sharma L.R, Kalia K.C., Principles of Inorganic Chemistry, MILESTONE publishers and Distributors, New Delhi, 2014.
2. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry, S. Chand & Company Pvt. (ltd), 2014 Ed.
3. Bahl, B. S. and G. D. Tuli and Arun Bahl, Essentials of Physical Chemistry, S. Chand Publishing, Revised Multicolor eds. 2012.
4. Sharma, B.K., Industrial Chemistry, Krishna Prakashan Media (P) Ltd, 1999 Edition.
5. Gopalan, R., D. Venkappaya, Sulochana Nagarajan, Text book of Engineering Chemistry, Vikas Publishing House, Third edition , 2010.
6. Veeraiyan, B., Textbook of Ancillary Chemistry, High mount Publishing House, Chennai, 1990.

### ***Reference Books***

1. Sathya Praksash, G. D. Tuli, S. K. Basu, R. D. Madhan, Advanced Inorganic Chemistry, Volume 1, S. Chand & Company, New Delhi, 2012.
2. Soni P.L, Text Book of Inorganic Chemistry, Sultan Chand & Co., New Delhi, 2013.
3. Jain, M.K., S.C. Sharma, Modern Organic Chemistry, Vishal Publishing Co., Delhi 2011.
4. Soni P.L, Text Book of Organic Chemistry, Sultan Chand & Co, New Delhi, Twenty ninth edition, 2012.
5. Bahl, B. S., G. D. Tuli and Arun Bahl, Essentials of Physical Chemistry. S. Chand & Co., New Delhi, 2010.
6. Puri, B.R., L.R. Sharma and S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., Jalandhar, 2013.

**ALLIED – A: PAPER 2: CHEMISTRY**

Total Credits: 4

Total Hours: 75

**Objective:***To make the students understand the basic concepts of chemistry.***UNIT-I****(15 Hrs)****Coordination compounds**

Addition compounds - double salts and complexes.

Complexes (Mononuclear complexes only)

- (i) General aspects- central metal atom, Ligand- types of ligands. Coordination number of central metal atom, oxidation number of central metal atom-Nomenclature (IUPAC system)
- (ii) Theories of Complexes - Werner's theory, Sidgwick theory - EAN, EAN rule, Pauling's theory - Diamagnetic and paramagnetic complexes- explanation with four and six coordination complexes.
- (iii) Chelation- Meaning, examples, EDTA applications.
- (iv) Biological role of Hemoglobin and Chlorophyll

Applications of complexes in qualitative and quantitative analysis.

**UNIT-II****(15 Hrs)****Amino acids and proteins**

- (i) **Amino acids – Classification\*** - Preparation - Gabriel Phthalimide synthesis, Strecker synthesis.
- (ii) **Proteins** – classification based on physical properties and biological functions, colour test for proteins, primary, secondary and tertiary structure of proteins and uses.

**UNIT-III****(15 Hrs)****Energetics**

Introduction - Scope and limitations - Basic terms - system, surroundings - Types of system, state of system, state variables. Thermodynamic processes - Isothermal, Adiabatic, Isobaric, Isochoric and cyclic processes - Reversible and irreversible processes - Spontaneous process. First law of thermodynamics - Mathematical formulation-limitations. Need for Second law - various statements of second law. Joule - Thomson effect. Enthalpy - Free energy change.

**UNIT-IV****(15 Hrs)**

**Synthetic dyes:** Colour and constitution – Relationship of colour observed to wavelength of light observed – Terms used in Colour Chemistry. Chromophore, Auxochromes, bathochromic shift and hypsochromic shift.

Classification of dyes according to their applications – Acid dyes, basic dyes, azo dyes, mordant dyes, Vat dyes, Sulphur dyes and Disperse dyes.

**UNIT-V****(15 Hrs)**

**Synthetic polymers** – Nomenclature, Types of polymers – Addition and condensation polymerization. **Synthetic fibers –Important requirement of a fiber\***, difference between natural and synthetic fiber, properties of synthetic fiber, Preparation of nylon 6 and nylon 6,6. **Synthetic plastics** – Classification, thermosetting and thermoplastic plastics–differences, properties.

### **TEXT BOOKS**

1. Puri B.R, Sharma L.R, Kalia K.C., Principles of Inorganic Chemistry, MILESTONE publishers and Distributors, New Delhi, 2014.
2. Arun Bahl, B.S. Bahl, Advanced Organic Chemistry, S.Chand & Company Pvt (ltd), 2014 Edition.
3. B.S. Bahl and G. D. Tuli, and Arun Bahl, Essentials of Physical Chemistry, S. Chand publishing, Revised multicolor edition, 2012.
4. Gurdeep Chatwal, Synthetic Dyes, Himalaya Publishing House, New Delhi, 1990.
5. Sharma, B.K., Industrial Chemistry, Krishna Prakashan Media (P) Ltd, 1999 Edition.
6. Gopalan, R., D. Venkappaya, S. Nagarajan, Text book of Engineering Chemistry, Vikas Publishing House, Third edition , 2010.

### **REFERENCE BOOKS**

1. Sathya Praksash, G. D. Tuli, S. K. Basu and R. D. Madhan, Advanced Inorganic Chemistry, Volume 1, S. Chand & Company, New Delhi, 2012.
2. Soni, P. L, Text Book of Inorganic Chemistry, Sultan Chand & Co., New Delhi, 2013.
3. M.K. Jain, S.C. Sharma, Modern Organic Chemistry, Vishal Publishing Co., Delhi 2011.
4. Soni, P. L, Text Book of Organic Chemistry, Sultan Chand & Co, New Delhi, Twenty ninth edition, 2012
5. Bahl, B. S., G.D. Tuli and Arun Bahl, Essentials of Physical Chemistry. S. Chand & Co., New Delhi, 2010.
6. B.R. Puri, L.R. Sharma and S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., Jalandhar, 2013.
7. Arora, M. G., Text Book of Dyes, Anmol Publications Private Ltd. New Delhi, 1996.
8. Gowariker, V. R., N. V. Viswanathan and Jayadev Sridhar, Polymer Science , New age international publishers, 2012.



**ALLIED - PAPER 3: BASIC MATHEMATICS AND STATISTICS**

Total Credits: 4

Total Hours: 75

***Objective:***

*To understand the basic concepts in mathematics and statistics and to analysis wide variety of data*

**UNIT – I****(21 Hours)**

Matrices –Types of Matrices-**\*Addition-Subtraction-** Multiplication-Determinant- Inverse of a matrix – Eigen values and Eigen vectors – Solution of simultaneous linear equation using Inverse matrix method and Cramer’s rule.

**UNIT – II****(21 Hours)**

Differentiation of algebraic, exponential and logarithmic functions-Physical interpretation of derivatives with reference to velocity and acceleration – Applications of differentiation to maxima and minima (simple problems).

**UNIT – III****(21 Hours)**

Integration of simple algebraic, exponential and logarithmic functions – Method of Partial fractions-Integration by parts.

**UNIT-IV****(21 Hours)**

Meaning and Scope of Statistics-Collection of data – Diagrammatic presentation: One dimensional and two dimensional-Graphical presentation: Histogram, frequency polygon, frequency curve and ogive curve. Measures of central tendency: Mean, median, mode, Geometric mean and Harmonic mean.

**UNIT-V****(21 Hours)**

Measures of Dispersion: Range – Quartile deviation – Standard deviation - coefficient of variation. Correlation: Definition – types of correlation –Scatter diagram - Karl Pearson’s coefficient of correlation – Spearman’s Rank correlation. Regression: Definition – Regression equations on two variables.

**Text Books:**

1. A.R. Vasistha, “Matrices”, Emerald publications, 2002.
2. S. Narayanan and T.K.M Pillai, “Calculus vol. I and II”, S. Viswanathan Printers and Publishers Pvt. Ltd. 2010.
3. R S N Pillai & Bhagavathi “Statistics”, S. Chand and sons, 7th edition, 2008.

**Reference Book:**

1. S.P. Gupta, “Statistics”, S. Chand and Company Ltd. 18<sup>th</sup> edition 2009.

*\* Self Study and Question for Examination must be taken from the self study portion also*

**ALLIED - PAPER 4: C-PROGRAMMING AND NUMERICAL METHODS**

Total Credits: 4

Total Hours: 75

***Objective:***

*To make the students understand the fundamentals of programming in C and numerical methods.*

**UNIT-I****(15 HRS)**

Introduction-Constants-Variables and Data Types-Operators: arithmetic, relational, logical, assignment, increment and decrement, conditional, bitwise, special-arithmetic expressions-evaluation of expressions-Mathematical functions. Managing Input and Output operators-Introduction –reading a character writing a character –formatted input-formatted output.

**UNIT-II****(15 HRS)**

Decision making and branching: Introduction-IF, IF ELSE, Nesting of IF ELSE, ELSE IF, The ELSE IF ladder-The Switch statement-? Operator-GOTO statement. Decision making and Looping-Introduction-WHILE, DO, FOR statements-**\*Jumps in loops.**

**UNIT-III****(15 HRS)**

Arrays: Introduction-One dimensional-Two dimensional- Initializing two dimensional arrays-multidimensional arrays. Structures and Unions: definition and initializing structure variable – array of structure.

**UNIT-IV****(15HRS)**

Solution of simultaneous linear algebraic equations: Gauss elimination method, Gauss Jordan method, Gauss Jacobi method, Gauss seidal method –Computation of inverse of matrix using Gauss elimination method.

**UNIT-V****(15 HRS)**

Interpolation: Newton Forward & Backward interpolation-Newton's Interpolation formula for unequal intervals- Lagrange's method. Numerical Integration: Trapezoidal rule-Simpson's 1/3<sup>rd</sup> rule-Simpson's 3/8 rule.

**Textbooks**

1. E. Balagurusamy, "Programming In Ansi C", 2<sup>nd</sup> Edition. Tata McGraw-Hill Publishing Co. Pvt. Ltd.2008.
2. M.K.Venkatraman, "Numerical Methods in Science and Engineering" The National Publishers Co., 5<sup>th</sup> edition 2007(For units IV and V).

**Reference Books**

1. V.Rajaraman, "Computer Programming In C" Prentice Hall of India, New Delhi, 2009.
2. P. Kandasamy , K. Thilagavathi, K. Gunavathi, "Numerical Methods" S.Chand & company Ltd. New Delhi Revised Edition 2005.

*\* Self Study and Question for Examination must be taken from the self study portion also*

**ALLIED – PRACTICALS: 2 - LAB. IN C – PROGRAMMING**

Total Credits: 2

***Objective:***

*To have hands on experience in C programming*

**WRITE A C PROGRAM FOR THE FOLLOWING**

1. To find the mean.
2. To find the median.
3. To find the correlation.
4. To find the regression.
5. To find the standard deviation.
6. To find sum and difference of a given matrices.
7. To find Multiplications of Matrices.
8. To find the trace matrix.
9. To convert temperature in Fahrenheit to Celsius and vice versa.
10. To convert days to months and days.

## UBT 22

### **MAJOR ELECTIVE - RESEARCH METHODOLOGY AND BIOSTATISTICS**

Total Credits: 5

Total Hours: 75

#### ***Objective:***

*To understand the basic concept of research and its methodologies adopted along with the tools used in statistics to interpret the scientific research details.*

#### **UNIT I (15 HRS)**

*Research:* Scope and significance, Types of Research, Research Process, Characteristics of good research, Problems in Research, Identifying research problems. Seminar paper preparation and presentation.

#### **UNIT II (15 HRS)**

*Thesis Writing:* Literature collection and citation, Research report writing: content, table, figure formatting and typing. Plagiarism, Research Article writing, Reference writing.

#### **UNIT III (15 HRS)**

*Biostatistics: Definitions and scope of biostatistics\**. Collection of data and tabulation, Graphical and diagrammatic representations. *Measures of central tendency:* mean, median, mode. *Measures of dispersion:* Absolute and relative measures. Range, standard deviation and variance. Coefficient of variation.

#### **UNIT – IV (15 HRS)**

*Correlation:* Definition, types and Karl Pearson's coefficient of correlation. *Regression:* definition, regression of Y on X and X on Y.

#### **UNIT – V (15 HRS)**

*Testing of Hypothesis:* Student's t test. Chi-square test and its applications. ANOVA and its significance. Designing of experiments and statistical analysis. Use of software for statistical analysis.

#### **Text Books**

1. Gurumani, N. 2006. Research Methodology for Biological Sciences. M JP Publishers, Chennai.
2. Pillai R. S. N. and Bhagavathi V., 2000. Statistics, Sultan Chand & Co., New Delhi.
3. Gupta, S.P., 2001. Statistical Methods, Sultan Chand & Co, New Delhi.

#### **References**

1. Kothari, C.R., 2004. Research Methodology – Methods and Techniques, Second edition, New Age International Pvt. Ltd, New Delhi.
2. Sundar Rao, P.S.S., and J. Richard., 2006. Introduction to Biostatistics and Research methods, PHI Publication, New Delhi.
3. Sandhu, T., 1990. Research Techniques in Biological Sciences, Anmol Publishers, New Delhi.

*\*Self-study and Question for Examination must be taken from the self-study portion also*

## UBT 23

### **MAROJ ELECTIVE – NANOBIO TECHNOLOGY AND INTELLECTUAL PROPERTY RIGHTS**

Total Credits: 5

Total Hours: 75

#### ***Objective:***

*To understand the new concept of nanotechnology applied to the area of biotechnology and to acquire requisite skills for the design and development of high throughput screening and assay methods leading to the novel drug discovery and designing.*

#### **UNIT-I**

**(15 HRS)**

Basic concepts of Nano science and technology - Quantum wire – Quantum well – Quantum dots. Superior properties of nano compared with bulk materials. **Use of Bio-molecules such as Proteins\***, DNA, RNA, Aptamers, Peptides, Antibody, Virus as nanoparticles for drug targeting and therapy.

#### **UNIT – II**

**(15 HRS)**

Strategies for synthesis of nanoparticles: top-down & bottom-up approach. Physical, chemical and biological), Physical methods- Microwave Synthesis, Physical Vapour deposition, Laser pyrolysis. Chemical methods- Coprecipitation, Sol-gel Processing, Microemulsions. Biological method- bacteria, fungi, virus, plants.

#### **UNIT – III**

**(15 HRS)**

*Bionanostructures:* Characterization of nanomaterials: **SEM** Scanning Tunneling and Atomic Force Microscopy, **TEM:** Structural and Functional principles of bionanotechnology, microbial systems for assembly of nanostructures ,

#### **UNIT- IV**

**(15 HRS)**

*Applications:* **Scope and applications of nanobiotechnology\***. Functional nanoparticles for targeted Cancer Theranostics. Nanoparticles for waste water treatment and management

#### **UNIT-V**

**(15 HRS)**

*Intellectual property rights:* meaning, evolution, Classification and forms, Patents : Concepts and principle of patenting – patentable subject matter, Procedure for obtaining patent – Rights of patent, Infringement of patent right, Remedies for infringement of patent rights-patentability and emerging issues.

#### **Text Book**

1. Lee, S and Savage, LM (2010) Biological Molecules in Nanobiotechnology.
2. Michael Kohler, Wolfgang Fritzscw. (2007) Nanotechnology an introduction to nanostructuring techniques. Willey –VCH.

#### **Reference**

1. Goodsell, DS (2004) Bionanotechnology: Lessons from Nature, Wiley-Liss, Inc., NY.
2. Strocio, MA and Dutta, M (2004) Biological Nanostructures and Applications of Nanostructures in Biology: Electrical, Mechanical, and Optical properties, Kluwer Academic / Plenum Publishers, USA.
3. David E. Reisner (2009). Bionanotechnology Global prospects. CRC Press. Taylor & Francis Group 6000 Broken Sound Parkway NW, Suite 300.
4. Cancer Nanotechnology - Methods and Protocols 2010 Stephen R. Grobmyer & Brij M. Moudgil Humana Press.
5. Singh, K., 2000. Intellectual Property Rights on Biotechnology, BCII, New Delhi.

*\*Self study and Question for Examination must be taken from the self study portion also*

## UBT 24

### **MAJOR ELECTIVE - BIODIVERSITY AND ENVIRONMENTAL BIOTECHNOLOGY**

Total Credits: 5

Total Hours: 75

#### **Objective:**

*To understand the pros and cons of the usage of bioscience in various aspects of environment and its applications.*

#### **UNIT-I (15 HRS)**

General Introduction, Types of Biodiversity, Measures of Biodiversity, Loss of Biodiversity – causes, Economic evaluation of Biodiversity: Direct and Indirect values; Hotspots of biodiversity.

#### **UNIT-II (15 HRS)**

Current levels of biodiversity-Extinction and endangered species- natural and human caused extinction. Essential services provided by natural ecosystems. Steps to preserve biodiversity. *In situ* and *Ex Situ* conservation. Interaction between environment and biota, Concept of habitat and ecological niches.

#### **UNIT-III (15 HRS)**

Biotechnology in Environmental Protection: Introduction, Waste water and effluent treatment-Biological treatment- aerobic and anaerobic. Use of genetically engineered organisms in waste water treatment. Carbon credits.

#### **UNIT-IV (15 HRS)**

Removal of specific pollutants: Heavy metal - Accumulation, Biosorption, and Bioleaching. Bioremediation: Applications and examples. Pollutant markers: **Eutrophication\*** and *Chironomous* sp, Xenobiotic compounds. Bioindicators and Biosensors for detection of pollutants.

#### **UNIT-V (15 HRS)**

Treatment of wastes - Pulp industry, Tanning industry, Distilling industry, Dye industry. Composting – process, decomposition stages in compost preparation and methods; Vermicomposting. Organic and biodynamic farming (**Vermitechnology\***).

#### **Textbooks**

1. Glick, B. R. and J.J. Pasternak, 1998. Molecular Biotechnology, 2<sup>nd</sup> Edition, ASM Press, Washington.
2. Jogdand, S. N, 2008. Environmental Biotechnology, Himalaya Publishing House, Mumbai.
3. Hosetti, B. B., 2002. Glimpses of Biodiversity. Deya Publishing House, New Delhi.

#### **References**

1. Atlas, R.M., 1997. Principles of Microbiology. McGraw-Hill, New York.
2. Cruger, W. and A. Cruger. 2003. A Textbook of Industrial Microbiology. Panima Publishing Corporation, New Delhi.
3. Scragg, A, 2005. Environmental Biotechnology, Oxford University Press, London.
4. Krishnamoorthy, K.V., 2003. An advanced text book on Biodiversity- Principles and Practice. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
5. Joshi, P.C. & N. Joshi. 2004. Biodiversity and Conservation. A.P.H. Publishing Corporation, New Delhi.

*\* Self Study and Question for Examination must be taken from the self study portion also*

## UBT 25

### **MAJOR ELECTIVE – MEDICAL BIOTECHNOLOGY**

Total Credits: 5

Total Hours: 75

#### ***Objective:***

*To understand the medical and clinical aspects of biotechnology and significance in diagnostics*

#### **UNIT I**

(15 HRS)

Introduction of Medical Biotechnology: Worldwide market in medical biotechnology, revolution in diagnosis, approaches of therapy, FDA - Organization chart and regulatory measures for drug discovery: Investigational new drug. Drug discovery: Overview, rational drug design, combinatorial chemistry in drug development, computer assisted drug design, role of bioinformatics in genome - based therapy, antisense RNA technology for drug designing

#### **UNIT II**

(15 HRS)

Role of biotechnology in healthcare. Molecular diagnosis-PCR based diagnosis of infectious disease (HIV and Hepatitis). Biosensors in clinical diagnosis, chiral technology, monoclonal antibodies for immunotherapy.

#### **UNIT III**

(15 HRS)

Vaccine technology: Subunit vaccines, drawbacks of existing vaccines, criteria for successful vaccine, peptide vaccine, minicells as vaccines, impact of genetic engineering on vaccine production, viral vector vaccines and AIDS vaccine chiral technology: Principle & Applications.

#### **UNIT IV**

(15 HRS)

Recent developments in medical biotechnology–Pharming for human proteins and nutraceuticals. Tissue engineering and therapeutic cloning, Application of nanotechnology in biomedical sciences - Green nanosubstances, gene delivery, drug delivery. Nanotechnology in replacing defective cells.

#### **UNIT V**

(15 HRS)

Different forms of Cancer therapy: Chemotherapy, Radiation Therapy, Detection of Cancers, Prediction of aggressiveness of Cancer, Advances in Cancer detection, Stem Cells and Gene therapy – genetically engineered stem cells. Stem cell in cellular assays for screening – stem cell based drug discovery, drug screening and toxicology.

#### ***Text Books***

1. Fundamentals of medical biotechnology by Aparna Rajagopalan, Ukaaz Publications.
2. Medical biotechnology by S. N. Jogdand, Himalaya Publications.

#### ***References***

1. Medical Microbiology - Mackie and Mc Cartney.
2. Medical Biotechnology: Achievements, Prospects and Perceptions – Albert Sasson, Published by United Nations University Press, 2006.
3. Microbial Biotechnology - Principles and Applications - Lee Yaun Kun. Published by World Science publications, 2006.

*\*Self study and Question for Examination must be taken from the self study portion also*

**RESEARCH PROJECT AND VIVA-VOCE \***

Total Credits: 4

Total Hours: 30

Max marks 100

**DIRECTIONS**

- Students are allocated a dissertation topic for a group under the supervision of faculty of the department.
- The dissertation must be similar to the thesis style and encompass:
  - (i) Introduction
  - (ii) Review of Literature
  - (iii) Materials and Methods
  - (iv) Results
  - (v) Discussion and Conclusion
  - (vi) Bibliography
- The dissertation should be submitted in type-written, bound form to the department for record.
- While evaluation of dissertation, 15 marks (internal) should be based on oral presentation before the faculty members of department in the presence of concerned supervisor during the period of CIA examinations and 5 marks for his/her regularity.
- External / end semester - 80 marks should include:
  - (i). Evaluation of project work (60 marks) based on:
    - (a) Scientific content and Objectives (20marks)
    - (b) Experiments and final outcome (20 marks)
    - (c) Presentation (20 marks)
  - (ii). Viva-voce by Examiners\*\* (20 marks)

\* *Group project*

\*\* *Project report and viva voce will be evaluated by both the project supervisor (Faculty of the department) and an External Examiner.*



**SKILL BASED SUBJECT 1: GENERAL AWARENESS (ONLINE)**

Total Credits: 3

Total Hours: 30

**UNIT I****(06 hrs)****1. Tamil and other Literatures**

Tamil, English, Christian and Muslim Literatures – Ancient Literature – Bakthi Literature – Epics – Medieval Literature – Modern Literature (Novel, Dramas, Short Stories, Modern Poetry).

**2. Economics and Commerce**

Basic Economics – Auditing – Management – Capital Market – Foreign Trade – Companies – Banking.

**3. Social studies**

Indian History – Inventions – Indian Poetry – Constitution – Judiciary – Languages – Literacy – Indian Geography – Lithosphere – Climate – Soil – Agriculture – Population.

**UNIT II****(06 hrs)****4. Numerical Aptitude**

Objective Arithmetic : Number systems – probability – **HCF and LCM of numbers\*** - decimal fractions – simplification – square roots and cube roots – average – percentage – profit and loss – ratio and proportion – time and work – simple interest – area, **volume and surface area\***.

**5. Verbal Aptitude**

Spot the odd one out – correct form of verb – preposition – find out the rightly spelt word – choose the correct meaning of idioms – synonyms and antonyms.

**6. Abstract Reasoning**

Logic Reasoning: Logic – statement – arguments – statement assumptions – Statement course of action – theme detection – deriving conclusion from passages.

Non – verbal Reasoning: Series – analogy – classification – analytical reasoning – mirror images – water images – paper folding – paper cutting – rule detection – grouping of identical figures.

**UNIT III****(06 hrs)****7. General Science and Technology**

**SCIENCE** - Basic principles and concepts in Physics, Chemistry, Botany and Zoology.

**TECHNOLOGY** - Metallurgy, instrumentation, discoveries and inventions of techniques.

**8. Computer Science**

Historical evolution of computers – Computer applications – Data processing concepts – Computer codes and arithmetic – Hardware components – Data Structures.

**9. Education**

Development process of the learner – Principles of development (physical, social, emotional and intellectual) – Learning process – Teaching and teacher behaviour – Interaction analysis – Microteaching – Teacher as a leader – Motivation – Personality dimension – concept of mental health – Counseling.

**UNIT IV****(06 hrs)****10. Library and Information Science**

Library and Information Science – Basics, Computer, Library Network and others like Research, Reprography etc.

## 11. Sports and Games

Athletics – Track Events – Field Events – Games – Indoor Games – Outdoor Games – General knowledge – Sport and Olympics – First Aid.

## 12. Current Affairs

State, Central and International affairs: Budgets – Politics – Sports – Education – Commerce and Industry – Inventions – Science and Technology – Currency – Agriculture – Movies – Guinness records – Awards – IT Industry – Space Research – Defense etc.

## UNIT V

(06 hrs)

### 13. National Cadet Corps (NCC)

Introduction to the Armed Forces (Army, Navy, Air Force) – Drill – Weapon Training – Map Reading – Civil Defense.

### 14. National Service Scheme (NSS)

History of NSS – History of Motto, Symbol, Badge – Aims and Objectives – Duties and Total Hours – Organizational and Administrative setup – History of voluntary organization – Regular activities – Special camp activities – Special programmes – awards – Important days.

### 15. Youth Red Cross (YRC)

History of International Red Cross – History of Indian Red Cross – History of Youth Red Cross – Main objectives of YRC – Emblem – Fundamental principles of Red Cross – Organizational Setup – Activities of Youth Red Cross – Role of different functionaries – Training programmes for YRC Program Officers – Training programme for YRC Volunteers – YRC Song – Working Hours – General orientation – Special orientation – Program skill learning

## Text Book

General Awareness, Question Bank, Kongunadu Arts and Science College, Coimbatore, First Edition 2014.

*\*Self study and Question for Examination must be taken from the self study portion also*

## Question Paper Pattern

**Max. Marks 100**

### **End of Semester Examination (ESE) On-Line Examination**

**75 Marks**

1. 150 questions are to be given. Each question carries ½ mark.
2. In each unit, 30 questions are to be given, covering all the 5 units.

### **Continuous Internal Assessment (CIA) (Through On-Line)**

**25 Marks**

- |                 |          |
|-----------------|----------|
| a) Two Exams.   | 15 Marks |
| b) Assignment** | 5 Marks  |
| c) Attendance   | 5 Marks  |

\*\* Each student has to submit an assignment in the Current Affairs area.

**SKILL BASED SUBJECT 2: HUMAN ANATOMY AND PHYSIOLOGY**

Total Credits: 3

Total Hours: 30

***Objective:****To understand the mechanism and functioning of human system and its anatomy.***UNIT I****(06 hrs)**

*Human Tissues:* Tissue types-Epithelium (Simple squamous, simple cuboidal, simple columnar, stratified squamous, stratified cuboidal, Pseudostratified columnar, Transitional etc.); Muscular Tissue (Smooth, Skeletal and Cardiac).

**UNIT II****(06 hrs)**

*Skeletal System:* Bone-structure and function, Cartilage, tendons and ligaments.

*Nervous System:* Structure and function of neuron. ANS, CNS and PNS nervous system.

*Skin-* structure and function;

**UNIT III****(06 hrs)**

*Respiratory System:* Structure and function of lungs and its disorders.

*Cardio Vascular System:* Structure and function of Heart and its disorders

**UNIT IV****(06 hrs)**

*Digestive System and Excretory System:* Structure and function of digestive system. Kidney-structure and function and its disorders.

**UNIT V****(06 hrs)**

*Endocrine System and Muscular System:* Glands (Pituitary, Hypothalamus, Thyroid, Parathyroid, Thymus, Adrenal, Pancreas, Ovary, Testis) and their position in human body, its functions and disorders. Structure and function of muscles, **Muscle contraction-Voluntary and involuntary actions\***,

**References**

- 1) Human Physiology by Dr. C. Chatterjee I & II. Medical Allied agency, Kolkatta.
- 2) Sambasiavaiah, Kamalakara Rao and Augustine Chellappa, 1990. A Textbook of Animal Physiology and Ecology, S. Chand & Co. Ltd., New Delhi-110 055, 480 pp.
- 3) William S. Hoar, 1976. General and Comparative Physiology, Prentice Hall of India Pvt. Ltd., New Delhi-110 001, 848 pp.
- 4) Elaine N. Marieb and Katja Hoehn, September 2003. Human Anatomy and Physiology, Benjamin-Cummings Pub Co. 1301 Sansome Street San Francisco, CA 94111-1122.
- 5) Wilhelm and Patricia Brady. Human Anatomy and Physiology, McGraw-Hill, New York.

*\*Self study and Question for Examination must be taken from the self study portion also*

**SKILL BASED SUBJECT 3: INFECTIOUS DISEASES, DIAGNOSTICS AND HEALTH MANAGEMENT**

Total Credits: 3

Total Hours: 30

**Objective:**

*To understand the immunology of the human system, diagnosing the various diseases and health assessment.*

**UNIT – I****(06 hrs)**

Introduction to human infections: Definitions, types of diseases, transmission- spread of disease in populations, reservoirs of infection (human, animal and non-living reservoirs), modes of transmission (contact, vehicles, vectors). Epidemiology – Introduction, types of epidemiological studies (Case Control Cohort).

**UNIT – II****(06 hrs)**

Pathogens: Blood borne-Hepatitis, Airborne-TB, Influenza and their control strategies. Defense mechanism: Host defenses, specific defenses, disease prevention and control. Viral Pathogenesis and its control, Immunizing agents (active and passive vaccines) and Indian vaccination table.

**UNIT – III****(06 hrs)**

Communicable diseases: Clinical features, causes, symptoms, epidemiology and treatment – Chicken pox, Cholera\*.

Non-communicable diseases: Clinical features, causes, symptoms, epidemiology and treatment – Coronary heart disease and Asthma. Disorder - Diabetes and Obesity\*.

**UNIT – IV****(06 hrs)**

*Role of clinical laboratory tests in diagnosis:* Importance of Diagnostic testing and screening; Normal and abnormal values (lipid profiling), - their meaning - high, low, subclinical or artifact (false positives and false negatives)-reliability of laboratory studies-sensitivity, specificity

**UNIT – V****(06 hrs)**

Assessment of behavioral and neurological functions: Cognition assessment (Erikson-Flanker test); Emotion assessment (Watson and Clark paradigm), Sensory assessment (Gustation, olfaction, vision, audition and pain). Health care and management: Introduction-Health education, health planning; Monitoring the health of populations, health system in India.

**Textbook**

Ananthanarayanan and Paniker's Textbook of Microbiology, 2005. Orient Blackman Publications

**References**

1. Woolverton J.C et al, 2013, Prescott's Microbiology. Tata McGraw-Hill Publishing Co. Ltd., Inc., New York.
2. Brooks *et al.*, 2013, Jawetz melnick and Adelbergs Meical Microbiology, 26<sup>th</sup> edition, Mc.Graw Hill Medical.
3. Merck's Manual of Diagnosis and Therapy: 18<sup>th</sup> Edition. Mark. H. Beers. Wiley Publications. 2006.
4. Bailey and Scotts Diagnostic Microbiology, Tille.M.P.2014.

*\*Self study and Question for Examination must be taken from the self study portion also*

## **UBT 30**

**SEMESTER - V**

**16UBT5X1**

### **EDC – 1: MOLECULAR DIAGNOSTICS**

Total Credits: 3

Total Hours: 30

*Objective: Defines basic terminology and describes concepts in molecular diagnostics that provide the foundation for implementing and adapting new techniques and assays.*

#### **UNIT-I**

**(06 hrs)**

Principles and Methods- Isolation and Purification of nucleic acids and protein – Labeling, electrophoresis, hybridization and molecular cloning.

#### **UNIT - II**

**(06 hrs)**

Pathogen identification in humans, animals and plants: Detection of bacterial, fungal, viral pathogens through PCR and Real time PCR.

#### **UNIT III**

**(06 hrs)**

DNA amplification techniques and applications including reverse transcriptase (RT)-PCR, in situ PCR, mutational analysis: PCR, experimental design, primers, controls, product detection. Gene chips - applications.

#### **UNIT IV**

**(06 hrs)**

PCR in forensic science and determination of paternity, DNA Fingerprinting-RAPD, RFLP for humans, animal and plants. Karyotypes to diagnose genetic disorders: Banding pattern (G, C, T, Q, NOR).

#### **UNIT V**

**(06 hrs)**

Immunological methods: Agglutination (ABO/Bacterial), Precipitation, Immunodiffusion, Immunoelectrophoresis, ELISA and Immuno-blotting; HLA typing.

#### **References**

1. Genes VIII (2004) by B. Lewin, Oxford University Press.
2. An Introduction to Genetic Analysis (2000) by A.J.F. Griffiths, J.H. Miller, D.T. Suzuki, R.C. Lewontin and W.M. Gelbart, W.H. Freeman, New York.
3. Molecular Biology of the Gene (2004) by J.D. Watson, Tania A baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Losick, Pearson Education Pte. Ltd.
4. Essentials of Molecular Biology (1998) by G. M. Malacinski and D. Friefelder, Jones & Bartlett Publishers.
5. An Introduction to Forensic DNA Analysis (2002) Rudin, N. and Inman, K. CRC Press.
6. Forensic DNA Typing. Biology, Technology and Genetics of STR markers (2005) John M. Butler, Elsevier Academic Press, Amsterdam.
7. Molecular Diagnostics: Fundamentals, Methods & Clinical applications (2007). Lele Buckingham and Maribeth L. Flaws.
8. Fundamentals of Molecular Diagnostics (2007). David E. Bruns, Edward R. Ashwood, Carl A. Burtis. Saunders Group.

*\*Self study and Question for Examination must be taken from the self study portion also*

## UBT 31

### PART IV

Semester I

15EVS101

## ENVIRONMENTAL STUDIES

(2016-17 onwards)

Total Credits: 2

Total Hours: 30

### UNIT I MULTIDISCIPLINARY NATURE OF ENVIRONMENT

(06 hrs)

- 1.1 Definition : **Scope and importance\***
- 1.2 Need for public awareness
- 1.3 Natural resources
- 1.3.1 Types of resources  
Forest Resources – Water Resources – Mineral Resources – Food Resources – Energy Resources – Land Resources.

### UNIT II ECOSYSTEMS

(06 hrs)

- 2.1 **Concept of an ecosystem\***
- 2.2 Structure and functions of an ecosystem
- 2.3 Producers, consumers and decomposers
- 2.4 Energy flow in the ecosystem
- 2.5 Ecological succession
- 2.6 Food chains, food web and ecological pyramids
- 2.7 Structure and function of the following ecosystem  
Forest Ecosystem – Grassland Ecosystem – Desert Ecosystem – Aquatic Ecosystem.

### UNIT III BIODIVERSITY AND ITS CONSERVATION

(06 hrs)

- 3.1 Introduction – Definition – Genetic – Species and ecosystem diversity
- 3.2 Biogeographical classification of India
- 3.3 Value of biodiversity
- 3.4 Biodiversity at global, national and local levels
- 3.5 India as a mega – diversity Nation
- 3.6 Hot spot of biodiversity
- 3.7 Threats to biodiversity
- 3.8 Endangered and endemic species of India
- 3.9 Conservation of Biodiversity - *insitu* Conservation of Biodiversity – *exsitu* Conservation of Biodiversity

### UNIT IV ENVIRONMENTAL POLLUTION

(06 hrs)

- 4.1 Definition
- 4.2 Causes, effects and control measures of: Air Pollution – Water Pollution – Soil Pollution – Marine Pollution – Noise Pollution – Thermal Pollution – Nuclear Pollution.
- 4.3 Solid Waste Managements: causes, effects, control measures of urban and industrial wastes.
- 4.4 Role of individual in prevention of pollution.
- 4.5 Pollution case studies – domestic waste water, effluent from paper mill and dyeing, cement pollution.
- 4.6 Disaster Management – Flood, Drought, Earthquake, Tsunami, Cyclone and Landslide.

## UNIT V SOCIAL ISSUES AND THE ENVIRONMENT

(06 hrs)

- 5.1 Sustainable Development
- 5.2 Urban problems related to energy
- 5.3 Water Conservation : Rain Water Harvesting and Watershed Management
- 5.4 Resettlement and rehabilitation of people, its problems and concerns, case studies – Narmatha Valley Project.
- 5.5 Environmental ethics, issues and possible solutions.
- 5.6 Climatic change, global warming, ozone layer depletion, acid rain, nuclear accidents and holocaust, case studies – Hiroshima and Nagasaki, Chernobyl.
- 5.7 Consumerism and waste products
- 5.8 Environmental Protection Act
- 5.9 Air Pollution Act (Prevention and Control)
- 5.10 Water Pollution Act (Prevention and Control)
- 5.11 Wild Life Protection Act
- 5.12 Forest Conservation Act
- 5.13 Issues involved in enforcement of environmental legislation
- 5.14 Public awareness
- 5.15 Human population and the environment
  - 5.15.1 Population Growth and Distribution
  - 5.15.2 Population Explosion – Family Welfare Programme
  - 5.15.3 Environment and Human Health
  - 5.15.4 Human Rights
  - 5.15.5 Value Education
  - 5.15.6 HIV / AIDS
  - 5.15.7 Women and Child Welfare
  - 5.15.8 Role of Information Technology in Environment and Human Health.

### **Text Book**

Arul, P. 2004. A Text Book of Environmental Studies, Environmental Agency, No 27, Nattar street, Velacherry main road, Velachery, Chennai – 42, First Edition.

### **References**

1. Purohit Shammi Agarwal, A text Book of Environmental Sciences, Publisher Mrs. Saraswati Prohit, Student Edition, Behind Naswan Cinema Chopansi Road, Jodhpur.
2. Dr.Suresh and K.Dhameja, Environmental Sciences and Engineering, Publisher S.K.Kataria & Sons, 424/6, Guru Nanak Street, Vaisarak, Delhi – 110 006.
3. J.Glynn Henry and Gary W Heinke, Environmental Science and Engineering, Prentice Hall of India Private Ltd., New Delhi – 110 001.

*\* Self Study (Questions may be asked from these portions also)*

**UBT 32**

**PART IV**

**Semester II**

**16VED201**

**Value Education – Moral and Ethics**

(2014-15 onwards)

Total Credits: 2

Total Hours: 30

<b>UNIT I</b>	Introduction –Meaning of Moral and Ethics – Ethics and culture – Aim of education	<b>(06 hrs)</b>
<b>UNIT II</b>	Swami Vivekanandha – A Biography	<b>(06 hrs)</b>
<b>UNIT III</b>	The Parliament of Religions - Teachings of Swami Vivekananda	<b>(06 hrs)</b>
<b>UNIT IV</b>	Yoga - Exercise	<b>(06 hrs)</b>
<b>UNIT V</b>	Meditation	<b>(06 hrs)</b>

**Text Book:**

Value Based Education – Moral and Ethics – Published by Kongunadu Arts and Science College, Coimbatore, First Edition, 2014.

**References :**

1. Easy step to Yoga by Swami Vivekananda, A divine Life Society Publication, 2000.

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**UBT 33**

**Question Paper Pattern for**  
**Environmental Studies & Value Education – Moral and Ethics**  
**(End-of semester only)**

Duration: 3 hours

Total Marks : 50

Answer all Questions (5 x 10 = 50 Marks)

Essay type, either or type questions from each unit.



**NON- MAJOR ELECTIVE - I: HUMAN RIGHTS**

(2016-17 onwards)

Total Credits: 2

Total Hours: 30

***Objectives:***

1. To prepare for responsible citizenship with awareness of the relationship between Human Rights, democracy and development.
2. To impart education on national and international regime of Human Rights.
3. To sensitize students to human suffering and promotion of human life with dignity.
4. To develop skills on human rights advocacy and to appreciate the relationship between rights and duties.
5. To foster respect for tolerance and compassion for all living creatures.

**UNIT – I**

- 1.1. Definition, Meaning, Concept, Theories and Kinds of Human Rights.
- 1.2. Evolution and Protection of Human Rights in India
- 1.3. Development of Human Rights under the United Nations.

**UNIT – II**

- 2.1 United Nations Charter and Human Rights
- 2.2 U. N. Commission on Human Rights
- 2.3 Universal Declaration of Human Rights
- 2.4 International Covenant on 1) Civil & Political Rights, 2) Economic, Social and Cultural Rights

**UNIT – III**

- 3.1 Human Rights and Fundamental Rights (Constitution)
- 3.2 Enactments regarding Human Rights Laws in India
- 3.3 National Human Rights Commission and State Human Rights Commission

**UNIT – IV**

- 4.1 Aged persons and their Human Rights
- 4.2 Human Rights of Persons with Disabilities
- 4.3 Tribal Human Rights in India
- 4.4 The Three Generation Human Rights

**UNIT – V**

- 5.1 Rights of Women, Child, Refugees and Minorities
- 5.2 Media and Human Rights
- 5.3 NGO's in protection of Human Rights
- 5.4 Right to Election

***Prescribed text***

**Human Rights**, V. Sugantha, Dean (Unaided), Kongunadu Arts and Science College, Coimbatore-641 029.

***Book for Reference***

**Human Rights, Humanitarian Law and Refugee Law** Published by P. Jaganathan, J. P. Arjun Proprietor, Usha Jaganath Law Series, 1<sup>st</sup> floor Narmatha Nathi Street, Magathma Gandhi Nagar, Madurai – 625014.

**NON- MAJOR ELECTIVE - II: WOMEN'S RIGHTS**

(2016-17 onwards)

Total Credits: 2

Total Hours: 30

**UNIT I****(06 hrs)****Laws, Legal Systems and Change**

Definition - Constitutional law, CEDAW and International Human Rights – Laws and Norms – Laws and Social Context – Constitutional and Legal Framework.

**UNIT II****(06 hrs)****Politics of land and gender in India**

Introduction – Faces of Poverty – Land as Productive Resources – Locating Identities – Women's Claims to Land – Right to Property - Case Studies.

**UNIT III****(06 hrs)****Women's Rights: Access to Justice**

Introduction – Criminal Law – Crime Against Women – Domestic Violence – Dowry Related Harassment and Dowry Deaths – Molestation – Sexual Abuse and Rape – Loopholes in Practice – Law Enforcement Agency.

**UNIT IV****(06 hrs)****Women's Rights**

Violence Against Women – Domestic Violence - The Protection of Women from Domestic Violence Act, 2005 - The Marriage Validation Act, 1982 - The Hindu Widow Re-marriage Act, 1856 - The Dowry Prohibition Act, 1961

**UNIT V****(06 hrs)****Special Women Welfare Laws**

Sexual Harassment at Work Places – Rape and Indecent Representation – The Indecent Representation (Prohibition) Act, 1986 - Immoral Trafficking – The Immoral Traffic (Prevention) Act, 1956 - Acts Enacted for Women Development and Empowerment - Role of Rape Crisis Centers.

**Prescribed Book**

Women's Rights Compiled by Kongunadu Arts and Science College, Coimbatore-29.

**References**

1. Nitya Rao "Good Women do not Inherit Land" Social Science Press and Orient Blackswan 2008.
2. International Solidarity Network "Knowing Our Rights" An imprint of Kali for Women 2006.
3. P.D. Kaushik "Women Rights" Bookwell Publication 2007.
4. Aruna Goal "Violence Protective Measures for Women Development and Empowerment" Deep and Deep Publications Pvt. 2004.
5. Monica Chawla "Gender Justice" Deep and Deep Publications Pvt. Ltd. 2006.
6. Preeti Mishra "Domestic Violence against Women" Deep and Deep Publications Pvt. 2007.
7. Clair M. Renzetti, Jeffrey L. Edleson, Raquel Kennedy Bergen, Source Book on "Violence Against Women" Sage Publications 2001.

**JOC 1 - MEDICAL CODING**

Total Credits: 3

*Objectives: Importance of this training: Medical coding has become a very important part of the healthcare services. Medical coders and billers are responsible for coding the documents necessary for the doctor to receive payment from the medical insurance providers.*

**UNIT I**

Treatments: Anesthesia; Radiology; Pathology and laboratory coding, Medicine, including injections, psychotherapy, and other office procedures, in addition to heart catheterizations.

**UNIT II**

Medical terminology; Evaluation and management service guidelines, Billing Process and filling the forms for claims. Coding guidelines: Types of coding systems. Comprehensive Surgery Coding.

**UNIT III**

Introduction to Current Procedural Terminology (CPT)/Procedure Coding System; CPT-4-numbers and their sequences, terminology and format; CPT Modifiers. Healthcare Common Procedure Coding System (HCPCS) codes.

**UNIT IV**

Diagnostic codes: Introduction to International Classification of diseases (ICD)-9/ICD-10, ICD-10-CM Manual, Code structure, Alphabetic index, benefits of ICD-10-CM.

**UNIT V**

ICD-10-Procedural codes (PCS) Coding in the Medical and Surgical Subsection; Pharmaceutical codes for identifying medications; Topographical codes indicating a specific location in the body; The Systematized Nomenclature of Medicine (SNOMED).

Text Books:

1. 2015 Medical Coding Training: CPC®- AAPC; AAPC publisher; ISBN-13: 978-1-626880-900
2. 2015 Medical Coding Training: Practical Application CPC®- AAPC; AAPC publisher; ISBN-13: 978-1-626880-924

Reference:

<http://www.icd10data.com/>

**JOC 2 - APPLIED BIOTECHNOLOGY – BIOMASS, BIOFERTILIZERS AND  
BIOCONTROL AGENTS**

Total Credits: 3

**UNIT - I**

*Biofertilizers*: Isolation, purification and characterization of *Rhizobium*, *Azospirillum*, *BGA*, *Azolla* and *Frankia*. Screening for their efficiency and strain improvement.

**UNIT - II**

Parts and design of a bioreactor for biofertilizer production. Mass production techniques of commercial biofertilizers - Bacteria (*Azospirillum*, *Rhizobium*) - Spirulina, biogas, biodiesel, SCP, mushroom.

**UNIT III**

Quality control of a biofertilizer, field application methods. Economics of biofertilizer production: cost of production, capital cost and profit.

**UNIT IV**

Biocontrol agents: Types and mass production strategies of Biocontrol agents: parasites, parasitoids, predators and entomopathogenic nematodes. Field application methods.

**UNIT V**

Biopesticides: Definition and significance, mass production and formulation of microbial control agents: Bt and NPV. Field utilization techniques. Economics of production of biocontrol agents and biopesticides: cost of production, capital cost and profit.

**Text book**

1. A Textbook of Biotechnology. R.C. Dubey. S. Chand and Co. Ltd., New Delhi. 1996.

**References**

1. Biofertilizers, In: Advances in Agricultural Science. N.S. Subba Rao. Oxford and IBH Pub. Co., New Delhi. 1982.

**UBT 38**

**QUESTION PAPER PATTERN for CIA and ESE**

**PART-I, PART – II, CORE PAPERS, MAJOR ELECTIVE PAPERS, SKILLED BASED  
SUBJECT AND EDC**

Maximum marks 75

**Section - A**

(10 x 1 = 10 marks)

**Q. No. 1 to 10 : Multiple choice type alone with four distracters each.**

**Section - B**

(5 x 5 = 25 marks)

**Q. No. 11 to 15 : Either or / short notes type questions (one question ‘a’ or ‘b’ from each unit).**

**Section - C**

(5 x 8 = 40 marks)

**Q. No. 16 to 20 : Either or / essay type questions (one question ‘a’ or ‘b’ from each unit).**

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## **UBT 41**

### **PRACTICALS – Question Pattern & Break-up of marks**

#### **END OF SEMESTER PRACTICAL EXAMINATION**

*Max. Marks: 60*

*Duration: 3 / 4 hrs*

<b>I.</b>	<b>Major</b>	(1 x 20 = 20)
<b>II.</b>	<b>Minor</b>	(1 x 10 = 10)
<b>III.</b>	<b>Spotters</b>	(3 x 5 = 15)
	Examine, identify and critically comment on the spotters A, B, C, D and E.	
<b>IV.</b>	<b>Viva</b>	(05)
<b>V.</b>	<b>Record / Observation*</b>	(10)

*\*Record for ESE; Observation for CIA exam.*

#### **INTERNAL - PRACTICAL MARKS**

From Model Practical Examination	-	25
Observation	-	10
Attendance	-	5
Total	-	40

## **UBT 42**

### **QUESTION PAPER PATTERN FOR SKILL BASED SUBJECT 1 & 2**

**Max. Marks 100**

**End of Semester Examination (ESE) - On-Line Examination**

**75 Marks**

1. 150 questions are to be given. Each question carries  $\frac{1}{2}$  mark.
2. In each unit, 100 questions are to be given, covering all the 5 units.

**Continuous Internal Assessment (CIA) (Through On-Line)**

**25 Marks**

- |               |          |
|---------------|----------|
| a) Two Exams. | 15 Marks |
| b) Assignment | 5 Marks  |
| c) Attendance | 5 Marks  |

\* Each student has to submit an assignment in the Current Affairs area.

## **UBT 43**

### **QUESTION PAPER PATTERN FOR NON-MAJOR ELECTIVES I & II (2012 - 2013 onwards)**

**Duration : 3 Hours**

**Max. Marks: 75**

**Answer ALL Questions**

#### **SECTION A**

**(5 x 5 = 25 marks)**

Short answers, either or type, one question from each unit.

#### **SECTION B**

**(5 x 10 = 50 marks)**

Essay type questions, either or type, one question from each unit.

# **B.Sc., BIOTECHNOLOGY**

*Curriculum & Scheme of Examination under CBCS*

Academic Year 2017-2018 onwards