

**SARDAR PATEL UNIVERSITY
VALLABH VIDYANAGAR**



SYLLABUS EFFECTIVE FROM: 2017-18

Under Choice Based Credit Scheme

M.Sc. GENETICS

SEMESTER-II

COURSE DETAILS

M. SC. GENETICS				
Course Type	I	II	III	IV
Core I (4 Credits)	Molecular Biology PS01CGEN21	Cytogenetics PS02CGEN21	Genetics of Mammalian Development PS03CGEN21	R-DNATechnology PS04CGEN21 (Same as PS04CMIC21)
Core II (4 Credits)	Bioinstrumentation PS01CGEN22	Microbial Genetics PS02CGEN22	Human Molecular Genetics PS03CGEN22	Animal Genetics and Genetic Counselling PS04CGEN22
Core III (4 Credits)	Cell Biology PS01CGEN23	Fundamentals of Immunology PS02CGEN23	Genetics in Crop Improvement PS03CGEN23	Lab-I (Practical based on PS04CGEN21 & PS04CGEN22) PS04CGEN23
Core IV (4 Credits)	Lab-I (Practical based on PS01CGEN21 & PS01CGEN22) PS01CGEN24	Lab-I (Practical based on PS02CGEN21 & PS02CGEN22) PS02CGEN24	Lab-I (Practical based on PS03CGEN21 & PS03CGEN22) PS03CGEN24	
Core V (4 Credits)	Lab-II (Practical based on PS01CGEN23 & PS01EGEN2X) PS01CGEN25	Lab-II (Practical based on PS02CGEN23 & PS02EGEN2X) PS02CGEN25	Lab-II (Practical based on PS03CGEN23 & PS03EGEN2X) PS03CGEN25	
Core VI (1 Credits)	Comprehensive Viva-Voce PS01CGEN26	Comprehensive Viva-Voce PS02CGEN26	Comprehensive Viva-Voce PS03CGEN26	Comprehensive Viva-Voce PS04CGEN26
Elective I (4 Credits)	Biochemistry PS01EGEN21	Biostatistics PS02EGEN21	Advanced Immunology PS03EGEN21 (Same as PS03EMIC21)	Lab-II I (Practical based on PS04EGEN2X & PS04EGEN2X) PS04EGEN21
Elective II (4 Credits)	Methods and Applications of Transgenic plants PS01EGEN22	Medical Microbiology PS02EGEN22	Bioinformatics PS03EGEN22 (Same as PS03EMIC22)	Dissertation PS04EGEN22 (12 Credits)
Elective III (4 Credits)	Phytoreources Utilization and Conservation PS01EGEN23	Microtechniques PS02EGEN23	Omics and Computational Biology PS03EGEN23 (Same as PS03EMIC23)	Population and Evolutionary Genetics PS04EGEN23

Elective IV (4 Credits)	Human Physiology PS01EGEN24	Toxicology PS02EGEN24		Food and Dairy Microbiology PS04EGEN24 (Same as PS04EMIC24)
Elective V (4 Credits)				IPR & Biosafety PS04EGEN25 (Same as PS04EMIC25)

SARDAR PATEL UNIVERSITY
Programme: M. Sc. (Genetics)
Semester: II
Syllabus with effect from: June 2017

Paper Code: PS02CGEN21	Total Credits: 4
Title of Paper: Cytogenetics	

Unit	Description in detail	Weightage
1	Introduction, chromosomal staining, banding and FISH techniques: An over view of Cell cycle, Mitosis and Meiosis, Global structure of Chromosomes, ISCN nomenclature system Image Analysis System: Charge-coupled device cameras, Image analysis Systems. Interpretation and reporting of chromosomal analysis Conventional staining (Giemsa and aceto-orcein), Giemsa banding, Quinacrine banding, Constitutive heterochromatin banding Reverse banding, Nucleolar organizing region staining Sister chromatid exchange Miscellaneous/Other banding Techniques. Applications of fluorescence <i>in situ</i> hybridization to chromosome analysis Latest techniques- Fiber FISH, Spectral karyotyping and Chromosomal painting (WCP & PCP).	25 %
2	Human Cytogenetics: Collection , transport and storage of samples for cytogenetic analysis Morphology and classification of human chromosomes Numerical chromosomal aberrations (Aneuploidy and Euploidy) Structural chromosomal abnormalities (Translocations, Inversions, Deletions, Insertions Duplications, Dicentric and sochromosomes, Ring chromosomes, Chromosomes breaks, gaps and fragile sites, Marker chromosomes).	25 %
3	Cytogenetics of pregnancy, cancer and cell lines: Lymphocyte culture, Amniotic fluid cell culture, Chorionic villus culture, Establishing fibroblast culture, Cytogenetic analysis of human sperm, oocyte and embryo, Chromosomal abnormalities in malignant disease (CML, AML, ALL etc.), Cytogenetic characterization of various cell lines.	25 %
4	Applications of cytogenetics in Humans, Domestic animals & Plants Humans: Individual with clinical features of Genetic diseases during the following: (Embryonic period, Neonatal period, During early childhood level, During puberty and secondary sexual	25 %

	<p>development, During adulthood, During infertility or reproductive failure)</p> <p>Domestic animals: Normal chromosomal complements in cattle, buffalo, sheep, goat, horse, pig, cat, dog and poultry; Importance of cytogenetic investigations in domestic animals.</p> <p>Plants : Role of cytogenetics in plants, Types of polyploidy, Artificial induction of polyploidy in plants, Polyploidy in Triticum spelta, Gossypium hirsutum and Triticosecale wittmack, Phenotypic effects of polyploidy.</p> <p>Genotoxicity testing</p>	
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Basic Text & Reference Books:

- Cell Biology, Genetics, Molecular Biology, Evolution and Ecology by P S Verma and V K Agrawal (Multicolour/14th Edition) Published by S. Chand and company Ltd., New Delhi (ISBN: 81-219-2442-1).
- Human Cytogenetics: Constitutional analysis by D. E. Rooney. Oxford University Press. New York (ISBN: 0-19-96384-3 (Hbk.)).
- Essential of Human Genetics (4th edition) by S. M. Bhatnagar, M. L. Kothari and L. A. Mehta (ISBN: 81-250-1426-8).
- Genetics in Medicine (3rd Edition) by Thompson and Thompson, W B Saunders and company, West Washington square, Philadelphia, PA-19105 (ISBN: 0-7216-8857-8).
- Genetics (2nd Edition) by Jan M Friedman, Fred J Dill, Michael R Hayden and Barbara C McGillivray, B I Waverly Pvt. Ltd., New Delhi, Noida, U.P. (ISBN: 81-7431-025-8).
- Essential of Modern Genetics by V C Shah. Nirav Prakashan, Ahmedabad.
- Cytogenetics in Animal reproduction by W. C. D. Hare and Elizabeth L. Singh, published by Commonwealth Agricultural Bureaux (ISBN: 0 85198 444 4)
- The AGT Cytogenetics Laboratory Manual Barch, Margaret J. / Knutsen, Turid./ Spurbeck, Jack L. (eds.) 3rd edition, Lippincott_raven Publishers, Philadelphia, 1997 ISBN 0-397-51651-7 (New updated edition is about to release)
- Human Cytogenetics: Malignancy and acquired abnormalities. A Practical Approach. 3rd edition, Oxford University Press, 2001, ISBN 1-19-963842-X (Hardback) / ISBN 1-19-963841-1 (Paperback).
- Verma, Ram S. / Babu, Arvind, Human Chromosomes, Principles and Techniques 2nd edition, Mc Graw-Hill, Inc., New York, 1995, ISBN 0-07-105432-4
- Hema Purandare & Amit Chakravarty, Bhalani Publishing House, Mumbai. Human Cytogenetic Techniques & Clinical Applications, 2000, ISBN 81 85578 41 9
- Lisa G. Shaffer, Marilyn L. Slovak, Lynda J. Campbell. International System for Human Cytogenetic Nomenclature: ISCN 2009, S. Karger Publishers, ISBN 978-3-8055-8985-7
- Bargaonkar, Digamber S., Chromosomal Variation in Man: A Catalog of Chromosomal Variants and Anomalies 8th edition, Wiley-Liss, New York, 1997, ISBN 0-471-24332-9

SARDAR PATEL UNIVERSITY
Programme: M. Sc. (Genetics)
Semester: II
Syllabus with effect from: June 2017

Paper Code: PS02CGEN22	Total Credits: 4
Title of Paper: Microbial Genetics	

Unit	Description in detail	Weightage
1	<p>Mutation, DNA damage and Repair Spontaneous mutations (Random v/s Adaptive nature of mutation; Mutation rate and its determination, Types of DNA damage and their consequences (spontaneous and chemical induced deamination, radiation induced DNA damage, loss of nitrogen bases, alkylation, intra and inter strand cross linking) , DNA repair pathways (Mis-match repair in prokaryotes and eukaryotes, Nucleotide excision repair in prokaryotes and in eukaryotes, base excision repair, recombinational repair, SOS pathway, specific repair of oxidative DNA damage, repair of pyrimidine dimers, repair of alkylation induced damage and adaptive response and other specific repair mechanisms).</p>	25 %
2	<p>Plasmid Biology (Types of plasmids, compatibility, regulation of plasmid copy number and plasmid segregation) Phage genetics (T-series, complementation and Fine structure analysis, biology of lambda phages) Recombination (Types, Models of homologous recombination, Molecular mechanism of homologous, Homologous recombination in eukaryotes, mating type switching, Site specific recombination and its biological significance) Fungal Genetics (Tetrad analysis and Mitotic recombination)</p>	25 %
3	<p>Genetic exchange in prokaryotes Transformation (Natural transformation in Bacillus subtilis, Streptococcus pneumonia and Haemophilus influenza). Transformation by inducing artificial competence, Gene linkage and mapping by transformation. Transduction (Generalized transduction in P22, P1, T4 and Mu bacteriophages, homologous recombination with recipient's chromosome, measuring transduction (co-transduction of markers, marker effects, abortive transduction, transduction of plasmids). Applications of generalized transduction, Specialized transduction and its applications.</p>	25 %

	Conjugation (F-factor mediated Conjugation in E. coli, Hfr conjugation and chromosomal transfer, F-prime conjugation and merodiploids, Conjugation of fertility inhibited F-like plasmids, Non conjugative mobilizable plasmids, chromosomal mobilization of non-F plasmids, Plasmid based conjugation in other bacteria (Salmonella, Pseudomonas, Streptomyces and streptococcus, Interrupted mating and conjugational mapping)	
4	<p>Agrobacterium genetics: Ti plasmid, Interkingdom gene transfer (Key early experiments, vir regulon, protein secretion apparatus, conjugation model of T-DNA transfer, Integration products).</p> <p>Restriction modification systems: Types of RM systems, Role of RM systems, salient features and insights into evolution of diverse types of Restriction endonucleases and Methyl transferases, Regulation of RM systems.</p> <p>Transposable elements: Types of bacterial transposable elements; Structure, genetic organization and mechanism of transposition of Tn5, Tn3, phage Mu, Tn7, IS911, Integrons, Retrotransposons, conjugative and mobilizable transposons, Assays of transposition.</p>	25 %

Basic References:

- Genes X: Lewin
- Molecular Biology of the Gene-Watson et al.
- Modern Microbial Genetics-Uldis Streips and Ronald Yasbin
- Microbial genetics-Stanley Molay, John Cronan and David Freifelder.
- Molecular Genetics of Bacteria-Snyder and Champness.
- Molecular Genetics-Stent and Calender
- Principles of Genetics- Snustad and Simmons
- Molecular Biology of the Cell-Alberts et al.

SARDAR PATEL UNIVERSITY
Programme: M. Sc. (Genetics)
Semester: II
Syllabus with effect from: June 2017

Paper Code: PS02CGEN23	Total Credits: 4
Title of Paper: Fundamentals of Immunology	

Unit	Description in detail	Weightage
1	Introduction to immune system: mechanisms of barrier to entry of microbes / pathogens; Cells and organs of the immune system involved in innate and adaptive immunity: cells of the immune system, primary and secondary lymphoid organs, Hematopoiesis and its regulation Innate immunity: receptors of the innate immunity (TLR and sensing of PAMPs, CLR,RLR and CLR); Inflammatory responses. Antigens: antigenicity, and immunogenicity. B and T cell epitopes.	25 %
2	Antibody: Structure of immunoglobulin; classes of immunoglobulins, Signal transduction pathways emanating from the BCR, The Organization and Expression of Lymphocyte Receptor Genes: Hozumi and Tonegawa's Experiment, Multigene organization of Ig Gene, Mechanism of VDJ recombination, B cell receptor expression, allelic exclusion,B cell isotype switching and somatic hypermutation; expression of membrane bound and soluble immunoglobulin; T cell receptor genes and expression. Complement system: Overview of classical, alternative and lectin complement pathways, functions of complement, regulation of complement, complement deficiencies, microbial complement evasion strategies.	25 %
3	The Major Histocompatibility Complex and Antigen Presentation: The structure and function of MHC molecules, general organization and inheritance of MHC, self – MHC restriction, endogenous and exogenous pathway of antigen processing and presentation; cross presentation of exogenous antigen, presentation of non peptide antigens Cytokines: properties, receptors, associated diseases, therapeutic applications, cytokines. signaling pathways: JAK-STAT and FAS-FASL signaling pathways.	25 %
4	Basics of Antigen-antibody interactions: Agglutination,	25 %

	<p>precipitation, RIA and ELISA. Cell and antibody mediated effector response: Antibody mediated effector response (Neutralization, opsonization/ phagocytosis, complement fixation, ADCC); Cell mediated effector response (Generation of effector CTL's, Granzyme and Perforin Mediated Cytolysis, Fas-FasL Mediated Cytolysis, NK cell mediated cytolysis Immunity to infection: Immunity to viruses, Immunity to bacteria and fungi, Immunity to parasites (protozoa and worms).</p>	
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References

1. Owen, J. A., Punt, J., & Stranford, S. A. (2013). *Kuby immunology* (7th Edn). New York: WH Freeman.
2. Murphy, K., & Weaver, C. (2016). *Janeway's immunobiology* (9th Edn) Garland Science.
3. Male, D., Brostoff, J., Roth, D., & Roitt, I. (2012). *Immunology* (8th Edn) *With STUDENT CONSULT Online Access*. Elsevier Health Sciences.
4. Abbas, A. K., Lichtman, A. H., & Pillai, S. (2014). *Cellular and molecular immunology* (6th Edn) Elsevier Health Sciences.
5. Relevant review articles / research papers / handouts of latest development in the subject.

PS02CGEN24: Lab-I (Practical based on PS02CGEN21 & PS02CGEN22)

PS02CGEN25: Lab-II (Practical based on PS02CGEN23 & PS02EGEN2X)

PS02CGEN26: Viva

SARDAR PATEL UNIVERSITY
Programme: M. Sc. (Genetics)
Semester: II
Syllabus with effect from: June 2017

Paper Code: PS02EGEN21	Total Credits: 4
Title of Paper: Biostatistics	

Unit	Description in detail	Weightage
1	Definition of Biostatistics Data Collection: Types of Biological Data: Qualitative (Categorical) Data: Nominal and Ordinal Data Quantitative (Numerical) Data: Discrete and Continuous Data Methods of Collecting Data: Survey Method: Concept of a statistical population and sample from a population; Methods of drawing sample from the population, Simple Random Sampling (SRS), Stratified Random Sampling, Cluster Sampling; Experimental Method Presentation: Construction of frequency distribution (Simple or Discrete and Grouped): Rules for constructing Grouped frequency distribution Diagrammatic Presentation: Bar Diagram (Chart), Simple, Sub – divided (Component), Percentage, Multiple, Pie Chart Graphical Presentation: Line Graph, Histogram (For uniform class width only), Frequency Polygon, Frequency Curve, Ogives or Cumulative Frequency Curves Descriptive Statistics: Measures of Central Tendency (Averages): Mean or Arithmetic Mean, Median, Mode, Partition Values (For Raw and Grouped Data), Quartiles, Deciles, Percentile, Partition values using graphs (Ogives). Measures of Dispersion (Variation): Range, Quartile Deviation (Q.D), Inter Quartile Range (IQR), Standard Deviation (SD) and Variance, Coefficient of Variation (C.V), Box – and – Whisker Plot. Measures of Skewness and Kurtosis: Karl – Pearson’s Coeff. of Skewness, Bowley’s Coeff. of Skewness, Kurtosis (Definition Only).	25 %
2	Probability and Probability Distributions: Elements of Probability theory: Concept, Classical definition of Probability, Laws of Probabilities (Statements Only), Conditional Probability, Examples Probability Distributions: Binomial Distribution. Definition, Conditions for applicability of Binomial Distribution, Examples applicable in the field of Biosciences; Normal Distribution, Definition (Normal and Standard Normal Distribution), Properties of Normal Distribution, Examples applicable in the field of Biosciences.	25 %
3	Correlation and Regression Analysis: Correlation: Meaning, Types of Correlation, Positive, Negative, Non – Sense or Spurious, Methods of studying correlation, Scatter Plot (diagram) method, Karl-Pearson’s Correlation Coefficient (Product Moment) Method; Properties of Correlation Coefficient Coefficient of determination and its meaning: Spearman’s Rank Correlation Coefficient; Properties of Rank Correlation Coefficient.	25 %

	Regression: Meaning, Properties of Regression Coefficients, Applications in the field of Biosciences. Testing Of Hypothesis: Contingency tables, Goodness of Fit	
4	Large Sample Test: Z - test for (Single) population proportion; Z - test for difference between two population proportions; Z - test for (Single) population mean; Z - test for difference between two population means Small Sample Test: t – test for (Single) Population Mean, t – test for difference between two population means (Unpaired t-test), t – test for difference between two population means (Paired t-test) Analysis Of Variance (ANOVA) : One – Way Classification , Two – Way Classification.	25 %

References:

- Fundamentals of statistics by S.C. Gupta
- Principles of Biostatistics by Marcello Pagano and Kimberlee Gaurea
- Biostatistics : A Foundation For Analysis in the Health Sciences by Daniel, Wayne(Seventh Edition), Wiley India Pub.

SARDAR PATEL UNIVERSITY
Programme: M. Sc. (Genetics)
Semester: II
Syllabus with effect from: June 2017

Paper Code: PS02EGEN22	Total Credits: 4
Title of Paper: Medical Microbiology	

Unit	Description in detail	Weightage
1	Basics in Medical Microbiology Sources of infection, Modes of transmission, Factors predisposing to microbial pathogenicity, Types of infectious diseases. Prevention and Control of Hospital acquired infections. Immunoprophylaxis: Types of vaccines and schedule of vaccination. Recent advances in diagnostic microbiology: Automation, Nucleic acid based detection methods.	25 %
2	Bacteriology: Morphology, Cultural Characteristics, Antigenic structures, Pathogenesis, Laboratory Diagnosis of following bacteria: <i>Staphylococcus</i> , <i>Streptococcus</i> including <i>Pneumococcus</i> , <i>Bacillus</i> , <i>Corynebacterium</i> , <i>Clostridium</i> , <i>Mycobacteria</i> , <i>Vibrios</i> , <i>E. coli</i> , <i>Salmonella</i> , <i>Shighella</i> , <i>Spirochaetes</i> , <i>Neisseria</i> .	25 %
3	Virology: The Nature and classification of viruses, Morphology: virus structure and Virus replication. General properties, diseases caused, lab diagnosis and prevention of Pox, Herpes (HSV), Hepatitis (HAV & HAB), Picorna (Polio virus), Orthomyxo (Influenza), Paramyxo (Mumps and Measles), Rabdo (Rabies), Ebola, Zika and HIV virus. Viral vaccines and antiviral agents.	25 %
4	Parasitology & Mycology Parasitology: Laboratory techniques in parasitology. Morphology, life cycle, laboratory diagnosis of following parasites <i>Parasites: Entamoeba, Giardia, Leishmania, Plasmodium, Helminths: Taenia, Ascaris, Wuchereria bancrofti, Schistosomes</i> Mycology: Morphology, diseases caused and lab diagnosis of:- Opportunistic fungi - <i>Cryptococcus, Candida, Aspergillus</i> . Fungi causing Cutaneous mycoses- <i>Dermatophytes</i> Subcutaneous mycoses - <i>Mycetoma</i> , Systemic mycoses- <i>Histoplasma</i>	25 %

References:

1. Textbook of Microbiology by Surinder Kumar
2. Medical Parasitology by R. Karyakarte.
3. P. B. Godkar. Text Books of Medical Laboratory Technology
4. Anathanarayana & Panikar – A Text Book of Medical Microbiology
5. P. Chakraborty- A Text Book of Microbiology

6. Chatterjee, KD – Parasitology
7. Danial Greenwood et al, Medical Microbiology, A guide to Microbial Infections, Pathogenesis, Immunity, Laboratory Diagnosis and control.
8. Jagdish Chander, Textbook of medical mycology.
9. Teri Shores- Understanding Viruses.
10. Biswas SB and Biswas A : An Introduction to Viruses.

SARDAR PATEL UNIVERSITY
Programme: M. Sc. (Genetics)
Semester: II
Syllabus with effect from: June 2017

Paper Code: PS02EGEN23	Total Credits: 4
Title of Paper: Microtechniques	

Unit	Description in detail	Weightage
1	Light microscopy Properties of lenses, Optical corrections, Properties and types of objectives, Oculars and Illumination. Light microscopes: Bright field, dark field, fluorescence, phase contrast, polarizing, differential interference contrast. Micrometry and photomicrography	25 %
2	Basic components of electron microscopes. Thermionic and field emission guns. Types of electron microscopes: TEM, SEM, STEM, ESEM and HVEM	25 %
3	Maceration, squash and clearing techniques. Sample preparation for light microscopy. Classification of fixatives, formulas', (Plant and animal samples). Sample preparation for light microscopy: Fixation, dehydration and infiltration procedures. Embedding media for light microscopy. Stains and staining procedures- negative and positive staining procedures. Microtomes: Rotary, sliding, cryostat. Histochemical localization of metabolites for light microscopy: Starch, proteins, lipids, total carbohydrates, lignins, polyphenols, nucleic acid, histones, cutin, suberin and waxes. Localization of enzymes: Peroxidase, acid phosphatase and succinic dehydrogenase.	25 %
4	Freeze etching and freeze fracturing. Sample preparation for Electron microscope: Fixatives, double fixation, dehydration and infiltration procedures, embedding media for electron microscopy. Fixation and embedding of particulate samples like bacteria, virus etc. ultra-microtome and freezing ultramicrotomesemithin sectioning, ultrathin sectioning, grids, formavar coating, Staining for electron microscopy. Ultrastructural cytochemistry: Tannin, protein, cell wall polysaccharide, lignin and membrane. Enzymes: Peroxidase and phosphatase. Immunocytochemistry.	25 %

References:

- Microscopy and Microtechnique: R Marimuthu MJP Publisher, Chennai
- The study of plant structure: Principles and selected methods- T. P. O' Brien and M E McCully.
- Plant Microtechnique- Johansen, DA, McGraw Hill Book Co., New York.
- Botanical Microtechnique and Cytochemistry; Graeme P. Berlyn and Jerome P Micksche.

SARDAR PATEL UNIVERSITY
Programme: M. Sc. (Genetics)
Semester: II
Syllabus with effect from: June 2017

Paper Code: PS02EGEN24	Total Credits: 4
Title of Paper: Toxicology	

Unit	Description in detail	Weightage
1	Definition and scope of toxicology: Eco-toxicology and its environmental significance. Toxic effects : Basic for general classification & nature. Dose-Response relationship: Synergism and Antagonism, Determination of ED50 & LD50. Acute and Chronic exposures. Factors influencing Toxicity. Pharmacodynamics & Chemodynamics, dose conversion between animals and human Diagnosis of toxic changes in liver and kidneys : Metabolism of drugs: paracetamol and aspirin with their toxic effects on tissues.	25 %
2	Xenobiotics Metabolism: Absorption & distribution. Phase I reactions. Oxidation, Reduction, Hydrolysis and Hydration. Phase II reaction/Conjugation: Methylation, Glutathione and amino acid conjugation. Detoxification. Biochemical basis of toxicity: Metabolism of Toxicity : Disturbances of Exitable membrane function. Altered calcium Homeostasis. Covalent binding of cellular macromolecules & Genoatotoxicity. Tissue specificity of Toxicity. Toxicity testing: Test protocol, Genetic toxicity testing & Mutagenesis assays: In vitro Test systems – Bacterial Mutation Test, Ames Test, Fluctuation Tests, <i>In vivo</i> Mammalian Mutation tests – DNA repair assays, Chromosome damage test, Evaluation of Apoptosis and necrosis	25 %
3	Pesticide toxicity: Insecticides : Organochlorines, Anti cholinesterases – Organophosphates and Carbamates, Fungicides. Herbicides, Environmental consequences of pesticide toxicity. Biopesticides. Food Toxicity: Role of diet in cardio-vascular disease and cancer. Toxicology of food additives.	25 %
4	Metal Toxicity: Toxicology of Arsenic, mercury, lead and cadmium. Environmental factors, affecting metal toxicity effect of light, temperature & pH. Air pollution: Common air Pollutant & their sources. Air pollution & ozone. Air pollution due to chlorofluorocarbons (CFCS) and asbestos.	25 %

References:

1. Klaassen, C. D (8th Eds.). (2013). *Casarett and Doull's toxicology: the basic science of poisons* . New York: McGraw-Hill.
2. John A. Timbrell (4th Edn) (2008) Principles of biochemical toxicology. Taylor & Francis Ltd, London,.
3. Smart, R. C., & Hodgson, E. (4th Eds.). (2013). Molecular and biochemical toxicology. John Wiley & Sons.
4. Relevant review articles / research papers / handouts of latest development in the subject.