

**SARDAR PATEL UNIVERSITY
VALLABH VIDYANAGAR**



SYLLABUS EFFECTIVE FROM: 2017-18

Under Choice Based Credit Scheme

M.Sc. GENETICS

SEMESTER-I

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-DNA Technology 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-I 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)	Phyto resources 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: I
Syllabus with effect from: June 2017

Paper Code: PS01CGEN21	Total Credits: 4
Title of Paper: Molecular Biology	

Unit	Description in detail	Weightage
1	DNA structure DNA structure: Chemistry of DNA, DNA structure, Different conformations of DNA (B, A and Z), Denaturation and Renaturation (Cot curves) of DNA. DNA topology: Supercoiling, Biology of Supercoiled DNA, DNA topoisomerases and their mechanism of action. DNA- protein interactions: General features, Sequence specific DNA binding protein motifs, ss DNA binding proteins.	25 %
2	Organization of genome and its replication Organization of DNA into chromosomes: Packaging of DNA and organization of chromosome in bacterial cells; Packaging of DNA in eukaryotic nucleosome and chromatin condensation, assembly of nucleosomes upon replication, chromatin modification. DNA replication: Mechanism of DNA polymerase catalyzed synthesis of DNA, Types of DNA polymerases in bacteria, Initiation of DNA replication and its regulation in prokaryotes, assembly of replisome and progress of replication fork, termination of replication. DNA replication in eukaryotes and archaea. Inhibitors of DNA replication.	25 %
3	Gene expression in prokaryotes and eukaryotes Transcription: RNA polymerases, features of prokaryotic and eukaryotic promoters, assembly of transcription initiation complex in prokaryotes and eukaryotes, and its regulation; synthesis and processing of prokaryotic and eukaryotic transcripts. Translation: structure and role of t-RNA in protein synthesis, ribosome structure, basic features of genetic code and its deciphering, translation (initiation, elongation and termination in detail in prokaryotes as well as eukaryotes).	25 %
4	Regulation of gene expression Regulation of gene expression in prokaryotes: Operon concept, positive and negative regulation. Examples of lac (including mutational analysis), ara, and trp operon regulation; global regulatory responses. Regulation of gene expression in eukaryotes: Transcriptional, translational and processing level control mechanisms.	25 %

References:

Genes X: Lewin
Molecular Biology of the Gene: Watson et al
Molecular Genetic of Bacteria: Snyder and Champness
Molecular Biology, 4th Edition: Burton E Tropp
Principles of Genetics: Snustad and Simmons

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

Paper Code: PS01CGEN22	Total Credits: 4
Title of Paper: Bioinstrumentation	

Unit	Description in detail	Weightage
1	Visualization techniques: Principle of working and applications of bright field microscopy, phase contrast microscopy, fluorescence microscopy, confocal microscopy, scanning and transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy. Principle and applications of cytophotometry and flow cytometry	25 %
2	Separation techniques: Basic principle and application of Differential, density and ultracentrifugation. Principle and applications of Native-PAGE, SDS-PAGE, Agarose and 2D gel electrophoresis. Capillary electrophoresis and its applications. Principle, methodology and applications of gel – filtration, ion –exchange and affinity chromatography; Thin layer and High Performance Thin Layer Chromatography. Gas chromatography, High performance liquid chromatography and FPLC.	25 %
3	Spectroscopy Principle, instrumentation and applications of UV, Visible, IR (including FTIR and ATR), AAS, NMR, fluorescence and CD spectroscopy.	25 %
4	Principle and applications of tracer technique in biology: Radioactive Isotopes and half-life of isotopes; Effect of radiation on biological system; autoradiography; cerenkov radiation; radiation dosimetry; ionization and scintillation based detection and quantification of radioactivity. Biosensors: Principle, types and applications. Principle of biophysical methods used for analysis of biopolymer structure: X ray diffraction and mass spectrometry.	25 %

References:

1. Instrumental method of chemical analysis: Sharma B K
2. Instrumental methods of analysis: D A Skoog
3. An introduction to practical Biochemistry: Plummer
4. Instrumentation: Chatwal and Anand
5. Modern experimental Biology: Boyer

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

Paper Code: PS01CGEN23	Total Credits: 4
Title of Paper: Cell Biology	

Unit	Description in detail	Weightage
1	Evolution of cell: Cell as a unit of living organism, evolution and structure of prokaryotic cell, evolution of eukaryotic cell. Structure of Plasma membrane, Transport across plasma membrane. Endocytosis (Phagocytosis, Receptor mediated endocytosis) Cell walls and extracellular matrix. Cell-Cell interactions (Cell adhesion protein, Tight junctions, gap junctions, plant cell adhesion and plasmodesmata).	25 %
2	Nucleus, Nuclear pore complex and transport across nuclear envelope. Structure and functions of Endoplasmic reticulum, Golgi complex and lysosomes (Protein sorting and transport, Types of vesicular transport and their functions). Structure and function of Mitochondria, Chloroplasts and Peroxisomes.	25 %
3	Cytoskeleton and cell movement (Structure and organization of actin filaments; Actin, myosin and cell movement; Intermediate filaments; Microtubules and microtubule motors and movements); cilia and flagella: structure and function. Cell signalling: Signalling molecules and their receptors, Functions of cell surface receptors, pathways of intracellular signal transduction, signal transduction and cytoskeleton, signalling in development and differentiation.	25 %
4	Cell division cycle (phases of CDC; Regulation by cell growth and extracellular signals; cell cycle check points; regulators of cell cycle progression-MPF, cyclins and CDKs, Inhibitors of cell cycle progression; M-phase and cytokinesis. Programmed Cell Death: Difference between necrosis, apoptosis and necroptosis, Caspases, Central regulators of apoptosis (Bcl-2 family), signalling pathways that regulate apoptosis. Cancer: Types of cancer, development and causes of cancer, properties of transformed cells, oncogenes and tumor suppressor genes..	25 %

References:

- The cell: A molecular approach-Geoffrey M Cooper and Robert E. Hausman
- Cell Biology-Karp
- Molecular Biology of the cell- Alberts
- Molecular Cell Biology-Lodish et al.

PS01CGEN24: Lab-I (Practical based on PS01CGEN21 & PS01CGEN22)

PS01CGEN25: Lab-II (Practical based on PS01CGEN23 & PS01EGEN2X)

PS01CGEN26: Viva

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

Paper Code: PS01EGEN21	Total Credits: 4
Title of Paper: Biochemistry	

Unit	Description in detail	Weightage
1	Chemical and physical foundations of biomolecules. Water, acid, base and buffers Carbohydrate metabolism: Glycolysis and alternate pathways of glucose utilization, TCA cycle, glyoxylate cycle, Gluconeogenesis, Glycogen synthesis and utilization.	25 %
2	Principles of Thermodynamics; Bioenergetics and energy metabolism in cells. Oxidative phosphorylation and Electron transport chain: Electron carriers, iron sulphur proteins, cytochromes, PMF, ATP synthetase complex. Uncouplers and inhibitors of energy transfer.	25 %
3	Lipids: Structure and properties of lipids, fatty acids, phospholipids, and other derived lipids; functions of lipoproteins, cholesterol, steroids and prostaglandins, membrane lipids. Lipid metabolism: synthesis and oxidation of fatty acids (α , β and ω oxidation of fatty acids). Ketone bodies: Formation and degradation Vitamins: structure and function.	25 %
4	Protein structure: primary, secondary, tertiary and quaternary structure of proteins. Determination of protein structure and its analysis, Ramachandran plot, Hydropathy plot. Structure, properties and classification of amino acids, amino acid metabolism, urea cycle and nitrogen balance. Disorders associated with amino acid metabolism Nucleotides: Structure and functions, Nucleotide metabolism.	25 %

References:

- Lehninger's Principles of Biochemistry: D L Nelson and M M Cox, Macmillan, Worth Pub. Inc., NY.
- Biochemistry : Lubert Stryer
- Harper's Biochemistry: R. K. Murray and others, Appleton and Lange, Stanford.
- Microbial Physiology: Moat, Foster and Spector.

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

Paper Code: PS01EGEN22	Total Credits: 4
Title of Paper: Methods and Applications of Transgenic Plants	

Unit	Description in detail	Weightage
1	Methods of plant transformation: Genetic modification by plant breeding versus genetic engineering, stable and transient transformation, Agrobacterium tumefaciens and Agrobacterium rhizogenes mediated transformation, microprojectile bombardment, agrolistics, in-planta transformation.	25 %
2	Precise genome modification in crops: Transformation by homologous recombination, gene editing nucleases, site specific recombination using zinc-finger nucleases, chloroplast transformation and maternal inheritance, gene containment.	25 %
3	Vectors, promoters and markers used in Transgenic plants: Constitutive, tissue-specific and inducible promoters, deletion analysis, isolation of promoter, transcription initiation site determination, selectable and screenable markers, marker free transgenics.	25 %
4	Characterization of transgenic plants: Screening of transformants- copy number determination, expression of transgene at RNA and protein level, analysis of metabolites using biochemical methods, homozygosity of transformants in progeny, position effect, transgene silencing, field trials and risks, global status of GM crops, regulatory committee.	25 %

Basic Text & Reference Books

- Ashwani Kumar and Sudhir K Sopory. "Recent advances in plant biotechnology and its applications" I.K. international publishers, 2008
- Adrian Slater, Nigel W. Scott, Mark R. Fowler. "Plant biotechnology: the genetic manipulation of plants" Oxford University Press, 2008

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

Paper Code: PS01EGEN23	Total Credits: 4
Title of Paper: Phytoresources Utilization and Conservation	

Unit	Description in detail	Weightage
1	Plant Biodiversity : Concept, status in India, utilization and concerns. Origin, evolution, botany, cultivation and uses of (i) Food, forage and fodder crops, (ii) fibre crops (iii) medicinal and aromatic plants, and (iv) vegetable oil – yielding crops Plants as sources of drugs, pharmaceuticals and pharmaceutical aids.	25 %
2	Ethnomedicobotany: Basic approaches to study traditional knowledge on herbal medicine; Scope and potential applications. Collection methods of ethnomedicobotanical data: Field methods and scrutiny of Herbarium specimens and folklore; verification of data; collection of materials for voucher specimen and for phytochemical screening; application of ethnomedicobotany. Creating indigenous knowledge base of traditional medicines of plant origin.	25 %
3	Forest products: Important timber yielding planting. Timber types, identification diagnostic features, structure & quality Important fire wood plants Non Timber forest products bamboos, rattans, fibers pulp; gums, resins, tanins, latex, fruits & tubers. Innovations for meeting world food demands. Plants used as avenue trees for shade, pollution control and aesthetics.	25 %
4	Principles of conservation; extinctions; environmental status of plants based on International Union for Conservation of Nature. Strategies for conservation – <i>in situ</i> conservation : International efforts and Indian initiatives; protected areas in India – sanctuaries, national parks, biosphere reserves, wetlands, mangroves and coral reefs for conservation of wild biodiversity. <i>Ex situ</i> conservation : Principles and practices; botanical gardens, fields gene banks, seed banks, <i>in vitro</i> repositories, cryobanks; general account of the activities of Botanical Survey of India (BSI), National Bureau of Plant Genetic Resources (NBPGR), Indian Council of Agricultural Research (ICAR), Council of Scientific & Industrial Research (CSIR), and the Department of Biotechnology (DBT) for conservation, non-formal conservation efforts.	25 %

References:

Anonymous. National Gene Bank: Indian Heritage on Plant Genetic Resources (Booklet).
National Bureau of Plant Genetic Resources, New Delhi.
Arora, R. K. and Nayar, E. R. Wild Relatives of Crop Plants in India. NBPGR Science Monograph.
Baker, H. G. Plants and Civilization. C. A. Wadsworth, Belmont.
Bole, P. V. and Vaghani, Y. Field Guide to Common Indian Trees. Oxford University Press, Mumbai.
Chandel, K. P. S., Shukla, G. and Sharma, N. Biodiversity in Medicinal and Aromatic Plants in India : Conservation and Utilization. National Bureau of Plant Genetic Resources, New Delhi.

Cristi, B. R. CRC Handbook of Plant Sciences and Agriculture. Vol. I. In-situ conservation. CRC Press, Boca Raton, Florida, USA

Council of Scientific & Industrial Research. The Useful Plants of India. Publications and Information Directorate, CSIR, New Delhi.

Plant Wealth of India. Special Issue of Proceedings India National Science Academy B – 63

Rodgers, N. A. and Panwar, H. S. Planning a Wildlife Protected Area Network in India. Vol. 1.

The Report Wildlife Institute of India, Dehradun.

Sahni, K. C. The Book of India Trees, Oxford University Press, Mumbai.

Sharma, O. P. Hill's Economic Botany. Tata McGraw Hill Co. Ltd., New Delhi.

Swaminathan, M. S. and Kocchar, S. L. Plants and Society. Macmillan Publication Ltd., London.

Thakur, R. S., Puri, H. S. and Husain, A Major Medicinal Plants of India. Central Institute of Medicinal and Aromatic Plants, CSIR, Lucknow.

S.K. Jain: A Manual of Ethnobotany

S.K. Jain: Glimpses of Indian Ethnobotany

S.K.Jain, B.K. Sinha and R.C.Gupta: Notable plants in Ethnomedicine of India

J.K. Maheswari: Dictionary of Indian Folk medicine and Ethnobotany

S.K. Jain: Useful plants of India

Wiley Chichester, CIBA Foundation Symposium 185: Ethnobotany and the search for new Drugs.

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

Paper Code: PS01EGEN24	Total Credits: 4
Title of Paper: Human Physiology	

Unit	Description in detail	Weightage
1	Homeostasis and the organization of body fluids, Control of Homeostasis, Positive and negative Feedback systems, Homeostatic Imbalances. An overview of human circulatory system. Anatomy of heart, cardiac cycle, cardiac output, blood pressure and regulation, ECG. The arterial system, venous system, the microcirculation and mechanics of capillary fluid exchange. Control of blood flow to the tissues. Portal circulations. Arterial pressure and its regulation. Blood-components and functional significance. Blood buffer systems, Blood coagulation and factors involved in coagulation. Laboratory tests to measure coagulation and thrombolysis. Hemopoiesis and blood groups, Disorders of circulatory system: coagulation disorders, hypertension, thalassaemias and anemias.	25 %
2	Digestive system – Composition, functions and regulation of saliva, gastric, pancreatic intestinal and bile secretions – digestion and absorption of carbohydrates, lipids, proteins nucleic acids, minerals and vitamins. The Muscular System – Types of muscles and their functions. Physiology of muscle contraction in striated and non-striated muscle.	25 %
3	Excretory system – structure of nephron formulation of urine, glomerular filtration, GFR, tubular reabsorption of glucose. renal and pulmonary control of blood pH, renal clearance.	25 %
4	Nervous System- Structure of neuron, function and organization of nervous system, Bloodbrain barrier, Neurotransmitters, Nerve impulse transmission. Reproductive physiology – secretion and function of reproductive hormones, pregnancy and lactation. Hormonal disturbances.	25 %

References:

Text book of Medical Physiology by A. C. Guyton and J. E. Harcourt.

Text book of Medical Physiology by Ganong.

Principles of anatomy and physiology by Gerard Tortora and Bryan Derrickson, 12th edition.