

**SARDAR PATEL UNIVERSITY
VALLABH VIDYANAGAR**



**SYLLABUS EFFECTIVE FROM: 2018-19
Under Choice Based Credit Scheme**

**M.Sc. GENETICS
SEMESTER-IV**

Paper Code: PS04CGEN21	Total Credits: 4
Title of Paper: R – DNA Technology	

Unit	Description in detail	Weightage
1	Concept and importance of Genetic Engineering; General strategies and Steps involved in gene cloning: Extraction and purification of DNA and RNA from bacteria, virus, plant and animal cells; physical and enzymatic methods for cutting DNA; DNA ligase and other enzymes involved in gene cloning; Construction genomic and cDNA libraries; Introduction of DNA into host cells; screening and selection methods for recombinant clones.	25%
2	Cloning vectors- Basic properties and cloning strategies for vectors derived from Plasmids, λ -bacteriophages, M-13 phage, Cosmids, Fosmids, Phagemids, Phasmids, YAC, BAC, HAC/MAC. Salient features of expression vectors for heterologous expression in <i>E. coli</i> , Yeast, Insect and Mammalian system, factors influencing heterologous gene expression.	25%
3	DNA sequencing and sequence assembly: Maxam-Gilbert's and Sanger's methods, Shot gun sequencing, Next generation sequencing strategies for large genomes. DNA mapping and DNA fingerprinting: Physical and molecular mapping, Hybridization and PCR based methods of fingerprinting. Site directed mutagenesis: Methods and applications. Polymerase Chain Reaction: Principle and basic types of PCR; Reverse Transcription and Real Time PCRs.	25%
4	Applications of Genetic engineering in improvement of plants, animals and microbes; Gene editing and its applications; Metagenomics and Metabolic engineering; Gene therapy; Restriction and regulations for the release of GMOs; Biosafety and levels of Physical and Biological containment; The Indian Guidelines for release and use of GM organisms.	25%

Basic Text & Reference Books:

- Genome 3rd Edition – Brown
- Molecular Biotechnology – Glick
- Principles of Genetic Manipulation – Old and Primrose
- Applied Molecular Genetics – Roger Miesfeld
- Biotechnology – H. K. Das
- Recombinant DNA – Watson et. al.
- Molecular cloning – Sambrook and Russel
- From genes to clones – Ernst Whittaker

Paper Code: PS04CGEN22		Total Credits: 4
Title of Paper: Animal Genetics and Genetics Counselling		
Unit	Description in detail	Weightage
1	Genetics and Animal Breeding: Introduction to cytogenetics applied to animal system. Principles of quantitative genetics applied to improvement of livestock and poultry Artificial animal breeding, Artificial insemination and Germ cell storage. In vitro fertilization and embryo transfer for improved breeding, embryo splitting , embryo sexing and embryo cloning, Techniques of nuclear transplantation Selective animal breeding- pure breeding and cross breeding, Progeny testing Diagnostics for selected genetic diseases (BLAD, Citrullinaemia, Factor XI deficiency syndrome and DUMPS), Percentage verification.	25 %
2	Transgenic Animal Technology : The concept of transgene and transgenics Techniques for producing transgenics and somatotransgenic animals (Localized in vitro gene transfer techniques), Production of transgenic cattle by pronuclear injection- Biological, physical and chemical methods . Applications of transgenic animals – Organ transplant and pharmaceutical proteins.	25 %
3	Principles of effective counselling: Including basic concepts of normal and abnormal psychology, normal human psychological development, interviewing and counselling principles and skills, crisis intervention, family dynamics and interventions, principles and techniques of assessment.	25 %
4	Genetic Counseling: Principles of genetic counselling, Causes and factors for seeking counselling, Dysmorphology, Ethical and legal issues in genetic counselling, Risk evaluation (Mendelian risk, empirical risk), Prenatal and preimplantation diagnosis. Non -invasive: Triple test, Ultrasonography (USG), Invasive: Amniocentesis (AC), chorionic villi sampling (CVS), Fetal blood sampling (FBS), Population screening for genetic disorders, Treatment and management of genetic disorders.	25 %

Basic Text & Reference Books:

- Animal Biotechnology by M M Ranga, Agrobios, Jodhpur. ISBN- 81-7754-309-1.
- Animal Biotechnology: recent concepts and developments by P Ramadas, MJP Publishers, Chennai. ISBN: 81-8094-042-X.
- Genetics of Livestock improvement by John F. Lasley, Prentice-Hall of India Priv.Ltd. New Delhi. ISBN: 9780133511062.
- Principles and methods of Animal breeding by R B Kelly, Agrobios (India), Jodhpur. ISBN: 8190906526.
- Elements of Breeding and breeds of cattle and Buffalo- P Kanakraj, Jaypee Brothers Medical, ISBN: 978-8180618420.
- Genetics: A Conceptual Approach, 4th Edition by Benjamin A. Pierce, ISBN-13: 978-1-4292-3250-0.
- Baker et al, A Guide to Genetic Counseling, Wiley-Liss, 1998.
- Robinson and Linden, Clinical Genetics Handbook, 2nd Edition Blackwell Science, 1994.
- Rasko and Downes, Genes in Medicine, Chapman & Hall, 1996.
- Young, Introduction to Risk Calculation in Genetic Counseling, 3rd Edition Oxford University Press, 2006.

PS04CGEN23 : Practical-I (Practical based on PS04CGEN21 & PS04CGEN22)

PS04EGEN21 : Practical-II (Practical based on PS04EGEN2X & PS04EGEN2X)

PS04EGEN22 : DISSERTATION (12 Credits)

Paper Code: PS04EGEN23		Total Credits: 4
Title Of Paper: Population and Evolutionary Genetics		
Unit	Description in detail	Weightage
1	Mandelian populations, Gene pool and gene frequencies Hardy-Weinberg law Applications of Hardy-Weinberg law: Estimation of gene frequency Factors influencing gene frequency: Natural selection, Mutation, Migration, Genetic drifts, Non random mating, Inbreeding and heterosis Threshold and heritability.	25 %
2	Evolution and origin of species: Theories of evolution, Evolutionary history Evolution of prokaryotes and eukaryotes, Genetic variation and genetic polymorphism, Species and speciation, Molecular phylogenics, Molecular clocks.	25 %
3	Conservation Genetics: Genetic diversity: A heart of conservation genetics Interspecific and intraspecific genetic diversity, Identification of genetic diversity, Impact of population size on species survival, Genetic erosion and genetic diversity Methods for conservation of genetic diversity.	25 %
4	Genetics in Forensic Sciences: DNA comparisons, Protein comparisons, RFLPs: Genetic fingerprints, VNTRs: Genetic profiles, Unique correlations, Sociobiology, autism, Kin selection and inclusive fitness, Haplodiploidy, Imprinting Phenomena.	25 %

Basic Text & Reference Books:

- Philip W. Hedrick, 2000, Genetics of Populations, Second edition, Jones and Bartlett Publishers, USA
- Principle of population genetics by Veena Chawla and Ramesh Yadav (Practical Manual).
- Fundamentals of Genetics by B D Singh.
- D.S.Flaconer, 1985, Introduction to Quantitative Genetics, Second edition, published by Longman Groups Limited, England
- Ching Chin Li , 1968, Population Genetics, The University of Chicago press, Ltd, London
- Strickbeger M.W.Genetics. Third Edition. Prentice- Hall of India Pvt. Ltd, New Delhi, 2005. ISBN:81-203-0949-9
- Emund W. Sinnott, L.C. Dunn & T. Dobzhansky, Principles of Genetics, Tata Mcgraw Hill Publishing Company Ltd, New Delhi, ISBN: 978-0070994133.
- P.K.Gupta, Genetics. Rastogi Publications, Meerut, India, ISBN: 81-7133-842-9
- Gardner E.J, Simmons M.J. & Snustad D.P. Principles of Genetics, Eighth edition, John Willey & Sons Inc. ISBN 9971-51-346-3
- Klug W.S. & Cummings M.R. Concepts of Genetics. Seventh edition. Pearson Education ISBN 81-317-0811-X
- Stent G.S. & Calendar R. Molecular Genetics: An Introductory Narrative. Second edition CBS Publishers and Distributors, New Delhi ISBN 811-239-0857-1
- Streips U. and Yasbin R. Modern Microbial genetics, Wiley – Liss, USA. ISBN: 0-471-38665-0
- Topic Related Review articles

Paper Code: PS04EGEN24	Total Credits: 4
Title of Paper: Food and Dairy Microbiology	

Unit	Description in detail	Weightage
1	<ul style="list-style-type: none"> • Scope of food microbiology • Food as a substrate a) Microorganisms important in food microbiology – Bacteria, yeasts and moulds. b) Factors influencing microbial growth in food. • Food Spoilage a) General principles underlying food spoilage and contamination. b) Spoilage of canned food, sugar products, vegetables, fruits, meat and meat products, milk and milk products fish, seafood and poultry. 	25 %
2	<ul style="list-style-type: none"> • Food poisoning a) Indicator food borne pathogens b) Bacterial food borne infections and intoxications-<i>Brucella</i>, <i>Campylobacter</i>, <i>Clostridium</i>, <i>Escherichia (ETEC/EHEC/EPEC/EAEC)</i>, <i>Salmonella</i>, <i>Shigella</i>, <i>Listeria</i>, <i>Vibrio</i>, and <i>Yersinia</i>. c) Non- bacterial food borne infections and intoxications, Nematodes, protozoa, algae, fungi, and viruses. d) Culture and non-culture based detection of food pathogens and viruses e) General methods for diagnosis of infections, intoxications and preventive measures. 	25 %
3	<ul style="list-style-type: none"> • Food preservation Principles of food preservation – Physical and chemical preservation methods, Bio preservatives • Food fermentations Starter cultures for fermented foods: Biochemical activities in fermentation of foods. Oriental fermented foods: Shoyu, Temph, Kimchi etc., Fermented milk products: yogurt, Kefir, Koumiss etc. Fermented vegetables – Sauerkraut Bread manufacture • Application of microbial enzymes in food industry 	25 %
4	<ul style="list-style-type: none"> • Genetically modified foods. Biosensors in food • Food research organizations/institutes in India • Recent foodborne outbreaks • Food sanitation – Microbiology of food plant sanitation, water and milk testing • Food laws and quality control – HACCP, Codex alimentarius, PFA, FPO, MFPO, BIS, AGMARK. 	25 %

Basic Text & Reference Books:

1. Food Microbiology, Frazier and Westhoff
2. Food microbiology, Adam and Moss
3. Dairy Microbiology by Robinson. Volume II and I
4. Fundamental Food Microbiology, Bibek Ray and Arun Bhuniya

Paper Code: PS04EGEN25	Total Credits: 4
Title of Paper: IPR and Biosafety	

Unit	Description in detail	Weightage
1	Biotechnology and society: Biotechnology and social responsibility, public acceptance issues in biotechnology, issues of access, ownership, monopoly, traditional knowledge, biodiversity, benefit sharing, environmental sustainability, public vs private funding. Social and ethical issues in biotechnology. Principles of bioethics. Ethical conflicts in biotechnology- interference with nature, unequal distribution of risk and benefits of biotechnology, bioethics vs business ethics.	25 %
2	Bio- safety: Definition of bio-safety, Biotechnology and bio-safety concerns at the level of individuals, institutions, society, region, country and world. Bio-safety in laboratory institution: laboratory associated infection and other hazards, assessment of biological hazards and level of biosafety. Bio safety regulation: handling of recombinant DNA products and process in industry and in institutions.	25 %
3	IPR I: Introduction to IPR: Forms of IPR and Intellectual property protection. Concept of property with respect to intellectual creativity, Tangible and Intangible property. WTO: agency controlling trade among nations, WTO with reference to biotechnological affairs, TRIPs. WIPO, EPO.	25 %
4	IPR II: Concept related to patents novelty, non-obviousness, utility, anticipation, prior art etc. Type of patents. Indian patent act and foreign patents. Patentability, Patent application, Revocation of patent, Infringement and Litigation with case studies on patent, Commercialization and Licensing.	25 %

Basic Text & Reference Books:

- Fleming, D.A., Hunt, D.L., (2000). Biotechnology and Safety Assessment (3rd Ed) Academic press. ISBN: 1555811804, 9781555811808.
- Thomas, J.A., Fuch, R.L. (1999). Biotechnology and safety assessment (3rd Ed). CRC press, Washington. ISBN: 1560327219, 9781560327219.
- Law and Strategy of biotechnological patents by Sibley. Butterworth publication (2007) ISBN: 075069440, 9780750694445.
- Intellectual property rights-Ganguli-Tat McGrawhill. (2001) ISBN-10: 074638602.
- Intellectual Property Right-Wattal-Oxford PublicationHouse.(1997)ISBN:0195905024.
- Biotechnology Biotechnology - A comprehensive treatise (Vol. 12). Legal economic and ethical dimensions VCH. (2nd ed) ISBN-10 3527304320.
- Encyclopedia of Bioethics 5 vol set, (2003) ISBN-10: 0028657748.
- Thomas, J.A., Fuch, R.L. (2002). Biotechnology and safety Assessment (3rd Ed) Academic press.
- B.D. Singh. Biotechnology expanding horizons.
- H.K.Das. Text book of biotechnology 3rd edition.