

FACULTY OF LIFE SCIENCES

SYLLABUS

FOR

B.Sc. (HONS. SCHOOL) HUMAN GENETICS

(Semester-I-VI)

(Under Credit Based Continuous Evaluation Grading System)

Examinations: 2012-13



GURU NANAK DEV UNIVERSITY AMRITSAR

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B.Sc. (HS) Human Genetics (Semester System)
(Under Credit Based Continuous Evaluation Grading System)

Eligibility Criteria:

i) B.Sc. (Hons. School) Human Genetics

- a) Senior Secondary Examination (12th grade) in Medical stream with at least 50% marks in aggregate.
- b) Any other examination recognized equivalent thereto.

Credit Structure of B.Sc. (Hons. School) in Human Genetics

Semester	Credits			
	Core	Elective	Interdisciplinary/ Optional	Total
I	28	–	–	28
II	27	–	–	27
Total Credits	55	–	–	55
III	19	–	3	22
IV	20	3	–	23
Total Credits	39	3	3	45
V	19	3	3	25
VI	20	3	3	26
Total Credits	39	6	6	51

B.Sc. (HS) Human Genetics (Semester System)
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SCHEME OF COURSE

Semester-I

Course No.	C/E/I	Course Title	L	T	P	Total Credits
Core Courses (28 Credits)						
HGL-101	C	Fundamentals of Genetics	3	1	0	4
HGL-102	C	Introductory Biochemistry	3	0	0	3
CYL-191	C	Organic Chemistry	3	1	0	4
PHL-191	C	Optics	3	1	0	4
MTL-161	C	Differential Calculus	3	0	0	3
	C	Communicative English-I	2	0	0	2
HGP-121	C	Lab Exercises in Genetics	0	0	2	2
CYP-191	C	Organic Chemistry Lab — Classical Qualitative Organic Analysis	0	0	3	3
PHP-192	C	Optics Lab	0	0	3	3
Total Credits			17	3	8	28

Semester-II

Course No.	C/E/I	Course Title	L	T	P	Total Credits
Core Courses (26 Credits)						
HGL-151	C	Introductory Cell Biology	3	0	0	3
HGL-152	C	Principles of Molecular Genetics	3	0	0	3
CYL-192	C	Inorganic Chemistry	3	1	0	4
PHL-196	C	Modern Physics	3	1	0	4
MTL-162	C	Integral Calculus	3	0	0	3
	C	Communicative English-II	2	0	0	2
HGP-171	C	Lab Techniques in Biochemistry and Molecular Biology	0	0	2	2
CYP-192	C	Inorganic Chemistry Lab — Qualitative Analysis	0	0	3	3
PHP-197	C	Electricity and Magnetism Lab	0	0	3	3
Total Credits			17	2	8	27

1. Course numbers of the papers “Communicative English-I” and “Communicative English-II” will be provided by the Department of English, GNDU, Amritsar.
2. Course contents of the papers “PHP-192 Optics Lab” and “PHP-197 Electricity and Magnetism Lab” are in continuation of theory papers “PHL-191 Optics” and “PHL-196 Modern Physics”, respectively, and will be provided by the Department of Physics.

B.Sc. (HS) Human Genetics (Semester System)
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Semester-III

Course No.	C/E/I	Course Title	L	T	P	Total Credits
Core Courses (19 Credits)						
HGL-201	C	Fundamentals of Human Anatomy	3	0	0	3
HGL-202	C	Concepts of DNA Technology	3	0	0	3
HGL-203	C	Human Evolution and Primatology	3	0	0	3
ESL-220	C	Environmental Studies (Compulsory)	3	0	0	3
PBL-103/ PHC-01	C	Punjabi-I / Punjab History and Culture-I	2	0	0	2
HGP-221	C	Fundamentals of Human Anatomy Practical	0	0	1.5	1.5
HGP-222	C	DNA Technology Practical	0	0	2	2
HGP-223	C	Human Evolution and Primatology Practical	0	0	1.5	1.5
Interdisciplinary/Optional Course (3 or 4 Credits)						
–	I	To be taken from outside the department	3	0	0	3
Total Credits			17	0	5	22

The students of the department are required to take one paper (Interdisciplinary/Optional) of 3 or 4 credits of their choice from other Life Sciences / Sciences departments.

Semester-IV

Course No.	C/E/I	Course Title	L	T	P	Total Credits
Core Courses (20 Credits)						
HGL-251	C	Fundamentals of Human Physiology	3	0	0	3
HGL-252	C	Human Biochemical Genetics	3	0	0	3
HGL-253	C	Human Ecology and Demography	2	0	0	2
CYL-291	C	Physical Chemistry	3	1	0	4
PBL-104/ PHC-02	C	Punjabi-II / Punjab History and Culture-II	2	0	0	2
HGP-271	C	Lab Exercises in Human Physiology	0	0	1.5	1.5
HGP-272	C	Human Biochemical Genetics Practical	0	0	1.5	1.5
CYP-292	C	Physical Chemistry Lab	0	0	3	3
Elective Course (3 Credits)						
HGL-281	E	Introductory Cultural Anthropology	3	0	0	3
HGL-282	E	Human Embryology	3	0	0	3
HGL-283	E	Genetic Engineering	3	0	0	3
Total Credits			16	1	6	23

The students are required to opt for one 'Elective' paper.

B.Sc. (HS) Human Genetics (Semester System)
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Semester-V

Course No.	C/E/I	Course Title	L	T	P	Total Credits
Core Courses (19 Credits)						
HGL-301	C	Human Genetics and Cytogenetics-I	3	0	0	3
HGL-302	C	Principles of Human Growth and Development	3	0	0	3
HGL-303	C	Human Population Genetics	3	0	0	3
HGL-405	C	Computer Applications	3	0	0	3
MTL-261	C	Biostatistics	3	1	0	4
HGP-321	C	Human Genetics and Cytogenetics Practical	0	0	1.5	1.5
HGP-322	C	Anthropometry Practical	0	0	1.5	1.5
Elective Course (3 Credits)						
HGP-381	E	Lab Exercises in Molecular Genetics	0	0	3	3
HGP-382	E	Lab Exercises in Growth and Development	0	0	3	3
HGP-383	E	Lab Exercises in Tissue Culture-I	0	0	3	3
Interdisciplinary/Optional Course (3 or 4 Credits)						
–	I	To be taken from outside the department	3	0	0	3
Total Credits			18	1	6	25

1. The students are required to opt for one 'Elective' paper.
2. The students of the department are required to take one paper (Interdisciplinary/Optional) of 3 or 4 credits of their choice from other Life Sciences / Sciences departments.

Semester-VI

Course No.	C/E/I	Course Title	L	T	P	Total Credits
Core Courses (20 Credits)						
MBL-451	C	Concepts in Immunology	4	0	0	4
HGL-351	C	Human Genetics and Cytogenetics-II	3	0	0	3
HGL-352	C	Principles of Human Physique and Body Composition	3	0	0	3
HGL-353	C	Principles of Quantitative Genetics	3	0	0	3
HGL-354	C	Applied DNA Technology	3	0	0	3
HGP-371	C	Human Genetics and Molecular Genetics Practical	0	0	2	2
HGP-372	C	Human Physique and Body Composition Practical	0	0	2	2
Elective Courses (3 Credits)						
HGP-391	E	Lab Exercises in Biochemistry	0	0	3	3
HGP-392	E	Lab Exercises in Quantitative Genetics	0	0	3	3
HGP-393	E	Lab Exercises in Tissue Culture-II	0	0	3	3
Interdisciplinary/Optional Course (3 or 4 Credits)						
–	I	To be taken from outside the department	3	0	0	3
Total Credits			19	0	7	26

1. The students are required to opt for one 'Elective' paper.
2. The students of the department are required to take one paper (Interdisciplinary/Optional) of 3 or 4 credits of their choice from other Life Sciences / Sciences departments.

HGL-101 FUNDAMENTALS OF GENETICS

Credits: 3-1-0

Unit-I

Brief history of genetics, cell cycle, cell division, DNA and RNA as genetic material, Chromosome structure in brief, Types of chromosomes, Variation in chromosome structure and number: Deficiency, Duplication, Translocation, Inversions, Monosomy, Nullisomy, Trisomy, Tetrasomy, Haploidy, Polyploidy. Origin and transmission of chromosomal aberrations.

Unit-II

Mendelian principles, Gene interactions: Epistasis, additive, modifiers, lethal, Penetrance, Expressivity, Phenocopies, Pleiotropic genes. Genomic imprinting, maternal effects, extranuclear inheritance in mitochondria and chloroplast.

Unit-III

Sex determination, Dosage compensation with reference to X-inactivation in man, Sex-linkage in diploid organisms. Crossing-over, non-disjunction, recombination, linkage, Use of sexual process in bacteria and bacteriophages in genetic mapping, genetic mapping in haploid and diploid eukaryotes.

Introduction to quantitative genetics and polygenic inheritance. Basic concept of multiple alleles, ABO and Rh system of blood groups, Hardy-Weinberg principle and its Implications in brief. Effect of selection, mutation, migration and genetic drift on Hardy-Weinberg equilibrium.

Books Recommended:

1. Brooker, R.J. (1999). Genetics, Principles and Analysis. Addison Wesley Longman, California.
 2. Cummings, M.R. (2009). Human Genetics. Cenage Learning, USA.
 3. Gardner, E.J. (2008). Human Genetics. Viva Books Pvt. Ltd., India.
 4. Klug, W.S. and Cummings, M.R. (2003). Concepts of Genetics. Pearson Education, Inc., New Delhi.
 5. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, Inc., New York.
 6. Strickberger, M.W. (1999). Genetics. Prentice-Hall India Pvt. Ltd., New Delhi.
 7. Tamarin R.H. (2002). Principles of Genetics. Tata McGrawHill, New York.
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HGL-102 INTRODUCTORY BIOCHEMISTRY

Credits: 3-0-0

Unit-I

Definition, classification, structure, isomerism and physiological importance of carbohydrates, Definition and function of lipids, structure of phosphosphingolipids, cerebrosides and gangliosides, essential fatty acids, Structure of amino acids, Non-protein and rare amino acids, Structural organization of proteins (primary, secondary, tertiary, quaternary and domain structure), Protein classification and function, Supramolecular assemblies of proteins.

Unit-II

Definition, nomenclature and classification of enzymes, Chemical basis of enzyme action, Kinetics of enzyme catalyzed reactions, Enzyme inhibition, Allosteric enzymes, Regulation of enzyme activity, Co-factors, co-enzymes and prosthetic groups, Vitamins and minerals in brief.

Unit-III

Metabolism of carbohydrate, Glycolysis, Citric acid cycle, Hexose monophosphate shunt, Electron transport chain, Oxidative phosphorylation and gluconeogenesis, Dietary lipid metabolism, Oxidation of fatty acid, Ketone body production, Metabolism of proteins and amino acids, Urea cycle and disposal of ammonia.

Books Recommended:

1. Berg, J.M. and Tymoczko, J.L. and Stryer, L. (2002). Biochemistry. W.H. Freeman and Co., New York, 5th ed.
2. Murray, R.K., Bender, D.A., Botham, K.M., Kenelly, P.J., Rodwell, V.W. and Mayes, P.A. (2009). Harper's Illustrated Biochemistry. McGraw-Hill, California.
3. Nelson, D.L. and Cox, M.M. (2008). Lehninger's Principles of Biochemistry. W.H. Freeman and Co., New York.
4. Rama Rao, A.V.S.S. (1995). Textbook of Biochemistry. Prentice-Hall India, New Delhi.
5. Voet, D. and Voet, J.G. (2004). Biochemistry. John Wiley and Sons, New York.

CYL-191 ORGANIC CHEMISTRY

Credits: 3-1-0

1. Stereochemistry

Molecular chirality, enantiomers/symmetry in achiral structures, chiral centres in chiral molecules, properties of chiral molecules –optical activity, absolute and relative configuration, the Cahn-Ingold Perlog R-S notional system physical properties of enantiomers. Stereochemistry of chemical reactions that produce chiral centres, chemical reactions that produce stereoisomers, Resolution of enantiomers, chiral centres other than carbon.

2. Chemistry Alkanes and Alkenes:

Conformations of alkanes and cycloalkanes: conformational analysis of ethane, butane, cyclohexane, monosubstituted and disubstituted cyclohexane, conformation of small, medium and large ring cycloalkanes and of polycyclic ring systems. Stereochemistry of alkenes, naming stereo isometric alkenes by the E-Z system, mechanism of hydrogenation of alkenes. Stereochemistry of hydrogenation of cycloalkenes, Dehydration of alcohols and regioselectivity of these reactions . Acid catalysed dehydration of alcohols with complete mechanistic discussion. Mechanism of dehydrohalogenation of alkylhalides (E mechanism), stereoselective and antielimination in E reactions, the E Mechanism, electrophilic addition of hydrogen halides to alkenes its regioselectivity explained on the basis of mechanism, free radical addition of hydrogen bromide to alkenes, acid catalysed hydration of alkene with mechanism stereochemistry of halogen addition to alkenes and its mechanistic explanation. Hypohalous acid addition to alkenes, epoxidation of alkenes.

3. Alkynes:

Acidity of acetylene and terminal alkenes, metal ammonia reduction of alkyne, addition of hydrogen halides and water to alkynes, with detailed discussion of mechanism of these reactions, the diels Alder reaction, orbital symmetry and the diels Adler reaction.

4.Nucleophilic Substitution and Addition Reaction:

- (a) Functional group transformation by nucleophilic substitution, the bimolecular (SN), mechanism of nucleophilic substitution, stereochemistry of SN reactions, how SN reactions occur, steric effect in SN reaction, nucleophiles and nucleophilicity, the unimolecular (SN) mechanism of nucleophilic substitution, carbocation stability and the rate of substitution, by the SN mechanism stereochemistry of SN reactions, carbocation real arrangements in SN reactions, solvent effect, substitution and elimination as competing reactions.

- (b) Principles of nucleophilic addition to carbonyl groups: Hydration acetal formation, cyanohydrins formation; reactions with primary and secondary amines, Wittig reaction, stereoselective addition to carbonyl groups mechanism of halogenations, acid and base catalysed chlorination, haloform reaction, aldol condensation, conjugate nucleophilic addition to unsaturated carbonyl compounds.

5. Spectroscopy:

Principles of molecular spectroscopy, electromagnetic radiation, quantized energy states, NMR (H) Spectroscopy, nuclear shielding and chemical shift measurements, chemical shift and molecular structure, interpreting proton NMR spectra, spin-spin splitting in NMR and conformations carbons- ¹³ nuclear magnetic resonance, the sensitivity problem, interpretation of spectra. Infrared spectroscopy, ultraviolet visible (UV-VIS) spectroscopy and mass spectrometry.

Text and Reference Books:

1. R.T. Morrison and R.N. Boyd, Organic Chemistry.
 2. I.L. Finar, Organic Chemistry, Vol. I IV ed.
 3. Advanced Organic Chemistry, Reactions Mechanism and Structure by J. March.
 4. Schaum's Outlines Series Theory and Problems of Organic Chemistry.
 5. Problems and their solution in Organic Chemistry by I.L. Finar, Modern Organic Chemistry by J.D. Roberts and M.C. Caserio.
 6. Organic Chemistry by D.J. Cram and G.S. Hammond.
 7. J.E. Banks, Naming Organic Compounds Programmed Introduction to Organic Chemistry.
 8. E.L. Eliel, Stereochemistry of carbon compounds.
 9. W. Camp, Organic Spectroscopy
 10. F.A. Carey, Organic Chemistry
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PHL-191 OPTICS

Credits: 3-1-0

Interference: Young's experiment, Coherent Source, Phase and Path differences, Theory of interference fringes, Fresnel's biprism, thickness of thin transparent sheet, interference in thin film due to reflected and transmitted light colour of thin film, Newton's rings and their application, Michelson & Fabry-Perot Interferometer, Anti reflection coatings, Holography.

Diffraction: Introduction, Fraunhofer diffraction at a single slit and its discussion, Fraunhofer diffraction at double slit, missing orders in a double slit, Diffraction of N slits and its discussion, Diffraction grating, Missing orders, dispersive power, Rayleigh Criterion for resolving power, resolving power of a diffraction grating.

Polarization: Transverse nature of light, Polarization by reflection and refraction, Brewster's Law, Malus Law, Double refraction, Nicol Prism, Elliptically and circularly polarized light, Quarter-wave and half-wave plates, production and detection of polarized light, Optical activity, specific rotation. Half shade polarimeter.

Reference Books:

1. Text book of Optics : N. Subramanayam, B. Lal and M.N. Avadhamulu.
2. Fundamentals of Optics: Jenkins and White

MTL-161 DIFFERENTIAL CALCULUS**Credits: 3-0-0**

Functions, Domain and Range of a function, Graph of a function, Inverse functions, Exponential and logarithmic functions, Limit of functions, Algebraic computation of limits, Continuity of function at a point.

Differentiation — Derivability and Derivative, Derivatives of standard functions, Formulae on derivative of sum, difference, product and quotient of functions, Chain rule.

Derivative of trigonometric functions, inverse trigonometric functions, hyperbolic functions, exponential and logarithmic functions, Derivative of implicit functions. Derivative of functions expressed in parametric form Logarithmic differentiation.

Derivative of higher order (up to 2nd order). Maxima and minima of a function of a single variable. Introduction to partial differentiation.

Book Recommended:

1. Shanti Narayan: Differential Calculus.

COMMUNICATIVE ENGLISH-I

Credits: 2-0-0

Objectives: To introduce students in a graded manner to the communication skills of Reading and Writing in English. At the end of semester-I, the students should be able to demonstrate adequate competence in comprehending the prescribed text and performing the given writing tasks.

Reading:

a) Developing Habits of Independent and Fast Reading:

Students will be required to read a prescribed prose anthology titled selections from Modern English Prose (Ed. Haladhar Panda published by University Press, Hyderabad). The essays in the anthology will be read by students at home with the help of glossary given in the book. Progressing from one lesson to another, they should learn to read fast. Students are supposed to keep a record of their reading in the form of notes, difficulties, summaries, outlines and reading time for each essay. Class teacher may use this record for award of internal assessment (if any).

b) Developing Comprehension Skills:

Teacher will provide guided comprehension of the prescribe texts in the class and help students in answering the questions given at the end of each lesson. Teacher can construct more questions of factual and inferential nature to enhance the comprehension skills of the students. The teacher shall also guide students to do the vocabulary and grammar exercises given at the end of each lesson.

Writing:

a) Developing Skills in Personal Writing:

Students will be required to learn short personal write ups involving skills of description and narration. The types of composition task may include personal letter writing, telegram writing, notice writing, diary writing etc. Teacher shall instruct the students about the appropriate format and usual conventions followed in such writing. The teacher may also prescribe any composition / writing book if so required.

b) Developing Writing Skills Based on Guided Composition:

The students will be required to write a longish composition on a question from the essays of Selections from Modern English Prose. The composition will require presentation of ideas beyond the prescribed essays. Sample composition topics are given at the end of each lesson.

**Question Paper: The following format is suggested for a 3-hour test
(Appropriate choices may be given where possible)**

1. Short answer comprehension question (at least 5) based on the lesson included in Selection from Modern English Prose
App. Weighting: 30%
2. Questions on grammar and vocabulary (words, phrases, proverbs)
App. Weighting: 20%
3. Two short writing tasks of app. 150 words. One a personal letter involving narration of a personal experience or description of objects, persons, places or events. The second may be a telegram or public notice or a diary entry about a personal or family achievement loss or celebration
App. Weighting: 30%
4. One long composition of about 300 words on one of the topics discussed in Selections from Modern English Prose. Due consideration be given to the organization of details and coherence in writing.
App. Weighting: 20%

Internal Assessment: The teacher may consider the following for award of internal assessment, if any.

1. Evidence of independent reading as given above. Teacher may suggest some special tasks to suit the needs of their students.
 2. Students may be asked to keep diary of their daily or specific routines.
Students may be asked to write a certain number of compositions on selected topics during the semester.
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HGP-121 LAB EXERCISES IN GENETICS

Credits: 0-0-2

Numericals based on Mendelian principles, Linkage and Hardy-Weinberg principle. Human morphogenetic traits, Barr body analysis in buccal smear, Blood grouping for ABO and Rh, Finger-ball dermatoglyphics, Karyotype solid-stained and G-banded metaphases from photographs.

**CYP-191 ORGANIC CHEMISTRY LAB —
CLASSICAL QUALITATIVE ORGANIC ANALYSIS (Practical)**

Credits: 0-0-3

The preliminary examination of physical and chemical characteristics (Physical state, color, odor and ignition tests), elemental analysis (nitrogen, sulphur, chlorine, bromine, iodine), solubility tests including acid-base reactions, classification tests involving functional reactivity other than acid-base test, preparation of derivatives for given pure organic compounds.

The following categories of compounds should be analyzed

- phenols, carboxylic acids
- carbonyl compounds- ketones aldehydes
- carbohydrates
- aromatic amines
- amides, ureas and anilides
- aromatic hydrocarbons and their halo-derivatives.

Suggested Book

1. Practical Organic Chemistry by F.G. Mann and B.C. Saunders.
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PHP 192: Optics Lab.

HGL-151 INTRODUCTORY CELL BIOLOGY

Credits: 3-0-0

Unit-I

Structure and dynamics of cells (prokaryotes and eukaryotes), Structure and function of cell wall, nucleus, DNA and RNA organization in prokaryotes and eukaryotes, Overview of genetic code and central dogma.

Unit-II

Structural organization and function of intracellular organelles — mitochondria, golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plasmids, vacuoles, chloroplasts and cytoskeletons.

Unit-III

Molecular constituents and supramolecular architecture of biological membranes, Model membranes and liposomes, Solute transport across membranes, Ion transduction (Na^+ and K^+ -ATPase), Electrical properties of membrane, Mechanism of sorting and regulation of intracellular transport, Cell surface receptors, Signalling through G-protein-coupled receptors, Signal transduction pathways, Second-messenger systems, Regulation of signalling pathways, Principles of cell communication, Cell adhesion and role of adhesion molecules, Gap junction, Extracellular matrix.

Books Recommended::

1. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, I.D. (2007). Molecular Biology of Cell. Garland Publishing Co., Inc., New York.
2. Berg, J.M. and Tymoczko, J.L. and Stryer, L. (2002). Biochemistry. W.H. Freeman and Co., New York, 5th ed.
3. Blackburn, G.M. and Gail, M.I. (1996). Nucleic Acids in Chemistry and Biology. Oxford University Press.
4. Gupta, P.K. (1999). A Textbook of Cell and Molecular Biology. Rastogi Publications, Meerut.
5. Horton (2001). Principles of Biochemistry. Prentice-Hall Press, New Jersey.
6. Karp, G. (1999). Cell and Molecular Biology, Concepts and Experiments. John Wiley and Sons, New York.
7. Lehninger, A.L., Nelson, D.L. and Cox, M. (1993). Principles of Biochemistry. CBS Publishers and Distributors, New Delhi, 3rd ed.
8. Lodish, H., Berk, A., Zipursky, S.L., Malsudaira, P., Baltimore, D. and Darnell, J. (2000). Molecular Cell Biology. W.H. Freeman and Co., New York.
9. Voet, D. and Voet, J.G. (2004). Biochemistry. John Wiley and Sons, Inc., New York, 3rd ed.
10. Zubey, G.L., Parson, W.W. and Vance, D.E. (1998). Principles of Biochemistry. W.M.C. Brown Publishers, USA.

HGL-152 PRINCIPLES OF MOLECULAR GENETICS

Credits: 3-0-0

Unit-I

An overview of molecules involved in the flow of genetic information, Structure of gene, Gene families, Central dogma of life, Double helical structure of DNA, Different forms of DNA, DNA denaturation and renaturation, Factors affecting DNA stability.

Unit-II

Mechanisms of DNA replication in prokaryotes and eukaryotes, Different types of DNA polymerases in eukaryotes and prokaryotes, Topoisomerases and their role, The Messelson-Stahl experiment, Different types of RNA, their structure and role.

Unit-III

Transcription process, Prokaryotic and eukaryotic RNA polymerases, Transcription factors, Reverse transcription, Genetic code, Post-transcriptional processing of RNA, RNA splicing, Prokaryotic and eukaryotic ribosomes, translation process: initiation, elongation, termination of polypeptide chain, Post-translation modifications of polypeptides.

Books Recommended:

1. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K. and Watson, J.D. (2007). Molecular Biology of the Cell. Garland Press, USA, 3rd ed.
2. Brown, T.A. (2005). Genetics, A Molecular Approach. Bios Scientific Publishers Ltd., Oxford, 3rd ed.
3. Brown, T.A. (2006). Genomes 3. Bios Scientific Publishers Ltd., Oxford, 3rd ed.
4. Brown, T.A. (2010). Gene Cloning and DNA Analysis: An Introduction. Blackwell Publishing Co., Oxford, 6th ed.
5. Hartl, D.L., Jones, E.W. (2005). Genetics: Analysis of Genes and Genomes. Jones and Bartlett Publishers, 6th ed.
6. Korf, B.R. (2007). Human Genetics and Genomics. Blackwell Scientific Publications, USA, 3rd ed.
7. Lewin, B. (2008). Genes-IX. Jones and Barlett Publishers, Inc., USA.
8. Lodish, H., Baltimore, D., Berk, A., Zipursky, S.L., Matsudaira, P. and Daniell, J. (2000). Molecular Cell Biology. W. H. Freeman and Co., San Fransisco.
9. Singer, M. and Berg, P. (1991). Genes and Genomes. Blackwell Scientific Publications, USA.
10. Strachan, T. and Read, A. (2010). Human Molecular Genetics. Garland Publishers, London. 4th ed.
11. Weaver, R.F. (2002). Molecular Biology. McGraw Hill, New Delhi.

CYL-192 INORGANIC CHEMISTRY

Credits: 3-1-0

1. Co-ordinations Chemistry

Introduction, Werner's coordination theory, naming of co-ordinate complexes. Co-ordination numbers 1-12 and their stereo-chemistries.

Factors affecting co-ordination numbers and stereo-chemistry

(a) Configurational Isomers (b) Conformational isomerism. VSPER theory, molecular orbital theory applied to homonuclear diatomic molecules and heteronuclear Diatomic molecules.

2. Bonding in metal complexes

Valence bond theory for co-ordinate complexes, inner and outer orbital complexes, Electro-neutrality and back bonding, limitations of V.B theory.

3. Stability of coordination compounds

Introduction, Stability constant, stepwise stability constant, overall stability constant. Factors affecting the stability of metal ion complexes with general ligands. HSAB principle.

4. Crystal Field theory: Splitting of d-orbitals in octahedral, tetrahedral, cubic and square planar fields of ligands. Calculation of C.F.S.E. in high spin and low spin octahedral and High spin tetrahedral complexes, factors affecting the $10 Dq$ value. Structural effects of crystal field splitting (Jahn-Teller distortion, variation of Ionic radii with increase in atomic number). Thermodynamic effects of C.F. splitting, variation in lattice energies. Hydration energies, Dissociation energies, Formation constants of hexammines. Site selection in spinels, Paramagnetism, diamagnetism, ferro and antiferromagnetism. Microstates and spectroscopic terms, a calculation of spectroscopic terms for $d^1 - d^{10}$ electronic configurations, L.S coupling, Hund's rule for finding the ground state terms. Electronic spectral properties of 1st transition series, Orgel Diagrams for $d^1 - d^{10}$ systems, for weak field octahedral and tetrahedral complexes, limitations of C.F.T

5. Molecular Orbital Theory: Evidence for Covalent character in Bonding, MOEL diagram for octahedral and tetrahedral complexes involving bonding, charge transfer transitions.

6. II Acid Ligands

Definition Carbon monoxide complexes, bonding in linear MCO groups, polynuclear metal carbonyls, vibrational spectra, Reactons, carbonyl hydrides and halides. Metal-metal bonding metal-metal multiple bonding, isolable analogies, Structure of high nuclearity carbonyl clusters, counting of electrons in carbonyl clusters.

7. Alkali Metal and Alkaline Earth Metal Chelators

Macrocyclic ligands, Macrocyclic effect, Crown ethers and podands, Coronands, Cryptands, Structure of 18 crown 6 complex with KNCS, Ion cavity complex, Effect of anion and cation type on complex structure, simultaneous complexation of metal ion and water or of two metal ions, Sandwich formation, Cryptands and their cation complexes, podands with aromatic donors and groups.

Text and Reference Books:

1. J.E. Huheey, Inorganic Chemistry, 3rd Ed.
2. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry.
3. B.E. Douglas and D.H. McDaniel, Concepts and Models of Inorganic chemistry.
4. R. Hilgenfeld and W. Saenger, Topic in Current chemistry Vol-II.

PHL-196 MODERN PHYSICS

Credits: 3-1-0

Dual Nature of Matter and Radiation — De Broglie's hypothesis, electron diffraction experiments of Davission and Germer, Wave group and particle velocities Heisenberg's uncertainty principle, principle of the electron microscope, Diffraction of X-rays from crystals, Planck's quantum hypothesis, Bragg's law of determination of structure of simple crystals.

Radioisotopes and their Application — Radioactive decay laws, Uranium and Carbon dating, introduction to α , β and γ decays, Radioisotopes, their production and separation, mass spectrograph, uses of radioisotopes in medicine, agriculture and geology, Radiation doses and their units, Biological effects of radiation.

Elementary Particles: Uses of ionization chamber, cloud chamber, Scintillation counter and photographic emulsions as detectors, Classification of elementary particles and their properties, conservation laws. Antiparticles, Origin and general characterization of cosmic rays (Primary and Secondary).

Reference Books:

1. Concepts of Modern Physics: A. Beiser.
 2. Essentials of Modern Physics: V. Acota and C.L Grown.
 3. Fundamentals of Modern Physics: B.D. Duggal and C.L. Chhabra.
-

MTL-162 INTEGRAL CALCULUS**Credits: 3-0-0**

Integration as inverse of differentiation. Indefinite integral of standard forms. Integration by parts. Integration by substitution.

Integration using method of partial fractions (of algebraic rational functions).

Definite integral and geometric interpretation of definite integral as an area.

Differential Equations: Definition. Solution of differential equations of first order and first degree (Variables separable, homogeneous equations, linear equations and equations reducible to the linear form). Applications of first order differential equations to biology.

Book Recommended:

1. Shanti Narayan: Integral Calculus.
-

COMMUNICATIVE ENGLISH-II

Credits: 2-0-0

Objectives: To introduce students in a graded manner to the communication skills of Reading and Writing in English. At the end of semester-II, the students should be able to demonstrate adequate competence in comprehending an unseen passage and performing the prescribed communication/ writing tasks.

Prescribed Reading: Vandana R. Singh. The Written Word, Oxford University Press, New Delhi (Selected chapters)

“Orient Longman: Wisdom and Experience”

a) Developing Comprehension Skills:

Students will be required to read sample comprehension passage as given in chapter *critical reading and comprehension* of the prescribed book, teacher will help students in handling text and answering questions given at the end of each passage. Teacher can bring in more texts and construct questions of factual and inferential nature to enhance the comprehension skill of the students.

b) Developing Habits of Additional Reading :

The students will be required to show evidence of additional independent reading. They will maintain a scrapbook consisting of such readings as clippings from newspapers and magazines, short articles, stories etc. The minimum quantum of such additional reading will be decided by the class teacher, who will also test students individually on their additional reading (and appropriately award internal assessment, if required).

Writing:

a) Developing Vocabulary and Using it in the Right Context

Students will be required to pay special attention to build up their vocabulary; They should master the contents of the chapter on vocabulary in the prescribed book. Teacher will help the students learn the correct and appropriate use of the given set of words/phrases/expressions.

b) Developing skills in formal

Students will be required to do write-ups involving skills of making formal complaints, requests, orders etc., reporting, note taking, summarizing and transcoding. The types of composition task may include business and public interest letters, new/feature writing, speeches, minutes, instructions, summary reports etc. Teacher shall instruct the students about the appropriate format and usual conventions followed in such writings, the following chapters in the prescribed book may be consulted for exercise materials on these tasks:

- ❖ Paragraph and Essay Writing
- ❖ Report Writing
- ❖ Letter Writing
- ❖ Note Making and Summerising
- ❖ Transcoding

Question Paper: The Following Format Is Suggested For A 3-Hour Test.

(Appropriate Choices May Be Given Where Possible)

1. One Unseen Passage Of App. 300 Words With At Least Five Questions For Testing Comprehension (At Least Three Of Them May Be Multiple Choice)
App. Weighting 20%
2. Vocabulary And Other Expressions
App. Weighting 20%
3. Two Writing Tasks Pertaining To Formal Letter Writing, Reporting, Note Taking, Summary Writing Etc.
App. Weighting 40%
4. One Task Involving Transcoding From Dialogue To Prose Or Prose To Dialogue
App. Weighting 20%

Internal Assessment: The Teacher May Consider The Following For Award Of Internal Assessment, If Any.

- 1) Evidence Of Independent And Additional Reading As Given Above Teacher May Suggest Some Special Reading List To Suit The Needs Of Their Student.
- 2) Classroom Tests On Vocabulary And Suggested Writing Tasks.
- 3) Project Writing Involving The Communication Skills Referred In Writing Tasks.

HGP-171 LAB TECHNIQUES IN BIOCHEMISTRY AND MOLECULAR BIOLOGY

Credits: 0-0-2

Washing and sterilization of glassware and plasticware, Calculations for preparing stock solutions, Preparation of stock solutions and adjustment of pH, Autoclaving solutions, Preparation of working solutions from stock solutions, Genomic DNA extraction from buccal cells, Agarose gel electrophoresis for DNA quantification.

Qualitative/Quantitative analysis of carbohydrates, lipids and proteins, Paper chromatography, Quantitative analysis of proteins to study the action of salivary amylase on starch, Isolation of casein from milk.

CYP-192 INORGANIC CHEMISTRY LAB — QUALITATIVE ANALYSIS (Practical)

Credits: 0-0-3

Identification of cations and anions in a mixture which may contain four ions (2 cations and 2 anions)

Perform systematic group analyses to identify the cations in the mixture. Any cation from Group I, Group II (Group IIA and IIB) Group IV, Group V and Group VI may be present.

Book: Vogel's book on Inorganic Qualitative Analysis.

PHP-197 (Electricity & Magnetism Lab)

HGL-201 FUNDAMENTALS OF HUMAN ANATOMY**Credits: 3-0-0****Unit-I**

Fields of anatomy, Skeletal system — Classification of bones, Ossification and growth of bone, Histology of bone, Fracture and repair, Types of joints.

Muscular system — Classification of muscles, Structure of smooth, cardiac, skeletal muscle, neuromuscular junction.

Digestive system — Brief description of gross anatomy and histology of constituent parts.

Unit-II

Circulatory system — Blood composition, Structure of heart and blood vessels, Types of blood vessels, Brief description of arterial, venous system and lymphatic system.

Respiratory system — Brief description of anatomy of constituent parts, olfactory receptors.

Unit-III

Nervous system — Gross anatomy of brain and spinal cord, Ascending and descending tracts of neurons, Autonomic nervous system, Special senses — Eye, ear, Integumentary system — Skin, hair, nail, touch receptors.

Endocrine system — Brief anatomy of endocrine glands, Urinary system — Brief anatomical description of constituent parts, Reproductive system — Brief anatomical description of male and female reproductive organs.

Books Recommended:

1. Drake, R., Vogl, W. and Mitchell, A. (2004). Gray's Anatomy for Students. Churchill Livingstone, USA.
2. Marieb, E.N. (2004). Human Anatomy and Physiology. Dorling Kindersley (India) Pvt. Ltd., 6th ed.
4. Ross and Willson (2000). Anatomy and Physiology. ELBS Publication.
5. Standring, S. (2008). Gray's Anatomy. Churchill Livingstone, USA. 40th ed.
6. Tortora, G.J. and Grabowski, S.R. (2002). Principles of Anatomy and Physiology. Harper Collins College Publishers.
7. Tortora, G.J. and Henderson, S.R. (2009). Principles of Anatomy and Physiology. Harper Collins College Publishers.

HGL-202 CONCEPTS OF DNA TECHNOLOGY

Credits: 3-0-0

Unit-I

Types and classification of mutagens, Types of mutations, Gene, DNA and amino acid variants nomenclature, Enzymes used in DNA technology — Restriction enzymes, Polymerases, Ligases, Kinases and Phosphatases.

Unit-II

DNA repair mechanisms — Direct repair, Mismatch repair (MMR), Excision repair (Base excision repair and nucleotide excision repair), Recombination repair, The SOS repair system.

Unit-III

Overview of primers, nucleic acid probes and vectors, Polymerase chain reaction (PCR), Types and applications of PCR, Different techniques of mutation detection — Single-strand conformation polymorphism (SSCP), Amplification refractory mutation system (ARMS), Restriction fragment length polymorphism (RFLP) and DNA sequencing.

Books Recommended:

1. Brown, T.A. (2006). Genomics 3. Bios Scientific Publishers Ltd., Oxford, 3rd ed.
2. Brown, T.A. (2010). Gene Cloning and DNA Analysis: An Introduction. Blackwell Publishing Co., Oxford, 6th ed.
3. Freifelder, D.C. (2008). Molecular Biology. Narosa Publishing House, New Delhi, 2nd ed.
4. Hartl, D.L. and Jones, E.W. (2011). Genetics: Analysis of Genes and Genomes. Jones and Barlett Publishers, USA, 7th ed.
5. Lewin, B. (2008). Genes-IX. Jones and Barlett Publishers, Inc., USA.
6. Pasternak, J.J. (2005). An introduction to Human Molecular Genetics, Mechanisms of Inherited Diseases. John Wiley and Sons, Inc., New Jersey.
7. Pierce, B.A. (2011) Genetics: A Conceptual Approach. W.H. Freeman and Company, New York, 4th ed.
8. Sambrook, J., Fritsch, E.F. and Maniatis, T. (2001). Molecular Cloning: A Laboratory Manual. Cold Spring Harbor, New York, Vol. 1,2&3.
9. Strachan, T. and Read, A. (2010). Human Molecular Genetics. Garland Publishers, London. 4th ed.
10. Wilson, K. and Walker, J. (2000). Practical Biochemistry, Principles and Techniques. Cambridge University Press, 5th ed.

HGL-203 HUMAN EVOLUTION AND PRIMATOLOGY

Credits: 3-0-0

Unit-I

Theories of evolution, Classification and significant characteristics of primates, Primate as a mammalian heritage, Reproduction, Offspring care and social structure of primates, Physical characteristics, Distribution and social structure of gibbons, orangutans, gorillas and chimpanzees.

Unit-II

Overview of human evolution, Primitive hominids and australopithecine stages, Evolutionary trends and relationship with family trees, Distributions, Physical characteristics, Brain size and cultural behaviour of pithecanthropine stage, neanderthal transition stage, neanderthal stage and modern human.

Unit-III

Characteristics of modern human (*Homo sapiens*), Current models and debates such as multi-regional model, African model and out of Africa model, Fossil evidence, Genetic evidence such as DNA polymorphism and chromosome evolution.

Books Recommended:

1. Balding, D.J., Bishop, M. and Cannings (Eds.) (2007). Handbook of Statistical Genetics. John Wiley and Sons Ltd., England, Vol. 1&2, 3rd ed.
2. Hartl, D.L. and Clark, A.G. (2007). Principles of Population Genetics. Sinaur Associates, Inc., Massachusetts, 4th ed.
3. Hedrick, P.W. (2011). Genetics of Population. Jones and Bartlett Publishers, Massachusetts, 4th ed.
4. Jobling, M.A., Hurles, M. and Tyler-Smith, C. (2004). Human Evolutionary Genetics: Origin, Peoples and Diseases. Taylor and Francis Group, New York.
5. Relethford, J.H. (2007). The Human Species: An Introduction to Biological Anthropology. McGraw-Hill, USA.

ESL 220 Environmental Studies (Compulsory Paper) **(Under Credit Based Continuous Evaluation Grading System)**

Credit 3-0-0

- 1. The Multidisciplinary Nature of Environmental Studies:** Definition, scope & its importance, Need for public awareness.
- 2. Natural Resources:** Natural resources and associated problems.
 - a) Forest Resources:** Use of over exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
 - b) Water Resources:** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
 - c) Mineral Resources:** Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
 - d) Food Resources:** World food problems, change caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problem, salinity, case studies.
 - e) Energy Resources:** Growing of energy needs, renewable and non-renewable energy resources, use of alternate energy sources, case studies.
 - f) Land Resources:** Land as a resource, land degradation, soil erosion and desertification.
 - g) Role of an individual in conservation of natural resources, Equitable use of resources for sustainable lifestyles.**
- 3. Ecosystem:**

Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids.

Introduction, types, characteristic features, structure and function of the following ecosystems:

 - a. Forest ecosystem
 - b. Grassland ecosystem
 - c. Desert ecosystem
 - d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).
- 4. Biodiversity and its Conservation:**

Definition: Genetic, species and ecosystem diversity, Biogeographical classification of India.

Value of Biodiversity: Consumptive use; productive use, social, ethical, aesthetic and option values.

Biodiversity of global, National and local levels, India as mega-diversity nation "Hot-spots of biodiversity.

Threats to Biodiversity: Habitat loss, poaching of wild life, man wildlife conflicts

Endangered and endemic species of India.

Conservation of Biodiversity: In situ and Ex-situ conservation of biodiversity.

5. Environmental Pollution:

Definition, Causes, effects and control measures of:

- a) Air Pollution
- b) Water Pollution
- c) Soil Pollution
- d) Marine Pollution
- e) Noise Pollution
- f) Thermal Pollution
- g) Nuclear Hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution.

Pollution case studies Disaster Management: Floods, Earthquake, Cyclone and Landslides

6. Social Issues and Environment:

- * From unsustainable to sustainable development
- * Urban problems related to energy
- * Water conservation, rain water harvesting, watershed management
- * Resettlement and rehabilitation of people; its problems and concerns. Case studies
- * Environmental ethics: Issues and possible solutions.
- * Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
- * Wasteland reclamation
- * Consumerism and waste products
- * Environmental Protection Act
- * Air (prevention and Control of Pollution) Act
- * Water (prevention and Control of Pollution) Act
- * Wildlife Protection Act
- * Forest Conservation Act
- * Issues involved in enforcement of environmental legislation
- * Public awareness

7. Human Population and the Environment

- * Population growth, variation among nations
- * Population explosion-Family welfare programme
- * Environment and human health
- * Human rights
- * Value education
- * HIV / AIDS
- * Women and child welfare
- * Role of information technology in environment :and human health
- * Case studies
- * **Road Safety Rules & Regulations:** Use of Safety Devices while Driving, Do's and Don'ts while Driving, Role of Citizens or Public Participation, Responsibilities of Public under Motor Vehicle Act, 1988, General Traffic Signs
- * **Accident & First Aid:** First Aid to Road Accident Victims, Calling Patrolling Police & Ambulance

B.Sc. (HS) Human Genetics (Semester-III)
(Under Credit Based Continuous Evaluation Grading System)

- 8. Field Work:** Visit to a local area to document environmental assets—river / forest / grassland / hill / mountain. Visit to a local polluted site—Urban / Rural / Industrial / Agricultural. Study of common plants, insects, birds. Study of simple ecosystems—pond, river, hill slopes, etc. (Field work equal to 5 lecture hours)

References:

1. Agarwal, K. C. 2001. Environmental Biology, Nidhi Publications Ltd. Bikaner.
2. Bharucha, E. 2005. Textbook of Environmental Studies, Universities Press, Hyderabad.
3. Bharucha, E. 2004. The Biodiversity of India, Mapin Publishing Pvt. Ltd. Ahmedabad.
4. Brunner, R. C. 1989. Hazardous Waste Incineration, McGraw Hill Inc. New York.
5. Clark, R. S. 2000. Marine Pollution, Clanderson Press Oxford.
6. Cunningham, W. P., Cooper, T. H., Gorhani, E. & Hepworth, M. T. 2001. Environmental Encyclopedia, Jaico Publications House, Mumbai.
7. De, A. K. 1989. Environmental Chemistry, Wiley Eastern Ltd.
8. Down to Earth, Centre for Science and Environment, New Delhi.
9. Hawkins, R. E. 2000. Encyclopedia of Indian Natural History, Bombay Natural History Society.
10. Heywood, V. H & Waston, R. T. 1995. Global Biodiversity Assessment, Cambridge House, Delhi.
11. Jadhav, H. & Bhosale, V. M. 1995. Environmental Protection and Laws. Himalaya Pub.
12. Joseph, K. and Nagendran, R. 2004. Essentials of Environmental Studies, Pearson Education (Singapore) Pte. Ltd., Delhi.
13. Kaushik, A. & Kaushik, C. P. 2004. Perspective in Environmental Studies, New Age International (P) Ltd, New Delhi.
14. Miller, T. G. Jr. 2000. Environmental Science, Wadsworth Publishing Co.
15. Odum, E. P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA.
16. Rajagopalan, R. 2005. Environmental Studies from Crisis to Cure. Oxford University Press, New Delhi.
17. Sharma, B. K. 2001. Environmental Chemistry. Geol Publishing House, Meerut.
18. Sharma, J. P. 2004. Comprehensive Environmental Studies, Laxmi Publications (P) Ltd, New Delhi.
19. Sharma, P. D. 2005. Ecology and Environment, Rastogi Publications, Meerut.
20. Subramanian, V. 2002. A Text Book in Environmental Sciences, Narosa Publishing House, New Delhi.
21. Survey of the Environment. 2005. The Hindu.
22. Tiwari, S. C. 2003. Concepts of Modern Ecology, Bishen Singh Mahendra Pal Singh, Dehra Dun.
23. Townsend, C., Harper, J. and Michael, B. 2001. Essentials of Ecology, Blackwell Science.
24. Booklet on Safe Driving. Sukhmani Society (Suvidha Centre), District Court Complex, Amritsar

PBL103: ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ - I

ਪਾਠ-ਕ੍ਰਮ ਅਤੇ ਪਾਠ-ਪੁਸਤਕਾਂ

Credit: 2-0-0

- (I) 1. ਆਤਮ ਅਨਾਤਮ (ਸੰਪ. ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ ਅਤੇ ਡਾ. ਸੁਹਿੰਦਰਬੀਰ ਸਿੰਘ, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ) ਵਿੱਚੋਂ ਹੇਠ ਲਿਖੇ ਕਹਾਣੀਕਾਰ

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| (ੳ) ਗੁਰਮੁਖ ਸਿੰਘ ਮੁਸਾਫਿਰ | : | ਗਟਾਰ |
| (ਅ) ਸੁਜਾਨ ਸਿੰਘ | : | ਪਠਾਣ ਦੀ ਧੀ |
| (ੲ) ਕਰਤਾਰ ਸਿੰਘ ਦੁਗਲ | : | ਉੱਚੀ ਅੱਡੀ ਵਾਲੀ ਗੁਰਗਾਬੀ |
- (ਕਹਾਣੀ-ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਹਾਣੀ-ਕਲਾ, ਕਹਾਣੀਕਾਰ)

2. ਗੁਰਮੁਖੀ ਔਰਥੋਗਰਾਫੀ ਦੀ ਜੁਗਤ, (ਪੈਂਤੀ; ਮੁਹਾਰਨੀ; ਬਿੰਦੀ, ਟਿੱਪੀ ਤੇ ਅੱਧਕ); ਵਿਰਾਮ ਚਿੰਨ੍ਹ, ਸ਼ਬਦ ਜੋੜ (ਸ਼ੁਧ-ਅਸ਼ੁਧ)

- (II) 1. ਆਤਮ ਅਨਾਤਮ (ਸੰਪ. ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ ਅਤੇ ਡਾ. ਸੁਹਿੰਦਰਬੀਰ ਸਿੰਘ, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ) ਵਿੱਚੋਂ ਹੇਠ ਲਿਖੇ ਕਹਾਣੀਕਾਰ

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| (ੳ) ਸੰਤੋਖ ਸਿੰਘ ਧੀਰ | : | ਸਾਂਝੀ ਕੰਧ |
| (ਅ) ਕੁਲਵੰਤ ਸਿੰਘ ਵਿਰਕ | : | ਉਜਾੜ |
| (ੲ) ਮਹਿੰਦਰ ਸਿੰਘ ਸਰਨਾ | : | ਜਥੇਦਾਰ ਮੁਕੰਦ ਸਿੰਘ |
- (ਕਹਾਣੀ-ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਹਾਣੀ-ਕਲਾ, ਕਹਾਣੀਕਾਰ)

2. ਲੇਖ ਰਚਨਾ (ਜੀਵਨੀ-ਪਰਕ, ਸਮਾਜਕ ਅਤੇ ਚਲੰਤ ਵਿਸ਼ਿਆਂ ਉੱਤੇ):
10 ਲੇਖ ਲਿਖਵਾਉਣੇ (ਕਲਾਸ ਵਿਚ ਅਤੇ ਘਰ ਲਈ ਅਭਿਆਸ)

- (III) 1. ਆਤਮ ਅਨਾਤਮ (ਸੰਪ. ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ ਅਤੇ ਡਾ. ਸੁਹਿੰਦਰਬੀਰ ਸਿੰਘ, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ) ਵਿੱਚੋਂ ਹੇਠ ਲਿਖੇ ਕਹਾਣੀਕਾਰ

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| (ੳ) ਪ੍ਰੇਮ ਪ੍ਰਕਾਸ਼ | : | ਮਾੜਾ ਬੰਦਾ |
| (ਅ) ਗੁਲਜ਼ਾਰ ਸਿੰਘ ਸੰਧੂ | : | ਕੁਲੱਛਣੇ |
| (ੲ) ਮੋਹਨ ਭੰਡਾਰੀ | : | ਘੋਟਣਾ |
| (ਸ) ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ | : | ਦਲਦਲ |
- (ਕਹਾਣੀ-ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਹਾਣੀ-ਕਲਾ, ਕਹਾਣੀਕਾਰ)

2. ਪੈਰਾ ਪੜ੍ਹ ਕੇ ਪੁਸ਼ਨਾਂ ਦੇ ਉੱਤਰ ਦੇਣਾ
(ਆਤਮ ਅਨਾਤਮ ਪੁਸਤਕ ਦੇ ਕਹਾਣੀ ਭਾਗ ਵਿੱਚੋਂ 15 ਪੈਰਿਆਂ ਦੇ ਅਭਿਆਸ ਕਰਵਾਉਣੇ)

HISTORY & CULTURE OF THE PUNJAB (1450-1716)
(Special paper in lieu of Punjabi Compulsory)
HSL: 101

Credits: 2-0-0

Instructions for the Paper Setters/Examiners:

**Examination Minor–I shall cover Theme No. 1-3, Minor–II shall cover Theme No. 4-6.
The Major shall cover the entire syllabus.**

1. Land and the People
2. Bhakti Movement
3. Life and Teachings of Guru Nanak Dev.
4. Contribution of Guru Angad Dev, Guru Amar Das and Guru Ram Das.
5. Guru Arjun Dev.
6. Guru Hargobind
7. Martyrdom of Guru Tegh Bahadur
8. Guru Gobind Singh and the Khalsa
9. Banda Singh Bahadur: Conquests and Execution.

Suggested Readings:

1. Kirpal Singh (ed.): *History and Culture of the Punjab*, Part-II, Punjabi University, Patiala, 1990.
 2. Fauja Singh (ed.): *History of Punjab*, Vol. III, Punjabi University, Patiala, 1987.
 3. J.S. Grewal: *The Sikhs of the Punjab*, CUP, Cambridge, 1991.
 4. Sukhwant Singh. *Agriculture Growth under Colonial Constraints: The Punjab 1849-1947*, Manpreet Publication, Delhi, 2000.
 5. Khushwant Singh, *A History of the Sikhs*, Vol. I, OUP, New Delhi, 1990.
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HGP-221 FUNDAMENTALS OF HUMAN ANATOMY PRACTICAL

Credits: 0-0-1.5

Anatomical positions — Superior, Inferior, Anterior, Medial, Posterior, Lateral, Proximal, Distal, External, Internal, Parietal, Visceral, Cavities and planes of human body. Classification of bones, Skull – different views, Vertebrae, Sternum, Scapula, Bones of upper and lower limbs, Innominate, Clavicle, Sex differentiation in skull, innominate, sacrum.

HGP-222 DNA TECHNOLOGY PRACTICAL

Credits: 0-0-2

Preparation of stock solutions, Preparation of working solutions from stock solutions, Extraction of genomic DNA from human blood by inorganic method, Quality and quantity checking of DNA by agarose gel electrophoresis, Uses of biological databases such as PUBMED, MEDLINE, OMIM, GDB, PDB, HGMD.

HGP-223 HUMAN EVOLUTION AND PRIMATOLOGY PRACTICAL

Credits: 0-0-1.5

To study the geological time scale showing different geological conditions, animals and plant lives, table of history of life, calendar of earth's history, To study transparencies of dating methods, different human fossil sites, process of fossilization and nature of fossil record, To study skull models of ancestors of *Homo sapiens*, pongid-I, pongid-II, proaimian primates, To study locomotion in living primates, evolution of primate locomotions, view of hand and feet of selected primate species, To study the hypothetical ancestral karyotype of primates, comparison of chromosomes of human and chimpanzee, comparison of gorilla with modern man and australopithecus, comparison of brain of primate and modern man, primate dentition.

HGL-251 FUNDAMENTALS OF HUMAN PHYSIOLOGY**Credits: 3-0-0****Unit-I**

Physiology of muscle contraction, Physiology of digestion and absorption, Functions of blood and lymphatic system, Blood clotting.

Unit-II

Cardiac cycle, Heart and circulation, Blood pressure, Role of hemoglobin in regulation of respiration, Physiology of respiration, Physiology of excretion and urine formation, Regulation of body fluids by kidneys.

Unit-III

Action potential, Transmission at synapse, Neurotransmitters, Functions of brain, Autonomic nervous system, Reflex action, Special senses – Hearing, vision, taste, smell, pain, touch, Function of endocrine glands, Physiology and hormonal control of reproduction.

Books Recommended:

1. Guyton, A.C. and Hall, J.E. (2011). Textbook of Medical Physiology. Elsevier Publications, New York.
2. Ross and Willson (2009) Anatomy and Physiology. ELBS publication.
3. Tortora, G.J. and Grabowski, S.R. (2009). Principles of Anatomy and Physiology. Harper Collins College Publishers.

HGL-252 HUMAN BIOCHEMICAL GENETICS**Credits: 3-0-0****Unit-I**

Gene concept — one-gene one-enzyme, one-gene one-polypeptide, Effects of single amino acid substitutions — sickle cell disease, Hereditary methoglobinemias, Unstable haemoglobins, Haemoglobin, Haemoglobin variants, Structures of variant haemoglobins, Genetic polymorphism — Balanced and transient, ABO, MN and Rh blood group systems, Molecular structure of ABH antigens and their biosynthesis.

Unit-II

Multilocus enzymes, Effects of unequal crossing-over, deletions, chain elongations, duplications and other rearrangements on protein structure, Haptoglobin variants, Quantitative and qualitative variation of enzymes.

Unit-III

Inborn errors of metabolism: Albinism, Phenylketonuria, Alkaptonuria, Tay-Sachs disease, Galactosemia, Porphyria, Lesch-Nyhan syndrome, Congenital adrenal hyperplasia and Cystinuria.

Books Recommended:

1. Beaudet, A.L. (1990). Introduction to Human Biochemical and Molecular Genetics. McGraw-Hill, New York.
2. Delves, P.J., Martin, S.J., Burton, D.R. and Roit, I.M. (2001). Essential Immunology. Blackwell Scientific Publications, Oxford.
3. Fernandes, J., Sandubray, J.M. and Bergne, G.V. (Eds.) (2006). Inborn Metabolic Diseases, Diagnosis and Treatment. Springer-Verlag, New York.
4. Harris, H. (1980). The Principles of Human Biochemical Genetics. North-Holland/Elsevier, Boston.
5. Lodish, H., Berk, A., Kaiser, C.A., Krieger, M. and Scott, M.P. (2007). Molecular Cell Biology. W.H. Freeman and Co., New York.
6. Nelson, D.L. and Cox, M.M. (2008). Lehninger's Principles of Biochemistry. W.H. Freeman and Co., New York.
7. Porth, C. (2006). Essentials of Pathophysiology. Wolters Kluwer Health, New York.
8. Tamarin, R.H. (2002). Principles of Genetics. Tata McGraw Hill, USA, 7th ed.

HGL-253 HUMAN ECOLOGY AND DEMOGRAPHY**Credits: 2-0-0****Unit-I**

Introduction to human ecology, Human adaptation to ultraviolet radiation, cold and heat stress, body size and shape, Cultural adaptation for extreme climate, High-altitude adaptation, Social structure, Stratification and problems of Indian tribal people.

Unit-II

Demographic measures of fertility, mortality and migration, Components of population growth, Age and sex structure of populations, World fertility and replacement levels, Global family planning, Demographic transition.

Unit-III

Geographical distributions of simple genetic diseases, Evolution of human diseases, Epidemiologic transition, Human genetic disease heritage, Basic approaches to identifying disease susceptibility genes.

Books Recommended:

1. Hedric, P.W. (2011). Genetics of Population. Jones and Bartlott Publishers, Massachusetts, 4th ed.
2. Jobling M.A., Hurles, M.E. and Tyler-Smith, C. (2004). Human Evolutionary Genetics: Origin, People and Diseases. Taylor and Francis, New York.
3. Kormondy, E.J. (2002). Concept of Ecology. Prentice-Hall of India, New Delhi.
4. Relethford, J.H. (2007). The Human Species: An Introduction to Biological Anthropology. McGraw Hill, USA.

CYL-291: PHYSICAL CHEMISTRY

Credits: 3-1-0

1. Chemical Thermodynamics

System and surroundings properties and variables of a system, laws of thermodynamics, Enthalpy of a system, heat capacity, Isothermal & adiabatic process in ideal gases, Joule-Thomson effect, Carnot cycle, thermodynamic efficiency, Thermo-Chemistry : heat of reaction at constant volume and pressure thermochemical equations, calculations of E from H & vice versa, Hess's law of heat summation, heat of formation, heats of combustion, heat of solution, heat of neutralization of acids and bases, heat of formations of ions, heat of reaction from bond enthalpies, dependence of H & E for a reaction (Kirchoff's equation).

II and III law of thermodynamics : Entropy, dependence of entropy on variables of a system, Entropy change in ideal gases, entropy of mixing for ideal gases, entropy change in physical transformations, Entropy change in chemical reactions, absolute Entropies, residual entropy, thermodynamics of III Law.

2. Spontaneity and Equilibrium

General conditions for Equilibrium and Spontaneity under constraints. Helmholtz free energy (A) for reactions. Gibbs free energy.

3. Chemical Equilibrium

Chemical potential, Gibbs free energy and entropy of mixing of ideal gases. The Equilibrium constants K_p and K_c of real gases. Temperature dependence of Equilibrium constant. The Lechatelier principle.

4. Phase Rule

Gibbs Phase rule, derivation of phase rule, one component system, the water system, the sulphur system, two components system-simple eutectic diagram, formation of compound with congruent M.pt.

5. Chemical Kinetics

Measurement of reaction rate, order, molecularity of reaction, first order reactions, second order reactions, third order reactions, Methods of determination of order, effect of temperature, activation energy, catalysis, Homogeneous catalysis in gases, homogeneous catalysis in solutions.

6. Electro Chemistry

Conductance and Ionic Equilibrium: Faraday's law of electrolysis, transference numbers determination of transference numbers, electrolytic conductance, variation of conductance with concentration, equivalent conductance at infinite dilution, intrinsic attraction theory of conductance. Absolute velocities of ions, degree of ionization and conductance activity & activity coefficients of strong electrolytes, determination of activity coefficients, Debye-Huckel Theory of activity coefficients, Ionization constants of weak acids, and weak bases. Ionic product of water, pH & pOH Buffer solution, hydrolysis, calculation of hydrolytic constants, solubility product, salt effect and solubility.

7. Electrochemical Cells

Reversible and Irreversible cells, standard cells, cell reaction & EMP. Single electrode potential and its calculation, thermodynamic and EMF, standard potential and equilibrium constants, Classification of electrodes, chemical and concentration cells, Junction potential, solubility product and EMF.

Books Recommended:

1. Physical Chemistry by Samuel H, Carl P. Putton Americ Inc. Co.
 2. Physical Chemistry by Glasstone, The Macmillian Press Ltd.
 3. Kinetic and Mechanism by Frost A and Pearson R.G, Wiley Eastern Pvt. Ltd.
 4. Chemical Kinetic by K.J. Laidler, Harper and Row.
 5. Physical Chemistry by Glberg W. Castellian Addison- Wesley publishing Comp.
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PBL-104

ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ-II

ਪਾਠ-ਕ੍ਰਮ ਅਤੇ ਪਾਠ ਪੁਸਤਕਾਂ

Credits: 2-0-0

- (I) 1. ਆਤਮ ਅਨਾਤਮ (ਸੰਪ. ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ ਅਤੇ ਡਾ. ਸੁਹਿੰਦਰਬੀਰ ਸਿੰਘ, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ) ਵਿੱਚੋਂ ਹੇਠਾਂ ਲਿਖੇ ਕਵੀ
- (ੳ) ਭਾਈ ਵੀਰ ਸਿੰਘ
(ਅ) ਪ੍ਰੋ: ਪੂਰਨ ਸਿੰਘ
(ੲ) ਪ੍ਰੋ: ਮੋਹਨ ਸਿੰਘ
(ਕਵਿਤਾ-ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਾਵਿ-ਕਲਾ, ਕਵੀ)
2. ਪੰਜਾਬੀ ਸ਼ਬਦ ਬਣਤਰ : ਧਾਤੂ/ਮੂਲ, ਵਧੇਤਰ (ਅਗੇਤਰ, ਪਿਛੇਤਰ, ਵਿਉਂਤਪਤ ਅਤੇ ਰੁਪਾਂਤਰੀ), ਸਮਾਸ ।
- (II) 1. ਆਤਮ ਅਨਾਤਮ (ਸੰਪ. ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ ਅਤੇ ਡਾ. ਸੁਹਿੰਦਰਬੀਰ ਸਿੰਘ, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ) ਵਿੱਚੋਂ ਹੇਠ ਲਿਖੇ ਕਵੀ
- (ੳ) ਅੰਮ੍ਰਿਤਾ ਪ੍ਰੀਤਮ
(ਅ) ਡਾ. ਹਰਭਜਨ ਸਿੰਘ
(ੲ) ਸ਼ਿਵ ਕੁਮਾਰ ਬਟਾਲਵੀ
(ਕਵਿਤਾ-ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਾਵਿ-ਕਲਾ, ਕਵੀ)
2. ਪੈਰ੍ਹਾ ਰਚਨਾ : ਕਲੱਸ ਵਿੱਚ 10 ਵਿਸ਼ਿਆਂ (ਸਭਿਆਚਾਰਕ, ਧਾਰਮਿਕ ਅਤੇ ਰਾਜਨੀਤਕ) ਤੇ ਪੈਰ੍ਹਾ ਰਚਨਾ ਦੇ ਅਭਿਆਸ ਕਰਵਾਉਣੇ ।
- (III) 1. ਆਤਮ ਅਨਾਤਮ (ਸੰਪ. ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ ਅਤੇ ਡਾ. ਸੁਹਿੰਦਰਬੀਰ ਸਿੰਘ, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ) ਵਿੱਚੋਂ ਹੇਠ ਲਿਖੇ ਕਵੀ
- (ੳ) ਡਾ. ਜਸਵੰਤ ਸਿੰਘ ਨੇਕੀ
(ਅ) ਡਾ. ਜਗਤਾਰ
(ੲ) ਡਾ. ਸੁਰਜੀਤ ਪਾਤਰ
(ਸ) ਪਾਸ਼
(ਕਵਿਤਾ-ਸਾਰ, ਵਿਸ਼ਾ-ਵਸਤੂ, ਕਾਵਿ-ਕਲਾ, ਕਵੀ)
2. ਮੁਹਾਵਰੇ ਤੇ ਅਖਾਣ (ਅਖਾਣ ਤੇ ਮੁਹਾਵਰਾ ਕੋਸ਼ ਵਿੱਚ) 200 ਮੁਹਾਵਰਿਆਂ ਅਤੇ 100 ਅਖਾਣਾਂ ਨੂੰ ਵਾਕਾਂ ਵਿੱਚ ਵਰਤਣ ਦੇ ਅਭਿਆਸ ਕਰਵਾਉਣੇ (ਕਲਾਸ ਵਿੱਚ ਤੇ ਘਰ ਲਈ) ।

HISTORY & CULTURE OF THE PUNJAB (1717-1947)
(Special Paper in lieu of Punjabi Compulsory)
HSL: 102

Credits: 2-0-0

Instructions for the Paper Setters/Examiners:

Examination Minor–I shall cover Theme no. 1-3, Minor–II shall cover Theme no. 4-6.

The Major shall cover the entire syllabus.

1. Sikh Struggle for Sovereignty
2. Ranjit Singh: Conquests, Administration and the Anglo-Sikh Relations
3. Anglo-Sikh Wars and the Annexation
4. The Punjab under the British: New Administration, Education and Social Change
5. Economic Changes: Agricultural
6. Socio-Religious Reform Movements
7. Role of Punjab in the Freedom Struggle
8. Fairs and Festivals
9. Folk Dances and Legends

Suggested Readings:

1. Kirpal Singh (ed.): *History and Culture of the Punjab*, Part-II, Punjabi University, Patiala, 1990.
 2. Fauja Singh (ed.): *History of Punjab*, Vol. III, Punjabi University, Patiala, 1987.
 3. J.S. Grewal: *The Sikhs of the Punjab*, CUP, Cambridge, 1991.
 4. Sukhwant Singh. *Agricultural Growth under Colonial Constraints: The Punjab 1849-1947*, Manpreet Publication, Delhi, 2000.
 5. Khushwant Singh, *A History of the Sikhs*, Vol. I, OUP, New Delhi, 1990.
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HGP-271 LAB EXERCISES IN HUMAN PHYSIOLOGY

Credits: 0-0-1.5

Movements at joints, Bleeding and clotting time, Haemoglobin concentration, RBC and WBC counts, Osmotic fragility of RBC, ESR estimation, Blood pressure and pulse rate estimation, Spirometry.

HGP-272 HUMAN BIOCHEMICAL GENETICS PRACTICAL

Credits: 0-0-1.5

Blood grouping from erythrocytes, blood stains, saliva stains and urine stains by absorption-inhibition and absorption-elution method, Analysis of variant haptoglobins and haemoglobins, Estimation of serum cholesterol, triacylglycerides, HDL, LDL, blood sugar, SGOT and SGPT using semi-automated blood analyzer, Analysis of PKU and alkaptonuria, Thin layer chromatography.

CYP-292 PHYSICAL CHEMISTRY LAB

Credits: 0-0-3

1. Determination solubility of benzoic acid by titration method.
2. To determine the molecular weight of a compound by Rast's micro method
3. Determination of coefficient of viscosity of a given liquid by viscometer.
4. To find the mol. wt. of high polymer by using viscosity measurements.
5. Determination of surface tension of a given liquid by drop number method by stalagmometer.
6. To determine the unknown composition of a mixture of two liquids by surface tension measurements.
7. To determine the critical micelle concentration of a soap (sodium laurate) by surface tension measurements.
8. Determination of molecular weight of a given liquid by steam distillation.
9. To determine refractive index of a liquid by Abbe's refractometer and hence the specific and molar refraction.
10. To determine the unknown composition of a given mixture of two liquids by refractive index measurements.
11. Determine molar refractivity of methyl acetate, ethyl acetate-n-hexane and carbon tetra chemical evaluate the refraction equivalent of carbon, hydrogen .
12. To study the adsorption of acetic acid from its aqueous solution by activated charcoal

Books Recommended:

1. Findlay's Practical Physical Chemistry.
 2. Advanced Practical Physical Chemistry by J.B. Jadav
 3. Quantitative Organic Analysis by Vogel.
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HGL-281 INTRODUCTORY CULTURAL ANTHROPOLOGY

Credits: 3-0-0

Unit-I

Overview of human biological and cultural evolution, Concept of race, racial variations, Concept and features of culture, Social structure, tool-making, language in humans.

Unit-II

Marriage, Patterns of marital residence, family, kinship, rules of descent, classification of kinship, Social groups — age-set, bonds, tribes, kinship system in North India.

Unit-III

Endogamous groups, Origin of caste, Racial elements in India, Genetic and morphological diversity among people of India.

Books Recommended:

1. Bhasin, M.K. and Walter, H. (2001). Genetics of Castes and Tribes of India. Kamla-Raj Publishers, Delhi.
2. Ember, C.R. and Ember, M. (1985). Anthropology. Prentice Hall, USA.
3. Kumar, D. (2004). Genetic Disorders of the Indian Subcontinent. Kluwer Academic Publishers.
4. Patricia, U. (1994). Family, Kinship and Marriage in India. Oxford University Press, Delhi.
5. Relethford, J.H. (2007). The Human Species: An Introduction to Biological Anthropology. McGraw Hill, USA.

HGL-282 HUMAN EMBRYOLOGY**Credits: 3-0-0****Unit-I**

Fertilization, Cleavage, Blastocyst formation, Bilaminar disc, Gastrulation, Three-germ layer, Notochord formation, Establishing body axes, fate map during gastrulation, Derivative of three-germ layers, Placentation.

Unit-II

Overview of development of skeletal system, Muscular system, Body cavities, Cardiovascular system, Head and neck, Integumentary system.

Unit-III

Overview of development of cardiovascular system, Respiratory system, Digestive system, Urogenital system, Central nervous system, Ear and eye.

Books Recommended:

1. Gilbert, S.F. (2011). Developmental Biology. Sinauer Associates, Inc., Sunderland, MA.
2. Sadler, T.W. (2010). Langman's Medical Embryology. Williams and Wilkins, USA, 11th ed.
3. Singh, I. and Paul, G.P. (2009). Human Embryology. McMillan Co., New Delhi.

HGL-283 GENETIC ENGINEERING**Credits: 3-0-0****Unit-I**

Bacterial cell, Bacterial genome, Transposable elements, Methods of microbial DNA replication, transcription and translation, Genetic code, DNA damage, DNA repair mechanisms, Mutagenesis and types of mutations in bacteria, Ames test.

Unit-II

Methods of genetic exchange — Conjugation, transformation and transduction, Gene expression, Regulation of gene expression — Tryptophan, lactose and arabinose operon, Genetic approaches in bacteria, Bacteriophages, Structure of phages, Genetics of phages, Different stages in phage life cycle — Lysogenic cycle and lytic cycle.

Unit-III

Cloning strategies in bacteria, Drug resistance, Characteristics of vectors, Insertional vectors, Replacement vectors, Preparation of inserts, Insertional inactivation, Genetic engineering, Applications of genetic engineering.

Books Recommended:

1. Birge, E.A. (2006). Bacterial and Bacteriophage Genetics. Springer Science and Business Media, Inc., USA, 5th ed.
2. Dale, J. and Park, S. (2010). Molecular Genetics of Bacteria. John Wiley and Sons, Inc., New York, 5th ed.
3. Grath, S.M. and Sinderen, D. (2007). Bacteriophage: Genetics and Molecular Biology. Caister Academic Press, Norfolk.
4. Maloy, S.R., Cronan, J.E. and Freifelder, D. (1994). Microbial Genetics. Jones and Barlett, MA, 2nd ed.
5. Perdew, G.H., Heuvel, J.P.V. and Peters, J.M. (2006). Regulation of Gene Expression: Molecular Mechanisms. Humana Press, Totowa, NJ.
6. Snyder, L. and Champness, W. (2007). Molecular Genetics of Bacteria. AS Press, USA, 3rd ed.
7. Sonenberg, N., Hershey, J.W.B. and Mathews, M.B. (2000). Translational Control of Gene Expression. Cold Spring Harbour Press, New York.
8. Streips, U.N. and Yasbin, R.E. (2002). Modern Microbial Genetics. Wiley-Liss, Inc., New York, 2nd ed.
9. Tropp, B.E. and Freifelder, D. (2007). Molecular Biology: Genes to Proteins. Jones and Barlett, MA.
10. Trun, N.J. and Trempy, J.E. (2004). Fundamental Bacterial Genetics. John Wiley and Sons, Inc., New York.

HGL-301 HUMAN GENETICS AND CYTOGENETICS-I

Credits: 3-0-0

Unit-I

Molecular organization of the human genome, Transposable elements, Human chromosome organization and structure, Chromatin, Nucleosome, Solenoid model, Centromeres, Neocentromeres, Kinetochores, Telomeres, Human artificial chromosomes.

Unit-II

Mapping the human genome — Markers, Genetic maps, Cytological maps, Chromosome maps, Physical maps, Somatic cell hybridization in cytogenetic analysis, Animal cell culture techniques – Primary culture, Secondary culture, Serum-free cultures, Cell lines.

Unit-III

Chromosome banding techniques — G,C,R,Q,T,NOR, High-resolution banding, Molecular correlates of chromosome bands, Fragile sites, Chromosome nomenclature and cytogenetic notation for G-banded chromosomes.

Books Recommended:

1. Cummings, M.R. (2003). Human Heredity: Principles and Issues. Thompson, Brooks/Cole, 6th ed.
2. Cummings, M.R. (2009). Human Genetics. Cengage Learning, USA.
3. Czepulkowski, B. (2004). Analysing Chromosomes. Bios Scientific Publishers Ltd., Oxford.
4. Farzaneh, F. and Cooper, D.N. (Eds.) (1995). Functional Analysis of the Human Genome. Bios Scientific Publishers Ltd., Oxford.
5. Freshney, R.I. (1992). Animal Cell Culture: A Practical Approach. IRL Press, Oxford, 2nd ed.
6. Gardner, E.J. (2008). Human Genetics. Viva Books Pvt. Ltd., India.
7. Gersen, S.L. and Keagle, M.B. (2005). The Principles of Clinical Cytogenetics. Humana Press, USA, 2nd ed.
8. Hancock, J.H. (2008). Molecular Genetics. Viva Books Pvt. Ltd., India.
9. Harper, P.S. (2006). First Years of Human Chromosomes. Scion, USA.
10. Korf, B.R. (2006). Human Genetics and Genomics. Blackwell Publishing Co., Oxford.
11. Roif-Dieter (1994). Diagnostic Cytogenetics. Springer-Verlag, New York.
12. Rooney, D.E. and Czepulkowski, B.H. (1986). Human Cytogenetics: A Practical Approach. IRL Press Ltd., Oxford.
13. Sambamurty, A.V.S.S. (2006). Genetics. Narosa Publishing House, New Delhi.
14. Schaffer, L.G., Stovak, M.L. and Campbell, L.J. (2009). ISCN-2009. Karger Publishers, Germany.
15. Strachan, T. and Read, A. (2010). Human Molecular Genetics. Bios Scientific Publishers, Oxford.
16. Sumner, A.T. (2003). Chromosomes: Organization and Function. Blackwell Publishing Co., Oxford.
17. Tamarin, R.H. (2002). Principles of Genetics. Tata McGraw Hill, USA, 7th ed.
18. Therman, E. and Miller, O.J. (2001). Human Chromosomes. Springer-Verlag, New York, 4th ed.

HGL-302 PRINCIPLES OF HUMAN GROWTH AND DEVELOPMENT**Credits: 3-0-0****Unit-I**

Methods of studying growth, Growth curves and charts, Laws of Growth, Concepts of percentiles and growth standards, Assessment of physical growth with the help of body measurements, Disorders of Growth.

Unit-II

Growth during prenatal period, Childhood and adolescence, Precocious puberty and delayed puberty, Skeletal maturity, dental maturity and sexual maturity, Morphological and physiological changes during ageing.

Unit-III

Assessment of normal development, Screening tools for development, Developmental disabilities, Factors affecting growth and development, Secular trends, Catch-up growth, Tempo of growth.

Books Recommended:

1. Ghai, O.P., Gupta, P. and Paul, V.K. (2004). Essential Pediatrics. CBS Publishers and Distributors, New Delhi, 6th Revised ed.
2. Harrison, G.A. Weiner, J.S. Tanner, J.M. and Barnicot, N.A. (1990). Human Biology. Oxford University Press.
3. Singh, S.P. and Mehta, P. (2009). Human Body Measurements: Concepts and Applications. PHI Learning Pvt. Ltd., New Delhi.
4. Ulizaszek, S.J., Johnston, F.E. and Preece. M.A. (1998) The Cambridge Encyclopedia of Human Growth and Development. Cambridge University Press.

HGL-303 HUMAN POPULATION GENETICS

Credits: 3-0-0

Unit-I

Introduction, Applications and subdivisions of human population genetics, Frequencies of genes and genotypes, Hardy-Weinberg law, Dynamics and conditions of Hardy-Weinberg law and its application for autosomal locus with two alleles and multiple alleles, Testing of Hardy-Weinberg proportion.

Unit-II

Systematic changes of gene frequency, Mutation (non-recurrent and recurrent), Kinetics of mutation pressure, Estimation of mutation rates, Selection — Total selection intensity, selection against recessive/dominant/partial dominant/overdominant genes, etc. Average fitness, Genetic load and selection coefficient, Heterozygous advantages, Balance between mutation and selection, Kinetics of migration and genetic drifts.

Unit-III

Consanguinity and inbreeding, Inbreeding coefficient of a population and individuals through path analysis, Computation of Wright's 'F', Computation of 'F' for autosomal gene, Biological consequences of inbreeding, Concept of genetic load and its measurements, Classification of races through UNESCO guidelines, Admixture of races, Ethnic elements in Indian population (Classification by A.C. Haddon, S.S. Sarkar and Guha), Objectives of racial classification.

Books Recommended:

1. Balding, D.J., Bishop, M. and Cannings, C.C. (Eds.) (2007). Handbook of Statistical Genetics. John Wiley and Sons, England, Vol. 1&2, 3rd ed.
2. Brandon, R.N. (1996). Concepts and Methods in Evolutionary Biology. Cambridge University Press, USA.
3. Cavalli-Sforza, L.L. and Bodmer, W.F. (1971). The Genetics of Human Population. W.H. Freeman and Co., San Francisco, CA.
4. Falconer, F.S. and MacKay, T.F.C. (1996). Introduction to Quantitative Genetics. ELBS/Longman, England, 4th ed.
5. Hamilton, M.B. (2009). Population Genetics. Wiley-Blackwell, USA.
6. Hartl, D.L. and Clark, A.G. (2007). Principles of Population Genetics. Sinaur Associates, Inc., Massachusetts, 4th ed.
7. Hedrick, P.W. (2011). Genetics of Population. Jones and Bartlett Publishers, Massachusetts, 4th ed.
8. Neale, B., Ferreira, M.A.R., Medland, S.E. and Posthuma, D. (Eds) (2008). Statistical Genetics: Gene Mapping through Linkage and Association. Taylor and Francis Group, USA

HGL-405 COMPUTER APPLICATIONS

Credits: 3-0-0

Unit-I

Computer fundamentals, Internet basics and MS-Office 2003, Introduction to digital computers, Organization, Number system, I/O devices, Storage devices, Introduction to internet and its applications – www, email, ftp.

MS-Windows basics, MS-Word – Meaning of Word-Processing, Creating, Saving, Printing documents, Formatting, Spell-Check, Adding page numbers, Header and Footer, Macros, Creating tables, Converting table to text and vice-versa, Mail Merge.

MS-Excel – Spreadsheets, Using different types of formulae, Creating graphs and charts, Exporting charts to MS-Word, MS-PowerPoint – Creating presentations, Formatting, Adding effects and timings.

Unit-II

Data analysis and database – Brief description and tabulation of data, Measure of central tendency and dispersion – Mean, Median, Mode, Range, Standard Deviation, Variance and Correlation coefficient using SPSS.

Types of errors and level of significance, Tests of significance (F and t-test), Chi-square tests, Introduction to Data, Information, Database, DBMS (Advantages and disadvantages), Introduction to SQL (Data retrieval).

Unit-III

Virtual library and some useful sites on Internet – Searching MEDLINE on the Pubmed system from National Centre for Biotechnology and Information.

Assessing full text journals on the internet and printing articles using EndNote.

Books Recommended:

- 1 Sinha, P.K. (1992). Computer Fundamentals.
- 2 Peter Norton's Introduction to Computers, 6th Ed.
- 3 Windows Based Computer Courses, Sumit Kumar, JBD Publishers.
- 4 Gupta, S.C. (2004). Fundamentals of Statistics. Himalaya Publishing House.

Website Links

Databases (Genes Bank), search tools and software at <http://www.ncbi.nlm.nih.gov>.

Restriction enzyme site digestion webcutter2.0 at

<http://www.firsmarket.com/cutter/cut2.html>.

PCR and multiplex PCR guide and troubleshooting at

<http://www.med.yale.edu/genetics/ward/tavi/Trblesht.html>

Image analysis program at <http://www.scioncorp.com>.

MTL-261 BIOSTATISTICS

Credits: 3-1-0

Note:- The scope of this paper is restricted only to the applications of various statistical techniques. The mathematical derivations of various results are excluded.

Statistical Methods — Collection of data, Frequency distribution and its graphical representation, Measures of Central Tendency, Dispersion, Skewness and Kurtosis moments.

Correlation and Regression — Relationship between variables, Covariance, Karl-Pearson's Correlation Coefficient, Spearman's rank Correlation Coefficient, Least square technique for regression lines (without proof), Regression Coefficients, Relationship between Correlation analysis and Regression Analysis.

Probability — Mathematical definition of probability of an event, Use of permutations and combinations in calculations of Probability, Conditional probability, Additive and Multiplication law of Probability, Random Variables and its pmf, pdf, cdf, Mathematical expectation and variances, Theoretical Distributions: Binomial, Poisson and normal, Properties of these distributions (applications only).

Hypothesis Testing — Sample, Population, Statistics and Parameters, Null Hypothesis, Level of significance, Definitions of Chi-square, 't' and 'F' variates and their pdfs only, Applications of these distributions in testing of hypothesis.

Analysis of Variance — Meaning of analysis variance with linear models, Analysis of variance for one-way classified data, Analysis of variance for two-way classified data with one observation for cell, analysis of variance for two-way classified data with multiple but equal number of observations per cell (data analysis only).

Text Books

1. Fowler, J., Cohen, L. and Jarvis, P. (1998). Practical Statistics for Field Biology. John Wiley and Sons, 2nd ed. [Chapters: 4,5,6,7,(7.1–7.6), 9 (9.1–9.4), 12 (12.1–12.7), 13 (13.1–13.4, 13.6,13.7), 14 (14.1–14.5, 14.7), 15 (15.3–15.8, 15.10–15.11), 16 (16.9–16.13), 17 (17.1–17.3, 17.5,17.6,17.8)].
2. Raghavarao, D. (1983). Statistical Techniques in Agricultural and Biological Research Oxford and IBH Publishing Co. [Chapters: 2,3,4,5,7,8,9 and 10].

Reference Books:

1. Bland, M. (2006). An Introduction to Medical Statistics. Oxford University Press, 3rd ed.
2. Finney, D.J. (1980). Statistics for Biologists. Chapman and Hall Ltd.
3. Hoel, P.G. (1971). Elementary Statistics. John Wiley and Sons, 3rd ed.
4. Ross, S.M. (2005). Introductory Statistics. Academic Press, 2nd ed.
5. Wayne, W, Daniel (1999). Biostatistics: A Foundation for Analysis in Health Sciences. John Wiley and Sons, 7th ed.
6. Woodworth, G. (2004). Biostatistics: A Bayesian Introduction. John Wiley and Sons.

HGP-321 HUMAN GENETICS AND CYTOGENETICS PRACTICAL

Credits: 0-0-1.5

Demonstration of short-term blood lymphocyte culture – Washing and sterilization of glassware and plasticware, Preparation of chemical solutions and culture medium, Harvesting the culture, Staining, Banding and Scoring of prepared slides, Demonstration of photomicrography, Developing and printing of photographs, Karyotyping of solid-stained and G-banded chromosome preparations, Identification of structural and numerical chromosomal aberrations from photographs, Sister chromatid exchange analysis from peripheral blood lymphocyte culture, Numericals on chromosome nomenclature.

HGP-322 ANTHROPOMETRY PRACTICAL

Credits: 0-0-1.5

Growth charts, Directions of distance curves, Planes, axes and landmarks of the body,
Protocols for anthropometric measurements.

HGP-381 LAB EXERCISES IN MOLECULAR GENETICS

Credits: 0-0-3

The paper is based on the current techniques in Molecular Genetics. The students will have laboratory attachments with different faculty members for varying time span and will be examined for different practical techniques that they have learnt during the semester.

HGP-382 LAB EXERCISES IN GROWTH AND DEVELOPMENT

Credits: 0-0-3

The paper is based on the current techniques in Human Growth and Development. The students will have laboratory attachments with different faculty members for varying time span and will be examined for different practical techniques that they have learnt during the semester.

HGP-383 LAB EXERCISES IN TISSUE CULTURE-I

Credits: 0-0-3

The paper is based on the current techniques in Tissue Culture. The students will have laboratory attachments with different faculty members for varying time span and will be examined for different practical techniques that they have learnt during the semester.

MBL-451 CONCEPTS IN IMMUNOLOGY**Credits: 4-0-0****Unit-I****Introduction:**

Types of immunity — innate and adaptive, Features of immune response — memory, specificity and recognition of self and non-self, Terminology and approaches to the study of immune system.

Cells and Organs of the Immune System:

Lymphoid cells, Heterogeneity of lymphoid cells, T-cells, B-cells, Null cells, Monocytes, Polymorphs, Primary and secondary lymphoid organs-thymus, bursa of fabricius, spleen, lymph nodes, lymphatic system, mucosa associated lymphoid tissue (MALT), Lymphocyte traffic.

Unit-II**Humoral Immunity:**

Antigen-antibody interactions, Affinity and avidity, High and low affinity antibodies, Immunoglobulins — classes and structure, complement fixing antibodies, Complement cascade.

Cell Mediate Immunity:

T-cell subsets and surface markers, T-dependent and T-independent antigens, Recognition of antigens by T-cells and role of MHC, Structure of T-cell antigen receptors, TCR, BCR.

Unit-III**Immunological Disorders:**

Types of hypersensitivity reactions, Autoimmune disorders — their underlying molecular mechanism, etiology, diagnostic, prognostic and prophylactic aspects, Immunodeficiency disorders — AIDS.

Immunodiagnostic Procedures:

Various types of immunodiffusion and immunoelectrophoretic procedures — immunoblot, ELISA, RIA, agglutination of pathogenic bacteria, hemeagglutination and hemeagglutination inhibition, cellular techniques.

Books Recommended:

1. Goldsby, R.A., Kindt, T.J. and Osborne, B.A. (2000). Immunology. W.H. Freeman and Company, New York, 4th ed.
2. Janeway, C., Travers, P., Capra, J.D. and Walport, M.J. (1999). Immunobiology: The Immune System in Health and Disease, Garland Pub., USA.
3. Roitt, I.M., Brostoff, J. and Male, D.K. (2001). Immunology. Mosby Inc, UK.
4. Janeway, C.A., Trevers, P., Walport, M. and Schlomchick, M. (2001). Immunobiology, The Immune System in Health and Disease. Garland Publications, USA, 5th ed.

HGL-351 HUMAN GENETICS AND CYTOGENETICS-II

Credits: 3-0-0

Unit-I

Cell-cycle progression and check points, Chromosome dynamics in M-phase, Role of SMC and non-SMC proteins in regulation of cell cycle.

Unit-II

Modes of inheritance in humans, Mendelian and Non-Mendelian inheritance, Multifactorial inheritance and quantitative traits, Threshold model and recurrence risks, Genetics of sex determination, Sex-linked, sex-limited and sex-influenced traits, Manifesting Heterozygotes, Mosaics and chimeras, True- and pseudo-hermaphrodites, Sex ratio.

Unit-III

Introduction to light, fluorescent and confocal microscopy, FISH, CGH technique, Genetic basis of cancer — Proto-oncogenes, oncogenes and tumour-suppressor genes, Marker chromosomes, Chromosomal basis of neoplasia, Chromosomal instability syndromes – Ataxia telangectasia, Fanconi anemia, Bloom's Syndrome, Nijmegen breakage syndrome, Genetic toxicology.

Books Recommended:

1. Cummings, M.R. (2003). Human Heredity: Principles and Issues. Thompson, Brooks/Cole, 6th ed.
2. Cummings, M.R. (2009). Human Genetics. Cengage Learning, USA.
3. Farzaneh, F. and Cooper, D.N (Eds.) (1995). Functional Analysis of the Human Genome. Bios Scientific Publishers Ltd., Oxford.
4. Gardner, E.J. (2008). Human Genetics. Viva Books Pvt. Ltd., India.
5. Hancock, J.H. (2008). Molecular Genetics. Viva Books Pvt. Ltd., India.
6. Harper, P.S. (2006). First Years of Human Chromosomes. Scion, USA.
7. Korf, B.R. (2006). Human Genetics and Genomics. Blackwell Publishing Co., Oxford.
8. Sambamurty, A.V.S.S. (2006). Genetics. Narosa Publishing House, New Delhi.
9. Strachan, T. and Read, A. (2004). Human Molecular Genetics. Bios Scientific Publishers, Oxford.
10. Sumner, A.T. (2003). Chromosomes: Organization and Function. Blackwell Publishing Co., Oxford.
11. Tamarin, R.H. (2002). Principles of Genetics. Tata McGraw Hill, USA, 7th ed.
12. Therman, E. and Miller, O.J. (2001). Human Chromosomes. Springer-Verlag, New York, 4th ed.

HGL-352 PRINCIPLES OF HUMAN PHYSIQUE AND BODY COMPOSITION

Credits: 3-0-0

Unit-I

Conceptual models of body composition, Elementary composition of human body — Fat mass, Fat-free mass, Adipose tissue, Functions of fat and fat-free mass, Regional distribution of fats, Densities of body components, Negative and positive impacts of fat and fat-free mass in performance.

Unit-II

Reference man and reference woman, Methods for assessing body composition – Densitometry, Anthropometry, Bioelectrical impedance, Roentgenogrammetry, Magnetic resonance imaging, Computed tomography.

Unit-III

Body composition changes during embryonic period, childhood, adolescence, adulthood and undernutrition, Classification of human physique by external body form — Viola's method, Kretschmer's methods, Sheldon's method and Heath-Carter method, Somatochart and somatoplot, Sex difference in physique.

Books Recommended:

1. Forbes, C.B. (1987). Human Body Composition. Springer-Verlag, New York, Berlin.
2. Gibney, M.J., Macdonald, I.A. and Rocho, H.M. (2004). Nutrition and Metabolism. Blackwell Publishing Co., Oxford.
3. Harrison, G.A., Weiner, J.S., Tanner, J.M. and Barnicot, N.A. (1990). Human Biology. Oxford University Press.
4. McArdle, W.D., Katch, F.I. and Katch, V.L. (2001). Exercise Physiology. Williams and Wilkins, Lippincott.
5. Singh, S.P. and Mehta, P. (2009). Human Body Measurements: Concepts and Applications. PHI Learning Pvt. Ltd., New Delhi.
6. Ulizaszek, S.J., Johnston, F.E. and Preece, M.A. (1998). The Cambridge Encyclopedia of Human Growth and Development. Cambridge University Press.

HGL-353 PRINCIPLES OF QUANTITATIVE GENETICS

Credits: 3-0-0

Unit-I

Polygenic variation, Genetic and environmental components of variance, Heritability estimation through twin data, Polygenic variation, Genetic and environmental components of variance, Measures of heterozygosity and gene diversity (through Nei and others), Test for genetic heterogeneity for two alleles, Descriptive epidemiology, incidence and prevalence.

Unit-II

Notation of genetic distances with different indices, Natural selection and sex ratio, Measurements of genetic similarities and distance between the populations, Analysis of racial differences of the basic polymorphic genes.

Unit-III

Estimation of genetic correlation, Gene fixation probability and fixation time, Effective population size, Concept and significance of genetic admixture, Estimating admixture proportions from frequencies of a single allele, Quantitative trait loci (QTL), Quantitative genetics models — Phenotypic plasticity, Cultural transmission, Wright's 'F'-statistics and 'G'-statistics.

Books Recommended:

1. Balding, D.J., Bishop, M. and Cannings, C.C. (Eds.) (2007). Handbook of Statistical Genetics. John Wiley and Sons, England, Vol. 1&2, 3rd ed.
2. Brandon, R.N. (1996). Concepts and Methods in Evolutionary Biology. Cambridge University Press, USA.
3. Cavalli-Sforza, L.L. and Bodmer, W.F. (1971). The Genetics of Human Population. W.H. Freeman and Co., San Francisco, CA.
4. Falconer, F.S. and MacKay, T.F.C. (1996). Introduction to Quantitative Genetics. ELBS/Longman, England, 4th ed.
5. Hamilton, M.B. (2009). Population Genetics. Wiley-Blackwell, USA.
6. Hartl, D.L. and Clark, A.G. (2007). Principles of Population Genetics. Sinaur Associates, Inc., Massachusetts, 4th ed.
7. Hedrick, P.W. (2011). Genetics of Population. Jones and Bartlett Publishers, Massachusetts, 4th ed.
8. Neale, B., Ferreira, M.A.R., Medland, S.E. and Posthuma, D. (Eds) (2008). Statistical Genetics: Gene Mapping through Linkage and Association. Taylor and Francis Group, USA

HGL-354 APPLIED DNA TECHNOLOGY

Credits: 3-0-0

Unit-I

Recombinant DNA (rDNA) technology, Cloning vectors — Plasmids, Cosmids, Phagemids, Enzymes used in DNA technology — Restriction endonucleases, Ligases, Kinases and Phosphatases.

Unit-II

Linkers and adaptors, Site-directed mutagenesis, Applications of site-directed mutagenesis, Applications of recombinant DNA technology, Safety issues in rDNA experiments, Reverse transcriptase, Reverse transcription.

Unit-III

Principles and applications of blotting techniques — Southern blotting, Northern blotting, Western blotting, Dot-slot blotting, Agarose gel, Polyacrylamide gel, Pulse-field gel electrophoresis.

Books Recommended:

1. Brown, T.A. (2010). Gene Cloning and DNA Analysis: An Introduction. Blackwell Publishing Co., Oxford, 6th ed.
2. Freifelder, D.C. (2008). Molecular Biology. Narosa Publishing House, New Delhi, 2nd ed.
3. Glick, B.R.R. and Pasternak, J.J. (2002). Molecular Biotechnology: Principles and Applications of Recombinant DNA. ASM Press, Washington, DC.
4. Lewin, B. (2008). Genes-IX. Jones and Barlett Publishers, Inc., USA.
5. Pasternak, J.J. (2005). An introduction to Human Molecular Genetics, Mechanisms of Inherited Diseases. John Wiley and Sons, Inc., New Jersey.
6. Pierce, B.A. (2011) Genetics: A Conceptual Approach. W.H. Freeman and Company, New York, 4th ed.
7. Sambrook, J., Fritsch, E.F. and Maniatis, T. (1989). Molecular Cloning: A Laboratory Manual. Cold Spring Harbor, New York, Vol. 1,2&3.
8. Strachan, T. and Read, A. (2010). Human Molecular Genetics. Garland Publishers, London. 4th ed.
9. Wilson, K. and Walker, J. (2000). Practical Biochemistry, Principles and Techniques. Cambridge University Press, 5th ed.

HGP-371 HUMAN GENETICS AND MOLECULAR GENETICS PRACTICAL

Credits: 0-0-2

Numericals on Mendelian and non-Mendelian inheritance in humans, Pedigree analysis, To test PTC tasting ability in a random sample and calculate gene frequencies for the taster and non-taster alleles, To study fingerball and palmar dermatoglyphics and calculate indices, To test for colour blindness using Ishihara charts, Demonstration of polymerase chain reaction (PCR), Agarose gel electrophoresis to test amplified products, Demonstration of polyacrylamide gel electrophoresis (PAGE).

HGP-372 HUMAN PHYSIQUE AND BODY COMPOSITION PRACTICAL

Credits: 0-0-2

Assessment of body proportions, (body mass index, waist-hip ratio, androgyny score, dysplasia), Anthropometric determination of human physique and body composition.

HGP-391 LAB EXERCISES IN BIOCHEMISTRY

Credits: 0-0-3

The paper is based on the current techniques in Biochemistry. The students will have laboratory attachments with different faculty members for varying time span and will be examined for different practical techniques that they have learnt during the semester.

HGP-392 LAB EXERCISES IN QUANTITATIVE GENETICS

Credits: 0-0-3

The paper is based on the current techniques in Quantitative Genetics. The students will have laboratory attachments with different faculty members for varying time span and will be examined for different practical techniques that they have learnt during the semester.

HGP-393 LAB EXERCISES IN TISSUE CULTURE-II

Credits: 0-0-3

The paper is based on the current techniques in Tissue Culture. The students will have laboratory attachments with different faculty members for varying time span and will be examined for different practical techniques that they have learnt during the semester.