KARNATAK UNIVERSITY, DHARWAD

Regulations

For

MASTER OF SCIENCE IN APPLIED GENETICS

CHOICE BASED CREDIT SYSTEM

2008-2009& Onwards

KARNATAK UNIVERSITY, DHARWAD

REGULATIONS

For

MASTER OF APPLIED GENETICS

CHOICE BASED CREDIT SYSTEM

From

2008-2009& Onwards

KARNATAK UNIVERSITY, DHARWAD

Regulations concerning Master Degree Programme

Faculty of Science, from 2008-2009

Master Degree Programme in Applied Genetics (CBCS)

Regulations Governing the Post-Graduate Master Degree Programmes under Choice Based Credit System (KU-CBCS), framed under Section 44(1)(C) of K.S.U. Act, 2000.

MASTER OF APPLIED GENETICS
CHOICE BASED CREDIT SYSTEM (CBCS)

Title:

These Regulations shall be called "Regulations Governing Post-Graduate programmes in the Faculty of Science & Technology under the Choice Based Credit System" in Karnatak University, Dharwad

Commencement:

These Regulations shall come into force from the academic year 2008-2009.

Definitions:

3.0 Definitions

a. In these Regulations, unless otherwise provided:

"Academic Council" means Academic Council of the University constituted accordingto the *Karnatak State Universities Act, 2000.*

b**. "Board of Studies"** means P.G. Board of Studies of the University, Adhoc/Combined and Steering Committees of International Diploma Programmes in the discipline/subjects concerned.

c. **"Compulsory Course"** means fundamental paper, which the student admitted to a particular Post-Graduate Programme, should successfully complete to receive the Post Graduate Degree in the concerned subject.

d. **"Course Weightage"** means number of credits assigned to a particular course.

e. "**Credit"** means the unit by which the course work is measured. One Credit means one hour of teaching work or two hours of practical work per week. As regards the marks for the courses, 1 credit is equal to 25 marks, 2 credits are equal to 50 marks, 3 credits are equal to 75 marks and 4 credits are equal to 100 marks.

f**. "Cumulative Grade point Average (CGPA)"** refers to the Cumulative Grade Point Averages weighted across all the semesters and is carried forward from first semester to subsequent semesters.

g**. "Degree"** means Post-Graduate Degree.

h **"Grade"** is an index to indicate the performance of a student in the selected course. These grades are arrived at by converting marks scored in each course by the candidate in both Internal Assessment and Semester-end Examinations.

i. **"Grade Point Average (GPA)"** refers to an indication of the performance of the student in a given semester. GPA is the weighted average of all Grades a student gets in a given semester.

j.**"Open Elective Course"** means a paper offered by a Department to the students of other Departments.

k.**"Post-Graduate Programme"** means semesterised Master's Degree Programmes excluding P.G.Diploma.

l.**"Specialization course"** means advanced paper offered by a Department that a student of that Department can opt as a special course.

m**. "Student"** means the student admitted to programmes under (k).

n. **"University"** means KarnatakUniversity, Dharwad.

Minimum Eligibility for Admission:

A candidate, who have successfully completed Bachelor's Degree programme in Science or any other Degree programme of this University of any other University recognized as equivalent thereto by this University, shall be eligible for admission to the Post Graduate Programme in science provided the candidate also satisfied the conditions like the minimum percentage marks and other eligibility conditions as prescribed by the University from time to time.

Admissions shall be as per Government of Karnatak reservation policy and the directions issed in this regard from time to time.

5.0 Durations of the Programme

The Durations of the study for the Post-Graduate programme shall extended over a period of two (three in case of MCA) consecutive academic years, each academic year comprising two semesters, and each semester comprising sixteen weeks with a minimum of ninety working days.

However, the students, who discontinue the programme after one or more semesters due to extraordinary circumstances, are allowed and complete the programme with due approval from the Registrar. Candidate shall not register for any other regular course other than Diploma and Certificate courses being offered on the campus during the durations of P.G. Programme.

6.0 Medium of Instruction and Evaluation

The medium of instruction shall be English. However, the students may write the examinations in Kannada if so provided by the concerned Board of Studies.

7.0 Programme Structure

7.1 The students of Post-Graduate programme shall study the courses as may be approved by the concerned Board of Studies. Faculty and the Academic Council of theUniversity from time to time subject to minimum and maximum credits as outlined in these regulations.
7.2 There shall be three categories of courses namely, Compulsory Courses, Specialization courses and Open Elective Courses.

7.3 Each programme shall have a set of Compulsory Courses, as stipulated in the regulations governing the concerned programme that a student must complete to get the concerned degree.

7.4 In those programmes that offer specialization courses, the students shall choose the prescribed number of Specialization Courses offered within the Department.

7.5 Each Department shall offer Open Elective courses for students of other Departments. The students of a Department shall choose Open Elective courses from among those prescribedby the University and selected by the Department from time to time. P.G. Centres and affiliated colleges can offer those Open Electives Courses which are approved of prescribed by their Parent Department of the University. Such Open Elective courses shall be taught by qualified teachers approved by the University.

7.6 The credits for each of the Compulsory Courses may vary from 2 to 4: for Specialization Course, from 2 to 4 and for Open Elective Course, from 2 to 4, wherever project work/field work/practical are involved in the course, the credits may extend to 6 or as otherwise provided by concerned programme.

7.7 The minimum credits for P.G. Programme shall be 96. In the case of MCA, the minimum number of credits shall be 158 and in case of M.Sc. Computer Science the minimum credits are 116.

7.8 The students shall undertake project/field work during the programme as compulsory course or in lieu of Specialization Course or Open Elective Course if so specified by concerned Board of Studies.

7.9 The ratio between Compulsory, Specialization and Open Elective may differ from department to department

7.10 The detailed programme structure for Faculty of Science & Technology shall be as prescribed and shown in Annexure-I, Annexure-Ia & Annexure-Ib

7.11 The Open Elective Courses generally will have practical component, unless otherwise specified by the respective Board of Studies. The number of students admitted to the course shall commensurate with the availability of infrastructure.

8.0 Attendance

8.1 Each course shall be taken as a unit for the purpose of calculating the attendance.

8.2 Each student shall sign the attendance register maintained by the Department for each course for every hour/unit of teaching /practical. The course teachers shall submit the monthly attendance report to the Chairperson of the Department who shall notify the same on the notice board of the Department during the second week of the subsequent month.

8.3 Marks shall be awarded to the student for attendance as specified in the regulations concerning evaluation.

8.4 A student shall be considered to have satisfied the required attendance for each course if he/she has attended not less than 75% of the total number of instructional hours during the semester.

8.5 There is no provision for condoning shortage of attendance.

8.6 The students who do not satisfy the prescribed requirement of attendance shall not be eligible for the ensuing examination. Such candidates may seek admission a fresh to the given semester.

8.7 Such of the candidates who have participated in State/National level Sports, NSS, NCC, Cultural activities and other related activities as stipulated under the existing regulations shall be considered for giving attendance for actual number of days utilized in such activities (including travel days) subject to the production of certificates from the relevant authorities within two weeks after the event.

9.0 Examination

9.1 There shall be an examination at the end of the each semester. The odd semester examinations shall be conducted by the respective Departments/P.G. Centres/Colleges. The even semester examinations shall be conducted by theUniversity.

9.1.1 Unless otherwise provided, there shall be semester-end examination of 3 hoursduration for 75/100 marks; 1.5 hours for 50 marks and 2/4 hours for 35/75 marks for practical examination.

9.1.2 Every student shall register for each semester-end examinations as per the University Notification by submitting duly completed application form through the proper channel and shall also pay the fees prescribed.

9.1.3 The Office of the Registrar (Evaluation) shall allot the Register Number to the candidate at 1st semester-end examination. That will be the Register Number of the candidate for all subsequent appearances at semester-end examinations.

9.1.4 The Answer scripts shall be in the safe custody of the University for a maximum period of six months from the date of announcement of results. These shall be disposed off after sixmonths.

9.1.5 The programme under CBCS is a fully carry-over system. A candidate reappearing for either the odd or even semester examinations shall be permitted to take examinations as and when they are conducted (even semester examination in even semester and odd semester examination in odd semester).

9.1.6 Candidates who have failed, remained absent or opted for improvement in any course/courses shall appear for such course/courses in the two immediate successive examinations that are conducted. However, in the case of the candidates appearing for improvement of their marks, the marks secured in the previous examination shall be retained, if the same is higher.

9.1.7 Candidates who desire to challenge the marks awarded to them, in the even semester-end examinations, may do so by submitting an application along with the prescribed fee to the Registrar (Evaluation) within 15 days from the announcement of results.

9.2 Odd Semester Examination

9.2.1 There shall be a Board of Examiners to set, scrutinise and approve question papers.

9.2.2 The BOE shall scrutinize the question papers submitted in two sets by the paper setters and submit the same to the office of the Registrar (Evaluation)

9.2.3 The office of the Registrar Evaluation shall dispatch the question papers to the Departments/P.G. Centres/Colleges who shall conduct the Examinations according to the Schedule announced by the University.

9.2.4 The Chairperson of the Department/Administrator of the P.G. Centre/Principal of the College shall appoint one of their full time course teachers as Post Graduate Programme (PGP) Coordinator who shall conduct the examinations and arrange for evaluation of answer scripts.

9.2.5 Answer scripts shall be valued by the examiners appointed by the University. However, in those centres where an examiner for a particular course is not available, then the answer scripts of that course shall be dispatched to the office of the Registrar (Evaluation) who shall arrange for valuation of the same.

9.2.6 There shall be single valuation. The examiners (Internal or External) shall value the answer scripts and shall indicate the marks awarded to each question on the answer script.

9.2.7 The Marks List, a copy of the Examination Attendance Sheet and the sealed bundles of the answer scripts shall be dispatched by PGP Coordinator to the Registrar (Evaluation)"s Office at the conclusion of the valuation at the respective centres.

9.2.8 The Office of the Registrar Evaluation shall process and announce the results.

9.3 Even Semester Examination

9.3.1 There shall be a Board of Examiners to set, scrutinize and approve question papers.

9.3.2 As far as practicable, it will be ensured that 50% of the paper setters and examiners are from other Universities/Research Institutes.

9.3.3 Each answer script of the semester-end examination (theory and project report) shall be assessed by two examiners (one internal and another external). The marks awarded to that answer script shall be average of these two evaluations. If the difference in marks between two evaluations exceeds 20% of the maximum marks, such a script shall be assessed by a third examiner. The marks allotted by the third examiner shall be averages with nearer award of the two evaluations.

Provided that in case of the number of answer scripts to referred to the third examiner in a course exceeds of 5 or 20% of the total number of scripts, at the even semester-end examinations, such answer scripts shall be valued by the Board of Examiners on the date to be notified by the Chairperson of the Board of Examiners and the marks awarded by the Board shall be final.

9.3.4 Wherever dissertation/project work is prescribed in the even semesters of a programme, the same shall be evaluated by both internal and external examiners. The evaluation shall be as prescribed by the concerned Board of Studies.

9.3.5 In Case of programmes with practical examination details of maximum marks, credits or duration may vary from Department to Department as specified by the concerned Board of Studies.

9.4 Evaluation

9.4.1 Each Course shall have two evaluation components- Internal Assessment (IA) and the Semester End Exams.

9.4.2 The IA Component in a course shall carry 25% / 30% /50% and the Semester End Examination shall carry 75% /70% /50% respectively, as the case may be. Courses having 25% & 30% / 50% marks as internal assessment shall have 3 / 5 marks allotted to attendance. However, in case of project work, the distribution of marks for Internal Assessment and Examination shall be left to the discretion of the concerned BOS.

9.4.3 Marks for attendance shall be awarded to the students according to the following table.

For courses carrying 25% of marks for IA, the attendance marks shall be

Attendance (in percentage)	**Marks**
Above 90	3
Above 80 and up to 90	2
Above 75 and up to 80	1

9.4.4 Internal Assessment (IA) shall be based on written tests, practical and seminars. However, the number of IA components per course per semester shall not be less than two.

9.4.5 The IA marks list shall be notified on the Department Notice Board as and when the individual IA components are completed and the consolidated list shall be submitted to the Office of the Registrar Evaluation before the commencement of semester-end examination, or as directed by the University.

9.4.6 The tests shall be written in a separately designated book supplied by the University which shall be open for inspection by the students after evaluation.

9.4.7 There is no provision for seeking improvement of Internal Assessment marks.

9.4.8 The IA records, pertaining to Semester Examination, shall be preserved by the Department/Centres/Colleges for a period of one year from the date of semester examination. These records may be called by the University or body constituted by the University as and when deemed necessary.

9.4.9 The dissertation /project work viva-voce shall be conducted by an internal and external examiner.

10.0 Maximum duration for completion of the Programme

10.1 A candidate admitted to a post graduate programme shall complete it within a period which is double the duration of the programme from the date of admission.

10.2 Whenever the syllabus is revised, the candidate reappearing shall be allowed for the examinations only according to the new syllabus.

11.0 Declaration of Results

11.1 The minimum for a pass in each course shall be 40% of the total marks including both IA and the semester-end examinations. Further, the candidate shall obtain at least 40% of the marks in the semester-end examination. There is no minimum for the IA marks.

11.2 Candidates shall secure a minimum of 50% in aggregate in all courses of a programme in each semester to successfully complete the programme.

11.3 Candidates shall earn the prescribed number of credits for the programme to qualify for the PG Degree.

11.4 For the purpose of announcing the results, the aggregate of the marks secured by a candidate in all the semester examinations shall be taken into account. However, Ranks shall not be awarded in case of the candidate has not successfully completed each of the semesters in first attempt or has not completed the programme in stipulated time (vide Regulation 5) or had applied for improvement of results.

12.0 Marks, Credit Points, Grade points, Grades and Grade Point Average

12.1 The grade points and the grade letters to candidates in each course shall be awarded as follows:

Percentage of marks	**Grade points**	**Grade Letter**
75 and above, up to 100.00 %	7.50 to 10.00	A
60 and above but less than 75%	6.00 and above but less than 07.5	B
50 and above but less than 60%	5.00 and above but less than 6.0	C
40 and above but less than 50%	4.00 and above but less than 5.00	D
Less than 40%	Less than 4.00	F

12.2 Credit Point (CP): The Credit Point for each course shall be calculated by multiplying the grade obtained by the credit of the course.

12.3 The award of Grade Point Average (GPA) for any student is based on the performance in the whole semester. The student is awarded Grade Point Average for each semester basedon the Total Credit Points obtained and the total number of credits opted for. The GPA is calculated by dividing the total credit points earned by the student in all the courses by the total number of credits of those courses of the semester.

12.4 The Cumulative Grade Point Average (CGPA) shall be calculated by dividing the total number of credit points in all the semesters by the total number of credits in all the semesters. The CGPA to date shall calculated by dividing the total number of credit points in all the semesters to date by the total number of credits in all the semesters to date.
CGPA for the I Semester= Sum of the CP of the I Semester+Sum of the credits of the I Semester

CGPA for the II Semester= Sum of the CP of the Sem +Sum of the CP of II Sem +Sum of the Credits of the I Semester+II Semester

CGPA for the III and IV Semester shall be computed accordingly.

12.5 The Grade Card at each semester examination shall indicate the courses opted by thestudent, the credit for the course chosen by the student, the credit points obtained in each course, the grade letter and the grade point average. No. class shall be awarded for each semester and the same would only be awarded at the end of all the semesters based on Cumulative Grade point Average.

12.6 Class shall be awarded to the successful candidates based on the Cumulative Grade Point Average (CGPA) as specified below.

Cumulative Grade Point Average (CGPA)	**Class to be awarded**
7.5 to 10.0	First Class with Distinction
6.0 and above but below 7.5	First Class
5.0 and above but below 6.0	Second Class

13. Miscellaneous:

a) Notwithstanding anything contained in these regulations, the semester system at Post-Graduate level is hereby repeated.
b) The provisions of any order, Rules or Regulations in force shall be inapplicable to theextent of its inconsistency with these Regulations.
c) The University shall issue such order, instructions, procedures and prescribe such format asit may deem fit to implement the provisions of this Regulations.
d) The procedural details may be given by the University from time to time.
e) Any unforeseen problems/difficulties may be resolved by the Vice Chancellor, whosedecision in the matter shall be final.

Course Outline for the M.Sc. Applied Genetics

SEMESTER – I

Paper Code	Title of the paper	Max. Marks	IA marks	Total Marks	Credits	Teaching hrs
CT 1.1	Biological Chemistry (Theory)	75	25	100	04	50 hrs
CT 1.2	Genetics & Cytogenetics(Theory)	75	25	100	04	50 hrs
CT 1.3	General Microbiology(Theory)	75	25	100	04	50 hrs
CT 1.7	Biophysical & Biochemical Techniques (Theory)	75	25	100	04	50 hrs
CP 1.4	Biological Chemistry (Practical)	40	10	50	02	48 hrs
CP 1.5	Genetics & Cytogenetics(Practical)	40	10	50	02	48 hrs
CP 1.6	General Microbiology(Practical)	40	10	50	02	48 hrs
CP 1.8	Biophysical & Biochemical Techniques (Practical)	40	10	50	02	48 hrs

SEMESTER – II

Paper Code	Title of the Paper	Max. Marks	Internal Assessment	Total Marks	Credits	Teaching Hrs.
CT 2.1	Developmental & Evolutionary Genetics(Theory)	75	25	100	04	50 hrs
CT 2.2	Molecular Biology(Theory)	75	25	100	04	50 hrs
CT 2.3	Intermediary Metabolism (Theory)	75	25	100	04	50 hrs
ET 2.7	Molecular Biology Techniques (Elective) (Theory)	75	25	100	04	50 hrs
CP 2.4	Developmental & Evolutionary Genetics(Practical)	40	10	50	02	48 hrs
CP 2.5	Molecular Biology(Practical)	40	10	50	02	48 hrs
CP 2.6	Intermediary Metabolism (Practical)	40	10	50	02	48 hrs

SEMESTER – III

Paper Code	Title of the Paper	Max. Marks	Internal Assessment	Total Marks	Credits	Teaching Hrs.
CT 3.1	Genetic Engineering (Theory)	75	25	100	04	50 hrs
CT 3.2	Microbial Genetics &	75	25	100	04	50 hrs
	Technology(Theory)	75	25	100	04	50 hrs
CT 3.3	Human Genetics & Genetic Counselling	75	25	100	04	50 hrs
ET 3.7	Genetic Disorders & Counselling					
CP 3.4	Genetic Engineering (Practical)	40	10	50	02	48 hrs
CP 3.5	Microbial Genetics & Technology(Practical)	40	10	50	02	48 hrs
CP 3.6	Human Genetics & Genetic Counselling(Practical)	40	10	50	02	48 hrs

SEMESTER – IV

Paper Code	Title of the Paper	Max. Marks	Internal Assessment	Total Marks	Credits	Teaching Hrs.
CT 4.1	Bioinformatics (Theory)	75	25	100	04	50 hrs
CT 4.2	Immunogenetics &	75	25	100	04	50 hrs
CT 4.3	Immunotechnology(Theory)	75	25	100	04	50 hrs
	Molecular Diagnosis & Molecular Medicine(Theory)					
CPJ4.7	Project work	125	25	150	06	
CP 4.4	Bioinformatics(Practical)	40	10	50	02	48 hrs
CP 4.5	Immunogenetics &					
CP 4.6	Immunotechnology(Practical)	40	10	50	02	48 hrs
	Molecular Diagnosis & Molecular Medicine(Practical)	40	10	50	02	48 hrs

Annexure-I

The Programme structure of the Master of Science Degree shall be as follows:

Semester	No. of compulsory & Specialization courses (credit s/course)	Total credits for compulsory & Specialization courses	No.of open elective course (credits/ course	Total credits of open elective course	Total credits for the semester
Sem. I	Th:04(04)=16 Pra/Th*:02(04)=08	24	----	--	24
Sem.II	Th:03(04)=12 Pra/Th*:03(02)=06	18	Th:01(04)=04	04	22
Sem.III	Th:03(04)=12 Pra/Th*:03(02)=06	18	Th:01(04)=04	04	22
Sem.IV	Th:03/04** (04) =12/16 Pra/Th*:3/4**(02) =06/08 D# 01(06)=06	24	--		24
Total	Th 13(04)= 52 Pra /Th 12/13(02)=24/26 D1(06) =06	84	Th: (04)=08	08	92

Note: Except for I &IV Semester, the concerned Department shall offer one each of open elective theory and practical course or two *open elective Theory courses for students of other science departments.
*Only for Mathematics; ** for Mathematics and Statistics; # except Mathematics & Statistics
Abbreviations: Th=Theory; Pra=Practical; D=Dissertation;

GRADE CARD
Programme: M.Sc. ( )
Name of the Candidate:…… Semester: IV
Seat No: Month & Year:

Course	Course Code	Credit	IA Marks	Theory/ Practical		Max	Marks obtained		Semester Grade point	Credit Points
Max			Obt	Max				Obt		
Compulsory Courses										
Course-I	XXCT 4.1	04	25	15	75	45	100	60	6.00	24.00
Course-II	XXCT 4.2	04	25	15	75	59	100	74	7.40	29.60
Course-III	XXCT 4.3	04	25	15	75	28	100	43	4.30	17.20

Course-IV	XXCT 4.4	02	15	06	35	34	50	40	8.00	16.00
Course-V	XXCT 4.5	02	15	06	35	34	50	40	8.00	16.00
Course-VI	XXCT 4.6	02	15	06	35	34	50	40	8.00	16.00
Course-VII	XXCD# 4.7 Or	06	25	20	125	100	150	120	8.00	48.00 *Or*
Course-VI	XXCT* 4.7	04	25	15	75	28	100	43	4.30	17.20
Course-VIII	XXCP+/CT ψ 4.8	02	15	05	35	35	50	40	8.00	16.00
Total		24			600				200.00/185.00	

XX refers to course abbreviations, 4.1 refers to IV semester course 1;e.g. CHI CT 1.1=chemistry
Inorganic compulsory theory 1.1
except for Mathematics and Statistics; * For Statistics and mathematics;+ Only for satistics; Ψ Only for Mathematics

GPA for IV Semester- CP(IV Sem)/Credits(IV Sem)=200/24.00=8.33

GPA for I semester =CP(I sem)/Credits (I sem)

CGPA for I semester = GPA for I semester

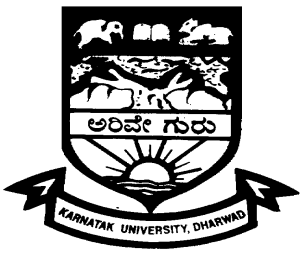
$$\text{CGPA for II Sem} = \frac{\text{CP (I sem)} + \text{CP (II sem)}}{\text{Credits (I sem)} + \text{Credits (II sem)}}$$

$$\text{CGPA for III Sem} = \frac{\text{CP (I sem)} + \text{CP (II sem)} + \text{CP (III sem)}}{\text{Credits (I sem)} + \text{Credits (II sem)} + \text{Credits (III sem)}}$$

$$\text{CGPA for the programme} = \frac{\text{CP (I sem)} + \text{CP (II sem)} + \text{CP (III sem)} + \text{CP (IV)}}{\text{Credits (I sem)} + \text{Credits (II sem)} + \text{Credits (IIIsem)} + \text{Credits (IV sem)}}$$

(*CP: Credit point)

KARNATAK UNIVERSITY, DHARWAD



SYLLABUS

For

MASTER OF SCIENCE IN APPLIED GENETICS

CHOICE BASED CREDIT SYSTEM

(CBCS)

Paper code and Name	PG71T101 CT 1.1 : BIOLOGICAL CHEMISTRY
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	• To understand the fundamental biochemistry principles, such as structure/function of biomolecules, • To study the classification, characteristics and significance of Biomolecules • To understand the importance of vitamins and enzymes in health and disease.

PARTICULARS	Teaching Hours (Max. 50)
UNIT-I: Chemical Bonds andProperties of Water	
- Covalent, Coordinate, Electrostatic Hydrogen, Ionic bonds. - Van der Waals forces, hydrophilic and hydrophobic Interaction, Functional groups. - Structure, properties of water - Water as a salvent and its importance in biological system - Importance of pH, pK and buffer, - Henderson-Hasselbalch equation and its application.	10 Hours
UNIT-II: Carbohydrates and Proteins	
- Classification, outline of methods of structure elucidation, structure and stereochemistry of carbohydrates. - Derivatives of monosaccharides: amino sugars deoxysugars, and glycosides. - Structure of disaccharides: sucrose, lactose andmaltose. - Structure of polysaccharides: starch, cellulose, glycogen, dextrin, hemicellulose, pectins, lignins, agar -agar, chitin, hyaluronic acid, heparin, chondroitin sulphate, peptidoglycan. - Carbohydrates on cell surface. - Amino acids: General structure, chemical structure, chemical reaction of amino acids, and physiological properties. - Peptides: peptide bond, structure determination, C-terminal and N-terminal residue determination, peptide synthesis. - Proteins: Isolation, purification, and chemical reactions of proteins.Primary, secondary and tertiary structures, denaturation.	14 Hours
UNIT-III: Lipidsand Terpenes	
- Classification of lipids, chemistry of fatty acids. - Chemistry of triacylglycerides: drying of oils, saponification and iodine values of oils and fats. - Occurrence and structure of phospholipids (Lecithin and cephalin) and sphingolipids (sphingomyelin, cerebroside and gangleoside). - Terpenes: Introduction, sterols, general introduction and structure of cholesterol classification of terpenes - Chemistry of farnesol, phytol, squalene and carotenes.	12 Hours
UNIT-IV Nucleotides, Vitamins, Antibiotics, Alkaloids, Pigments and Metal ions in	

Biomecules	
- Nucleotides: Chemistry of nucleic acids, structure of purines and pyrimidines, modified bases nucleosides, nucleotides and polynucleotide, structural polymorphism of DNA and RNA types. - Vitamins: Chemistry, fat and water-soluble vitamins and their biological functions. - Antibiotics: Structure and Chemistry of penicillin, streptomycin, chloramphenicol and tetracyclines. - Alkaloids: General introduction, chemistry of medicinally and industrially important alkaloids. - Pigments: Chemistry of chlorophylls, heme, phenolics and tannins. - Metal ions in Biomolecules : Examples and their role.	14 Hours
REFERENCES	
1. Nelson, D.I and Cox, MM, Lchninger, A.L. (2000) Principles of Biochemistry, Illrd Ed. Mc. Millan Press, Hamshire. 2. Mathews, C, K. Van Holde and Ather, K. (2000): Biochemistry, V Ed. Benjamin/cummings Publishing Co. Inc. N.Y. 3. Voet D and Voet J. 2000: Biochemistry Jobn Wiley and Suns 4. Stryer L. 2000, Biochemistry, st Ed. W H. Freeman and Ca. New York. 5. Robert J.D., and Caserio, M.C. (1974); Basic Principles of Organic Chemistry, I Ed. W.A. Benjamin, Inc. N.Y. 6. Bloom Field, V.A. and Harrington, ILE. (Ed) 1995: Biophysical Chemistry, W.H. Freeman and Co. N.Y.	

Paper code and Name	PG71T102 CT 1.2 : GENETICS AND CYTOGENETICS
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	• To understand the principles of inheritance as formulated by Mendel and its extensions. • To understand the analysis of genetic data using statistical procedures. • To understand structure and composition of animal and plant cells, nuclear content and the concept of cell cycle. • To understand the concept chromosome number, structure, and behavior in human, animal and plant cells.

PARTICULARS	Teaching Hours (Max. 50)
UNIT-I: History of genetics and Extension of Mendelism	
- **History of genetics**:Genetics in Biology. Role of genetics in agriculture, industry and medicine, impact on society. - Overview of Mendelian genetics. - Application of laws of probability (product rule, sum rule, binomial property). - Chi square test and its application in analysis of genetic data. - **Extension of Mendelism**: Basis of dominant and recessive mutation. - Visible, sterile and lethal mutations. - Genotype to phenotype. - Effect of environment on phenotype development- penetrance and expressivity, - Phenocopoies - Overview of gene interaction and modifying genes. - Pleiotropy. - Multiple alleles- Eye color in fruit fly, coat color in locus in Maize. - Testing gene mutation for allelism complementation.	12 Hours
UNIT-II: Linkage, recombination and gene mapping in eukaryotes; Sex determination and Inheritance of quantitative traits	
- **Linkage, recombination and gene mapping in eukaryotes**: Linkage studies in fruit fly and maize. - Detection of linkage by test cross. Two point cross, three point cross and four point cross. - Gene mapping coincidence and interference. - Recombination frequency and genetic map distance. - Chiasma frequency and genetic map distance: genetic distance and physical distance. - Evolutionary significance of recombination, - Genetic control of recombination. - Cytogenetic and physical maps using molecular markers. - **Sex determination**: Autosomes and sex chromosomes- fruit fly, birds, melandrium and humans. - Sex linked, sex limited and sex influenced characters, environmental	13 Hours

determination of sex, - Dosage compensation of X-linked genes. - Molecular mechanism of sex determination. - **Inheritance of quantitative traits**: Continuous and discontinuous variations. - Polygenic inheritance, genetic variance, heritability- nairow sense and broad sense, genetic advance under selection. .	
UNIT-III: Extra chromosomal inheritance; Eukaryotic Chromosome and Mechanism of Cell division	
- Mendelian inheritance, - Variegation in leaves of higher plants,Correns studies in *Mirabilis jalapa*. - Extra nuclear genes - *chlamydomonas* mutants showing unipatental inheritance - Chloroplast and mitochondrial genome. - Chromatin, its chemical nature, Macromolecular organization. Nucleosome structure, chromosome model, centromeric DNA, Telomere organization. - Law of DNA constancy and C-value paradox. - **Mechanism of Cell division:** Mitotic apparatus, cytokinesis, chromosome movement present concept. - Regulation of eukaryotic cell cycle- Overview of cell cycle, molecular mechanism of regulating mitotic events, cell cycle control in mammalian cells. - Mutation causing loss of cell cycle control. - Meiotic process- stages, chromosome pairing and chaisma formation. Molecular mechanism of recombination, synaptinemal complex and recombination nodule. - Spermatogenesis and oogenesis , biochemical studies with oocytes,eggand early embryos.	13 Hours
UNIT-IV Ploidy and Chromosome engineering	
- **Haploidy :** Occurrence , production, detection, meiosis, breeding behavior, use in genetic analysis and plant breeding. - **Polyploidy :** Autopolyploidy – Origin, induction, cytological , genetic and breeding behavior. Allopolyploidy- cytogenetics, genome analysis, synthesis of new genera.Ploypoidy in animal kingdom - **Aneuploidy:**Hyperploids- Trisomics and Tetrasomics- Origin, meiotic behavior and its uses. Hyperploidy in animals and humans.Hypoploidy-monosomies and nullisomies source, cytological behavior, genetics and their uses in gene mapping. - **Chromosome engineering**: Transfer of whole genome, genome reconstruction, chromosome sorting, transfer of individual chromosome, substitution of alien chromosome arm. - Cytogenetic basis of apomixis: Classification, detection, embryological, cytological and genetic basis. Apomixis in plant breeding.	12 Hours
REFERENCES	

1.Griffith et. al., 2000: An introduction to genetic analysis, 7th Ed. W.H. Freeman, London 2. Strickberger, M.W. 1995: Genetics, 3rd Edn. Prentice-Hall Inc. London. 3. Tamrin, R.M. 2000: Principles of Genetics, 6th Ed. W.M.C. Brown Publications Co. London. 4. Snustod, D.P. and Simmons, M.J. (2003) Principles of Genetics, 3rf Edn John Wiley and sonsinc. N.Y. 5. Alberts, B., Bray, D., Lewin, J., Raff, M., Roberts, K. and Watson J.D. (1994): Molecular Biology of The Cell, 3rf Edn. 6. Lodish, H., Berk»A.,Ziprusky, S.L., Matsudairra. P., Baltiore, D., and Damell, J. (2000): Molecular Cell Biology. Freeman W.H. and CO. N.Y. 7. Kaip. G. (1996): Cell and Molecular Biology: Concept and Experiments. John Willey and Sons. Inc. N.Y. 8. Gupta, P.K., (1965): Cytogenetics. Rastogi Publication Meerut. 9. Schulz Schaeffer, J. (1980): Cytogenetics: Plants, Animals and Humans. Springer-Verlag N.Y. 10. Lewis, W.H. (1980): Polyploidy: Biological Relevance Plenum Press N.Y. 11. Bumham, CJL (1962): Discussion in cytogenetics. Bergress Minneapolis.	

Paper code and Name	PG71T103 CT 1.3 : GENERAL MICROBIOLOGY
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO 1	• To understand the source, isolation, enrichment, purification and also to know various physical and chemical means of sterilization. • To understand the use of different media and staining purposes for isolation, culture, classification and identification of microbes. • Master aseptic techniques and be able to perform routine culture handling tasks safely and effectively • Comprehend the various methods for identification of unknown microorganisms

PARTICULARS	Teaching Hours (Max. 50)
UNIT-I: Introduction to microbiology, classification and media	
- Scope and development of microbiology. - Comparative study of prokaryotic and Eukaryotic microorganisms. Study of structure of bacteria genetic elements ribosomes, membranes, cell envelope capsule, flagella, Pilli, and endospores. - **Classification of Microorganisms:** Nomenclature and study of different types of microorganisms, - Characterization of Microorganisms: bacteria, fungi, actinomycetes, algae, protozoa, mycoplasmas, chlamidae, rickettsia. - Methods of sterilization: Principles, physical and chemical sterilizmg agents, pasteurization and disinfection, batch and continuous sterilization of media and air. - **Nutrition and culture media:** Nutritional requirement and nutrition classes of microorganisms. Types of culture media selective, differential, indicator and transport media.	12 Hours
UNIT-II: Isolation of pure cultures; Cultivation and Identification of bacteria	
- Different methods of isolation and pure cultures spread, plate pour plate and streak plate methods, enumeration of cell number, enrichment culture techniques. - Methods of inoculation and culturing streak, stab, lawn or carpet culture, liquid culture. - Growth and reproduction in microorganisms, growth curve of bacteria and factors affecting the growth curve, synchronous and diauxic growth, - Methods of growth measurement plating tuibidometry, metabolic product, Nitrogen content - Preservation of microbial cultures-stabing glycerol. - **Identification of bacteria:** Morphological identification, - Staining methods: simple staining, capsule cell wall, flagella and endospore staining, - Biochemical identification: IMVIC test, oxidase, catalase urease, Sugar fermentation and H_2S production.	12 Hours

UNIT-III: Habitats of Microorganisms, Viruses and Clinical microbiology	
- **Habitats of Microorganisms:** Microbes of air, water, soil, food, and normal human body flora. - **Viruses:** Physiochemical properties and classification of viruses. - Isolation, cultivation and assay of viruses. - Bacteriophages: odd and even T phages, ΦX174. - Structure, mode of infection, replication and assembly of T even phage. - Lytic and lysogenic cycle.Viriods and prions-Yeast. - **Clinical microbiology :** Infection and intoxication endo and exotoxins, air, water and food borne diseases of man and domestic animals,causative agent, epidemiology and diagnosis. - Microbial antibiotics curative and prophylactic measures. - Monoclonal antibodies: Production and application. - Insulin production by genetically engineered microbes (GEM) - Vaccines killed attenuated and recombinant vaccines. - Integrated pest control management.	13 Hours
UNIT-IV Food, Environmental and Fuel Microbiology	
- Microbes in the spoilage of food and milk and their prevention. - Microbes in the production of food-cheese, vitamins, amino acids, organic acids and in alcoholic beverages. - Microbes as food: Single Cell protein from algae, bacteria, yeast and fungi as mushroom. - **Environmental and Fuel Microbiology:** Environmental pollution: Agricultural domestic and industrial wastes. - Microbes in liquid and solid waste management. - Saccharification, Silage production and composting microbes in degradation of pesticides and Xenobiotics. - Microbial fertilizers. - Biological control of pest by *B. thurengiensis*. - Metal leaching and extraction, microbes as non-conventional energy source. - Biogas production, Methane and butanol and hydrogen gases - Alcohol production	14 Hours
REFERENCES	
1. Pelczar, MJ. Chan, EOSA and Kreig^.R., (1993). Microbiology, McGraw Hill Inc., N.Y. 2. Atlas, R.M (1998); Microbiology, Fundamentals and applications II Ed. Me. Millan Publications Co. N.Y. 3. Prescott, L.M., Harley, J.P., and Klein, D.A., (1996): Microbiology, Wm C Brown PubL N.Y. 4. Holt, J.S., Kreig, N.R., Sneath, P.HA. and Williams S.T. (1994): Bergey's Manual of Systematic Bacteriology, 9* ed. William and Wilkins, Baltimore. 5. Frazier, W.C. and Westhaff ; D.C. (1998): Food Microbiology, Tata Me Graw Hill Publishers, New Delhi. 6. Warren, L., and Ernest, J. (1994): Medical Microbiology and Immunology. Appleton and Lange, Stanford.	

7. Sullia, S.B. and Shantharam, S. (1998): General Microbiology, Oxford IBH, New Delhi.
8. Edward Alcamo I. (1997). Fundamentals of Microbiology 5th Edn.Adelison Wesley Longmon. Inc. New York.
9. Madigon, M.T., Martinco, J.M. and Parker J. (1997) Brock Biology of Microorganisms, 8th Ed. McGraw Hill,Inc. New York.
10. Alexander (1997) Introduction to Soil Microbiology. John Wiley and Sons Inc. New York.
11. Biswas, S.B. and Anita Biswas (1997), An Introduction to Viruses. 4th revised edition.Vikas Publishing House,Pvt. Ltd. New Delhi.
12. Alexopoulos CJ. and Mims (1979) Introductory Mycology, Wiley Eastern Limited, New Delhi.
13. Ram R. C. (2007) Microbial Diversity- Modem Trendo, Mittal Publications, New Delhi.

Paper code and Name	PG71T104 CT 1.4 : BIOPHYSICAL AND BIOCHEMCIAL TECHNIQUES50 HOURS
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	• To understand the state-of-the-art biophysical methods that are being applied to study the structure and function of biological macromolecules and biological systems at the molecular level. • To understand the principle, procedure and application of various analytical techniques viz. microscopy, chromatography, electrophoresis, centrifugation, spectroscopy etc. • To understand the handling, storage, analysis and downstream processing of various biological macromolecules.

PARTICULARS	Teaching Hours (Max. 50)
UNIT-I: Introduction to Biophysics, Characterization of biological molecules and Microscopy	
- Scope of biophysics, physical loss, interaction of living and non living matter, chemical foundation of biophysics. - **Characterization of biological molecules:** Hydrodynamics properties of biomolecules- viscosity, diffusion, osmosis, partial specific volume and Donnal effect. - **Microscopy:** Principles of microscopy, light, phase, contrast. - Fluorescence, X-ray, UV, transmission and scanning electron microscope, confocal microscope and atomic force microscope. - **Preparation of specimen for microscopy:** Microtome technique, fixation, embedding, sectioning and staining for light and electron microscopy.	12 Hours
UNIT-II: Separation methods	
- **Chromatography:** Paper, thin layer, gas liquid, column, gel filtration, ion exchange, affinity, HPLC, RPLC. - **Centrifugation:** Preparative and analytical centrifuges, rotors, sedimentation analysis, rate- zonal and equilibrium gradient centrifugation, ultra centrifugation, subcellular isolation. - **Electrophoresis:** Types of electrophoresis- Paper and gel (starch, acrylamide and agarose) electrophoresis, capillary, disc, slab vertical gel electrophoresis, submarine horizonatalagarose gel electrophoresis, gradient gel electrophoresis, isoelectric focusing, immune electrophoresis, pulsed field gel electrophoresis, blotting of nucleic acids and proteins from gel to solid supports.	13 Hours
UNIT-III: Concentrartion of macromolecules and Analytical methods	
- **Concentration of macromolecules:** Salting out with ammonium sulphate, flash evaporation, lyophilization, pressure dialysis, reverse dialysis, hallow fiber membrane and reverse osmosis. - **Analytical methods:** Spectroscopy, photobiophysics, electromagnetic spectrum of light, simple theory of absorption of light by molecules, Beer-Lamberts law, types of detectors. UV-Visible spectrophotometry,	13 Hours

infrared spectroscopy, Raman spectroscopy, fluorescence spectroscopy, flame photometry, atomic absorption, plasma emission, mass, ESR and NMR spectroscopy, MALDI-TOF MS, LC-MS, ORD and CD, X-ray diffraction and X-ray crystallography. - Biological importance of LASERS, Microwaves and radiations.	
UNIT-IV Radioisotope tracer techniques and Methods of detection and quantitzation of macromolecules on gels	
- **Radioisotope tracer techniques:** Nature and types of radioactivity, decay units, preparation of labeled biological compounds, detection and measurement of radioactivity (GM counter, Scintillation counter, Cerenkove radiation, autoradiography, photographic emulsion, Gamma ray counter), Quench correction, safety measures in handling radioisotope, biological uses of radioisotopes. - Automatic analysers for amino acids, protein sequencer, nucleotide sequencing system, peptide and polynucleotide synthesizer. - **Methods of detection and quantitzation of macromolecules on gels:** Staining procedures for proteins, nucleic acids, carbohydrates, pigments.Zymograms, densitometric methods and transilluminators.	12 Hours
REFERENCES	
1. Boyer R.F. (2001): Modern experimental biochemistry. 3rd Ed Benjamin/Cummings Pub.Co. 2. Jayaraman J. (1998): Laboratory manual of biochemistry. Wiley Eastern limited New Delhi. 3. Work T.S. and Burdon R.G.: laboratory techniques in biochemistry and molecular biology. 4. Skoog D.A., West D.M., Holler F.J. and Crouch S.K. (2004). Fundamentals analytical chemistry. Thomason Asia Pte Ltd., Singapore. 5. Cantor C.R. and Schimmel P.R. (2004): Biophysical chemistry part-I, II and III. W.H. Freeman and Company, New York. 6. Wilson K and walker J (2005): Principles and techniques of biochemistry and molecular biology. 6th Ed. Cambridge University Press, USA. 7. Sadasivam S. and Manikam A. (1992): Biochemical Method. Willey Eastern Limited New Delhi.	

Paper code and Name	**PG71P101 - 1.5 : Biological chemistry**
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	To learn hands on about preparation of biological buffers, isolation and purification of biomolecules and its characterization.

PARTICULARS	Per week 4 hours

1. Preparation of buffers-citrate buffer, Tris-HCl buffer and phosphate buffer.
2. Determination of pk of proteins and amino acids.
3. Estimation of inorganic phosphorus by Fiske-Subbarowe method.
4. Sorenson-Formal titration for estimation % purity of glycine.
5. Isolation and estimation of protein using various colorimetric (Lowry, Biuret methods) and spectrophotometric methods.
6. Determination of molecular weight of a protein by gel filtration chromatography or SDS-PAGE.
7. Estimation of total-sugars/reducing sugars.
8. Isolation and estimation of DNA/RNA
9. Extraction and estimation of plants pigments.
10. Extraction of lipids and fatty acid composition (TLC or GLC)
11. Saponification value and iodine number of fats.

REFERENCES

1. S. Sadavasivam and A. Manikam (1992), Biochemical Methods for Agricultural Sciences. Wiley Eastern Ltd, New Delhi.
2. J. Jayaraman (1968). Laboratory Manual for Biochemistry, Wiley Eastern Ltd, New Delhi.
3. Plummer D.T., (1977). An Introduction to Practical Biochemistry.Tata McGraw Hill, Bombay.
4. Dr.Palanivelu, (2001). Analytical Biochemistry and Separation Techniques- A Laboratory Manual for B.Sc. and M.Sc. Sudents.

Paper code and Name	**PG71P102 - 1.6 : Genetics and Cytogenetics**
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	• To learn hands on about collection, handling, identification and breeding of model organism *Drosophila melanogaster, Neurospora, Sordaria and Ascbolus.* • To evaluate Mendelian principles and its extension using model organisms.\ • To study nuclear events like chromosomal variations viz, aneuploidy, polyploidy and structural variations in chromosomes hands on.

PARTICULARS	Per week 4 hours
1. 1. Preparation of fruit fly media and handling of fruit flies. 2. Morphology of adult fruit fly, recognizing the sex of adult fly. Life cycle of fruit fly.Collection of virgin flies. 3. Examination of mutant flies. 4. Study of law of segregation and law independent assortment in ftuit fly. 5. Linkage studies in fruit fly. 6. Preparation of media and culture methods for *Neurospora / Sordaria and Ascobolus*. 7. Ordered and unordered tetrad analysis *in Neurospora/Sordaria and Ascobolus*.	

8. Preparation of reagents, stains and dehydration grades for cytological studies.
9. Cytological methods: Chromosomes counting, Chromosome banding techniques and Karyotype analysis
10. Analysis of polytene chromosome, sex chromosomes.
11. Structural and numerical changes in Chromosomes.
12. Induction of polyploidy and characterization of autoploids.

REFERENCES

1 Ashbumer M, Golic K. G. and Scott Hawley R. (2005), Drosphila a Laboratory Handbook, 2 Edn. Coij Spring Harbor Laboratory Press, Cold Spring Harbor, New York.
2. Khanna V.K, (2006), Laboratory Manual Plant Cytogenetics. Kalyani Publishers.
3. Batch Margret J. (1997), AgtCytogentics Laboratory Manual. Lippincott Williams and Wilkins Publishers.

Paper code and Name	**PG71P103 - 1.7 : General Microbiology**
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	• To learn hands on about microbial culture, differentiation, identification and classification. • To study life cycles of different model microbes, biochemical analysis, effect of physical and chemical parameters on its growth.

PARTICULARS	Per week 4 hours
1. Preparation of nutrient broth and nutrient agar slants, and sterilization. Culture of microorganisms using various methods. 2. Isolation of microorganisms from soil sample and determination of the number of colony forming units. Isolation of pure culture techniques. 3. Simple and differential staining procedures, endospore staining, flagellar staining, cell wall staining, capsular staining and negative staining. 4. Identification of bacteria by biochemical tests. 5. Life cycle of bacteria, fungi, actinomycetes, blue green algae and Clostridium. 6. Study of growth curve of E. coli cells-effect of pH, temperature, salt concentration, nutrient and agitation on growth phase. 7. Antibiotic sensitivity test, LD-50, potency of drug/antibiotic. 8. Microbiological assays of vitamins. 9. Isolation of bacteriophages.	

REFERENCES

1. Pelczar, M.J. Chan, EOSA and Kreig,N.R., (1993). Microbiology, McGraw Hill Inc., N.Y.
2. Atlas, R.M (1998); Microbiology, Fundamentals and applications II Ed. Me. Millan

Publications Co. N.Y.
3. Prescott, L.M., Harley, J.P., and Klein, D.A., (1996): Microbiology, Wm C Brown Publ. N.Y.
4. Holt, J.S., Kreig, N.R., Sneath, P.H.A. and Williams S.T. (1994): Bergey's Manual of Systematic Bacteriology, 9th ed. William and Wilkins, Baltimore.
5. Alexander (1997) Introduction to Soil Microbiology. John Wiley and Sons Inc. New York.
6. Alexopoulos C.J. and Mims (1979) Introductory Mycology, Wiley Eastern Limited, New Delhi.
7. Ram R. C. (2007) Microbial Diversity- Modem Trendo, Mittal Publications, New Delhi.
8. Cappuccino, J.G. and Sherman, N (1999) Microbiology a Laboratory Manual AddossionWeisly.

Paper code and Name	PG71P108 - 1.8 : Biophysical and biochemical techniques
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	To learn hands on about the various techniques used in physical, physiological and biochemical analysis of cells viz, centrifugation, microscopy, spectroscopy and biomolecule fractionation and separation.

PARTICULARS	Per week 4 hours
1. Purification of peptides/proteins-salt precipitation, dialysis, column purification. 2. Molecular weight determination of peptides/proteins by gel filteration chromatography/SDS-PAGE. 3. Effect of salt, pH and temperature on proteins. 4. Blotting of nucleic acids/ proteins. 5. Extraction of lipids and fatty acid composition. 6. Estimation of hormones by HPLC. 7. Analysis of elements- AAS/Flame photometer/Kjeldahl method.	

REFERENCES

1. S. Sadavasivam and A. Manikam (1992), Biochemical Methods for Agricultural Sciences. Wiley Eastern Ltd, New Delhi.
2. J. Jayaraman (1968). Laboratory Manual for Biochemistry, Wiley Eastern Ltd, New Delhi.
3. Plummer D.T., (1977). An Introduction to Practical Biochemistry.Tata McGraw Hill, Bombay.
4. Dr.Palanivelu, (2001). Analytical Biochemistry and Separation Techniques- A Laboratory Manual for B.Sc. and M.Sc. Sudents.

Paper code and Name	PG71T201- CT 2.1 : DEVELOPMENTAL AND EVOLUTIONARY GENETICS.

COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	• The course gives an in-depth insight into the development of animals, amphibian, insects, chick and birds. Molecular aspects of life - the central dogma. • To understand basic genetic principles, both at the individual and population level, and appreciate the concept of natural selection as the driving force of evolution. • To appreciate how interactions between organisms and the environment, between individuals within a species, and between individuals of different species can shape selective forces and evolutionary outcomes.

PARTICULARS	Teaching Hours (Max. 50)
UNIT-I: History and basic concepts, Patterning of the vertebrate body plan, Development of fruit fly body plan	
- Model organisms for genetic analysis of development: Insect-drosophila amphibians-*Xenopusjarvis*, birds-chick, mammals-mouse, identifying developmental genes. - Axes and germ layers-settling of the body axes mesoderm and early nervous system-somite formation and patterning, neural induction and the role of the organizer. - Maternal gene activity, polarization of body axes during oogenesis, zygotic gene activity in early embryo, segmentation-activation of pair rule genes, selector and homeotic genes, segment polarity genes and compartments.	12 Hours
UNIT-II: Genetics of embryonic development in plant, Genetics of seedling development, Genetics of flowering, seed and fruit development	
UNIT-II - Early events in embryogenesis, gene expression in embryo, genetics of embryogenesis-embryolethal mutants, apical-basal axis mutants, segment deletion mutant, radial axis mutants. Cell fate maps in embryo development. - Photomorphogenesis, shoot development, leaf development and root development. - Transition from vegetative to floral development, ABC model and homeotic genes, mad box genes. Genetics of anther development and pollen formation.Seed development- Endosperm, endosperm balance number, maturation stage, LEA protein and control of seeds dormancy and germination.Fruit development and control of ripening.Genetics of aging and Senescence in animals and plants.	12 Hours
UNIT-III: Theories of organic evolution, Changes in gene frequencies, Inbreeding and heterosis:	
UNIT-III - Lamarkism and neo-lamarkism, Darwinism and neoDarwinism. Gene frequencies and Equilibrium Gene pool and Gene frequency.Hardy-Weinberg law, attainment of equilibrium at 2 or more loci and	13 Hours

sexlinkage.Estimation of equilibrium frequencies in natural population-Codominance and dominance in natural population, Sex linkage in natural populations. - Mutation rate, selection, fitness, gametic and zygotic selection, heterozygous advantage. Unstable equilibrium, equilibrium between mutation and selection.Mutation rate and equilibrium frequencies estimation, migration, Random genetic drift. - Inbreeding and assortative mating, inbreeding coefficient from genotypes and pedigrees. Effect of inbreeding on genotype frequencies, phenotypic mean and variance, Cross breeding and heterosis.	
UNIT-IV Genetic Structure of Population, Molecular phylogenies and evolution,	
- Optimum phenotype and selection pressure, types of selection, Fischer's theorem on natural selection, genetic variability in natural populations, Canalization, genetic homoeostasis, genetic load and genetic drift. Genetics of evolutionary process: Race formation, Isolating mechanisms, modes of speciation. Genetic Polymorphism: Types of Polymorphism, Maintaining polymorphisms, sampling the genome, Multilocus selection models, neutral alleles, Molecular evolutionary clock. - Amino acid sequences, DNA and repetitive DNA sequences, DNA-DNA hybridization, Restriction enzyme sites. Molecular Polymorphism and its evolutionary implications Nucleotide sequence homologies, rate of molecular changes, regulating genes and evolutionary consequences.	13 Hours
REFERENCES	
1. Bhojawani, S.S, and Bhatnagar, S.P. (2000): The embryology of Angiosperms Vikas Publication House, New Delhi. 2. Carlson, B.M. (1996): Pattern's foundation of embryology. McGraw Hill Inc. N.Y. 3. Hartl. D.L. (1988): A primer of population genetics. Sinauersunderland USA. 4. Howell, S.H. (1998): Molecular genetics of plant development. Cambridge University Press, Cambridge. 5. Lewin. B. (2001): Genes VII. Oxford University Press. Oxford. 6. Li. W and Graur (1990): Fundamental of Molecular evolution. Sinauer associates Sunderlandbd, USA. 7. Price, P.W. (1996): Biological evolution. Saunders pub. Philadelphia. 8. Russo, V.E.A., Brody, S., Cove. D. And Okkolenghi (1992): Development. The molecular genetic approach.Springer Verlag Berlin. 9. Snustad, D.P., and Simmons, M.J. (2003): Principles of Genetics, 3[1] Edn. John Wiley and Sons, inc. N.Y. 10. Strickberger, M.W. (1996); Evolution, 2[nd]Edn. Jones and Barlett Pub. London. 11. Strickberger, M.W. (1996): Genetics, 3[rd]Edn. Prentice Hall of India, New Delhi. 12. Tamarin, R.H. (2000): Principles of Genetics 6 Edn. W.C. Brown Publishers, London. 13. Wolpert, L.et.al. (2002): Principles of development, 2d ed. Oxford University Press, Oxford.	

Paper code and Name	**PG71T202-CT 2.2 : MOLECULAR BIOLOGY**
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	• The course gives an in-depth insight into the molecular aspects of life - the central dogma spanning from DNA Replication till Protein Synthesis and Reverse transcription. • It explains molecular aspects of genes and its regulation- genome- gene expressions heredity- recombination- protein synthesis- molecular basis of diseases- mutations genetic analysis etc.

PARTICULARS	Teaching Hours (Max. 50)
UNIT-I: Genetic Material, DNA replication,	
- Discovery, Overvie w- DNA-Chemical composition and molecular structure, polymorphism in DNA structure. RNA-Chemical composition and macromolecular structure and types of RNA. - Overview, enzymes of replication. Replication apparatus- Primosomes and Replisomes.Mechanism of Replication.Continuous and discontinuous DNA synthesis, supercoiling and termination of replication.Eukaryotic DNA Replication, telomere length and aging.	08 Hours
UNIT-II: introduction, translation	
- Central dogma, role of DNA in protein synthesis, General features of RNA synthesis. Prokaryotic transcription RNA polymerase, mechanism of transcription.Eukaryotic transcription- RNA polymerases, transcription factor, Post transcription modification of mRNA- Capping and Polyadenylation. Split genes- intron, exons and gene splicing .Reverse transcription. - Genetic code- Properties of genetic code, Deciphering of genetic code, initiation and termination codons, degeneracy of genetic code, quasiuniversal nature of genetic code, wobble hypothesis and evolution of genetic code. Protein synthesis- ribosomes, amino acid activation, initiation, elongation and termination in prokaryotes and eukaryotes, post translational modification of proteins.Inhibitors of translation. - .	12 Hours
UNIT-III: Mutagenesis, DNA repair mechanism, Regulation of gene expression in prokaryotes, Regulation of gene expression in eukaryotes.	
- Spontaneous mutations. Mutation frequency, Physical mutagens Ionizing radiations and non-ionizing radiations, Radiosensitivity.Chemical mutagens- mutagenic compounds, mode of action, molecular basis of mutation. In vitro site directed mutagenesis. - DNA damage, dark repair, light repair, post replication repair, SOS repair systems. Mobile genetic elements in eukaryotes, transposon tagging of genes, Genetics and evolutionary significance. - Operon models- Lac operon inducible system, cap protein and catabolite	20 Hours

repression, His operon repressible system, Trp operon attenuation control. Posttranscriptional control- feed back inhibition and protein degradation. - Short term regulation, heat shock proteins, activators, enhancers and silencers. Hormonal regulations, DNA methylation, Z-DNA.Molecular control of transcription, gene expression and chromosome organization, euchromatin and heterochromatin, and gene amplification. Role of RNA in gene expression: siRNA, antisence RNA, hairpin RNA and RNAi.	
UNIT-IV Genome organization, Genomics	
- Genome size, cot analysis, DNA constancy and enigma. DNA complexity, coding and non-coding sequences, LINES and SINES and multigene families. - Introduction, structural genomics- cytogenetic maps, FISH, SNP, STR, AFLP, RFLP, RAPD, mapping quantitative traits using QTL, construction of chromosome specific library, positional cloning-chromosome walk and jumps. Functional genomics-gene expression sequences, DNA micro array and genome evolution.	10 Hours
REFERENCES	
References: 1. Freifelder, D (1999): Molecular Biology. Narosa Pub. House. New Delhi. 2. Griffith et al (2000): An introduction to genetic analysis. Freeman W.H..and Company, NY 3. Karp, G. (1996): Cell and Molecular biology. Concepts and Experiments.John Willey and Sons. Inc. N.Y. 4. Lewin, B. (2001): Genes VII, Oxford University Press, Oxford. 5. Lodish, H, Berk A., Zipursky, S.L., Matsudaiva, P., Baltimore, D., and Darnell, J. 2000: Molecular Cell Biology.W.H. Freeman and Co. 6. Sambrook, J., Fritsch, E.F. and Meniates, T (2000): Molecular Cloning, CSHLPress. NY 7. Snustad, D.P and Simmons, M.J. (2002): Principles of Genetics. IIIrdEdn.John Willey and Sons. N.Y. 8. Twyman, R.M. (1998): Advanced Molecular Biology. Viva Book Pvt. New Delhi.	

Paper code and Name	PG71T203- CT 2.3 : INTERMEDIARY METABOLISM
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	• Describes the kinetics of enzymatic reactions and to understand enzyme substrate models and mechanism of enzyme catalysis also describes the fundamental concepts of metabolic pathways, importance and their regulatory mechanism • The Course gives an in-depth knowledge of all Biomolecules Metabolisms and their regulations.

PARTICULARS	Teaching Hours (Max. 50)
UNIT-I: Bioenergetics, Metabolism of Carbohydrates	
- Free energy change in biological transformations, thermodynamic principles in biology, redox potential, high energy compounds, brief account of enzymes and coenzymes involved in biological oxidations, organization of respiratory electron transport system, mechanism of oxidative phosphorylation, biological energy transducers, chemiosomatic generation of ATP. - Glycolysis, Citric acid cycle, glyoxylate cycle, gluconeogenesis, pentose phosphate pathway, glycogenolysis and glycogen synthesis, Biosynthesis of Lactose and starch. Energetics and regulations of the pathways .	12 Hours
UNIT-II: Metabolism of Amino acids, Metabolism of Lipids.	
- Hydrolysis of proteins, Proteases, biosynthesis of amino acids and their catabolism(deamination, decarboxylation, transamination) Co-ordinated control of amino acid metabolism, formation of ammonia and Urea, Nitrogen cycle, Biological nitrogen fixation (symbiotic and non symbiotic). - Lipid Hydrolysis, lipases, outlines of schemes of oxidation of fatty acids (saturated and unsaturated), Biosynthesis of fatty acids, Biosynthesis of Cholesterol, Phospholipids and Glycolipids, Leukotrienes and cicosanoides, prostaglandins and thromboxanes. Lipid peroxidation, metabolism of ketone bodies.Regulation of lipid metabolism.	12 Hours
UNIT-III: Metabolism of Heme, Metabolism of Nucleotides, Signal Transduction.	
- Biosynthesis and degradation of hemeporphyrin, regulation, porphyries. - Biosynthesis of purine and pyrimidine nucleotides by *denovo*and salvage pathways. Regulation Inhibitors of nucleotide biosynthesis.Degradation of nucleotides. - Inter and Intra cellular signalling: Signal molecules-Protein and non-proteins signals. Organisms involved in the synthesis and release, transport, target cells/tissues. Signal receptors, distribution interaction between the signal receptors, signal transducing elements and the mechanism of transduction. Role of second messangers, such as calcium, cAMP, cGMP, Phosphotidyl inositol phosphatises. A general	12 Hours

view of plant signals, phytoharmones, calcium, phosphotidyl inositol and their mechanisms.	
UNIT-IV Photosynthesis, Biochemistry of Hormones	
- Introduction, Photosynthesis pigments, photosystems, cyclic and noncyclic electron flow and photophosphorylation, CO_2 fixation by Calvin Cycle, C_3, C_4 and CAM pathways, photorespiration. - Classification, structure and functions of hormones Biosynthesis of steroid hormones, thyroid hormones, hormone receptors, second messengers, signal transduction, signal component receptors, mechanism of signal transduction.	14 Hours
REFERENCES	
1. Lodish, H. Berk A., Zipursky, S.L., Matsudaira, P. Baltimore D and Darnell J. 2000: Molecular Cell Biology. W.H. Freeman and Co. 2. Voet D and Voet J. 2000: Biochemistry, John Wiley and Sons. 3. Stryer L. 2000: Biochemistry, 5th Ed. W.H. Freeman and Co. New York. 4. Moran L.A., Sceimgeour K.G., Hortan H.R., Ochs R.S., and Rawn J.D., Biochemistry 3rd Ed. Neil Patterson Publishing prentice Hall. 5. Lehninger A: Principles of Biochemistry .C.B.S. Publishers. 6. Mathews and Van Holde: Biochemistry.	

Paper code and Name	PG71P201- CP 2.4 : Developmental and Evolutionary genetics
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	• To learn hands on about selection, preparation, fixation, embedding section and staining of plant/animal tissues for developmental studies. • To learn principles of evolution and population genetics by experimentation and calculations.

PARTICULARS	Per week 4 hours
1. Fixation of plant and animal tissues, preparation of paraffin blocks and microtomy. Staining and microscopic observations. 2. Types of eggs and cleavage. 3. Development of *Arabidopsis*/fruitfly/fish/frog/mammals. 4. Mounting of imaginal discs in fruit fly. 5. Demonstration of cell death. 6. Gametogenesis, embryogenesis and seed development. 7. Root and shoot differentiation. 8. Estimation of allelic frequency in natural population-PTC loci. 9. Genetic variation in natural population- beak shape, colour pattern in lady beetle, flower colour variation, Mimicry- butterfly and orchid flowers, Metroglyph analysis. 10. Estimation of genetic diversity in natural population. 11. Mechanism of speciation-Polyploidy. 12. Genetic analysis of inbreeding.	
REFERENCES	
1. 1. Johnson, D.A., (1940) Plant Microtechnique, McGraw Hill, New York. 2. Vasudevarao. K, (2004) Developmental Biology, A Modern Synthesis, Oxford Publishing Co. Pvt. Ltd. New Delhi. 3. Subramanium. T (2002) Developmental Biology: Narosa Publication 4. Kalthoff. K (1996). Analysis of Biological Development, McGraw Hill, Inc. New York. 5. Strickberger M.W. (1996), Evolution Jones and Bailett H. Publishers, Sudbury, Massachusetts. 6. Gilbert Scott F. (1996). Developmental Biology, Sunderland, Sinauer Associates. 7. Miglani G.S. (2006) Developmental Genetics, I.K. International Publishing House, Pvt. Ltd. Bangalore.	

Paper code and Name	PG71P202 CP 2.5 : Molecular Genetics
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	• To learn isolation, purification separation, and quantification of nucleic acids from animals, plants and microbes. • To learn about mutation induction, mutant characterization and DNA repair.

	• To learn how gene expression induced by changing substrates in model organisms.

PARTICULARS	Per week 4 hours
1. Isolation of genomic DNA from plants, microbes and mammals 2. Quantification of DNA by UV-spectrophotometer 3. Agarose gel electrophoresis and quality check of isolated DNA 4. Isolation and quantification of RNA by UV-spectrophotometer 5. Electrophoresis of RNA using denaturing gels 6. Induction and characterization of mutations using Chemical/Physical mutagens in plants and animals 7. Induction and demonstration of heat shock proteins 8. Mutation and DNA repair system in microorganisms 9. Substrate induced enzyme synthesis in *E. coli*	

REFERENCES

1. Molecular Cloning: A laboratory manual, J. Sambrook, E.F. Fritsch and T. Maniatis. Cold Spring Harbor Laboratory Press, New York, 2000.
2. DNA cloning: A Practical Approach, D.M. Glover and B.D. Hames, IRL Press, Oxford. 1995.
3. Molecular and Cellular Methods in Biology and Medicine, P.B. Kaufman, W. Wu, D. Kim and L.J. Cseke, CRC Press, Florida, 1995.
4. DNA Science: A first course in Recombinant Technology, D.A. Mickloss and G.A. Freyer, Cold Spring Harbor Laboratory Press, New York, 1990.

Paper code and Name	PG71P203 CP 2.6 : Intermediary metabolism
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	To learn enzyme kinetics, detection and estimation of biomolecules, elements and hormones

PARTICULARS	Per week 4 hours
1. Qualitative analysis of Carbohydrates. 2. Qualitative analysis of Proteins. 3. Qualitative analysis of Amino acids. 4. Qualitative analysis of Lipids 5. Estimation of mineral elements (Na/P/K/Ca/Fe) 6. Determination of Salivary amylase activity 7. Extraction and estimation of vitamins: Thiamine or Niacin/Ascorbic acid or Vitamin-A 8. Estimation of lycopene 9. Estimation of plant hormone- IAA/Ethylene	

REFERENCES

1. S. Sadavasivam and A. Manikam (1992), Biochemical Methods for Agricultural Sciences. Wiley Eastern Lid, New Delhi.
2. Jayaraman (1968). Laboratory Manual for Biochemistry, Wiley Eastern Ltd, New Delhi.
3. Plummer D.T., (1977). An Introduction to Practical Biochemistry. Tata McGraw Hill, Bombay.
4. Dr.Palanivelu, (2001). Analytical Biochemistry and Separation Techniques- A Laboratory Manual for B.Sc. and M.Sc. Sudents.

Paper code and Name	**PG71T204A ET 2.7. MOLECULAR BIOLOGY TECHNIQUES (ELECTIVE)**
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	• The course is designed to non-genetics background students to understand basic principles of techniques applied in genetics and molecular biology. • The course discusses about the topics spanning from structure and function of nucleic acids to analytical techniques applied for nucleic acid analysis and modification viz. electrophoresis, PCR, nucleic acid detection and recombinant DNA techniques. • The course reveals computational biology and bioinformatics methodologies applied to interrogate genomes and proteomes.

PARTICULARS	Teaching Hours (Max. 50)
UNIT-I: Microscopy, Techniques, Ph and buffer	
- Sample preparation light microscopy, phase contrast microscopy, Electron microscopy. - Spectrophotometry, Fluorescence, Fluorescent microscopy, Confocal laser scanning microscopy, Flow cytometry, FACS. Radiochemistry-Scintallation Spectrophotometer, α -rays counter. - PH and Buffer: pH measurement, centrifugation-Analytical preparative differential, Differential gradient.	12 Hours
UNIT-II: Introduction to proteins, Immunogens	
- Levels of protein structure, protein denaturation; chromatography-introduction types membrane and detergents, electrophoresis/SDS PAGE- IEF and protein detection. Protein purification and sequencing. - Features, preparation, Antibodies- Immunoblotting, ELISA,	13 Hours

Immunoprecipitation monoclonal antibodies. -	
UNIT-III: Nucleic acids, Electrophoresis, Probes, PCR, Recombinant DNA.	
- Structure and isolation of DNA and RNA; modifying DNA-Nucleases, restriction enzymes. - Agarose and PFGE. Blotting and hybridization: Northern blots and Southern : blots. - Radioactive and non-radioactive labelling; - Quantitative PCR and types of PCR; - Vectors, ligation, identifying recombinants, expression of recombinant proteins, DNA sequencing.	12 Hours
UNIT-IV Genomics and proteomics	
- **Computational Biology or Bioinformatics: Sequence alignments pair-wise sequence alignment. Database searching, BLAST search** - **Initial identification and characterization protem identification, mixed peptide sequencing**	14 Hours
REFERENCES	
- Sambrook, J., Fritsch, E.F. and Meniates, T (2000): Molecular Cloning. CSHLPress.NY Glick. B.R., Pasternak J.J., 3rd Ed. (2003): - Molecular Biotechnology: Principles and Application of Recombinant DNA. ASM Press, Washington DC.	

Paper code and Name	**PG71T301 CT 3.1. GENETIC ENGINEERING**
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	• To expose students to the concept of genetic engineering including the techniques, applications in various industries like agriculture, food, health, environment etc. and its limitations. • To train students in strategizing research methodologies employing genetic engineering techniques.

PARTICULARS	Teaching

	Hours (Max. 50)
UNIT-I: General introduction to the concept of Genetic Engineering, Restriction Endonucleases, Cloning vectors.	
- Milestones in genetic engineering; Isolation of enzymes, DNA sequencing: synthesis and mutation, detection and separation, cloning, gene expression. Patenting of life forms, genetic engineering guidelines - Modification Methylases and other enzymes needed in genetic engineering - Plasmids and plasmid vectors, phages and phage vectors, phagemids, cosmids, artificial chromosome vectors (YAC, BAC, HAC), Animal virus derived vectors – SV40 and retroviral vectors.	12 Hours
UNIT-II: Molecular cloning, DNA analysis.	
- Recombinant DNA techniques, construction of genomic DNA and cDNA libraries, screening of recombinants.Expression strategies for heterologous genes. - labeling of DNA and RNA probes. Southern blotting and fluorescence in situ hybridization, DNA fingerprinting, chromosome walking.	13 Hours
UNIT-III: Analysis of gene expression, DNA Sequencing	
- Northern and Western blotting, gel retardation technique, DNA footprinting, Primer extension, S1 mapping, Reporter assays, RT-PCR and micro array. - chemical synthesis of oligonucleotides; techniques of *invitro* mutagenesis, Site-directed mutagenesis, gene replacement and gene targeting.Polymerase chain reaction and its applications.	13 Hours
UNIT-IV Use of transposons in genetic analysis, Applications of genetic engineering, Biosafety regulation:	
- Transposon tagging and its use in identification and isolation of genes - Transgenic animals, production of pharmaceuticals, gene therapy, disease diagnosis - Physical and Biological containment	12 Hours
REFERENCES	
1. Molecular Cloning: A laboratory manual, J. Sambrook, E.F. Fritsch and T. Maniatis. Cold Spring Harbor Laboratory Press, New York, 2000. 2. DNA cloning: A practical Approach, D.M. Glover and B.D. Hames, IRL Press, Oxford. 1995. 3. Molecular and Cellular Methods in Biology and Medicine P.B. Kaufman, W.Wu. D. Kim and L.J. Cseke, CRC Press, Florida, 1995 4. Methods in Enzymology, Guide to Molecular Cloning Techniques vol. 152. S.L. Berger and A.R. Kimmel,Academic Press Inc., San Diego, 1996. 5. Methods in Enzymology, vol. 185. Gene Expression technology D.V. Goeddel. Academic Press Inc. San Diego,1990. 6. DNA Science: A first course in Recombinant Technology, D.A. Mickloss	

and G.A. Freyer, Cold Spring Harbor Laboratory Press, New York. 1990.
7. Molecular Biotechnology 2nd Edn., S.B. Primrose, Blackwell Scientific Publishers Oxford, 1994.
8. Milestones in Biotechnology, Classic papers on genetic Engineering, J.A. Davies and W.S. Reznikoff-Butterworth Heinemann, Boston, 1992.
9. Route Maps in Gene Technology, M.R. Walker and R. Rapley, Blackwell Science Ltd. Oxford. 1997.
10. Genetic Engineering: An introduction to gene analysis and Exploitation in Eukaryotes, S.M. Kingsman and A.J.Kingsman, Blackwell Scientific Publications, Oxford, 1998.
11. Molecular Biotechnology-Glick

Paper code and Name	**PG71T302 CT 3.2. MICROBIAL GENETICS AND TECHNOLOGY**
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	• To understand metabolic regulation of various biochemical and physiological pathways in microbes and its application in metabolic engineering. • To understand biology and genetics of phages and its application. • To understand techniques involved strain improvement by mutagenesis, recombination and genetic engineering. • To understand fermentation technology and its application in industrial production.

PARTICULARS	Teaching Hours (Max. 50)
UNIT-I: Metabolic regulation in bacteria, Mutagenesis in bacteria	
- Microbial metabolism, catabolism, EMP, PP, ED, PK pathway in brief; TCA cycle, respiration and fermentation. Anabolism-biosynthesis of nucleic acids, proteins, peptidoglycan and lipids in brief. Metabolic regulation: Modification of enzyme activity, control of enzyme synthesis, mechanism of general regulation. Secondary metabolism and its control, non-ribosomal peptide synthesis, auto regulation, end-product regulation, inducible effects, nitrogen and phosphate regulation.Use of metabolic Inhibitors and tracer techniques in the investigation of metabolic pathways. - Isogenic strains, types of mutants- auxotrophic and antibiotic mutants; mutagenic agents and mechanism of action of mutagens; isolation and characterization of mutants, replica plating; reversion and suppression.	13 Hours
UNIT-II: Phage genetics, Fine structure analysis of gene	
- Phage genetic material, phage mutants. T4 phage and its life cycle. Genetic recombination and mapping in T4 phage Lambda phage-gene organization, lytic cycle, transcription, replication and recombination in lambda phage and non essential genes. Lysogeny-immunity and excision and other modes of lysogeny.Lambda phage and carcinogen	12 Hours

screening. - One gene one enzyme hypothesis. Argenine biosynthesis in *Neurospora*, colinearity between gene and protein Tryptophan synthase gene in *E. Coli*. Genetic analysis of rII region of T4 phage and cistron concept. .	
UNIT-III: Plasmid biology, Transposable genetic elements, Recombination in bacteria:	
- Types of plasmids, plasmids, isolation and purification of plasmid DNA, transfer of plasmid DNA, in vitro plasmid transfer, plasmid replication. Properties of F plasmid, R plasmid, Col plasmids, Ti plasmid, broad host range plasmids and other plasmids. - IS elements, detection of transposition, Transposition mechanism, and excision of transposons, phage mu, transposition and evolution. - Transformation biology of transformation, molecular mechanism, transformation mapping and other applications. Conjugation-F factor, Hfrtransfer and mapping.Recombination in recipient cells, Rec mutants-properties, rec protein and function. Transduction- generalized and specialized transduction, transduction and mapping and its role as cloning vehicle.	13 Hours
UNIT-IV Genetic improvement of industrial microorganisms, Industrial fermentation:	
- Screening selection and genetic improvement of industrial culture. Mutation and screening-random and rational screening.Use of recombinant DNA technology in SIP. Problem associated with SIOP. Improvement of character other than product.Importance of media in SIP. - Industrial fermentation and production of organic acids, aminoacids, antibiotics, alcohol, enzymes, polymers, biomass, solvents, steroids and vitamins. Recent advances in industrial products using microbes: Biosensors, biochips, biofertilizers, bioplastic and bioremediation, immobilized cells and enzymes.	12 Hours
REFERENCES	
References: 1. Maylor, S.R., Cronan, J.E., Freifelder, D. (1994): Microbial Genetics 2nd Edn. Jones and Bartlett Pub. Boston. 2. Hayes, W. (1968): Genetics of bacteria and their viruses, 2nd Ed. John Wiley and Sons N.Y. 3. Dale. J.W. (1994): Molecular genetics of bacteria, 2nd John Wiley and Sons N.Y. 4. Synder, L and Champness, W. (1997): Molecular genetics of bacteria ASM Press, Washinton. 5. Glazer, A.N.,andNikaido, H. (1995): Microbial Biotechnology, W.H. Freeman N.Y. 6. Stanbury, P.F. and Whitaker, A. (1984): Principles of fermentation Technology, Pergamon Press Ltd. London.	

Paper code and Name	PG71T303 CT 3.3. HUMAN GENETICS AND GENETIC COUNSELLING
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	• This course covers historical development of human genetics and its relationship with other biological science and medicine • To understand the pattern of polygenic and multi factorial diseases. • To understand the biochemical and molecular basis of human diseases like inborn errors of metabolism disorders, hemoglobin disorders and lysosomal storage disorders. • To understand principles, objectives and goals of genetic counselling.

PARTICULARS	Teaching Hours (Max. 50)
UNIT-I: Meaning and scope of Human Genetics, Patterns of monogenic inheritance, Patterns of polygenic and multifactorial inheritance	
- Historical development of human Genetics. Its relationship with other Biological sciences and medicine. - Pedigree construction Autosomal inheritance, sex linked inheritance. Other modes of inheritance- mitochondrial genes, genomic imprinting, uniparentaldisomy. - Continuous and discontinuous traits, Multifactorial threshold traits Pyloric stenosis, Neural tube defect. Congenital heart defects. Complex disorders of adult life.	12 Hours
UNIT-II: Human cytogenetics, Gene mapping and linkage analysis.	
- Normal human karyotype, sex chromosomes, chromosome preparation methods- Leucocyte culture, bone marrow, solid tissue, testicular and ovarian biopsies. Chromosome banding methods and nomenclature of chromosome bands.Autosomal abnormalities- abnormalities of chromosome number and structure.Sex chromosomal abnormalities. - Physical mapping of human genes- somatic cell genetics, mapping by gene dosage, FISH and high resolution mapping approaches. Detection and measurement of linkage in humans. Linkage maps and its applications. Human genome project- organizations and goals. Genome organization Nuclear and mitochondrial genome, gene families. Mapping strategies, current status. Human genome diversity and comparative genomics.	13 Hours
UNIT-III: Biochemical genetics, Genetics of Cancer.	
- Biochemical and molecular basis of human diseases. Inborn errors of metabolism- amino acid, carbohydrate and nucleic acid metabolisms. Haemoglobinopathies- globin gene mutation and genetic disorders. Lysosomal and other genetic disorders. - Forms of cancer, genetic basis and properties of cancer cells, clonal nature, oncogenes, tumor suppressor genes. Familial cancer, cancer cytogenetics, chemical and radiation carcinogenesis.	13 Hours

UNIT-IV Applied Human Genetics, Genetic Counseling	
- Prevention and cure of hereditary diseases: prenatal diagnosis and preimplantation diagnosis, amniocentesis, chorion villi sampling, ultrasonography, cytogenetic and biochemical analysis Genetic screening of hereditary diseases, gene therapy. DNA fingerprinting and paternity diagnosis. Eugenics. - Meaning, Objectives and goals. Process of genetic counselling, diagnosis, family history calculating the risk, discussing the options, genetic testing of children, carrier detection, ethical and legal aspects	12 Hours
REFERENCES	
1. Thompson, M.W., Mc. Innes, R.R., Willard, M.F. (1991), 5 Edn W.B. Saunders and Co. London. 2. ISCN (1995): An international system for human cytogenetic nomenclature. F. MitlemanKarger, Freiburg. 3. Mange, E.J. and Mange, A.P. (1999): Basic Human Genetics, 2 Ed. Sinauer Assoc. Inc. Mass. 4. Pasternak, S. (2000): Introduction to molecular human genetics, Fritzgarland. 5. Limoine, W.R. and Cooper D.NB (1996): Gene Trophy, Bios Scientific Pub. Oxford. 6. Snustad, D.P., and Simmons, M.J. (2003): Principles of Genetics 3" ed. John Wiley and Sons Inc. N.Y. 7. Conner, J.M. and Smith, MAF (2000): Essential Medical Genetics Blackwell Sci. Pub. Oxford.	

Paper code and Name	PG71P301 CP 3.4 : Genetic engineering
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	• To learn hands on isolation of gene, cloning, expression and analysis of recombinant protein using bacterial host. • To learn PCR, sequencing, and reporter gene assays

PARTICULARS	Per week 4 hours
1. Bacterial culture and antibiotic selection media. Preparation of competent cells 2. Isolation of plasmid DNA 3. Quantification of plasmid DNA 4. Agarose gel electrophoresis and restriction mapping of DNA 5. Construction of restriction map of plasmid DNA 6. Cloning in plasmid vectors 7. Preparation of single stranded DNA template 8. DNA sequencing 9. Gene expression in *E.coli* and analysis of gene product 10. PCR 11. Reporter gene assay (GUS/CAT/a-GAL) 12. Gene silencing (Demonstration using teaching kit)	

REFERENCES

1. Molecular Cloning: A laboratory manual, J. Sambrook, E.F. Fritsch and T.Maniatis. Cold Spring Harbor Laboratory Press, New York, 2000.
2. DNA cloning: A practical Approach, D.M. Glover and B.D. Hames, IRL Press, Oxford. 1995.
3. Molecular and Cellular Methods in Biology and Medicine P.B. Kaufman, W.Wu. D. Kim and L.J. Cseke, CRC Press, Florida, 1995.
4. Methods in Enzymology, Guide to Molecular Cloning Techniques vol. 152. S.L. Berger and A.R. Kimmel, Academic Press Inc., San Diego, 1996.
5. Methods in Enzymology, vol. 185, Gene Expression technology D.V. Goeddel. Academic Press Inc. San Diego, 1990.
6. DNA Science: A first course in Recombinant Technology, D.A. Mickloss and G.A. Freyer, Cold Spring Harbor Laboratory Press, New York. 1990.

Paper code and Name	PG71P302 CP 3.5: Microbial genetics and technology
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	• To learn hands on recombination and mutation in bacteria.

	• To learn fermentation techniques.

PARTICULARS	Per week 4 hours
1. Induction and characterization of mutants in bacteria 2. UV-dose survival curve in bacteria 3. Conjugation in bacteria 4. Isolation of plasmid 5. Transformation in bacteria 6. Microbial fermentation. 7. Microbiological assay of Vitamins. 8. Estimation of Vitamin C by 2,4-dinitro-phenyl hydrazine method. 9. Estimation of Vitamin A by calorimetric method. 10. Estimation of Calcium, Phosphorus and Iron. Estimation of Nitrogen by Microjeldahl's method. 11. Estimation of Lipids 12. Estimation of Carbon content 13. Analysis of water	

REFERENCES

1. Dale, J.W. (1994): Molecular genetics of bacteria, 2d John Wiley and Sons N.Y.
2. Glazer, A.N., and Nikaido,H. (1995): Microbial Biotechnology, W.H. Freeman N.Y.
3. Strepis and Yasbin (2001) Modern Microbial Genetics, Niley Ltd.

Paper code and Name	PG71P303 CP 3.6 : Human genetics and Genetic Counselling
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	To learn hands on about detection of inborn errors of metabolism, cancer and other genetic diseases by cytogenetic, molecular, and biochemical methods.

PARTICULARS	Per week 4 hours
1. Detection of inborn errors of metabolism. 2. Identification of ABO and Rh blood group alleles. 3. Estimation of Hemoglobin 4. Estimation of Lipid Profile (HDL, LDL, VLDL). 5. Culture of human leucocytes and chromosomal preparations 6. Human Karyotyping 7. Chromosomal abnormalities in some human syndromes 8. Cytogenetic characterization of cancerous cells 9. In vitro fertilization and embryo transfer (demonstration) 10. Genetic counseling methods based on case history.	

11. Assessment of inheritance of quantitative characters.
12. Study of sex chromatin in humans.

REFERENCES

1. ISCN (1995): An international system for human cytogenetic nomenclature, F. MitlemanKarger, Freiburg.
2. Mange, E.J. and Mange, A.P. (1999): Basic Human Genetics, 2nd Ed. Sinauer Assoc. Inc. Mass.
3. Pasternak, S. (2000): Introduction to molecular human genetics, Fritzgarland. Limoine, W.R. and Cooper,D.NB (1996): Gene Trophy, Bios Scientific Pub. Oxford.
4. Snustad, D.P., and Simmons, M.J. (2003): Principles of Genetics 3d ed. John Wiley and Sons Inc. N.Y.
5. Conner, J.M. and Smith, MAF (2000): Essential Medical Genetics Blackwell Sci. Pub. Oxford.
6. Stacy L Blachford (Editor) (2001). The Gale Encyclopedia of Genetic Disorders. Gale Group Publishers, Vol. 1 (A-L), Vol. II (M-Z)

Paper code and Name	**PG71T401-CT 4.1. Bioinformatics**
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	• Recall the basic concepts of atomic structure and explain the fundamental principles and origin of spectral lines • Provide an overview of various bioinformatics tools, databases available and sequence analysis. • Provide knowledge on database concept, management, retrieval along with utilization in gene and protein analysis. • Impart basic knowledge of patenting, intellectual property rights, laws available and copyrights.

PARTICULARS	Teaching Hours (Max. 50)
UNIT-I: Information Theory and Biology, Biological Databases.	
- Concepts of probability, joint probability, conditional probability. Shannon Entropy and Information, Mutual information, Information theory, Bayes theorem, Markov chains, Hidden Markov Models, applications to DNA and protein sequences. - Introduction. Construction, file formats, contents, search and retrieval tools of various biological databases: GenBank, SwissProt, Protein Data	13 Hours

Bank, PubMed, Online Mendelian Inheritance in Man, Species 2000, KEGG pathway database, Gene Expression Omnibus, prosite, BLOCKS, Stuctural Classification of Proteins (SCOP) Database.	
UNIT-II: Sequence alignment	
- Pair wise Sequence Alignment and database sequence similarity search: Meaning of Sequence alignment, pairwise sequence alignment, Global alignment, Local Alignment, Dynamic Programming Method, Needleman Wunsch algorithm, Smith - Waterman algorithm, Substitution matrices - Unitary matrix, PAM and BLOSUM matrices, Gap penalties, Evolutionary basis and significance of sequence alignment. Sequence similarity search methods for DNA and protein sequences, their significance. - FASTA- Algorithm, Parameters, Output and interpretation of results, Versions of FASTA. b. BLAST - Parameters, Output and interpretation of results, Versions of Algorithm, BLAST. c. PSI-BLAST and PHI-BLAST. -	12 Hours
UNIT-III: Multiple Sequence Alignment, Molecular Phylogenetics.	
- Meaning of Multiple Sequence Alignment, Global Multiple Sequence Alignment: Progressive Alignment method CLUSTALW. Local Multiple sequence Alignment: Profile Analysis, Block Analysis. Significance of Multiple Sequence Alignment. Multiple Sequence Alignment editors: JalView, GeneDoc, CLUSTALX, Boxshade. - Meaning of phylogenetic analysis. Relationship between Multiple Sequence Alignment and Phylogenetic Analysis. Meaning and significance of evolutionary trees. Methods of phylogenetic prediction: Distance based methods: Fitch Margoliash method, Neighbor joining method, Unweighted pair group method with arithmetic mean. Maximum Parsimony method, Maximum Likeihod method. Reliability of phylogenetic predictions, uses of phylogenetic analysis. - Commonly used phylogenetic analysis programs: PHYLIP and PAUP	12 Hours
UNIT-IV Genome Databases and Genome Analysis, Protein Structure Prediction	
Genomic sequence databases; GOLD, human genome sequence	12 Hours

database, Mouse Genome database, Arabidopsis genome resource, E.coli genome database.Genome sequence analysis. Principle, salient features and drawbacks of methods of gene prediction/gene modeling: GRAIL, GENEMARK, GLIMMER. Promoter prediction methods. salient features and drawbacks of methods of genome comparison: MUMMER, significance ot comparative genomics. Microarrays: Principle, construction and applications. Principle, salient features and drawbacks of methods of prediction of protein secondary structure: Chou-Fasman, GOR, PSI-PRED, PROF, PHD. Principle, salient features and drawbacks of methods of prediction of tertiary structure of proteins: Comparative protein modeling, threading and ab initio structure prediction. -	

REFERENCES

1. Durbin, Eddy, Krogh and Mitchinson (2004): Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids. Allied Publishers
2. Nucleic Acids Research, Database Issue, Oxford University Press. 15th January every year.
3. David W. Mount (2005): Bioinformatics Sequence and Genome Analysis, 2 Edition. Cold Spring Harbor Laboratory Press, USA / CBS Publishers, India.
4. Silberschatz, Korthand Sudarshan (2005): Database Concepts, 4th Edition.
5. TA Brown (2003): Genomes. John Wiley and Sons Publishers.

Paper code and Name	**PG71T402-CT 4.2. IMMUNOGENETICS AND IMMUNOTECHNOLOGY**
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	• To provide overview of immune system, antigen, antibody structure and interactions. • Understanding of innate and adaptive immunity along with major cells and

	molecules involved. • To integrate immunology with health and enrich the knowledge for autoimmune disorders, • To study hypersensitivity reaction, MHC and serological reactions

PARTICULARS	Teaching Hours (Max. 50)
UNIT-I: Introduction, Cells and Organs of Immune system, Antigens.	
- Phylogeny of Immune system, innate and acquired immunity, clonal nature of immune response. - Hematopoiesis, Immune system cells: Lymphoid cells, Mononuclear cells,Granulocytic cells; organs of the immune system, primary and secondary lymphoid organs, B-Cell receptor - Factors that influence immunogenecity, epitope Properties of B-Cell epitope and T-cell epitope (Eptope)	14 Hours
UNIT-II: Immunoglobulin Genes, Immune response to infectious diseases	
- Genetic model compatible with Ig structure, mutagenic organization of Ig genes, Gene arangements, Generation of antibody diversity, expression of Ig genes, regulation of Ig gene transcription - Viral, Bacterial and Protozoan diseases: Autoimmunity. Immunodeficiency diseases, Phagocytic, Humoral, Cell-mediated and combined immunodeficiency. .	12 Hours
UNIT-III: Immune systems and AIDS, Transplantation immunology.	
- The immune system in AIDS, HIV, diagnosis of HIV infection and AIDS, immunologicalabnormalities in AIDS, development of an AIDS vaccine. - Immunological basis of graft rejection, MHC and HLA polymorphism tissue typing, general - and specific immunosuppressive therapy; Cancer and lmmune system: tumors of the immune system, tumor antigens, Immune response to tumor, cancer immunotherapy.	12 Hours
UNIT-IV Immunotechnology	
- Introduction, production of polyclonal and monoclonal antibodies,	12 Hours

engineered antibodies: purificationand fragmentation of immunoglobins; imunoprecipitation, labeling antibodies; immunoblotting and immunoassay; immunohistocytochemistry	
REFERENCES	
References: 1. Immunology, Janis Kuby,3" ed. W.H. Freeman and Co., (1997) 2. KubyImmunololgy, 4h ed., R.A. Goldsby, Thomas. J. Kindt, Barbara A. Osborne (Freeman) 3. Immunology, A short Course, 4 ed, Eli Benjamin, Richard Coico, Geoffrey Sunshine (Wiley-Liss) 4. Fundamentals of Immunology, William Paul. 5. Immunology by Roitt and others.	

Paper code and Name	PG71T403-CT 4.3. MOLECULAR DIAGNOSIS AND MOLECULAR MEDICINE
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	• Recall the basic concepts of discovering human disease genes, cloning human disease genes • Provide an overview of various techniques like PCR, Protein blotting techniques, reverse line blotting, hybridization probs, DNA finger printing etc., • Provide knowledge on molecular cytogenetics, molecular diagnosis of genetic diseases, concept and perspectives of molecular medicine.

PARTICULARS	Teaching Hours (Max. 50)
UNIT-I: Introduction to Molecular Basis of Diagnosis, DNA Diagnostic Systems.	
- Discovering human disease genes, cloning human disease genes. Functionaland, positional cloning of candidate gene - Polymerase Chain Reaction (PCR) Techniques, DNA, RNA and Protein blotting, Reverse lineblotting, Hybridization probes, non radioactive hybridization procedures, molecular beacons, DNA fingerprinting, SingleNucleotide Polymorphisms (SNP), Restriction Fragment Length Polymorphisms (RFLP), Randomly Amplified PolymorphicDNA (RAPD), Pedlock probes, genotyping with fluorescence labelled PCR primers. DNA micro-array.	14 Hours
UNIT-II: Molecular Diagnosis of Genetic disease	
- Direct detection of nmutations in Human disease genes-Single strand conformation,polymorphism analysis, Sensitive conformation gel electrophoresis., Denaturing Gradient Gel Electrophoresis, Heteroduplexanalysis, Chemical mismatch cleavage., Direct DNA sequencing, Protein truncation test, Linkage analysis. Examples-SickleCell anaemia, Hemophilia etc.	12 Hours
UNIT-III: Molecular Cytogenetics, Applications of FISH	
- Basic Principles of FISH, Steps in typical FISH procedure, signal amplification procedure, othersystems of FISH: Comparative Genomic Hybridization (CGH) Molecular FISH, Primed insitu hybridization (PRINS) and Insitu PCR. - Probes hybridizing to unique sequences Prader Willi syndrome,	13 Hours

Angleman syndrome, translocations.(Probes hybridizing to entire chromosomes) Chromosomes painting, chromosome insitu suppression (CISS), reverse painting.	
UNIT-IV Concepts and perspectives of molecular Medicine	
- Basic Biochemistry, Molecular Biology and Genetics relevant to Molecular Medicine. Human Genome: Implications and applications Gene Therapy as a potential tool to cure human diseases. Recombinant molecules inmedicine. Transgenic and knockout animal models. Stem cell research and its application in human health. Intellectual property Right (IRP) Issues and Ethical Legal, and Social (ELSI).	12 Hours
REFERENCES	
1. Gelehrter R.D., Collins F.S. and Ginsburg D. (1998) Principles of Medical Genetics, Baltimore, Williams and Wilkins 2. Kingston H.(1994) An ABC of Clinical Genetics, London, BMJ publishing. 3. Thompson M. and Mcinnes J. (1998) Genetics in Medicine, Philadelphia, Saunders 4. King R.A., Rotter J.I. and Motulsky A.G. (1992) The Genetic Basis of common diseases Oxford, Oxford University Press 5. Jameson, L.J. (ED) (1998) Principles of Molecular Medicine, New Jersey, Humana. 6. Strachan T. and Reid A.P (1996) Human Molecular Genetics, Oxford Bios. 7. Trent R.J., (1997) Molecular Medicine an Introductory Text. Edinburg Churchill Livingstone. 8. Krawczak M. and Schmidtke J. (1994) DNA Fingerprinting, Oxford, Bios. 9. Desnick R.J. (ed.) (1991) Treatment of Genetic diseases.London, Churchill Livingstone Report on the Ethics or Gene Therapy (1992) London. HMSO. A clear and simple review covering the general principles as well as the ethics	

Paper code and Name	PG71P401- CP 4.4 : Bioinformatics
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	• To learn hands on about how to search literature, nucleic acid and protein sequences using various databases. • To learn hands on about retrieval, alignment, comparison, structure prediction and phylogenetic analysis of nucleic analysis and proteins. • To learn molecular docking techniques.

PARTICULARS	Per week 4 hours
1. Literaturedatabasesearch: Pub Med. (I Session) 2. Database search and retrieval using keywords:GenBank,WISS-FrOL, PDB, OMIM, KEGG, GEO, ProSite, GOLD (4 Sessions) 3. Pairwise sequence alignment: using GAP and SIM algorithms, (I Session) 4. Sequence search and retrieval using BLAST, ((Session) 5. Sequence search and retrieval using FASTA, (I Session) 6. Multiple sequence alignment: Using CLUSTAL W. (I Session) 7. Phylogenetic analysis using Phylip or PAUP (1 Session) 8. Gene prediction using algorithms like GRAIL, GLIMER, GENEMARK, (1I Session) 9. Genome comparison using MUMMER (I Session) 10. Protein Structure prediction using algorithms like GOR, PSI-Pred, PROF, PHD.(I Session)	
REFERENCES	
1. Durbin, Eddy, Krogh and Mitchinson (2004): Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids. Allied Publishers. 2. Nucleic Acids Research, Database Issue, Oxford University Press. 15t January every year.	

3. David W. Mount (2005):Bioinformatics Sequence and Genome Analysis, 2nd Edition. Cold Spring Harbor Laboratory Press, USA / CBS Publishers, India.

Paper code and Name	PG71P402- CP 4.5: Immunogenetics and immunotechnology
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	To learn techniques used in immunology *viz.* antibody purification, detection, antigen-antibody interaction and immunodiagnostic techniques.

PARTICULARS	Per week 4 hours
1. Blood film Preparation and identification of cells 2. Lymphoid organs and their structured organization 3. Immunization, collection of serum 4. Double diffusion and immuno- electrophoresis 5. Radial immuno diffusion 6. Purification of IgG from serum 7. Separation of mononuclear cells by Ficoll- Hypaque method 8. Con-A induced proliferation of thymocytes (by MIT method) 9. Western-blotting 10. ELISA 11. Hapten conjugation and quantitization 12. Immunodiagnostics (demonstration using commercial kits)	
REFERENCES	
1. Gordon J.R., (1998). A Practical Guide to Cellular and Molecular Methods in Immunology. Gordon Publishers.	

Paper code and Name	PG71P403-CP 4.6 : Molecular Medicine and molecular diagnosis
COURSE OUTCOMES (COs)	
After completing this paper, the students will be able to:	
CO	To learn hands on about molecular diagnosis of infectious diseases, hemoglobinopathies and human DNA fingerprinting.

PARTICULARS	Per week 4 hours
1. Polymerase Chain Reaction (PCR) 2. Detection of HIV in serum (ELISA Method) 3. Detection of HIV using PCR primers. 4. Detection of HPV using InnoLipa Kit method 5. Detection of Hemophilia and Sickle cell anemia mutations by SSCP/SCGE 6. Human DNA fingerprinting.	

7. FISH demonstration.

REFERENCES

1. Molecular Cloning: A laboratory manual, J. Sambrook, E.F. Fritsch and T.Maniatis. Cold Spring Harbor Laboratory Press, New York, 2000.