



Parvatibai Chowgule College of Arts and Science
(Autonomous)

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Best Affiliated College-Goa University Silver Jubilee Year Award



**POST GRADUATE DIPLOMA PROGRAMME IN
CLINICAL GENETICS AND MEDICAL
LABORATORY TECHNIQUES
(PGDCG&MLT)**

2022-2023

POST GRADUATE DIPLOMA PROGRAMME IN CLINICAL GENETICS AND MEDICAL LABORATORY TECHNIQUES

COURSE DESCRIPTION:

Overall the course is designed to provide a strong foundation in all areas of Human genetics and medical lab techniques with opportunities for hands-on laboratory and clinical experience. The curriculum includes lectures, practicals, classroom discussions and intensive practical training (Internship). The Objective of the courses is to enable the students in having job opportunities in Research and Development and in medical field. The course syllabus is designed considering the need for trained technicians and technologists in the genetic and pathological field. This self financed, job oriented course will meet the demand for genetic and pathological technicians in diagnostic labs and hospitals.

ELIGIBILITY FOR ADMISSION:

To be eligible for admission to the programme leading to the award of Post Graduate Diploma in Clinical Genetics and Medical Laboratory Techniques/ Certificate Programme, the candidate must have passed the Bachelor's Degree examination of this University or the equivalent examination of any other recognized University, securing a minimum of 45% marks on aggregate or equivalent Grade or as specified for a specific Programme in Biological Science (Science graduate with Zoology, Microbiology, Biotechnology -6 units / or 3 units).

CAPACITY:

Admission is open for 15 candidates (maximum).

COURSE DURATION:

Duration for the PG Diploma in "Clinical Genetics and Medical Laboratory techniques" is a two semester programme followed by Hands on training in Clinical Laboratories / Pathology Lab / Genetic Lab for a period of three months equivalent to 240 hours.

COURSE STRUCTURE:

The PG Diploma is a two semester programme followed by A student shall be eligible for the award of Post-Graduate Diploma on successful completion of 32 Credits. 08 Credits of Internship is compulsory besides Core and elective Courses. Ordinarily a Diploma Programme shall consist of eight courses with four courses per semester.

One (1) Credit (Theory) shall be equivalent to 15 clock hours of contact teaching. One (1) Credit (Practical) shall be equivalent to 30 clock hours of contact teaching. A student shall obtain 20 credits from Core Courses and 20 Credits from elective courses, which includes 08 credits of Internship/Hands on training.

COURSE EVALUATION:

To pass PGD programme in Clinical Genetics and Medical Laboratory Techniques, candidate shall secure a minimum of 40% marks in theory as well as practical component of each course / paper separately, and followed by Hands on Training. The final grade shall be computed based on the candidate's best performance in the minimum number of credits required for the award of the Diploma. 08credits, of internship, shall be depicted in the form of grade in the final mark sheet. The assessment of the Courses shall be based on the examination at the end of each semester. The examination shall consist of comprehensive written exam (theory) or a comprehensive laboratory examination (practicals) and continuous assessments for theory and practicals. The examination of the Core/elective Courses shall carry maximum of 100 marks (Theory = 50 mks, Practical = 50 mks). Continuous assessment and semester end examination for theory with be 40:60 weightage. Practical assessment will consist of continuous assessment and semester end comprehensive laboratory examination with 50:50 weightage.

A report is to be submitted by the candidate after completion of the internship/hands-on training. Submission may be in the form of a report or Portfolio which shall be evaluated for 200 marks and indicated as grades. Every student shall have to secure a minimum of 'P' grade to pass the Course.

COURSE STRUCTURE
POST GRADUATE DIPLOMA PROGRAMME IN CLINICAL GENETICS AND MEDICAL
LABORATORY TECHNIQUES (PGDCG&MLT)

SEMESTER	COURSE CODE	CORE COURSES	ELECTIVE COURSES (Any One)	NUMBER OF CREDITS	CONTACT HOURS	MARKS
SEMESTER I	PGD-CGMLT-C1	Clinical Genetic Techniques I		Theory = 02 Practical = 02	Theory = 30 Practical = 60	Theory = 50 Practical = 50
	PGD-CGMLT-C2	Clinical Biochemistry I		Theory = 02 Practical = 02	Theory = 30 Practical = 60	Theory = 50 Practical = 50
	PGD-CGMLT-C3	Clinical Microbiology (General and Systemetic)		Theory = 02 Practical = 02	Theory = 30 Practical = 60	Theory = 50 Practical = 50
	PGD-CGMLT-E1		Clinical Pathology and Histopathology	Theory = 02 Practical = 02	Theory = 30 Practical = 60	Theory = 50 Practical = 50
	PGD-CGMLT-E2		SWAYAM course: Analytical Techniques	Theory = 04 credits	Swayam Online	Theory = 100
	PGD-CGMLT-E3		SWAYAM course: Essentials Of Biomolecules: Nucleic Acids And Peptides	Theory = 04 credits	Swayam Online	Theory = 100
SEMESTER	COURSE CODE	CORE COURSES	ELECTIVE COURSES (Any 02)	NUMBER OF CREDITS	CONTACT HOURS	MARKS
SEMESTER II	PGD-CGMLT-C4	Clinical Genetic Techniques II		Theory = 02 Practical = 02	Theory = 30 Practical = 60	Theory = 50 Practical = 50
	PGD-CGMLT-C5	Clinical Biochemistry II		Theory = 02 Practical = 02	Theory = 30 Practical = 60	Theory = 50 Practical = 50
	PGD-CGMLT-E4		Clinical Parasitology, Mycology and Virology	Theory = 02 Practical = 02	Theory = 30 Practical = 60	Theory = 50 Practical = 50
	PGD-CGMLT-E5		Hematology and Transfusion Medicine	Theory = 02 Practical = 02	Theory = 30 Practical = 60	Theory = 50 Practical = 50
	PGD-CGMLT-E6		SWAYAM course- Biomolecules: Structure, Function In Health And Disease	Theory = 04 credits	Swayam Online	Theory = 100
	PGD-CGMLT-E7		SWAYAM course- Immunology	Theory = 04 credits	Swayam Online	Theory = 100
Internship (Elective)	03-06 months internship at Hospital/Clinics.			08 credits		Report/Portfolio = 100

COURSE SYLLABUS: SEMESTER I

(03 Core + 1 Elective course)

Semester 1:

Core courses:

1. Clinical Genetic Techniques I
2. Clinical Biochemistry I
3. Clinical Microbiology (General and Systemic)

Elective courses (Any one)

1. Clinical Pathology and Histopathology
2. SWAYAM course: Analytical Techniques
3. SWAYAM course: Essentials Of Biomolecules: Nucleic Acids And Peptides

CORE COURSE: CLINICAL GENETICS- I	
COURSE CODE:	PGD-CGMLT-C1
MARKS:	100 [50 – Theory : 50 – Practical]
CREDITS:	04 [02 – Theory : 02 – Practical]
CONTACT HOURS	THEORY :30 HOURS (02 LEC/WEEK) PRACTICALS :60 HOURS (02 PRACTICAL / WEEK)
COURSE OBJECTIVES:	<ul style="list-style-type: none"> • Acquaint students with recent genetic techniques • Know about the structure and function of genetic material • Learn about structural and numerical abnormalities their inheritance pattern and pedigree analyses.
COURSE OUTCOME	<p>On completion of the course the student should be able to:</p> <p>CO 1: Understand the functions of the genetic material.</p> <p>CO 2: Correlate genetic mutations to diseases in human population.</p> <p>CO 3: Perform Karyotyping using software.</p> <p>CO 4: Construct and analyse human pedigrees.</p>

PGD-CGMLT-C1:CLINICAL GENETICS I		
MODULE	TOPICS	CONTACT HOURS
Module 1: Introduction to Human Genetics	<ul style="list-style-type: none"> • Growth of human genetics; levels of genetics. • Structure and composition of the human chromosome: basic structure of DNA; molecular structure and organisation. • Classification of Human chromosomes: Paris nomenclature / ISCN; methods of studying chromosomes; identification of individual chromosomes; Flow Karyotyping (Quantification on DNA of individual chromosomes); FACS – Fluorescence activated cell sorter. 	10
Module 2: Chromosomal Abnormalities	<ul style="list-style-type: none"> • Numerical abnormalities (somes; ploidies; mosaic; chimera; syndromes.) • Structural: Translocations; Deletions; Duplications; Inversion; isochromosomes; Ring chromosomes; causes for genetic abnormalities-meiotic and mitotic nondisjunction; uniparental disomy; mutations; single gene disorders. 	10
Module 3: Pattern Of Inheritance	<ul style="list-style-type: none"> • Autosomal Dominant, Autosomal Recessive, X-linked Dominant, X-linked Recessive, Y-linked, sexlimited inheritance, sex influenced inheritance, X inactivation, Multifactorial inheritance, mitochondrial inheritance, imprinting 	10

PRACTICAL COMPONENT OF PGD-CGMLT-C1: CLINICAL GENETICS I
[DURATION – 04HRS/WEEK]

Practical	No. of Practicals
Lab Based Practical works: <ol style="list-style-type: none"> 1. Specimen procurement and logging for cytogenetic procedure. (01 practical) 2. Sterilization of requirements required for culture media preparation. (01 Practical) 3. Culture media preparation & sterilization by filtration method. (01 Practical) 4. Identification of Chromosomes. (02 Practicals) 5. Inoculation of Lymphocyte culture/peripheral blood culture. (01 practical) 6. Harvesting of Lymphocyte culture to obtain metaphase plates. (02 Practicals) 7. Chromosomal banding technique: GTC Banding. (02 Practicals) 8. Karyotyping of Human chromosomes: (03 practical) <ul style="list-style-type: none"> - use of Cytovision / any other Karyotyping software - Microphotography - Image capturing, image processing, and analysis 9. Study of Karyotypes: Normal male and female(2 practical) 	15
Activity Based Practical Works: <ol style="list-style-type: none"> 1. Application of banding techniques in detection of human disorders. (02 Practical). 2. Application of different types of Medias used for genetic analysis. (02 Practicals). 3. Construction of Pedigree(02 Practicals). 4. Analysis of pedigree charts to determine the mode of inheritance(03 practicals). 5. Case Studies: Pedigree analysis (06 Practicals) <ul style="list-style-type: none"> - Haemophilia, - Color blindness, - Duchenne Muscular Dystrophy (DMD), - Achondroplasia - PKU. - Cystic Fibrosis 	15

REFERENCE BOOKS:

1. Jorde L, Carey J and Bamshad M (2016). Medical Genetics. Fifth edition. Elsevier Publication imprint. eBook ISBN: 9780323391979.
2. Singh BD (2014): Fundamentals of Genetics. Second Edition, Kalyani Publishers, New Delhi.
3. Matheiesen A and Roy K (2018). Foundation of Perinatal Genetic counseling. eISBN: 9780190681111
4. Gardner EJ, Simmons MJ and Snustad DP (2013): Principles of Genetics, Eighth Edition, John Wiley Publication, Singapore
5. De Robertis EDP, De Robertis EMF (2012): Cell and Molecular Biology, Eighth Edition. Wolter Kluwer Publication, Philadelphia.
6. Thompson JS, Thompson MW (1966): Thompson & Thompson Genetics in Medicine, Elsevier Publication, Philadelphia.

REFERENCE BOOKS FOR PRACTICALS:

7. Arumuga N, Meyyan RP (2016): Advances in Genetics Volume 1 (Dr. N. Arumugam, R P Meyyan, Saras Publication, Nagercoil, Tamil Nadu.
8. Gardner A and Davies T (2010) Human Genetics 2nd Edition, Viva books publication, Delhi.

CORE COURSE: CLINICAL BIOCHEMISTRY I	
COURSE CODE:	PGD-CGMLT-C2
MARKS:	100 [50 – Theory : 50 – Practical]
CREDITS:	04 [02 – Theory : 02 – Practical]
CONTACT HOURS	THEORY :30 HOURS (02 LEC/WEEK) PRACTICALS :60 HOURS (02 PRACTICALS / WEEK)
COURSE OBJECTIVES:	<ul style="list-style-type: none"> • Understanding concepts of human cell organization for further study of its role in metabolic functions • Study of chemistry of various body enzymes, vitamins, minerals, carbohydrates, proteins and lipid for further estimation of the same from blood and body fluid samples such as urine etc.
COURSE OUTCOME	<p>On completion of the course the student should be able to:</p> <p>CO 1: Explain the chemical organization of cells</p> <p>CO2: Compare and contrast the chemistry of biomolecules.</p> <p>CO 3:Perform quantitative and qualitative tests for biomolecules.</p> <p>CO4: Estimate enzymes and minerals from serum.</p>

PGD-CGMLT-C2:CLINICAL BIOCHEMISTRY I		
MODULE	TOPICS	CONTACT HOURS
Module 1: The scope of biochemistry	<ul style="list-style-type: none"> • Chemical organization of the cell. • Organic and inorganic components of the cell. • Marker enzymes of the cell. • Hydrogen ion concentration and buffers: pH • Blood buffers, regulation of blood pH. • Acid base metabolism. 	10
Module 2: Carbohydrate,Proties,Lipid (Chemistry)	<ul style="list-style-type: none"> • Carbohydrate chemistry. • Protein chemistry. • Lipid chemistry. 	10
Module 3: Enzymes, Vitamins and Minerals)	<ul style="list-style-type: none"> • Enzymes: Definition, classification, factors affecting enzyme action. • Enzyme inhibition, • Isoenzymes, • Regulation of enzyme activity. • Vitamins. • Minerals. 	10

PRACTICAL COMPONENT OF PGD-CGMLT-C2: CLINICAL BIOCHEMISTRY I
[DURATION – 04 HRS/WEEK]

Practical	No. of Practicals
Lab Based Practical works: <ol style="list-style-type: none"> 1. Estimation of pH. Use of pH meter. 2. Estimation of haemoglobin by 'cyanmethhaemoglobin' 3. Qualitative and quantitative Carbohydrate chemistry (02 Practicals) 4. Qualitative and quantitative Protein chemistry (02 Practicals) 5. Qualitative and quantitative Lipid chemistry (02 Practicals) 6. Estimation of chloride in serum (02 Practicals) 7. Estimation of serum calcium (02 Practicals) 8. Estimation of serum inorganic phosphorus. 	15
Activity Based Practical Works: <ol style="list-style-type: none"> 1. Estimation of serum Na⁺/ K⁺ ions by Flame photometer-Demonstration 2. Separation of amino acid and its identification by paper chromatography -Demonstration. 3. Case studies: <ul style="list-style-type: none"> - Diabetes - Atherosclerosis - Cardiac arrest - Calcium deficiency - Salts in normal functioning of the body 	15

REFERENCE BOOKS:

1. Lieberman MA and Ricer R(2019). BRS Biochemistry, Molecular Biology, and Genetics. WolterKulver Publication.
2. Nelson DL and Cox MM(2019). Lehninger Principles of Biochemistry, Seventh edition. Wiki publications.
3. Panini RS(2013). Medical biochemistry – an illustrated review. Thieme Medical Publishers, New York.
4. Vasudevan DM(1995): Textbook of Biochemistry for medical student's first edition: Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi.
5. Vasudev DM(2013): Textbook of Biochemistry for medical student's seventh edition Jaypee Medical Publishers Pvt Ltd, New Delhi.
6. Sood R (1999) fifth edition: Medical Laboratory Technology, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi.
7. SoodR(1985) first edition: Medical Laboratory Technology, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi.

REFERENCE BOOKS FOR PRACTICALS:

8. Mukherjee KL (1988) Volume II: Medical Laboratory Technology, Tata McGraw-Hill Publishing Company Ltd. New Delhi.
9. KamatG(2011). Practical manual of Hematology. Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi.

CORE COURSE: CLINICAL MICROBIOLOGY (GENERAL AND SYSTEMATIC)	
COURSE CODE:	PGD-CGMLT-C3
MARKS:	100 [50 – Theory : 50 – Practical]
CREDITS:	04 [02 – Theory : 02 – Practical]
CONTACT HOURS	THEORY :30 HOURS (02 LEC/WEEK) PRACTICALS :60 HOURS (02PRACTICALS / WEEK)
COURSE OBJECTIVES:	<ul style="list-style-type: none"> • Hands on training on preparation of culture medias for isolation of bacterias from blood or body fluid samples provided. • To be aware of diagnostic features of bacteria for reporting the correct results observed after analyses using definite proceddures • Learning about the advanced techniques used in recent time to obtain better and faster results to provide immediate treatment.
COURSE OUTCOME	<p>On completion of the course the student should be able to:</p> <p>CO 1: Explain the basis of bacterial culture and identification.</p> <p>CO2: Correlate the microbial techniques with clinical conditions in humans.</p> <p>CO 3: Perform various staining techniques and tests for microbial analysis</p> <p>CO4: Process body samples to detect pathogenic bacteria.</p>

PGD-CGMLT-C3: CLINICAL MICROBIOLOGY (GENERAL AND SYSTEMATIC)		
MODULE	TOPICS	CONTACT HOURS
Module 1: Introduction to microbiology	<ul style="list-style-type: none"> • Historical prospective, principle of microbiology, microscopes (types and uses) • Bacteria: Classification, anatomy, reproduction, growth and nutrition. • Sterilization: - methods employed, both physical and chemical. • Media used in Microbiology: - Classification, types, constituents, methods of preparation, adjustment of pH, sterilization. 	10
Module 2: Serology	<ul style="list-style-type: none"> • Serology: Antigen, antibody, antigen-antibody reaction. • Newer methods of diagnosis: PCR, Bactec, Flow cytometry. 	10
Module 3: Systemic (Individual Bacteria)	<ul style="list-style-type: none"> • Systemic (Individual Bacteria): Diagnosis features (morphology, cultured characters, biochemical reaction,, antigenic characters, pathogenicity and laboratory diagnosis) of Staphylococcus, Streptococcus, Pneumococcus, Neisseria, Corynebacteria, Clostridia, Escherichia coli, Klebsiella species, Salmonella, Shigella, Proteus, Pseudomonas, Mycobacterium tuberculosis, Treponema pallidum. 	10

PRACTICAL COMPONENT OF PGD-CGMLT-C3:CLINICAL MICROBIOLOGY
(General and Systematic)
[DURATION – 04 HRS/WEEK]

Practical	No. of Practicals
Lab Based Practical works: <ol style="list-style-type: none"> 1. Preparation of smears for staining and fixation from samples and culture media (both liquid and solid media). 2. Care and use of microscopes (including Fluorescent microscope). 3. Staining techniques: (Gram staining, zeihl nelson, Fluorescent method): preparation of satins, procedure, reporting of smears, principle involved (02 Practicals). 4. Equipments used in sterilization: Description (structure), working principle involved, articles sterilized, advantages and disadvantages. 5. Widal, VDRL, RPR. 6. Culture media: types, constituents of each media, method of preparation, adjustment of pH, sterilization, uses. (02 Practicals). 7. Culture techniques: different methods of inoculation from clinical samples and bacterial growth from media. (02 Practicals). 8. Preparation of wet mount and motility of organisms. 9. Sputum examination: Physical examination, wet preparation, smear examination, concentration techniques for mycobacteria. 	15
Activity Based Practical Works: <ol style="list-style-type: none"> 1. Systemic bacteriology: Practical demonstration of diagnostic features of <ol style="list-style-type: none"> i. Gram positive organisms. ii. Gram negative organisms. iii. Anaerobes, spirochetes. iv. Mycobacteria. 2. Case studies <ol style="list-style-type: none"> i. Meningitis ii. Gonorrhea iii. Tetanus iv. Botulinum v. Tuberculosis vi. UTI vii. Food poisoning viii. Pneumonia 	15

REFERENCE BOOKS:

1. Wilson J(2000). *Clinical Microbiology*. Eighth edition, Elsevier Publication. Bailière Tindall imprint.
2. Willey JL(2017). *Prescott's Microbiology*. 10 edition. McGraw-Hill Education / Europe, Middle East & Africa;
3. Firkin F (1958) *Clinical Haematology*: Blackwell publishings, Wiley India
4. Ramnik Sood (1985) first edition: *Medical Laboratory Technology*, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi.
5. Vasudev DM(2013): *Textbook of Biochemistry for medical student's* seventh edition Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi.
6. Sood R(1985) first edition: *Medical Laboratory Technology*, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi.

REFERENCE BOOKS FOR PRACTICAL:

7. Chakraborty P(1995): *A text book of microbiology*, New Central Book Agency Pvt Ltd, Calcutta.
8. Sood R(1985) first edition: *Medical Laboratory Technology*, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi

COURSE CODE:	PGD-CGMLT-E1
MARKS:	100 [50 – Theory : 50 – Practical]
CREDITS:	04 [02 – Theory : 02 – Practical]
CONTACT HOURS	THEORY :30 HOURS (02 LEC/WEEK) PRACTICALS :60 HOURS (02 PRACTICALS / WEEK)
COURSE OBJECTIVES:	<ul style="list-style-type: none"> • Learning techniques of collection of samples such as body fluids and tissues for studying cytological aspect. • Hands on training in learning techniques of processing the tissue samples for further analyses and treatment of particular disease.
COURSE OUTCOME	<p>On completion of the course the student should be able to:</p> <p>CO 1: Describe and demonstrate staining techniques for pathological evaluations.</p> <p>CO2: Explain different techniques used for examining body fluids.</p> <p>CO 3: Process tissue and Perform histopathological techniques</p> <p>CO4: Examine body sample for pathological analysis.</p>

PGD-CGMLT-E1: CLINICAL PATHOLOGY AND HISTOPATHOLOGY

MODULE	TOPICS	CONTACT HOURS
Module 1: Histo- pathological techniques	<ul style="list-style-type: none"> • Fixatives and fixation, clearing, embedding, microtome knives, section cutting, errors, decalcification, frozen section, mounting media, automation. • Staining: Theory of staining, dyes and stains, mordants, differentiation, haematoxylin and eosin staining-principles and procedures, special stains P.A.S., Verhoff's, Massons trichrome, Von Giessons, fat stains and other stains. 	10
Module 2: Examination of body fluids	<ul style="list-style-type: none"> • Sample collection, physical and chemical tests, principles and methods, reagent strip method, microscopic examination- crystals, casts, sediments, pregnancy tests. • Stool examination, semen analysis, sputum examination. 	10
Module 3: Cytological techniques	<ul style="list-style-type: none"> • Exfoliative cytology, fixation, pap staining, cytological processing of fluids. Fine needle aspiration cytology (FNAC): procedure, staining of slides, automation, H & E and MGG staining. • Examination of CSF and other body fluids: pleural, peritoneal, synovial fluid. 	10

PRACTICAL COMPONENT OF PGD-CGMLT-E1:CLINICAL PATHOLOGY AND HISTOPATHOLOGY[DURATION – 02 HRS/WEEK]

Practical	No. of Practicals
Lab Based Practical works: <ol style="list-style-type: none"> 1. Histopathological techniques: fixation, dehydration, clearing, impregnation, embedding, decalcification. 2. Microtomes knives and their sharpening, section cutting, errors in section cutting, frozen sectioning, mounting media. 3. Routine staining techniques: routine staining, hematoxylin and eosin (H &E) staining. 4. Grossing and Museum techniques. 5. Examination of urine: Physical and chemical. 6. Examination of urine: multiple reagent strips methods, microscopic. 7. Pregnancy tests. 8. Sputum examination 9. Stool examination 10. Semen analysis. 	15
Activity Based Practical Works: <ol style="list-style-type: none"> 1. Special staining virtual demonstrations (05 Practicals) <ol style="list-style-type: none"> i. P.A.S., Verhoeff's, ii. Massons trichrome, iii. Von Giessons, iv. Fat stains and other stains. 2. C.S.F. examination (02 Practicals) 3. Examination of body cavity fluids: pleural, peritoneal and synovial. (04Practicals) 4. Exfoliative cytology: principles, Papanicolauo staining procedure. (02 Practicals). 5. Fine needle aspiration cytology (F.N.A.C): hematoxylin and eosin (H &E), MGG staining. 	15

REFERENCE BOOKS:

1. KawthalkarSM(2018). *Essential of Clinical Pathology. Second Edition.* Jaypee Medical publishers, New Delhi.
2. Vasudev DM(2013): *Textbook of Biochemistry for medical student's seventh edition* Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi.
3. SoodR(1985) *first edition: Medical Laboratory Technology*, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi.
4. Chakraborty P(1995): *A text book of microbiology*, New Central Book Agency Pvt Ltd, Calcutta.
5. Dereck AC and Cameron IR(2012). *Histopathology Specimens: Clinical, Pathological and Laboratory Aspects.* Springer publication.

REFERENCE BOOKS FOR PRACTICAL:

6. Mohan H(2017).*Practical pathology.* Jaypee Medical publishers, New Delhi.
7. Mukherjee KL (1988) *Volume II:Medical Laboratory Technology*,Tata McGraw-Hill Publishing Company Ltd. New Delhi.
8. Chatterjee MN (2013): *Textbook of Medical Biochemistry* eight edition: Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi.

ELECTIVE COURSE: ANALYTICAL TECHNIQUES**COURSE CODE:** PGD-CGMLT-E2**MARKS:** Theory : 100**CREDITS:** 04**CONTACT HOURS** THEORY : SWAYAM Course (15 Wks)

COURSE OBJECTIVES: This course deals with various techniques their principles, experimental details etc., including general Laboratory techniques, separation techniques based on hydrodynamic properties, centrifugation (sub-cellular fractionation etc), and Chromatographic, and Electrophoretic techniques, HPLC, Purification methods, ELISA etc. Application in biomedical research and some clinical diagnostic methods RIA, ELISA, PET etc., Molecular diagnostics, PCR, etc., Microscopic techniques and clinical biochemistry

COURSE OUTCOME On completion of the course the student should be able to:
CO 1: Discuss and explain the cell techniques and their principles.
CO2: Explain the cytological techniques used in biomedical research.
CO 3: Compare and contrast molecular diagnostic techniques.
CO4: Describe Microscopic techniques and clinical biochemistry procedures.

ELECTIVE COURSE: PGD-CGMLT-E2: ANALYTICAL TECHNIQUES

By Dr. MOGANTY R. RAJESWARI | All India Institute of Medical Sciences, New Delhi-110029

The analytical techniques routinely used in Biochemistry take a very important place in Biochemistry, learning them is not just a requirement but, absolutely essential. This is because, the understanding of the subject mainly comes from the strong basis of the experiments and techniques on which the theories are built.

COURSE LAYOUT

- Week 1
Aqueous solutions, Acids, Bases, buffers systems and pH meter, Colorimetry and UV-VIS absorption spectroscopy Introduction to Hydrodynamic Techniques
- Week 2
Centrifugation: Principles & Methodology Density Gradient centrifugation : Rate Zonal and isopycnic Differential centrifugation for Sub-cellular Fractionation
- Week 3
Gel filtration: Principle, Methodology & Applications Planar Chromatography: Principles and Applications
- Week 4
Ion-exchange chromatography, Affinity chromatography
- Week 5
Gas chromatography, HPLC, Protein Estimation Techniques
- Week 6
Electron Microscopy, TEM and SEM Fluorescence Microscopy : Application to live cell imaging
- Week 7
IHC and IF, Flow cytometry: Theory and concept Flow cytometry: Application in

biology and medicine

- Week 8
Light Microscopy and Confocal Microscopy, SDS-PAGE
- Week 9
Western Blotting Techniques, 2D Electrophoresis and DIGE, Principles of Mass spectrometry
- Week 10
Clinical Proteomics Methods to quantify and Integrity check of DNA
- Week 11
Methods to quantify and Integrity check of RNA, PCR and Real Time PCR, Blotting techniques for Nucleic acids
- Week 12
Sequencing techniques of nucleic acids, Introduction to Recombinant DNA Technology
- Week 13
Expression techniques of recombinant proteins using Bacteria and yeast, Expression techniques of recombinant proteins by insects and mammalian cells, Introduction to Genomic Techniques
- Week 14
Techniques for studying Nucleic acid, Protein interactions, ELISA, RIA :Diagnostic applications
- Week 15

CLIA and its Diagnostic application, PET and its Diagnostic applications, Single cell Biology.

REFERENCE BOOKS:

1. Ghosal S and Sharma AA(2018). Fundamentals of Bioanalytical techniques and instrumentation. Second edition. PHI Learning Pvt Ltd. New delhi.
2. Ternynck T and S. Avrameas S(1990). Immunoenzymatic Techniques (Techniques in Immunology) . INSERM publication

ELECTIVE COURSE: ESSENTIALS OF BIOMOLECULES: NUCLEIC ACIDS AND PEPTIDES	
COURSE CODE:	PGD-CGMLT-E3
MARKS:	Theory : 100
CREDITS:	04
CONTACT HOURS	SWAYAM Course of 12 weeks
COURSE OBJECTIVES:	To provide essentials of chemistry and biology of two very important classes of biomolecules: nucleic acids (DNA/RNA) and proteins.
COURSE OUTCOME	On completion of the course the student should be able to: CO 1: Explain how structural features are translated into biological functions CO2: Describe the process of DNA replication CO 3: Mechanism of step-wise synthesis of specific sequence of proteins; CO4: Know the application of recent molecular techniques used for disease detection
ELECTIVE COURSES PGD-CGMLT-E3: ESSENTIALS OF BIOMOLECULES: NUCLEIC ACIDS AND PEPTIDES By Prof. Lal Mohan Kundu IIT Guwahati The proposed course aims to provide essentials of chemistry and biology of two very important class of biomolecules: nucleic acids (DNA/RNA) and proteins. The course allows to decipher: how structural features are translated into biological functions; how highly organized and selective chemical reactions are adopted that allows DNA to replicate or dictates step-wise synthesis of specific sequence of proteins; how organic chemistry tools in combination with enzymes were ingeniously applied to determine sequences of DNA and proteins and how chemical modifications could be done to mimic similar biological properties. The course also includes modern techniques, development of biomolecular probes as high-throughput detection of biomolecules, single nucleotide polymorphisms and disease diagnosis. Overall, the course falls within the domain of organic chemistry and chemical biology. COURSE LAYOUT Week 1: Introduction, Nucleic acids and proteins Week 2: Synthesis of nucleobases, nucleotides and oligonucleotides Week 3: Solid phase synthesis of oligonucleotides Week 4: DNA replication, Polymerases, DNA sequencing and PCR Week 5: DNA damage, mutations and cancer Week 6: DNA to proteins: transcription, translation and genetic code Week 7: Peptides, sequencing and applications in therapeutics Week 8: Solution phase and solid phase peptide synthesis Week 9: Expansion of genetic code: PNA, LNA and molecular probes Week 10: Modern techniques for biomolecules and disease diagnosis Week 11: Structures and chemistry of sugars and carbohydrates Week 12: Carbohydrate based polymers as biomolecular probes and therapeutics; conclusion BOOKS AND REFERENCES 1. Essentials of Chemical Biology by A. Miller and J. Tanner	

2. Biochemistry by Berg, Tymoczko and Stryer
3. Molecular Biology of The Cell by Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter
4. Molecular Biology of The Gene by James D. Watson, Tania A. Baker, Stephen P. Bell, Alexander Gann, Michael Levine, Richard Losic

COURSE SYLLABUS: SEMESTER II

(02 Core + 2 Elective course + Internship)

Core courses: 02

1. Clinical Genetic Techniques II
2. Clinical Biochemistry II

Elective courses: Any 02

1. Clinical Parasitology, Mycology and Virology
2. Hematology and Transfusion Medicine
3. SWAYAM course- Biomolecules: Structure, Function In Health And Disease
4. SWAYAM course- Immunology

Internship/hands-on training:

- **At Hospital/Clinics.**

CORE COURSE: CLINICAL GENETICS II	
COURSE CODE:	PGD-CGMLT-C4
MARKS:	100 [50 – Theory : 50 – Practical]
CREDITS:	04 [02 – Theory : 02 – Practical]
CONTACT HOURS	THEORY :30 HOURS (02 LEC/WEEK) PRACTICALS :60 HOURS (02 PRACTICAL / WEEK)
COURSE OBJECTIVES:	<ul style="list-style-type: none"> • To get acquainted with recent procedures used in artificial reproductive techniques and their acceptance in the society. • Techniques for analysis of samples for success of procedures conducted • Knowledge of recent techniques used for better results and treatment • To learn about genetic counseling and steps to help guide patient for particular medical treatment available.
COURSE OUTCOME	<p>On completion of the course the student should be able to:</p> <p>CO 1: Describe and explain the molecular genetic techniques used in genetic diagnosis and reproductive techniques which can be recommended to overcome infertility.</p> <p>CO2: Demonstrate the application of dermatoglyphic prints in disease detection.</p> <p>CO 3: Perform procedures of DNA isolation, Molecular size determination, and disease detection for inborn errors of metabolism.</p> <p>CO4: Analyze FISH images and DNA fingerprints.</p>

PGD-CGMLT-C4: CLINICAL GENETICS II		
MODULE	TOPICS	CONTACT HOURS
Module 1: Molecular genetic, Genetics of Cancer, Dermatoglyphics	<ul style="list-style-type: none"> • Molecular genetic techniques used in genetic diagnosis: Blotting techniques – Southern, Northern and Western, PCR / RFLP, FISH, DNA sequencing & DNA fingerprinting. • Genetics of Cancer: introduction, characteristics of cancer cells, origin of cancer cells, genes associated with cancer, environmental causes of cancer, human genome data tailor diagnosis and treatment. • Dermatoglyphics: Introduction, classification, Flexion creases. Dermatoglyphics in clinical disorders, Clinical application & its advantages and limitations. 	10
Module 2: Reproductive technologies, Genetics and Society	<ul style="list-style-type: none"> • Reproductive technologies: infertility and subfertility, assisted reproductive technologies (IUI, surrogate motherhood, IVF, GZIT, ZIFT), preimplantation genetic diagnosis. • Genetics and Society : (i) Human genome project : (ii) Forensic science (iii) DNA finger printing application (iv) Gene therapy (v) Eugenics. vi) Stem cell research. 	10

Module 3: Prenatal Diagnosis, Genetic Counselling	<ul style="list-style-type: none"> • Prenatal Diagnosis: Definition: Various procedures - Amniocentesis, Chorionic villus sampling, Ultrasonography and Fetoscopy. • Genetic Counselling (Stage 1: History and Pedigree Construction, Stage 2: Examination, Stage 3: Diagnosis, Stage 4: Counselling; and Stage 5: Follow up). 	10
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PRACTICAL COMPONENT OF PGD-CGMLT-C4: CLINICAL GENETICS II [DURATION – 02 HRS/WEEK]		
Practical	No. of Practicals	
Lab Based Practical works: <ol style="list-style-type: none"> 1. Introduction to molecular genetic lab: general rules. (02 Practicals) 2. Handling of chemicals, equipment. (02 Practical). 3. Handling biological materials and waste disposal. (01 Practical). 4. Isolation of DNA from human blood. (02 Practicals) 5. Determination of molecular size of DNA. (02 Practicals) 6. Analysis of DNA fingerprints and FISH images (02 Practicals) 7. Dermatoglyphics: Recording of print of fingertips and palm. (01 Practical). 8. Manual DNA sequencing and data analysis. (01 Practical). 9. Disease suspicion by spot tests: Fanconi syndrome, PKU, maple syrup urine disease, Tryptophanuria (02 Practicals) 	15	
Activity Based Practical Works: <p>Case studies of Genetic disorders:</p> <ul style="list-style-type: none"> - Duplication - Translocation - Deletion <p>Case studies of Prenatal testing for Genetic disorders:</p> <ul style="list-style-type: none"> - Down's syndrome - Edward syndrome - Patau's syndrome - Klinefelter's syndrome - XXX syndrome - Cri-du-chat syndrome 	15	

REFERENCE BOOKS:

1. Jorde L, Carey J and Bamshad M (2016). *Medical Genetics*. Fifth edition. Elsevier Publication imprint. eBook ISBN: 9780323391979.
2. Singh BD (2014): *Fundamentals of Genetics*. Second Edition, Kalyani Publishers, New Delhi.
3. Matheisen A and Roy K (2018). *Foundation of Perinatal Genetic counseling*. eISBN: 9780190681111
4. Gardner EJ, Simmons MJ and Snustad DP (2013): *Principles of Genetics*, Eighth Edition, John Wiley Publication, Singapore
5. De Robertis EDP, De Robertis EMF (2012): *Cell and Molecular Biology*, Eighth Edition. Wolter Kluwer Publication, Philadelphia.
6. Thompson JS, Thompson MW (1966): *Thompson & Thompson Genetics in Medicine*, Elsevier Publication, Philadelphia.

REFERENCE BOOKS FOR PRACTICALS:

7. Arumuga N, Meyyan RP (2016): *Advances in Genetics Volume 1* (Dr. N. Arumugam, R P Meyyan, Saras Publication, Nagercoil, Tamil Nadu).
8. Gardner A and Davies T (2010) *Human Genetics 2nd Edition*, Viva books publication, Delhi.

CORE COURSE: CLINICAL BIOCHEMISTRY II	
COURSE CODE:	PGD-CGMLT-C5
MARKS:	100 [50 – Theory : 50 – Practical]
CREDITS:	04 [02 – Theory : 02 – Practical]
CONTACT HOURS	THEORY :30 HOURS (02 LEC/WEEK) PRACTICALS :60 HOURS (02 PRACTICAL / WEEK)
COURSE OBJECTIVES:	<ul style="list-style-type: none"> • Testing, observing and analyzing blood function test • Knowledge about the Clinical aspects and use of it during performance of test.
COURSE OUTCOME	<p>On completion of the course the student should be able to:</p> <p>CO 1: Understand and explain clinical significance of metabolism of biomolecules.</p> <p>CO2: Explain the significance of function tests of body systems</p> <p>CO 3: Perform Chemical examination of body fluids.</p> <p>CO4: Conduct Liver, Thyroid and Kidney function tests.</p>

PGD-CGMLT-C5: CLINICAL BIOCHEMISTRY II		
MODULE	TOPICS	CONTACT HOURS
Module 1: Carbohydrate, Protein, Lipid Metabolism	<ul style="list-style-type: none"> • Carbohydrate metabolism: Clinical aspects of Regulation of Blood sugar and Diabetes • Protein metabolism: starvation, and protein energy malnutrition • Lipid metabolism : Clinical aspects of lipid profile, arteriosclerosis. 	10
Module 2: Function Tests 1	<ul style="list-style-type: none"> • Gastric function tests. • Pancreatic function tests. • Cardiac function test 	10
Module 3: Function Tests 2	<ul style="list-style-type: none"> • Liver function tests. • Thyroid function tests. • Kidney function test 	10

REFERENCE BOOKS FOR PRACTICALS:

1. *Wintrobe's Clinical Laboratory Tests*, 12th Edition, Williams & Wilkins, Baltimore, 1996.
2. *Textbook of Clinical Biochemistry*, 2nd Edition, by S. S. Ghosh, New Delhi, 1996.

PRACTICAL COMPONENT OF PGD-CGMLT-C5: CLINICAL BIOCHEMISTRY II [DURATION – 02 HRS/WEEK]	
Practical	No. of Practicals
Lab Based Practical works: <ol style="list-style-type: none"> 1. Chemistry of saliva. (01 Practical) 2. Chemistry of gastric juices (01 Practical) 3. Estimation of glucose in blood. GTT and its interpretation (03 Practical) 4. Normal urine (01 Practical) 5. Full urine report (02 Practicals) 6. Serum lipid profile (02 Practicals) 1. Estimation of bilirubin. (01 Practical) 2. Estimation of serum proteins. (01 Practical) 3. Estimation of blood urea. (01 Practical) 4. Estimation of creatinine in blood. (01 Practical) 5. Estimation of uric acid in blood. (01 Practical) 	15
Activity Based Practical Works: <ol style="list-style-type: none"> 1. Different methods for estimation of glucose. (03 Practicals) 2. virtual demonstration : <ul style="list-style-type: none"> • Clearance tests – (02 Practicals) • Demonstration of liver function test(03 Practicals) • Demonstration of cardiac function (02 Practicals) • Demonstration of kidney function tests. (03 Practicals) • C.S.F. examination. (02 Practicals) 	15

REFERENCE BOOKS:

1. Lieberman MA and Ricer R(2019). *BRS Biochemistry, Molecular Biology, and Genetics*. WolterKulver Publication.
2. Nelson DL and Cox MM(2019). *Lehninger Principles of Biochemistry, Seventh edition*. Wiki publications.
3. Panini RS(2013). *Medical biochemistry – an illustrated review*. Thieme Medical Publishers, New York.
4. Vasudevan DM(1995): *Textbook of Biochemistry for medical student's first edition*: Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi.
5. Vasudev DM(2013): *Textbook of Biochemistry for medical student's seventh edition* Jaypee Medical Publishers Pvt Ltd, New Delhi.
6. Sood R (1999) fifth edition: *Medical Laboratory Technology*, Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi.
7. Chatterjee MN (2013): *Textbook of Medical Biochemistry eight edition*: Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi.

REFERENCE BOOKS FOR PRACTICALS:

8. Mukherjee KL (1988) *Volume II: Medical Laboratory Technology*, Tata McGraw-Hill Publishing Company Ltd. New Delhi.
9. KamatG(2011). *Practical manual of Hematology*. Jaypee Brothers Medical Publishers Pvt Ltd, New Delhi.

ELECTIVE COURSE: CLINICAL PARASITOLOGY, MYCOLOGY AND VIROLOGY	
COURSE CODE:	PGD-CGMLT-E4
MARKS:	100 [50 – Theory : 50 – Practical]
CREDITS:	04 [02 – Theory : 02 – Practical]
CONTACT HOURS	THEORY :30 HOURS (02 LEC/WEEK) PRACTICALS :60 HOURS (02 PRACTICAL / WEEK)
COURSE OBJECTIVES:	<ul style="list-style-type: none"> • Learning about the parasitological, mycological and virological aspects, their life cycle and understanding clinical aspects about the same for analyses and treatment. • Awareness of virus spread and tests performed for the same for their analyses
COURSE OUTCOME	<p>On completion of the course the student should be able to:</p> <p>CO 1: Describe the pathogenecity and laboratory diagnosis of protozoans, Cestodes and Helminthes.</p> <p>CO2: Know the basis of identification and classification of Fungi and viruses.</p> <p>CO 3: Perform Gross and microscopic observation procedures for detecting endoparasites.</p> <p>CO4:</p>

PGD-CGMLT-E4: CLINICAL PARASITOLOGY, MYCOLOGY AND VIROLOGY		
MODULE	TOPICS	CONTACT HOURS
Module 1: Parasitology	<ul style="list-style-type: none"> • Introduction to parasitology, terminologies, definitions, relationships. • Protozoa: geographic distribution, habitat, morphology, life cycle, pathogenecity, laboratory diagnosis of the following parasites:<i>Entamoeba histolytica</i>, <i>Giardia lamblia</i>, <i>Trichomonas vaginalis</i>, <i>Leishmania donovani</i>, <i>Plasmodium</i> • Cestodes: On the same line as protozoan parasites for the following:<i>Taenia sagenata</i>, <i>Taenia solium</i>, <i>Echinococcus granulosus</i> • Helminths: On the same line as protozoan parasites for the following:<i>Trichuris trichiura</i>, <i>Ankylostoma duodenale</i>, <i>Ascaris lumbricularis</i>, <i>Enterobius vermicularis</i> 	10
Module 2: Mycology	<ul style="list-style-type: none"> • Introduction to mycology including classification • <i>Candida albicans</i> and other candida species • Dermatophytes • <i>Cryptococcus</i> • Opportunistic fungi (<i>Aspergillus</i>, <i>Penicillium</i>, <i>Mucor</i>) <p>NB: Serial no: ii-v will be on the basis of morphology, cultural characters, biochemical (if any), antigens, pathogenecity and laboratory diagnosis.</p>	10
Module 3: Virology	<ul style="list-style-type: none"> • General virology: Definitions, classification, properties of viruses, viral replication, cultivation, laboratory diagnosis. • Systemic virology: On the basis of structure, cultivation, pathogenicity, Laboratory diagnosis of the following viruses:<i>Bacteriophage</i>; <i>Picomaviruses</i> (<i>Polio viruses</i>); <i>Rhabdoviruses</i> (<i>Rabies virus</i>); <i>Arboviruses</i>(<i>Dengue</i>, <i>Chikungunya</i>, <i>JE</i>); <i>Influenza virus</i>; <i>Hepatitis virus</i>; <i>HIV</i>; <i>Herpes virus</i> 	10

**PRACTICAL COMPONENT OF PGD-CGMLT-E4:CLINICAL PARASITOLOGY,
MYCOLOGY AND VIROLOGY[DURATION – 02 HRS/WEEK]**

Practical	No. of Practicals
Lab Based Practical works: <ol style="list-style-type: none"> 1. Stool examination: gross, microscopic, for adult parasite, segment of Taenia, ova, cysts, and larvae of parasite (02 Practicals) 2. Gross and microscopic features (<i>whenever applicable</i>) of intestinal/ vaginal protozoa (02 Practicals). 3. Laboratory diagnosis of malaria: demonstration of whole parasite, parasite antigen, enzymes, serology, (04 Practicals) 4. Gross and microscopic features of cestodes: to include adult worms, segment, larvae, eggs. (02 Practicals) 5. Gross and microscopic features of Helminthes: to include adult worms, eggs, larvae. (03 practicals) 6. Diagnostic features- practical demonstration of gross and microscopic features (wet mount, slide culture) and other tests whenever applicable for following: Candida, Cryptococcus, Dermatophyte, Opportunistic fungi. (02 Practicals) 7. Laboratory diagnosis of the following viruses: HIV, Hepatitis. 	15
Activity Based Practical Works: <ol style="list-style-type: none"> 1. General virology: types of symmetry, morphology of virus models, cultivation in embryonated egg. (03 Practicals) 2. Laboratory diagnosis of the following viruses: Poliovirus, Rhabdovirus. (03 Practicals). 3. Bacteriophage—structure using a model. (01 Practical). 4. Case studies: (08 Practicals) <ol style="list-style-type: none"> i. Candida ii. Aspergillosis iii. Dermatophytes iv. Whipworm v. Hookworm vi. Pinworm/Seatworm vii. Roundworm 	15

REFERENCE BOOKS:

1. Procop GW and Koneman EW (2016). *Koneman's Color Atlas and Textbook of Diagnostic Microbiology*. Seventh Edition. Wolters Kluwer publications.
2. Ward KN, Mc Cartney AC and Thakker B (2008). *Notes on Medical Microbiology: Including Virology, Mycology and Parasitology*. Second edition. Churchill livingstone Publishers.
3. Bhushan V, Tao L and Pali V (2005). *Microbiology: Virology, Immunology, Parasitology, Mycology*. Fourth Edition. "Blackwell Underground Clinical Vignettes publication.
4. Swanson TA, Kim SL and Flomin OE (2007). *Underground Clinical Vignettes Step 1: Microbiology I: Virology, Immunology, Parasitology, Mycology (Underground Clinical Vignettes Series)*. Wolters Kluwer publications.

REFERENCE BOOKS FOR PRACTICAL:

5. P. Chakraborty (1995): *A text book of microbiology*, New Central Book Agency Pvt Ltd, Calcutta.
6. Kanai L. Mukherjee (1988) *Volume III: Medical Laboratory Technology*, Tata McGraw-Hill Publishing Company Ltd. New Delhi.

ELECTIVE COURSE: HEMATOLOGY AND TRANSFUSION MEDICINE	
COURSE CODE:	PGD-CGMLT-E5
MARKS:	100 [50 – Theory : 50 – Practical]
CREDITS:	04 [02 – Theory : 02 – Practical]
CONTACT HOURS	THEORY :30 HOURS (02 LEC/WEEK) PRACTICALS :60 HOURS (01 PRACTICAL / WEEK)
COURSE OBJECTIVES:	<ul style="list-style-type: none"> • To get acquainted to blood collection and analyses of blood. • To learn various components of blood • Understanding importance of blood donation and learn grouping systems.
COURSE OUTCOME	<p>On completion of the course the student should be able to:</p> <p>CO 1: Explain the composition of blood and changes in Hemolytic disorders.</p> <p>CO2: Describe the structure and functions of WBCs and explain the tests associated with detection of Hemolytic disorders.</p> <p>CO 3: Perform various hemocytometric procedures.</p> <p>CO4: Perform various hematological tests for disease detection.</p>

PGD-CGMLT-E5: HEMATOLOGY AND TRANSFUSION MEDICINE		
MODULE	TOPICS	CONTACT HOURS
Module 1: Hematology – Blood composition and Hemolytic disorders	<ul style="list-style-type: none"> • Blood: composition, haemopoiesis, RBC'S- structure function, synthesis: Hemoglobin- structure, function, abnormal haemoglobin, reticulocytes, blood indices, peripheral blood smear, parasites in blood. • Hemolytic disorders: investigations, screening tests, sickling, osmotic fragility, Heinz bodies, G-6-P-D screening, Hb electrophoresis, Hb-F estimation. 	10
Module 2: WBCs and Platelets	<ul style="list-style-type: none"> • White blood corpuscles: Description, morphology, leucocyte counts, leucopenia, leucocytosis, leukemia, leukemoid reaction, absolute count, differential count, bone marrow iron staining, special stains for leukemias. • Platelet structure and function: Bleeding disorders and investigations, coagulation process and theory, disorders. 	10
Module 3: Transfusion medicine	<ul style="list-style-type: none"> • Blood groups: ABO and sub groups, antigen and antibodies, Rh blood grouping, other blood group systems, compatibility testing, antihuman globulin test. • Blood transfusion: Selection of blood donors, blood transfusion procedures, Complications of blood transfusion, Blood component therapy, organization and administration of blood bank, blood safety. 	10

PRACTICAL COMPONENT OF PGD-CGMLT-E5: HEMATOLOGY AND TRANSFUSION MEDICINE [DURATION – 02 HRS/WEEK]	
Practicals	No. of Practical
Lab Based Practical works: <ol style="list-style-type: none"> 1. Use and care of microscopes, study of improved neubaur chamber (01 Practical). 2. Anticoagulants and blood collection (01 Practical) 3. Haemoglobinometry: Sahli's method, Cyanmethemoglobin method. (01 Practical). 4. Haemocytometry: Erythrocyte count (01 Practical). 5. Haemocytometry: Total WBC count (01 Practical). 6. Blood smear preparations: Staining, differential WBC count (01 Practical). 7. Peripheral bloods smear examination and morphological abnormalities (01 Practical). 8. Reticulocyte count- absolute eosinophil count (02 Practicals) 9. E.S.R, P.C.V, Blood indices (02 Practicals) 10. Platelet count, BT, CT, CRT (02 Practicals) 11. Prothrombin time, A.P.P.T, FDP estimation (01 Practical) 12. ABO grouping and Rh typing. (01 Practical) 	15
Activity Based Practical Works: <ol style="list-style-type: none"> 1. Activity on- Bone marrow examination- staining of smear, special stains- PAS, Sudan black, Myeloperoxidase. (02 Practicals) 2. Hemolytic work-up osmotic fragility test, Heinz bodies, sickling, G-6-P-D estimation, Hb-electrophoresis, Hb-F estimation. (03 practicals) 3. Case studies: (10 Practicals) <ol style="list-style-type: none"> i. Iron deficiency anemia ii. Pernicious anemia/ Vitamin B12 deficiency anemia iii. Leukemia iv. Bleeding disorders v. Thrombocytopenia vi. Neutrophilia vii. Eosinophilia viii. Basophilia ix. Monocytosis x. Lymphocytosis 	15

REFERENCE BOOKS:

1. Rao GH, Eastlund T and Jagannath L(2006).Handbook Of Blood Banking & Transfusion Medicine. Jaypee Medical Publishers, New Delhi.
2. A.B. Dutta (2006) :BloodBanking and Transfusion, Satish Kumar Jain for CBS Publishers, New Delhi.
3. RudmannSV(2005).Textbook of Blood Banking and Transfusion Medicine. Second Edition. Elsevier Saunders Publication.
4. Bharadwaj K(2015).Transfusion Update. Indian Society of Blood Transfusion and Immunohaematology. Jaypee Medical Publishers, New Delhi.

REFERENCE BOOKS FOR PRACTICAL:

5. Mukherjee KL (1988) Volume II:Medical Laboratory Technology,Tata McGraw-Hill Publishing Company Ltd. New Delhi.

ELECTIVE COURSE: BIOMOLECULES: STRUCTURE, FUNCTION IN HEALTH AND DISEASE	
COURSE CODE:	PGD-CGMLT-E6
MARKS:	Theory : 100
CREDITS:	04
CONTACT HOURS	15 Week SWAYAM Course
COURSE OBJECTIVES:	To give an overview of importance of biomolecules starting from the simplest molecule, water to complex biomolecules.
COURSE OUTCOME	On completion of the course the student should be able to: CO 1: Explain 3D Structure, separation and sequencing of proteins. CO2: Describe and identifying biomarkers using clinical proteomics CO 3: Discuss the detailed structure of genetic material and its interactive role in disease. CO4: understand and explain the cellular function of biomolecules in physiology and pathology.
ELECTIVE COURSE PGD-CGMLT-E6: BIOMOLECULES: STRUCTURE, FUNCTION IN HEALTH AND DISEASE By Prof. M.R Rajeswari Department of Biochemistry, All India Institute of Medical Sciences, New Delhi This course on Biomolecules is one of the basic course for all PG Students of Biological Sciences. 1. Gives an overview of importance of biomolecules starting from the simplest molecule, water. 2. Elaborate the need to study proteins: Their 3D Structure,proteinseparation,sequencing etc. 3. To understand the pathology and identifying biomarkers using clinical proteomics. 4. Explain in detail DNA,RNA their structures, interactions role in disease,genomics.epigenetics. 5. Enumerate the role of carbohydrates,lipids and their cellular function in physiology and pathology. 6. To briefly introduce to system biology COURSE LAYOUT Week 1 Chemical bonds:Different types of Bonds, Bond energies,Bond Angles etc, Water:The molecule of life,AqueousSolution,Acids&Bases,Measurements of pH, Henderson Haselbatchequation,Titration Curve &pKvalues,Buffers Week 2 Amino acids, chirality, peptide bond and polypeptides,Structural levels of proteins and Stabilizing forces,Conformational properties of polypeptides and Ramachandran plot Week 3 Turns, loops, Super secondary structures, motifs and domains in proteins,Structures and function of Fibrous Proteins,Structure and function of Actin and myosins	

Week 4

Hemoglobin, Myoglobin and Oxygen binding, Role of Protein Structure in Health and Disease, Assessment 1

Week 5

Protein Separation Techniques: Centrifugation & Chromatography, Protein sequencing

Week 6

Methods of structure determination of proteins : X-ray, NMR, CD etc, Clinical Proteomics

Week 7

Antigen-Antibody Complex and their Applications in Immunology, Protein-Ligand (Small Molecules including drugs) interaction

Week 8

Components of Nucleic Acids, Conformational parameters of Nucleic acids and DNA double helix, DNA Polymorphism

Week 9

Circular DNA, Supercoil DNA

Week 10

Interactions of small molecules (ions, drugs) with DNA, Different types and structures of RNA

Week 11

DNA-Protein interactions, Assessment 2

Week 12

Introduction to Carbohydrates, Structures of polysaccharides, Saturated and unsaturated fatty acids, Nomenclature of fatty acids and Essential and non-essential fatty acids

Week 13

Glycoproteins and Proteoglycans, Classification of Lipids: simple and compound lipids, phospholipids, Cholesterol, Micelles and Liposomes : Applications in biology and medicine

Week 14

Lipids: extraction, separation and analysis, Components and architecture of Cell membrane, Various membrane models including Fluid-mosaic model

Week 15

Cholesterol and its role in health and disease, Interrelationship of Biomolecules : System Biology, Epigenetics and Human Diseases, Final Assessment

BOOKS AND REFERENCES

1. *An Introduction to Biophysics* by Moganty R Rajeswari, 2013.
2. *Biophysical Chemistry, Part II, Techniques for the study of biological structure and function*, by Cantor C.R. and Schimmel P R., W.H. Freeman and Company, 1980.
3. *Nucleic Acids in chemistry and Biology*, by Blackburn G.M. and Gait M.J., IRL Press, 1990.
4. *Biochemistry*, by Voet D. and Voet J.G., John Wiley and sons, 1995.
5. *Physical Biochemistry*, by Freifelder D., W.H. Freeman and company, 1976-1982.

ELECTIVE COURSE: IMMUNOLOGY

COURSE CODE:	PGD-CGMLT-E7
MARKS:	Theory : 100
CREDITS:	04
CONTACT HOURS	12 week SWAYAM Course
COURSE OBJECTIVES:	To supplement and enhance the understanding of students about different dimensions of Immunology starting from defense systems of the body, immunity, antigens, antibodies, hypersensitivity, cytokines, complement system, vaccines and how our body continuously defends us from various pathogens and maintains homeostasis against many environmental challenges.
COURSE OUTCOME	On completion of the course the student should be able to: CO 1: Explain the mechanisms adopted to impart immunity CO2: Describe the Organization and functioning of the immune organs. CO 3: Discuss the Structure and functions of different classes of immunoglobulins CO4: identify and correlate Immunoassays to Immune dysfunctions.

ELECTIVE COURSE PGD-CGMLT-E7: IMMUNOLOGY

By Dr. Manzoor Ahmad Mir | University of Kashmir

The course is specially designed to supplement and enhance the understanding of students about different dimensions of Immunology starting from defense systems of the body, immunity, antigens, antibodies, hypersensitivity, cytokines, complement system, vaccines and how our body continuously defends us from various pathogens and maintains homeostasis against many environmental challenges.

The objectives of this course is to give the target students/audience an understanding of:

- Fundamentals of the immunology and how our body responds to different environmental challenges.
- Early theories of Immunology, Cells , organs and molecules of the Immune system.
- Different types of immunity (innate and adaptive) employed by the immune system to defend us from foreign pathogenic attacks.
- Organization and functioning of the immune organs, cells and molecules like antibodies, cytokines and chemokines.
- Structure and functions of different classes of immunoglobulins, Antigen-antibody interactions
- Immune dysfunctions (Rheumatoid Arthritis and AIDS)
- Immunoassays (ELISA, RIA, immunoblotting and Hybridoma technology) Monoclonal antibodies in therapeutics and diagnosis
- Hypersensitivity and complement system Vaccines and their developmen

COURSE LAYOUT

- WEEK 1
 - Historical Perspective of Immunology
 - Early Theories of Immunology
 - Cells of the Immune System
 - Organs of the Immune System
- WEEK 2
 - Anatomical barriers of Immune system
 - Inflammation
 - Cells and Molecules of Innate Immunity

- Cell Mediated and Humoral Immunity
- WEEK 3
 - Passive and active Immunity (Artificial and Natural)
 - Immune Dysfunction (Rheumatoid Arthritis and AIDS)
 - HIV-AIDS a Global Health Emergency
 - Antigenicity and Immunogenicity
- WEEK 4
 - Immunogens (Factors influencing immunogenicity)
 - Adjuvants and Haptens
 - Types of Antigens
 - B and T-cell Epitopes
- WEEK 5
 - Types of Immunoglobulin's
 - Antigen antibody interactions
 - Immunoassays
 - Hybridoma Technology
- WEEK 6
 - Monoclonal Antibodies in Therapeutics and Diagnostics
 - ELISA, RIA and Immunofluorescence
 - Alexa floure tagging of antibodies and Flow cytometry
 - Structure and function of MHC Molecules
- WEEK 7
 - Endogenous and Exogenous pathways
 - Antigen Presenting cells
 - Antigen processing
 - Antigen presentation
- WEEK 8
 - B Cell and T cell Signalling in antigen presentation
 - Costimulation and reverse costimulation in presentation
 - Cytokines and their types
 - Properties and Functions of cytokines
- WEEK 9
 - Therapeutic cytokines
 - Chemokines and cytokines in infectious diseases
 - Complement System and its components
 - Pathways of Complement system
- WEEK 10
 - Hypersensitivity and Allergy
 - Gell and Coombs classification of Hypersensitivity
 - Aeroallergens and their control
 - Various types of hypersensitivities
- WEEK 11
 - Vaccines and their properties
 - Live Vaccines
 - Attenuated and Heat killed Vaccines
 - DPT, Influenza and Polio vaccines

BOOKS AND REFERENCES

At the End of every module reference materials are given in quadrant 3 INSTRUCTOR BIO

POST GRADUATE DIPLOMA PROGRAMME IN CLINICAL GENETICS AND MEDICAL LABORATORY TECHNIQUES

COURSE DESCRIPTION:

Overall the course is designed to provide a strong foundation in all areas of Human genetics and medical lab techniques with opportunities for hands-on laboratory and clinical experience. The curriculum includes lectures, practicals, classroom discussions and intensive practical training (Internship). The Objective of the courses is to enable the students in having job opportunities in Research and Development and in medical field. The course syllabus is designed considering the need for trained technicians and technologists in the genetic and pathological field. This self financed, job oriented course will meet the demand for genetic and pathological technicians in diagnostic labs and hospitals.

ELIGIBILITY FOR ADMISSION:

To be eligible for admission to the programme leading to the award of Post Graduate Diploma in Clinical Genetics and Medical Laboratory Techniques/ Certificate Programme, the candidate must have passed the Bachelor's Degree examination of this University or the equivalent examination of any other recognized University, securing a minimum of 45% marks on aggregate or equivalent Grade or as specified for a specific Programme in Biological Science (Science graduate with Zoology, Microbiology, Biotechnology -6 units / or 3 units).

CAPACITY:

Admission is open for 15 candidates (maximum).

COURSE DURATION:

Duration for the PG Diploma in "Clinical Genetics and Medical Laboratory techniques" is a two semester programme followed by Hands on training in Clinical Laboratories / Pathology Lab / Genetic Lab for a period of three months equivalent to 240 hours.

COURSE STRUCTURE:

The PG Diploma is a two semester programme followed by A student shall be eligible for the award of Post-Graduate Diploma on successful completion of 32 Credits. 08 Credits of Internship is compulsory besides Core and elective Courses. Ordinarily a Diploma Programme shall consist of eight courses with four courses per semester.

One (1) Credit (Theory) shall be equivalent to 15 clock hours of contact teaching. One (1) Credit (Practical) shall be equivalent to 30 clock hours of contact teaching. A student shall obtain 20 credits from Core Courses and 20 Credits from elective courses, which includes 08 credits of Internship/Hands on training.

COURSE EVALUATION:

To pass PGD programme in Clinical Genetics and Medical Laboratory Techniques, candidate shall secure a minimum of 40% marks in theory as well as practical component of each course / paper separately, and followed by Hands on Training. The final grade shall be computed based on the candidate's best performance in the minimum number of credits required for the award of the Diploma. 08credits, of internship, shall be depicted in the form of grade in the final mark sheet. The assessment of the Courses shall be based on the examination at the end of each semester. The examination shall consist of comprehensive written exam (theory) or a comprehensive laboratory examination (practicals) and continuous assessments for theory and practicals. The examination of the Core/elective Courses shall carry maximum of 100 marks (Theory = 50 mks, Practical = 50 mks). Continous assessment and semester end examination for theory with be 40:60 weigtage. Practical assessment will consist of continuous assessmment and semester end comprehensive laboratory examination with 50:50 weigtage.

A report is to be submitted by the candidate after completion of the internship/hands-on training. Submission may be in the form of a report or Portfolio which shall be evaluated for 200 marks and indicated as grades. Every student shall have to secure a minimum of 'P' grade to pass the Course.

COURSE STRUCTURE
POST GRADUATE DIPLOMA PROGRAMME IN
CLINICAL GENETICS AND MEDICAL LABORATORY TECHNIQUES
(PGDCG&MLT)

SEMESTER	COURSE CODE	CORE COURSES	ELECTIVE COURSES (Any One)	NUMBER OF CREDITS	CONTACT HOURS	MARKS
SEMESTER I	PGD-CGMLT-C1	Clinical Genetic Techniques I		Theory = 02 Practical = 02	Theory = 30 Practical = 60	Theory = 50 Practical = 50
	PGD-CGMLT-C2	Clinical Biochemistry I		Theory = 02 Practical = 02	Theory = 30 Practical = 60	Theory = 50 Practical = 50
	PGD-CGMLT-C3	Clinical Microbiology (General and Systemetic)		Theory = 02 Practical = 02	Theory = 30 Practical = 60	Theory = 50 Practical = 50
	PGD-CGMLT-E1		Clinical Pathology and Histopathology	Theory = 02 Practical = 02	Theory = 30 Practical = 60	Theory = 50 Practical = 50
	PGD-CGMLT-E2		SWAYAM course: Analytical Techniques	Theory = 04 credits	Swayam Online	Theory = 100
	PGD-CGMLT-E3		SWAYAM course: Essentials Of Biomolecules: Nucleic Acids And Peptides	Theory = 04 credits	Swayam Online	Theory = 100
SEMESTER	COURSE CODE	CORE COURSES	ELECTIVE COURSES (Any 02)	NUMBER OF CREDITS	CONTACT HOURS	MARKS
SEMESTER II	PGD-CGMLT-C4	Clinical Genetic Techniques II		Theory = 02 Practical = 02	Theory = 30 Practical = 60	Theory = 50 Practical = 50
	PGD-CGMLT-C5	Clinical Biochemistry II		Theory = 02 Practical = 02	Theory = 30 Practical = 60	Theory = 50 Practical = 50
	PGD-CGMLT-E4		Clinical Parasitology, Mycology, and Virology	Theory = 02 Practical = 02	Theory = 30 Practical = 60	Theory = 50 Practical = 50
	PGD-CGMLT-E5		Hematology and Transfusion Medicine	Theory = 02 Practical = 02	Theory = 30 Practical = 60	Theory = 50 Practical = 50
	PGD-CGMLT-E6		SWAYAM course- Biomolecules: Structure, Function In Health And Disease	Theory = 04 credits	Swayam Online	Theory = 100
	PGD-CGMLT-E7		SWAYAM course- Immunology	Theory = 04 credits	Swayam Online	Theory = 100
Internship (Elective)	03-06 months internship at Hospital/Clinics.			08 credits		Report/Portfolio = 100