



DEPARTMENT OF PARAMEDICAL SCIENCES
Subharti Medical College

Recognized by Govt. of India, Ministry of Health & Family Welfare, Govt. Letter No. U.12012/69/96-ME(P)
Website: medical.subharti.org, e-mail: paramedical@subharti.org, Ph.: 0121-3055000 (Extn: 2118), Telefax: 0121-2439127, 2439087

A constituent college of
SWAMI VIVEKANAND SUBHARTI UNIVERSITY

(Established under U.P. Govt. Act no. 29 of 2008 and approved under section 2(f) of UGC Act 1956)



Ref. No-/SVSU/PMS/2023/.....2

Date: 18/12/2023

NOTICE

A meeting of board of studies of Department of Paramedical Sciences will be held on 22nd December 2023 at 10:00 am in the chamber of Chairperson. All faculty members, External member & Alumni are directed to attend the meeting. Faculties must come up with proposal in respect of different programs and their ordinance if any.

Agenda to be discussed:

Agenda: 1. Introduction of New course Post Graduate Diploma in Clinical Genetics.

Agenda: 2. Any changes and modification in Ordinance.

Thanking you.



Dr. Pankaj Kishor Mishra
Prof. & Head
Dept. of Paramedical Sciences
SMC, Meerut



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Ref. No./SVSU/PMS/2023/3849

Dated: 22.12.2023

Minutes of Meeting

A BOS Meeting was held on 22nd December, Friday at 10:00 AM in Departmental Conference Hall under the guidance of Prof. (Dr.) Pankaj Kishor Mishra, Head of Department of Paramedical Sciences, SMC, Meerut.

The following members were present in meeting-

1. Prof. (Dr.) Pankaj Kishor Mishra
2. Dr. Umesh Kumar
3. Dr. Anshu Kumar Singh
4. Dr. Meenakshi Mishra
5. Dr. Ravindra Kumar Manik
6. Mr. Akash Kumar
7. Mrs. Hiba
8. Ms. Akanksha Singh
9. Mr. Rahul
10. Mr. Pushpendra Rajput
11. Mr. Ankit
12. Ms. Shmruti
13. Ms. Yashika Bhardwaj
14. Mr. Vishwanath Pratap Singh
15. Mr. Sumit Kumar Sagar
16. Ms. Khushi Kansal
17. Mr. Navdeep Singh

Head of Department

Member

Member

Member

Member

Member

Member

Member

Member

Member

Member

Member

Member

Member

Member

Member

Member

Subject Expert

1. Dr. Biswa Pritam Das Purkayastha

Associate Professor, CRS, Subharti Medical College

All the participants were welcomed by Prof. (Dr.) Pankaj Kishor Mishra, Head of Department,
The following agendas were discussed in the meeting-

Agenda 1: Discussion on the Implementation of last BOS agenda.

Suggestion: Last BOS agendas have been implemented.

Agenda 2: Introduction of New course Post Graduate Diploma in Clinical Genetics.

Suggestion: All the BOS Members discuss and agree to introduce a New course Post Graduate Diploma in Clinical Genetics.

HOD, Department of Paramedical Sciences, has concluded the BOS meeting with the vote of thanks.

Dr. Pankaj Kishor Mishra
Prof. & Head
Dept. of Paramedical Sciences
SMC, Meerut



Ordinance No. ()

**Ordinance Relating to Post Graduate Diploma in Clinical Genetics (PGDCG)
Course**

Chapter – 1

General

1. This ordinance may be called the “Ordinance Relating to **Post Graduate Diploma in Clinical Genetics Course**”.
2. It shall come into force with Academic session 2024-25.

Chapter – 2

Eligibility for Admission

- 2.1. A candidate must possess the basic degree in science of this university or any other university recognized by the UGC (graduates from multidiscipline like MBBS/ BDS/ MD/ MS or B.Sc/ M.Sc with Biology/Life Science/ Genetics/ Zoology/ Medical Microbiology/ Botany/ Biochemistry/Biotechnology and other allied subjects like Anatomy, Physiology, Pathology, Medical Laboratory Technology, Radio Imaging Technology, Operation Theatre Technology, etc) with at least 50% marks.™
- 2.2. Admission to the course shall be made on the basis of eligibility and merit in the Aptitude test (preferably online), followed by an interview.
- 2.3. Successful candidates on the basis of the Test will be called for the interview & shall have faced an interview board.

Chapter – 3

Teaching Course

- 3.1. The course will be one academic year duration consisting of two semesters.
- 3.2. The academic calendar shall be as follows

1st Semester Session

Session	--	15 th July to 15 th December
Examination	-	16 th December to 31 st December

2nd Semester Session

Session	-	10 th January to 10 th June
Examination	-	11 th June to 30 th June



Chapter 4

Attendance

The students are expected to attend all the classes and should not have less than 75 % attendance in theory as well as in practical classes, wherever held, to become eligible to appear for the university examination. Short fall in attendance can, however be condoned in deserving cases to the extent of 10% by the Principal. If the short fall is more than 10% but not more than 15%, the Principal may recommend deserving cases to the Vice Chancellor for condonation. The order of the Vice Chancellor in this regard shall be final.

Chapter 5

Examination

5.1. The Examination are to be designed with a view to ascertain whether the candidate has acquired adequate knowledge and skills along with clear concepts of the fundamentals, which are necessary for him to carry out his professional day to day work competently. Evaluation will be carried out on an objective basis.

5.2. University Examination:

Only those candidates will be allowed to appear in University Examinations who fulfill the following criteria:

5.2.1. Attendance: 75% of attendance in a subject for appearing in the examination is compulsory.

5.2.2. Internal assessment: Candidate must have obtained a minimum of 40% marks allotted for internal assessment.

5.2.3. The attendance for practical and clinical posting must have to be above 80% for eligible to appear in University examination.

5.3. Record Book: At the time of practical examination each candidate shall submit to the Examiner the record logbook and practical manual duly certified by the head of the Department as a bonafide record of work done by the candidate.

5.4. Internal Assessment:

Internal assessment for Theory will be based on class test and terminal examinations.

Internal assessment for Practical work shall be based on day to day work assessment (practical manual) and marks obtained in Practical class test & terminal examinations.

A maximum of **10 marks** in each subject shall be awarded for attending classes (theory / practical) as per the following norms:

85% or more attendance	-	10 Marks
80% or more but less than 85% attendance	-	9 Marks
75% or more but less than 80% attendance	-	8 Marks
70% or more but less than 75% attendance	-	7 Marks

65% or more but less than 70% attendance	-	5 Marks
60% or more but less than 65% attendance	-	3 Marks
51% or more but less than 60% attendance	-	2 Marks
50% attendance	-	1 Mark
Less than 50% attendance	-	0 Mark

5.5. The entire course has to be completed within a maximum of two years from the date of original admission in the course.

Chapter-6 **Paper setting, Evaluation & Results**

The work of setting the End semester examination papers, conduct of the End semester and Annual examinations, Evaluation and declaration of results shall be as per the laid down Examination policies / latest University Notifications.

Chapter – 7 **Power to Modify**

In the event of any emergent situation, if any deviation is considered necessary, the Vice Chancellor is authorized to modify the Ordinance, subject to subsequent ratification by the University Academic Council.

Chapter – 8 **Intake Capacity**

The intake of this course is 10 Seats initially.

Chapter – 9
Evaluation Scheme

Post Graduate Diploma in Clinical Genetics
Semester-I

S. No	Subject Code	Subject Name	Credits				Examination Scheme				
			L	T	P	C	Theory Marks		Practical Marks		Grand Total
							UE	IE	UE	IE	
1	PGDCG-101	Basic Human Genetics	3	1	2	6	70	30	35	15	150
2	PGDCG-102	Human Cytogenetics	3	1	2	6	70	30	35	15	150
3	PGDCG-103	Biochemistry and Instrumentation	3	1	2	6	70	30	35	15	150
4	PGDCG-104	Genomics	3	1	2	6	70	30	35	15	150
5	PGDCG-105	Clinical Posting-I	0	0	2	2			35	15	50
Total Credit			12	4	10	26	280	120	175	75	650

*L- Lecture, T-Tutorial, P- Practical, C -Credit, IE- Internal Evaluation, UE- University External

Semester-II

S. No	Subject Code	Subject Name	Credits				Examination Scheme				
			L	T	P	C	Theory Marks		Practical Marks		Grand Total
							UE	IE	UE	IE	
1	PGDCG-201	Recombinant DNA Technology and Immunology	3	1	2	6	70	30	35	15	150
2	PGDCG-202	Clinical Genetics and Genetic Counseling	3	1	2	6	70	30	35	15	150
3	PGDCG-203	Physiology and Pathology	3	1	2	6	70	30	35	15	150
4	PGDCG-204	Developmental and Reproductive Genetics	3	1	2	6	70	30	35	15	150
5	PGDCG-205	Clinical Posting-II	0	0	2	2			35	15	50
Total Credit			12	4	10	26	280	120	175	75	650

*L- Lecture, T-Tutorial, P- Practical, C -Credit, IE- Internal Evaluation, UE- University External

**Curriculum outline/ Syllabus
(Paper code and subject title)**

SEMESTER -1

Subject Code/ Subject Name: PGDCG-101/Basic Human Genetics:

Theory

DNA as the genetic material, genetic code, flow of genetic information, alteration

Principles of inheritance and probability rules

Pedigree construction & family study

Complications in pedigree analysis (variable expressivity, heterogeneity, penetrance, anticipation, epigenetics, mosaicism)

Non-Mendelian inheritance

5.1 Polygenic inheritance

5.2 Multifactorial trait

5.3 Threshold trait

5.4 Genetic Susceptibility & risk factors

6. Mapping and identification of disease genes (linkage analysis, LOD score, association study)

7. Allele frequency in population, estimation of carrier frequency

Practicals

Good laboratory practice

Universal safety precaution, importance of personal hygiene, disposal of organic waste washing, cleaning of glass ware, sterilization of glassware and lab ware

Drawing blood, preparation of blood film and identification of cells

Learning professional English, use of OMIM

Use of computers, word processing and retrieval of data

Retrieval of information from patients, informed consent, preparation of reports

Tissue culture

Cleaning, sterilization and maintenance of culture chamber, cleaning and maintenance of laminar flow hood, preparation of culture medium

Collection and storage of samples (blood, biopsy material), culturing lymphocytes, stem cells (from limbal tissue and articular cartilage (chondrocytes), chorionic villi, preparation of cell lines from blood cells

Basic Human Genetics

Preparation of pedigree, recording of physical feature (facial morbidity, gonadal abnormality), other physical and physiological abnormality

Dermatoglyphics, understanding the prescription and test reports, preparation of report

Risk calculation and prediction of recurrence

Detection of patterns of inheritance by PCR-RFLP and microsatellite markers

Subject Code/ Subject Name: PGDCG-102/Human Cytogenetics:

Theory

1. Organization of cell and cell cycle
2. Cell division (Mitosis, Meiosis)
3. Chromatin structure and chromosome organization
4. Chromosomal basis of inheritance, sex chromosome, X-chromosome inactivation
5. Basics of cell culture
6. Techniques of cell cultures (short term lymphocyte, primary and secondary cell cultures, maintenance of cell lines)
7. Techniques of chromosome analysis

Chromosome preparation from cultured lymphocytes, cell lines and solid tumors
Karyotyping, C-, G-banding and fluorescence banding, nomenclatures of bandings
In-situ hybridization techniques

1. Meiotic chromosomes
8. Chromosomal anomalies and disorders
 - 8.1 Numerical (polyploidy, aneuploidy, autosomal, sex- chromosomal)
 - 8.2 Structural (deletion, duplication, translocation, inversion, isochromosome, ring chromosome)
 - 8.3 Chromosomal abnormalities in cancer

Practicals

Microscopy

Metaphase chromosome preparations from bone marrow of mouse, rat, human

Chromosome preparation from lymphocyte culture

G-banding, C-banding, R-banding

cells
lines

Karyotyping

Fluorescence *in-situ* Hybridization (FISH), Chromatin-immunoprecipitation (ChIP)

Meiosis in mouse testis

Sex chromatin (buccal mucosa, hair bud)

Comet assay

Micronuclei assay

Chromosome preparation from chorionic villi, stem cells, cell line

Sister Chromatid Exchange (SCE)

Subject Code/ Subject Name: PGDCG-103/Biochemistry & Instrumentation:

Theory

Introduction to Nucleic Acids, Proteins, Carbohydrates, Lipids, Vitamins, Minerals

Instrumentation (pH-meter, spectrophotometer, centrifugation, ELISA, radioactivity detection,

Mass spectrometry, High performance liquid chromatography)

Biochemical tests: sugar, albumin, urea, protein, globulin, vitamin

Biochemistry and diagnostic tests of following diseases

Duchenne Muscular Dystrophy (DMD) (Creatine phosphokinase-CPK)

Phenylketonuria-PKU (phenylketone)

G6PD deficiency syndrome (G6PD)

Mucopolysaccharidosis

- a. Endocrine disorders related to thyroid and reproduction (TSH, T3, T4, Estradiol, Testosterone, LH, FSH)

Practicals

Weighing, preparation of distilled and purified water, preparation of solutions and stains, pH-meter, spectrophotometer, centrifugation, ELISA, microscope

Biochemical tests for sugar, albumin, Creatine phosphokinase-CPK, glucose 6 phosphate dehydrogenase-G6PD

Subject Code/ Subject Name: PGDCG-104/Genomics:

Theory

Organization of the Genetic material

Mitochondrial genome organization

Overview of the Central Dogma

Mutation and its different types

Genome organization, annotations and databases, markers (microsatellites, SNPs)

Pharmacogenomics, Ecogenomics, Metabolomics, Teratogenetics

Practicals

Extraction of DNA (from human blood, other tissues) and RNA, quantification

Polymerase chain reaction (PCR) & its different types

cDNA preparation and RT-PCR

DNA sequencing (demonstration)

Subject Code/ Subject Name: PGDCG-105/Clinical Posting-I

The clinical posting will be held in CRS and hospital.

SEMESTER -2

Subject Code/ Subject Name: PGDCG-201 / Recombinant DNA Technology &

Immunology:

Theory

1. Recombinant DNA Technology
 - 1.1 Bacterial culture
 - 1.2 Restriction enzymes
 - 1.3 Vectors
 - 1.4 Transformation and transfection
2. Immunology
 - 2.1 Overview of immune system
 - 2.2 Antigens and antibodies
 - 2.3 Antigen-antibody interactions
 - 2.4 Major Histocompatibility Complex (MHC), HLA typing
 - 2.5 Immunotherapy

Practicals

E. coli culturing, Transformation and Cloning

1. Extraction of DNA from Plasmid and Restriction-enzyme mapping of plasmid DNA
2. Immunogenetics (HLA typing), ELISA, SDS-PAGE, Western blotting
3. Cell-sorting and isolation methods

Subject Code/ Subject Name: PGDCG-202/ Clinical Genetics & Genetic

Counselling

Theory

1. Genetic Disorders
 - 1.1 Classification of genetic disorders
 - 1.2 Single gene Disorders (Cystic Fibrosis, Marfan's disease)
 - 1.3 Multifactorial disorders (Diabetes, Atherosclerosis, Schizophrenia)
2. Molecular Techniques
 - 2.1 PCR-RFLP
 - 2.2 ARMS-PCR

- 2.3 Multiplex-PCR
- 2.4 SSCP, CSGE, DGGE, DHPLC
- 2.5 MALDI-TOF
- 2.6 DNA Sequencing

3. Disease identification and Genetic tests for following disorders

- 3.1 Thalassemia, Fanconi anemia, Sickle Cell anemia, Fragile-X syndrome, Alzheimer's disease
- 3.2 Duchenne Muscular Dystrophy/Becker's Muscular Dystrophy, Huntington's disease
- 3.3 Allelic susceptibility test for multifactorial disorders (Neural Tube Defect, Cleft Lip and Palate, Cardio Vascular Disorder, Male infertility)
- 3.4 Molecular basis of cancer

4. Genetic Counseling

- 4.1 Principles of genetic counseling
 - 4.2 Causes and factors for seeking counseling
 - 4.3 Dismorphology
 - 4.3 Ethical and legal issues in genetic counseling
 - 4.4 Risk evaluation (Mendelian risk, empirical risk)
 - 4.5 Prenatal and pre-implantation diagnosis.
- Non-invasive: Triple test, Ultrasonography (USG)
- Invasive: Amniocentesis (AC), chorionic villi sampling (CVS), Fetal blood sampling (FBS)
- Population screening for genetic disorders
1. Treatment and management of genetic disorders

Practicals

Detection of mutation using ARMS-PCR (e.g.; Thalassemia) and microsatellite markers (e.g.; fragile-X syndrome)

Tests for genetic disorders like;

- 2.1 Overview of genetic diagnostics
- 2.2 SNP (e.g.; cleft lip and palate)
- 2.3 STS (e.g.; male infertility: Y-chromosome microdeletion)
- 2.4 Triplet repeat polymorphism (e.g.; Huntington's disease)
- 2.5 Molecular markers for tumor detection like;
 - BCR-ABL (RT-PCR)
 - BRCA1 (PCR)
 - Her2new (FISH)

Genetic counseling (pedigree analysis in disease conditions, risk calculation)

Haplotyping of risk alleles in multifactorial disorders

Subject Code/ Subject Name: PGDCG-203/ Physiology & Pathology

Theory

1. Blood (formation, composition, function and pathology of blood disorders (haemoglobinopathies, sickle cell anemia, hemophilia)
 2. Muscle disorders (Duchenne muscular dystrophy-DMD, Becker's muscular dystrophy-BMD, spinal muscular atrophy-SMA)
 3. Bone disorders (Osteogenesis imperfecta, Rheumatoid arthritis)
 4. Skin disorder (Albinism)
 5. Eye disorder (Retinitis pigmentosa)
 6. Tests at cellular level: TLC, DLC, platelets
 7. Molecular Pathology – principles & application
- Infectious diseases and Pathogen (Tuberculosis-*M. tuberculi*, Peptic ulcer-*H. pylori*, Cervical Cancer-HPV, AIDS-HIV, Hepatitis- Hepatitis virus, Rubella- Rubella virus)
- Homocysteinuria
- Nutritional deficiency and disease
- Genetic susceptibility to infectious diseases

Practicals

Total leucocyte count (TLC), differential leucocyte count (DLC), general blood picture (GBP), hematocrit, hemoglobin (Hb) content and electrophoretic resolution of Hb in human blood, platelets

DNA based detection of HPV, *H. pylori*, *M. Tuberculi*, *M. lepri* etc.

Assay of Homocysteine, Vitamin-B-12, Folic-acid

Subject Code/ Subject Name: PGDCG-204/ Developmental & Reproductive Genetics

Theory

- Overview of human development and developmental disorders (DiGeorge syndrome, neural tube defect, cleft lip and palate, microcephaly)
1. Sex Determination
 2. Hormonal basis of sexual differentiation
 3. Reproductive organs and gonads

Reproductive Disorders: Genetic and environmental susceptibility for reproductive disorders (Male infertility), endometriosis, recurrent early pregnancy loss, polycystic ovarian disorder

4. Assisted Reproductive technologies (ART)
5. Ethical and legal issues

Practicals

Models for human developmental stages Hormone assay for thyroid (TSH, T3, T4) and sexual disorders (testosterone, dihydrotestosterone, estradiol, FSH, LH by RIA), semen analysis, Y-chromosome microdeletion

Subject Code/ Subject Name: PGDCG-205/Clinical Posting-II

The clinical posting will be held in CRS and hospital.

Recommended Books:

- Principles of Genetics by D. Peter Snustad and Michael J Simmons
- Genetics: A Conceptual Approach by Benjamin A. Pierce
- Molecular Biotechnology by Primose SB
- Essential of Medical Genetics by Conner & Smith, Blackwell Publishers
- Human Cytogenetics- A Practical Approach by Rooney & Czepulkowski, IRL
- Biochemistry by Voet & Voet, Wiley
- A Clinical Guide to Inherited Metabolic Diseases by JTR Clarke, Cambridge University Press
- Gene Cloning & DNA Analysis by TA Brown, Blackwell Publishings
- Molecular Cloning: A Laboratory Manual (3 Volume Set) by J Sambrook, CSHL Press
- An introduction to Human Molecular Genetics-Mechanism of Inherited Diseases by Pasternak J. Fitzgerald, Science Press
- Introduction to Molecular Human Genetics by Pasternak, Fritzgerald
- The Metabolic & Molecular Bases of Inherited Disease by Scriver, Vogelstein et. al., McGraw Hill
- Chromosome Abnormalities and Genetic Counseling (Oxford Monographs on Medical Genetics) by RJM Gardner & GR Sutherland, Oxford University Press
- Emery's Elements of Medical Genetics by Peter D Turnpenny, Churchill Livingstone-Elsevier
- Chromosome Abnormalities and Genetic Counseling (Oxford Monographs on Medical Genetics) by RJM Gardner & GR Sutherland, Oxford University



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Date: 25/12/2023

Ref. No-SVSU/PMS/2023/.....3864

To
The Principal,
Subharti Medical College,
Swami Vivekanand Subharti University, Meerut

Subject: Minutes of Meeting of Board of Studies which held on 22/12/2023

Dear Sir,

A meeting of Board of Studies, Department of Paramedical Sciences, SMC was held on 22/12/2023 and following agendas was discuss in meeting and send to Faculty board for the approval.

Agenda 1: Discussion on the Implementation of last BOS agenda.

Agenda 2: Introduction of New program "Post Graduate Diploma in Clinical Genetics"



Dr. Pankaj Kishor Mishra
Prof. & Head
Dept. of Paramedical Sciences
SMC, Meerut

Enclosure: Minutes of Meeting

2. Ordinance & Syllabus