

**DRAFT REGULATION FOR CHOICE BASED CREDIT SYSTEM
(CBCS)**

**FOR MASTER OF SCIENCE (M.Sc.) PROGRAMME UNDER SRI
GURU RAM DAS UNIVERSITY OF HEALTH SCIENCES, SRI
AMRITSAR**



**Implemented from
Academic Session 2024-2025**

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CONTENT

Sr. No.	Contents	Page No.
1.	Preamble	4
2.	Title and Commencement	4-5
3.	Objectives	5
4.	Applicability of CBCS and Grading System	5
5.	Duration (Time frame)	5
6.	Choosing Program study courses	5
7.	Eligibility for Admission	6
8.	Definitions	6-8
9.	Evaluation of Students	8
10.	Examination Schedule	8
11.	Eligibility for Appearing in End Semester Examination	8
12.	Thesis Submission Guidelines	9
13.	Academic Qualifications and Appointment of External/Internal Examiners	10
14.	Examinations and Evaluation of Students	10
15.	Supplementary Examinations	11
16.	Re-Evaluation	11
17.	Grading System	11-14
18.	Programme Continuation/Discontinuation	14-15
19.	Correction of Errors	15
20.	Question Pattern and Paper Setting	15
21.	List of Electives Courses	16
22.	Course Codes	17
23.	M.Sc. Medical Anatomy course content	18-19
24.	M.Sc. Medical Anatomy syllabus	20-47

DRAFT REGULATION FOR MASTER OF SCIENCES CBCS

M.Sc. DEGREE/ P.G. DIPLOMA/ P.G. CERTIFICATE UNDER SRI GURU RAM DAS UNIVERSITY OF HEALTH SCIENCES, SRI AMRITSAR

1. PREAMBLE

The National Education Policy (NEP) 2020, along with the University Grants Commission (UGC) guidelines, aims to bring significant reforms to postgraduate (PG) education in all disciplines, including medical sciences, through the implementation of the Choice Based Credit System (CBCS). This framework seeks to enhance the quality, flexibility, and interdisciplinary nature of M.Sc. programs, aligning them with global standards and promoting a student-centric approach. NEP 2020 proposes varied structures for PG programs, acknowledging the diversity in undergraduate education. The curriculum and credit framework for M.Sc. programs are aligned with the National Higher Education Qualifications Framework (NHEQF). Credits earned will be managed under the National Credit Framework (NCrF), facilitating credit transfer and accumulation. CBCS provides students with the flexibility to choose courses based on their interests and career goals. It encourages interdisciplinary learning, allowing students to select courses from within their discipline and potentially from other disciplines. Students with majors or minors in their UG program may be able to pursue PG studies in either, provided they demonstrate competence.

The framework supports multiple entry and exits options in M.Sc. programs through the Academic Bank of Credits (ABC), allowing students to accumulate credits and resume their studies after a break. The framework encourages the adoption of various learning modes, including offline, online, hybrid, and Open Distance Learning (ODL) methods, providing greater accessibility and flexibility. Emphasis will be on continuous and formative assessment strategies, along with rigorous plagiarism checks. A comprehensive grading system, often a 10-point scale, will be used to evaluate student performance. The Academic Bank of Credits (ABC) facilitates the seamless transfer and accumulation of credit points, supporting both horizontal (across institutions) and vertical (across different levels of education) mobility within the higher education system. Flexibility to choose specialized elective courses within or related to their medical specialization. Implementation of a standardized grading system that aligns with UGC guidelines, facilitating better comparison of academic performance across institutions.

The introduction of CBCS for M.Sc. programs in medical sciences, as per NEP UGC guidelines, holds the potential to modernize medical education, enhance its flexibility, and promote interdisciplinary learning.

2. TITLE AND COMMENCEMENT

These Regulations shall be called the Sri Guru Ram Das University of Health Sciences regulations for Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) for Master of Science Degree Programmes. These Regulations shall be

applicable to all candidates admitted into the full-time M.Sc. programmes run under Sri Guru Ram Das University of Health Sciences, Sri Amritsar from the calendar year 2024.

3. OBJECTIVES:

Introduction of Choice Based Credit System has following objectives:

- i. To make the course curriculum learner centric and encourage inter-disciplinary without disturbing the domain centric knowledge
- ii. To promote mobility of students and help in optimizing learning
- iii. To allow autonomy to the teachers with built in accountability.
- iv. Continuous evaluation of students to help in optimizing learning
- v. To introduce transparency in the evaluation system and improve employability among students

4. APPLICABILITY OF CBCS AND GRADING SYSTEM

The Regulation herein specified applies to all full-time M.Sc. Programmes (Medical and Paramedical) under choice Based Credit System by the Sri Guru Ram Das University of Health Sciences herein after referred to as the University.

- i. The Institute imparting M.Sc. teaching, hereinafter, shall be referred to as Institute (SGRDIMSR).
- ii. The Regulations, herein specified, shall apply to full-time Post- Graduate Programmes offered by the Sri Guru Ram Das University of Health Sciences, hereinafter, referred to as the “University”.
- iii. The University Department/College/Institute imparting M.Sc. teaching, hereinafter, shall be referred to as the “Department /College/ Institute”.

5. DURATION (TIME FRAME)

- i. The M.Sc. programme for a regular student shall be for a period of two years to be completed in a maximum of ‘Four Years’ period from the date of admission/registration of the candidate.
- ii. Each academic year shall comprise of two semesters, viz. Odd and Even semesters.
- iii. Odd Semesters shall be from August to January and the Even Semester shall be from February to July.

6. CHOOSING PROGRAM STUDY COURSES

- i. At the time of admission each student will identify a Degree/ Diploma/ Certificate Programme.
- ii. Every programme will have core courses (Foundation, core and elective) as prescribed by the concerned M.Sc. Board of Studies and the Faculty.

7. ELIGIBILITY-FOR ADMISSION

- i. The candidate seeking admission in M.Sc. programmes must have obtained at least 50% marks in the subject concerned at the Graduation/equivalent examinations.
- ii. The M.Sc. Programme is open to a candidate who has passed Undergraduate degree in Medical Sciences (B.Sc. Medical Stream)/MBBS/BDS/BPT/BAMS or equivalent examination from a Statutory Institution/University.

OR

Any other examination recognized by the Board of Management of this University as an equivalent course/examination thereto, from time to time.

- iii. The selection of the candidates shall be purely on Merit/Performance in the Centralised Entrance Test (CET) conducted by SGRDUHS

OR

The National Testing Agency conducted the CUET (PG).

- iv. The Centralised Entrance Test shall be a Multiple choice questions examination of 2 hours duration of 50 marks.
- v. The syllabus for M.Sc. test includes the syllabus of B.Sc. Medical Sciences as per the chosen specialization.

8. DEFINITIONS:

- i. **Academic Year:** Two consecutive (one odd + one even) semesters constitute one academic year.
- ii. **Academic Calendar:** An Academic Calendar will be prepared by the university to maintain uniformity in the CBCS of all M.Sc. Programmes, semesters and course in the college/institute run under the university.
- iii. **Semester:** An academic year comprising 180 working days in the least is divided into two semesters, each semester having at least 90 working days. With six working days in a week this would mean that each semester will have $90 / 6 = 15$ teaching/working weeks. Considering that each teaching day has 5 teaching/ working hours, a teaching week would have $5 \times 6 = 30$ working /teaching hours and each semester will have $30 \times 15 = 450$ teaching hours available for each student. In nut shell, each semester will have 14 — 15 weeks of teaching and the remaining time of the semester will be utilized for examinations, evaluation and publication of the result. Each week will impart 30 hours of teaching spread over 6 days.
- iv. The odd semester is scheduled from August to January and the even semester from February to July. Each week has a minimum 30 working hours spread over 6 days.
- v. Each semester will include – Admission, Course work, conduct of examinations and declaration of result including semester break.
- vi. **Choice Based Credit System (CBCS):** CBCS provides choice for students to select from the prescribed Programme.
- vii. **Programmes:**
 - i. Programme: An educational programme leading to award of Master's degree, diploma or certificate.

- ii. A Participant of the programme is a student who registered himself/herself with the University for any of the programmes and attend the same as per the schedule followed by the Department/Institute/College.
 - iii. Full-time programmes are those programmes in which the participants devote their full time in fulfilment of the academic schedule of the programme(s) and are not employed elsewhere.
- viii. **Courses:**
- a) Course is a structured set of instructions that are imparted to a student on the basis of a syllabus or a framework decided beforehand and has the sanction of the different academic (Board of Studies, Faculty, Academic Council) and executive (Senate/ Executive Council, Finance Committee) bodies of the University extended over a semester
 - b) Each course is designed variously under instructions given as Lectures, Tutorials, and Practical (laboratory and field exercises). Usually, these components are referred to as L, T, and P components. The credits for each course determine the volume of the course content. where L stands for Lecture session, T stands for Tutorial session consisting participatory discussion/self-study/desk work/ brief seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the Lecture classes and P stands for Practice session and it consists of Hands-on experience/Laboratory Experiments/OPD-IPD Studies/ Case studies that equip students to acquire the much-required skill component.
 - c) **Foundation Courses (FC):** The Foundation Courses may be of two kinds: Compulsory Foundation and Elective foundation. Compulsory Foundation courses are the courses based upon the content that leads to Knowledge enhancement. They are mandatory for all disciplines. Elective Foundation courses are value-based and are aimed at man-making education.
 - d) **Core Courses (CC):** There may be Core Courses in every semester. This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirement of a programme in a said discipline of study.
A Core course may be a Soft Core if there is a choice or an option for the candidate to choose a course from a pool of courses from the main discipline/subject of study or from a related discipline/courses which supports the main discipline/courses. In contrast to the phrase Soft Core, a compulsory core course is called a Hard Core Course.
 - e) **Elective Course (EC):** This is a course which can be chosen from a pool of courses. It may be: Supportive to the discipline of study, Providing an expanded scope, Enabling an exposure to some other discipline/domain, Nurturing students' proficiency/skill.
Generic Elective course (GE): An elective may be "Generic Elective (GE)" focusing on those courses which add generic proficiency to the students.
Discipline Centric Course (DC): An elective may also be "Discipline Centric (DC)" or may be chosen from an unrelated discipline. It may be called an "Open Elective".
Skill Enhancement Course (SEC/AE): "Skill Enhancement (SE)" is leading to adding to the skill/ability enhancement specific to the programme.
- ix. The BOS may add or delete courses in combination of programme.

- x. Each PG Degree Programme shall be designed as 80 credits, full-time postgraduate programme delivered in Four (04) Semesters.
- xi. **Credit:** The term 'credit' refers to the weightage given to a course, usually in terms of the number of instructional hours per week assigned to it. This explains why usually 'credit' is taken to mean 'credit hours'. The credits also determine the volume of course contents and delivery of programme such as lectures tutorials, practical, assignments etc. **Credit:** Credit stands for following in the context of CBCS. Term Credit has a connotation of achievement or earning through learning effort.
Credit: A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit shall mean one hour of teaching (lecture or tutorial) or two hours of laboratory /practical work per week in a semester of 16-18 weeks.

9. EVALUATION OF STUDENTS

- i. Continued Internal Assessment has to be followed by giving at least four examinations, unannounced quiz, assignment, field work etc.
- ii. Postgraduate Programme: Purely internal evaluation for courses and external evaluation for thesis/dissertation/project work.

10. EXAMINATION SCHEDULE

- i. At least four examinations shall be held—First hourly examination (weightage 10%), Mid-term examination (weightage 25%), Second hourly examination (weightage 10%) and end semester examination (weightage not less than 50%) and 5% attendance weightage. The weightage for Continued Internal Assessment and the End Semester Examination will be equal
- ii. The teacher may decide to give an assignment or a class seminar in lieu of the first or second hourly examination with intimation to Head of the Department.
- iii. All postgraduate examinations will be held in the regular class and conducted by the class teacher under supervision of Head of the Department.
- iv. All the teachers offering courses shall submit a midterm report to COE in a prescribed format within one week of holding the midterm examination.
- v. All the examinations will be held during the week earmarked by the Registrar in the academic calendar.

11. ELIGIBILITY FOR APPEARING IN END SEMESTER EXAMINATION

- i. 50% aggregate marks in First Hourly, Second Hourly and Mid Term Examination.
- ii. 75% attendance in class lectures and practical classes.
- iii. List of students detained in different courses to be displayed by the concerned Head of the Department well in advance of filling examination forms.

12. THESIS SUBMISSION GUIDELINES

- i. After the allotment of Supervisor and Co-Supervisor in the first semester by the Competent Authority of the Institution (Director Principal, Registrar, Dean). Every candidate shall submit a thesis plan (synopsis) to the University within second semester from the date of admission.
- ii. Every candidate shall carry out work on an approved research project under the guidance of a recognized PG Teacher (First preference given to Professor only or I. Teachers holding Ph.D. qualification having at least 3 years teaching experience after Ph.D. may be appointed as supervisor, II. After MD/MS 10 years of teaching and research experience). The teachers mentioned at [I and II] should also have at least 5 research papers in indexed National and International Journals.
- iii. Thesis shall be submitted to the University before the commencement of the fourth semester Theory Examinations i.e. by March of the preceding year for July/August examinations.
- iv. The Vice-Chancellor may allow a candidate to submit the thesis within one month after the date fixed for the purpose with the prescribed late fee.
- v. The thesis shall embody the results of the candidate's own research and/or experience and shall contain precise reference to the publications quoted, and 'must attain a good standard and shall be satisfactory in literary presentation and in other respects and should end with a summary embodying conclusion arrived at by the candidate. The original thesis as well as the photocopies should be prepared on a high quality white paper of A4 size. All pages must have at least 4 cm margin on the left 1.5 cm on right and 2.5 cm on the top and bottom. The general text of the manuscript should be typed in 1.5 line space in Arial font, size 12 with one side printing of the paper. The text of the manuscript should be justified.
- vi. After completion of all prescribed requirements of the programme, five hard bound copies of thesis using high quality Rexene (The colour of Rexene to be used for binding will be Navy Blue) with printing in golden letters on the front cover as well as on the spine shall be submitted for stamping by the Registrar. A soft copy of thesis on a CD will be submitted.
- vii. The thesis shall be examined by a minimum of two examiners. One internal and one external examiner. Ordinarily, this examiner will not be appointed the External Examiner for theory and Clinical/Practical examination. The candidates who have submitted the thesis in University will be allowed to appear in the final examination. However, the result shall be declared only on receipt of the thesis acceptance from both the examiners.
- viii. The internal examiner shall send only report to the University after evaluation of thesis and the evaluated copy will be deposited in the CoEs office. The external examiner shall also send copy of the thesis along with the report to the University. The University shall keep two copies of thesis in the University Library for reference of the students.

13. ACADEMIC QUALIFICATIONS AND APPOINTMENT OF EXTERNAL/INTERNAL EXAMINERS

- i. M.D/Ph.D. as per specialization (Anatomy/Biochemistry/Microbiology /Pathology/Physiology/Genetics) with minimum one year of teaching/professional experience after Postgraduation in a teaching institution. OR
- ii. M.Sc. Medical with minimum five years of teaching/professional experience of which at least 2 years after the post-graduate qualification in a teaching Institution.
- iii. There shall be two examiners out of which one shall be external examiner recommended by Board of Studies and approved by Academic Council. The Board of Studies shall supply the panel of examiners to university for appointment of internal/external examiners by the Vice Chancellor.

14. EXAMINATIONS AND EVALUATION OF STUDENTS

- i. In case a student could not appear in any component of the Continuous Internal Assessment of a course due to medical reasons or under other exceptional circumstances (supported by documentary evidence), a separate examination in that component will be arranged by the concerned teacher with the approval of respective HOD before the beginning of End Semester Examination.
- ii. A student will be permitted to appear in the End-Semester Examination as per the Conduct of Examinations Rules after filling up the prescribed examination form, payment of the prescribed examination fee, satisfying the attendance requirement and fulfilling other eligibility criteria.
- iii. The question paper pattern of the End Semester Examination will be prescribed by the concerned Board of Studies and at least two sets of question papers for these examinations will be submitted to COEs in the beginning of the semester, one of these sets will be passed on to the concerned HOD one hour before the Examination. It will be compulsory to pass the End Semester Examination for successful completion of the course.
- iv. Unless prescribed in the Regulations and the Scheme of Examination of a particular programme, a candidate will be deemed to have completed his/her course successfully if he/she obtains minimum 50% marks/Grade point of 5.00/ as per the 10-point scale.
- v. If a student fails in the End Semester Examination, a supplementary examination within six weeks of declaration of result will be arranged for such students by the respective department with the help of COEs. The marks for all other components as applicable will however, be carried forward in such cases. The students will be required to deposit the examination form along with prescribed fee for all such examinations.
- vi. The marks obtained in the Continued Internal Assessment and all the examinations will be shown to the students. The evaluation scheme will also be explained to students.
- vii. At the end of semester, the result for each course is compiled by the concerned teacher, discussed with the head of department and compiled result submitted by HOD to COE.

15. SUPPLEMENTARY EXAMINATIONS

- i. If a student fails in the End Semester Examinations, a supplementary examination will be conducted with next semester examinations. The marks for all other components as applicable will however, be carried forward in such cases. Whereas shortfall in attendance will be covered by assignments or lecture attendance.
- ii. Supplementary examination can be given for maximum of three courses (including practicals) or 50% courses (core & foundation courses).
- iii. After declaration of result the Principal concerned shall display the list of students eligible to take supplementary examinations.
- iv. The eligible students shall apply for the examination within three days of display of this list after paying the fee and filling the prescribed application form.
- v. The students who fail to get pass marks shall have to register the course again and no more chance to appear in the supplementary examination shall be permitted until or unless some serious circumstances.

16. RE-EVALUATION

- i. The re-evaluation is applicable only for final theory examinations conducted under External Examination System. If the student is eligible for supplementary examination, he/she can either opt for re-evaluation of the final paper or request for supplementary examination.
- ii. Only one of these two options shall be considered by the Controller of Examinations. Once the student appears in the supplementary examination then only, the paper of supplementary examination can be considered for re-evaluation if desired by the student.
- iii. The number of courses for re-evaluation in a semester can be availed up to 50% of the number of courses registered or three, whichever is less, even if a candidate has passed the course in the final examination while considering eligibility for re-evaluation, based on 50% of registered courses, the fraction of 0.5 and above will be rounded off upwards.
- iv. The student may apply for re-evaluation with prescribed fee within fifteen working days of declaration of the result in a prescribed performa. The re-evaluation will be done by an examiner other than the one who has earlier marked the answer book. The re-evaluation result will be submitted to the Controller of Examinations through the teacher concerned for revision of the result, if need be.

17. GRADING SYSTEM:

A. Award of Grades and Credit points

- i. Adopted the UGC recommended 10-point grading system of awarding grades and CGPA under ChoiceBased Credit Semester System.
- ii. Grading of Performance Based on the performance, each student shall be awarded a final grade at the end of the semester for each course. Absolute grading is used by converting the marks to grade, based on predetermined class intervals.
- iii. UGC 10 point grading system is used with pass grade modified.

Table 1: CBCS Grading System and Marks Equivalence

Percentage Marks	Letter Grade	Grade Points
>90 to ≤100	O (Outstanding)	9.1-10
>80 to 90	A+ (Excellent)	8.1-9.0
>70 to ≤80	A (Very Good)	7.1-8.0
>60 to ≤70	B+ (Good)	6.1-7.0
>50 to ≤60	B (Above Average)	5.1-6.0
>40 to ≤50	C (Average)	4.1-5.0
≥35 to ≤40	F (Fail)	3.5-4.0
Below 40	F (Fail)	0
Absent (Ab)	F (Fail)	0

For Medical/Paramedical Programme – Pass is at C Grade (5.0 grade point) 50% and above

Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA). SPGA is the weighted average of the grade points obtained in all courses by the student during the semester.

- i. A student obtaining Grade F shall be considered failed and will be required to reappear in the examination. Registrations of such students for the respective courses shall be treated as cancelled and the candidate has to re-register and repeat the course when it is offered next time.
- ii. For non-credit courses ‘Satisfactory’ or ‘Unsatisfactory’ shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/CGPA.

B. SGPA Computation

Course Number	Credits	Letter grade	Grade point	Credit point (Credit × grade)
1	3 (C1)	A	8 (G1)	3 × 8 = 24
2	4(C2)	B+	7(G2)	4 × 7 = 28
3	3(C3)	B	6(G3)	3 × 6 = 18

SGPA=	$C1G1+C2G2+C3G3$	70	=7
	$C1+C2+C3$	10	

Table 2. Illustration of Computation of SGPA and CGPA

Course	Credit	GradeLetter	Grade Point	Credit Point (Credit x Grade)
Course 1	3	A	8	3 X 8 = 24
Course 2	4	B+	7	4 X 7 = 28
Course 3	3	B	6	3 X 6 = 18
Course 4	3	O	10	3 X 10 = 30
Course 5	3	C	5	3 X 5 = 15
Course 6	4	B	6	4 X 6 = 24
	20			139
Illustration for SGPA				
Thus, SGPA = 139/20 = 6.95				

Table 3: Total SGPA

Semester 1	Semester 2	Semester 3	Semester 4
Credit : 20	Credit : 22	Credit : 25	Credit : 26
SGPA : 6.9	SGPA : 6.8	SGPA : 6.6	SGPA : 6.0
Semester 5	Semester 6		
Credit : 26	Credit : 25		
SGPA : 6.3	SGPA : 8.0		
Illustration for CGPA			

Thus,

$$CGPA = \frac{20 \times 6.9 + 22 \times 6.8 + 25 \times 6.6 + 26 \times 6.0 + 26 \times 6.3 + 25 \times 8.0}{144}$$

$$= 6.75/B+$$

C. Transcript:

Based on the above recommendations on Letter grades, grade points and SGPA and CGPA, the transcript for each semester and a consolidated transcript indicating the performance in all semesters may be issued.

D. Re-Entry after Break of Study:

- i. The University regulations for readmission are applicable for a candidate seeking re-entry to a program.
- ii. Students admitted the program and absenting for more than 3 months must seek readmission into the appropriate semester as per university norms.
- iii. The student shall follow the syllabus in vogue (currently approved/is being followed) for the program.
- iv. All re-admissions of students are course to the approval of the Vice-Chancellor.
- v. All dropped students with CGPA of less than 5.0 in PG programmes, have right to petition for readmission to first year class against vacant seats.
- vi. The student shall apply to the Registrar within seven days of his/her dropping from the university.
- vii. The case will be reviewed by a petition committee.
- viii. Readmission shall be permitted only once.

E. Ranking

- i. The first two ranks of the programme will be decided on the basis of grades of CGPA in the courses.
- ii. In case of a tie, marks % of core courses only will be taken into account.

F. Normal, Maximum and Minimum Credit Load in a Semester

- i. In a programme, the normal full-time programme of work in a semester shall be 24 credit hours.
- ii. A maximum of 30 and a minimum of 18 credit hours may be taken by a student.
- iii. The PG students on 'Good Standing' may be allowed to register a maximum of 34 credit hours (4 extra credit hours) during their semesters by the Dean, provided these courses registered have been offered on regular basis.

18. PROGRAMME CONTINUATION / DISCONTINUATION:

The continuation/discontinuation and Exit with Degree shall be governed as follows:

- i. A candidate shall be allowed to continue the programme provided he/she maintains a CGPA of 5.0 both in all theory and lab courses at the end of the even semesters (e.g. 2nd, 4th for the academic programmes). Otherwise, the candidate shall remain in the same year till he/she maintains the required CGPA as 5.0.

- ii. Further, if a student who has been detained due to shortage of attendance in more than 50% course in a semester and due to that he/she is not able to maintain minimum criteria of required CGPA 5.0, then such student will be detained in entire semester and shall have to attend regular classes of all courses in next academic year of said semester.
- iii. A candidate shall have to re-appear in semester examinations of the courses with Fail/Absent grade (as per Grade Assignment Table), as and when the same course is offered during regular course of study. Such students shall retain their internal/sessional marks.
- iv. Attendance requirement for appearing in End Semester Examination of each of the semesters shall be 75%.
- v. A student who has been detained due to shortage of attendance shall not be allowed to be promoted to next semester and he/she will be required to repeat only those courses where the student could not make up required 75% attendance in a semester. That is, attendance of a student shall be considered course-wise and if any student fails to maintain minimum criteria of 75% attendance in a course, then he/she will be detained in that particular course only and all such students will have to reappear for that course(s) and also attend the class of that particular course with the next batch of students of said semester.
- vi. Maximum three attempts including main exam (main exam + two backlogs) shall be provided to all students to clear his/her backlogs/arrear in order to get promoted in next year/semester. That is, maximum two academic years are permissible for a student for the completion of the academic programme/course. In no situation a student will be allowed to take more than two academic years, for any reason whatsoever, including for the reasons of detention for shortage of attendance or deficiency of CGPA during the whole term of completion of the course/programme.
- vii. A student who has already availed two additional academic years to clear his/her backlogs/arrears in order to be eligible for the Degree in stipulated time period, will not get any further chance and therefore admission of such student(s) would be automatically stand cancelled.

19. CORRECTION OF ERRORS

In case of any error is detected in the marks recorded on the award list, the examiner(s) concerned shall make a request to correct the mistake to the Principal through the Head of the department, and shall attach relevant documentary evidence. A committee consisting of the following members shall take suitable remedial measures depending upon the merit of the case.

- a) Dean/Principal (Chairman)
- b) Head of the department.
- c) Two Faculty Member nominated by the Dean

20. QUESTION PATTERN AND PAPER SETTING

- i. At least two sets of question papers for the examinations will be submitted to COE in the beginning of the semester, one of these sets will be passed on to the concerned in-

charge one hour before the Examination. It will be compulsory to pass the End Semester Examination for successful completion of the course.

- ii. Question Paper Pattern for End Term Examinations (100 Marks for 3 hours) includes- (a). Filling in the blanks 10 marks, (b) Multiple choice questions 10 marks., (c). Short notes 10x3=30 marks and (d). Essay type questions 10x5=50 marks
- iii. Question Paper Pattern for End Term Examinations (50 Marks for 2 hours) includes- (a). Filling in the blanks 5 marks, (b). Multiple choice questions 5 marks, (c). Short notes 5x2=20 marks and (d). Essay type questions 3x10=30 marks.
- iv. Similar pattern for first hourly, second hourly and Midterm/sendup examinations should be followed.

21. LIST OF ELECTIVES COURSES

Course code	Title	Credits
HVE.501	Human Values & Ethics (Value added course)	03
RMB.501	Research Methodology and Biostatistics	03
IPR.550	Bioethics & Intellectual Property Rights	03
BMW.575	Biomedical waste management	03
ACA.575	Advances in Cancer Biology	03
PGC.575	Principles of Medical Genetics	03
GEP.575	Genomics and Proteomics	03
RDT.575	Recombinant DNA Technology and Genetic Engineering	03

COURSE CODES			
Sr. No.	Programme	Course code	Number code
1.	MSc Human Anatomy	M.Sc.-ANT	5.1
2.	MSc Human Physiology	M.Sc.-PHY	5.2
3.	MSc Medical Biochemistry	M.Sc.-BIC	5.3
4.	MSc Medical Microbiology	M.Sc.-MIC	5.4
5.	MSc MLT Biochemistry	M.Sc.MLT-BIC	5.5
6.	MSc MLT Microbiology	M.Sc.MLT-MIC	5.6
7.	MSc MLT Histopathology	M.Sc.MLT-HIS	5.7

Postgraduate Level	Human Physiology	PHY.501 onwards PHY.601 onwards
	Human Anatomy	ANT. 501 onwards ANT. 601 onwards
	Biochemistry MLT Biochemistry	BIC.501 onwards MLTB.501 onwards
	Genetics	MGC.501 onwards
	Microbiology MLT Microbiology	MIC.501 onwards MLTM.501 onwards
	Histopathology	MLTHP.501 onwards
	Research Methodology and Biostatistics	RMB.501 RMB.601
	Seminar in respective discipline	599
	Masters Research in respective discipline	600
Advanced level Certified courses	Seminar in respective discipline	699
	Research in respective discipline	700

Sri Guru Ram Das University of Health Sciences, Amritsar

Course Structure for the M.Sc. Anatomy

Course code	Course Title	Course Type	L+T+P	Total Credits	Weightage
Semester-I					
ANT.501	General Anatomy & Related Systemic Histology-I	Core Course	3+1+0	4	100
ANT.502	Osteology & Gross Anatomy (Upper Limb & Thorax)-I	Core course	3+1+0	4	100
ANT.503	General Embryology & Related Systemic Embryology-I	Core course	3+1+0	4	100
HVE.501	Human values & ethics	Value added course	3+0+0	3	NC**
ANT.525	Practical in Medical Anatomy-I	Core course	0+0+3	3	100
ANT.550	D-Hall rotation	Core course	0+0+2	2	-
ANT.599	Seminar-I/Journal Club/Assignments	Core course	2+0+0	2	50
		Total Credits	14+3+5	22	450
Semester-II					
ANT.504	Osteology & Gross Anatomy (Lower Limb, Abdomen, Pelvis)-II	Core course	3+1+0	4	100
ANT.505	Systemic Embryology-II	Core Course	3+0+0	3	100
ANT.506	Systemic Histology-II	Core course	2+1+0	3	100
ANT.507	Anthropometry & Genetics	Core Course	3+0+0	3	100
ANT.526	Practical in Medical Anatomy-II	Core course	0+0+3	3	100
ANT.550	D-Hall rotation	Core course	0+0+5	5	-
ANT.600	Thesis Plan/Synopsis writing	Core course	2+0+0	2	-
		Total Credits	13+2+8	23	500
Semester-III					
ANT.508	Osteology & Gross Anatomy (Head & Neck)-III	Core course	3+1+0	4	100
ANT.509	Systemic Histology & Histological techniques-III	Core course	3+0+0	3	100
ANT.510	Gross Anatomy Brain & Neuro Anatomy	Core course	3+0+0	3	100
RMB.501	Research Methodology and Biostatistics	Elective course	4+0+0	4	100
IPR.550	Bioethics & Intellectual Property Rights	Elective Course	3+0+0	3	NC*
ANT.599	Seminar-II/Journal Club/Assignments	Core Course	2+0+0	2	50
ANT.525	Practical in Medical Anatomy-III	Core Course	0+0+3	3	100
ANT.550	D-Hall rotation	Core course	0+0+4	4	-
		Total Credits	18+1+7	26	550
Semester-IV					
ANT.600	Thesis /Dissertation Work	Core course	0+0+20	20	100
ANT.511	Radiological & Forensic Anatomy	Core course	3+0+0	3	50
*Elective	Optional Elective course	Elective course	3+0+0	3	50
ANT.550	D-Hall rotation	Core course	0+0+3	3	-
		Total Credits	6+0+23	29	200
Grand Total Credits			51+6+43	100	1700

* Choose any one					
BMW.575	Biomedical waste management	Elective course	3+0+0	3	50
ACA.575	Advances in Cancer Biology	Elective course	3+0+0	3	50
PGC.575	Principles of Medical Genetics	Elective course	3+0+0	3	50
GEP.575	Genomics and Proteomics	Elective course	3+0+0	3	50
RDT.575	Recombinant DNA Technology and Genetic Engineering	Elective course	3+0+0	3	50
Thesis/Dissertation work: Thesis/Dissertation work will begin in third semester. The proposal for Thesis/Dissertation work shall be finalized in second semester.					

SYLLABUS OF M.Sc. MEDICAL ANATOMY

SEMESTER-I		
Name of the Programme	M.Sc. Medical Anatomy	
Name of the Course	General Anatomy & Related Systemic Histology-I	
Course Code	ANT.501	
Credit hours	04	
Teaching Objective	<ul style="list-style-type: none"> i. To introduce and define the normal anatomical position as the standard reference point for all anatomical descriptions. ii. To describe the structure and functions of the skin and its appendages (hair, nails, glands). iii. To describe the structure, blood supply, and functions of bone. iv. To provide a detailed classification of joints (e.g., fibrous, cartilaginous, synovial) with examples. 	
Learning Outcomes	<ul style="list-style-type: none"> i. Students should be able to describe the normal anatomical position. ii. Students should be able to list the layers of the skin and its appendages. iii. Students should be able to classify bones and provide examples. iv. Students should be able to identify and demonstrate the movements possible at different synovial joints. v. Students should be able to describe the structural differences between blood vessels. 	
Unit No.	Content	Lectures
1.	Anatomical terminology: Normal anatomical position, Various planes, Terms used in relation to Trunk and Limbs, laterality and movements in the human body	3
2.	Skin-structure & functions of skin with its appendages, principles of skin incisions, dermatomes, Fascia- superficial and deep fascia with modifications,	5
3.	Classification of bones with examples, structure, blood supply, functions, types and laws of ossification,	2
4.	Classification of Cartilage with examples, structure and functions, Classification of joints with examples, features and movements in detail, Classification of muscles with examples, structure, functions, Shunt and Spurt muscles,	5
5.	Cardiovascular system-structure and functions of arteries, veins and capillaries, differences between arteries and veins, between pulmonary and systemic circulation and significance of end-arteries,	5
6.	Lymphatic system-components and functions, mechanism of lymph circulation, spread of tumors via lymphatics,	5
7.	Nervous system-components of central, peripheral & autonomic nervous system, structure and classification of neurons.	5
8.	Related Systemic Histology-I Epithelial tissue-Variety types that correlate to its function, ultrastructure, Glands- Classification and structure-function correlation of the same, Connective tissue--Variety types with functional correlation, ultrastructure	5
9.	Cartilage - Microanatomy of Hyaline, Elastic and Fibrocartilage, Bone – Variety types and structure- function correlation of the same,	5
10.	Muscular tissue- Microanatomy of smooth, cardiac and striated muscles, Nervous Tissue- Microanatomy of spinal cord, cerebral cortex and cerebellum	5
11.	Cardiovascular system- Microanatomy of elastic and muscular arteries, veins, capillaries, heart	3

12.	Lymphoid-tissue- Microanatomy of Spleen, thymus, tonsil, lymph node	2
13.	Mammary gland lactating and non-lactating	5
14.	Integumentary System - Microanatomy of skin	5
15.	Respiratory system- Microanatomy of Epiglottis, Trachea and Lungs	5
	Total	65

SEMESTER-I		
Name of the Programme	M.Sc. Anatomy	
Name of the Course	Osteology & Gross Anatomy (Upper limb & Thorax)-I	
Course Code	ANT.502	
Credit hours	04	
Teaching Objective	<p>Include understanding the structures and their functions, including bones, muscles, nerves, blood vessels, and their relationships within these regions.</p> <p>Describe the anatomy and movements of the shoulder, elbow, and wrist joints.</p> <p>Identify and describe the muscles of the thorax, including those involved in breathing and movement of the upper limb and neck.</p> <p>To help to Identify the location and relationships of the lungs, heart, and other thoracic organs.</p>	
Learning Outcomes	Students should be able to identify these structures, understand their roles in movement and function, and apply this knowledge to clinical contexts, such as regional anesthesia or understanding potential injuries.	
Unit No.	Content	Lectures
1.	Osteology Upper Limbs Identification of given bone, Side determination, Salient features and anatomical position, Joints formed by the given bone, Important Muscle Attachments, Identify bones in an articulated hand and foot, Scaphoid fracture and anatomical basis of avascular necrosis, Clinical correlation	10
	Osteology Thorax: Bones of Thorax with attachments, Ribs (Typical and Atypical) & Costal cartilages, Sternum, Joints of the thorax Vertebrae - typical, atypical vertebrae, thoracic, parts of vertebra, salient features of all vertebrae, articulations, attachments, blood supply.	10
3.	Gross Anatomy-Upper Limb Introduction to upper limb, Pectoral Region, Breast, Axilla & brachial Plexus, Scapular Region, Front & back of Arm, Cubital Fossa, Front of Forearm & palm, Back of Forearm & Dorsum of hand, Joints of upper limb, Arteries of upper limb, Venous & Lymphatic drainage of upper Limb, Nerves, Dermatomes and Nerve Injuries, Applied anatomy of each region, Comparison of upper and Lower limbs	15
4.	Gross Anatomy Thorax Introduction to thorax Walls of thorax & Respiratory Movements, Thoracic inlet, cavity and outlet, Lungs (bronchopulmonary segments) with Pleura, Heart with Pericardium, Coronary circulation, Superior vena cava, Aorta and pulmonary Trunk, Trachea, Oesophagus and Thoracic Duct, Arteries & veins of Thorax, Sympathetic Chain, Intercostal nerves, Mediastinum- subdivisions, detailed contents and applied, Joints of thorax, Applied aspects of all regions	15
5.	Arthrology/ Joints (Upper Limb & Thorax) Definition and Classification of joints, Bones taking part, Articular cartilage, Capsule and its thickenings, Ligaments, Synovial membrane, Intra capsular structures (if any), Structure, nutrition of articular cartilage and its significance, Innervation, Blood supply, Movements with muscles responsible for such movements, Relations, Clinical correlation	15
	Total	65

SEMESTER-I		
Name of the Programme	M.Sc. Anatomy	
Name of the Course	General Embryology & Related Systemic Embryology-I	
Course Code	ANT.503	
Credit hours	04	
Teaching Objective	<p>Developing an understanding of gamete formation, fertilization, and the key stages of early embryonic development, such as cleavage, blastulation, and gastrulation.</p> <p>Learn about the formation of different organs from the three germ layers, the development of extra- embryonic membranes, and the formation of the placenta. Embryological development with clinical significance, including understanding the causes of congenital anomalies.</p>	
Learning Outcomes	Student will learn about the normal development of the cardiovascular & nervous, as well as the genetic and environmental factors that can lead to congenital anomalies.	
Unit No.	Content	Lectures
1.	General embryology Introduction: Stages of human life, explain the terms phylogeny, ontogeny, trimester, viability, Uterine changes occurring during the menstrual cycle, spermatogenesis, Oogenesis, growth of ovarian follicle and ovulation, Second week of development-cleavage, blastocyst formation	10
2.	Implantation: types, formation of decidua, its subdivisions and abnormal implantation, development of trophoblast, bilaminar germ disc, Extraembryonic mesoderm, Extraembryonic coelom, connecting stalk, formation of prochordal plate, Third week of development- Primitive streak, Primitive node	10
3.	Formation of intra-embryonic mesoderm, trilaminar germ disc, notochord, buccopharyngeal and cloacal membranes, pericardial bar, intra-embryonic mesoderm, intra - embryonic coelom, derivatives of ectoderm, endoderm, mesoderm	5
4.	Fourth to eighth week of development- Formation of somites, neural tube, neural tube defects, cephalo - caudal folding and lateral foldings of embryo, formation of gut and its subdivisions, vitelline duct	5
5.	Foetal Membranes - Formation, functions & fate of chorion, amnion, yolk sac, allantois and decidua	5
6.	Placenta- Formation, features, types, foetomaternal circulation, placental barrier, role of placental hormones in uterine growth & parturition	5
7.	Umbilical cord- Formation & structure, various types of umbilical cord attachments, Prenatal Diagnosis- indications, process and disadvantages of amniocentesis, chorion villus biopsy and other methods, Twinning- Embryological basis of monozygotic & dizygotic twins	5
8.	Development of respiratory system Development of nervous system Development of skeletal system and muscular system,	6
9.	Development of heart loop, formation of chambers, Development of interatrial and interventricular septum,	5
10.	Embryological basis of atrial septal defect, ventricular septal defect, Fallot's tetralogy	5
11.	Development of Mammary gland	4
	Total	65

Name of the Course	HUMAN VALUES AND ETHICS	
Course Code	HVE.501	
Credit hours	03	
Teaching Objective	<p>1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.</p> <p>2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.</p> <p>3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature. Thus, this course is intended to provide a much needed orientational input in value education to the young enquiring minds.</p>	
Learning Outcomes	<p>By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.</p>	
Unit No.	Content	L+T
Module 1	<p>Introduction to Value Education (6 lectures and 3 tutorials for practice session)</p> <p>Lecture 1: Understanding Value Education</p> <p>Lecture 2: Self-exploration as the Process for Value Education</p> <p>Tutorial 1: Practice Session PS1 Sharing about Oneself</p> <p>Lecture 3: Continuous Happiness and Prosperity – the Basic Human Aspirations</p> <p>Lecture 4: Right Understanding, Relationship and Physical Facility</p> <p>Tutorial 2: Practice Session PS2 Exploring Human Consciousness</p> <p>Lecture 5: Happiness and Prosperity – Current Scenario</p> <p>Lecture 6: Method to Fulfill the Basic Human Aspirations</p> <p>Tutorial 3: Practice Session PS3 Exploring Natural Acceptance</p>	5+4
Module 2	<p>Harmony in the Human Being</p> <p>Lecture 7: Understanding Human being as the Co-existence of the Self and the Body</p> <p>Lecture 8: Distinguishing between the Needs of the Self and the Body</p> <p>Tutorial 4: Practice Session PS4 Exploring the difference of Needs of Self and Body</p> <p>Lecture 9: The Body as an Instrument of the Self</p> <p>Lecture 10: Understanding Harmony in the Self</p> <p>Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the Self</p> <p>Lecture 11: Harmony of the Self with the Body</p> <p>Lecture 12: Programme to ensure self-regulation and Health</p> <p>Tutorial 6: Practice Session PS6 Exploring Harmony of Self with the Body</p>	7+3

Module 3	Harmony in the Family and Society (6 lectures and 3 tutorials for practice session) Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction Lecture 14: Values in Human-to-Human Relationship Lecture 15: 'Trust' – the Foundational Value in Relationship Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust Lecture 16: 'Respect' – as the Right Evaluation Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect Lecture 17: Understanding Harmony in the Society Lecture 18: Vision for the Universal Human Order Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal	6+3
Module 4	Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session) Lecture 19: Understanding Harmony in the Nature Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature Lecture 21: Realizing Existence as Co-existence at All Levels Lecture 22: The Holistic Perception of Harmony in Existence Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence	4+2
Module 5	Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session) Lecture 23: Natural Acceptance of Human Values Lecture 24: Definitiveness of (Ethical) Human Conduct Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order Lecture 26: Competence in Professional Ethics Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education Lecture 27: Holistic Technologies, Production Systems and Management Models Typical Case Studies Lecture 28: Strategies for Transition towards Value-based Life and Profession Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order	6+3

Suggested Readings:

Text Book and Teachers Manual

The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1 b.

The Teacher's Manual Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

SEMESTER-I		
Name of the Programme	M.Sc. Anatomy	
Name of the Course	Practicals-I	
Course Code	ANT.525	
Credit hours	04 (2 hrs. practical for 4 days)	
Teaching Objective	To provide a comprehensive understanding of human anatomy through hands-on experience, enhancing spatial reasoning, anatomical knowledge, and appreciation for anatomical variation. To provide knowledge for preservation of cadaver.	
Learning Outcomes	Cadaver dissection allows students to visualize and understand the three-dimensional relationships between different anatomical structures, which is crucial for comprehending anatomical variations and surgical approaches.	
Unit No.	Content	Lectures
1.	Procurement, Embalming and Preservation of human cadavers	10
2.	Preparation of tanks for preserving bodies Dissection of cadaver	10
3.	Preparation of specimens for museum with display a) soft parts b) models c) charts	15
4.	Preparation and preservation of human bones / skeleton	10
	Total	45

SEMESTER-II		
Name of the Programme	M.Sc. ANATOMY	
Name of the Course	Osteology & Gross Anatomy (Lower Limb, Abdomen, Pelvis)-II	
Course Code	ANT.504	
Credit hours	03	
Teaching Objective	<p>To help to understand the bones, muscles, nerves, blood supply, and other key anatomical structures of these regions, their functions and clinical relevance.</p> <p>Identify and describe the major joints of the lower limb, such as the hip joint, knee joint, and ankle joint, including their movements and stability.</p> <p>Describe the boundaries and contents of the abdominal cavity, including the abdominal wall, peritoneum, and major organs.</p>	
Learning Outcomes	<p>Students would be able to identify bony landmarks, describe muscle actions, trace nerve pathways, and explain the blood supply of the lower limb, abdomen, and pelvis. They understand the relationships between these structures and how they contribute to movement, support, and other bodily functions.</p> <p>Students should be able to identify, locate, and describe various structures, understand their functions, and relate them to clinical procedures.</p>	
Unit No.	Content	Lectures
1.	<p>Lower Limb</p> <p>Introduction to Lower Limb, Front, Medial side and back of Thigh, Gluteal region, Popliteal fossa, Front of Leg & dorsum of foot, Back of Leg & Sole of foot, Lateral & medial sides of leg, Arteries of Lower Limb, Venous drainage & lymphatic drainage of lower limb, Joints of lower limb, Arches of foot, Nerves, dermatomes and nerve injuries, Applied anatomy of each region.</p>	10
2.	<p>Abdomen and Pelvis</p> <p>Introduction of Abdomen and pelvis, Abdominal walls (anterior & posterior) including fascia, Peritoneal cavity including details of fossae, sub-phrenic spaces, Viscera of abdominal cavity – stomach, duodenum, small and large gut, rectum, anal canal, appendix, caecum, Liver, gall bladder, spleen, pancreas, supra-renal glands, clinical correlation of each part, Extrahepatic biliary apparatus, Portal vein & portocaval anastomoses, Diaphragm including details of diaphragmatic hernias, Boundaries and contents of Pelvis, pelvic viscera, pelvic inlet, pelvic outlet, pelvic floor, Vessels of Abdomen and pelvis, Nerves of abdomen and pelvis, Female reproductive system- Uterus, uterine tubes, ovaries, cervix, vagina, Male reproductive system- Testis, epididymis, vas deferens, prostate & penis, Urinary system –Kidneys, ureters, urinary bladder, urethra, Perineum, Pelvic diaphragm, Joints of abdomen and pelvis, Applied aspects of each region</p>	15
3.	<p>Trunk</p> <p>of cervical, lumbar & sacral regions, sacralization of lumbar vertebra, lumbarization of 1st sacral vertebra, Vertebral column – normal and abnormal curvatures, Intervertebral disc – structure and functions, Clinical correlation.</p>	15
4.	<p>Pelvis</p> <p>Anatomical position, Parts, Differences between male and female pelvis with types, Articulations, Attachments, Blood supply and nerve supply</p>	5
	Total	45

SEMESTER-II		
Name of the Programme	M.Sc. ANATOMY	
Name of the Course	Systemic Embryology-II	
Course Code	ANT.505	
Credit hours	03	
Teaching Objective	<p>To describe the understanding the formation of the abdominal wall, the development of the diaphragm, and the descent of the abdominal viscera. Students should also grasp the formation of the peritoneal cavity and the development of the gastrointestinal tract, including its rotation and fixation.</p> <p>Focus areas include the development of the bony pelvis, the formation of the pelvic floor, and the development of the internal and external genitalia.</p> <p>Understand the timing of limb bud formation, the development of the cloaca, and the formation of the peritoneal cavity.</p>	
Learning Outcomes	<p>Students should be able to describe the formation of the lower limb, abdominal wall, and pelvic girdle, including the development of muscles, bones, and associated structures.</p> <p>They should also be able to identify and explain the developmental basis of common congenital anomalies in these regions.</p>	
Unit No.	Content	Lectures
1.	Development of body cavities Development of digestive system, Rotation of gut, Development of Liver, gall bladder, spleen and pancrease	12
2.	Development of hindgut, Development of urinary system Development of genital system in male, Development of genital system in female,	16
3.	Development of arteries, Development of Portal vein, inferior vena cava, Foetal circulation,	8
4.	Development of glands – Exocrine and endocrine, Congenital malformations associated with each system	9
	Total	45

SEMESTER-II		
Name of the Programme	M.Sc. Anatomy	
Name of the Course	Systemic Histology-II	
Course Code	ANT.506	
Credit hours	02	
Teaching Objectives	To describe the microscopic structure and organization of tissues and organs in these regions.	
Learning Outcomes	Students should be able to identify and describe the various tissues (epithelial, connective, muscle, and nervous) and organs (e.g., skin, muscle, bone, nerves, blood vessels, and viscera) found in the lower limb, abdomen, and pelvis.	
Unit No.	Content	Lectures
1.	Digestive system- Microanatomy of tongue, salivary glands, oesophagus, stomach, duodenum, jejunum, ileum, appendix, large gut, liver, gall bladder and pancreas, Urinary System-Microanatomy of kidney, ureter and urinary bladder,	16
2.	Male reproductive system- Microanatomy of testis, epididymis, vas deferens, prostate Female reproductive system- Microanatomy of ovary, fallopian tube, uterus, cervix, placenta, umbilical cord	16
	Total	32

SEMESTER-II		
Name of the Programme	M.Sc. Anatomy	
Name of the Course	Anthropometry	
Course Code	ANT.507	
Credit hours	03	
Teaching Objective	To give knowledge and skills to accurately measure and interpret human body dimensions and composition understanding the principles of anthropometric measurements, selecting appropriate techniques and equipment, and applying these measurements to assess nutritional status, growth patterns, and other relevant health indicators. Importance of standardization, quality control, and ethical considerations in anthropometric data collection.	
Learning Outcomes	Students will able to grasp the fundamental principles of anthropometry, including the different types of measurements (e.g., static, dynamic, body composition) and the rationale behind selecting specific measurements for different purposes.	
Unit No.	Content	Lectures
1.	Anthropometry- Brief Historical Background, Division of Anthropometry, Type of Measurement and Applications of Anthropometry.	5
2.	Instrumentation- Anthropometre Rod, Calipers, Osteometry Board, Goniometre, Parllelograph Crainiophore, , Mandibulometre, Orbitoetre, Palatometre Skinfold Caliper etc.	6
3.	Anthropometry measurements (height, weight, body mass index (BMI), body circumferences (waist, hip and limbs), skinfold thickness, Measuring instruments Procedures, Types, Characteristics, Uses, Importance, Anthropometry and biomechanics	5
4.	Somatometry: Height Vertex, Height Tragus, Height Acromion, Sitting Height Vertex, Bi-acromial Diameter, Hand Length, Hand Breadth, Foot Length & Breadth, Body Weight, Maximum Head Length, Maximum Head Breadth, Nasal Length, Nasal Breadth, Cephalic Index, Nasal Index, Facial Index, Body Mass Index (BMI) 2. Somatoscopy: Hair Form, Nose Form, Eyes Form, Lips Form.	7
5.	Craniometry: Maximum Cranial Length, Maximum Cranial Breadth, Glabella-Inion Length, Nasion-Inion Length, Nasion-Basion Length, Bi-Maxillary Breadth, Nasal Length, Nasal Breadth Cranial Index, Cranial Nasal Index, Minimum & Maximum Frontal Breadth, Circumference of Skull, Length of Foramen Magnum, Upper Facial Height, Maximum Bizygomatic Breadth, Bimaxillary Breadth, Biogonial Breadth, Mandibular Length or Length of Lower Zaw.	8
6.	Prehistory: Meaning and Scope, Different types of Archaeology – Classical, Historical, Protohistoric and Pre – historic Archaeology. 2. Dating method: Absolute and Relative Dating Method. 3. The Great Ice Age: Stratigraphic and other evidence of Ice-Age, River, Moraines and Estate Fluctuations. Alpine and Himalayan Glaciations and Pluviations. 4. The Stone Age and Tools, Typology and Technology: Paleolithic, Mesolithic and Neolithic Age, Chalcolithic Age, Iron Age, Bronze Age. 5. Pre-historic Dimension of Indian	10

	Culture: Paleolithic, Mesolithic, Neolithic Culture and Chalcolithic Cultures, Megalithic Culture. 6. Indus Valley Civilization and Harrapan Civilization.	
	Total	45

SEMESTER-II		
Name of the Programme	M.Sc. Anatomy	
Name of the Course	Genetics	
Course Code	ANT.507	
Credit hours	03	
Teaching Objective	Focus on imparting an understanding of how genes work, how they are inherited, and how they influence traits. Students should grasp key concepts like DNA, chromosomes, and the relationship between genotype and phenotype. To analyze genetic information, solve related problems, and understand the role of genetics in evolution and everyday life are common goals. To describe the disorders like AR, AD and X linked disorders.	
Learning Outcomes	Students will develop skills in experimental design, data analysis, and problem-solving related to genetic principles. Furthermore, they will learn about the applications of genetics in various fields like medicine, agriculture, and biotechnology.	
Unit No.	Content	Lectures
1.	Human Chromosomes - Structure, number and classification, methods of chromosome preparation banding patterns. Chromosome abnormalities, Autosomal and Sex chromosomal abnormalities syndromes, Molecular and Cytogenetics.	10
2.	Single gene pattern inheritance: Autosomal and Sex chromosomal pattern of inheritance, Intermediate pattern and multiple alleles, Mutations, NonMendelian inheritance, Mitochondrial inheritance, Genome imprinting, parental disomy.	10
3.	Multifactorial pattern of inheritance: Criteria for multifactorial inheritance, Teratology, Structure gene, Molecular Screening, Cancer Genetics - Haematological malignancies, Pharmacogenetics.	10
4.	Reproduction Genetics - Male and Female Infertility, Abortuses, Assisted reproduction, Preimplantation genetics, Prenatal diagnosis, Genetic Counseling and Ethics of Genetics.	10
5.	Principles of Gene therapy and its applied knowledge.	5
	Total	45

SEMESTER-II	
Name of the Programme	M.Sc. Anatomy
Name of the Course	Practical-II
Course Code	ANT.525
Credit hours	04
Teaching Objective	Providing a comprehensive understanding of the principles, techniques, (RT-PCR, Banding technique, pedigree analysis, microscopic sections, karyotyping as well as others) and applications of different

	methods, with a strong emphasis on their clinical relevance.
Learning Outcomes	Students will be able to identify appropriate indications for molecular testing, interpret results accurately, and understand the strengths and limitations of different techniques. They should also be prepared to collaborate effectively within interprofessional teams and contribute to improved patient outcomes.
Unit No.	Practicals1
1.	Cytogenetics Preparation of media, different solutions, stains etc.
2.	Preparation of buccal smear for sex chromatin Human chromosome preparation from peripheral blood and karyotyping.
3.	Banding techniques (G and C)
4.	Making of Pedigree charts for study of patterns of inheritance.
5.	Chromosomal Analysis
6.	PCR, RT-PCR amplifications, Protein gel electrophoresis
7.	Preparation of brain and spinal cord macroscopic and microscopic sections and identification of different parts in them.

SEMESTER-III		
Name of the Programme	M.Sc. Anatomy	
Name of the Course	Osteology & Gross Anatomy (Head & Neck)-III	
Course Code	ANT.508	
Credit hours	03	
Teaching Objective	<p>Understanding the bones of the skull, face, and cervical spine, including their key landmarks and articulations.</p> <p>Identifying and describing the muscles of the head and neck, including their origins, insertions, actions, and innervation.</p> <p>Describing the cranial nerves, their pathways, and their functions, with a particular focus on the trigeminal and facial nerves.</p> <p>Identifying the major arteries and veins of the head and neck, and understanding their role in supplying blood to these regions.</p> <p>Understanding the types of joints in the head and neck and how their structure enables movement.</p> <p>To describe the Specific areas include the skull, face, ear, nasal cavity, pharynx, larynx, oral cavity, and cervical and thoracic regions.</p>	
Learning Outcomes	<p>Help to understand the structure, function, and relationships of various anatomical parts, including bones, muscles, nerves, blood vessels, and spaces, along with their clinical relevance.</p> <p>Students will understand how structures relate to each other, and applying this knowledge to clinical scenarios. Specific areas of focus include the skull, face, ear, nasal cavity, pharynx, larynx, oral cavity, and cervical and thoracic regions.</p>	
Unit No.	Content	Lectures
1.	Head and Neck Skull Anatomical position of skull, Features of Norma Frontalis, Verticalis, Occipitalis, Lateralis and Basalis, Classification and distribution of sutures, wormian bones,	15

	Subdivisions of cranial cavity, Identification of foramina and structures passing through them, Salient features, articulation, muscle attachments of Individual skull bones and Clinical correlation.	
2.	Mandible- Parts, articulations, attachments, important relations blood and nerve supply, clinical correlation, age changes.	7
3.	Head and Neck Scalp, face and Parotid region, Facial nerve Palsy, Cervical fascia, General arrangement of triangles of neck with contents, Cranial cavity with dural venous sinuses, Vertebral canal, Orbit (muscles, nerves and vessels), Ganglia- Otic, Ciliary, submandibular and Pterygopalatine, Submandibular region & submandibular ganglion, Temporal & infratemporal regions, Lymph nodes & lymphatic drainage of head & neck, Deep structures in neck, Nose and paranasal air sinuses, Tongue, Mouth and Pharynx , Larynx , External, middle and internal Ear, Eyeball, Sympathetic chain, Cranial Nerves with their, nuclei, Blood Vessels of head & neck, Joints of head and neck, Applied anatomy of all regions of head and neck	10
4.	Endocrine system - Microanatomy of pituitary, pineal, thyroid, parathyroid and adrenal, Special sense organs- Microanatomy of cornea and retina	5
5.	Development of Face, Eye and Ear Development of Tongue	5
	Total	45

SEMESTER-III		
Name of the Programme	M.Sc. Anatomy	
Name of the Course	Systemic Histology & Histological techniques-III	
Course Code	ANT.509	
Credit hours	04	
Teaching Objective	To describe the microscopic structure of the CNS, differentiating between gray and white matter, identifying different cell types (neurons and neuroglia), and recognizing the structure and function of the choroid plexus. To demonstrate various histological techniques like paraffin and frozen sectioning, and the application of different stains.	
Learning Outcomes	Students will be able to identify and describe the components of the CNS, including neurons (cell bodies, dendrites, axons), neuroglia (astrocytes, oligodendrocytes, microglia), and supporting structures like the pia and arachnoid with different histological techniques.	
Unit No.	Content	Lectures
1.	Epithelial tissue-Variety types that correlate to its function, ultrastructure, Glands- Classification and structure-function correlation of the same, Connective tissue--Variety types with functional correlation, ultrastructure	10
2.	Cartilage - Microanatomy of Hyaline, Elastic and Fibrocartilage, Bone – Variety types and structure- function correlation of the same,	5

3.	Muscular tissue- Microanatomy of smooth, cardiac and striated muscles, Nervous Tissue- Microanatomy of spinal cord, cerebral cortex and cerebellum	6
4.	Cardiovascular system- Microanatomy of elastic and muscular arteries, veins, capillaries, heart	5
5.	Lymphoid-tissue- Microanatomy of Spleen, thymus, tonsil, lymph node	4
6.	Digestive system- Microanatomy of tongue, salivary glands, oesophagus, stomach, duodenum, jejunum, ileum, appendix, large gut, liver, gall bladder and pancreas, Urinary System-Microanatomy of kidney, ureter and urinary bladder,	10
7.	Male reproductive system- Microanatomy of testis, epididymis, vas deferens, prostate Female reproductive system- Microanatomy of ovary, fallopian tube, uterus, cervix, mammary gland lactating, non –lactating, placenta, umbilical cord	10
8.	Integumentary System - Microanatomy of skin	5
9.	Respiratory system- Microanatomy of Epiglottis, Trachea and Lungs	5
10.	Endocrine system - Microanatomy of pituitary, pineal, thyroid, parathyroid and adrenal, Special sense organs- Microanatomy of cornea and retina	5
	Total	65

SEMESTER-III		
Name of the Programme	M.Sc. Anatomy	
Name of the Course	Gross Anatomy Brain & Neuro Anatomy	
Course Code	ANT.510	
Credit hours	03	
Teaching objectives	<p>To describe the nervous system's structure and function, including its cellular components, signaling pathways, and organization. Key areas include gross anatomical structures, sensory and motor systems, and the functional organization of the brain, with a focus on clinical correlations and the ability to apply knowledge to real-world scenarios.</p> <p>This includes the pathways and structures involved in sensory perception (e.g., vision, hearing, touch) and motor control, including the cerebral cortex, basal ganglia, cerebellum, and spinal cord. central and peripheral nervous systems, including the brain, spinal cord, and peripheral nerves.</p>	
Learning outcome	<p>Students able to understand the whole neuroanatomy including neurological deficits that can result from damage to specific brain regions or pathways, and the ability to apply neuroanatomical knowledge to diagnose and treat neurological disorders.</p>	
Unit No.	Content	Lectures
1.	<p>Cells of the nervous System – Structure and functions of neurons and neuroglia, Peripheral nervous System - spinal nerves, plexus formation and peripheral Ganglia, Autonomic nervous System- Subdivisions, distribution, ganglia, functions and clinical applications.</p>	5

2.	Spinal Cord- External & internal features, transverse section at sacral, lumbar, thoracic, cervical levels, grey matter & white matter, functional columns of nuclei, ascending & descending tracts, central canal, blood supply, applied anatomy, lumbar puncture, Meninges- Extent & modifications, CSF- Composition, secretion, circulation with its applied anatomy, cisterns	10
3.	Medulla Oblongata - External & internal features, transverse sections, cranial nerve nuclei in medulla oblongata, blood supply, medial and lateral medullary syndrome, Pons- External & internal features, cranial nerve nuclei in pons, transverse sections, blood supply, applied anatomy, Mid brain- External & internal features, transverse sections, cranial nerve nuclei in midbrain, blood supply, applied anatomy,	10
4.	Cerebellum- Subdivisions with functional and evolutionary correlations, structure, submerged nuclear masses, structural organization, Connections of cerebellar cortex, cerebellar peduncles, cerebellar dysfunction,	5
5.	Thalamic Complex- Subdivisions and functions, connections, thalamic nuclei, applied anatomy, Hypothalamus, metathalamus, epithalamus, subthalamus – Parts, gross relations, major nuclei, connections, applied anatomy	5
6.	Cerebral hemisphere- Surfaces, sulci, gyri, poles, functional areas, structure and connections of basal ganglia, white matter, structural organization, blood supply and applied anatomy	5
7.	Limbic System- Parts, connections, functions and clinical correlations, Ventricular system- Boundaries and features of Lateral, 3 rd and 4 th ventricle, Cranial nerves - Nuclei, course, distribution, branches, lesions.	5
Total		45

Name of the Course		RESEARCH METHODOLOGY AND BIOSTATISTICS
Course Code		RMB.501
Credit hours		04
Teaching Objective		To equipping learners with the knowledge and skills to design, conduct, and interpret research, understand statistical concepts, and apply them in their respective fields. This involves developing abilities in formulating research questions, selecting appropriate research designs, collecting and analyzing data, and reporting findings ethically includes defining research, its purpose, scope, and various types (e.g., qualitative, quantitative, experimental, observational).
Learning Outcomes		Students get an idea about collection, interpretation and presentation of statistical data.
Unit No.	Content	Lectures
1.	Definitions-Scope of Biostatistics- Variables in biology, collection, classification and tabulation of data- Graphical and diagrammatic representation. Measures of central tendency – Arithmetic mean, median and mode. Measures of dispersion Range, standard deviation, Coefficient of variation	15
2.	Correlation – Meaning and definition - Scatter diagram –Karl pearson’s correlation coefficient. Rank correlation. Regression: Regression in two variables – Regression coefficient problems – uses of regression	12
3.	Test of significance: Tests based on Means only-Both Large sample and Small sample tests - Chi square test - goodness of fit. Analysis of variance – one way and two way classification. CRD, RBD Designs	15

4.	Research: Scope and significance – Types of Research – Research Process – Characteristics of good research – Problems in Research – Identifying research problems. Research Designs – Features of good designs	12
5.	Sampling Design: Meaning – Concepts – Steps in sampling – Criteria for good sample design. Scaling measurements – Techniques – Types of scale.	10
Total		64

Suggested Books

Sr. No.	Authors/ Name of Books/Publisher
1.	Deepak Chawla, Neena Sondhi, Research Methodology Concepts and Cases, Vikas books publishers, 2 th edition, 2016
2.	Donald H. McBurney -Theresa L. White "Research Methods" (Cengage learning India Pvt. Ltd), 5 th edition, 2006
3.	B. K. Mahajan, Methods in Biostatistics: for medical students and Research workers. Kothari Book Depot, Mumbai, 7 th edition

Name of the Course	BIOETHICS AND INTELLECTUAL PROPERTY RIGHT	
Course Code	IPR.550	
Credit hours	03	
Teaching Objective	Students will gain a comprehensive understanding of foundational ethical principles and their application to medicine and healthcare. They will learn to analyze and resolve complex ethical dilemmas in clinical and research settings, considering topics from patient rights and end-of-life care to emerging biomedical technologies. Additionally, students will develop a solid grasp of intellectual property rights (IPR), particularly patents in biotechnology, and learn to critically evaluate the ethical and legal conflicts surrounding IPR, such as access to medicine and biopiracy.	
Learning Outcomes	By the end of this course, students will be able to: <ul style="list-style-type: none"> i. Apply ethical theories like utilitarianism and deontology to real-world healthcare scenarios. ii. Critically evaluate the four core principles of bioethics: autonomy, beneficence, non-maleficence, and justice. iii. Demonstrate a systematic approach to ethical decision-making in both clinical practice and medical research. iv. Analyze and navigate the legal and ethical landscape of intellectual property, including patenting biological materials and managing patent applications. v. Debate and articulate informed positions on major controversies at the intersection of bioethics and IPR, such as compulsory licensing and the protection of traditional knowledge. 	
Unit No.	Content	Lectures
1.	Introduction to ethics: Exploration of fundamental ethical concepts, theories (like utilitarianism and deontology), and their application to medicine and healthcare. Core principles of bioethics: In-depth analysis of the four central principles: autonomy (respect for the patient's right to choose), beneficence (the duty to do	8

	<p>good), non-maleficence (the duty to do no harm), and justice (the fair distribution of benefits and burdens).</p> <p>Historical context: Study of significant historical events that shaped modern bioethics, such as the Nuremberg Code and the Tuskegee syphilis study.</p> <p>Ethical decision-making: Training in systematic approaches for resolving ethical dilemmas in clinical and research settings.</p>	
2.	<p>Ethical issues in clinical practice:</p> <p>Patient rights: Understanding patient rights, informed consent, truth-telling, and confidentiality.</p> <p>Beginning-of-life issues: Discussion of ethical considerations related to reproductive technologies, abortion, contraception, and genetic screening.</p> <p>End-of-life care: Moral and legal issues surrounding euthanasia, physician-assisted suicide, advance directives, and organ transplantation.</p> <p>Doctor-patient relationships: Exploration of the power dynamics, trust, and communication necessary for therapeutic relationships.</p>	7
3.	<p>Ethical issues in medical research</p> <p>Human experimentation: Ethical guidelines for clinical trials, research involving vulnerable populations (e.g., children, prisoners), and the use of placebos.</p> <p>Biomedical technology: Ethical analysis of emerging technologies such as stem cell research, genetic engineering, cloning, and artificial intelligence in medicine.</p> <p>Animal rights: Debate surrounding the ethical use of animals in research and testing.</p> <p>Biobanking: Ethical issues involved in the collection, storage, and use of human biological samples for research.</p>	5
4.	<p>Introduction to IPR</p> <p>Fundamentals of IPR: Definition and rationale behind intellectual property, including its role in incentivizing innovation in the healthcare industry.</p> <p>Types of IP: Overview of the main forms of IPR, including patents, copyrights, trademarks, and geographical indications, with relevance to the life sciences.</p> <p>International framework: Study of international agreements like the World Intellectual Property Organization (WIPO) and the TRIPS Agreement (Trade-Related Aspects of Intellectual Property Rights). Indian Position on WTO Regime. General Agreement on Trade and Tariff (GATT).</p>	10
5.	<p>Patents in biotechnology and medicine</p> <p>Patentability criteria: Detailed examination of the requirements for patenting biotechnological inventions, including novelty, inventive step (non-obviousness), and industrial applicability.</p> <p>Patenting biological materials: Analysis of patenting issues related to genes, microorganisms, and other life forms, referencing landmark court cases such as <i>Diamond v. Chakrabarty</i>.</p> <p>Indian patent law: Indian Patent Act 1970 (Patent Amendment Acts-1999, 2002 and 2005)</p> <p>Patent process: Practical guidance on drafting and filing patent applications and managing a patent portfolio.</p>	5
6.	<p>Ethical and legal controversies in IPR</p> <p>Biopiracy and traditional knowledge: Investigation of the appropriation of traditional knowledge and biological resources by pharmaceutical companies, Patent Case study: Basmati Case, Neem Controversy, Turmeric Case</p> <p>Access to medicine: Examination of the ethical conflict between a company's patent rights and the public's need for affordable medicines. This includes discussions on compulsory licensing.</p> <p>Data and privacy: IPR issues related to medical data, digital technologies, and the protection of patient information.</p> <p>Case studies: Use of real-world cases to explore conflicts between patent protection, patient welfare, and global health priorities.</p>	10
	Total	45

Suggested Books:

Important Links
http://www.w3.org/IPR/

<http://www.wipo.int/portal/index.html.en>
http://www.ipr.co.uk/IP_conventions/patent_cooperation_treaty.html
www.patentoffice.nic.in
www.iprlawindia.org/ - 31k - Cached - Similar page
<http://www.cbd.int/biosafety/background.shtml>
<http://www.cdc.gov/OD/ohs/symp5/jyrtext.htm>
<http://web.princeton.edu/sites/ehs/biosafety/biosafetypage/section3.html>
 Bioethics - by Ellen Frankel Paul , Fred D. Miller, Jeffrey Paul , Fred Dycus Miller
<http://www.accessexcellence.org/RC/AB/IE/#Anchor-Bioethics-6296> www.bioethics.net
 Bioethics & Science
http://www.americanprogress.org/issues/domestic/science?_kk=bioethics&_kt=21a1e10d-48e4-44bc-8b39-21c695383746
The Stem cell debate
<http://www.billmuehlenberg.com/2005/09/02/the-stem-cell-debate/>

SEMESTER-III	
Name of the Programme	M.Sc. Anatomy
Name of the Course	Practical-III/HISTOLOGICAL TECHNIQUES
Course Code	ANT.525
Teaching objectives	This involves to understanding and mastering various procedures like fixation, dehydration, embedding, sectioning, and staining, and being able to interpret stained tissue sections.
Learning outcomes	students will be well-prepared to work in histology laboratories, contribute to medical research, and participate in the diagnosis and treatment of diseases.

UNIT

1.	Preparation of common fixatives embalming fluid 10% formalin, Bouin's fluid etc.
2.	Making paraffin blocks and section cutting and mounting
3.	Preparation of staining set for H and E staining and staining paraffin sections with the stain
4.	Making celloidin, araldite, gelatin blocks and their section cutting
5.	Processing hard tissues, decalcification of bones, block making and sectioning, preparation of ground sections of calcified bones.
6.	Frozen section cutting on freezing microtome and cryostat
7.	Honing and Stropping of microtome knives, including sharpening by automatic knife sharpener
8.	Histology file in which LM and EM pictures of all the organs and tissues of the body should be drawn and a small description of salient features written
9.	Histochemical Methods Practical classes for staining of glycogen, mucopolysaccharides, alkaline phosphatase acid phosphatase, and calcium

SEMESTER-IV		
Name of the Programme	M.Sc. Anatomy	
Name of the Course	Radiological & Forensic Anatomy	
Course Code	ANT.511	
Credit hours	02	
Teaching Objective	To understand and utilize various imaging techniques like X-rays, CT scans, MRI, ultrasound. Comprehending the normal and abnormal anatomical structures visualized through medical imaging. Understanding minimally invasive procedures guided by imaging. Studying the anatomy of various species for forensic comparison.	
Learning Outcomes	students with the knowledge and skills will able to understand, interpret, and apply medical imaging techniques for diagnosis and treatment, as well as to analyze forensic evidence and apply legal principles in medicolegal context, as well as understanding of radiological anatomy, pathology, and safety, as well as determine the age& sex and other forensic aspect of Skelton through bones.	
Unit No.	Content	Lectures
1.	Radiological anatomy Principles of various procedures Plain X ray abdomen, Barium swallow, Barium meal, Barium enema, Cholecystography, Intravenous Pyelography, Hysterosalpingography, Arteriography, Ultrasound, CT Scan, MRI, PET scan, SPECT scan, other special procedures to visualize viscera and cavities.	16
2.	Forensic anatomy Anatomy applicable to forensic medicine with respect to age determination, sexing of bones and other forensic aspects.	16
	Total	32

Name of the Course	THESIS WORK-IV	
Course Code	ANT.600	
Credit hours	15	
Teaching Objective	<ul style="list-style-type: none"> i. To train students in independent biomedical research. ii. To provide experience in experimental design, data collection, and analysis. 	
Learning Outcomes	<p>Students will be able to:</p> <ul style="list-style-type: none"> i. Design and execute an independent, hypothesis-driven research project in a relevant area of clinical or laboratory medical biochemistry. ii. Apply appropriate statistical and bioinformatic methods to analyze and critically interpret complex experimental data. iii. Produce a comprehensive scientific thesis that adheres to established academic conventions for structure, citation, and ethical reporting. 	
Sr. No.	Content	
1.	Review of literature search	
2.	Laboratory base research work	
3.	Compilation of data	

Elective courses

SEMESTER-IV		
Name of the Course	BIOMEDICAL WASTE MANAGEMENT	
Course Code	BWM.575	
Credit hours	03	
Teaching Objective	The objective of the paper is to · Teach how to manage biomedical waste · Provide Knowledge about various biomedical management and handling rules · Learn the treatment and disposable techniques used for biomedical management · Teach biomedical waste management rules.	
Learning Outcomes	Understand how to manage biomedical waste Know various biomedical management and handling rules Learn the treatment and disposable techniques of biomedical management. Know various biomedical waste management rules.	
Unit No.	Content	Lectures
1.	Waste disposal management, Hospital waste management, Biosafety-regulatory framework for GMOs, bioethics and its socio economic impact, Hazards associated with poor health care waste management	10
2.	Characterization of medical waste- Bio-medical wastes (Management and Handling) Rules, 1998, Amendments and guidelines, segregation, packaging, storage, transport of infectious waste. Techniques of Biomedical waste management. Health and safety rules. Protocols, issues, and challenges in transportation of Biomedical waste.	10
3.	Treatment method- Autoclave, Hydroclave, Microwave, Chemical Disinfection, Solidification and stabilization, Bioremediation, Thermal Conversion Technologies, accumulation and storage of hazardous waste, land disposal of hazardous waste, other treatment and disposal method. Common Hazardous Waste Treatment Facilities (TSDF)	11
4.	Biomedical waste management rule: Biomedical wastes categories and their segregation, collection, treatment, processing, and disposal options, Standards For Treatment and Disposal Of Bio-Medical wastes, Standards for autoclaving of bio-medical waste, standards of microwaving, standards for deep burial, standards for the efficacy of chemical disinfection, standards for dry heat sterilization, standards for liquid waste	14

Suggested Readings

Sr. No.	Authors/ Name of Books/Publisher
1.	Biomedical Waste Management: R. Radharisham
2.	Hospital Waste Management's-A guide for self-assessment and review: ShishirBasarkar
3.	Biomedical Waste Disposal: Anantpreet Singh and Sukhjit Kaur
4.	Medical Waste Management and Disposal: V. J. Landrum

SEMESTER-IV		
Name of the Course	Principles of Medical Genetics	
Course Code	PGC.575	
Credit hours	03	
Teaching Objective	<p>To describe about Mendel's Laws (Law of Segregation, Law of Independent Assortment), Alleles, Genotype, and Phenotype.</p> <p>To Understand the Punnett Squares, Probability and Genetics</p> <p>To describe how to connect Mendelian principles to real-world examples, such as human genetic diseases, animal breeding, or plant genetics.</p>	
Learning Outcomes	<p>Student will understand how traits are passed from parents to offspring through the principles of inheritance, including the laws of segregation and independent assortment. Students should be able to analyze patterns of inheritance, predict offspring genotypes and phenotypes using <u>Punnett squares</u>, and apply these concepts to real-world scenarios.</p>	
Unit No.	Content	Lectures
1.	Mendelian Genetics: Introduction to human genetics; background and history; types of genetic diseases; role of genetics in medicine. Human pedigrees; patterns of single gene inheritance-autosomal recessive; autosomal dominant; X linked inheritance. Complicating factors-incomplete penetrance; variable expression; multiple alleles; co dominance; sex influenced expression; hemoglobinopathies-genetic disorders of hemoglobin and their diseases.	4
2.	Non Mendelian inheritance patterns: Mitochondrial inheritance; genomic imprinting; Lyon hypothesis; isodisomy. Complex inheritance– genetic and environmental variation; Heritability; twin studies; behavioral traits; analysis of quantitative and qualitative traits.	4
3.	Cytogenetics: Cell division and errors in cell division; Non disjunction; Structural and numerical chromosomal abnormalities–deletion; duplication; translocation; sex determination; Role of Y chromosome. Genetic recombination; disorders of sex chromosomes and autosomes. Molecular cytogenetics–Fluorescence In Situ Hybridization (FISH); Comparative Genomic Hybridization (CGH).	7
4.	Developmental genetics: Genes in early development; maternal effect genes; pattern formation genes; homeotic genes; and signaling and adhesion molecules.	5
5.	Immunogenetics: Major histocompatibility complex; immunoglobulin genes-tissue antigen and organ transplantation. Single gene disorders of immune system.	5
6.	Genetic variation: Mutations; kinds of mutation; agents of mutation; genome polymorphism; uses of polymorphism.	5
7.	Gene mapping and human genome project: Physical mapping; linkage and association.	5
8.	Population genetics and evolution: Phenotype; genotype; gene frequency; Hardy-Weinberg law; factors disturbing Hardy-Weinberg equilibrium; mutation selection; migration; gene flow; genetic drift. human genetic diversity; origin of major human groups.	5

	Total	45
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Suggested Books:

Sr. No.	Authors/ Name of Books/Publisher
1.	S.R. Maloy, J.E. Cronan, D. Friefelder, Microbial Genetics, 2nd Edition, Jones and Bartlett Publishers, 1994.
2.	Strachan T and Read A P, Human molecular genetics, 3rd Edition Wiley Bios, 2006.
3.	Mange E J and Mange A. P., Human genetics, 2nd Edition, Sinauer Associates publications, 1999.
4.	Hartl L D and Jones B, Analysis of genes and genomes, 3rd Edition, Jones and Bartlett Publishers, 1994.

SEMESTER-IV

Name of the Course		Recombinant DNA Technology and Genetic Engineering
Course Code		RDT.575
Credit hours		03
Teaching Objective	To define and differentiate between recombinant DNA technology and genetic engineering. To understand the process of gene cloning, including the isolation, purification, and amplification of specific DNA fragments. Understand how these enzymes work to cut and paste DNA fragments is crucial. To describe various Methods like RT PCR & its application with sequencing analysis.	
Learning Outcomes	Students will understand the principles, techniques, and applications of manipulating genetic material. Students will grasp the core concepts of gene cloning, understand the tools and enzymes involved, and appreciate the wide-ranging applications in various fields. Students will learn about the various tools used, such as restriction enzymes (molecular scissors), ligases (molecular glue), and <u>vectors</u> (vehicles for carrying DNA)	
Unit No.	Content	Lectures
1.	Basics Concepts: DNA Structure and properties; restriction enzymes; DNA ligase, Klenow enzyme, T4 DNA polymerase, polynucleotide kinase, alkaline phosphatase; cohesive and blunt end ligation; linkers; adaptors; homopolymeric tailing; labeling of DNA: nick translation, random priming, radioactive and non-radioactive probes. Hybridization techniques: Northern, Southern and Colony hybridization, fluorescence in situ hybridization; chromatin immunoprecipitation; DNA-Protein interactions-electromobility shift assay; DNaseI footprinting; methyl interference assay	10
2.	Cloning Vectors: Plasmids; bacteriophages; M13 mp vectors; PUC19 and bluescript vectors, phagemids; lambda vectors; insertion and replacement vectors; EMBL; cosmids; artificial chromosome vectors (YACs; BACs); animal virus derived vectors-SV-40; vaccinia/baculo & retroviral vectors; expression vectors; pMal; GST; pET based vectors. <u>Protein purification:</u> His-tag; GST-tag; MBP-tag etc.; Intein-based vectors; Inclusion bodies; Methodologies to reduce formation of inclusion bodies; baculovirus and pichia vectors system, plant based vectors, ti and ri as vectors, yeast vectors, shuttle vectors.	9

3.	Cloning Methodologies: Insertion of foreign DNA into host cells; transformation; construction of libraries; isolation of mRNA and total RNA; cDNA and genomic libraries; cDNA and genomic cloning; Expression cloning; jumping and hopping libraries; Southwestern and Far-western cloning; protein-protein interactive cloning and yeast two hybrid system; phage display; principles in maximizing gene expression	8
4.	PCR and its Applications: Primer design; fidelity of thermostable enzymes; DNA polymerases; Types of PCR – multiplex, nested, reverse transcriptase, real time PCR, touchdown PCR, hot start PCR, colony PCR, cloning of PCR products; T vectors; proof reading enzymes; PCR in gene recombination; deletion; addition; overlap extension; and SOEing; site specific mutagenesis; PCR in molecular diagnostics; viral and bacterial detection; PCR based mutagenesis, mutation detection: SSCP, DGGE, RFLP, Oligo Ligation Assay (OLA), MCC (Mismatch Chemical Cleavage, ASA (Allele-Specific Amplification), PTT (Protein Truncation Test)	10
5.	Sequencing methods; Enzymatic DNA sequencing; chemical sequencing of DNA; automated DNA sequencing; RNA sequencing; chemical Synthesis of oligonucleotides; introduction of DNA into mammalian cells; Transfection techniques; Gene silencing techniques; introduction to siRNA; siRNA technology; Micro RNA; construction of siRNA vectors; principle and application of gene silencing; gene knockouts and gene therapy; creation of knock out mice; disease model; somatic and germ-line therapy- in vivo and ex-vivo; suicide gene therapy; gene replacement; gene targeting; transgenics; cDNA and intragenic arrays; differential gene expression and protein array.	8
Total		45

Suggested Books

Sr. No.	Authors/ Name of Books/Publisher
1.	S.B. Primrose, R.M. Twyman and R.W.Old; Principles of Gene Manipulation. 6th Edition, S.B.University Press, 2001.
2.	J. Sambrook and D.W. Russel; Molecular Cloning: A Laboratory Manual, Vols 1-3, CSHL, 2001.
3.	Brown TA, Genomes, 3rd ed. Garland Science 2006
4.	Selected papers from scientific journals and Technical Literature from Stratagene, Promega, Novagen, New England Biolab etc.

SEMESTER-IV

Name of the Course	Genomics and Proteomics
Course Code	GEP.575
Credit hours	03
Teaching Objective	Imparting a comprehensive understanding of genome structure and function, exploring the dynamic nature of the proteome, and developing skills in relevant experimental and computational methodologies A core objective is to equip students with knowledge of techniques

	like DNA sequencing, genome mapping, and various molecular biology tools used in genomics research. Analyzing genomic data, including sequence alignment, annotation, and phylogenetic analysis.	
Learning Outcomes	Students will be able to understand how to identify the structure, function, and regulatory elements of genes and other genomic sequences. Student will be able to analyze genomic data, including sequence alignment, annotation, and phylogenetic analysis.	
Unit No.	Content	Lectures
1.	Introduction to Genomics: Structure and organization of prokaryotic and eukaryotic genomes - nuclear, mitochondrial and chloroplast genomes; Computational analysis of sequences- finding genes and regulatory regions; gene annotation; similarity searches; pairwise and multiple alignments; alignment statistics; prediction of gene function using homology, context, structures, networks; genetic variation-polymorphism, deleterious mutation; phylogenetics; tools for genome analysis- PCR, RFLP, DNA fingerprinting, RAPD, automated DNA sequencing; linkage and pedigree analysis; construction of genetic maps; physical maps, FISH to identify chromosome landmarks.	10
2.	Genome sequencing: Human genome project-landmarks on chromosomes generated by various mapping methods; BAC libraries and shotgun libraries preparation; Physical map-cytogenetic map, contig map, restriction map, DNA sequence; DNA sequencing and sequence assembly; Model organisms and other genome projects; comparative genomics of relevant organisms such as pathogens and non-pathogens; evolution of a pathogen e.g. Hepatitis C virus or a bacterial pathogen; taxonomic classification of organisms using molecular markers- 16S rRNA typing/sequencing;	9
3.	DNA Microarray technology: Basic principles and design: cDNA and oligonucleotide arrays; Applications: Global gene expression analysis, Comparative transcriptomics, differential gene expression; genotyping/SNP detection; detection technology; computational analysis of microarray data.	6
4.	Proteomics: Overview of protein structure-primary, secondary, tertiary and quaternary structure; Relationship between protein structure and function; outline of a typical proteomics experiment; identification and analysis of proteins by 2D analysis; spot visualization and picking; tryptic digestion of protein and peptide fingerprinting; mass spectrometry : ion source (MALDI, spray sources); analyzer (ToF, quadrupole, quadrupole ion trap) and detector; clinical proteomics and disease biomarkers; Prions; proteins in disease; protein-protein interactions: Solid phase ELISA, pull-down assays (using GST-tagged protein), far western analysis, by surface plasmon resonance technique, yeast two hybrid system, phage display; Protein interaction maps; Protein arrays-definition, applications-diagnostics, expression profiling.	10
5.	Human disease genes; DNA polymorphism including those involved in disease; hemoglobin and the anemias; phenylketonuria (monogenic) and diabetes (multigenic) genetic disorders; 'disease' gene vs. 'susceptibility' gene; SNP detection: hybridization based assays (allele specific probes); polymerization based assays (allele specific nucleotide incorporation, allele-specific PCR); ligation based assays (allele specific oligonucleotide	10

	ligation); polymorphism detection without sequence information: SSCP; proteomics and drug discovery; high throughput screening for drug discovery; identification of drug targets; pharmacogenomics and pharamacogenetics and drug development; toxicogenomics; metagenomics.	
	Total	45

Suggested Books:

Sr. No.	Authors/ Name of Books/Publisher
1.	Brown TA, Genomes, 3rd Edition, Garland Science, 2006.
2.	Campbell AM & Heyer LJ, Discovering Genomics, Proteomics and
3.	Bioinformatics, 2nd Edition, Benjamin Cummings, 2007.
4.	Primrose S & Twyman R, Principles of Gene Manipulation and Genomics, 7th Edition, Blackwell, 2006.
5.	Glick BR & Pasternak JJ, Molecular Biotechnology, 3rd Edition, ASM Press, 1998.
6.	Ed. C. Cantor and C.L. Smith, Genomics: The Science and Technology behind the Human Genome Project, Wiley-Interscience, 2000.
7.	G. Gibson, S. V. muse, A Primer of Genome Science, Sinauer Associates Inc. Publishers, 2002.
8.	H. Rehm, Protein Biochemistry and Proteomics, 4th Edition, Academic Press, 2006.
9.	E. de Hoffman and V. Stroobant, Mass Spectrometry, 2nd Edition, Wiley. 2002.

SEMESTER-IV

Name of the Course		Advances in Cancer Biology
Course Code		ACA.575
Credit hours		03
Teaching Objective	To equip students with a comprehensive understanding of cancer's biological mechanisms, its causes, and potential treatments. This includes understanding the molecular and cellular processes that drive cancer development, as well as the latest research and therapeutic strategies. Including proliferation, metastasis, angiogenesis, and evasion of cell death. Help to Understand the role of mutations in oncogenes and tumor suppressor genes, and the influence of hereditary and environmental factors on cancer development.	
Learning Outcomes	This includes understanding the molecular and cellular processes that drive cancer development, as well as the latest research and therapeutic strategies. Ultimately, the goal is to train students to contribute to the fight against cancer through research, diagnosis, and treatment.	
Unit No.	Content	Lectures
1.	Cancer Epidemiology, Geographic, Environmental and age factors: Genetic basis of cancer, autosomal dominant/ recessive inherited cancer, DNA damage. Familial cancer, Non-Genetic basic of cancer. Chronic inflammation, precancerous condition, oxidative stress.	5
2.	Molecular basis of cancer, introduction, essential alteration for malignant transformation, proto-oncogenes, oncogenes, oncoproteins. Growth	10

	factors and their receptors, signal transducing proteins, insensitivity to growth inhibition & escape from senescence, role of tumor suppressors genes, genomic instability, dysregulation of cancer associated genes.	
3.	Carcinogenic agents & their cellular interactions, radiation (Ionizing and Non Ionizing), microbial (Oncogenic RNA & DNA viruses).	5
4.	Stem cells, history and axis of research, what makes stem cell a stem cell, stem cell therapies. Future regeneration medicine	10
5.	Bioinformatics and cancer	5
6	Biologically important techniques in cancer research, laboratory diagnosis of cancer, histological & cytological. Immuno histo chemistry, flow cytometry, molecular diagnosis (Polymerase chain reaction, fluorescent in-situ hybridization). Cytogenetic Techniques (Karyotyping), DNA Microarray, comparative genomic hybridization, snp chips, gene sequencing, tumor markers.	10
	Total Credits	45