RAMAIAH UNIVERSITY OF APPLIED SCIENCES

M.S. Ramaiah University of Applied Sciences

Programme Structure and Course Details

Of

MD Biochemistry 2022 onwards

M.S. Ramaiah University of Applied Sciences

Ramaiah Medical College

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Bangalore - 560 054

Dean - Academics
M.S. Ramaiah University of Applied Sciences
Bangalore - 560 054

Shalini

Approved by the Academic Council meeting held on 27th September 2022

RAMAIAH UNIVERSITY OF APPLIED SCIENCES

M.S. Ramaiah University of Applied Sciences

Programme Specifications

MD Biochemistry Programme 2022 onwards

Programme Code: MD129

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Ramaiah Medical College

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Principal and Dean
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University's Vision, Mission and Objectives

The M. S. Ramaiah University of Applied Sciences (MSRUAS) will focus on student-centric professional education and motivates its staff and students to contribute significantly to the growth of technology, science, economy and society through their imaginative, creative and innovative pursuits. Hence, the University has articulated the following vision and objectives.

Vision

MSRUAS aspires to be the premier university of choice in Asia for student centric professional education and services with a strong focus on applied research whilst maintaining the highest academic and ethical standards in a creative and innovative environment

Mission

Our purpose is the creation and dissemination of knowledge. We are committed to creativity, innovation and excellence in our teaching and research. We value integrity, quality and teamworkin all our endeavors. We inspire critical thinking, personal development and a passion for lifelong learning. We serve the technical, scientific and economic needs of our Society.

Objectives

1. To disseminate knowledge and skills through instructions, teaching, training, seminars, workshops and symposia in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and SocialSciences to equip students and scholars to meet the needs of industries, business and society

2. To generate knowledge through research in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences to meet the challenges that arise in industry, business and society

3. To promote health, human well-being and provide holistic healthcare

4. To provide technical and scientific solutions to real life problems posed by industry, business and society in Engineering and Technology, Art and Design, Management and Commerce, Health and Allied Sciences, Physical and Life Sciences, Arts, Humanities and Social Sciences

5. To instill the spirit of entrepreneurship in our youth to help create more career opportunitiesin the society by incubating and nurturing technology product ideas and supporting technology backed business

6. To identify and nurture leadership skills in students and help in the development of our future leaders to enrich the society we live in

7. To develop partnership with universities, industries, businesses, research establishments, NGOs, international organizations, governmental organizations in India and abroad to enrichthe experiences of faculties and students through research and developmental programm

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Programme specification: MD Biochemistry

Faculty	Ramaiah Medical College
Department	Biochemistry
Programme	MD –Biochemistry
Programme Code	MD129
Dean of Faculty	Dr Shalini C Nooyi
Head of the Department	Dr Vanitha Gowda M N

1. **Title of the Award:** MD in Biochemistry
2. **Mode of Study:** Full-Time
3. **Awarding Institution /Body:** M. S. Ramaiah University of Applied Sciences, Bengaluru
4. **Joint Award:** Not Applicable
5. **Teaching Institution:** Faculty of Medicine, Ramaiah Medical College
6. **Date of Programme Specifications:** September 2022
7. **Programme Approval by the Academic Council of MSRUAS:** 27th September 22
8. **Programme Approving Regulating Body and Date of Approval:** National Medical Council of India
9. **Rationale for the Programme**

The purpose of PG education is to create specialists who would provide high-quality health care and advance the cause of science through research & training. Biochemistry is a specialized subject with inclination towards better patient care. A culture of discussions, interpretations, counter-interpretations and re-interpretations must be established to achieve the goal of quality translational research. The aim of MD Biochemistry training is to undertake innovation and creativity as the epicenter for all research initiatives. With a view to update, by inclusion of newer topics, and to provide a uniform syllabus and course contents in Indian universities and teaching medical institutions, the proposed guidelines provide course outlines based on recent developments in clinical medicine and other disciplines related to biochemistry.

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Program Outcomes (PO) for MD Biochemistry Postgraduate students

PO1. Develop the knowledge, skills and attitude to be a competent diagnostician (C, P).

PO2. Demonstrate a commitment to excellence and continuous professional development with integrity, compassion and sensitivity to patient care. (A)

PO3. Acquire and develop the knowledge, skills and attitude required to be a competent and ethical researcher and teacher. (A, C, P)

PO4. Be able to independently perform investigative procedures with a reasonable degree of professionalism and competence. (P)

Programme specific outcomes (PSO) for MD Biochemistry Postgraduate students

PSO1. Demonstrate the ability to practice quality control protocols required for the functioning of a clinical Biochemistry & Immunology laboratory with better precision and accuracy & give support for better diagnosis and management of diseases with special ability to maintain interdisciplinary coordination (C,A,P)

PSO2. Demonstrate the ability to interpret biochemical laboratory investigations and perform experiments relevant to clinical diagnosis along with ability to interpret the data obtained with reasonable accuracy and clinical correlation with short turnover time. (C,A, P)

PSO3. Demonstrate the ability to maintain all equipment, automation and their quality system procedures and quality assurance with the aid of SOPs along with safe and effective biomedical waste management. (C, A, P)

PSO4. Demonstrate the ability to organize teaching/training sessions for students and health care workers. Ability to apply basic principles of Biostatistics for research work. Acquire skills to conduct fundamental and applied research either independently (including thesis work) or as part of a team. (C, A, P)

PSO5. Develop skill in performing and interpreting data generated by advanced biochemical techniques including organ function tests. Learn application of principles of professionalism, ethics and effective communication in the conduct of routine services, teaching activities and research. (C, A,P)

Note: A- Affective Domain, C- Cognitive Domain & P- Psychomotor Domain

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Course- PO - PSO Mapping

Course Code and name	Program Outcomes				Program Specific Outcomes				
	PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4	PSO5
MDC509A Biomolecules, Analytical techniques and research methodology.	3	2	3	3	2	3	3	3	2
MDC510A Metabolism & Nutrition	3	3	2	2	3	2	2	3	3
MDC511A Molecular biology & Immunology	3	2	3	3	2	3	3	3	3
MDC512A Clinical biochemistry	3	3	2	3	2	3	2	3	3
MDP503A Thesis-Biochemistry			3						3

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10. Regulations:

(A) Attendance, Progress and Conduct

1. A candidate pursuing degree course should work in the concerned department of the institution for the full period as a full time student. No candidate is permitted to run or work in clinic/laboratory/nursing home while studying postgraduate course. No candidate shall join any other course of study or appear for any other examination conducted by this university or any other university in India or abroad during the period of study.

2. Each year shall be taken as a unit for the purpose of calculating attendance. Attendance of 80% every term is mandatory for appearing in the final university examination.

3. Every student shall attend symposia, seminars, conferences, journal review meetings, grand rounds, CPC, case presentation, clinics and lectures during each year as prescribed by the department and not absent himself / herself from work without valid reasons.

4. Every candidate is required to attend a minimum of 80% of the training during each academic term of the post graduate course. Provided further, leave of any kind shall not be counted as part of academic term without prejudice to minimum 80% attendance of training period every term.

5. Any student who fails to complete the course in the manner stated above shall not be permitted to appear for the University Examinations.

(B) Monitoring of progress of Studies

1. Work diary / Log Book - Every candidate shall maintain a work diary and record of his/her participation in the training programmes conducted by the department such as journal reviews, seminars, etc. as per the model checklists and logbook specimen copy.

2. Special mention may be made of the presentations by the candidate as well as details of clinical or planning procedures, if any conducted by the candidate. The work diary shall be scrutinized and certified by the Head of the Department and Head of the Institution, and presented in the university practical/clinical examination.

3. Procedure for defaulters: There will be a committee constituted by all teachers to review such situations. The defaulting candidate is counselled by the guide and head of the department. In extreme cases of default, the departmental committee may recommend that defaulting candidate will be withheld from appearing the examination, if she/he fails to fulfil the requirements in spite of being given adequate chances to set himself or herself right.

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11. TEACHING AND LEARNING METHODS

During the course, students should have formal training in teaching and research. The sessions should be in the form of:

Teaching methodology- Active and interactive learning should be the mainstay of the program. The following methods are to be used to facilitate learning by and training of MD students.

1. **Interactive lectures, tutorials, problem-based learning, case discussions, seminars, guest lectures, E-learning**- these teaching learning methods should be employed for the post graduate students to acquire updated knowledge on various aspects of basic and clinical biochemistry, immunology and molecular biology, and their application in modern medicine and also to learn to communicate effectively.
2. Journal clubs & Seminars : Journal club/ Seminar sessions should be used by post graduate students to learn to search medical literature, to learn how scientific data is to be disseminated, to develop skills in presentation of research papers, to critically analyse and evaluate data, to become familiar with research methodologies, to keep oneself updated on new developments/emerging trends in biochemistry and to learn to communicate effectively
3. Practical exercises- These exercises should be used by post graduate students to equip themselves with knowledge and hand-on skills in various techniques used for laboratory bench-work in Biochemistry and molecular biology and in a diagnostic laboratory, and to learn to analyze and interpret data obtained.
4. Thesis-Under the supervision of a Professor or Associate Professor in the Department of Biochemistry, each PG student is expected to generate a hypothesis/research question and design a research protocol to test/answer it. The protocol should have clearly defined objectives and a work plan. The post graduate student will carry out the experimental research work proposed, analyze data, interpret results and write a thesis/dissertation based on the work done and results obtained.
5. Presentation of work done on thesis to peers- A post graduate student of a postgraduate degree course in broad specialities/super specialities would be required to present one poster presentation, to read one paper at a national/state conference and to present one research paper which should be published/accepted for publication/sent for publication during the period of his postgraduate studies so as to make him eligible to appear at the postgraduate degree examination.
6. Teaching of undergraduates-Postgraduate students in Biochemistry shall be required to participate in teaching and training programmes of undergraduate students. They should learn how to organize, conduct and co-ordinate UG laboratory teaching in practical classes, to participate in clinical case-based teaching sessions and small group discussions (as part of a team that includes faculty members and senior residents of the department), to develop skills of self-directed learning, effective communication and leadership. They should learn how to work as part of a team and to facilitate learning by students.
7. Horizontal and vertical integration of teaching of Biochemistry with other pre-clinical, para-clinical and clinical departments. The post graduate students should

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take part in integrated teaching of undergraduates by participation in joint teaching sessions and seminars with different departments, participation in clinical rounds for discussing cases of interest and by small group discussions of case-based problems.

8. Training in the basics of medical education and technology-The post graduate students may be provided with training in the basics of medical education and technology through workshops at the departmental and/or institutional level.
9. Development of communication skills-The post graduate students should develop effective communication skills by making presentations at seminars and journal club sessions and by teaching undergraduates.
10. Training in Clinical Biochemistry: The post graduate students should receive hands-on training in a diagnostic laboratory in Biochemistry; such training should be extensive and rigorous enough for each post graduate student to acquire adequate skills and expertise to manage and supervise such a laboratory. The post graduate students should be posted in all sections of the laboratory in the institution, starting from sample collection and processing. They should become proficient in working with the autoanalysers in the laboratory, in quality control methods, setting up of a clinical biochemistry laboratory, specialized assays and statistical analysis of data. It would also be desirable for them to acquire experience in running a 24-hours diagnostic laboratory; towards this end, it would help if they are posted in the laboratory out of regular hours as well.
11. Rotation in clinical Departments-It would be desirable for the post graduate students to be posted in clinical departments after their training period in the diagnostic laboratory, for up to 3 months of the course. Suggested departments and durations of postings are as follows: General medicine (3 month which includes Cardiology, Nephrology, Gastroenterology, Emergency Medicine), Hematology (10 days), Routine Microbiology (10 days), Pediatrics (10 days). These postings will help post graduate students get a better perspective on diagnostic tests in clinical practice and will enable them to contribute more effectively to patient care.
12. Log Book: -All post graduate students should maintain a log book that documents all the work that they have done during their years of training. This log book should be checked and assessed periodically by the faculty members involved in the training programme.
13. Department should encourage e-learning activities.

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Specific practice-based competencies: By the end of the course, the post graduate student should have acquired practical skills in the following:

Name/Description of practice based competencies
1. Practical's done in PG laboratory
1.1 Performance of reactions of carbohydrates, amino acids and proteins, and lipids
1.2 Experiments to demonstrate constituents of milk
1.3 Experiments to demonstrate normal and abnormal constituents of urine
1.4 Determination of iodine number and saponification number of fats
1.5 Estimation of ammonia and amino acids by Sorenson formal titration
1.6 Estimation of phosphorus by Fiske Subbarao method
1.7 Estimation of proteins by Folin's method and dye binding method.
1.8 Two-dimensional paper chromatography for separation of amino acids
1.9 Preparation and qualitative analysis of starch, glycogen, cholesterol, casein (phosphorus in casein) and hemoglobin from biological samples
2. Estimation of clinical analytes as detailed below:
2.1 Blood glucose, glycated haemoglobin; performance of glucose tolerance test
2.2 Electrolytes, arterial blood gas analysis
2.3 Cholesterol, triglycerides, free fatty acids, phospholipids, Lp (a), urea, creatinine, uric acid, ammonia, microalbuminuria
2.4 Parameters of liver function tests (bilirubin, hepato-biliary enzymes such as AST, ALT, ALP, GGT, serum proteins/albumin and prothrombin time)
2.5 Calcium, magnesium, copper (and ceruloplasmin), serum iron, TIBC and ferritin
2.6 Markers of myocardial damage (CK, CK MB, troponins, LDH)
2.7 Other enzymes of diagnostic relevance (eg. phosphatases, amylase etc)
2.8 Vitamins D and B12 and folate
2.9 Electrophoresis of serum proteins
2.10 Electrophoresis of lipoprotein (Optional)
2.11 Electrophoretic separation of LDH isozymes or any other isoenzymes (Optional)
2.12 Clearance tests
2.13 CSF analysis
2.14 Thyroid function tests and other hormone assays by ELISA/RIA
2.15 Preparation of buffers.
3. Clinical Laboratory
3.1 Taking any one parameter, students should prepare a Levy Jennings chart and plot inter-assay and intra-assay variation for the laboratory.

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3.2 Implementation of Westgard rules. 3.3 Optional: Determination of reference values for any one parameter for the clinical laboratory
5. In addition, all efforts should be made to ensure that students at least see a demonstration of the following techniques. 1.1 Separation of peripheral blood lymphocytes using Ficoll Hypaque. 1.2 Subcellular fractionation/marker enzymes for organelles to demonstrate fractionation. 1.3 Ultracentrifugation 1.4 Isolation of high molecular weight DNA from tissues/blood 1.5 Isolation of RNA; synthesis of cDNA by reverse transcription; PCR (both conventional and real-time) 1.6 Isolation of plasmids and agarose gel electrophoresis for proteins and nucleic acids 1.7 Basic techniques in cell culture 1.8 High performance liquid chromatography (HPLC)

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D. YEAR WISE ACTIVITIES

	ACADEMICS/RESEARCH/PROFESSIONALISM
stYear	• Orientation to the subject and departmental activities • Understand the Competency, syllabus and assessment of the PG curriculum in Biochemistry as per the RUAS requirement • Attend regular Undergraduate MBBS lectures, practical's, ECE & integrated teaching sessions. • Mandatory to attend all lecture/practical class Start taking Undergraduate small group • Start Journal clubs and seminars • AttendthePGresearchmethodologytrainingprogrammeandmandatoryto completeMCI/NMC prescribed online research methodology course • Attend the Postgraduate Medical education training program(PGMET) • Selection of topic for thesis–Synopsis • Preparation and submission of the synopsis • Maintain log book entry of all activities • Internal assessment I-theory, practical & viva voce • Begin review and data collection for thesis • Attend CME/Conferences/training Workshops • Preparation for Poster/Oral Presentation in State/ National conference/International • Submission of 1st year logbook to HOD for signature • Feedback from guide and HOD
2ND year	• Continue academic activities as per syllabus • Continue teaching of Undergraduate medical students • Plan for rotational postings • Continue Journal club and seminars • Complete record book • An oral/poster presentation in State / National conference / international conference • Submission of logbook entry to HOD signature with all entries of the teaching learning methods and training programmes • Internal assessment II–both theory, practical and viva voce • Review thesis preparation • Feedback from Guide and HOD
3rdyear	• Continue academic activities as per syllabus • Continue teaching of Undergraduate medical students • Complete thesis • Presentation of thesis • Complete log book entries • Practice pedagogy sessions • Preliminary examination (IIIIA–theory, practical and viva voce) three months prior to university examination • Feedback from Guide and HOD

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12. Innovative teaching learning practices

1. Teaching learning activities eg. Interactive sessions on relevant topics, chart preparation and presentation and bimonthly tests on theory topics.

2. Focused discussion on recent advances in clinical biochemistry and instrumentation. Parallel projects with dissertation to assert interest in the areas of research and publication

4. Faculty Lecture during first year: Helps in bridging the learning gap and it reinforces learning basic concepts

13. ASSESSMENT: It is essential to monitor the learning progress of each candidate through continuous appraisal and regular assessment. It not only also helps teachers to evaluate students, but also students to evaluate themselves. The monitoring will be done by the staff of the department based on participation of students in various teaching/learning activities.

1. Formative assessment should be continual and should assess medical knowledge, procedural & academic skills, interpersonal skills, professionalism, self-directed learning and ability to practice in the system. During the three year training period,

- A record of all theoretical, practical and experimental work done by the post graduate student and its assessment will be kept and shall be available for examiners at the time of the final practical and viva voce examination.
- There will be periodical examinations (Part completion tests) during the course of training.
- Internal assessments – Theory, Practical's and Viva at the end of each academic year.
- The pre- final theory and practical examination will be conducted.

2. During last six months the post graduate student will have weekly assessment tutorials conducted by the faculty. All activities will be evaluated.

3. General Principles

Internal Assessment covers all domains of learning and used to provide feedback to improve learning; it also covers professionalism and communication skills.

Quarterly assessment during the MD training will be based on:

1. Journal based / recent advances learning
2. Patient based /Laboratory or Skill based learning
3. Self-directed learning and teaching , Pedagogy as a tool in formative assessment helps the student to be a better teacher
4. Departmental and interdepartmental learning activity
5. External and Outreach Activities / CMEs

The student to be assessed periodically as per categories listed in postgraduate student appraisal form (Annexure VII).

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SUMMATIVE ASSESSMENT:

The summative examination will be carried out as per the University Regulations as amended from time to time.

The Post Graduate examination will be in three parts:

1. Thesis: Every post graduate student shall carry out work on an assigned research project under the guidance of a recognised Post Graduate Teacher, the result of which shall be written up and submitted in the form of a Thesis. Work for writing the Thesis is aimed at contributing to the development of a spirit of enquiry, besides exposing the post graduate student to the techniques of research, critical analysis, acquaintance with the latest advances in medical science and the manner of identifying and consulting available literature.

Thesis shall be submitted at least six months before the Theory and Clinical / Practical examination. The thesis shall be examined by a minimum of three examiners; one internal and two external examiners, who shall not be the examiners for Theory and Clinical examination. A post graduate student shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by all the examiners.

2. Theory The examinations shall be organised on the basis of 'Grading 'or 'Marking system' to evaluate and to certify post graduate student's level of knowledge, skill and competence at the end of the training. Obtaining a minimum of 50% marks in 'Theory' as well as 'Practical' separately shall be mandatory for passing examination as a whole. The examination for M.D./ MS shall be held at the end of 3rd academic year. An academic term shall mean six month's training period.

There shall be four theory papers.

Paper I, Paper-II, Paper-III , Paper- IV

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Scheme of Examination: Summative

A. Theory (Written Paper) 400 marks

There shall be four question papers, each of three hours' duration. Each paper shall consist of 10 short essay questions each carrying 10 marks. Total marks for each paper will be 100. Questions on recent advances may be asked in any or all the papers. Details of distribution of topics for each paper will be as follows.

Name of the course	Course Code	Topics	Marks
Biomolecules, Analytical techniques and research methodology.	MDC509A	Biomolecules, cell biology, Analytical techniques and instrumentation in Biochemistry, Biostatistics and research methodology, basics of medical education in teaching and assessment of Biochemistry.	100
Metabolism & Nutrition	MDC510A	Enzymes, bioenergetics, biological oxidation, Metabolism of Carbohydrates, Lipids, Proteins, Nucleotides, and Heme and their associated disorders, intermediary metabolism and regulation, Metabolism of xenobiotics, Free radicals, and antioxidant defense systems in the body and associations with the disease process	100
Molecular biology & Immunology	MDC511A	Molecular biology, molecular and genetic aspects of cancer, immunology, Nutrition in health and disease, Vitamins, Minerals Environmental Biochemistry- Toxic elements & effects of environmental pollutants on the body, health and population	100
Clinical Biochemistry	MDC512A	Basic principles and practice of clinical biochemistry along with Total quality management and Quality Control, Clinical correlates and analytical procedures including diagnostic assessment of body systems and organ functions, endocrinology and recent advances in Biochemistry, Biomedical waste management	100
Thesis – Biochemistry	MDP503A	Approval 6 months before final examination.	

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A. Practical's: 200 marks -spread over a minimum of 2 days

The practical examinations will be held over 2 days; one day will be mainly for the practical exercises and the second day for the oral/ viva voce. The practical examinations will have the following components.

1. A clinical case examination/ A paper based case scenario and discussion to be done. The clinical features of the patient and relevant laboratory investigation of biochemical abnormalities present will be discussed. (25 marks) Complete standardization and estimation of 01 related laboratory investigation (50 marks), single standard estimation of 01 minor analyte/enzyme to be done (25 marks).
2. Identification the carbohydrate/amino acid provided and confirm of its identity by paper chromatography, Urine analysis OR Performance of an electrophoresis for serum proteins and discussion of electrophoretic pattern. (80 marks)
3. Quality Control, its interpretation and Method validation, Clinical lab data Interpretation, Interpretation of clinical data from cases on liver function, renal function, thyroid function, cardiac diseases, endocrine diseases, electrolyte and acid base disorders, analysis of body fluids, lipid profile, vitamin deficiencies, mineral metabolism, nutritional disorders etc. (5 cases with lab data, each carrying 4 marks).
4. Viva-voce Examination: (60 marks) - Viva Voce examination will be conducted conjointly by all the examiners to test comprehension, analytical approach, expression and interpretation of facts.
5. Thesis presentation (of about 15 mins duration) (20 marks)
6. Pedagogy (20 mins duration plus 10 mins for questions) (20 marks)

A. Total Marks Distribution:

Maximum marks for M.D degree course	Theory	Practical	Viva	Grand Total
	400	200	100	700

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Sl No 1	Reg No	PRACTICALS				Total 200	VIVA VOCE						Total 100
		PART A	PART B	PART C	PART D		PART E				PART F	PART G	
		CASE Presentation Discussion(25) & Standardization & 2 analyte Estimation (75)	Body fluid Analysis & Chromatography (30)	Case scenario followed by electrophoresis technique (30)	Quality control, its interpretation and method validation (20) & Clinical lab data interpretation (20		Ex1 (15)	Ex2 (15)	Ex3 (15)	Ex 4 (15)	Dissertation (20)	Pedagogy (20)	

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Annexures

1. Evaluation of Journal Review Presentations
2. Evaluation of Pedagogy
3. Evaluation of Seminar Presentations
4. Dissertation Presentation
5. Continuous Evaluation of Dissertation work by Guide / Co-Guide
6. Log book
7. Post Graduate student Appraisal Form

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Annexure – I

CHECK-LIST FOR EVALUATION OF JOURNAL REVIEW PRESENTATIONS

Date:

Name of the Student:

Name of the Faculty/Observer:

Sl. No.	Items for observation during presentation	Poor 0	Below Average 1	Average 2	Good 3	Very Good 4
1.	Article chosen was					
2.	Extent of understanding of scope& objectives of the paper by the candidate					
3.	Whether cross references have been consulted					
4.	Whether other relevant publications consulted					
5.	Ability to respond to questions on the paper/subject					
6.	Audio-Visual aids used					
7.	Ability to discuss the paper					
8.	Clarity of presentation					
9.	Any other observation					
	Total Score					

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Annexure– II

EVALUATION OF PEDAGOGY

Name of the candidate: Date:

Register No.:

Centre:

Topic: Max.Marks:20

Skills		Marks
Marks Set induction (1.5marks)	• Aroused interest in the beginning by relating to previous learning, throwing a new idea, questioning, etc. • Specified the objectives of presentation	
Planning(5marks)	• Organized material in a logical sequence • Used relevant content matter	
Presentation(5marks)	• Changed the pace of presentation by shifting emphasis, etc • Used specific example to • illustrate main Ideas • Used non-verbal cues, eye contact, etc	
Pupil participation(5marks)	• Allowed questions from students • Asked question • Solicited/Raised questions • Rewarded pupil effort	
Use of AV aids(2.5marks)	• Used proper AV aids • Used the aid(s) effectively	
Closure(1mark)	• Summarized most important points at the end of the session Over all marks	
____(out of 20) Signature		

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Annexure – III

CHECK-LIST FOR EVALUATION OF SEMINAR PRESENTATIONS

Date:

Name of the Student:

Name of the Faculty/Observer:

Sl.No.	Items for observation during presentation	Poor 0	Below Average 1	Average 2	Good 3	V. Good 4
1.	Whether other relevant publications consulted					
2.	Whether cross references have been consulted					
3.	Completeness of Preparation					
4.	Clarity of Presentation					
5.	Understanding of subject					
6.	Ability to answer questions					
7.	Time scheduling					
8.	Appropriate use of Audio-Visual aids					
9.	Overall Performance					
10.	Any other observation					
	Total					

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Annexure – IV

CHECKLIST FOR DISSERTATION PRESENTATION

Name: Faculty/Observer: Date:

Sl. No.	Points to be considered divine	Poor 0	Below Average 1	Average 2	Good 3	Very Good 4
1.	Interest shown in selecting a topic					
2.	Appropriate review of literature					
3.	Discussion with guide &other faculty					
4.	Quality of protocol					
5.	Preparation of proforma					

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Annexure – V

CONTINUOUSEVALUATIONOFDISSERTATIONWORKBY GUIDE/CO-GUIDE

Name: Faculty/Observer: Date:

Sl.No.	Items for observation during presentation	Poor 0	Below Average 1	Average 2	Good 3	Very Good 4
1.	Periodic consultation with guide/co-guide					
2.	Regular collection of case material					
3.	Depth of analysis/discussion					
4.	Departmental presentation of findings					
5.	Quality of final output					
6.	Others					
	Total Score					

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Annexure VI

LOG BOOK

Table1: Academic activities attended by the student

Name: Admission Year:

College:

Date	Type of Activity Seminar/Journal Club/Presentation/ UG teaching	Particulars

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Annexure VI

LOG BOOK

Table2: Academic presentation made by the Student

Name: Admission Year:

College:

Date	Topic	Specify type of presentation Seminar/ Journal Club presentation/UG teaching, etc.

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Annexure – VII

POSTGRADUATE STUDENTS APPRAISAL FORM

PRE-CLINICAL DISCIPLINES

Date:

Name of the Department:

Name of the Student:

Period of Training: From ..... To .....

0: Poor,1: Average,2: Good, 3: Verygood,4: Exceptional

Sl. No.	Particulars	Poor 0	Below Average 1	Average 2	Good 3	Very Good 4
1.	Ability to teach UG students and Juniors					
2.	Knowledge of Subject in PG course					
3.	Performance in Journal Club					
4.	Performance in Seminar					
5.	Punctuality at work					
6.	Ability to work in a team					
7.	Attitude towards colleagues/Faculty					
8.	Ability to communicate with students					
9.	Departmental and interdepartmental activity initiatives					
10.	Thesis/Research work					
11.	Logbook maintenance					
12.	IA eligibility	Yes/No				
13.	Publications	Yes/No				
14.	Paper/Poster presentations	Yes/No				
15.	Remarks					

***REMARKS: Any significant positive or negative attributes of a postgraduate student to be mentioned. For score less than 3 in any category, remediation must be suggested. Individual feedback to postgraduate student is strongly recommended.**

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Course Specifications

MD Biochemistry 2022 onwards

Course Code: MDC509A

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Course Specifications

Course Title	**Biomolecules, Analytical techniques and research methodology.**
Course Code	**MDC509A**
Department	**Biochemistry**
Faculty	**Ramaiah Medical College**

Course summary:

This course is designed in such a way that the student will master the basics of Analytical techniques and instrumentation in biochemistry along with biostatistics and research methodology.

CO 1: The student should be able to understand and clearly explain concepts of biochemistry and correlate them with processes at cellular and molecular levels along with their role in health and disease. These are given in detail in subsequent sections. (C, A, P)

CO 2: Explain energy transactions in a living system, and describe the importance of biomolecules in sustaining the life process. (C, A, P)

CO 3: Acquire skills in teaching, research methodology, biostatistics epidemiology & basic information technology Acquire knowledge and apply the principle of statistics, biostatistics and epidemiology to the evaluation and interpretation of molecular and metabolic disease states. (C, A, P)

Course content:

Biomolecules, cell biology, Analytical techniques and instrumentation in Biochemistry, biostatistics and research methodology, basics of medical education in teaching and assessment of Biochemistry

I. **Biomolecules:**

1. Properties of water, Concept of an acid, a base, pH, pK, buffer and buffering capacity.
2. Classification, structure and functions of amino acids and peptide, structural organization of proteins and relationship with their functions- Primary, secondary, tertiary and quaternary structure of proteins. Protein folding and denaturation. Structure-function relationship of Proteins, hemoglobin and myoglobin Structure and function of collagen. Structure and function of immunoglobulins.
3. Classification, functions, properties, and reactions of carbohydrates.
4. Classification, properties and importance of lipids Fatty acids
5. Biological membranes - structure, function, properties and importance Micelles and liposomes.
6. Nucleotides and nucleic acids.

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II. Cell biology :

1. Structure of the cell and different subcellular organelles.

III. Analytical techniques and instrumentation in Biochemistry

2. Principles of basic techniques used in a clinical biochemistrylaboratory Spectrophotometry (UV and visible spectrophotometry).
3. Atomic absorption spectrophotometry. Flame photometry. Fluorometry. Turbidimetry and nephelometry. Gravimetry. Electrochemistry (pH electrodes, ion-selective electrodes, gas-sensing electrodes). Chemiluminescence. Water testing. Electrophoresis (principle, types, applications; isoelectric focusing capillary electrophoresis; 2-D electrophoresis). Chromatography (principle, types [including high performance liquid chromatography and gas chromatography, UPLC). Techniques in molecular biology: Blotting techniques, polymerase chain reaction (PCR), DNA and protein sequencing, Microarrays and DNA chip technology, cloning techniques, genomics, proteomics, and metabolomics. Ultracentrifugation. Cell fractionation. Osmometry, mass spectrometry, immunochemical techniques, automation, point of care testing,) automation. Flow cytometry. Microscopy-electron and fluorescent Nanotechnology and microfabrication. Techniques to study in vivo metabolism –NMR, SPECT, PET scans etc Radioisotope – based techniques and its applications

IV. Biostatistics and research methodology:

V. Basics of Medical Education in teaching and assessment of Biochemistry

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Course Mapping (CO-PO-PSO Mapping)

Course Code and name	Course Outcome	Program Outcomes				Program Specific Outcomes				
		PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4	PSO5
MDC509A Biomolecules, Analytical techniques and research methodology.	CO1	3	2	3	3	2	3	3	3	2
	CO2	3	3	2	2	3	2	2	3	3
	C0 3	3	2	3	3	2	3	3	3	2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution										

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Course Specifications

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Course Code: MDC510A

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Course Specifications

Course Title	Metabolism & Nutrition
Course Code	MDC510A
Department	Biochemistry
Faculty	Ramaiah Medical College

Course summary:

This course is designed in such a way that the student will master the concepts of biochemistry and correlate them with metabolic processes at cellular and interpret their role at molecular levels

Course outcomes:

CO 1: Should be able to understand and clearly explain concepts of biochemistry and correlate them with metabolic processes at cellular and interpret their role at molecular levels along with their effect in health and disease. (C, A, P)

CO 2: Describe pathways of the intermediary metabolism along with their individual and integrated regulation and apply the knowledge in understanding the functioning of the body. (C, A, P)

CO3: Understand the overview of metabolism and intermediary metabolism. (C, A, P)

Course Content:

Enzymes, bioenergetics, biological oxidation, Metabolism of carbohydrates, Lipids, Proteins, Nucleotides and Heme and its associated disorders, intermediary metabolism and regulation, Metabolism of xenobiotics, Free radicals and antioxidant defence systems in the body and associations with disease process

1. Enzymes: Properties, classification, mechanism of action, coenzymes and cofactors, kinetics of enzyme activity, Enzyme inhibition regulation of enzyme activity, isoenzymes, diagnostic and therapeutic enzymes, principles of assays of enzymes, enzymes as therapeutic targets of drugs.
2. Biological oxidation
3. Basic concepts of thermodynamics and its laws, as applied to living systems,
4. Exergonic and endergonic reactions and coupled reactions, redox potential
5. High energy compounds
6. Classification and role of oxidoreductases
7. Cytochromes; cytochrome P450 system Respiratory chain and oxidative phosphorylation Components, complexes and functioning of the respiratory chain Process of oxidative phosphorylation: Mechanisms of ATP synthesis and regulation Mitochondrial transport systems and shuttles, Inhibitors, uncouplers and ionophores OXPHOS diseases
8. Overview of metabolism and intermediary metabolism Metabolism of carbohydrates
9. Digestion and absorption,
10. Glycolysis and TCA cycle, including regulation
11. Glycogen metabolism and its regulation

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12. Cori cycle, gluconeogenesis and control of blood glucose
13. Metabolism of fructose and galactose
14. Pentose phosphate and uronic acid pathways and their significance
15. Polyol pathway
16. Regulation of blood glucose levels
17. Diabetes mellitus (including gestational diabetes mellitus) – classification, pathogenesis, metabolic abnormalities, diagnostic criteria, principles of treatment, pathogenesis of complications, laboratory tests
18. Metabolism of ethanol [Metabolism of lipids
19. Digestion and absorption, including role of bile salts
20. Biosynthesis and oxidation of fatty acids . Ketone bodies – formation, utilisation and regulation Metabolism of unsaturated fatty acids and eicosanoids
21. Metabolism of triacylglycerol; storage and mobilisation of fats
22. Metabolism of cholesterol
23. Metabolism of lipoproteins
24. Metabolism in adipose tissue
25. Role of liver in lipid metabolism o Role of lipids in atherogenesis
26. Metabolism of phospholipids and associated disorders
27. Metabolism of amino acids and proteins
28. Digestion and absorption
29. Pathways of amino acid degradation - transamination, oxidative deamination
30. Transport and metabolism of ammonia
31. Metabolism of individual amino acids.
32. Plasma proteins Metabolism of nucleotides
33. De novo synthesis of purine nucleotides
34. Salvage pathway for purines
35. Degradation of purines
36. De novo synthesis of pyrimidine nucleotides
37. Degradation of pyrimidine
38. Metabolism of haem , Biosynthesis of heme and associated disorders
39. Degradation of heme and associated disorders
40. Metabolism in Individual tissue and in the fed and fasting states
41. Liver, adipose tissue, brain, RBC's, skeletal muscle and cardiac muscle
42. Composition of lens, Biochemical Changes during cataractogenesis
43. Metabolism of xenobiotics
44. Free radicals and antioxidant defence systems in the body and associations with disease process

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Course Mapping (CO-PO-PSO Mapping)

Course Code and name	Course Outcomes	Program Outcomes				Program Specific Outcomes				
		PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4	PSO5
MDC510A Metabolism & Nutrition	CO1	3	3	2	2	3	2	2	3	3
	CO 2	3	3	2	3	2	3	3	3	2
	CO 3	3	2	3	3	3	3	2	3	2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution										

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Course Specifications

MD Biochemistry 2022 onwards

Course Code: MDC511A

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Course Specifications

Course Title	Molecular biology & Immunology
Course Code	MDC511A
Department	Biochemistry
Faculty	Ramaiah Medical College

Course summary:

This course is designed in such a way that the student will master the concepts of Molecular biology, genetic aspects of cancer and immunology, associated with role of micro and macronutrients in health and disease.

Course outcomes:

CO 1: Demonstrate comprehensive knowledge and able to explain concepts of biochemistry and correlate them with processes at molecular levels along with their role in health and disease. Able to develop differential diagnoses for molecular and metabolic causes of diseases. (C, A, P)

CO 2: Demonstrate the application of various aspects of genetic engineering in medicine (C, A, P)

CO 3: Demonstrate ability to integrate principles of immunology and role of micro and macronutrients in Biochemistry. (C, A, P)

Course Content:

Molecular biology, molecular and genetic aspects of cancer, immunology, Nutrition in health and disease, Vitamins, Minerals Environmental Biochemistry- Toxic elements & effects of environmental pollutants on the body, health and population,

1. Structure and organization of chromosomes and chromatin re-modelling DNA replication
2. DNA replication in prokaryotes and eukaryotes (including important differences between the two):
3. Roles of DNA polymerase, helicase, primase, topoisomerase and DNA ligase
4. Replication fork
5. Okazaki fragments and its importance in replication.
6. Overview of role of major DNA repair mechanisms – mismatch repair, base excision repair, nucleotide excision repair and double strand break repair.
7. Diseases associated with abnormalities of DNA repair systems
8. DNA recombination
9. Transcription
10. Structure of a gene - exons and introns, promoter, enhancers/repressors and response elements.
11. Process of transcription in prokaryotes and eukaryotes – initiation, elongation and termination (including important differences).
12. Post-transcriptional processing – capping, tailing and splicing.
13. Genetic code and mutations
14. Characteristics of the genetic code
15. Molecular basis of degeneracy of the genetic code (Wobble hypothesis)

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16. Mutagens- examples of physical, chemical and biological mutagens.
17. Types of mutations – point mutations and chromosomal mutations
18. Relationship of mutations with specific diseases
19. Translation
20. Basic structure of prokaryotic and eukaryotic ribosomes.
21. Structure of tRNA (diagram of clover leaf model of tRNA structure) and its function in protein synthesis.
22. Function of aminoacyl tRNA synthase.
23. Process of protein synthesis (translation) – initiation, elongation and termination (including important differences between prokaryotic and eukaryotic translation).
24. Inhibition of prokaryotic translation by antibiotics.
25. Post-translational modifications
26. Regulation of gene expression in prokaryotes and eukaryotes
27. The operon concept in prokaryotes
28. Role of general and gene specific transcription factors
29. Small interference RNA (siRNA) and micro RNA (miRNA).
30. Other modes of regulation of gene expression: alternative splicing, alternative promoter usage, DNA methylation, Histone acetylation / deacetylation, RNA editing, alterations of RNA stability Recombinant DNA technology and its applications in modern medicine
31. Concepts of recombinant DNA, genetic engineering, biotechnology and cloning.
32. Restriction endonucleases.
33. Vectors for cloning – plasmids, cosmids and phages
34. Genomic and cDNA libraries
35. Applications of recombinant DNA technology in medicine
36. Gene therapy
37. Diagnosis of genetic diseases and genetic counselling
38. DNA fingerprinting
39. DNA sequencing
40. Microarrays
41. Fluorescent in situ hybridization (FISH)
42. DNA vaccines
43. Transgenic animals
44. Application of molecular techniques in forensic investigation and medico legal cases 51 Overview of Human Genome Project Basics of bioinformatics Principles of human genetics
45. Alleles, genotypes and phenotypes
46. Patterns of inheritance: monogenic and polygenic inheritance
47. Population genetics
48. Genetic factors in causation of diseases
49. Types of genetic diseases: Chromosomal, monogenic and polygenic disorders, mitochondrial disorders, nucleotide repeat expansion disorders, imprinting disorders
50. Screening for genetic diseases and prenatal testing
51. Ethical and legal issues related to medical genetics Stem cells in clinical medicine
52. Basic concepts regarding stem cells
53. Types of stem cells: embryonic and induced pluripotent stem cells (IPSC)
54. Potential applications in the clinical medicine
55. Ethical and legal issues related to use of stem cells in medicine
56. Cancer
57. Carcinogens: physical, chemical and biological
58. Clonal origin of cancers
59. Genetic basis of carcinogenesis
60. Role of oncogenes and tumour suppressor genes

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61. Familial cancer syndromes
62. Cancer stem cells
63. Epigenetic regulation in cancer
64. Gene expression profiling in cancer
65. Cancer cell biology: cell cycle abnormalities, telomerase activity, proliferative capacity and decreased apoptosis
66. Metastasis
67. Tumour markers
68. Biochemical basis of cancer chemotherapy and drug resistance
69. New methods of anti-cancer therapy: targeted cancer therapy, cancer immunotherapy.
70. Immunology
71. Innate and acquired immunity
72. Humoral and cell-mediated immunity
73. Cells and organs of the immune system - T and B cells, macrophages, dendritic cells, NK cells, granulocytes
74. Antigens, epitopes and haptens
75. Immunoglobulin classes, isotypes, allotypes, idiotypes, monoclonal antibodies, organization and expression of immunoglobulin genes, immunoglobulin gene rearrangement, class switching 52
76. Antigen-antibody interaction - immunochemical techniques
77. Major histocompatibility complex, antigen processing and presentation,
78. T cell and B cell receptor, toll like receptors
79. T cell maturation/activation/differentiation
80. B cell generation/activation/differentiation
81. Cytokines
82. Complement system, cell
83. Immune response to infections
84. Hypersensitivity reactions
85. Vaccines
86. Immuno-deficiency syndromes
87. Autoimmunity
88. Transplantation immunology
89. Cancer and immune system,
90. Immunodiagnostics
91. Immunotherapy
92. Nutrition in health and disease
93. Principles of food components
94. General nutritional requirements
95. Energy requirements – calculation of calorie requirements in healthy individuals and diseased states
96. Biological value of proteins
97. Thermogenic effect of food
98. Balanced diet, diet formulations in health and disease, mixed diet
99. Nutritional supplements
100. Food Toxins & additives
101. Disorders of nutrition, obesity, protein and protein energy malnutrition, dietary fibers, undernutrition, laboratory diagnosis of nutritional disorders
102. National Nutrition Program
103. Vitamins
104. Classification, chemistry, absorption and transport, biochemical role, sources, RDA and deficiency state of each vitamin (including diagnostic tests for deficiency and treatment, hypervitaminosis)
105. Minerals

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106. Classification, biochemical role, sources, requirement and deficiency state of each mineral (including diagnostic tests for deficiency and treatment and toxic manifestation of minerals)

107. Environmental Biochemistry: Toxic elements and effects of environmental pollutants on the body, health and population

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Course Mapping (CO-PO-PSO Mapping)

Course Code and name	Course Outcomes	Program Outcomes				Program Specific Outcomes				
		PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4	PSO5
MDC511A Molecular biology & Immunology	CO1	3	2	3	3	2	3	3	3	3
	CO 2	3	3	2	3	2	3	3	2	3
	CO 3	3	2	2	3	2	3	2	3	2
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution										

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Course Specifications

MD Biochemistry 2022 onwards

Course Code: MDC512A

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Course Specifications

Course Title	**Clinical Biochemistry**
Course Code	**MDC512A**
Department	**Biochemistry**
Faculty	**Ramaiah Medical College**

Course summary:

This course is designed in such a way that the student will master the concepts of Molecular biology, genetic aspects of cancer and immunology, associated with role of micro and macronutrients in health and disease.

Course outcomes:

CO 1: Demonstrate knowledge of Basic principles and practice of clinical biochemistry along with Total quality management and Quality Control. (C, A, P)

CO 2: Demonstrate comprehensive knowledge to clinical correlate and towards analytical procedures including diagnostic assessment of body systems and organ functions, endocrinology and recent advances in Biochemistry, Biomedical waste management (C, A, P)

CO 3: Demonstrate knowledge of contemporary advances and developments in the field of Clinical Biochemistry and comprehensive knowledge in differential diagnoses for molecular and metabolic causes of diseases (C, A, P)

CO 4: Demonstrate standard operating procedures of various methods and techniques used in clinical biochemistry. (C, A, P)

Course Content:

Basic principles and practice of clinical biochemistry along with Total quality management and Quality Control, Clinical correlates and analytical procedures including diagnostic assessment of body systems and organ functions, endocrinology and recent advances in Biochemistry, Biomedical waste management

1. Basic principles and practice of clinical biochemistry Units of measure, reagents, clinical laboratory supplies, basic separation techniques, laboratory calculations, specimen collection and processing, safety in the laboratory, clinical utility of laboratory tests (including sensitivity, specificity, ROC curves, etc), analysis in the laboratory, selection and evaluation of methods (including statistical techniques), evidence based laboratory medicine, establishment and use of reference values, pre-analytical variables and biological variations, Total quality management and Quality Control, c1inical laboratory informatics
2. Clinical correlates and analytical procedures
3. • Amino acids, peptides and proteins; non-protein nitrogenous compounds • Enzymes • Carbohydrates • Lipids, lipoproteins and apolipoproteins and other cardiovascular risk

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factors • Regulation of fluid and electrolyte balance and its associated disorders • Blood gases, pH, buffers, H-H Equation and Regulation of acid-base balance and associated disorders • Hormones and associated disorders • Catecholamines and serotonin • Haemoglobin and bilirubin • Porphyrins and associated disorders

4. Bone and mineral metabolism
5. Tumour markers
6. Assessment of organ functions (hypothalamus and pituitary, adrenal glands, gonads, thyroid, parathyroid, liver, kidney, heart, stomach, pancreas, intestine, etc) and associated disorders
7. Pregnancy and maternal and fetal health • Reproduction related disorders – infertility
8. New-born screening for Inborn errors of metabolism
9. Haemostasis
10. Therapeutic drug monitoring Clinical toxicology
11. Body fluid analyses
12. Biochemistry of Endocrine system • Classification and general mechanism of action of hormones • Biosynthesis, secretion, regulation, transport and mode of action of hypothalamic peptides, adenohypophyseal and neurohypophyseal hormones, thyroid and parathyroid hormones, calcitonin, pancreatic hormones, adrenocortical and medullary hormones, gonadal hormones, gastrointestinal hormones, opioid peptides, parahormones. • Biochemistry of conception, reproduction and contraception • Endocrine interrelationship and their involvement in metabolic regulation • Neuro-modulators and their mechanism of action and physiological significance • Biochemical aspects of diagnosis and treatment of endocrinal disorders:
13. Hematopoietic disorders • Iron deficiency and other hypoproliferative anaemias - iron metabolism, laboratory tests of iron status, iron therapy • Anaemia of chronic disease, anaemia of renal disease • Hemoglobinopathies - sickle cell anaemia, methaemoglobinemias, thalassemia syndromes, Megaloblastic anaemia • RBC membrane and metabolism • Haemolytic anaemia - inherited defects in RBC membrane and enzymes (G6PD deficiency), immunologic causes of hemolysis • ABO blood group system - biochemical basis, transfusion biology. • Plasma cell disorders - multiple myeloma. Hemostasis and thrombosis • Biochemical mechanisms, related laboratory tests, antiplatelet/anticoagulant/fibrinolytic therapy
14. Cardiovascular system • Atherosclerosis - pathogenesis, risk factors, prevention and treatment Cardiac failure, acute coronary syndrome, cardiac biomarkers
15. Respiratory system • Gaseous exchange in lungs - physiological features and disturbances, arterial blood gases Pathogenesis of cystic emphysema, alpha-1 anti-trypsin deficiency
16. Nervous system: • Neurotransmitters and their receptors • Ion channels and channelopathies • Neurotrophic factors • Protein aggregation and neurodegeneration • Alzheimer's disease, Parkinson's disease, Huntington's disease, multiple sclerosis • Prions and prion diseases • Guillain-Barre syndrome – immunopathogenesis • Myasthenia gravis – pathophysiology • Hereditary myopathies - Duchenne muscular dystrophy • Inherited disorders of muscle energy metabolism • Mitochondrial myopathies • Pathophysiology of psychiatric disorders such as anxiety, depression and schizophrenia
17. Kidney Kidney function tests; pathophysiology, biochemistry, laboratory findings and management in acute kidney injury and chronic kidney disease; estimation of GFR; glomerular diseases - pathogenesis and mechanisms of glomerular injury, nephrotic syndrome, diabetic nephropathy; tubular disorders - renal tubular acidosis, proteinuria, nephrolithiasis, kidney transplant; biochemical aspects of renal stones.
18. Gastrointestinal system • Gastric physiology • Pathophysiology of peptic ulcer disease, including role of H. pylori; gastric function tests; Zollinger-Ellison syndrome • Digestion

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and absorption of nutrients; evaluation of malabsorption (steatorrhea, lactose intolerance) • Celiac disease • Inflammatory bowel disease • Protein losing enteropathy • Regulatory peptides in the gut • Neuroendocrine tumors

19. Liver • Liver function tests • Hyperbilirubinemias • Viral hepatitis • Serologic/virologic markers • Alcoholic liver disease, fatty liver, chronic liver disease, cirrhosis and its complications Pathogenesis of ascites • Hepatic encephalopathy • Metabolic diseases affecting liver • Reye's syndrome • Diseases of gall bladder/bile ducts - pathogenesis of gallstones
20. • Pancreas - acute and chronic pancreatitis, cystic fibrosis, pancreatic function tests.
21. Bone and mineral metabolism • Bone structure and metabolism; metabolism of calcium, phosphate and magnesium; regulation and abnormalities of bone metabolism; vitamin D; parathyroid hormone; calcitonin; parathyroid hormone-related (PTHrP); osteoporosis – pathophysiology; markers of bone turnover

22. Biomedical waste management

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Course Mapping (CO-PO-PSO Mapping)

Course Code and name	Course Outcomes	Program Outcomes				Program Specific Outcomes				
		PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4	PSO5
MDC512A Clinical biochemistry	CO1	3	3	2	3	2	3	2	3	3
	CO 2	3	2	3	3	2	3	2	3	2
	CO 3	3	2	2	3	2	3	3	3	3
	CO 4	3	3	2	2	2	3	2	2	3
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution										

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Course Specifications

MD Biochemistry 2022 onwards

Course Code: MDP503A

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Course Specifications

Course Title	**Thesis – Biochemistry**
Course Code	**MDP503A**
Department	**Biochemistry**
Faculty	**Ramaiah Medical College**

Course summary:

The course is designed in such a way that the student will master the science of research in terms of designing, conducting and interpreting the results.

Course Outcome:

Describe the techniques of research, identify available literature and critically analyse the same. (C)

Course details:

Every candidate pursuing MD Medicine degree course is required to carry out work on a selected research project under the guidance of a recognised post graduate teacher. The results of such a work shall be submitted in the form of a dissertation.

The dissertation is aimed to train a post graduate student in research methods and techniques. It includes identification of a problem, formulation of a hypothesis, search and review of literature, getting acquainted with recent advances, designing of a research study, collection of data, critical analysis, and comparison of results and drawing conclusions.

Every candidate shall submit to the Registrar (Academic) of the University in the prescribed proformas, a synopsis containing particulars of proposed dissertation work within six months from the date of commencement of the course on or before the dates notified by the University. The synopsis shall be sent through the proper channel.

Such synopsis will be reviewed and the dissertation topic will be registered by the University. No change in the dissertation topic or guide shall be made without prior approval of the University. The dissertation should be written under the following headings:

1. Introduction
2. Aims or Objectives of study
3. Review of Literature
4. Material and Methods
5. Results
6. Discussion
7. Conclusion
8. Summary
9. References (Vancouver style)
10. Tables
11. Annexures

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Course Mapping (CO-PO-PSO Mapping)

Course Code and name	Course Outcomes	Program Outcomes				Program Specific Outcomes				
		PO1	PO2	PO3	PO4	PSO1	PSO2	PSO3	PSO4	PSO5
MDP503A Thesis-Biochemistry	CO 1		1	3						3
3: Very Strong Contribution, 2: Strong Contribution, 1: Moderate Contribution										

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Course Materials:

Books (latest edition)

1. Murray RK, Grannar DK, Mayes PA, Rodwell VW, Harper's Illustrated Biochemistry, McGraw – Hill.
2. Champe PC, Harvey RA, Ferrier DR, Lippincott's Illustrated reviews: Biochemistry, Wolter Kluwer (India) Pvt Ltd, New Delhi.
3. Devlin TM, Textbook of Biochemistry with Clinical Correlations –Wiley-Liss, New York.
4. Berg JM, Tymoczoko JL, Stryer L. Biochemistry – WH Freeman and Company, New York.
5. Lehninger AL, Nelson DL, and Cox MM. Lehninger's Principles of Biochemistry, WH Freeman and company, New York.
6. Voet D and Voet J, Biochemistry – John Wiley and Sons, New York.
7. Voet D and Voet J, Principles of Biochemistry, John Wiley and Sons, New York.
8. Marshall WJ, and Bangert SK, Clinical Chemistry: Metabolic and Clinical aspects, Mosby Elsevier, New York.
9. Baynes JW and Dominiczak MH, Medical Biochemistry, Mosby Elsevier, New York.
10. Bhagavan NV and Ha Chung-Eun, Essentials of Medical Biochemistry with clinical cases, Elsevier, New York.
11. Smith CM, Marks AD, Lieberman M. Marks Basic Medical Biochemistry: A clinical Approach, Lippincotts Williams and Wilkins, Philadelphia.
12. Henry et al, Clinical chemistry.
13. Chhabra Namrata, A case- o r i e n t e d approach towards Biochemistry, Jaypee Brothers Medical Publishers (P) Ltd. New Delhi.
14. Montgomerry R, Biochemistry: A case oriented approach, Mosby Harcourt Health Sciences Company, Sydney.
15. Bruce Alberts. Molecular Biology of the Cell, Taylor and Fracis, New York.
16. Bondy PK and Rosenberg LE, Duncan's Diseases of Metabolism, W B Saunders company, Philadelphia.
17. Scriver CR., et al. Metabolic and Molecular basis of Inherited diseases, McGraw Hill International edition, New York.
18. Rose BD, Clinical Physiology of acid-base and electrolyte disorders- McGraw Hill International edition, New York.
19. Burtis CA and Ashwood ER, Tietz Fundamentals of Clinical Chemistry, Harcourt (India) Ltd.

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20. Burtis CA, A s h w o o d ER, Burns DE. Tietz textbook of Clinical Chemistry and Molecular Diagnostics, Elsevier, Philadelphia.
21. Kaplan LA and Pesee AG, Clinical Chemistry: Theory, analysis and Correlation – CV Mosby and Co. St Lousis, MO.
22. Gowenlock and Bell, Varley's Practical Clinical Biochemistry – CBS, New Delhi.
23. Bishop ML, Fody EP, Schoeff LE, Clinical Chemistry; Techniques, Principles, Correlations, Wolter Kluwer (India) Pvt Ltd, New Delhi.
24. Wilson Keith and Walker John, Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press.
25. Williamson MA, Snyder LM. Wallachs Interpretation of Diagnostic tests, Wolter Kluwer (India) Pvt Ltd, New Delhi.
26. Watson JD, Molecular Biology of gene, Pearsons education, Singapore Pvt Ltd.
27. Glick BR, Pasternak JJ, Molecular Biotechnology: Principles and applications of Recombinant DNA, ASM Press, Washington DC

Note: Students should be aware of latest WHO guidelines and updates

Journals and Other Periodicals:

1. Clinical Chemistry
2. Annals of Clinical Biochemistry
3. Clinical Biochemistry
4. Clinica Chimica Acta
5. Journal of Clinical Investigation
6. Indian Journal of Clinical Biochemistry
7. Indian journal of Medical Biochemistry
8. Indian journal of Biochemistry and Biophysics
9. Indian journal of Human genetics
10. Indian Journal of Medical research
11. Annual Review of Biochemistry
12. Clinical chemistry reviews
13. Journal of Clinical Endocrinology and Metabolism
14. Diabetes care
15. Trends in Biochemical Sciences

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ADDITIONAL READING:

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1. Compendium of recommendations of various committees on Health and Development (1943-1975). DGHS, 1985 central bureau of health intelligence Directorate General of Health Services, Ministry of Health and Family Welfare, Govt Of India, Nirman Bhawan, New Delhi.

2. National health Policy, Ministry of Health and Family Welfare, Govt Of India, Nirman Bhawan, New Delhi.

3. Santosh Kumar, the elements of research, writing and editing1994, Dept of urology, JIPMER, Pondicherry.

4. Srinivasa D.K.etal, Medical Education Principles and Practice, 1995, National Teacher Training centre, JIPMER Pondicherry

5. Indian Council of Medical Research, "Policy statement of Ethical Consideration involved in research on Human Subjects", 1982, I.C.MR., New Delhi.

6. Code of medical ethics framed under section 33 of the Indian Medical Council Act 1956. Medical Council of India, Kotla Road, New Delhi.

7. Francis C.M medical Ethics, JP Publications2nd edition 2004.

8. Indian National Science Academy, Guidelines for care and use of animals in Scientific research, New Delhi, 1994.

9. International Committee of Medical Journal Editors, Uniform requirements for manuscripts submitted to biomedical Journals, N Engl J Med 1991.

10. Kirkwood B.R, Essentials of Medical Statistics, 1st Ed., and Oxford: Blackwell Scientific Publications 1988.

11. Mahajan B K. Method in Biostatistics for medical students, 5thEd. New Delhi, Jaypee Brothers Medical Publishers, 1989.

12. Raveendran, B Gitanjali, A Practical approach to PG Dissertation, New Delhi JP Publications 1998.

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