

**THE TAMIL NADU Dr. M.G.R. MEDICAL UNIVERSITY,
CHENNAI - 600 032.**



REGULATIONS AND SYLLABUS FOR
M.D. / M.S. POST-GRADUATE (NON-CLINICAL) COURSES

THE TAMIL NADU Dr. M.G.R. MEDICAL UNIVERSITY,
CHENNAI - 600 032.

M.D. / M.S. POST-GRADUATE (NON-CLINICAL) COURSES

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**THE TAMIL NADU Dr. M.G.R.MEDICAL UNIVERSITY,
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**REGULATIONS FOR THE M.D. / M.S. POST-GRADUATE
(NON-CLINICAL) COURSES**

In exercise of the powers conferred by Section 44 of the Tamil Nadu Dr. M.G.R. Medical University, Chennai, Act, 1987 (Tamil Nadu Act 37 of 1987), the Standing Academic Board of the Tamil Nadu Dr. M.G.R. Medical University, Chennai hereby makes the following Regulations :-

1. SHORT TITLE AND COMMENCEMENT :

These regulations shall be called “THE REGULATIONS FOR THE M.D./ M.S. POST-GRADUATE (NON-CLINICAL) COURSES OF THE TAMIL NADU Dr. M.G.R. MEDICAL UNIVERSITY, CHENNAI”.

They shall come into force from the academic year 2006-2007. *

The Regulations and the Syllabi are as prescribed under these Regulations and are subject to modification by the Standing Academic Board from time to time.

2. AIMS AND OBJECTIVES :

At the end of the course the student should have acquired :-

- (1) Broad understanding of the principles of basic sciences related to his speciality.
- (2) Ability and skills to perform and interpret investigative procedures related to his speciality.
- (3) The student should have acquired :
Basic skills in clinical diagnosis of common conditions, planning of investigations and knowledge of principles of management of clinical conditions.
- (4) Capabilities to take independent decisions in emergency situations, perform required procedures in that particular speciality and manage complications.

* 31st S.A.B. dated 29-06-2006

- (5) Ability to critically appraise published literature, interpret data and to broaden his knowledge by keeping abreast with modern developments in the speciality.
- (6) Ability to search online, use information technology to his advantage and critically evaluate medical literature and draw his own conclusion.
- (7) Ability to teach post graduates, undergraduates and nursing students in the basic management of the diseases in his speciality.
- (8) Ability to get acquainted with allied and general clinical disciplines to ensure appropriate and timely referral.
- (9) Ability to conduct research.
- (10) Ability to become a consultant and capability of organising speciality department.
- (11) Competence in intensive care with practical knowledge of working with resuscitative and monitoring equipments.

3. **BRANCH OF STUDY :**

Candidates shall be examined in one of the following branches :

M.D.

Branch III : Pathology

Branch IV : Microbiology

Branch V : Physiology

Branch VI : Pharmacology

Branch XIII : Bio-Chemistry

M.S.

Branch V : Anatomy

4. **ELIGIBILITY :**

Candidates for admission to the first year of the M.D. / M.S. Post-Graduate Degree (Non-Clinical) Courses shall be required to possess the following qualifications:

- (a) He / she having qualified for the M.B.B.S. Degree of this University or any other Universities recognised as equivalent thereto by this University and the Indian Medical Council and obtained permanent registration from any of the State Medical Councils.
- (b) The admitting authorities of the Institutions will strictly ensure that every candidate admitted to the M.D. / M.S. Post-Graduate (Non-Clinical) courses has obtained permanent registration certificate from any one of the State Medical Councils.

5. ELIGIBILITY CERTIFICATE :

Candidates who have passed any qualifying examination as stated in Regulation No.4 above other than the Tamil Nadu Dr. M.G.R. Medical University, Madurai Kamaraj University, University of Madras, Bharathiar University and Bharathidasan University ** shall obtain an “Eligibility Certificate” from this University by remitting the prescribed fees along with the application form and required documents before seeking admission to any one of the affiliated medical institutions. The application form is available in the University website : www.tnmmu.ac.in.

6. COMMENCEMENT OF THE COURSE : *

The academic year for M.D. / M.S. Post-Graduate (Non-Clinical) course shall commence from 2nd May of the academic year.

7. CUT-OFF DATES FOR ADMISSION :

The candidates admitted up to 31st May of the academic year shall be registered for that academic year and shall take up their Final Third year regular examination in March of the due year. There will not be any admission after 31st May for the academic year even if seats are unfilled.

8. DURATION OF THE COURSE :

- a) The duration of certified study and training for the M.D. / M.S. Post-Graduate (Non-Clinical) course shall be three completed years (including the period of examination).
- b) No exemption shall be given from this period of study and training.

Provided that in the case of students having a recognised two years postgraduate diploma course in the same subject, the period of training including the period of examination, shall be two years.

* XXVI S.A.B dated 16-12-2003

** 33rd S.A.B. dated 20-6-2007

9. DURATION OF COMPLETION OF THE COURSE :

The duration for completion of the course is double the duration of the course i.e. 6 years to pass the examination, from the date of joining the course, otherwise he/she has to get fresh admission.*

10. REGISTRATION OF CANDIDATES :-

A candidate admitted into M.D. / M.S. Post-Graduate Degree (Non-Clinical) Courses in any of the affiliated Institution of this University shall register his/her name in this University by submitting the prescribed application form for Registration duly filled in all respects along with the prescribed fee and a declaration in the format (as in Annexure I of the Regulation) to the Academic Officer ** of this University through the affiliated Institutions within 60 days from the cut-off date prescribed for admission to the course.

11. RECOGNITION FEE :

Candidates who have passed the M.B.B.S. Degree / Post-graduate Diploma from any other University shall remit a recognition fee as prescribed along with the stipulated registration fees.

12. MIGRATION / TRANSFER OF CANDIDATES :

- a) Migration / Transfer of candidates from one recognised Medical College to another recognised Medical College of this University or from another University shall not be granted unless a No Objection Certificate is obtained from the Medical Council of India.
- b) The provision of combination of attendance shall be granted to a transferee for admission to the examinations of this University on satisfactory fulfillment to the regulations of this University.

13. RE-ADMISSION AFTER BREAK OF STUDY :

A separate Regulation book for readmission after break of study is available for all the U.G./P.G. courses of this University.

* XXV S.A.B. dated 25-06-2003.

- Enrolment of candidates – Deleted w.e.f. the academic year 2006-07 (31st S.A.B. dt.29-06-2006)

** 31st S.A.B. dated 29-06-2006.

14. POSTING AND TRAINING IN OUTSIDE CENTRES :

The Head of the Post-graduate Departments should make necessary arrangements for their post-graduate candidates to undergo training in various skills in other centres within and outside the State if advanced facilities are not available in their own institution or hospitals.

15. MAINTENANCE OF LOG BOOK :

- (a) Every Post-graduate candidate shall maintain a record of skills he/she has acquired during the training period certified by the various Heads of Departments where he / she has undergone training including outside the institution.
- (b) The candidate should also be required to participate in the teaching and training programme of post-graduate and intern-students.
- (c) In addition, the Head of the Department shall involve their post-graduate candidates in Seminars, Journal Clubs, Group Discussions and participation in clinical, clinico-pathological conferences.
- (d) Every Post-graduate candidate should be encouraged to present short title papers in conferences and improve on it and submit them for publication in reputed medical journals. Motivation by the Heads of Departments is essential in this area to sharpen the research skills of the post-graduate candidates.
- (e) The Head of the Department shall scrutinize the Log Book every three months.
- (f) At the end of the course, the candidate should summarise the contents and get the Log Book certified by the Head of the Department.
- (g) The Log Book should be submitted at the time of practical examination for the scrutiny of the Board of Examiners.

16. ATTENDANCE REQUIREMENTS FOR ADMISSION TO EXAMINATION :

No candidate shall be permitted to appear for the examination unless he/she has put in a minimum of 80% * attendance during his/her period of study and training in the affiliated institution recognised by this University and produces the necessary certificate of study, attendance and progress from the Head of the institution.

* XXX S.A.B. held on 28-12-2005.

17. CONDONATION OF LACK OF ATTENDANCE :

There shall be no condonation of lack of attendance for the course.

18. COMMENCEMENT OF EXAMINATIONS :

The Examination for M.D. / M.S. Post-Graduate (Non-Clinical) Course shall be held at the end of three academic years (six academic terms). The Academic term shall mean six months training period.

There shall be two University examinations in an academic year.

15th March/15th September **

If the date of commencement of the examination falls on Saturdays, Sundays or declared Public Holidays, the examination shall begin on the next working day.

19. DISSERTATION:

- (a) All candidates admitted to undergo Post-Graduate Degree (Non-Clinical) courses shall be assigned a topic for dissertation / Thesis by the head of the concerned Unit and the title of the topics assigned to the candidates be intimated to the Controller of Examinations of this University by the Head of the Department through the Head of the Institution before the end of 1st year of the course.
- (b) The dissertation / thesis shall be a bound volume of a minimum of 50 pages and not exceeding 75 pages of typed matter (Double line spacing and on one side only) excluding certification, acknowledgements, annexures and Bibliography.
- (c) 4 copies of dissertation shall be submitted six (6) months prior to the commencement of the theory examinations on the prescribed date to the Controller of Examinations of this University.
- (d) Two copies are to be submitted as an electronic version of the entire dissertation in a standard C.D. format by mentioning the details and technicalities used in the C.D. format.

** XXIX S.A.B. held on 05-08-2005.

- (e) The concerned Professors/Readers are to supervise and to see that the dissertations are done properly by utilizing the clinical materials of their own department/institution. The students must learn the design and interpretation of research studies, responsible use of informed consent and research methodology and interpretation of data and statistical analysis. They should seek the help of qualified staff members in the conduct of research. If necessary, they can utilise the facilities in other Institutions. They must learn to use the library and computer based search. This training will help them to develop skills in planning, designing and conduct of research studies.

20. EVALUATION OF DISSERTATION :**

- a) The dissertation should be approved by the Professor of that branch and the same has to be forwarded to the Controller of Examinations by the Head of the Department through the Dean / Principal of that college six months prior to practical examination and examined by a set of two examiners.
- b) No marks will be allotted for dissertation in M.D. / M.S. Post-Graduate (Non-Clinical) degree course and the Board of Examiners should mark the dissertation either “Approved” or “Not Approved”.
- c) No grading should be given as ‘Good’, ‘Very Good’ or ‘Excellent’ for the approved dissertation.
- d) Two copies of the evaluation report of the dissertation should be submitted by the Examiners to the Controller of Examinations of this University.
- e) If the dissertation is “Not Approved” or “Rejected” by the majority of the examiners, the results shall be withheld till the resubmitted dissertation is approved.
- f) If the candidate fails in the written / practical examination but his dissertation is “Approved”, the approval of the dissertation shall be carried over to the subsequent examinations.

21. REVALUATION OF ANSWER PAPERS :

There shall be no re-valuation of answer papers. However, re-totaling is allowed in the failed subjects.

** XXVIII S.A.B. held on 22-12-2004.

ANNEXURE – I

REGULATION (10)

DECLARATION

I.....
 Son of / Daughter of

 residing at
 and admitted to First year of (Name of the course/
 U.G./P.G.) at
 (Name of the College) do hereby solemnly affirm and sincerely state as follows :

I declare that I shall abide by the rules and regulations prescribed by the
 Tamil Nadu Dr. M. G. R. Medical University, Chennai for the

 (course) including the regulations for re-admission after the break of study.

Date:

Signature of the candidate.

/ Countersigned /

Dean / Principal / Director.

(Office date seal)

BRANCH –III M.D. (PATHOLOGY)

**GUIDELINES FOR COMPETENCY BASED POST GRADUATE TRAINING PROGRAMME
FOR M.D. PATHOLOGY**

Preamble

The purpose of this programme is to standardize Pathology teaching at Post Graduate level through out the country so that it will benefit in achieving uniformity in undergraduate teaching as well and resultantly creating suitable manpower with appropriate expertise.

Programme Objectives

A candidate upon successfully qualifying in the M.D. (Pathology) examinations should be -

- 1) Capable of offering a high quality diagnostic opinion in a given clinical situation with an appropriate and relevant sample of tissue, blood, body fluid, etc., for the purpose of diagnosis and overall wellbeing of the ill.
- 2) Able to teach and share his knowledge and competence with others. He / She should be imparted training in teaching methods in the subject which may enable them to take up teaching assignments in Medical Colleges / Institutes.
- 3) Capable of pursuing clinical and laboratory based research. He / She should be introduced to basic research methodology so that they can conduct fundamental and applied research.

Specific Learning Objectives :-

Cognitive Domain –

- 1) Diagnose routine and complex clinical problems on the basis of Histopathology (Surgical Pathology) and Cytopathology specimens, Blood and Bone Marrow examination and various tests of Laboratory Medicine (Clinical Pathology, Clinical Biochemistry) as well as Blood Banking (Transfusion Medicine).
- 2) Interpret and correlate clinical and laboratory data so that clinical manifestations of disease can be explained.
- 3) Advice on the appropriate specimens and tests necessary to arrive at a diagnosis in a problematic case.
- 4) Correlate clinical and laboratory findings with Pathology findings at autopsy, identify discrepancies and the causes of death due to diseases (apart from purely metabolic causes).
- 5) Should be able to teach Pathology to undergraduates, postgraduates, nurses and paramedical staff including laboratory personnel.

- 6) Plan, execute, analyse and present research work.
- 7) Make and record observations systematically and maintain accurate records of tests and their results for reasonable periods of time. Identify problems in the laboratory, offer solutions thereof & maintain a high order of quality control.
- 8) Capable of safe & effective disposal of laboratory waste.
- 9) Able to supervise and work with subordinates and colleagues in a laboratory.

Psychomotor Domain –

- 1) Able to perform most of the routine tests in a Pathology Laboratory including grossing of specimens, processing, cutting of paraffin and frozen sections, making smears, and staining.
- 2) Able to collect specimens by routinely performed non-invasive out-patient procedures such as vene-puncture, finger-prick, fine needle aspiration of superficial lumps and bone-marrow aspirates, and provide appropriate help to colleagues performing an invasive procedure such as a biopsy or an imaging guided biopsy.
- 3) Perform an autopsy, dissect various organ complexes and display the gross findings.
- 4) Should be familiar with the function, handling and routine care of equipment in the laboratory.

Affective Domain –

- 1) Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
- 2) Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel & to respect the rights of the patient including the right to information and second opinion.
- 3) Develop communication skills to word reports and professional opinions as well as to interact with patients, relatives, peers and paramedical staff, & for effective teaching.

Post Graduate Training :-

Based on the available facilities, department can prepare a list of postgraduate experiments pertaining to basic and applied Pathology. Active learning should form the mainstay of postgraduate training there should be lectures for postgraduates (at least 20 per year) along with seminars, symposia, group-discussions, Journal clubs. The postgraduate students should regularly the ward rounds of various clinical departments and learn cases of interest for discussion with the Pharmacology faculty. Each college should have a medical education unit to generate teaching resource material for U.G. and evolving of problem solving modules.

The three-year training programme for the M.D. degree may be arranged in the form of postings to different assignments / laboratories for specified periods as outlined below. The period of such assignments / postings is recommended for 35 months. Posting schedules may be modified depending on needs, feasibility and exigencies. For facilities not available in the parent institution as well as for additional knowledge & skill, extramural postings may be undertaken.

<u>Section / Subject</u>	<u>Duration in Months</u>
(i) Surgical Pathology and Autopsy	14
(ii) Surgical Pathology Techniques	1
(iii) Haematology	8
(iv) Cytopathology	6
(v) Laboratory Medicine	2
(vi) Transfusion Medicine / Blood Bank	1
(vii) Basic Sciences including Immunopathology, Electronmicroscopy, Molecular Biology, Research Techniques and Cytogenesis, etc.	1
(viii) Elective / Reorientation	2
Total	= <u>35 months.</u>

The training programme should be designed to enable the student to acquire a capacity to learn and investigate for himself/herself, to synthesize and integrate a set of facts and develop a faculty to reason. The curricular programmes and scheduling of postings must provide the student with opportunities to achieve the above broad objectives. Much of the learning is to be accomplished by the student himself. Interactive discussions are to be preferred over didactic sessions. The student must blend as an integral part of the activities of an academic department that usually revolves around three equally important basic functions of teaching, research and service. As mentioned earlier the emphasis is recommended under a residency programme or learning while serving / working. The following is a rough guidelines to various teaching / learning activities that may be employed :-

- Collection of specimens including Fine needle aspiration of superficial lumps.
- Grossing of specimens.
- Performing autopsies.
- Discussions during routine activities such as during signing out of cases.
- Presentation and work-up of cases including the identification of special stains and ancillary procedures needed.
- Clinico-pathological conferences.
- Intradepartmental and interdepartmental conferences related to case discussions.

- Conferences, Seminars, Continuing Medical Education (CME) Programmes.
- Journal Club.
- Research Presentation and review of research work.
- Guest and in-house lectures.
- Participation in workshops, conferences and presentation of papers, etc.
- Laboratory-work.
- Use and maintenance of equipment.
- Maintenance of records.
- Teaching undergraduates and paramedical staff.

Post Graduate Examination :-

The Post Graduate Examination shall be in three parts :-

- 1) **Thesis, to be submitted by each candidate at least 6 months before the date of commencement of the theory examination.**
- 2) **Theory: There shall be four theory papers— as given separately**
- 3) **Practicals and Viva/Oral**

The practical examination shall consist of the following and should be spread over two days.

- (i) **Clinical Pathology :** Discussion of a clinical case history.
Plan relevant investigations of the above case (Two investigations should be performed including at least one Biochemistry exercise).
Complete urinalysis.
- (ii) **Haematology :** Discuss haematology cases given the relevant history.
Plan relevant investigations.
Perform complete hemogram and atleast two tests preferably including coagulation exercise.
Identify electrophoresis strips, osmotic fragility charts, etc.
Examine, report and discuss around ten cases given the history and relevant blood smears and / or bone marrow aspirate smears.
- (iii) **Transfusion Medicine :** Perform blood grouping.
Perform the necessary exercise given a relevant history.
- (iv) **Histopathology & Cytopathology :** Examine, report and discuss ten to twelve histopathology and three to five cytopathology cases given in the relevant history and slides.
Perform a Haematoxylin and Eosin stain and any special stain on a paraffin section.
Report on a frozen section.
- (v) **Autopsy :** Given a case history and relevant organs (with or without slides) give a list of anatomical diagnosis in a autopsy case.

- (vi) **Gross Pathology :** Describe findings of gross specimens, give diagnosis and identify the sections to be processed.
- (vii) **Basic Sciences :** Identify electronmicrographs.
Identify gels, results of PCR, immunological tests including staining for direct / indirect immuno fluorescence.
Identify histochemical and immunohistochemistry stains.

All practical exercises are to be evaluated jointly by all the examiners. An oral question-answer session should be conducted at the end of each exercise.

- (a) Viva on dissertation and research methodology.
(b) General Viva-Voce.

Course Content :-

The study of Pathologic Anatomy includes all aspects of Pathology as encompassed in the branches of General and Systemic Pathology. Only the broad outlines are provided.

- 1)
 - A) **General Pathology :**
Normal cell and tissue structure and function. The changes in cellular structure and function in disease. Causes of disease and its pathogenesis. Reaction of cells, tissues, organ systems and the body as a whole to various sublethal and lethal injuries.
 - B) **Systemic Pathology :**
The study of normal structure and function of various organ systems and the aetiopathogenesis, gross and microscopic alterations of structure of these organ systems in disease & functional correlation with clinical features.
- 2) **Haematology :**
The study of Haematology includes all aspects of the diseases of the blood and bone marrow. This would involve the study of the normal, and the causes of diseases and the changes thereof.
- 3) Laboratory Medicine (Clinical Biochemistry / Clinical Pathology including Parasitology).
- 4) Transfusion Medicine (Blood-Banking).
- 5) In the following fields, the student is expected to acquire a general acquaintance of techniques and principles and to interpret data :
 - a) Immunopathology.
 - b) Electron microscopy.
 - c) Histochemistry.
 - d) Immunohistochemistry.

- e) Cytogenetics.
- f) Molecular Biology.
- g) Maintenance of records.
- h) Information retrieval, Computer, Internet in Medicine.

It is difficult to give a precise outline of the Course Content for postgraduate training. A postgraduate is supposed to acquire not only professional competence of a well-trained specialist but also academic maturity, a capacity to reason and critically scientific data as well as to keep himself/herself abreast of the latest developments in the field of the pathology and related sciences. A brief outline of what is expected to be learnt during the M.D. Course is given under each head.

Surgical Pathology :-

Knowledge –

- The student should be able to demonstrate an understanding of the histogenetic and patho-physiologic processes associated with various lesions.
- Should be able to identify problems in the laboratory and offer viable solutions.

Skills -

- Given the clinical and operative data, the student should be able to identify, and systematically and accurately describe the chief gross anatomic alterations in the surgically removed specimens and be able to correctly diagnose at least 80 percent of the lesions received on an average day from the surgical service of an average teaching hospital.
- A student should be able to demonstrate ability to perform a systematic gross examination of the tissues including the taking of appropriate tissue sections and in special cases as in intestinal mucosal biopsies, muscle biopsies and nerve biopsies, demonstrate the orientation of tissues in paraffin blocks.
- The student should be able to identify and systematically and accurately describe the chief histomorphological alterations in the tissue received in the surgical pathology service. He / She should also correctly interpret & correlate with the clinical data to diagnose at least 90% of the routine surgical material received on an average day. He / She should be able to diagnose at least 75% of the classical lesions being commonly encountered in the surgical pathology service without the aid of the clinical data.
- Be conversant the automatic tissue processing machine and the principles of its running.
- Process a tissue, make a paraffin block and cut sections of good quality on a rotary microtome.
- Stain paraffin sections with at least the following :
 - (i) Haematoxylin and eosin.
 - (ii) Stains for collagen, elastic fibers and reticulin.
 - (iii) Iron stain.
 - (iv) PAS stain.
 - (v) Acid fast stains.
 - (vi) Any other stains needed for diagnosis.

- Demonstrate understanding of the principles of :
 - (i) Fixation of tissues.
 - (ii) Processing of tissues for section cutting.
 - (iii) Section cutting and maintenance of related equipment.
 - (iv) Differential (Special) stains and their utility.
- Cut a frozen section using freezing microtome / cryostat, stain and interpret the slide in correlation with the clinical data provided, and correctly diagnose at least 75 percent of the lesions within 15 minutes. Perform fat stain on frozen section.
- Demonstrate the understanding of the utility of various immunohistochemical stains especially in the diagnosis of tumour subtypes.

Autopsy Pathology :-

Knowledge –

- Should be aware of the technique of autopsy.
- Should have sufficient understanding of various disease processes so that a meaningful clinico-pathological correlation can be made.
- Demonstrate ability to perform a complete autopsy independently with some physical assistance, correctly following the prescribed instructions. Correctly identify all major lesions which have caused, or contributed to, the patient's death on macroscopic examination alone on microscopy in at least 90% of the autopsies in an average teaching hospital.
- In places where non-medicolegal autopsies are not available each student / candidate should be made to dissect organs from atleast five medicolegal autopsies.
- Write correctly and systematically Provisional and Final Anatomic Diagnosis reports.

Cytopathology :-

Knowledge –

- Should possess the background necessary for the evaluation and reporting of Cytopathology specimens.
- Demonstrate familiarity with, the following, keeping in mind the indication for the test :
 - (i) Choice of site from which smears may be taken (as in the case of vaginal smears).
 - (ii) Type of samples.
 - (iii) Method of obtaining various specimens (urine sample, gastric smear, colonic lavage, etc.)
 - (iv) Be conversant with the principles and preparation of solution of stains.

Skills –

- Independently prepare and stain good quality smears for cytopathologic examination.
- Be conversant with the techniques for concentration of specimens : i.e., various filters, centrifuge and cytocentrifuge.

- Independently be able to perform fine needle aspiration of palpable superficial lumps in patients; make good quality smears, and be able to decide on the type of staining in a given case.
- Given the relevant clinical data, he / she should be able to independently and correctly :
 - (i) Evaluate hormonal status in all cases as may be required.
 - (ii) Diagnose the status of malignancy or otherwise in at least 75% of the cases received in a routine laboratory and categorise them into negative, inconclusive and positive.
 - (iii) Demonstrate ability in the technique of screening and dotting the slides for suspicious cells.
 - (iv) Indicate correctly the type of tumour, if present, in at least 75% cases.
 - (v) Identify with reasonable accuracy the presence of organisms, fungi and parasites in at least 75% of cases.

Haematology :-

Knowledge –

- Should demonstrate the capability of utilizing the principles of the practice of Haematology for the planning of tests, interpretation and diagnosis of diseases of the blood and bone marrow.
- Should be conversant with various equipments used in the Haematology laboratory.
- Should have knowledge of automation and quality assurance in Haematology.
- Correctly plan a strategy of investigating at least 90% of the cases referred for special investigations in the Haematology Clinic and give ample justification for each step in consideration of the relevant clinical data provided.

Skills –

- Correctly and independently perform the following special tests, in addition to doing the routine blood counts :
 - (i) Haemogram including Reticulocyte and Platelet counts.
 - (ii) Bone marrow staining including stain for iron.
 - (iii) Blood smear staining.
 - (iv) Cytochemical characterization of leukemia with special stains like Peroxidase, Leukocyte Alkaline Phosphatase (LAP), PAS, Sudan Black, etc.
 - (v) Hemolytic anaemia profile including HbF, Hb electrophoresis, etc.
 - (vi) Coagulation profile including PT, APTT.FDP.
 - (vii) BM aspiration and BM biopsy.
- Demonstrate familiarity with the principle and interpretation of results and utility in diagnosis of the following :
 - (i) Platelet function tests including platelet aggregation and adhesion and PF3 release.

- (ii) Thrombophilia profile : Lupus anticoagulant (LAC), Anticardiolipin Antibody (ACA), Activated Protein C Resistance (APCR), Protein C (Pr C), Protein S (Pr S) and Antithrombin III (AT III).
 - (iii) Immunopheno typing of leukaemias.
 - (iv) Cytogenetics.
- Describe accurately the morphologic findings in the peripheral and bone marrow smears, identifying and quantitating the morphologic abnormalities in disease states and arriving at a correct diagnosis in at least 90% of the cases referred to the Haematology clinic, given the relevant clinical data.

Laboratory Medicine :-

Knowledge –

- Possess knowledge of the normal range of values of the chemical content of body fluids, significance of the altered values and its interpretation.
- Possess knowledge of the principles of following specialized organ function tests and the relative utility and limitations of each and significance of the altered values :
 - (i) Renal function test.
 - (ii) Liver function test.
 - (iii) Gastric and Pancreatic function.
 - (iv) Endocrine function test.
 - (v) Tests for malabsorption.
- Know the principles, advantages and disadvantages scope and limitation of Automation in laboratory.
- Know the principles and methodology of quality control in laboratory.

Skills –

- Plan a strategy of laboratory investigation of a given case, given the relevant clinical history and physical findings in a logical sequence, with a rational explanation of each step; Be able to correctly interpret the laboratory data of such studies, and discuss their significance with a view to arrive at a diagnosis.
- Demonstrate familiarity with and successfully perform.
 - (i) routine Urinalysis including Physical, Chemical and Microscopic, examination of the sediment.
 - (ii) macroscopic and microscopic examination of Faeces and identify the ova and cysts of common parasites.
 - (iii) A complete examination; physical, chemical and cell content of Cerebrospinal Fluid (C.S.F.), Pleural and Peritoneal fluid.
 - (iv) Semen analysis.
 - (v) Examination of Peripheral Blood for the commonly occurring parasites.
- Independently and correctly perform at least the following Quantitative Estimations by Manual Techniques and / or Automated Techniques :
 - (i) Blood urea.
 - (ii) Blood sugar.
 - (iii) Serum Proteins total & fractional.
 - (iv) Serum Bilirubin total & fractional.

(v) Serum amylase.

- Demonstrate familiarity with the following Quantitative Estimations of blood / serum by Automated Techniques, serum cholesterol, Uric acid, Serum Transaminases (ALT and AST / SGOT and SGPT), etc.
- Prepare standard solutions and reagents relevant to the above tests, including the preparation of normal solution, molar solution and Buffers.
- Explain the principle of Instrumentation, use and application of the instruments commonly used in the laboratories, eg., Photoelectric colorimeter, Spectrophotometer, pH meter, Centrifuge, Electrophoresis apparatus, ELISA Reader, Flow cytometer.

Transfusion Medicine (Blood Banking) :-

Knowledge –

Students should possess knowledge of the following aspects of Transfusion Medicine :

- Basic immunology.
- ABO and Rh groups.
- Clinical significance of other blood groups.
- Transfusion therapy including the use of whole blood and RBC concentrates.
- Blood component therapy.
- Rationale of pre-transfusion testing.
- Infections transmitted in blood.
- Adverse reactions to transfusion of blood and components.
- Quality control in blood bank.

Skills –

Students should be able to correctly and independently perform the following :

- Selection and bleeding of donors.
- Preparation of blood components i.e., Cryoprecipitates, Platelet concentrate, Fresh Frozen Plasma, Single Donor Plasma, Red Blood Cell concentrates.
- ABO and Rh grouping.
- Demonstrate familiarity with Antenatal and Neonatal work :
 - (i) Direct antiglobulin test.
 - (ii) Antibody screening and titre.
 - (iii) Selection of blood for exchange transfusion.
- Demonstrate familiarity with principle and procedures involved in :
 - (i) Resolving ABO grouping problems.
 - (ii) Identification of RBC antibody.
 - (iii) Investigation of transfusion reaction.
 - (iv) Testing of blood for presence of :
 - (a) HBV (Hepatitis B Virus Markers).
 - (b) HCV (Hepatitis C Virus Markers).
 - (c) HIV (Human Immunodeficiency Virus Testing).
 - (d) VDRL.

Basic Sciences (in relation to Pathology) :-**a) Immunopathology :****Knowledge –**

- (i) Demonstrate familiarity with the current concepts of structure and function of the immune system, its aberrations and mechanisms thereof.
- (ii) Demonstrate familiarity with the scope, principles, limitations and interpretations of the results of the following procedures employed in clinical and experimental studies relating to immunology :
 - (a) ELISA techniques.
 - (b) Radioimmuno assay.
 - (c) HLA typing.
- (iii) Interpret simple immunological tests used in diagnosis of diseases and in research procedures.
 - (a) Immnoelectrophoresis.
 - (b) Immunofluorescence techniques especially on kidney and skin biopsies.
 - (c) Anti-nuclear Factor (ANF).
 - (d) Anti-neutrophil cytoplasmic antibody (ANCA).

b) Electron Microscopy :**Knowledge -**

- (i) Demonstrate familiarity with Principles and Techniques of electron microscopy and the working of an electron microscope (including Transmission and Scanning Electron Microscope : TEM and SEM).
- (ii) Recognise the appearance of the normal subcellular organelles and their common abnormalities (when provided with appropriate photographs).

c) Enzyme Histochemistry :**Knowledge -**

Should be familiar with the principles, use and interpretation of common enzyme histochemical procedures (Alkaline Phosphatase, Acid Phosphatase, Glucose-6-Phosphate Dehydrogenase, Chloroacetate Esterse).

d) Immunohistochemistry :**Knowledge –**

Demonstrate familiarity with the principles and exact procedures of various immunohistochemical stains using both PAP (Peroxidase-Antiperoxidase) and AP-AAP (Alk. Phosphatase-anti Alk. Phosphatase) ABC (Avidin-Biotin Conjugate) Systems;

employing monoclonal and polyclonal antibodies. Be aware of the limitations of immunohistochemistry.

Skills (desirable) –

Be able to perform immunohistochemical staining using paraffin section with at least one of the commonly used antibodies (*Cytokeratin or LCA*) using PAP method.

e) Molecular Biology :

Knowledge –

Should understand the principles of Molecular Biology especially related to the understanding of disease processes and its use in various diagnostic tests.

Should be conversant with the principle & steps and interpretations of a Polymerase Chain Reaction (PCR Western Blot, Southern Blot, Northern Blot and Hybridisation procedures).

f) Cytogenetics :

Knowledge –

Demonstrate familiarity with methods of Karyotyping and Fluorescent *in-situ* Hybridisation (FISH).

g) Tissue Culture :

Knowledge –

Demonstrate familiarity with methods of tissue culture.

h) Principles of Medical Statistics :

Knowledge –

Demonstrate familiarity with importance of statistical methods in assessing data from patient material and experimental studies.

POST GRADUATE COURSE CONTENT**BRANCH-III M.D.(PATHOLOGY)****I Year**

<u>Subject</u>		<u>Duration</u>
I Clinical Pathology & Laboratory Medicine	-	3 months.
II Blood Bank & Transfusion Medicine	-	1 month.
III Biopsy & Museum	-	3 months.
IV Special Techniques : Immunofluorescence, IHC & Frozen Section.	-	1 month.
V Cytology	-	2 months.
VI Autopsy	-	2 months.

	Total	= 12 months.

II Year

<u>Subject</u>		<u>Duration</u>
I Clinical Pathology	-	2 months.
II Biopsy	-	3 months.
III Cytology	-	2 months.
IV Surgical Pathology	-	3 months.

Specialities :

- (1) General Surgery.
- (2) General Medicine.
- (3) Gynaecology.
- (4) Paediatrics.
- (5) Oncology.
- (6) Dermatology.
- (7) Neuropathology.

V Special Techniques : Molecular Techniques; Genetics & EM.	-	1 month.
VI Autopsy	-	1 month.

Total	=	12 months.

III Year

<u>Subject</u>		<u>Duration</u>
I Clinical Pathology	-	1 month.
II Biopsy	-	6 months.
III Cytology	-	3 months.
IV Autopsy	-	2 months.

Total	=	12 months.

Following Centres may be utilized for exposure to the specialised areas :-

- | | | |
|--|-----|--|
| 1) Blood Banking | - | M.G.R. University / CMC. |
| 2) Cytogenetics | - | M.G.R. University / CMC. |
| 3) Immunology | - | M.G.R. University / Egmore
T.B. Research Institute. |
| 4) E.M. | - | CMC. |
| 5) Haemato oncology | - | CMC. |
| 6) Molecular Techniques | - | Cancer Institute. |
| 7) Statistics; Epidemiology;
Human Resources; Telepathology,
Research Methodology. | } - | M.G.R. Medical University. |
-

At the end of 3rd Year :**PATTERN OF EXAMINATION :- ***

FOUR PAPERS - 100 Marks each

3 Hours duration each

<u>Theory</u>	<u>Title</u>	<u>Duration</u>	<u>Marks</u>
Paper – I	General Medical and Surgical Pathology including applied aspects in Pathology.	3 hrs.	100
Paper – II	General Pathology	3 hrs.	100
Paper – III	Systemic Pathology	3 hrs.	100
Paper – IV	Immunopathology, Haematology, Principles and Application to Technological Advances in Laboratory Services.	3 hrs.	100
Total			400

Distribution of Marks : **

2 Essays	2 x 20 =	40 Marks
10 Short Notes	10 x 6 =	60 Marks
Total		100 Marks

PRACTICAL EXAMINATION :-**Total Marks :200**

2 Days Practical Examination -

* 30th SAB held on 28-12-2005 - March 2006 Examination onwards.** 32nd SAB held on 21-12-2006 - March 2008 Examination onwards.

DAY-I

<u>S.No.</u>	<u>Subjects</u>	<u>Time</u>	<u>Marks</u>
1)	Autopsy	2 hrs.	15
2)	Gross : Spotters & Discussion	1 hr.	20
3)	Histotechnology H & E Spl. Stains PAP	2 hrs.	20
4)	Haematology & Cytology (5 + 5 = 10 Nos. X 4)	2 hrs.	40

DAY - II

1)	Histopathology Slides (15 Nos.) (15X4)	2 hrs.	60
2)	Clinical Pathology Patient / Paper Case Blood, Urine, Immunology.	1 ½ hrs.	25
3)	OSPE : Immunohistochemistry, Haematology, Molecular Cytogenetics, Special Techniques.	1 hr.	20
		Total	200
Viva + Pedagogy (50 + 50)		½ hr.	100

NOTE : No. of candidates to be examined 4 Per day for Practical/Viva

DISSERTATION :
(No Marks)

APPROVED / NOT APPROVED

<u>** MARKS QUALIFYING FOR A PASS</u>	<u>MAXIMUM MARKS</u>	<u>QUALIFYING FOR A PASS 50% MARKS</u>
Theory Examination	400	200
Practical Examination	200	100
Oral/Viva & Pedagogy (50 + 50)	100	No Minimum
Aggregate	700	350

** 33rd SAB held on 20-06-2007 – March 2008 Examination onwards.

RECOMMENDED LIST OF BOOKS

I. ESSENTIAL READING :-

- 1) Robbins Pathologic basic of disease – 7th edn Elsevier
- 2) Diagnostic Surgical Pathology – Sternberg.
- 3) Ackerman's Surgical Pathology – Juan Rosai – 9th edn Mosby
- 4) Diagnostic Histopathology of Tumours – Fletcher – 2nd edn Churchill Livingston.
- 5) Soft Tissue Tumours – Enzinger & Weiss
- 6) Manual and Atlas of fine needle aspiration cytology – Orell 2nd edn 2005 elsevier.
- 7) Diagnostic exfoliative Cytology – Koss 5th edn 2006 Lippincott.
- 8) AFIP fascicles on various tumours.
- 9) WHO fascicles.
- 10) Wintrobe's Haematology, 2004
- 11) Practical Haematology, Dacie ELBS edn.
- 12) Theory & Practice of Histological techniques - & staining – Bancroft & Stevens.
- 13) Recent Advances in Pathology Churchill Livingston
- 14) Handbook of autopsy practice Ludwig Humana press

II. EXTENDED READING :-

- 1) Pathology of Liver – Macsween
- 2) Breast pathology by Rosen Lippincott 2001
- 3) Gastrointestinal pathology – Morson & Dawson Blackwell 2003.
- 4) Practical pulmonary pathology Leslie & Wick Churchill Livingston 2005
- 5) Iochim's Lymph node pathology Iochim & Ratech Lippincott William Wilkins
- 6) Blaustein's Pathology of female genital tract Springer 2002
- 7) Atlas of orthopedic pathology – Wold, Adleer, Sim, Unni 2003
- 8) Histopathology of Skin – Lever.
- 9) Pathology of Skin – Mckee, Calonje Elsevier Mosby 2005
- 10) Bone Marrow pathology – Bain Claud Lampert Wilkins 2001
- 11) Ophthalmic pathology – Spencer WB Saunders latest edn.
- 12) Biopsy interpretation series
- 13) Paediatric Pathology – Stocker & Dehner William & Wilkins 2001
- 14) Surgical pathology of nervous system and its coverings – Burger, Scheithaur, Vogel Churchill Livingston 2002.

BRANCH-IV M.D. (MICROBIOLOGY)

**GUIDELINES FOR COMPETENCY BASED POST GRADUATE TRAINING PROGRAMME
FOR M.D. MICROBIOLOGY**

Preamble :-

The purpose of this programme is to standardize Microbiology teaching at Post Graduate level throughout the country so that it will benefit in achieving uniformity in undergraduate teaching as well.

Programme Objectives :-

A candidate upon successfully qualifying in the M.D. (Microbiology) examinations, should be able to :

- a) Be a competent Microbiologist.
- b) Conduct such clinical / experimental research as would have significant bearing on human health and patient care.
- c) Interact with the allied departments by rendering services in advanced laboratory investigations.
- d) Acquire skills in conducting collaborative research in the field of Microbiology & allied sciences.
- e) Must be able to demonstrate to the students how the knowledge of Microbiology can be used in a variety of clinical settings to solve diagnostic and therapeutic problems.

Specific Learning Objectives :-

- a) Establish good clinical microbiological services in a hospital and in the community in the fields of bacteriology, virology, parasitology, immunology and mycology.
- b) Plan, execute and evaluate teaching assignments in Medical Microbiology.
- c) Plan, execute, analyse and present the research work in Medical Microbiology.
- d) Conduct such clinical and experimental research, as would have a significant bearing on human health and patient care.
- e) Encourage interaction with the allied departments by rendering services in advanced laboratory investigations and relevant expert opinion.
- f) Encourage the student to participate in various workshops / seminars / journal clubs / demonstration in the allied departments, to acquire various skills for collaborative research.
- g) Uphold the prestige of the discipline amongst the fraternity of doctors.
- h) Undergo specialization in any of the above subspecialties.

Post-Graduate Training :-

Based on the available facilities, department can prepare a list of post-graduate experiments pertaining to basic and applied microbiology. Active learning should form the mainstay of post-graduate training. There should be lectures for post-graduates along with seminars, symposia, group-discussions, Journal clubs. They should render special investigative services in their respective area of specialization. Each college should have a Medical Education Unit to generate teaching resource material for U.G. and evolving of problem solving modules.

Post-Graduate Examinations :-

The Post-graduate examinations should be in 3 parts :

- 1) **Thesis, to be submitted by each candidate at least 6 months before the date of commencement of the theory examination.**
- 2) **Theory : There shall be four theory papers – as given separately.**
- 3) **Practicals and Viva/Oral.**

Course Content :-**General Microbiology –**

- 1) History of Microbiology.
- 2) Microscopy.
- 3) Biosafety including universal containment.
- 4) Physical and biological containment.
- 5) Sterilization and disinfection.
- 6) Morphology of bacteria and other microorganisms.
- 7) Nomenclature and classification of microorganisms.
- 8) Normal flora of human body.
- 9) Growth & nutrition of bacteria.
- 10) Bacterial metabolism.
- 11) Bacterial toxins.
- 12) Bacteriocins.
- 13) Microbiology of hospital environment.
- 14) Microbiology of air, milk and water.
- 15) Host-parasite relationship.
- 16) Antibacterial substances and drug resistance.
- 17) Bacterial genetics & bacteriophages.
- 18) Molecular genetics relevant for medical microbiology.
- 19) Molecular techniques in diagnosis of microbial infections.
- 20) Quality assurance & quality control in microbiology.
- 21) Accreditation of laboratories.

Immunology :

- 1) Components of immune system.
- 2) Innate and acquired immunity.
- 3) Cells involved in immune response.
- 4) Antigens.
- 5) Immunoglobulins.
- 6) Mucosal immunity.
- 7) Complement.
- 8) Antigen & antibody reactions.
- 9) Hypersensitivity.

- 10) Cell mediated immunity.
- 11) Cytokines.
- 12) Immunodeficiency.
- 13) Auto-immunity.
- 14) Immune tolerance.
- 15) MHC complex.
- 16) Transplantation immunity.
- 17) Tumour immunity.
- 18) Vaccines and immunotherapy.
- 19) Measurement of immunological parameters.
- 20) Immunological techniques.
- 21) Immunopotential & immunomodulation.
- 22) Immuno Haematology.

Systematic Bacteriology :

- 1) Isolation & identification of bacteria.
- 2) Gram positive cocci of medical importance including Staphylococcus, Micrococcus, Streptococcus, Anaerobic cocci, etc.
- 3) Gram negative cocci of medical importance including Neisseria, Branhamella, Moraxella, etc.
- 4) Gram positive bacilli of medical importance including Lactobacillus, Coryneform organisms, Bacillus & Aerobic bacilli, Actinomyces, Nocardia, Actinobacillus and other Actinomycetales, Erysipelothrix, Listeria, Clostridium and other spore bearing Anaerobic bacilli, etc.
- 5) Gram negative bacilli of medical importance including Vibrios, Aeromonas, Plesiomonas, Haemophilus, Bordetella, Brucella, Gardnerella, Pseudomonas & other non-fermenters, Pasturella, Francisella, Bacteriodes, Fusobacterium, Leptotrichia and other anaerobic gram negative bacilli, etc.
- 6) Helicobacter, Campylobacter & Spirillum.
- 7) Enterobacteriaceae.
- 8) Mycobacteria.
- 9) Spirochaetes.
- 10) Chlamydiae.
- 11) Mycoplasmatales; Mycoplasma, Ureaplasma, Acholeplasma and other Mycoplasmas.
- 12) Rickettsiae, Coxiella, Bartonella, etc.
- 13) Miscellaneous bacteria.

Mycology :

- 1) General characteristics & classification of fungi.
- 2) Morphology & reproduction of fungi.
- 3) Isolation and identification of fungi.
- 4) Tissue reactions to fungi.
- 5) Yeasts and yeast like fungi of medical importance including Candida, Cryptococcus, Malassezia, Trichosporon, Geotrichum, Saccharomyces, etc.
- 6) Mycelial fungi of medical importance including Aspergillus, Zygomycetes, Pseudoallescheria, Fusarium, Piedra, other dematiaceous hyphomycetes and other hyalohyphomycetes, etc.
- 7) Dimorphic fungi including Histoplasma, Blastomyces, Coccidioides, Paracoccidioides, Sporothrix, Penicillium marneffeii, etc.
- 8) Dermatophytes.

- 9) Fungi causing mycetoma, keratomycosis & otomycosis.
- 10) *Phythium insidiosum*.
- 11) *Prototheca*.
- 12) *Pneucocystis carinii* infection; *Pneumocystis jeroviei*.
- 13) *Rhinosporidium seeberi* & *Loboa lobo*.
- 14) Common laboratory contaminant fungi.
- 15) Mycetism & mycotoxicosis.
- 16) Antifungal agents & invitro antifungal susceptibility tests.

Virology :-

- 1) General properties of viruses.
- 2) Classification of viruses.
- 3) Morphology : Viral structure, Bacteriophages.
- 4) Viral replication.
- 5) Isolation & identification of viruses.
- 6) Cultivation of viruses.
- 7) Epidemiology and Pathogenesis of viral infections.
- 8) Genetics of viruses.
- 9) DNA viruses of medical importance including Poxviridae, Herpesviridae, Adenoviridae, Hepadna virus, Papova and Parvo viruses, etc.
- 10) RNA viruses of medical importance including Enteroviruses, Togaviridae, Flaviviruses, Orthomyxoviruses, Paramyxoviruses, Reoviridae, Rhabdoviridae, Arenaviridae, Bunyaviridae, Retroviridae, Filoviruses, Human immunodeficiency virus, Arboviruses, Coronaviridae, Calci viruses, etc.
- 11) Slow viruses including prions.
- 12) Oncogenic & Teratogenic Viruses.
- 13) Hepatitis viruses.
- 14) Virioids.
- 15) Unclassified viruses.
- 16) Vaccines, anti-viral drugs & anti-viral agents.

Parasitology :

- 1) General characters & classification of parasites.
- 2) Laboratory diagnosis of parasitic infections.
- 3) Protozoan parasites of medical importance including *Entamoeba*, Free living amoebae, *Giardia*, *Trichomonas*, *Leishmania*, *Trypanosoma*, *Plasmodium*, *Toxoplasma*, *Sarcocystis*, *Cryptosporidium*, *Microsporidium*, *Cyclospora* *Isospora*, *Babesia*, *Balantidium*, etc.
- 4) Helminths of medical importance including those belonging to Cestodes(*Diphyllobothrium*, *Taenia*, *Echinococcus*, *Hymenolepis*, *Dipylidium*, *Multiceps*, etc.), Trematodes (*Schistosomoes*, *Fasciola*, *Fasciolopsis*, *Gastrodiscoides*, *Paragonimus*, *Clonorchis*, *Opisthorchis*, etc.) and Nematodes (*Trichiuris*, *Trichinella*, *Strongyloides*, *Ancylostoma*, *Necator*, *Ascaris*, *Toxocara*, *Enterobius*, Filarial worms, *Dracunculus*, etc.).
- 5) Cultivation of Parasites.
- 6) Entomology : common arthropods & other vectors viz., mosquito, sandfly, ticks, mite, cyclops, louse, myasis.
- 7) Antiparasitic agents.

Applied Microbiology :-

- 1) Epidemiology of infectious diseases.
- 2) Hospital acquired infections.
- 3) Management of hospital waste.
- 4) Investigation of an infectious outbreak.
- 5) Infections of various organs and systems of human body viz., respiratory tract infections, urinary tract infections, central nervous system infections, congenital infections, reproductive tract infections, gastrointestinal infections, hepatitis, pyrexia of unknown origin, infections of eye, ear & nose, septicaemia, endocarditis, haemorrhagic fever, etc.
- 6) Opportunistic infections.
- 7) Sexually transmitted diseases.
- 8) Vaccinology : principle, methods of preparation, administration of vaccines.
- 9) Information technology (Computers) in microbiology.
- 10) Automation in Microbiology.
- 11) Statistical analysis of microbiological data and research methodology.
- 12) Animal and human ethics involved in microbiological work.

Practical Training :-**General Bacteriology, Systematic Bacteriology and Applied Microbiology –**

- 1) Collection / transport of specimens for microbiological investigations.
- 2) Preparation, examination & interpretation of direct smears from clinical specimens.
- 3) Plating of clinical specimens on media for isolation, purification, identification and quantification purposes.
- 4) Preparation of stains viz., Gram, Albert's, capsules, spores, Ziehl Neelsen (ZN) Silver impregnation stain and special stains, etc.
- 5) Preparation and pouring of media like Nutrient agar, Blood agar, Mac-conkey agar, Sugars, Serum sugars, Kligler iron agar, Robertson's cooked meat broth, Lowenstein Jensens medium, Sabouraud's dextrose agar, etc.
- 6) Preparation of reagents – oxidase, Kovac etc.
- 7) Quality control of media, reagents, etc.
- 8) Operation of autoclave, hot air oven, distillation plant, filters like sietz and membrane filters.
- 9) Care and operation of microscopes.
- 10) Washing and sterilization of glassware (plugging and packing).
- 11) Care and maintenance of common laboratory equipments like water bath, centrifuge, refrigerators, incubators, etc.
- 12) Aseptic practices in laboratory and safety precautions.
- 13) Sterility tests.
- 14) Identification of bacteria of medical importance upto species level (except anaerobes which could be upto generic level).
- 15) Techniques of anaerobiosis.
- 16) Tests for Motility : hanging drop, Cragie's tube, dark ground microscopy for spirochaetes.
- 17) In-vitro toxigenicity tests – Elek test, Naegler's reaction.
- 18) Special tests – Bile solubility, chick cell agglutination, sheep cell haemolysis, niacin and catalase tests for Mycobacterium, Satellitism, CAMP test, catalase, slide & tube Coagulase test.
- 19) Preparation of antibiotic discs; performance of antimicrobial susceptibility testing eg., Kirby-Bauer, Stoke's method, Estimation of Minimal Inhibitory / Bactericidal concentrations by tube / plate dilution methods.

- 20) Test for Beta-lactamase production.
- 21) Inoculation of infective material by different routes in animals.
- 22) Bleeding techniques of animals including sheep.
- 23) Performance of autopsy on animals & disposal of animals.
- 24) Animal pathogenicity / toxigenicity tests for *C.diphtheriae*, *C.tetani*, *S.pneumoniae*, *S.typhimurium*, *K.pneumoniae*, etc.
- 25) Care and breeding of laboratory animals viz., mice, rats, guinea pigs, rabbits, etc.
- 26) Testing of disinfectants – Phenol coefficient and “in use” tests.
- 27) Quantitative analysis of urine by pour plate method and semi quantitative analysis by standard loop tests for finding significant bacteriuria.
- 28) Disposal of contaminated materials like cultures.
- 29) Disposal of infectious waste.
- 30) Bacteriological tests for water, air and milk.
- 31) Maintenance & preservation of bacterial cultures.
- 32) Intradermal test like mantoux.

Practical Training in Immunology :-

- 1) Collection of blood by venepuncture, separation of serum and preservation of serum for short and long periods.
- 2) Preparation of antigens and their standardization.
- 3) Preparation of antiserum in laboratory animals.
- 4) Performance of serological tests viz., widal, Brucella agglutination, Weil Felix, cold agglutination, VDRL, Paul Bunnell, Rose Waaler, IFA.
- 5) ELISA.
- 6) Latex and staphylococcal co-agglutination test separation of lymphocyte.
- 7) Separation of Lymphocyte and T cell rosette.
- 8) Immunoelectrophoresis.

Practical Training in Virology :

- 1) Preparation of glassware for tissue cultures (washing, sterilization).
- 2) Preparation of media like Hanks, MEM.
- 3) Preparation of clinical specimens for isolation of viruses.
- 4) Preparation of monkey kidney cells (Primary) and maintenance of continuous cell lines by subcultures. Preservation in -70°C and liquid nitrogen.
- 5) Recognition of CPE producing viruses.
- 6) Performance of haemadsorption for Parainfluenza Haemagglutination for influenzas, Immunofluorescence, neutralization for Enteroviruses and Respiratory viruses identification tests on tissue cultures and supernatants etc.
- 7) Serological tests – Elisa for HIV, HBsAg, Haemagglutination inhibition and Haemadsorption for influenza virus.
- 8) Chick embryo techniques – Inoculation and harvesting.
- 9) Handling of Mice, rat, guinea pigs for collection of blood / pathogenicity tests etc.,

Mycology – (Practical Training) :-

- 1) Collection of Specimen.
- 2) Direct Examination of Specimen.
- 3) Examination of Histopathology slides.
- 4) Isolation and identification of fungi & slide culture

- 5) Special techniques.
- 6) Maintenance of stock cultures.
- 7) Animal Pathogenicity

Parasitology – (Practical Training) :-

- 1) Collection of Specimen.
 - 2) Examination of faeces for parasitic ova and cyst by direct and concentration method.
 - 3) Egg counting techniques for helminths.
 - 4) Examination of blood smears for protozoa.
 - 5) Histopathology sections – Examination and identification of parasites.
 - 6) Leishman and Giemsa staining.
 - 7) Identification of common arthropods and vectors.
 - 8) Preservation of parasites – mounting fixing & staining.
-

Details of Training M.D. (MICROBIOLOGY)

- | | | |
|-----|--|-------------|
| 1) | Collection of Clinical samples in the Central Laboratory | : 1 month. |
| 2) | Sterilisation of Laboratory material | : 1 month. |
| 3) | Media preparation | : 1 month. |
| 4) | Bacteriological techniques | : 2 months. |
| 5) | Reporting culture | : 4 months. |
| 6) | Serology | : 2 months. |
| 7) | Preparation for Dissertation Protocol submission | : 2 months. |
| 8) | Special Microscopy and Staining | : 1 month. |
| 9) | Bacterial culture and antibiogram | : 4 months. |
| 10) | Mycobacteriology | : 1 month. |
| 11) | Anaerobic culture | : 15 days. |
| 12) | Mycology | : 1 month. |
| 13) | Parasitology | : 1 month. |
| 14) | Dissertation work | : 3 months. |
| 15) | Virology | : 2 months. |

16)	Immunology	: 2 months.
17)	Animal Experiment	: 15 days.
18)	Vaccine & Biological control	: 1 month.
19)	Molecular Biology & Biotechnology	: 15 days.
20)	Medical Statistics	: 1 week.
21)	Bacterial Genetics	: 1 week.
22)	Epidemiology	: 1 week.
23)	STD	: 1 week.
24)	Pathology	: 1 week.

- *The P.Gs. will participate in Seminars, Symposiums, Journal Clubs and Tutorials and Clinical Meetings.*
- *They should organise and conduct Practicals for U.Gs. and paramedical students.*
- *The services from the Institutions having the facilities for the technique can be sought for the above training.*

PATTERN OF EXAMINATIONS *

FOUR PAPERS - 100 Marks each 3 Hours Duration

<u>Theory</u>	<u>Title</u>	<u>Duration</u>	<u>Marks</u>
Paper – I	General Microbiology and Immunology	3 Hours	100
Paper – II	Systematic Bacteriology	3 Hours	100
Paper – III	Virology & Parasitology	3 Hours	100
Paper – IV	Mycology, Applied Microbiology and Recent Advances.	3 Hours	100
		Total	400

* 30th SAB held on 28-12-2005 - March 2006 Examination onwards.

Distribution of Marks : **

2 Essays	(2 x 20)	=	40 Marks
10 Short Notes	(10 x 6)	=	60 Marks
	Total		100 Marks

Practical (3 days) :

<u>Practical</u>	<u>Time</u>
Day 1 Practical 1 – Clinical Bacteriology	10.00 to 11.30 a.m.
2 – Bacteriological Techniques	11.30 to 1.00 p.m.
3 – Immuno Serology	2.00 to 3.30 p.m.
4 – Animal Experiments	3.30 to 5.00 p.m.
Day 2 Continuation of Clinical Bacteriology	11.00 to 11.30 a.m.
5 – Virology	11.30 to 1.00 p.m.
6 – Mycology	2.00 to 3.30 p.m.
7 – Parasitology	3.30 to 5.00 p.m.
Day 3 Clinical Bacteriology (Final Report)	10.00 to 11.30 a.m.
Histopathology	11.30 to 12.30 p.m.

Oral and Pedagogy

NOTE : No. of candidates to be examined 6. Per day for Practical/Viva

Post-graduate Examination :**Practicals –**

Should be spread over 3 days and include the following components.
(Total Marks – 200).

** 32nd SAB held on 21-12-2006 - March 2008 Examination onwards.

<u>Bacteriology –</u>	<u>Marks</u>	
1) Identification of a pure culture.	40	
2) Isolation and identification of bacteria from clinical samples.	50	
3) Bacteriological techniques :	10	
(a) Special Staining.		
(b) PH Adjustment.		
(c) Media Preparation.		
(d) Anaerobic Culture.		
(e) Antimicrobial Susceptibility Testing. M.I.C., M.B.C.		
<u>Immuno serology -</u>	20	
Serological Tests :-		
1) Conventional Serological Test. ELISA, VDRL, WIDAL, Agglutination Tests, IFA.		
2) Rapid Tests.		
<i>(One conventional and one rapid test to be performed for the practical examination).</i>		
<u>Virology -</u>	15	
1) Haemagglutination, Haemagglutination inhibition.		
2) ELISA – HIV / HBSAG.		
3) Interpretation of Tissue Culture slides with CPE.		
<u>Mycology -</u>	15	
1) Identification of fungal cultures.		
<u>Parasitology -</u>	20	
1) Processing and identification of ova and cysts in stool samples. Saline / Iodine / Concentration technique.		
2) Blood smear examination for malarial parasite, microfilaria & special staining techniques for stool examination.		
<u>Animal Experiments –</u>	10	
1) Bleeding Techniques of animals.		
2) Inoculation of infective material, by different routes in animals.		
<u>Histopathology Slides –</u>	20	
a) Stained Smear	} Applied to microbial infections.	
b) Tissue Sections		
	Total	<u>200</u>

Pedagogy and Oral (50 + 50)-

100 marks.

Pedagogy –

The teaching skills of the candidate will be assessed. The candidate will be given a topic by the 4 examiners at the end of the first day of practical examination for a lecture presentation. The examiners shall evaluate the candidates ability.

DISSERTATION :
(No Marks)
APPROVED / NOT APPROVED

** <u>MARKS QUALIFYING FOR A PASS</u>	<u>MAXIMUM MARKS</u>	<u>QUALIFYING FOR A PASS 50% MARKS</u>
Theory Examination	400	200
Practical Examination	200	100
Oral/Viva & Pedagogy (50+50)	100	No Minimum
Aggregate	----- 700	----- 350

List of Books :

- 1) Medical Microbiology – Greenwood Vol. I and II.
- 2) Zinsser's Microbiology.
- 3) Review of Medical Microbiology – Jawaetz et al.
- 4) Topley and Wilson's textbook of Bacteriology, Virology and Immunology – 6 volumes.
- 5) Essential Immunology – Ivan Roitt.
- 6) Basic and Clinical Immunology – Danial P. stites et al.
- 7) Immunology by Joseph A. Bellanti.
- 8) Diagnostic Microbiology – By Finegold.
- 9) Cumitech series 1-25 (By American Society for Microbiologists).

** 33rd SAB held on 20-06-2007 - March 2008 Examination onwards.

- 10) Medical Virology By Fenner.
 - 11) Medical Parasitology – By Chatterjee.
 - 12) Textbook of Medical Parasitology By Jayaram Panicker.
 - 13) Textbook of Microbiology – By Jayaram Panicker.
 - 14) Medical Mycology – Conant and Smith.
 - 15) Mycology – Emmons.
 - 16) Mycology – Rippon.
 - 17) Diagnostic Bacteriology – Joan Stoke.
 - 18) Mycology – By Jagadeesh Chander.
 - 19) Parasitology – By Parija.
 - 20) Immunology by Kuby
-

LIST OF JOURNALS RECOMMENDED FOR REFERENCE

I. INDIAN JOURNALS :-

- 1) Indian Journal of Medical Research.
- 2) Indian Journal of Microbiology.
- 3) Indian Journal of Pathology and Bacteriology.
- 4) Indian Journal of Public Health.

II. FOREIGN JOURNALS :-

- 1) WHO Bulletin.
- 2) WHO Technical Report Series.
- 3) WHO Chronicle.
- 4) Bacteriological Review.
- 5) Journal of Medical Microbiology.
- 6) Immunological Techniques.

- 7) Journal of Infection and Immunity.
- 8) Journal of Infectious Diseases.
- 9) Acta Pathol, Microbiol Scand.
- 10) Journal of Hygiene.
- 11) American Journal of Tropical Medicine and Hygiene.
- 12) Journal of Clinical Pathology.
- 13) Journal of Laboratory Sciences.
- 14) New England Journal of Medicine.
- 15) Virus News.
- 16) Science.
- 17) Lancet.
- 18) Scientific American.
- 19) JAMA.
- 20) Parasitology.
- 21) Clinical Epidemiology.
- 22) Practitioner.
- 23) Nature.
- 24) Journal of Leprosy.
- 25) Sabouraudia.
- 26) Journal of Experimental Immunology.

LOG BOOK RECOMMENDATIONS :-

- 1) Structural Log Book is needed.
- 2) Must carry updated information of the department.

- 3) Must provide the details of training and skills acquired.
- 4) Should be monitored and verified periodically by the H.O.D.

BRANCH-V M.D. (PHYSIOLOGY)**GUIDELINES FOR COMPETENCY BASED POST GRADUATE TRAINING PROGRAMME
FOR M.D. PHYSIOLOGY****Preamble**

The purpose of this program is to standardize Physiology teaching at Post Graduate level through out the country so that it will benefit in achieving uniformity in undergraduate teaching as well. Accordingly the training in M.D. Physiology should be distinctive from that in M.Sc., Ph.D., (Physiology), where the approach to the subject is primarily experimental.

Programme Objectives

A candidate upon successfully qualifying in the M.D. (Physiology) examinations, should be able to :

- a) Be a competent physiologist.
- b) Effectively teach undergraduate medical (and paramedical) students the basic physiological mechanisms of human body, with reference to their implications in the pathogenesis of diseases (pathophysiology) and the physiological basis of their management.
- c) Conduct such clinical / experimental research as would have significant bearing on human health and patient care.
- d) Interact with the allied departments by rendering services in advanced laboratory investigations.
- e) Acquire skills in conducting collaborative research in the field of physiology & allied sciences.
- f) Must be able to demonstrate to the students how the knowledge of physiology can be used in a variety of clinical settings to solve diagnostic and therapeutic problems.

Specific Learning Objectives

- a) Effectively teach undergraduate medical students the basic physiological mechanisms of human body, with reference to their implications in the pathogenesis of diseases (pathophysiology) and their management.
- b) Trained to conduct such clinical and experimental research, as would have a significant bearing on human health and patient care.
- c) Encourage interaction with the allied departments by rendering services in advanced laboratory investigations and relevant expert opinion.
- d) Encourage the student to participate in various workshops / seminars / journal clubs / demonstration in the allied departments, to acquire various skills for collaborative research.
- e) Uphold the prestige of the discipline amongst the fraternity of doctors.

Training Period	3 yrs.	
I yr.	Learns the basics in Physiology in the Department of Physiology, Takes Practical classes for U.Gs Training in teaching methods (attends a workshop), Computer training in Word Processing, Power point presentation & Internet Browsing.	
II yr.	<u>1st 6 months :</u> Posting in the clinical & other basic Science Department – Training in Research Methodology. Chooses topics for Dissertation & submits to the University.	<u>2nd 6 months :</u> Works on the Dissertation.
III yr.	Actively involves in U.G. teaching. Prepares for the University Examinations.	

Details of the training in the Clinical & other Basic Science Departments.

Medicine	1 Month
Anatomy	15 days
Biochemistry	15 days
Clinical pathology	15 days
Blood Bank	15 days
Endocrinology	15 days
Cardiology	15 days
Neurology	15 days
Chest Medicine	15 days
Medical Gastroenterology	15 days
Biostatistics	15 days
Physiology	6 Months

**M.D. BRANCH – V PHYSIOLOGY
DETAILS OF TRAINING FIRST YEAR**

- | | | | |
|------|---|---|----------|
| I. | Medical Ward Posting | : | 1 month. |
| II. | Cardiology Department | : | 15 days. |
| III. | Neurology Department | : | 15 days. |
| IV. | Chest Medicine
(Pulmonary function Laboratory) | : | 15 days. |
| V. | Medical Gastroenterology | : | 15 days. |

VI.	Department of Endocrinology	:	15 days.
VII.	Clinical Biochemistry	:	15 days.
VIII.	Haematology Department	:	15 days.
IX.	Blood Bank	:	15 days.
X.	Anatomy (Histology Laboratory)	:	15 days.
XI.	Department of Biostatistics and Research Methodology	:	15 days.
XII	Department of Physiology	:	6 months.

	Total	=	12 Months

The Post Graduate students shall attend the clinical postings in the forenoon session between 10 a.m. to 1 p.m. and attend to his / her Departmental teaching work in the afternoon session.

Post-Graduate Examinations :-

The Post-graduate examinations should be in 3 parts :

- 1) **Thesis, to be submitted by each candidate at least 6 months before the date of commencement of the theory examination.**
- 2) **Theory : There shall be four theory papers – as given separately.**
- 3) **Practicals and Viva/Oral.**

Syllabus :- **(Theory Only)**

I. GENERAL PHYSIOLOGY :

- 1) Body Fluids.
- 2) Membrane and Potentials & Action Potentials.
- 3) Functional Morphology of Cell.
- 4) Homeostasis.
- 5) Aging.

II. PHYSIOLOGY OF EXCITABLE TISSUE :

- 1) Nerve.
- 2) Skeletal Muscle.
- 3) Cardiac Muscle.
- 4) Smooth Muscle.

III. NEURO PHYSIOLOGY :

- 1) Synaptic & Function Transmission.
- 2) Initiation of Impulses of sense organs.
- 3) Reflexes.
- 4) Cutaneous & Deep Visceral sensation.
- 5) Control of Posture & Equilibrium.
- 6) Sleep Arousal Mechanisms, the Electrical Activity of the Brain.
- 7) Central Regulation of Visceral Function.
- 8) The Autonomic Nervous System.
- 9) Neural Basis of Instinctual Behaviour & Emotions.
- 10) Higher Functions of the Nervous : Conditioned Reflexes, Learning & Related Phenomena.

IV. SPECIAL SENSE :

- 1) Vision.
- 2) Hearing.
- 3) Smell & Taste.

V. BLOOD:

- 1) Composition and functions.
- 2) Structure, functions and origin of blood cells.
- 3) Immunity
- 4) Blood groups.
- 5) Haemostasis
- 6) Reticuloendothelial System

VI. ENDOCRINOLOGY & METABOLISM :

- 1) Energy Balance, Metabolism & Nutrition.
- 2) The Thyroid Gland.
- 3) Endocrine Functions of the Pancreas & Regulation of Carbohydrate Metabolism.
- 4) The Adrenal Medulla & Adrenal Cortex.
- 5) Hormonal Control of Calcium Metabolism & the Physiology of Bone.
- 6) The Pituitary Gland.
- 7) The Gonads : Development & Function of the Reproductive System.
- 8) Other Endocrine Organs.

VII. GASTROINTESTINAL FUNCTION :

- 1) Digestion & Absorption.
- 2) Regulation of Gastrointestinal Function.

VIII. CIRCULATION :

- 1) Circulating Body Fluids.
- 2) Origin of the Heartbeat & the Electrical Activity of the Heart.

- 3) The Heart as a pump.
- 4) Dynamics of Blood & Lymph Flow.
- 5) Cardiovascular Regulatory Mechanisms.
- 6) Circulation Through Special Regions.
- 7) Cardiovascular Homeostasis in Health & Diseases.

IX. RESPIRATION :

- 1) Pulmonary Function.
- 2) Gas Transport between the Lungs & the Tissue.
- 3) Regulation of Respiration.
- 4) Respiratory Adjustments in Health & Diseases.
- 5) Environmental Physiology.

X. FORMATION & EXCRETION OF URINE :

- 1) Renal Function & Micturition.
- 2) Regulation of Extracellular Fluid Composition & Volume.

Skills to be Acquired during the Clinical Postings :-

I. MEDICAL WARD POSTINGS :

- 1) Clinical Examination of a patient.
Learning the pathophysiology of common medical problems.
- 2) Should learn to carry out all investigative procedures -
 - a) Drawing of Blood.
 - b) Pleural tap.
 - c) Lumbar puncture.
- 3) Interpretation of Data -
 - a) X-rays.
 - b) ECG.

II. CARDIOLOGY DEPARTMENT :

Learn to operate E.C.G. apparatus, Echo, Doppler, Cardiac Monitor, Learn the methodology of Cardiac Catheterisation, Resuscitation technique, Interpretation of E.C.G. and other records.

III. NEUROLOGY DEPARTMENT :

- 1) Clinical Examination of patient.
- 2) Principles of EEC, EMG.
- 3) Interpretation of EEG, EMG and other investigative Data.
- 4) Nerve condition.

IV. CHEST MEDICINE :
(Pulmonary function Laboratory)

Lung function tests and interpretation of results.

V. MEDICAL GASTROENTEROLOGY :

Endoscopy Technique.

VI. ENDOCRINOLOGY :

- 1) Clinical Examination of patients.
- 2) Radio Immuno Assay techniques.

VII. CLINICAL BIOCHEMISTRY :

Learn the methodology of all clinical Biochemical tests and interpretation of data.

Lectures on Metabolism of Carbohydrate - 6 hrs.
Protein and Lipids and Acid base balance.

VIII. HAEMATOLOGY DEPARTMENT / CLINICAL PATHOLOGY :

All Blood investigations & interpretations.

IX. BLOOD BANK :

- 1) Collection, storage, transfusion of Blood.
Transfusion Reactions - Lecture - 2 hrs.
- 2) Blood grouping and cross matching.

X. ANATOMY :
(Histology Laboratory)

Section cutting, slide preparation, staining techniques, mounting of specimens.
Histology of normal structure.

XI. BIOSTATISTICS AND RESEARCH METHODOLOGY :

A Postgraduate candidate should undergo a training in Research Methodology and gain knowledge of Biostatistics.

Study and training in the Department of Physiology.

DETAILS OF PRACTICALS

PRACTICAL

MAMMALIAN EXPERIMENTS:

- I. Recording of Blood Pressure, Heart rate, Respiration in the DOG under the following:
 1. Demonstration of action of drugs.
 2. Carotid Sinus Manipulations
 3. Effects of asphyxia.
- II Recording of myocardial contractions.
- III Recording of Intestinal movements in vitro (Jacksons enterographs)
- IV Recording of urine output and effect of drugs and chemicals
- V Study salivary secretions

MAMMALIAN EXPERIMENTS:

(Rabbit / Guinea Pig / Rat)

1. In vitro experiments
 - intestinal movements
 - uterine contractions
2. Demonstration of Hypophysectomy, Thyroidectomy, adrenalectomy, pinealectomy.
3. Perfusion of mammalian heart & effects of drugs and ions.

AMPHIBIAN EXPERIMENTS : (Frog)

1. Preparation of decorticate / spinal animal.
2. Vegal stimulation & action of atrophine & nicotine.
3. Perfusion Experiments on Isolated heart.
4. Isometric contraction.
5. Velocity of nerve impulse conduction
6. Rectus Abdominus preparation.
7. Frogs skeletal muscle contraction experiments.
8. Cardiac muscle experiments.

SLIDES:

HISTOLOGY slides of all tissues and organs of the body.

CHARTS :

Recordings for interpretation: ECG, EEG, EMG, ERG, AUDIOGRAM, SPIROGRAPH, FTM, GTT, Electrophoresis, Blood Gas Analysis, Flow-Volume Curves.

HAEMATOLOGY :

Red Blood Cell count
Total White Cell count
Differential Leucocyte count
Reticulocyte count
Platelet count
Eosinophil count
Arneth index
Prothrombin time
Blood grouping
Hb% estimation

HUMAN EXPERIMENTS :

Examination of:
Respiratory system
Cardiovascular system
Nervous system

Perform or record & interpret the data or finding:

- 1) Autonomic Function Tests.
- 2) Physical Fitness.
- 3) ECG, EMG, EEG.
- 4) Spirometry.
- 5) Ergometry
- 6) Perimetry.
- 7) Stethography

- 8) Respiratory efficiency & endurance.
- 9) Recording of respiratory movements using stethograph and effects of: Hyperventilation, swallowing, speech, breath holding, exercise on respiratory movement.

PEDAGOGY :

The teaching skills of the candidate will be assessed. The candidate will be given a topic by the 4 Examiners at the end of the first day of the practical examination for a Lecture presentation on the next day to an imaginary audience. The Examiners shall evaluate the candidates ability (Trial class room lecture for under graduate students)

PATTERN OF EXAMINATION :- *

FOUR PAPERS - 100 Marks each 3 Hours duration each

<u>Theory</u>	<u>Title</u>	<u>Duration</u>	<u>Marks</u>
Paper – I	General Physiology, Blood Digestion and Tissues of the Body.	3 hrs.	100
Paper – II	Circulation Respiration, Environmental Physiology and Excretion, Comparative Physiology	3 hrs.	100
Paper – III	Nervous System and Special Senses.	3 hrs.	100
Paper – IV	History of Medicine, Recent Advances in Clinical Physiology, Endocrinology And Reproductive Systems.	3 hrs.	100
Total			400

Distribution of Marks : **

2 Essays	2 x 20 =	40 Marks
10 Short Notes	10 x 6 =	60 Marks
Total		100 Marks

* 30th SAB held on 28-12-2005 - March 2006 Examination onwards.

** 32nd SAB held on 21-12-2006 - March 2008 Examination onwards.

Practical Examination - **Practicals** 2 days.**Day – 1**

	Marks	Duration
Mammalian (Dog) Graphs.	20	1 hr.
Mammalian Isolated Organ.	35	1 hr.
Heart Amphibian or Skeletal Muscle	35	1 hr.
Haematology.	35	1 hr.

Day – 2 :-

Clinical Examinations	40	1 hr.
Clinical (Human) Experiments.	35	1 hr.
Total	200	

Pedagogy 50 20 min.

Orals 50 45 min.

NOTE : No. of candidates to be examined 4 Per day for Practical/Viva.

DISSERTATION :
(No Marks)

APPROVED / NOT APPROVED

** <u>MARKS QUALIFYING FOR A PASS</u>	<u>MAXIMUM MARKS</u>	<u>QUALIFYING FOR A PASS 50% MARKS</u>
Theory Examination	400	200
Practical Examination	200	100
Oral/Viva & Pedagogy (50+50)	100	No Minimum
Aggregate	700	350

**** 33rd SAB held on 20-06-2007 - March 2008 Examination onwards.**

BRANCH -VI M.D. (PHARMACOLOGY)**GUIDELINES FOR COMPETENCY BASED POST GRADUATE TRAINING PROGRAMME
FOR M.D. PHARMACOLOGY****Preamble :-**

The purpose of this programme is to standardize Pharmacology teaching at Post Graduate level throughout the country so that it will benefit in achieving uniformity in undergraduate teaching as well. Accordingly, the training in M.D. Pharmacology should be distinctive from that of M.Sc., Ph.D., (Pharmacology), where the approach to the subject is primarily experimental.

Programme Objectives :-

A candidate upon successfully qualifying in the M.D. (Pharmacology) examinations should be able to :

- 1) Teach Pharmacology and Therapeutics to students of medical and allied disciplines.
- 2) Independently plan and undertake research related to drugs (basic as well as Clinical Pharmacology) and communicate the findings in conferences / journals.
- 3) Set up therapeutic drug monitoring, ADR monitoring, therapeutic audit and drug information services.
- 4) Plan and conduct toxicity studies and clinical trials.
- 5) Educate the public about use and misuse of drugs.
- 6) Supervise breeding and upkeep of small laboratory animals.
- 7) Act as medical advisor in a pharmaceutical house.

Specific Learning Objectives :-

- 1) Demonstrate sound knowledge of general pharmacological principles, systemic pharmacology and rational use of drugs.
- 2) Plan and conduct lecture, demonstration, practical and tutorial classes for students of medical and allied disciplines.
- 3) Understand the principles of essential drug concept and rational use of drugs including rational pharmacotherapy.
- 4) Carry out screening of drugs for pharmacological and toxicological profile.
- 5) Carry out drug related literature search, formulate a research project and undertake the same. Apply appropriate statistical methods for summarizing and analyzing data.
- 6) Present research findings in conferences (oral / poster sessions), Communicate research / educational papers in peer reviewed journals, Critically review and comment on research papers.
- 7) Measure drug levels in blood and other biological fluids using suitable chemical assay methods and interpret the same in therapeutic / toxicological context.
- 8) Monitor adverse drug reactions. Carry out therapeutic audit and provide drug information service to doctors / public.
- 9) Use computer and IT tools for teaching, research and presentation / publication of data.

- 10) Demonstrate knowledge of National Health Policy, essential drug concept / lists and supervise drug management in a hospital.
- 11) Demonstrate knowledge of drug rules and regulations existing in the country.

Post Graduate Training :

Based on the available facilities, department can prepare a list of postgraduate experiments pertaining to basic and applied Pharmacology. Active learning should form the mainstay of postgraduate training. There should be lectures for postgraduates (at least 20 per year) along with seminars, symposia, group-discussions, journal clubs. The postgraduate students should regularly go on the ward rounds of various clinical departments and lean cases of interest for discussion with the Pharmacology faculty. Each college should have a medical education unit to generate teaching resource material for U.G. and evolving problem solving modules.

Post-Graduate Examinations :-

The Post-graduate examinations should be in 3 parts :

- 1) **Thesis, to be submitted by each candidate at least 6 months before the date of commencement of the theory examination.**
- 2) **Theory : There shall be four theory papers – as given separately.**
- 3) **Practicals and Viva/Oral.**

Course Content :-

General Pharmacology :

History of Pharmacology, Pharmacokinetics, Pharmacodynamics, Adverse Drug Reactions, Drug Interactions, Pediatric Pharmacology, Geriatric Pharmacology, Drugs in Pregnancy and Lactation. Dosage calculation in special situations, Factors modifying drug action, Pharmacogenetics, Drug delivery systems and Fixed dose combinations, Gene therapy, Sources of drugs. Principles of Toxicology, Principles of prescription writing.

Systemic Pharmacology, Chemotherapy and Therapeutics :

Pharmacology of drugs acting on autonomic, peripheral and central nervous systems; cardiovascular, endocrine, respiratory, renal, gastrointestinal and haemopoietic systems and treatment of diseases affecting these systems; Pharmacology of anti-microbial and anti-parasitic drugs and treatment of infective diseases; cancer chemotherapy, immuno-pharmacology and ocular Pharmacology, Dermatological pharmacology vitamins, Heavy metals and antagonists, Miscellaneous.

Experimental Pharmacology, Bioassay :

Experimental methodologies involved in the discovery of drugs (in vivo, in vitro ex vivo). Animal handling and animal care. Methods of anaesthetizing animals and methods of euthanasia. Restraining and blood collection methods. Drug screening methods involved in the evaluation of anti-ulcer, antidepressant, anti-anginal, anti-hypertensive, anti-arrhythmic, anti-diabetic, anti-cataract, anti-platelet,

anticancer, anti-inflammatory, anti-diarrheal, anti-epileptic, analgesic, anti-thyroid, antipyretic, anti-glaucoma, anti-hyperlipidemic, anti-asthmatic drugs and cough suppressants. Drug screening methods used in screening anti-fungal, anthelmintic, antibacterial and antiviral agents. Drug screening methods for heart failure, posterior pituitary, adrenal, steroid (gluco & mineralo), testicular, parathyroid, ovarian, thyroid hormones, Methods involved in testing teratogenicity, carcinogenicity and organ toxicities in animals. Bio-assay and dose response relationship.

Clinical Pharmacology and Biostatistics :

Principles of therapeutics, Individualisation of drug therapy, Drug regulatory systems, Placebo, Drug development, Pharmacoeconomics, Pharmacoepidemiology, Therapeutic drug monitoring, Ethics of clinical trial, Ethical committee, Drug utilization studies, Essential drug concept and rational drug use. Patient compliance.

Practical Training :-

Experimental Methods Discussion :

A. Screening and Evaluation of Drug Activities including Animal Models for Study of following Actions :

- | | |
|----------------------------------|---|
| 1) Analgesic. | 14) Local anaesthetic. |
| 2) Antiinflammatory. | 15) Antihistaminics, Antiallergic. |
| 3) Antipyretic; pyrogen testing. | 16) Antisecretory & drugs for peptic ulcer. |
| 4) Anticonvulsant. | 17) Antiemetic. |
| 5) Antianxiety. | 18) Hypoglycaemic. |
| 6) Antipsychotic. | 19) Antifertility. |
| 7) Antidepressant. | 20) Anticancer. |
| 8) Antiparkinsonian. | 21) Diuretic. |
| 9) Sedative, hyponotics. | 22) Antimalarial. |
| 10) Antihypertensive. | 23) Antitubercular. |

- | | |
|-------------------------------|--|
| 11) Antianginal. | 24) Antidiabetic. |
| 12) Antiarrhythmic. | 25) Antiatherosclerotic. |
| 13) Skeletal muscle relaxant. | 26) Bronchodilator & anti-asthmatic drugs. |
-

B. Bioassay of :

- | | |
|--------------------------------|---------------------|
| 1) Acetylcholine. | 5) Insulin. |
| 2) Adrenaline / noradrenaline. | 6) Antibiotics. |
| 3) Histamine. | 7) Digoxin. |
| 4) 5-Hydroxytryptamine. | 8) Glucocorticoids. |
-

C. Quantitative study of agonists and antagonists on isolated tissues.

D. Measurement of blood pressure in conscious and anaesthetized animals.

EXPERIMENTAL PHARMACOLOGY EXERCISES :-

- 1) Frog's rectus abdominis muscle : dose response curve (DRC) and cumulative DRC of acetylcholine; potentiation of ACh by physostigmine and antagonism by tubocurarine / pancuronium.
- 2) Study of drug action on perfused frog's heart.
- 3) Dose-response curve of histamine on isolated guineapig ileum, Cumulative dose response curve of histamine in isolated guinea pig tracheal chain.
- 4) Bioassay of histamine on guineapig ileum by matching method, 3 point method and 4 point (Latin square design) method.
- 5) Bioassay of ACh on frog's rectus abdominis muscle.
- 6) Determination of EC₅₀ and pD₂ values of histamine and ACh on guineapig ileum and frog rectus abdominis muscles.
- 7) Bio-assay on estrogen primed rat uterus.
- 8) Demonstration of muscarinic and nicotinic actions of ACh and carbachol on the B.P. and respiration.

- 9) Study of local anaesthetics by rabbit cornea, guineapig intradermal wheal, frog lumbar plexus.
- 10) Study of analgesic activity of drugs using rat tail-hotwire method, hot plate method, acetic acid induced writhing.
- 11) Study of anti-inflammatory activity of drugs against carraginin induced rat paw oedema.
- 12) Antagonism of histamine aerosol induced bronchospasm by anti-histaminics.
- 13) Effect of psychopharmacological drugs on conditioned avoidance response (Cook's pole climbing).
- 14) Effect of psychopharmacological agents on foot shock induced aggression in rats.
- 15) Effect of psychopharmacological agents on elevated plus maze.
- 16) Effect of drugs on spontaneous motor activity of mice, photoactometer.
- 17) Study of anorectic activity of amphetamine in mice.
- 18) Potentiation of barbiturate sleeping time.
- 19) Study of miotics and mydriatics on rabbit's eye.

Minor Procedures :

- (i) Rat tail vein injection.
- (ii) Administration of drugs to rats by gastric cannula.
- (iii) Collection of blood from rat tail.
- (iv) Collection of blood by Cardiac puncture in rat.
- (v) Injection of drugs through marginal ear vein of rabbits.
- (vi) Intraperitoneal and subcutaneous injection to rats and mice.

Chemical Pharmacology Exercises :

- 1) Identification of unknown compounds by using chemical tests.
- 2) Estimation of drug levels using colorimetry, spectrophotometry, fluorimetry, flame photometry, high performance liquid chromatography (HPLC), enzyme linked immunoassay.

Clinical Pharmacology Exercises :

- 1) Training at poison information center.
 - 2) Molarity calculations and preparations of reagents.
-

SCHEME OF TRAINING :-**I Year -**

<u>Duration</u>	<u>Department</u> (Forenoon :10 – 1 p.m.)	<u>Department</u> (Afternoon : 2 – 4.30 p.m.)
	Pharmacology.	Pharmacology.
	a) Getting acquainted with the department. b) Attending all the classes.	
	Introduction to Dissertation including statistical classes.	
	Visits to Pharmaceutical Industries and Toxicology centres.	
12 th month	Selection & Planning of Dissertation. Submitting the topic to the University.	
	II & III yr. will be spent by the student in the department of Pharmacology wherein :	
	a) The Practical Training as specified by the M.C.I. will be given, depending upon the availability of animals & other facilities.	
	b) The student will acquire skills – <ul style="list-style-type: none"> i) To conduct practical classes for the U.Gs. ii) To take lectures for the U.Gs. iii) To plan an undergraduate teaching programme & to set questions including MCQs. 	
	c) The student will participate & contribute to other academic activities of the department like Journal clubs, Seminars and CME programmes. Students will be, in addition, encouraged to attend conferences, workshops and present papers in scientific sessions.	

PATTERN OF EXAMINATION : *

FOUR PAPERS – 100 Marks each

3 Hours duration each

<u>Theory</u>	<u>Title</u>	<u>Duration</u>	<u>Marks</u>
Paper – I	General Pharmacology Experimental Pharmacology Bioassay.	3 hrs.	100
Paper – II	Systematic Pharmacology including Recent Advances.	3 hrs.	100
Paper – III	Clinical Pharmacology and Pharmacotherapeutics including Recent Advances.	3 hrs	100
Paper – IV	Applied Pharmacology, Forensic Pharmacology	3 hrs.	100
Total			400

Distribution of Marks : **

2 Essays	2 x 20 =	40 Marks
10 Short Notes	10 x 6 =	60 Marks
Total		100 Marks

* 30th SAB held on 28-12-2005 - March 2006 Examination onwards.** 32nd SAB held on 21-12-2006 - March 2008 Examination onwards.

BRANCH -XIII M.D. (BIOCHEMISTRY)**GUIDELINES FOR COMPETENCY BASED POST GRADUATE TRAINING PROGRAMME
FOR M.D. BIOCHEMISTRY****Preamble :-**

The purpose of this program is to standardize Biochemistry teaching at post-graduate level through out the country so that it will benefit in achieving uniformity in undergraduate teaching of the subject as well. Accordingly the training in M.D. Biochemistry should be distinctive from that in M.Sc., Ph.D., (Biochemistry), where the approach to the subject is primarily experimental.

Programme Objectives :-

A candidate upon successfully qualifying in the M.D. (Biochemistry) examinations, should be able to :

- 1) be a competent biochemist.
- 2) work as a teacher in medical faculty both at undergraduate & post graduate level.
- 3) supervise modern laboratory techniques & procedures in clinical Biochemistry in the hospital.
- 4) pursue her / his interest to undergo further specialization.
- 5) carry out & conduct various research problems both at basic and applied level.
- 6) guide thesis at both post graduate and doctoral level.
- 7) suggest, evaluate, interpret biochemical investigation in a given clinical situation and apply knowledge in clinical problems.

SPECIFIC LEARNING OBJECTIVES

- 1) Describe the concept of Biochemistry regarding biomolecules – carbohydrates, proteins, lipids, nucleic acids, enzymes, minerals.
- 2) Discuss the intermediary metabolism of the above biomolecules & their regulation.
- 3) Discuss the impairments in metabolism of the above, including inborn errors of metabolism.
- 4) Describe the role of nutrition in health & disease.
- 5) Apply theoretical knowledge to interpretation of biochemical parameters in health and disease.
- 6) Develop skills in performing biochemical techniques like electrophoresis, colorimetry, spectrophotometry, flame photometry & interpreting the data obtained. Optional – ELISA, RIA, techniques in molecular genetics.

Postgraduate Training

Based on the available facilities, department can prepare a list of postgraduate experiments pertaining to basic and applied biochemistry. Active learning should form the mainstay of postgraduate training. There should be lectures for postgraduates (at least 20 per year).

Postgraduate Examinations

The postgraduate examinations shall be in 3 parts.

1. **Thesis, to be submitted by each candidate at least 6 months before the date of commencement of the theory examination.**
2. **Theory :** There shall be four theory papers - as given separately
3. **Practicals and Viva/Oral.**

Practical will have 2 components namely – exercises and viva voce.

A) Practical comprising of 3 exercises.

B) Viva-voce or the oral session including a pedagogy of at least 15 minutes duration.

COURSE CONTENT

REVISED SYLLABUS FOR M.D. – BIOCHEMISTRY

PHYSICAL AND ORGANIC ASPECTS OF BIOCHEMISTRY, INSTRUMENTATION BIOCHEMICAL TECHNIQUES, BIostatISTICS

1) Physical Chemistry :

Water as universal biological solvent.

pH.

Buffers.

Colloidal state and Gibbs – Donnan equilibrium.

Van der waals forces.

Surface tension.

Osmosis, diffusion and viscosity.

Law of mass action.

Hydrogen bonding, hydrophobic interactions and ionic bridges.

Determination of molecular weights.

2) Chemistry of Carbohydrates :

Structure, physical and chemical properties and biological role of :

Glucose, fructose, galactose, mannose, ribose, xylose, xylulose,

Lactose, maltose, sucrose.

Deoxy and amino sugars.

Uronic acids and sugar alcohols.

Dextrin, starch, glycogen, cellulose, insulin.

Glycosaminoglycans and glycoproteins.

3) Chemistry of Proteins :

Structure, physical and chemical properties and biological functions of :

Amino acids present in proteins, including selenocysteine

Amino acids not found in proteins.

Modified amino acids.

Dissociation constant (pK_a).

Amino acids as buffers, amino acid titration, zwitterions and isoelectric point.

Cross-links, hydrogen bonds, disulphide bonds, non-covalent and ionic bonds in peptides and proteins.

X-ray diffraction studies.

Covalent structure of proteins.

Primary, secondary, tertiary and quaternary structure of proteins and elucidation of these

Mass spectrometry.

Tandem mass spectrometers.

4) Protein structure and function :

Relationship of function to the three dimensional structure of myoglobin, haemoglobin, collagen and elastin.

Enzymes and peptide hormones.

Immunoglobulins.

Peptide sequencing and peptide synthesis.

5) Chemistry of lipids :

Structure, physical and chemical properties of :

Saturated and unsaturated fatty acids.

Polyunsaturated fatty acids.

Eicosanoids.

Triacylglycerol.

Sterols.

Phospholipids.

Glycolipids.

Sphingolipids.

Lipoproteins.

Membranes and fluid mosaic model.

6) Chemistry of purines and pyrimidines :

Nucleotides and their derivatives.

Polynucleotides.

Synthetic nucleotides.

7) Principles of laboratory analyses and safety :

Units of measurement.

International system of units in laboratory medicine.

Conversion from conventional units to SI units.

IFCC and IUPAC system recommendations.

Reference materials.

Reagent grade water production.

Testing for water purity.

8) Instrumentation and techniques :

Centrifugation.

Ultracentrifugation.

Radioactivity, properties of radionuclides and measurement of radioactivity.

Techniques that are radioisotopes

Autoradiography.

Geiger counter.

Scintillation counting.

Radio-immuno assay (RIA).

Radio-receptor assay.

Immuno-radiometric assay (IRMA).

Stable isotopes and mass spectrometry.

Spectrophotometry.

Reflectance photometry.

Flame emission photometry.

Atomic absorption spectrophotometry.

Flurometry.

Phosphorescence, chemiluminescence and bioluminescence.

Nephelometry.

Turbidimetry.

Direct vision spectroscope.

Electrochemistry- chemical sensors, potentiometry, ion selective electrodes, optical chemical sensors, enzyme electrodes and enzyme immobilization.

Osmometry.

Electrophoresis (zone) – paper, agar gel, PAGE, SDS PAGE, iso-electric focusing.

Chromatography – column, paper, TLC, GLC, HPLC, gel filtration, ion exchange and their applications.

Principles of immunochemistry.

Immuno-electrophoresis.

Blotting techniques.

ELISA.

Automation in clinical chemistry.

9) Laboratory Management :

Common hazards in the laboratory.

Management of biological, chemistry and radioactive wastes.

Computer applications in clinical chemistry.

Setting up a clinical chemistry laboratory and a 24 hours emergency laboratory service.

10) Sample collection :

Anticoagulants and preservatives for blood.

Timed urine collections and urine preservatives.

11) Quality assurance :

Use of reference values.
Quality assurance in clinical laboratories.

12) Basic principles of biostatistics as applied to health sciences :

Concepts of probability.
Mean.
Standard deviation.
Coefficient of variation.
Correlation coefficient.
Tests of significance.
Selecting an analytical method.
Evaluation of an analytical method.
Evaluation of a diagnostic test.

CELL PHYSIOLOGY, MOLECULAR BIOLOGY AND HUMAN GENETICS**1) Cell Physiology :**

An overview of cellular structure and function.
Prokaryotic and eukaryotic cells.
Structure of eukaryotic cells – sub cellular organelles, cytosol, endoplasmic reticulum, nucleus, nucleolus, mitochondria, lysosomes, ribosomes, Golgi apparatus, peroxisomes, plasma membranes and their functions.
Receptor-mediated endocytosis.
Properties of biological membranes – motility, permeability, concept of semi-permeable membranes, electrochemical gradient and pumps, artificial membranes and liposomes.
Transport across membranes – active, facilitated and passive.
Transport mechanisms – ion channels including gated channels, carrier proteins, glucose transporters (GLUT), active transporters, symporters and antiporters.
Non-membrane organelles – cytoskeleton, microfilaments, microtubules and microvilli.
Evolution of organic molecules, endosymbiosis hypothesis, evolution of cells.
Sub-cellular fractionation – density gradient centrifugation, differential centrifugation, markers for each organelle and fraction.
Cell interactions and adhesion – types of junctions : tight junctions and gap junctions.
Surface glycoproteins and cell surface labeling – ABO blood groups, major histo-compatibility complex (MHC).
Adhesion molecules – cadherins, selectins, integrins (beta 1 and beta 2 integrins).
Cell cycle – concept of cell cycle, regulation of cell cycle, regulators – cyclins and their regulators, extracellular regulators of cell cycle.

Cell division – mitosis and meiosis.
 Cells as experimental models – E.coli, yeast, Drosophila melanogaster, viruses.
 Programmed cell death.

2) **Human genetics :**

Structure of DNA and RNA.
 Histones, chromatins, nucleosomes and chromosomes.
 Different types of DNA.
 Agents that cause DNA damage – ionizing radiation, ultraviolet light, mutagens, (chemical and viral).
 Different types of RNA – messenger, ribosomal, transfer, heterogenous nuclear RNA, SNurps.
 DNA replication – prokaryotic and eukaryotic.
 Transcription – prokaryotic and eukaryotic.
 Post-transcriptional modifications.
 Antibiotics and transcription.
 Regulation of transcription.
 Genetic code.
 Mitochondrial and plasmid DNA.
 Translation – eukaryotic and prokaryotic.
 Post-translational modifications.
 Factors affecting protein synthesis.
 Regulation of protein synthesis and gene expression, helix turn helix motif, zinc finger motif and leucine zipper motif.
 Signal peptides, protein targeting and chaperones.
 Disorders of post-translational modifications.
 Constitutive, inducible and repressible enzymes.
 Viral genetics – DNA and RNA viruses.
 HIV and drugs in the treatment of HIV.

3) **Molecular genetics and biotechnology :**

Isolation of nucleic acids.
 DNA digestion with restriction enzymes.
 DNA electrophoresis.
 Restriction maps.
 Southern analysis : hybridization and blotting.
 Polymerase chain reaction (PCR) : principle, procedure, and visualization of products.
 Reverse transcriptase PCR (RT-PCR).
 DNA sequence analysis.
 Automated DNA sequencing.
 Cloning and vectors – definition, characteristics of different vectors and basic cloning techniques.
 Gene libraries.
 cDNA libraries.
 The human genome project – sequencing of the genome and physical mapping.
 Genetic maps.
 Restriction fragment length polymorphisms and their applications.
 DNA diagnostics – methods of identifying genes in human disease.
 Fluorescent in-situ hybridization (FISH).

Gene therapy.
 Repeat DNA and mobile DNA elements.
 DNA repair and associated disorders.
 Reporter genes.
 Transgenic animals.
 The human proteome.

4) Molecular basis of carcinogenesis :

Carcinogenic agents – radiation, chemicals and viruses.
 Oncogenes and tumor suppressor genes.
 Genetic cancer syndromes – familial breast cancer, familial adenomatous polyposis coli and retinoblastoma.
 Inherited conditions that predispose to development of cancer (e.g., ataxia telangiectasia, xeroderma pigmentosum, Fanconi syndrome).
 Mechanisms of action of cytotoxic drugs.
 Basics of cytogenetics.

5) Population genetics :

Risk assessment and genetic counseling.
 Medical ethics in counseling.

6) Bioinformatics :

Basics of bioinformatics – proteomics, drug designing (pharmacogenomics), protein data bases and micro arrays.

INTERMEDIARY METABOLISM, MACRO AND MICRO NUTRIENTS AND INBORN ERRORS OF METABOLISM

1) Enzymes :

Biomedical importance.
 Nomenclature.
 Classification.
 General properties.
 Coenzymes and cofactors.
 Mechanism of action.
 Action of serine proteases.
 Kinetics of enzyme action.
 Km value and its significance.
 Inhibitors of enzymes, naturally occurring enzyme inhibitors.
 Regulation of enzyme activity.
 Enzymes in clinical medicine.

Isoenzymes and isoforms of enzymes.
 Metalloenzymes and metal activated enzymes.
 Isolation and purification of enzymes from natural sources.
 The use of enzymes as laboratory tools (for diagnostic and research applications).

2) Vitamins :

Structure, sources, recommended dietary allowances (RDA), biochemical role, metabolism in the body and deficiency manifestations of water soluble and fat-soluble vitamins.
 Megavitamin therapy.
 Hypervitaminosis.
 Antivitamins and vitamin analogues.
 Use of vitamins in therapy.

3) Bioenergetics and biological oxidation :

The role of ATP and other high-energy phosphates.
 Biologic oxidation.
 The respiratory chain.
 Oxidative phosphorylation – theories, inhibitors, uncouplers.
 Mitochondrial diseases.

4) Carbohydrates :

An overview of metabolism.
 Methods of studying intermediary metabolism.
 Carbohydrates of physiological significance.
 Digestion and absorption of carbohydrates.
 Various pathways of metabolism of glucose.
 Generation of ATP by substrate – level phosphorylation.
 Pathways of metabolism of fructose and galactose.
 Regulation of the major metabolic pathways of carbohydrates.
 Inborn errors that occur in the metabolic pathways of carbohydrate metabolism.
 Regulation of blood glucose levels.
 Metabolism of glycosaminoglycans and glycoproteins; associated disorders.
 Disorders of carbohydrate metabolism – diabetes mellitus, lactose intolerance, galactosemia, disorders of fructose metabolism.
 Metabolism of alcohol.

5) Lipids :

Lipids of physiological significance.
 Digestion and absorption of lipids.
 Importance of bile.
 Assembly of chylomicrons and their metabolism.
 Oxidation of fatty acids.
 Biosynthesis of fatty acids.
 Metabolism of triacylglycerol.

Metabolism in adipose tissue (including brown adipose tissue).
 Metabolism of ketone bodies and associated disorders.
 Metabolism of cholesterol and associated disorders.
 Compounds derived from cholesterol.
 Metabolism of apoproteins and lipoproteins and associated disorders.
 Functions and metabolism of eicosanoids.
 Metabolism of phospholipids.
 Lipid storage disorders.
 Obesity.
 Metabolic adaptations in starvation and obesity.
 Metabolic syndrome.

6) Proteins :

Digestion and absorption of proteins.
 General reactions of catabolism of amino acids.
 Urea cycle and associated disorders.
 Hyperammonemia.
 Catabolism of carbon skeleton of amino acids.
 Biosynthesis of nonessential amino acids.
 Degradation of individual amino acids.
 Specialized products formed from amino acids.
 Inborn errors of amino acid metabolism.

7) Integration of metabolism :

The provision of metabolic fuels.
 Convergent points of acetyl CoA and glucose 6-phosphate.

8) Metabolism in specialized tissues :

Erythrocytes.
 Liver.
 Muscle.
 Central nervous system.
 Adipose tissue.
 Lens.
 Kidney.

9) Nucleic acids :

Metabolism of purines.
 Disorders associated with abnormalities in the metabolism of purines.
 Metabolism of pyrimidines.
 Disorders associated with abnormalities in the metabolism of pyrimidines.
 Nucleotide analogues in chemotherapy.

10) Haem :

Functions.
 Biosynthesis.

Disorders associated with defects in biosynthesis.
 Degradation of haem.
 Metabolism of bilirubin.
 Disorders associated with abnormalities in the metabolism of bilirubin.
 Laboratory diagnosis in these disorders.
 Abnormal haemoglobins and haemoglobinopathies.

11) Biochemical and molecular aspects of processes in the body :

Muscle contraction.
 Nerve conduction.
 Coagulation of blood.

12) Metabolism of minerals :

Sodium.
 Potassium.
 Calcium.
 Phosphorus.
 Magnesium.
 Copper.
 Zinc.
 Iron.
 Chromium.
 Selenium.
 Cobalt.
 Manganese.
 Other trace minerals.
 Inborn errors of mineral metabolism.

13) Metabolism of xenobiotics and detoxification.

14) Free radicals and anti-oxidants.

**CLINICAL BIOCHEMISTRY, HUMAN NUTRITION, ENDOCRINOLOGY, IMMUNOLOGY
 AND RECENT ADVANCES IN BIOCHEMISTRY**

The following topics are to be covered with special emphasis on the laboratory investigations relevant to the conditions :-

1) Carbohydrates :

Diabetes mellitus including gestational diabetes mellitus.
 Laboratory diagnosis and monitoring of diabetes mellitus.
 Diabetic ketoacidosis.
 Other metabolic complications of diabetes mellitus.
 Monitoring of treatment.

Glycated proteins.

Urinary albumin excretion.

Hypoglycemia.

Inborn errors of carbohydrate metabolism – disorders of galactose, fructose lactose and pentose metabolism.

Glycogen storage disorders.

2) Lipids :

Disorders of lipoprotein metabolism.

Laboratory diagnosis of these disorders.

Association with atherosclerosis and the consequences.

Biochemical derangements in metabolic syndrome.

3) Proteins :

Plasma proteins in health and disease.

Proteins in other body fluids (urine, cerebrospinal fluid, amniotic fluid, saliva and faeces).

4) Amino acids :

Aminoacidurias and their laboratory diagnosis.

Disorders of amino acid metabolism and their laboratory diagnosis.

5) Clinical enzymology :

Enzymes of liver, cardiac and skeletal muscle.

Laboratory diagnosis of myocardial infarction.

Pancreatic enzymes.

6) Tumour markers.

7) Fluid and electrolyte homeostasis :

Maintenance of fluid and electrolyte balance

Associated disorders and laboratory diagnosis.

8) Hydrogen ion homeostasis :

Maintenance of pH

Associated disorders and laboratory diagnosis.

9) Renal function :

Disorders of renal function, including acute and chronic renal failure.

Laboratory assessment of renal function.

10) Laboratory assessment of gastrointestinal function :

Gastric function tests.
Pancreatic function tests.
Intestinal function tests.
Investigation of jaundice.
Investigation of hepatobiliary function.

11) Endocrinology :

Signal transduction due to neurotransmitters, hormones, growth factors, cytokines and rhodopsin.
Mechanisms of hormone action by interaction with intracellular and membrane – associated receptors.
Structure, functions, synthesis and regulation, metabolism, actions, associated disorders and laboratory assessment of various hormones produced by the hypothalamus, pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas, gastrointestinal tract and gonads.
Endocrine functions of kidney, heart, lungs and adipose tissue.
Placental hormones.
Biochemistry of conception, reproduction and contraception.

12) Mineral and bone metabolism :

Laboratory assessment of rickets, osteomalacia, osteoporosis.
Markers for osteoblasts and osteoclasts.
Hyper and hypocalcemia.
Disorders of magnesium.

13) Disorders of porphyrin metabolism :

Laboratory assessment of porphyrias.
Laboratory assessment of jaundice.

14) Cerebrospinal and other body fluids :

Analysis in health and disease.

15) Principles of hemo and peritoneal dialysis.**16) Immunology :**

Types of immunity.
Immunoglobulins – classification, functions, generation of antibody diversity (immunogenetics), multiple myeloma and other associated disorders, polyclonal and monoclonal antibodies and their applications.

17) Miscellaneous :

Neonatal screening for in-born errors in metabolism.
Prenatal diagnosis.
Fetal monitoring including fetal lung maturity.
Paediatric biochemistry.

Biochemistry in the elderly.
Lysosomal storage disorders.
Disorders of connective tissue.

18) Human Nutrition :

General nutritional requirements.
Energy requirements.
Macronutrients and their roles.
Biological value of proteins.
Specific dynamic actions.
Balanced diet.
Dietary fibre.
Dietary supplements.
Fortification of foods.
Food additives.
Food fads.
Vegetarianism.
Nutritional support.
Disorders of nutrition (protein malnutrition and protein energy malnutrition).
Biochemical assessment of nutritional status.
Laboratory diagnosis of nutritional disorders.
National Nutrition Programme.

LIST OF PRACTICALS

- 1) Reactions of carbohydrates, lipids, proteins and amino acids.
- 2) Chromatographic separation of sugars, amino acids and lipids.
- 3) Estimation of nitrogen in a protein.
- 4) Estimation of calcium and phosphorus in milk.
- 5) Haemoglobin and its derivatives.
- 6) Preparation and estimation of glycogen and casein from biological samples.
- 7) Determination of enzyme activity and kinetic properties of acid phosphatase and catalase.
- 8) Agarose gel electrophoresis.
- 9) Polyacrylamide gel electrophoresis (PAGE).
- 10) Experiments on milk.
- 11) Glucose estimation in plasma / serum.
- 12) Glucose tolerance test.
- 13) Estimation of cholesterol, triacylglycerol and lipoproteins in plasma.
- 14) Estimation of calcium, electrolytes, pH and blood gas.
- 15) Estimation of urea, uric acid, creatinine, ammonia in blood and urine.
- 16) Clearance studies.
- 17) Estimation of bilirubin, ALT, AST, GGT, cholinesterase, prothrombin time.
- 18) Estimation of copper, ceruloplasmin, lithium, iron, iron binding capacity, magnesium in serum.
- 19) T3 and T4 assays and TSH measurement.

- 20) Urinalysis for normal and abnormal constituents.
- 21) Estimation of 17-ketosteroids and vanillyl mandelic acid (VMA) in urine.
- 22) Analysis of gastric juice.
- 23) Analysis of renal and biliary calculi.
- 24) Estimation of LDH, phosphatases, amylase and creatine kinase in serum.
- 25) Separation of serum LDH isoenzymes by polyacrylamide gel electrophoresis.
- 26) Separation of serum alkaline phosphatase isoenzymes.
- 27) Estimation of ethanol in blood and urine.
- 28) CSF analysis for biochemical parameters.
- 29) Analysis of ascetic, pleural and other fluids.
- 30) Estimation of serum proteins.
- 31) Electrophoresis of serum proteins and lipoproteins.
- 32) Estimation of glycated haemoglobin.
- 33) Estimation of urine proteins.
- 34) Detection of Bence-Jones protein in urine.

PATTERN OF EXAMINATION :- *

FOUR PAPERS - 100 Marks each		3 Hours duration each	
<u>Theory</u>	<u>Title</u>	<u>Duration</u>	<u>Marks</u>
Paper – I	Physical and Organic aspects of Biochemistry, Instrumentation and Biochemical Techniques	3 hrs.	100
Paper – II	Enzymes, Intermediate Metabolism and Nutrition	3 hrs.	100
Paper – III	Clinical Biochemistry and Diagnostic Techniques	3 hrs.	100
Paper – IV	Recent Advances in Biochemistry and Molecular Biology.	3 hrs.	100
		Total	400

Distribution of Marks : **

2 Essays	2 x 20 =	40 Marks
10 Short Notes	10 x 6 =	60 Marks
	Total	100 Marks

* 30th SAB held on 28-12-2005 - March 2006 Examination onwards.

** 32nd SAB held on 21-12-2006 - March 2008 Examination onwards.

Practical Examinations :

These examinations will be held over 2 days. They should consist of 2 parts – Part I & II.

Part – I will consist of –

- | | | |
|----|---|--------------|
| 1) | General Biochemistry.
Qualitative identification of an unknown amino acids or sugar
and confirmation by chromatography | ... 30 marks |
| 2) | Preparation of a standard graph for a given analyte | ... 20 marks |
| 3) | Interpretation of clinical data (4 cases) from cases on
endocrine diseases, electrolyte and acid base disorders,
mineral metabolism, analysis of body fluids, lipid profile,
etc., to be given | ... 20 marks |

Part – II will consist of –

- | | | |
|-------|--|---------------|
| 1) | Clinical examination of a patient, making of a provisional
diagnosis and giving differential diagnosis, giving a list of
relevant investigations | ... 30 marks |
| 2) | Two to Three clinical biochemistry exercises, including
separation of proteins by electrophoresis | ... 100 marks |
| | Total | ... 200 marks |
| ----- | | |
| 3) | Pedagogy | ... 50 marks |
| 4) | Oral examination | ... 50 marks |
| | Total | ... 100 marks |
| ----- | | |

NOTE : No. of candidates to be examined 4 Per day for Practical/Viva

DISSERTATION :
(No Marks)

APPROVED / NOT APPROVED

** <u>MARKS QUALIFYING FOR A PASS</u>	<u>MAXIMUM MARKS</u>	<u>QUALIFYING FOR A PASS 50% MARKS</u>
Theory Examination	400	200
Practical Examination	200	100
Oral/Viva & Pedagogy (50+50)	100	No Minimum
	-----	-----
Aggregate	700	350

SUGGESTED TEXT BOOKS (latest editions recommended)

- 1) ALAN H. GOUENLOCK : Varley's Practical Clinical Biochemistry : 6/e – 1988.
- 2) BISHOP : Clinical Chemistry : 4/e – 2000.
- 3) CARL A. BURTIS : Tietz Fundamentals of Clinical Chemistry : 5/e – 2001.
- 4) DONALD VOET : Biochemistry : 2/e – 1997.
- 5) GEOFFERY M. COOPER : The Cell – A Modular Approach : 2/e – 2000.
- 6) HARPER : Illustrated Biochemistry : 26/e – 2003.
- 7) LEHNINGER : Principles of Biochemistry : 3/e – 2000`.
- 8) LIPPINCOTT'S : Illustrated reviews Biochemistry : 3/e – 2005.
- 9) LUBERT STRYER : Biochemistry : 4/e – 1995.
- 10) THOMAS M. DEVLIN : Text Book of Biochemistry with clinical correlations : 5/e – 2002.

SUGGESTED JOURNALS :-

- 1) Annual Review of Biochemistry.
- 2) Trends in Biochemical Sciences.
- 3) Nature.
- 4) Science.
- 5) Clinical Chemistry.
- 6) Lancet.
- 7) New England Journal of Medicine.

**** 33rd SAB held on 20-06-2007 - March 2008 Examination onwards.**

BRANCH – V M.S. (ANATOMY)

**GUIDELINES FOR COMPETENCY BASED POST GRADUATE TRAINING PROGRAMME
FOR M.S. ANATOMY**

Preamble :-

The purpose of this programme is to standardize Anatomy teaching at Post Graduate level through out the country so that it will benefit in achieving uniformity in undergraduate teaching as well. Accordingly the training in M.S. Anatomy should be distinctive from that in M.Sc., Ph.D., (Anatomy), where the approach to the subject is primarily experimental.

Programme Objectives :-

A candidate upon successfully qualifying in the M.S. (Anatomy) examinations should be able to :

- 1) Be a competent Anatomist.
- 2) Teach the undergraduate student gross anatomy, radiological anatomy, embryology, histology, neuroanatomy and elementary genetics.
- 3) Assess the students' understanding of the anatomical sciences.
- 4) Assess the undergraduate programmes.
- 5) Plan and modify the undergraduate curriculum.
- 6) Prepare the tissues for light microscopic study.
- 7) Enumerate the types of microscopes, their uses and their principles including electron microscope. Take care of maintenance of microscopes.
- 8) Embalm a cadaver.
- 9) Design Gross Anatomy and histology laboratories for teaching undergraduate and postgraduate students of Anatomy.
- 10) Plan and implement research programme.
- 11) Undertake histomorphometric studies.

Course Content :-

I) General Anatomy –

Tissues of the body, General osteology, Arthrology, Muscle & fascia, Nervous system, Principles governing arterial, Venous and lymphatic pathways, Innervation of blood vessels.

II) Gross Anatomy –

Detailed Gross Anatomy of the human body, including cross sectional anatomy. Anatomical basis of clinical conditions.

III) Embalming and Museum Techniques.

IV) Radiological Anatomy –

Principles involved in plain radiography, Special investigative procedures and newer imaging techniques such as ultrasound, CT – scans, MRI, PET, etc.

V) Embryology**General embryology –**

Special embryology of all the systems of the body including variations and congenital anomalies.

VI) Genetics –

Structure of chromosomes, Structure of gene, Karyotype, Chromosomal aberrations, Inheritance, Basic Molecular genetics, Common Genetic disorders.

VII) Comparative Anatomy**VIII) Histology –**

Histological and Museum Techniques, Microscopes – All Types, Care and maintenance of light microscope, General histology, Special histology of the systems of the body including their electronmicroscopic appearance.

IX) Neuroanatomy –

Structural organization of various parts of the nervous system with particular reference to their connections and functions.

Localisation & effects of lesions in different parts of the central nervous system and nerve injuries.

Neuroanatomical techniques for demonstration of Nissl substance, processes, myelin sheath.

X) Applied Anatomy including Radio Anatomy and Recent Advances -

- a) Applied aspects of Human Anatomy including Surgical Approaches to various structures and organs.
- b) Principles of Newer Imaging Techniques.
- c) Determination of age, sex, stature and race from skeletal remains.
- d) Determination of age of a living individual.
- e) Theoretical aspects of examination of Hair and Nail including differences between human and animal hairs.
- f) Application of Anatomical knowledge to fertility control.
- g) Sectional Anatomy.
- h) Principles and Interpretation of CT Scan, Sono Graphy and MRI.
- i) Surface Anatomy.
- j) Embalming Techniques including medico-legal aspects.

Post-Graduate Examinations :-

The Post-graduate examinations should be in 3 parts :

- 1) **Thesis, to be submitted by each candidate at least 6 months before the date of commencement of the theory examination.**
- 2) **Theory : There shall be four theory papers – as given separately.**
- 3) **Practicals and Viva/Oral.**

BRANCH –V M.S. (ANATOMY)**I. Period of Study (3 years) :-**

1 st year	-	Study of Anatomy, Dissertation topic decision and Clinical Postings.
2 nd year	-	1 st half – Decide on dissertation topic (and Clinical Postings if necessary). 2 nd half – Study of Anatomy & Dissertation.
3 rd year	-	Study of Anatomy.

II. Details of Clinical Training :-

Surgical Ward Posting	-	1 ½ months.
Medical Ward Posting	-	1 month.
Neurology Department	-	1 month.
Department of Biostatistics & Research Methodology	-	1 month.
Ultra Sonography, Body Scan, Doppler, Echo Cardiogram, Electron Microscopy	} -	1 ½ months. ----- 6 months. -----

III. Pattern of Examination :- *

FOUR PAPERS - 100 Marks each 3 Hours duration each

<u>Theory</u>	<u>Title</u>	<u>Duration</u>	<u>Marks</u>
Paper – I	Gross Anatomy	3 hrs.	100
Paper – II	Embryology and Genetics	3 hrs.	100
Paper – III	Histology, Neuroanatomy And Museum Techniques	3 hrs.	100
Paper – IV	Surgical Anatomy and Applied Anatomy and Recent Advances & Embalming techniques	3 hrs.	100
Total			----- 400

* 30th SAB held on 28-12-2005 - March 2006 Examination onwards.

Distribution of Marks : **

2 Essays	2 x 20 =	40 Marks
10 Short Notes	10 x 6 =	60 Marks

	Total	100 Marks

IV. Practical Examination - Practicals 1 ½ days.Day – 1

<u>Practicals</u>	<u>Session</u>	<u>Duration</u>	<u>Marks</u>
Practical – I Gross Anatomy (Dissection)	F.N.	3 hrs.]	75
Practical – II Histology	A.N.	3 hrs.]	

Break up Details (Practical – II) :-

Histology - 5 slides for spotters and discussion.
5 x 10 = 50 marks.

Section Cutting = 10 marks.

Staining of one
Paraffin section = 10 marks.

Embedding of one
Paraffin block = 5 marks.

75

Day – II

Practicals – III Embryology 2 Slides (2x10) = 20 marks	}	= 30 marks	50
Neuroanatomy 1 Slide			
Brain Dissection			
		-----	-----
	Total Practical Marks		200

Pedagogy (30 minutes) = 50 marks.

Oral/Viva = 50 marks.

NOTE : No. of candidates to be examined 4 Per day for Practical/Viva

** 32nd SAB held on 21-12-2006 - March 2008 Examination onwards.

V. DISSERTATION : **APPROVED / NOT APPROVED**
(No Marks)

VI. ** <u>MARKS QUALIFYING FOR A PASS</u>	<u>MAXIMUM MARKS</u>	<u>QUALIFYING FOR A PASS 50% MARKS</u>
Theory Examination	400	200
Practical Examination	200	100
Oral/Viva & Pedagogy (50+50)	100	No Minimum
Aggregate	700	350

RECOMMENDED LIST OF BOOKS

GROSS ANATOMY

- 1) Grays Anatomy
- 2) Essentials of Human Anatomy 3 Volume by A.K. Dutta.

EMBRYOLOGY

- 1) Human Embryology by W.J. Hamilton & H.W. Mossman.
- 2) Medical Embryology by Jan Langman.
- 3) Human Embryology by A.K. Dutta.
- 4) Human Embryology by Inderbir Singh.

GENETICS

- 1) Genetics in Medicine – J.S. Thompson & M.W. Thompson
- 2) Elements of Medical Genetics by Emery.

EMBALMING & MUSEUM TECHNIQUES

- 1) Anatomical Techniques by Tompsect.
- 2) Embalming Techniques by Dr. Jayavelu

NEURO ANATOMY

- 1) Human Nervous System – Ellis
 - 2) Clinical Neuro Anatomy by Snell.
 - 3) Text Book of Clinical Neuro Anatomy by Vishram Singh
 - 4) Neuro Anatomy by Inderbir Singh.
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**** 33rd SAB held on 20-06-2007 - March 2008 Examination onwards.**

OSTEOLOGY

- 1) Frazers Osteology

SURGICAL & APPLIED

- 1) Regional & Applied Anatomy by R.J. Last.
- 2) Anatomy for Surgeons W.H. Hollinshead Vol I, II & III
- 3) Synopsis of Surgical Anatomy D.J. Duplessis.

HISTOLOGY

- 1) Carltons Histological Techniques Drury R.A.B. Wallington E.A.
- 2) Ham's Histology
- 3) Text Book of Histology Bloom & Fawcett T.
- 4) Tissues of the body Lee Gross Clark.

COMPARATIVE ANATOMY by Rome R.**BIostatISTICS** - An introduction to Biostatistics.

A manual for students in Health Sciences P.S.S. Sunder Rao.

JOURNALS

- 1) Journal of Anatomical Society of India.
- 2) Journal of Anatomy London
- 3) Anatomical Record
- 4) American Journal of Anatomy
- 5) Clinical Adjuncts.
- 6) Anatomical Adjuncts.
- 7) Cells, Tissues & Organs (Formerly Acta Anatomica)
