

Revised Regulations and Curricula
For
Post Graduate Degree and Diploma Courses
in
Pre-Clinical Medical Sciences
2014



Rajiv Gandhi University of Health Sciences, Karnataka
4th 'T' Block, Jayanagar, Bangalore - 560 041

Revised Regulations and Curricula for Post Graduate Degree and Diploma
Courses in Pre-Clinical Medical Sciences

This book can be had from:
The Registrar
Rajiv Gandhi University of
Health Sciences, Karnataka
4th “T” Block, Jayanagar
Bangalore – 560041

Price: Rs. -----

**Revised Regulations and Curricula for Post Graduate Degree and Diploma Courses in
Pre-Clinical Medical Sciences**

(Annexure to University Notification No. AUTH/108Syn/ORD/006-007-008/2014-15

dated 16.09.2014)

Pre-Clinical Subjects

Contents

		Page No.
	Notification:	
Chapter I	: Regulations	8-22
Chapter II	: Goals and Objectives	22-24
Chapter III	: Course Description	
	M.D. Anatomy	25 -34
	M.D. Biochemistry	34-44
	M.D. Physiology	45-58
Chapter IV	: Monitoring Learning Progress	59-67
Chapter V	: Medical Ethics	68-70

Rajiv Gandhi University of Health Sciences, Karnataka, Bangalore

The Emblem



The Emblem of the Rajiv Gandhi University of Health Sciences is a symbolic expression of the confluence of both Eastern and Western Health Sciences. A central wand with entwined snakes symbolises Greek and Roman Gods of Health called Hermis and Mercury is adapted as symbol of modern medical science. The pot above depicts AmruthaKalasham of Dhanvanthri the father of all Health Sciences. The wings above it depict Human Soul called Hamsa (Swan) in Indian philosophy. The rising Sun at the top symbolises knowledge and enlightenment. The two twigs of leaves in western philosophy symbolises Olive branches, which is an expression of Peace, Love and Harmony. In Hindu Philosophy it depicts the Vanaspathi (also called as Oushadi) held in the hands of Dhanvanthri, which are the source of all Medicines. The lamp depicts human energy (kundalini). The script “DevahithamYadayahu” inside the lamp is taken from UpanishathShanthiManthram (BhadramKarnebhiShrunuyanadev...), which says “**May we live the full span of our lives allotted by God in perfect health**” which is the motto of the Rajiv Gandhi University of Health Sciences.

I. Rajiv Gandhi University of Health Sciences, Karnataka, Bangalore

Vision Statement

The Rajiv Gandhi University of Health Sciences, Karnataka, aims at bringing about a confluence of both Eastern and Western Health Sciences to enable the humankind “Live the full span of our lives allotted by God in Perfect Health”

It would strive for achievement of academic excellence by Educating and Training Health Professionals who

- ❖ Shall recognize health needs of community,
- ❖ Carry out professional obligations Ethically and Equitably and in keeping with National Health Policy,

It would promote development of scientific temper and Health Sciences Research.

It would encourage inculcation of Social Accountability amongst students, teachers and institutions.

It would Support Quality Assurance for all its educational programmes

Motto

Right for Rightful Health Sciences Education

No.AUTH/108Syn/ORD/006-007-008/2014-15

dated 16.09.2014

Notification

Sub: Revised Ordinance pertaining to Post Graduate Courses (Pre-Clinical Medical subject) course in Anatomy, Physiology and Biochemistry.

- Ref 1. Notification No: UA/ORD -6/1999-2000 dated 01.01.2000, for pre-clinical subjects.
 2. Minutes of the meeting of BOS Medicine (Pre-Clinical) (PG) held on 09/04/2014.
 3. Minutes of the meeting of Faculty of Medicine held on 06/06/2014.
 4. Minutes of the meeting of the Academic Council held on 19/06/2014.
 5. Minutes of the 108th meeting of the syndicate held on: 14/08/2014

In exercise of the powers conferred under 35(2) of the Rajiv Gandhi University of Health Science Act 1994, the Syndicate at its meeting held on 14/08/2014 has been pleased to approve the Revised Ordinance pertaining to Post Graduate Courses in Pre-Clinical Medical subjects –Anatomy, Physiology and Biochemistry as shown in the annexure appended herewith.

The revised ordinance shall come into force from the academic year 2014-15 and onwards.

By order

Sd/-
Registrar

To,

The Principles of all Medical Colleges conducting Medical PG courses, affiliated to RGUHS

Copy to:

1. The Secretary to Governor, Governor's Secretariat, Raj Bhavan, Bangalore – 56001
2. The Secretary to Government, Medical Education, Department of Health and Family Welfare, Vikasa Soudha, Bangalore -56001
3. All the member of the Syndicate/Senate/Academic Council
4. PA to VC/Registrar/Registrar (Evaluation)/Finance Officer
5. Programmer, Computer Section for Notification on the University Homepage on the internet, for general information of all interested.
6. Public Information Officer
7. Consultant, CDC/ DR Affiliation/DR Admission/ DR Examination
8. Guard File/Office Copy

Rajiv Gandhi University of Health Sciences, Karnataka, Bangalore.

Chapter I

**Revised Regulations and Curricula for Post Graduate Degree and Diploma Courses in
Pre-Clinical Medical Sciences**

1. Branches of Study

1.1 Postgraduate Degree Courses

The following courses of studies may be pursued.

A. *M.D. (Doctor of Medicine)* *M.S. (Master of Surgery)*

1. MD - Anaesthesiology
2. MD - Aviation Medicine
3. MD - Aviation Medicine/Aerospace Medicine
4. MD - Bio-Chemistry
5. MD - Bio-Physics
6. MD - CCM
7. MD - Community Health Administration
8. MD - Dermatology, Venereology & Leprosy
9. MD - Emergency Medicine
10. MD - Family Medicine
11. MD - Forensic Medicine/Forensic Medicine & Toxicology
12. MD - General Medicine
13. MD - Geriatrics
14. MD - Hospital Administration
15. MD - Immuno Haematology & Blood Transfusion
16. MD - Lab Medicine
17. MD - Maternity & Child Health
18. MD - Microbiology
19. MD - Nuclear Medicine
20. MD - Obstetrics & Gynaecology
21. MD - Paediatrics
22. MD - Palliative Medicine
23. MD - Pathology
24. MD - Pathology & Microbiology
25. MD - Pharmacology
26. MD - Physical Medicine & Rehabilitation
27. MD - Physiology
28. MD - Psychiatry
29. MD - Radio Diagnosis/Radiology
30. MD - Radiotherapy
31. MD - Rheumatology
32. MD - Social & Preventive Medicine / Community Medicine

33. MD - Sports Medicine
34. MD - Tropical Medicine
35. MD - Tuberculosis & Respiratory Diseases / Pulmonary Medicine
36. MD - Venereology
37. MD/MS - Anatomy
38. MD/MS - Obstetrics & Gynaecology
39. MD/MS - Ophthalmology
40. MD-Transfusion Medicine
41. MS - ENT
42. MS - General Surgery
43. MS – Orthopaedics

and such other subjects as might have been introduced by the Universities in Karnataka prior to commencement of Health University i.e., 1.6.1996, or recognised by Medical Council of India.

B. D.M. (Doctor of Medicine)

1. DM - Cardiac-Anaesthesia.
2. DM - Cardiology
3. DM - Clinical Haematology
4. DM - Clinical Immunology
5. DM - Clinical Pharmacology
6. DM - Critical Care Medicine
7. DM - Endocrinology
8. DM - Gastroenterology
9. DM - Geriatric Mental Health
10. DM - Haematology Pathology/Hematopathology
11. DM - Hepatology
12. DM - Immunology
13. DM - Infectious Disease
14. DM - Medical Genetics
15. DM - Neonatology
16. DM - Nephrology
17. DM - Neuro Anaesthesia
18. DM - Neuro Radiology
19. DM - Neurology
20. DM - Oncology
21. DM - Organ Transplant Anaesthesia & Critical Care
22. DM - Paediatric and Neonatal Anaesthesia
23. DM - Paediatric Critical Care
24. DM - Paediatric Haematology Oncology
25. DM - Paediatric Hepatology
26. DM - Paediatric Nephrology
27. DM - Paediatric Neurology
28. DM - Paediatric Oncology
29. DM - Paediatrics Cardiology

30. DM - Paediatrics Gastroenterology
31. DM - Pulmonary Medicine & Critical Care Medicine
32. DM - Pulmonary Medicine
33. DM - Reproductive Medicine
34. DM – Rheumatology

C. M.Ch (Master of Chirurgie)

1. M.Ch - Cardio Thoracic and Vascular Surgery
2. M.Ch - Cardio Thoracic Surgery
3. M.Ch - Endocrine Surgery
4. M.Ch - Gynaecological Oncology
5. M.Ch - HepatoPancreato Biliary Surgery
6. M.Ch - Neuro Surgery
7. M.Ch - Paediatric Surgery
8. M.Ch - Paediatric Cardio-Thoracic Vascular Surgery
9. M.Ch - Plastic Surgery
10. M.Ch - Surgical Gastroenterology/G.I. Surgery
11. M.Ch - Surgical Oncology
12. M.Ch - Thoracic Surgery
13. M.Ch - Urology/Genito-Urinary Surgery
14. M.Ch - Vascular Surgery
15. M.Ch. - Hand & Micro Surgery
16. M.Ch. - Hand Surgery
17. M.Ch. - Head and Neck Surgery

D. M.Sc (Master of Science)

1. M.Sc - Anatomy
2. M.Sc - Medical Anatomy
3. M.Sc - Medical Bacteriology
4. M.Sc - Medical Bio-chemistry
5. M.Sc - Medical Pathology
6. M.Sc - Medical Pharmacology
7. M.Sc - Pathology
8. M.Sc - Physiology

1.2 Postgraduate Diploma Courses

1. Diploma in Aviation Medicine
2. Diploma in Pathology & Bacteriology
3. Diploma (Marine Medicine)
4. Diploma in Dermatology, Venereology and Leprosy
5. Diploma in Allergy & Clinical Immunology
6. Diploma in Anaesthesia
7. Diploma in Bacteriology
8. Diploma in Basic Medical Sciences (Anatomy)

9. Diploma in Basic Medical Sciences (Pharmacology)
10. Diploma in Basic Medical Sciences (Physiology)
11. Diploma in Cardiology
12. Diploma in Child Health
13. Diploma in Clinical Pathology
14. Diploma in Community Medicine
15. Diploma in Dermatology
16. Diploma in Diabetology
17. Diploma in Forensic Medicine
18. Diploma in Health Education
19. Diploma in Health Administration
20. Diploma in Hospital Administration
21. Diploma in Immuno-Haematology and Blood Transfusion
22. Diploma in Industrial Health
23. Diploma in Industrial Hygiene
24. Diploma in Leprosy
25. Diploma in Maternity & Child Welfare
26. Diploma in Medical Radiology & Electrology
27. Diploma in Medical Virology
28. Diploma in Microbiology
29. Diploma in Obstetrics & Gynaecology
30. Diploma in Occupational Health
31. Diploma in Ophthalmology
32. Diploma in Orthopaedics
33. Diploma in Oto-Rhino-Laryngology
34. Diploma in Paediatrics
35. Diploma in Physical Medicine & Rehabilitation
36. Diploma in Psychological Medicine
37. Diploma in Public Health
38. Diploma in Radiation Medicine
39. Diploma in Radio Therapy
40. Diploma in Radio-Diagnosis
41. Diploma in Sports Medicine
42. Diploma in Tropical Medicine Health
43. Diploma in Tuberculosis & Chest Diseases
44. Diploma in Venereology

and such other subjects as might have been introduced by the Universities in Karnataka prior to commencement of Health University i.e., 1-6-1996, and recognised by Medical Council of India.

1.3 Post-doctoral certificate courses (PDCC)

1. PDCC - Aphaeresis Technology and Blood Component Therapy
2. PDCC - Cardiac-Anaesthesia
3. PDCC - Critical Care Medicine
4. PDCC - Gastro-Radiology

5. PDCC - Haemato-Oncology
6. PDCC - Infectious Diseases
7. PDCC - Interventional Radiology
8. PDCC - Laboratory Immunology
9. PDCC - Neuro-Anaesthesia
10. PDCC - Neuro-Radiology
11. PDCC - Nuclear Nephrology
12. PDCC - Organ Transplant Anaesthesia
13. PDCC - Paediatric Endocrinology
14. PDCC - Paediatric ENT
15. PDCC - Paediatric Gastroenterology
16. PDCC - Pain Management
17. PDCC - Renal Pathology
18. PDCC - Spine Surgery

1.4 PhD programmes (Doctor of Philosophy)

1. Ph. D - Anesthesia
2. Ph. D - Anatomy
3. Ph. D - Bio- Chemistry
4. Ph. D - Bio-Statistics
5. Ph. D - Bio-Technology
6. Ph. D - Cardio Thoracic & Vascular Surgery
7. Ph. D - Cardiology
8. Ph. D - Community Medicine
9. Ph. D - Dermatology & Venereology
10. Ph. D - Endocrinology & Metabolism
11. Ph. D - ENT
12. Ph. D - Forensic Medicine
13. Ph. D - Gastro & Human Nutrition Unit
14. Ph. D - Gastrointestinal Surgery
15. Ph. D - Haematology
16. Ph. D - Histo Compatibility & Immunogenetics
17. Ph. D - Hospital Administration
18. Ph. D - Lab Medicine
19. Ph. D - Medical Biochemistry
20. Ph. D - Medical Oncology
21. Ph. D - Medical Physics
22. Ph. D - Medicine
23. Ph. D - Microbiology
24. Ph. D - Nephrology
25. Ph. D - Neuro Magnetic Resonance
26. Ph. D - Neuro Surgery
27. Ph. D - Neurology
28. Ph. D - Nuclear Medicine
29. Ph. D - Obst. & Gynae
30. Ph. D - Ocular Bio Chemistry

31. Ph. D - Ocular Microbiology
32. Ph. D - Ocular Pharmacology
33. Ph. D - Orthopedics
34. Ph. D - Pediatrics
35. Ph. D - Pediatric Surgery
36. Ph. D - Pathology
37. Ph. D - Physical Medicine & Rehabilitation
38. Ph. D - Physiology
39. Ph. D - Psychiatry
40. Ph. D - Radio Diagnosis
41. Ph. D - Radiotherapy
42. Ph. D - Surgery
43. Ph. D - Urology
44. Ph. D-Pharmacology

1.5 Fellowship Programmes

1. F.C.P.S. (Medicine)
2. F.C.P.S. (Mid. & Gynae)
3. F.C.P.S. (Ophthalmology)
4. F.C.P.S. (Pathology)
5. F.C.P.S. (Surgery)
6. M C P S

2. Eligibility for Admission

2.1 MD / MS Degree and Diploma Courses: A candidate affiliated to this university and who has passed final year M.B.B.S. examination after pursuing a study in a medical college recognised by the Medical Council of India, from a recognised Medical College affiliated to any other University recognised as equivalent thereto, and has completed one year compulsory rotating internship in a teaching Institution or other Institution recognised by the Medical Council of India, and has obtained permanent registration of any State Medical Council shall be eligible for admission.

2.2 D.M and M.Ch Courses:

D.M.: Candidate seeking admission for D.M courses in any subject must possess recognised degree of MD (or its equivalent recognised degree) in the subject specified in the regulations of the Medical Council of India from time to time.

M.Ch : Candidate seeking admission for M.Ch course in any subject must possess recognised degree of MS (or its equivalent recognised degree) in the subject specified in the regulations of the Medical Council of India from time to time.

3. Obtaining Eligibility Certificate by the University before making Admission

No candidate shall be admitted for any postgraduate degree/diploma course unless the candidate has obtained and produced the eligibility certificate issued by the University. The candidate has to make an application to the University with the following documents along with the prescribed fee:

1. MBBS pass / degree certificate issued by the University.
2. Marks cards of all the university examinations passed MBBS course.
3. Attempt Certificate issued by the Principal.
4. Certificate regarding the recognition of the medical college by the Medical Council of India.
5. Completion of internship certificate.
6. In case internship was done in a non-teaching hospital, a certificate from the Medical Council of India that the hospital has been recognised for internship.
7. Registration by any State Medical Council and
8. Proof of SC/ ST or Category I, as the case may be.

Candidates should obtain the Eligibility Certificate before the last date for admission as notified by the University.

A candidate who has been admitted to postgraduate course should register his / her name in the University within a month of admission after paying the registration fee.

4. Intake of Students

The intake of students to each course shall be in accordance with the ordinance in this behalf.

5. Duration of Study

a) M.D /M.S Degree Courses

The course of study shall be for a period of 3 years consisting of 6 terms.

b) D.M /M.Ch

The courses of study shall be for a period of 3 years consisting of 6 terms.

c) Diploma courses:

The course of study shall be for a period of 2 years consisting of 4 terms.

6. Method of training

The training of postgraduate for degree/diploma shall be residency pattern with graded responsibilities in the management and treatment of patients entrusted to his/her care. The participation of the students in all facets of educational process is essential. Every candidate should take part in seminars, group discussions, grand rounds, case demonstration, clinics, journal review meetings, CPC and clinical meetings. Every candidate should be required to participate in the teaching and training programme of undergraduate students. Training should

include involvement in laboratory and experimental work, and research studies. Basic medical sciences students should be posted to allied and relevant clinical departments or institutions. Similarly, clinical subjects' students should be posted to basic medical sciences and allied speciality departments or institutions.

7. Attendance, Progress and Conduct

7.1 A candidate pursuing degree/diploma course should work in the concerned department of the institution for the full period as a full time student. No candidate is permitted to run a clinic/laboratory/nursing home while studying postgraduate course.

7.2 Each year shall be taken as a unit for the purpose of calculating attendance.

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

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

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

8. Monitoring Progress of Studies:

8.1 *Work diary / Log Book* - Every candidate shall maintain a work diary and record of his/her participation in the training programmes conducted by the department such as journal reviews, seminars, etc. (please see Chapter IV for model checklists and logbook specimen copy). Special mention may be made of the presentations by the candidate as well as details of clinical or laboratory procedures, if any conducted by the candidate. The work diary shall be scrutinised and certified by the Head of the Department and Head of the Institution, and presented in the university practical/clinical examination.

8.2 *Periodic tests:* In case of degree courses of three years duration (MD/MS, DM, MCh.), the concerned departments may conduct three tests, two of them be annual tests, one at the end of first year and the other in the second year. The third test may be held three months before the final examination. The tests may include written papers, practicals / clinicals and viva voce. Records and marks obtained in such tests will be maintained by the Head of the Department and sent to the University, when called for.

In case of diploma courses of two years duration, the concerned departments may conduct two tests, one of them be at the end of first year and the other in the second

year three months before the final examination. The tests may include written papers, practicals / clinicals and viva voce.

8.3 *Records*: Records and marks obtained in tests will be maintained by the Head of the Department and will be made available to the University or MCI.

9. Dissertation

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

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

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

9.4 Such synopsis will be reviewed and the dissertation topic will be registered by the University. No change in the dissertation topic or guide shall be made without prior approval of the University.

9.5 The dissertation should be written under the following headings:

- i. Introduction
- ii. Aims or Objectives of study
- iii. Review of Literature
- iv. Material and Methods
- v. Results
- vi. Discussion
- vii. Conclusion
- viii. Summary
- ix. References
- x. Tables
- xi. Annexures

9.6 The written text of dissertation shall be not less than 50 pages and shall not exceed 150 pages excluding references, tables, questionnaires and other annexures. It should be neatly typed in double line spacing on one side of paper (A4 size, 8.27" x 11.69") and bound properly. Spiral binding should be avoided. A declaration by the candidate that

the work was done by him/her should be included. It should be endorsed and certified by the guide, head of the department and head of the institution.

9.7 Four copies of dissertation thus prepared shall be submitted to the Registrar (Evaluation) along with a CD, through proper channel, six months before final examination on or before the dates notified by the University.

9.8 The dissertation shall be valued by examiners appointed by the University. Approval of dissertation work is an essential precondition for a candidate to appear in the University examination. Grades will be awarded to the dissertation as under:

A	:	Excellent > 70%
B	:	Good 60 - 70%
C	:	Satisfactory 50-60 %
D	:	Not Satisfactory <50%

Could be accepted if there is possibility to provide corrections within the next 2 months and submit. **If not accepted:** candidate to take up theory exam after 6 months with submission of thesis. To be informed to the candidate before the exam fees is paid. The thesis evaluation report of the students to be sent to the college from the university before student writes the university theory exam.

9.9 Guide: The academic qualification and teaching experience required for recognition by this University as a guide for dissertation work is as per Medical Council of India Minimum Qualifications for Teachers in Medical Institutions Regulations, 1998. Teachers in a medical college/institution having a total of eight years teaching experience out of which at least five years teaching experience as Lecturer or Assistant Professor gained after obtaining postgraduate degree shall be recognised as post graduate teachers.

A **Co-guide** may be included provided the work requires substantial contribution from a sister department or from another medical institution recognised for teaching/training by Rajiv Gandhi University of Health Sciences/Medical Council of India. The co-guide shall be a recognised postgraduate teacher of Rajiv Gandhi University of Health Sciences.

9.10 Change of guide: In the event of a registered guide leaving the college for any reason or in the event of death of guide, guide may be changed with prior permission from the university.

10. Schedule of Examination

The examination for M.D / M.S courses shall be held at the end of three academic years (six academic terms). The examination for D.M and M.Ch courses shall be held at the end of three years. The examination for the diploma courses shall be held at the end of two academic years (four academic terms). The university shall conduct two examinations in a year at an

interval of four to six months between the two examinations. Not more than two examinations shall be conducted in an academic year.

11. Scheme of Examination

11.1 M.D. / M.S. Degree

M.D. / M.S. Degree examinations in any subject shall consist of dissertation, written paper (Theory), Practical/Clinical and Viva voce.

11.1.1 Dissertation: Every candidate shall carryout work and submit a dissertation as indicated in Sl.NO.9. Acceptance of dissertation shall be a precondition for the candidate to appear for the final examination.

11.1.2 Written Examination (Theory): A written examination shall consist of **four** question papers, each of **three** hours duration. Each paper shall carry 100 marks.

Out of the **four** papers,

- Paper I in clinical subjects will be on applied aspects of basic medical sciences.
- Paper I will also include question on research methodology carrying 10 marks for all the subjects.(Preclinical, Paraclinical, and Clinical subjects).
- Recent advances may be asked in any or all the four papers.
- Reasoning type of questions shall be included in all or any of the question papers.
- Examiners shall be instructed to allot 25% of the marks for each paper to recent advances in that area
- The questions shall be structured. Open ended questions shall be avoided.

Model question papers (I-IV) based on the above recommendations may be prepared and sent to the paper-setter along with the syllabus. Subheadings for the model answers are to be provided by the paper-setter.

11.1.3 Practical / Clinical Examination:

In case of practical examination, it should be aimed at assessing competence and skills of techniques and procedures as well as testing students ability to make relevant and valid observations, interpretations and inference of laboratory or experimental work relating to his/her subject.

In case of clinical examination, it should aim at examining clinical skills and competence of candidates for undertaking independent work as a specialist. Each candidate should examine at least one long case and **two** short cases.

The total marks for practical / clinical examination shall be 200.

11.1.4 Viva Voce: Viva Voce Examination shall aim at assessing depth of knowledge, logical reasoning, confidence and oral communication skills. The total marks shall be 100 and the distribution of marks shall be as under:

- (i) For examination of all components of syllabus including dissertation topic

80 Marks

(ii) For Pedagogy

20 Marks

A model checklist for the evaluation of the pedagogy session is provided.

RGUHS MD/MS Postgraduate Viva Examination
Assessment /Evaluation of PEDAGOGY

Name of the candidate:

Date:

Register No

Centre:

Topic:

Max. Marks: 20

Skill		Name of the Examiner
Set induction (1.5 marks)	<ul style="list-style-type: none"> • Aroused interest in the beginning by relating to previous learning, throwing a new idea, questioning, etc • Specified the objectives of presentation 	
Planning (5 marks)	<ul style="list-style-type: none"> • Organized material in a logical sequence • Used relevant content matter 	
Presentation (5 marks)	<ul style="list-style-type: none"> • Changed the pace of presentation by shifting emphasis, joke, etc • Used specific example to illustrate main ideas • Used non-verbal cues, eye contact, etc 	
Pupil participation (5 marks)	<ul style="list-style-type: none"> • Allowed questions from students • Asked question • Solicited/Raised questions • Rewarded pupil effort 	
Use of AV aids (2.5 marks)	<ul style="list-style-type: none"> • Used proper AV aids • used the aid(s) effectively 	
Closure (1 mark)	<ul style="list-style-type: none"> • Summarized most important points at the end of the session 	
Overall marks _____ (out of 20)		
		Signature of the Examiner

11.1.5 Examiners: There shall be at least four examiners in each subject. Out of them two shall be external examiners and two shall be internal examiners. The qualification and teaching experience for appointment as an examiner shall be as laid down by the Medical Council of India.

11.1.6 Criteria for declaring as pass in University Examination:* A candidate shall secure not less than 50% marks in each head of passing which shall include (1) Theory, (2) Practical including clinical and viva voce examination.

A candidate securing less than 50% of marks as described above shall be declared to have failed in the examination. Failed candidate may appear in any subsequent examination upon payment of fresh fee to the Registrar (Evaluation).

* Amended as per notification UA/ORD-6/99-2000 dated 9.4.2001

11.1.7 Declaration of distinction: A successful candidate passing the University examination in first attempt will be declared to have passed the examination with distinction, if the grand total aggregate marks is 75 percent and above. Distinction will not be awarded for candidates passing the examination in more than one attempt.

11.2 D.M / M.Ch:

The examination shall consist of theory, clinical/practical and viva voce examination.

11.2.1 (Theory) (Written Examination): The theory examination shall consist of **four** question papers, each of **three** hours duration. Each paper shall carry 100 marks. Out of the **four** papers, the first paper will be on basic medical sciences. Recent advances may be asked in any or all the papers.

11.2.2 Practical / Clinical Examination:

In case of practical examination it should be aimed at assessing competence, skills of techniques and procedures as well as testing student's ability to make relevant and valid observations, interpretation and experimental work relevant to his / her subject.

In case of clinical examination it should aim at examining clinical skills and competence of candidates for undertaking independent work as a specialist. Each candidate should examine at least one long case and two short cases.

The maximum marks for Practical / Clinical shall be 200.

11.2.3 Viva Voce: Viva Voce examination shall aim at assessing thoroughly depth of knowledge, logical reasoning, confidence and oral communication skills. The maximum marks shall be 100.

11.2.4 Examiners: There shall be at least four examiners in each subject. Out of them, two shall be external examiners and two shall be internal examiners. The qualification

and teaching experience for appointment as an examiner shall be as laid down by the Medical Council of India.

11.2.5 Criteria for declaring as pass in University Examination*: A candidate shall secure not less than 50% marks in each head of passing which shall include (1) Theory, (2) Practical including clinical and viva voce examination.

A candidate securing less than 50% of marks as described above shall be declared to have failed in the examination. Failed candidate may appear in any subsequent examination upon payment of fresh fee to the Registrar (Evaluation).

* Amended as per notification UA/ORD-6/99-2000 dated 9.4.2001

11.3 Diploma Examination:

Diploma examination in any subject shall consist of theory (written papers), Practical / Clinical and Viva - Voce.

11.3.1 Theory: There shall be **three** written question papers each carrying 100 marks. Each paper will be of **three** hours duration. In clinical subjects paper I shall have questions on Applied and basic medical sciences. In basic medical subjects and para clinical subjects, questions on applied clinical aspects should also be asked.

11.3.2 Practical / Clinical Examination:

In case of practical examination it should be aimed at assessing competence, skills related to laboratory procedures as well as testing students ability to make relevant and valid observations, interpretation of laboratory or experimental work relevant to his/her subject.

In case of clinical examination, it should aim at examining clinical skills and competence of candidates for undertaking independent work as a specialist. Each candidate should examine at least one long case and two short cases.

The maximum marks for practical / Clinical shall be 150.

11.3.3 Viva Voce Examination: Viva Voce examination should aim at assessing depth of knowledge, logical reasoning, confidence and oral communication skills. The total marks shall be 50.

11.3.4 Criteria for Pass: Criteria for declaring as pass in University Examination*: A candidate shall secure not less than 50% marks in each head of passing which shall include (1) Theory, (2) Practical including clinical and viva voce examination.

A candidate securing less than 50% of marks as described above shall be declared to have failed in the examination. Failed candidate may appear in any subsequent examination upon payment of fresh fee to the Registrar (Evaluation).

11. 3.5 Declaration of distinction: A successful candidate passing the University examination in first attempt will be declared to have passed the examination with distinction, if the grand total aggregate marks is 75 percent and above. Distinction will not be awarded for candidates passing the examination in more than one attempt.

11.3.6 Examiners: There shall be at least four examiners in each subject. Out of them, two shall be external examiners and two shall be internal examiners. The qualification and teaching experience for appointment as an examiner shall be as laid down by the Medical Council of India.

* Amended as per notification UA/ORD-6/99-2000 dated 9.4.2001

12. Number of Candidates per day. The maximum number of candidates for practical/clinical and viva-voce examination shall be as under:

MD / MS Course: Maximum of 6 per day

Diploma Course: Maximum of 8 per day

DM / M.Ch Course: Maximum of 3 per day

CHAPTER II

Goals and General Objectives of Postgraduate Medical Education Program

Goal

The goal of postgraduate medical education shall be to produce competent specialist and /or Medical teacher:

- (i) who shall recognise the health needs of the community, and carry out professional obligations ethically and in keeping with the objectives of the national health policy;
- (ii) who shall have mastered most of the competencies, pertaining to the specialty, that are required to be practiced at the secondary and the tertiary levels of the health care delivery system:
- (iii) who shall be aware of the contemporary advances and developments in the discipline concerned;
- (iv) who shall have acquired a spirit of scientific inquiry and is oriented to the principles of research methodology and epidemiology; and
- (v) who shall have acquired the basic skills in teaching of the medical and paramedical professionals.

General Objectives

At the end of the postgraduate training in the discipline concerned the student shall be able to:

- i) Recognise the importance of the concerned speciality in the context of the health need of the community and the national priorities in the health sector.
- ii) Practice the speciality concerned ethically and in step with the principles of primary health care.
- iii) Demonstrate sufficient understanding of the basic sciences relevant to the concerned speciality.
- iv) Identify social, economic, environmental, biological and emotional determinants of health in a given case, and take them into account while planning therapeutic, rehabilitative, preventive and promotive measures/strategies.
- v) Diagnose and manage majority of the conditions in the speciality concerned on the basis of clinical assessment, and appropriately selected and conducted investigations.
- vi) Plan and advice measures for the prevention and rehabilitation of patients suffering from disease and disability related to the speciality.

- vii) Demonstrate skills in documentation of individual case details as well as morbidity and mortality data relevant to the assigned situation.
- viii) Demonstrate empty and humane approach towards patients and their families and exhibit interpersonal behaviour in accordance with the societal norms and expectations.
- ix) Play the assigned role in the implementation of national health programmes, effectively and responsibly.
- x) Organise and supervise the chosen/assigned health care services demonstrating adequate managerial skills in the clinic/hospital or the field situation.
- xi) Develop skills as a self-directed learner, recognise continuing educational needs; select and use appropriate learning resources.
- xii) Demonstrate competence in basic concepts of research methodology and epidemiology, and be able to critically analyse relevant published research literature.
- xiii) Develop skills in using educational methods and techniques as applicable to the teaching of medical/nursing students, general physicians and paramedical health workers.
- xiv) Function as an effective leader of a health team engaged in health care, research or training.

Statement of the Competencies

Keeping in view the general objectives of postgraduate training, each disciplines shall aim at development of specific competencies, which shall be defined and spelt out in clear terms. Each department shall produce a statement and bring it to the notice of the trainees in the beginning of the programme so that he or she can direct the efforts towards the attainment of these competencies.

Components of the PG Curriculum

The major components of the PG curriculum shall be:

- Theoretical knowledge
- Practical/clinical Skills
- Training in Thesis.
- Attitudes, including communication.
- Training in research methodology.

Source: Medical Council of India, Regulations on postgraduate medical education, 1997.

CHAPTER III

Subject wise Course Description

Curriculum

Pre-clinical Subjects

M.D.ANATOMY

I. **Goal** : The Postgraduate course M.D (Anatomy) should enable a medical graduate to become a competent specialist, acquire knowledge and skills in educational technology for teaching medical, dental and health sciences and conduct research in bio-medical sciences.

II. **Objectives**: At the end of the course, a Postgraduate in Anatomy shall be able to

1. Demonstrate comprehensive knowledge and understanding of gross and microscopic structure of human body and skills to demonstrate special dissection and histological and histochemical techniques.
2. Comprehend normal disposition, interrelationships, functional and applied anatomy of the various structures of the body.
3. Describe development of human body to provide an anatomical basis for understanding the structure and correlate with functions both in health and in disease presentations.
4. Demonstrate knowledge of basic and systemic embryology including genetic inheritance and sequential developments of organs and systems.
5. Recognize critical stages of development and the effects of common teratogens, genetic mutations and environmental hazards.
6. Explain developmental basis of major variations and abnormalities.
7. Aware of contemporary advances and developments in anatomy and related bio-medical field.
8. Demonstrate competence in basic concepts of research and acquire a spirit of enquiry in research.
9. Critically evaluate published research literature.
10. Recognize continuing educational needs and develop skills as a self-directed learner.
11. Select and use appropriate learning resources and teaching techniques as applicable for teaching and evaluation of medical and allied health science students.
12. Carryout professional obligations ethically and in keeping with objectives of National Health Policy.
13. Function as an effective member in health care, research and training.

14. Exhibit interpersonal behavior in accordance with social norms and expectations.
15. Acquire knowledge relating to latest non-invasive techniques like X-rays, CT scan, MRI, Ultrasound and their interpretation in health and disease conditions.
16. Describe the methodology, techniques of embalming, preservation of cadavers and museum techniques and perform the procedures.
17. Describe and interpret Anatomy Act as in existence.
18. To incorporate PBL training under different sections during PG training. One such example is Museum setting.
19. To undergo training in evaluation and preparation of blue print for question paper setting.
20. Preferably attend a PGMET (PG medical education technology) course.

III. Outline of Course Contents

A. Theory

1. History of Anatomy
2. General Anatomy
3. Basics of Research methodology
4. Elements of Anatomy
5. Gross Human Anatomy including Cross Sectional Anatomy and Applied Anatomy
6. Principles of Microscopy and Histological techniques.
7. General and Systemic Histology
8. General, and Systemic Embryology including Growth, Development and Teratology
9. Neuro Anatomy
10. Surface Anatomy
11. Radiological Anatomy including Principles of newer techniques and interpretation of CT Scan, Sonography and MRI
12. Human Genetics.
13. Museum Techniques, embalming techniques including medico legal aspects, and knowledge of Anatomy Act
14. Medical ethics
15. Recent Advances in Anatomy
16. To incorporate PBL training under different sections during PG training.

B. Practical schedule

1. During the course-the PG students should dissect the entire human cadaver
2. They should embalm and maintain the record of embalming work done
3. They should prepare and mount at least 10 museum specimens
4. In Histology section

Collection of tissues, fixing, block making, section cutting: use of different types of microtomes and preparation of general and systemic slides

Haemotoxylin& Eosin –

- i. Preparation of stains
 - ii. Staining techniques
- Knowledge of special staining techniques like Silver Nitrate, PAS staining, Osmium Tetroxide, Van Gieson etc..
 - Knowledge of light Microscope and electron microscope
 - Detailed microscopic study of all the tissues (General and Systemic slides)

IV. Method of Training

The candidate shall attend all the Undergraduate Theory and Practical Classes regularly. Rotation postings of PG students shall be made in all II and III years of the course as follows: Objectives of these postings – to learn the following from the respective postings

1. General Surgery	1 week
2. Orthopedics	1 weeks
3. Radio diagnosis	1 week
4. Pediatric surgery	1 week
5. Pathology	2 weeks
6. Forensic Medicine	1 week
7. Genetics / Pediatrics	2 weeks

If Genetics not available in parent institution, should be posted to recognized genetics labs.

Suggestions: Genetics labs in Bangalore.

- a. Gunasheela Infertility clinic
- b. Desai Nursing Home
- c. Lalbagh Nursing Home
- d. Rao's Clinical Laboratory, Rajajinagar

Learning Objectives

i. Pathology

- i. Special staining techniques at least one hands on experience.
- ii. Principle of Frozen microtomy or Cryostat, Electron microscopy
- iii. (Where feasible – one day visit to an electron microscopy lab – eg. In medical colleges located within city limits or nearby)

ii. Forensic Medicine

- i. Anthropometry and age estimation
- ii. If embalming if not available in Anatomy department, it should be learnt in Forensic Medicine
- iii. Any other topics relevant to Anatomy

- iii. **Radio diagnosis** - Principles and recent advances in the following: CT, MRI, USG plain & contrast radiography
- iv. **General Surgery** - Laparoscopic and Endoscopic visualization of viscera
- v. **Orthopaedics** - Arthroscopic visualization of structures, nerve injury cases etc.,
- vi. **Genetics / Paediatric Surgery** - Syndromes and Karyotyping, Counseling

At the end of the posting, a certificate has to be obtained from the concerned heads of the departments for satisfactory learning.

During the three years of the course, the Postgraduate students shall take part in teaching undergraduate students in gross anatomy, histology, tutorials, group discussions and seminars

IV. Seminars & Journals Review Meetings

The postgraduate students should actively participate in departmental seminar and journal reviews. A record showing the involvement of the student shall be maintained. A diary should be maintained. Seminars journal review are suggested to be conducted alternatively once in every 15 days.

These are to be assessed by the faculty as per the RGUHS curriculum assessment form

V. Maintenance of Record of Work Done

1. A diary showing each day/s work has to be maintained by the candidate, which shall be submitted to the head of the department for scrutiny on the first working day of the each month.
2. A practical record of work done in Histology and Gross Anatomy with an emphasis on Cross sectional Anatomy has to be maintained by the candidate and duly scrutinized and certified by the head of the department and to be submitted to the external examiner during the final examination.
3. A list of the seminars and journal clubs that have been attended and participated by the student has to be maintained which should be scrutinized by the head of the department.
4. Two presentations in conference to be made mandatory, during PG course

VI. Periodical Assessment and Progress Report

The post graduate students have to be assessed periodically by conducting written, practical and viva voce examination at the end of every year. The assessment should be based also on participation in seminars, journal review, and performance in the teaching and use of teaching aids and progress in dissertation work. Checklists are given in chapter IV for the assessments.

The assessment will be done by all the recognized P.G. teachers of the department and the progress record should be maintained by the head of the department.

VII. Dissertation work

During the course of study every candidate has to prepare a dissertation individually, on a selected topic under the direct guidance and supervision of a recognized postgraduate teacher as per MCI and RGUHS regulations.

The suggested time schedule for dissertation work is:

1. Preparation work for dissertation synopsis including pilot study and submission of the synopsis to the University within 6 months from the commencement of course or as per the dates notified by the University from time to time.
2. Data collection for the dissertation and writing the dissertation.
3. The candidates shall report the progress of the dissertation work to the concerned guide periodically and obtain clearance for the continuation of the dissertation work.
4. Submission of the dissertation six months prior to the final examination or as per the dates notified by the University from time to time.

Registration of dissertation topic.

Every candidate shall submit a synopsis in the prescribed proforma for registration of dissertation topic by the University after it is scrutinized by the PG training cum Research Committee of the concerned institution. The synopsis shall be sent within the first 6 months from the commencement of the course or as notified by the University in the calendar of events, to the Registrar .For details see chapter 1, sl no 9.

Submission of dissertation

The dissertation shall be submitted to the Registrar (Evaluation) of the University six months prior to the final examination or as notified in the calendar of events. Approval of the dissertation by the panel of examiners is a prerequisite for a candidate to appear for the University examination. (For further details see sl.no.9 in chapter 1).

IX. Scheme for Evaluation

A. Theory – 400 marks

The written examination consists of four papers, with maximum marks of 100 for each paper. Each paper will be of three hours duration.

Each paper shall have 2 long essay questions of 20 marks (20x2= 40). And six short essay questions of 10 marks (10x6=60).

Paper- I:

- a. History of Anatomy
- b. General Anatomy and Basics of Research methodology
- c. General and Elements of Anatomy
- d. Gross Anatomy with applied aspects

Paper- II:

- a. General & systemic – Embryology including growth, development and Teratology

Paper –III:

- a. General & Systemic – Histology and Principles of Microscopy

- b. Histological, museum and embalming techniques including medico legal aspects.
- c. Human Genetics.

Paper- IV:

- a. Neuroanatomy.
- b. Applied Anatomy, Cross Sectional Anatomy, Radiological Anatomy and Newer Imaging Techniques.
- c. Recent advances in Anatomy.

Questions on recent advances may be asked in any or all papers*

*The topics assigned to the different papers are given as general guidelines. A strict division of the subjects may not be possible. Some overlapping of topics is inevitable. Students should be prepared to answer the overlapping topics.

Preferably one question based on problem based learning in paper IV- Applied Anatomy.

At least 50% of the questions in each paper can be application based.

Questions should be structured so that evaluation is better, unbiased and uniform.

B. Practicals - 200 marks(Gross Anatomy – 100 marks, Histology – 100 marks).

i) Gross Anatomy

To dissect in 3 hours and display for discussion the allotted dissection exercise on a human cadaver.

Distribution of Marks.

Surface Anatomy= 10

Dissection= 40

Discussion= 50

Total= 100 marks

ii) Histology

1	Identification and discussion 10 stained sections which includes Neuroanatomy, Embryology and Human Genetics	10 x 4 = 40 marks
	i) Preparation of a paraffin block	10 marks
	ii) Taking serial sections from blocks provided	10 marks
	iii) Staining of given section with H & E and discussion	20 marks
	Discussion on Histological techniques	20 marks
	Total	100 marks

C. Viva Voce -100 marks

1. This includes all the components of the syllabus along with specimens, skiagrams, including newer imaging techniques, bones and embryology models including a

problem solving exercise and discussion on dissertation topic submitted for the examination (80 Marks).

2. Pedagogy: Demonstration of teaching skill / techniques (20 Marks.)

Maximum marks	Theory	Practicals	Viva – voce	Total
M.D. (Anatomy) Examination.	400	200	100	700

Requirement for passing – Aggregate of 50% overall in theory papers. (Viva marks not to be added to theory for passing).

Similarly minimum of 50% in viva and 50% in practical.

X. Recommended Text, Reference books and Journals

The Edition and Year of Publication listed here is current and latest, to a large extent. GROSS ANATOMY

1. Susan STamdring. Gray's Anatomy -39th Edition , Elseiver 2005
2. McMinn R M.H lasts , Anatomy-8th Edition ELBS ,1990
3. Bas majain V. John and Slonecker E Charles , Grants Method of Anatomy, 11th Edition Williams and Wilkins 1989
4. Hollinshed .W. Henry , Anatomy for Surgeon's -4th Edition , Harper and Raw Publishers , Williams and Wilkins 1989.
5. DUPLESSIS and Gadecker LEE Mcgregor's , Synopsis of Surgical Anatomy - 12th Edition. K.M Varghese company, 1986.
6. Snell .S .Richard, Clinical Anatomy for Medical Students – 5th Edition , Little Brown and Company,1985.
7. Grant boileau., An Atlas of Antomy -5th Edition, Williams and Wilkins -1984.
8. Graggs Hall E.C.B , Anatomy as a basis for Clinical Medicine- 2nd Edition . Williams and Williams, 1990.
9. McMinnM.H ., Robert , McMinn'sFunctional and Clinical Anatomy-1st Edition, Mosby Publications 1995.
10. A. K. Datta, Text Book of Anatomy Vol.I , II&III -4th Edition , 1997 Current Books International
11. Le Gross Clark , Tissues of the Body -6th Edition ,1980 Oxford University Press.
12. Keith and Moore ,Clinically Oriented Anatomy-3rd Edition ,1992 williams and Wilkins Histology
13. Cormack .H .David , Ham's Text Book of Histology -9th Edition , J.B.Lippincott Company , 1987.
14. Copenhagen M Wilfred etl, Bailey's text book of Histology,17th Edition , William and Wilkins,1978.
15. Difiore.S.H.Mariano, Atlas of Human Histology -5th Edition , Lea Febiger publishers ,1985.
16. Janqueira .C.Luisetal , basic histology-2nd edition , Large Medical Publications , 1971.

17. Drury R.A.B., Wallington E.A . Carlton's Histological Technique -5th Edition , Oxford Universtiy , Preces,1980.
18. Cullings , Histological Technique- 3rd Edition ,1994 Butterworths .
19. John D Bancroft , Manual of Histological Technique -1st Edition ,1984 Chruchill Livingstone.
20. Michael and H Ross , histology – a Text and Atlas -3rd Edition , 1985 Williams and Wilkins
21. Bloom and Fawcett, Text Book of Histology-W.B. Saunders's Company.

EMBRYOLOGY

1. Hamilton W.J. and Mossman H.W., Human Emryology -4th Edition ,Williams and Wilkins Company ,1972.
2. Sadler T.W.,langman's Medical Embryology -7th Edition , Williams and Wilkins Company 1995.
3. A.K .Datta, Essentials of Human Anatomy, Human Embryology -2nd Edition, Current Books International, 1991.
4. Moore Persaud, The Developing Human -7th Edition, Elseiver 2003
5. Larsen, Human Embryology -2nd Edition ,1997, Churchil Livingstone
6. Langman, Medical Embrology T W Sadur-9th Edition 2004,Lippincott, Williams and Willkins.

NEUROANATOMY

1. Everett N.B , Functional Neuroantaomy , 6th edition , Lee and Febigger,1971.
2. Chursid .G.Joseph , Correlative Neuroantomy and Functional Neurology -16th Edition, Lange Medical publication , 1976.
3. A.K.Datta, NeuroAnatomy , - 1st Edition , Current Books International , 1997.
4. Snell.S.Richard , Clinical Neuroanatomy for Medical Students , - 4th Edition, Lippincott-Raven,1982.
5. Parent Andre, Carpenter's Neuroantomy-9th Edition , Williams and Wilkins, 1996.
6. InderbirSingh , Neuroanatomy-5th Edition ,1997 Jaypee Brothers Medical Publications.

HUMAN GENETICS /MEDICAL GENETICS

1. Robert F Mueller , Emery's Elements of Medical Genetics- 9th Edition , 1995 Churchil Livingstone.
2. Nora and Frazer, Medical Genetics Principles-1974 Lee &Gebiger, Philadelphia .
3. Freidman, NMS Genetics -2nd Edition,1996
4. Alfred G Kudson JR., Genetics & Disease-McGraw Hill Book Company N.Y.,
5. Thomas D .Gelehrtar, Principles of Medical Genetics – 2nd Edition ,1990 William and Wilkins.
6. J.M.Conner MA Ferguson Smith –Essentials of Medical Genetics-BlackwellScientific publications.

COMPARATIVE ANATOMY

1. Banks Histology and Comparative Organology – A text & Atlas –Edition 1974
2. Wolstnhome, Taste & Smell in Vertebrates –Edition 1970.
3. Embryogenesis in Mammals CIBA foundation –Edition 1976.
4. George C.Kent , Comparative Anatomy of the Vertebrates -3rd Edition , 1983 MC.Graw HillBook Company.
5. Romer, Vertebrate body-5th edition , 1978, V.B. SaundersCompany.

PHYSICAL ANTHROPOLOGY

1. Harrision, Human Biology an introduction to Human Evolution and Growth-2nd Edition, 1970.
2. Poirie, Fossil Man, 1973.

EMBALMING TECHNIQUES

1. Tompsett RH Anatomical Techniques .
2. Edwards JJ, Medical Museum Techniques, Oxford University Press

JOURNALS

1. Journal of Anatomical Society of India
2. Journal of anatomy
3. ActaAnatomica
4. American Journal of anatomy
5. American Journal of PhysicalAnthropology
6. Journal of Morphology, Embryology
7. Anatomical Record
8. American Journal of Medical Genetics
9. Annual Review of Genetics

ADDITIONAL READING

1. Compendium of recommendations of various committees on Health and Development (1943-1975).DGHS , 1985 central bureau of health intelligence Directorate General of Health Services, Ministry of Health and Family Welfare, Govt Of India, NirmanBhawan , New Delhi.
2. National health Policy , Ministry of Health and Family Welfare, Govt Of India, NirmanBhawan , New Delhi.
3. Santosh Kumar, the elements of research ,writing and editing1994, dept of urology, JIPMER, Pondicherry.
4. SrinivasaD.K.etal, Medical Education Principles and Practice,1995,National Teacher Training centre, JIPMER Pondicherry
5. Indian Council of Medical Research, “Policy statement of Ethical Consideration involved in research on Human Subjects”, 1982,I.C.MR., New Delhi.
6. Code of medcial ethics framed under section 33 of the IndianMedical Council Act 1956. Medical Council of India,Kotla Road, New Delhi.
7. Francis C.M medical Ethics , JP Publications2nd edition 2004.
8. Indian National Science Academy, Guidelines for care and use of animals in Scientific research, New Delhi,1994.
9. International Committee of Medical Journal Editors,Uniform requirements for manuscripts submitted to biomedical Journals , N Engl J Med 1991.

10. Kirkwood B.R , Essentials of Medical Statistics, 1st Ed., Oxford : Blackwell Scientific Publications 1988.
11. Mahajan B K. Method in Biostatistics for medical students , 5thEd.New Delhi , Jaypee Brothers Medical Publishers ,1989.
12. Raveendran , BGitanjali, A Practical approach to PG Dessertation , New Delhi JP Publications 1998.

Post Graduate Course in Biochemistry

M. D. BIOCHEMISTRY

I. Goal:

The post graduate course M.D. Biochemistry should enable the student to acquire an in depth knowledge of the fundamental principles of the subject of biochemistry, so that he/she can apply this knowledge for understanding the basis of health and disease.

At the end of the course the student should have gained knowledge and expertise so that he/she is equipped to pursue a career in one or more of the following facets of biochemistry teaching, diagnostic work and research

II. Objectives

At the end of the course the MD student have gained knowledge in the following key areas of the subject:

1. The chemical and three dimensional structures of various classes of bio molecules such as carbohydrates, proteins, lipids and nucleic acids as a prelude to understanding the correlation between structure and function.
2. An in-depth insight into the metabolic pathways of the major classes of bio molecules, regulatory mechanisms, interactions, significance and alterations in disease states.
3. Mechanism of energy release, conservation, utilization and de arrangements thereof.
4. Role of micro and macro nutrients such as vitamins and minerals in health and the pathophysiology of nutritional disorders.
5. Mechanism involved in the storage, transmission and expression of genetic information.
6. Biochemical techniques and methodology used to assess health and aid in the diagnosis and prognosis of diseases.

7. Develop skill in performing and interpreting data generated by advance biochemical techniques such as electrophoresis, chromatography, enzyme assays, organ function tests etc.

III. Outline of course contents

THEORY

Paper I: Bioorganic Chemistry, Biophysical Chemistry and Biochemical Techniques

1. Proteins: functional roles of proteins in humans. Charge and chemical properties of amino acids and proteins. Amino acid sequence determination. Structure of proteins in detail (primary, secondary, tertiary and quaternary). Structure of insulin, collagen, haemoglobin and myoglobin. Methods of study of structure of proteins and different levels of structural organizations. Biological important peptides.
Conjugated proteins, lipoproteins and glycoproteins, structure of immunoglobulins.
Plasma proteins – Albumin (functions, clinical significance), globulins (alpha, beta, gamma), Separation by electrophoresis, transport proteins, Polymorphisms, acute phase proteins
2. Carbohydrates: biological importance of carbohydrates. Chemistry, structure and properties of monosaccharides, disaccharides and polysaccharides. Structure of functions of heteropolysaccharides,
3. Lipids: biological importance of lipids. Chemistry and structure of simple, compound and derived lipids. Chemistry of steroids.
4. Nucleic acids: biological importance of nucleic acids. Structure of nucleic acids (RNA, DNA and biological important nucleotides). Methods of study of base sequence of DNA. Structure and functions of gene with respect to mammalian genome. Recombinant DNA technology. General principles of blotting techniques. PCR and its application in medicine
5. Bio physical chemistry:
 - i. Water, pH, buffers, surface tension, osmosis, diffusion, viscosity, covalent and non-covalent interactions, atomic weight, molecular weight, Principles of thermodynamics, Donnan membrane equilibrium.
 - ii. Henderson – Hasselbalch equation. Principles and procedures of determination of pH, pO₂, pCO₂, (blood gas analysis)
 - iii. Isotopes – detection and measurement of stable and radioactive isotopes; their application in biochemistry.
 - iv. Bioenergetics- free energy change, high energy linkages, redox potentials.
6. Biochemical techniques:

- i. Chromatography: principles and applications of paper, thin layer, ion exchange, gas phase and affinity chromatography, HPLC, gel filtration and its application.
- ii. Electrophoresis: principles, procedures and applications of paper, agarose gel. Polyacrylamide, capillary, immuno- electrophoresis. Isoelectric focusing.
- iii. Photometry and spectrophotometry: principles and applications.
- iv. Flame photometry: principles and applications.
- v. Ultracentrifugation techniques: their applications in the study of lipoproteins.
- vi. Radio immune assay: competitive binding assay- principles, procedures and applications. ELISA principles and applications.
- vii. Ion selective electrodes: their applications in medicine.
- viii. Cell fractionation: isolation and purification of sub cellular particles, biochemical markers of different subcellular organelles.
- ix. Recent advances in Medical Laboratory Technology And Instrumentation: Semi Auto Analyzer, Auto Analyzer, PCR, etc
- x. Molecular Biology techniques
- xi. Cytogenetics – Karyotyping, FISH, centromeric probes, chromosome painting probes etc.
- xii. Cell culture techniques
- xiii. Microscopy – light, electron, fluorescent
- xiv. Mass spectrometry
- xv. Flow cytometry
- xvi. Bioinformatics and Computational biology – Basics, application in medicine and research
- xvii. Nanotechnology and Nanoparticles - Basics, application in medicine and research

Paper 2 - Intermediary Metabolism and Biochemical Genetics

- i. Introduction to intermediary metabolism, various methods of study of intermediary metabolism with examples. Their advantages and disadvantages.
- ii. Biological Oxidation – Structure of mitochondria, its role in biological oxidation, electron transport chain, mechanisms of electron transport and oxidative Phosphorylation. Regulation of oxidative Phosphorylation.
- iii. Carbohydrate metabolism: A detailed discussion of the metabolic pathways as it occurs in humans.
- iv. Amino acid metabolism: A detailed study of metabolism of the amino acids in humans.

- v. Lipid metabolism: Fatty acids- Oxidation of saturated and unsaturated fatty acids, bio-synthesis of fatty acids and triacylglycerol. Biosynthesis and degradation of phospholipids. Role of phospholipids, biosynthesis and metabolism of cholesterol. Plasma lipoproteins, role of adipose tissue and liver in fat metabolism. Hyper and hypo lipoproteinemias.
- vi. Integration of metabolic pathways of carbohydrate, protein and lipid. Regulation of metabolic pathways.
- vii. Biosynthesis and catabolism of purine and pyrimidine, nucleotides.
- viii. Protein biosynthesis in detail including regulation, mutations and their influences, latest aspects,
- ix. Intracellular traffic and sorting of proteins
- x. Free radicals, lipid peroxidation and antioxidants
- xi. Detoxification, metabolism of xenobiotics

Paper 3- Enzymes, Nutrition and Specialized Tissues, Cell biology, Hemostasis

1. Enzymes:

- i. Classification, kinetics, specificity.
- ii. Isoenzymes and coenzymes.
- iii. Enzyme inhibitions- competitive, non-competitive, uncompetitive and allosteric, mechanism and application. Enzyme poisons.
- iv. Active site of enzyme. Methods of locating the functional groups of active sites. Mechanism of enzyme action in detail. Enzyme regulations. Mechanism of specific enzymes.
- v. Immobilized enzymes- application.
- vi. Factors affecting enzyme catalyzed reactions, Michaelis-Menten constant, Lineweaver- Burk plot, Edey-Hofstee plot.

2. Nutrition:

- i. Detailed account of chemistry and biochemical roles of fat soluble and water soluble vitamins, requirements, source and deficiency symptoms. Antivitamins.
- ii. Detailed account of metabolism of the micronutrients.
- iii. Energy metabolism- B.M.R., R.Q., Energy requirement at different stages, balanced diet. Diet planning in health and disease. SDA of foods.
- iv. Protein, carbohydrates and fat requirements, RDA, biological values of proteins. Protein energy malnutrition,
- v. Obesity – Risk factors, metabolic derangements, genetics, hormonal regulation of adipose tissue metabolism, hormonal regulation of eating behavior, adipokines
- vi. Malabsorption syndromes, parenteral nutrition.

- vii. Modification and supplementation of dietary requirements in Health and Disease.

3. Specialized tissues:

- i. Muscle tissue- composition, mechanism of muscle contraction, Muscle energy metabolism, Muscular dystrophy
- ii. Nerve tissue- composition, transmission of nerve impulse, neurotransmitters.
- iii. Erythrocytes- composition and metabolism, enzymology of RBC, Blood group antigens, other blood cells, Phagocytosis, Anemia, Abnormal hemoglobins, Hemoglobinopathies, Thalassemias,
- iv. Extracellular matrix: Connective tissue- composition, chemistry of collagen, elastin, proteoglycans and other fibrous proteins, connective tissue disorders
- v. Adipose tissue including brown adipose tissue metabolism.
- vi. Bone and teeth – Composition, Markers of bone turnover, osteoporosis, osteoarthritis, rickets, Pagets disease
- vii. Composition of lens- biochemical changes during cataractogenesis.

4. Cell biology

- i. Stem cells and their differentiation
- ii. Cell cycle, regulation of cell cycle, apoptosis, biochemistry of aging
- iii. Cell surface molecules, cell-cell interactions and adhesion molecules
- iv. Cytogenetics
- v. Structure and function of cell, cell membrane and subcellular organelles, cytoskeleton
- vi. Different mechanisms of transport across cell membrane

5. Hemostasis and thrombosis

- i. The vessel wall, prostacyclin, Nitric oxide, Clotting factors, blood clotting.
- ii. Platelets, coagulation, Fibrinolysis, lab tests
- iii. Coagulation disorders, Bleeding disorders, Platelet disorders, anticoagulants

Paper 4 - Clinical Biochemistry

- i. Basic concepts in laboratory Investigations and Clinical laboratory management Reference ranges and clinical utility of all lab tests
- ii. Setting up of clinical chemistry lab
- iii. Evidence based laboratory medicine
- iv. Specimen collection and processing
- v. Preanalytical variables and biological variables
- vi. Total quality management
- vii. Instrumentation, Automation, POCT, Quality control
- viii. Biomedical waste management

- 1) Diagnostic enzymology- an exhaustive account.
- 2) Inborn errors of metabolism involving amino acid, carbohydrate, lipid, purine, pyrimidine and porphyrin metabolism, mucopolysaccharidoses.
- 3) Plasma lipoproteins in health and disease.
- 4) Liver Function tests
- 5) Kidney function tests.
- 6) Pancreatic function tests.
- 7) Gastric function tests.
- 8) Endocrines- A detailed account of the mechanism of action, chemistry and regulatory role of hormones secreted by pituitary, pancreas, adrenal, thyroid, parathyroid and gonads. Endocrine disorders. Methods of assay and clinical interpretations.
- 9) Basic immunology, Immune system, T & B Lymphocytes, antigen presenting cells, humoral immunity, cell mediated immunity, cytokines, lymphokines. Immune regulation. Monoclonal antibodies, application of immunological techniques
Complement system, Molecular mechanisms of antibody production, Transposition of genes, Somatic recombination, and molecular structure of antigens, HLA antigens, Immunodeficiency states, monoclonal and polyclonal gammopathy
- 10) Disorders of calcium and phosphorus metabolism.
- 11) Water and electrolyte balance, acid base balance- their disturbances.
- 12) Composition of CSF, alterations in disease.
- 13) Cancer Biology: Biochemical aspects of cancer. Tumor markers, Oncogenes, tumor suppressor genes, biochemical tests for cancer.
- 14) Systemic biochemistry:
Biochemical basis of normal physiological functions, pathophysiology, complications, laboratory evaluation, biomarkers of various systemic disorders:
 - Diabetes mellitus, Obesity, Metabolic syndrome
 - Cardiovascular system – Atherosclerosis, Acute coronary syndrome, Myocardial infarction, Dyslipidemia and cardiovascular risk assessment, shock, Hypertension, congestive heart failure
 - Nervous system – Parkinsons disease, Schizophrenia, Myasthenia gravis, Huntington disease, Alzheimers disease, Stroke, Epilepsy
 - Renal system - Acute and chronic kidney disease, Glomerulonephritis, Nephrotic syndrome, Renal tubular acidosis, Renal stones, Renal transplantation
 - Hepatobiliary system – Jaundice, Hepatitis, fatty liver, cirrhosis, hepatic coma, Gall stones and Cholestasis.

- Digestive system – Peptic ulcer, Malabsorption, hereditary and acquired enzyme defects, GI regulatory hormones, Investigations in diarrhea.
- Pregnancy and reproductive endocrinology – Prenatal diagnosis, Screening tests, Pregnancy induced hypertension, anemia, gestational diabetes, Infertility
- Biochemical processes in pediatric and geriatric population
- Newborn screening and Inborn errors of metabolism

15) Therapeutic drug monitoring

16) Clinical Toxicology - Pathomechanisms and symptoms of most important types of toxic syndromes (anticholinergic, cholinergic, opioid, sedative, sympathomimetic), Pharmacology and analysis of specific drugs and toxins

PRACTICALS

Part 1= General Biochemistry

1. Estimation of amino acids by ninhydrin method.
2. Estimation of protein by Folin's method.
3. Estimation of protein by dye-binding method.
4. Titration of amino acids- Formal titration and pK values.
5. Amino acid- paper chromatography, TLC. Two Dimensional paper chromatography.
6. Gross separation of proteins- precipitation by salts.
7. Absorption spectra of Phe, Tyr, Trp (UV).
8. Ion exchange chromatography of amino acids.
9. Paper electrophoresis.
10. Separation of mono and disaccharides by paper chromatography.
11. Cholesterol estimation.
12. Estimation of triglycerides and phospholipids.
13. Estimation of DNA- Diphenylamine method.
14. Absorption spectra of bases of nucleic acids.
15. Estimation of vitamin C.
16. Estimation of vitamin A.
17. Estimation of vitamin E.
18. Assay of trypsin, chymotrypsin.
19. Enzyme inhibitions.
20. Effect of pH, temperature on enzyme activity: Determination of K_m , V_{max} .
21. PAGE electrophoresis. Molecular weight determination.
22. Gel chromatography. Molecular weight determination.
23. Immunodiffusion.
24. Affinity chromatography.

Part – II: Clinical Biochemistry

1. Estimation of Plasma Glucose – Glucose oxidase method and O – Toluidine method.
2. Plasma Urea method – Urease method
3. Plasma Uric acid – Uricase method
4. Serum Creatinine – Jaffe’s Kinetic and end point methods
5. Cholesterol/ HDL Cholesterol by enzymatic method
6. Albumin/ Globulin ratio
7. Serum Calcium
8. Flame photometry; Na, K, Li, determination
9. Serum Bilirubin – direct and indirect
10. Alkaline and Acid phosphatases
11. AST, ALT; UV kinetic methods and Colorimetric assay of Gamma GT
12. LDH isoenzymes, CPK isoenzymes
13. Serum Amylase – Somoyogi Amylolytic method
14. Fe, Fe binding capacity
15. Agar gel electrophoresis of serum proteins, Hb
16. Lipoproteins – Electrophoresis
17. 17 – Ketosteroids in urine
18. Estriol by fluorometry
19. Creatinine clearance
20. Plasma Cl, HCO₃, pH, PO₂, PCO₂. Blood gas analysis
21. CSF analysis
22. Urine analysis
23. Stone analysis
24. Thyroid profile by chemiluminescence/ELISA
25. Fertility profile by chemiluminescence/ELISA
26. Tumor markers – PSA, β-hCG by chemiluminescence
27. Cardiac troponin by chemiluminescence

IV. Practical training in Biochemistry: (First half of I year)

1. Introduction to research methodology and Biostatistics. Every postgraduate student should be given an introductory course in research methodology and research techniques. He/ She must be taught as to how a research project can be planned and implemented. He/ She must also acquire a basic knowledge in the statistical methods and their applications.
2. Clinical Postings for a total duration of 6 months in the following departments:
 1. **Research methodology and Biostatistics** 15 days
 2. **Clinical postings**
 - a. Medicine 1 Month

- | | |
|--|---------|
| b. Pediatrics | 15 days |
| c. Emergency medicine / ICU | 15 days |
| d. Cardiology | 15 days |
| e. Endocrinology
(Including reproductive endocrinology) | 15 days |
| f. Nephrology | 15 days |

3. Clinical Lab postings

- | | |
|-----------------------|---------|
| a. Clinical Pathology | 15 days |
| b. Microbiology | 15 days |
| c. Molecular genetics | 15 days |
| d. Cytogenetics | 15 days |

Students may be posted to institution where these facilities are available for molecular genetics and cytogenetics (Govt. or Private)

Clinical postings in the forenoon to be attended and return to the department to do the experimental work in the afternoon.

Later half of I year, II year and first half of third year (2 years) study and training in the department of Biochemistry.

Third year (later half) Clinical Biochemistry (Exclusively) – 6 months

Every postgraduate student in Biochemistry shall be posted to clinical biochemistry laboratory of the department where clinical investigations of the attached hospital are done. Student should be trained in collection of samples, carrying out investigations, interpretation, reporting of the results and maintenance in records of investigations. Quality assurance.

Skills to be acquired during the clinical postings

During posting in medical and other related departments, the student should acquire relevant knowledge and skills. These generally include:

1. Clinical examination of a patient.
2. Investigations to be carried and their relevance
3. Drawing of blood, collection of urine and other specimens for investigations and their storage.
4. Biopsy techniques and handling of biopsy material to be sent for relevant tests/ investigations.
5. Interpretation of laboratory data, X ray and biopsy results.
6. Clinical pathology postings:

(Hematology, transfusion serology, coagulation and cellular immunology)

 - a. Determination of ESR, Hb, Hematocrit, cell count, MCV, MCH, MCHC.
 - b. Preparation and staining of blood smears
 - c. Morphological investigation of bone marrow Smears, different staining procedures.
 - d. Coagulation tests.
 - e. Determination of coagulation factors.

- f. Investigation of fibrinolysis.
- g. Blood group-typing, Cross matching for transfusion.
- h. Investigation of transfusion reactions.
- i. Preparation and application of blood components.
- j. Immunohistochemistry

7. Microbiology

(Covering bacteriology, virology, parasitology and mycology)

- a. Specimen collection.
- b. Specimen processing: smears, staining, culture and sensitivity.
- c. Serology tests
- d. Techniques for parasite and fungus identification.
- e. Immunological and molecular diagnosis (PCR) – HIV, Tuberculosis etc

V. Practical record

Student should maintain practical record for general and clinical biochemistry separately of all practicals done during the course and submit at the time of university examination after duly certified by the Head of the Department.

VI. Seminars and Journal clubs.

Students of biochemistry should be actively involved in departmental seminars and journal clubs. A record should be maintained for each student and the list of seminars and papers presented in journal club by each student should be presented at the time of university examination. These should be held fortnightly.

In addition, students should participate in undergraduate teaching, particularly in practicals and tutorial. For model check lists please see chapter IV

Clinical case presentations should be routinely conducted once in a month from 2nd year onwards

VII. Dissertation

Every student should submit dissertation on a selected research problem involving laboratory investigations. The dissertations have to be prepared by student and submitted to the university 6 months prior to the final examination as notified by the university. For further details please see chapter 1 , Sl. No. 9. Acceptance of dissertation is a pre-requisite for appearing in the university examination.

VIII. Periodical assessment and progress reports

Every student should be assessed. For assessment of performance, participation in seminars, journal clubs, standardization of analytical techniques and involvement in clinical laboratory investigations should be taken into consideration. Please see chapter IV for details.

IX. Scheme of Examination

A. THEORY

There shall be four papers of 100 marks each. Each paper shall be of 3 hours duration. Each paper shall have 2 long essay questions of 20 marks (20x2= 40). And six short essay questions of 10 marks (10x6=60).

The distribution of topics/chapters for the papers will be as under*

Paper-I- Bio-organic and Biophysical chemistry, biochemical techniques, etc.

Paper-II – Intermediary metabolism and biochemical genetics, etc

Paper-III – Enzymes, Nutrition and specialized tissues, etc.

Paper- IV – Clinical Biochemistry, etc

*The topics assigned to the different papers are given as general guidelines. A strict division of subjects may not be possible. Some overlapping of topics is inevitable. Students should be prepared to answer the overlapping topics.

B. PRACTICAL EXAMINATION: 200 marks

Duration: Two days

Part-I – Laboratory procedures in general biochemistry

Part-II – Clinical examination of a patient and relevant investigations in clinical biochemistry.

The assignment of work under part I and part II should begin on day 1 and the candidate is expected to complete the work by forenoon on second day, so that viva voce and pedagogy examinations are held on the second day afternoon

Part I – General Biochemistry (Total Marks: 100)

1. Qualitative identification of any Biological fluid (Urine, CSF, Pleural fluid) – interpretation and discussion (20 Marks)
2. Clinical lab data Interpretation (40 marks – 10 cases with lab data, each carrying 4 marks).

Interpretation of clinical data from cases on liver function, renal function, thyroid function, cardiac diseases, endocrine diseases, electrolyte and acid base disorders, analysis of body fluids, lipid profile, vitamin deficiencies, mineral metabolism, nutritional disorders etc

3. Experiments involving chromatography or electrophoresis to be given, separation and identification of amino acids or carbohydrates by chromatography or separation and interpretation of serum proteins, lipoproteins, isoenzymes of (LDH and CPK) by electrophoresis to be given. (40 marks)

Part- II – Clinical Examination and Clinical Chemistry Experiments (100 marks)

Each candidate is expected to perform clinical examination and list the laboratory investigations he/she deems appropriate for the case. The candidate presents the

case to the examiners would select 2 or 3 laboratory investigations, which the candidate will conduct.

1. Clinical examination and discussion (30 minutes) 25 marks
2. Clinical Biochemistry (3 relevant biochemical investigations including estimation of one parameter using standard curve) 75 marks

VIVA – VOCE (Total Marks:100)

1. Viva – Voce Examination: (80 marks)

Viva Voce examination will be conducted conjointly by all the examiners to test comprehension, analytical approach, expression and interpretation of facts. Students shall also be given case reports, charts for interpretation. It includes discussion on dissertation.

2. Pedagogy Exercise: (20 marks)

A topic would be given to each candidate along with the practical examination question paper on the first day. Student is asked to make a presentation on the topic on the second day for 20 minutes.

Maximum marks	Theory	Practicals	Viva-Voce	Total
	400	200	100	700

X. Recommended Books and Journals THIS ENTIRE LIST MUST BE INCLUDED

1. Murray RK, Grannar DK, Mayes PA, Rodwell VW, Harper's Illustrated Biochemistry, McGraw – Hill, 29th edition , 2012
2. Champe PC, Harvey RA, Ferrier DR, Lippincotts Illustrated reviews: Biochemistry, Wolter Kluwer (India) Pvt Ltd, New Delhi, 4th edition, 2008
3. Devlin TM, Textbook of Biochemistry with Clinical Correlations – Wiley-Liss, NewYork, 6th edition, 2006.
4. Berg JM, Tymoczko JL, Stryer L. Biochemistry – WH Freeman and Company, New York, 7thedition, 2012
5. Lehninger AL, Nelson DL, and Cox MM. Lehninger's Principles of Biochemistry, WH Freeman and company, New York, 5th edition, 2008
6. Voet D and Voet J, Biochemistry – John Wiley and Sons, New York, 4th edition, 2011
7. Voet D and Voet J, Principles of Biochemistry, John Wiley and Sons, New York, 4th edition, 2008
8. Marshall WJ, and Bangert SK, Clinical Chemistry: Metabolic and Clinical aspects, Mosby Elsevier, New York, 2nd edition, 2008.

9. Baynes JW and Dominiczak MH, Medical Biochemistry, Mosby Elsevier, New York, 3rd edition, 2009.
10. Bhagavan NV and Ha Chung-Eun, Essentials of Medical Biochemistry with clinical cases, Elsevier, New York, 1st edition, 2011
11. Smith CM, Marks AD, Lieberman M. Marks Basic Medical Biochemistry: A clinical Approach, Lippincotts Williams and Wilkins, Philadelphia 2nd edition, 2005.
12. Henry et al, Clinical chemistry
13. Chhabra Namrata, A case oriented approach towards Biochemistry, Jaypee Brothers Medical Publishers (P) Ltd. New Delhi, 1st edition, 2013
14. Montgomery R, Biochemistry: A case oriented approach, Mosby Harcourt Health Sciences Company, Sydney, 6th edition, 1996.
15. Bruce Alberts. Molecular Biology of the Cell, Taylor and Francis, New York, 5th edition, 2008
16. Bondy PK and Rosenberg LE, Duncans' Diseases of Metabolism, W B Saunders company, Philadelphia, 6th edition, 1969
17. Scriver CR., et al. Metabolic and Molecular basis of Inherited diseases, McGraw Hill International edition, New York, 8th edition, 2001.
18. Rose BD, Clinical Physiology of acid-base and electrolyte disorders- McGraw Hill International edition, New York, 4th edition, 1994.
19. Burtis CA and Ashwood ER, Tietz Fundamentals of Clinical Chemistry, Harcourt (India) Ltd., 5th edition, 2001
20. Burtis CA, Ashwood ER, Burns DE. Tietz textbook of Clinical Chemistry and Molecular Diagnostics, Elsevier, Philadelphia, 5th edition, 2012
21. Kaplan LA and Pesee AG, Clinical Chemistry: Theory, analysis and Correlation – CV Mosby and Co. St Louis, MO, 5th edition, 2010
22. Gowenlock and Bell, Varley's Practical Clinical Biochemistry – CBS, New Delhi, 6th edition, 1988
23. Bishop ML, Fody EP, Schoeff LE, Clinical Chemistry; Techniques, Principles, Correlations, Wolter Kluwer (India) Pvt Ltd, New Delhi, 6th edition, 2010
24. Wilson Keith and Walker John, Principles and Techniques of Biochemistry and Molecular Biology, Cambridge University Press, 7th edition, 2010
25. Williamson MA, Snyder LM. Wallachs Interpretation of Diagnostic tests, Wolter Kluwer (India) Pvt Ltd, New Delhi, 9th edition, 2011
26. Watson JD, Molecular Biology of gene, Pearsons education, Singapore Pvt Ltd, 5th edition, 2004
27. Glick BR, Pasternak JJ, Molecular Biotechnology: Principles and applications of Recombinant DNA, ASM Press, Washington DC, 2st edition, 1998

Journals and Other Periodicals:

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

ADDITIONAL READING:

1. Compendium of recommendations of various committees on Health and Development (1943 – 1975). DGHS, 1985 Central Bureau of Health Intelligence, Directorate general of Health services, Ministry of Health and Family welfare, Govt. of India, NirmanBhawan, New Delhi. P-335.
2. National Health Policy, Ministry of Health and Family welfare, NirmanBhawan, New Delhi. 1983.
3. Santhosh Kumar, The elements of Research writing and editing, 1994, Dept of Urology, JIPMER, Pondicherry.
4. Srinivasa DK, et al, Medical Education Principles and Practice, 1995, National Teacher training Centre, JIPMER, Pondicherry
5. Indian Council of Medical Research, “Policy statement of Ethical considerations involved in Research on Human Subjects”, 1982, I.C.M.R., New Delhi.
6. Code of Medical Ethics framed under section 33 of the Indian Medical Council Act, 1956. Medical Council of India, Kotla Road, New Delhi.
7. Francis CM, Medical Ethics, JP Publications, Bangalore, 1993.
8. Indian National Science Academy, Guidelines for care and use of animals in Scientific Research, New Delhi, 1994.
9. Indian National Committee of Medical Journal Editors, Uniform requirements for manuscripts submitted to biomedical journals, N Engl J Med 1991:424-8

10. Kirkwood BR. Essential of Medical Statistics, 1st edition, Oxford: Blackwell Scientific Publications, 1988
11. Mahajan BK, Methods in Biostatistics for Medical Students, 5th edition, New Delhi, Jaypee Brothers Medical Publishers, 1989.
12. Raveendran, B Gitanjali. A Practical approach to PG dissertation, New Delhi, J P Publications, 1998.

Post Graduate Course in Physiology

M.D. PHYSIOLOGY

- I. **Goals:** The Postgraduate course in MD Physiology should enable a medical graduate to be :
 - i. A competent Physiologist
 - ii. A good medical teacher in Physiology, practicing the required skills of teaching.
- II. **Objectives :** At the end of the course a postgraduate student in Physiology should be able to :
 - i. Demonstrate comprehensive knowledge and understanding of general and systemic Physiology.
 - ii. Comprehend and understand physiological basis of health and disease affecting various organ systems.
 - iii. Select and use appropriate teaching techniques and resources
 - iv. To effectively use the library facilities including computer, C.D. ROM and medline search
 - v. Critically evaluate published journal literature
 - vi. Carryout research independently
 - vii. Function as an effective member of teaching team and research team
 - viii. Carryout professional obligations ethically and keeping in view of national health policy.

III. Outline of course contents

Theory

- i. Principles of biomedical instrumentation
- ii. Essentials of Research Methodology.
- iii. Issues related to ethics of experimental physiology (animal & human). As this is part of their dissertation work.
- iv. History of Medicine with specific reference to Experimental Physiology. In the Theory paper, question can be framed on specific issues.**eg: Describe the classical**

- experiments that outlined the nature of the baroreflex, rather than write briefly on Claude Bernard / Pavlov etc., as is being done now.**
- v. General Physiology at Cellular, Sub Cellular and Molecular level. Biophysics and Genetics
 - vi. Comparative Physiology includes adaptation and evolution of physiological characters between vertebrates and invertebrates in relation to organ systems.
 - vii. Systemic Physiology. This includes the following organ systems-Hematology, Gastrointestinal Physiology, Renal physiology, Respiratory physiology, cardiovascular physiology, Endocrine and reproductive physiology, Nervous system, Special senses and Muscle Nerve Physiology.
 - viii. Clinical and Applied Physiology includes : Pathophysiology and physiological basis of management as related to the systems mentioned in (7)
 - ix. Exercise and Sports Physiology includes: In addition to Muscle and its contraction, body fluids, blood circulation, Respiration as covered under organ systems will include the skeletal system, Physical performance. Evaluation of Physical performance on the basis of tests. Functional significance of body dimensions, Physical training - Training principles. Effect of detraining and inactivity, Genetic factor in training response. Nutrition and physical performance. Applied work physiology and applied sport physiology.
 - x. Environmental Physiology includes: Gravitational environment - Effect of microgravity on various systems in the body. (Aviation and space physiology) Effect of hyper gravity: Acceleration environment. Hyperbaric environment - under water Physiology of man. Deep-sea diving, Thermal environment- temperature regulation to thermal stimulation. Exposure and adaptive response to extremes of cold and heat. Chrono biological environment - circadian rhythms, sleep, thermoregulation and circadian rhythms, relationship between food and sleep. The terrestrial altitude Environment- Evolutionary aspect of atmospheric oxygen and organisms' adaptation to stress, adaptation to hypoxia, hyperbaric hypoxia, Acute and chronic hypoxia in man. States of hypo and hyper oxygenation.
 - xi. Chrono Physiology - New born, adult and old age physiology, physiology of growth and development.
 - xii. Laboratory animal ethics- Guidelines for care and use of animals in scientific research .Breeding of and experiments on animals (control and supervision) rules, 1998 under prevention of cruelty of animals Act 1960.

Practical Training:

A) Animal Experiments

It is mandatory that each medical college be registered under the CPCSEA.

The animals to be procured as per CPCSA guidelines and prior permission taken from the animal ethical committee of the college to conduct the experiments.

Since animal experiments have been banned by the CPCSEA the practical will be held by way of interpretation of the pre-recorded graphs both for mammalian intact and isolated preparations and amphibian experiments listed in the respective sections. This section of the experiments will include asking questions as part of bench viva in the following areas:

- i. Animals commonly used: dogs rabbits, guinea pigs and rats

- ii. Anesthesia: types of drugs used, advantages and Disadvantages, route of administration
- iii. Equipment used for the experiments, their identification and uses.
- iv. Dissection procedure
- v. Composition and preparation of various mammalian fluids.

a) **Amphibian** : FROG

i. **Skeletal Muscle**

- 1) Effect of temperature
- 2) Velocity of nerve impulse
- 3) Determination of length tension relationship
- 4) Effect of two successive and multiple successive stimuli
- 5) Demonstration of Fatigue
- 6) Effect of Load on Muscle
- 7) To demonstrate compound action potential
- 8) Effect of various strength of stimuli

ii. **Cardiac Muscle**

- 1) Effect of temperature on Frog's Heart
- 2) Effect of Stannius ligatures
- 3) Properties of Cardiac Muscle
- 4) To demonstrate extra systole and compensatory pause
- 5) Effect of vagal stimulation on the Heart
- 6) To demonstrate the effect of drugs on vagal stimulation
- 7) Perfusion of Isolated Heart and to demonstrate effect of drugs
- 8) Perfusion of Isolated Heart and to demonstrate effect of ions
- 9) Otto Loewi experiment to demonstrate the chemical mediator with vagal stimulation of the heart.

ALTERNATIVES ARE AVAILABLE FOR FROG EXPERIMENTS AND SHOULD BE USED FOR TRAINING AND FINAL ASSESSMENT.

b) **Mammalian:**

i. **Isolated preparations** : In ,Rat or Rabbit

- 1) Langendorff preparation
- 2) Intestinal movements
- 3) Uterine smooth muscle preparation

Effects of drugs and ions on the above preparation. The above experiments should include demonstration of dose responses as an integral part.

ii. **Intact preparation**: Rat , rabbit ,

- 1) Measurement of BP and Respiration
- 2) Effects of haemorrhage, saline infusion on BP.

- 3) Effects of vagal stimulation on BP.
- 4) Effects of drugs namely sympathetic and parasympathetic drugs on BP and Respiration.
- 5) Carotid artery occlusion and its effects on BP and Respiration.

ALTERNATIVE TO ANIMAL EXPERIMENTS: BY SUBSTITUTING WITH ANIMAL SIMULATION AND COMPUTER ASSISTED LEARNING SHOULD BE ADOPTED

B) Human Physiology:

Laboratory procedures using normal subjects

I. Cardiovascular

- 1) Evaluation of Cardio - respiratory fitness using any one of the following
 - a. Harvard step test
 - b. Tread mill
 - c. Bicycle ergometer
- 2) To demonstrate cardio- respiratory responses to graded exercises.
- 3) To Compare the response of isotonic and isometric exercise on heart rate and blood pressure
- 4) Recording of ECG and interpretation

II. Respiratory system:

A. Spirometry using Benedict Roth Spirometer

- 1) Evaluation of lung functions in relation to FVC, FEV₁, PEF_R
- 2) To calculate Dyspnoeic Index after making appropriate measurement
- 3) To demonstrate chemical regulation of respiration

B. Stethography : To demonstrate the effect of following manoeuvres on respiration.

- 1) Effect of Hyperventilation
- 2) Effect of Breath holding
- 3) Effect of Rebreathing through a bag
- 4) Breathing through a long tube
- 5) Effect of deglutition

C. Cardiopulmonary Resuscitation (CPR)

Principles of Artificial Respiration and to demonstrate Manual method of Resuscitation provided mannequins are available in the department.

III. Body composition:

Measurement of anthropometry and to comment on

- 1) Nutritional status
- 2) Central Obesity

IV. ANS:

- 1) To evaluate the autonomic nervous system by using the following standard tests.

- i) Timed deep breathing
- ii) Sustained isometric contraction
- iii) Valsalva manoeuvre
- iv) Effect of posture (lying to standing)
- 2) Compare the contrasting effect of cold on Heart rate by the
 - 1) Ice cold pressor test
 - 2) Diving reflex (Head immersion)

V. Muscle - Nerve Physiology

- 1) Using ergography to demonstrate fatigue in skeletal muscle
- 2) To record EMG
- 3) To measure nerve conduction
- 4) To demonstrate Strength Duration curve
- 5) To record Compound Action Potential.

The list of human experiments listed under each of the above topics is just an outline of practical exercises. Individual department is entitled to formulate and create more questions to evaluate the practical exercises.

C) Clinical Physiology:

Clinical Examination

- i. CVS
- ii. RS
- iii. CNS
- iv. Special Senses
- v. Cranial Nerves

The subject could be a normal volunteer. The examiners should not insist on a patient to be brought from the Hospital. The students will be given a case history and based on the case the student will perform the examination of the system in normal subjects.

Case History Clinical Examination

A soldier in the war got a bullet shot at the Lumbar region and thereafter c/o loss of altered sensation on the right leg and paralysis of the left leg. Examine the given subject in the direction of the above case history and report.

D) Biochemistry:

- 1) Practicals to be performed from the following Biochemical investigations:
 - i) Blood Sugar
 - ii) Blood urea
 - iii) Blood creatinine
 - iv) Blood Protein.
 - v) Abnormal constituents of Urine
- 2) Students to be familiar with quality control procedures and the following terms:
 - i) intra - assay CV

- ii) inter - assay CV
- iii) quality control sample
- iv) Colorimeter –types, principle
- v) Standards

E) Haematology:

- i) Haemocytometry
- ii) Determination of Reticulocyte Count, platelet count, WBC count, RBC count, Eosinophil count in normal and diseased states.
- iii) Differential count of WBC
- iv) Heamoglobinometry, spectroscopy
- v) Blood grouping and cross matching
- vi) Determination of bleeding time, clotting time
- vii) Fragility test
- viii) ESR & PCV

The students will be given a case history and based on the case the student will perform one or more investigations which are most relevant.

Example: Hematology Practical question

A 40 year old woman with a 3 years h/o menorrhagia comes to the OPD with c/o tiredness and fatigability. O/E she has pronounced pallor. Perform the haematological examinations that would:

- i. confirm the primary diagnosis
- ii. Help you narrow down the causes of the problem.

F) Histology: Identification of histological feature of organ systems under light microscope followed by discussion.

List of slides

- | | |
|---------------------------------|--------------------------------|
| 1. Tendon | 12. Mixed salivary gland |
| 2. Elastic fibers | 13. Lymph node |
| 3. Hyaline Cartilage | 14. Thymus |
| 4. Elastic Cartilage | 15. Tongue - filiform papillae |
| 5. Skeletal Muscle - L.S | 16. Pituitary gland |
| 6. Cardiac Muscle | 17. Thyroid |
| 7. Nerve fibers - T.S | 18. Cerebrum - cerebral cortex |
| 8. Bone - T.S | 19. Cerebellum |
| 9. Medium sized artery and vein | 20. Spinal cord |
| 10. Large sized artery | 21. Eye ball |
| 11. Large sized vein | 22. Skin - thick |

23. Oesophagus
24. Stomach
25. Ileum
26. Liver
27. Pancreas
28. Spleen
29. Kidney
30. Urinary bladder
31. Testis
32. Ovary
33. Adrenal - Supra renal glands
34. Mammary gland
35. Trachea
36. Umbilical Cord
37. Seminal vesicle
38. Medulla
39. Spinal Cord
40. Embryonic Cartilage

IV. Time schedule and Rotation postings

The candidates shall attend the entire undergraduate theory and practical classes regularly in the first year. During the second year of the course postings may be made to other clinical and Para clinical subjects in co-ordination with concerned departments, only in the forenoon sessions as follows:

SL No	Department	Procedures	Duration
1	Cardiology dept.	Learn to operate ECG apparatus, Echo, Doppler, Cardiac monitor, Learn the methodology of cardiac catheterization. Resuscitation technique, interpretation of ECG & other records ASSIGNMENTS i. Cardiac stress testing ii. The ionic basis of antiarrhythmic drugs	15 days
2	Neurology	Observe and understand Neuro - Physiological Techniques (ENMG,EEG) (clinical Physiology) and its Interpretation and other investigation data. ASSIGNMENTS i. Physiological basis of ENMG and its clinical application ii. Evoked potentials and its clinical application	15 days
3	Medical Gastroenterology	To observe Endoscopic Techniques, Manometry Studies ASSIGNMENTS i. Oesophageal manometry and its application ii. Investigative methods of biliary tract	15 days
4	Clinical Biochemistry	To understand the principles of clinical biochemical tests and interpretation of data Liver function test. Renal function test Blood sugar estimation ASSIGNMENTS i. Methodology and principle of the working of auto analyser ii. Quality control in Biochemistry – Methods and standards	1 week
5	Clinical Hematology including pathology	To make peripheral blood smear and bone marrow smear To identify normal and abnormal blood cells. Blood Banking Pregnancy tests and its interpretation Semen analysis ASSIGNMENTS i. Fractions of whole blood and their clinical	1 week

		use ii. Blood donation – Donor criteria, storage precautions iii. Cross matching, changes during storage in iv. Blood components v. Tests for Infertility	
6	Paediatrics	ASSIGNMENTS i. Jaundice in the new born – Basis of therapeutics options ii. Basis of Growth chart and factors affecting growth	1 week
7	Neonatology	ASSIGNMENTS	1 week
8	Paediatric nephrology	ASSIGNMENTS	1 week
9	General Medicine	Clinical Examination, ECG	15 days
10	Chest Medicine	Pulmonary Function Tests, Sleep Lab ASSIGNMENTS i. Mechanics of respiration and lung functions in ii. Obstructive and restrictive lung disease	1 week
11	Endocrinology	ASSIGNMENTS i. Diabetes – types and monitoring	1 week

Total four months of clinical postings. At the end of these postings, a certificate has to be obtained from the concerned Heads of the Department about satisfactory learning or otherwise.

During three years of the course, the Postgraduate students shall participate in teaching the undergraduate students in practicals, tutorials and group discussions.

V. Seminars & Journal reviews.

The postgraduate students should actively participate in departmental seminars and journal clubs. A record showing the involvement of the student shall be maintained. A diary should be maintained. Seminars and journal clubs are suggested to be conducted alternately once in every 15 days. To attend and participate in all seminars and journal clubs conducted in the department. Log book to be maintained for attendance.

VI. Maintenance of Record of Work Done

1. A diary showing each day's work has to be maintained by the candidate, which shall be scrutinised by the Head of the Department once in every three months.
2. A practical record has to be maintained by the candidate and duly scrutinised and certified by the HOD and to be submitted to the external examiner during the final examination
3. A list of the Seminars and Journal reviews that has been attended and participated by the student has to be maintained which should be scrutinised by the Head of the Department.

VII. **Dissertation Work**

During the course of study every candidate has to prepare a dissertation individually on a selected topic under the direct guidance and supervision of a recognised post graduate teacher as per MCI and RGUHS regulations. The suggested time schedule for dissertation work is :

- Identification and selection of topic for dissertation - in first 4 weeks
- Preparatory work of dissertation / synopsis including pilot study if necessary and submission of the synopsis to the University within first 6 months from the beginning of course or as per the dates notified by the University
- Data collection for dissertation. Writing the dissertation in the following 1 1/2 years.
- Submission of the dissertation six months prior to the final examination or as per the dates notified by the University.

Registration of dissertation topic

Every candidate shall submit a synopsis in the prescribed proforma of the University. The post graduate Training cum Research Committee of the concerned institution will scrutinise the synopsis before it is sent to the university for approval and registration of the dissertation topic. The synopsis shall be sent within first 6 months from the commencement of course as notified in the University calendar of events, to the Registrar (Academic)

Submission of dissertation

The dissertation shall be submitted to the Registrar (Evaluation) of the University. Approval of the dissertation by the panel of examiners is a pre - requisite for a candidate to appear in the University examination.

VIII. **Periodical assessment and progress report** (Please see chapter IV)

A practical record has to be maintained by every candidate and duly scrutinised and certified by the head of the department and to be submitted to the external examiner during the final examination.

IX. **Scheme of Examination:**

University Examination

A. Theory :

1. The written examination consists of four papers of 100 marks each. Each paper will be of three hours duration.
2. In Theory Paper I in MD Physiology examination there shall be 10 marks allotted to research methodology & bio statistics
3. Each theory paper shall consist of :

Long Essay type questions - 2 x 20 marks = 40

Short Essay type questions - 6 x 10 marks = 60

Total marks = 100

Theory Paper I :

- i. General Physiology: Cellular structure and function, Membrane Physiology including transport, signaling and bioelectrical potentials, Genetics, Body fluid compartment
- ii. New born to ageing (Chronobiology)
- iii. Comparative Physiology

- iv. Ethics
- v. Research Methodology
- vi. History of Medicine (Major contribution to Physiological concepts by Physiologists and Scientists)

Theory Paper II

- i. Haematology
- ii. Cardiovascular system
- iii. Respiratory system
- iv. Environment physiology

Theory Paper III

- i. Renal system
- ii. Gastro intestinal system
- iii. Endocrine system
- iv. Reproduction physiology

Theory Paper IV

- i. Muscle Nerve
- ii. CNS and
- iii. Special Senses
- iv. Exercise and sports physiology

B. Practical

Scheme of Examination for practicals (Total 200 marks)

1)	Human Experiment	50 marks
2)	Clinical Examination	30 marks
3)	Mammalian (Isolated)*	25 marks
4)	Mammalian (Intact)*	15 marks
5)	Amphibian*	10 marks
6)	Haematology	30 marks
7)	Biochemistry	20 marks
8)	Histology 5 slides (4 marks each)	20 marks

***Interpretation of pre-recorded graphs**

*** USE OF ALTERNATIVES**

C. VIVA VOCE: (100 marks) The division of Marks to be clearly demarcated:

- Dissertation Viva 20 marks
 - Subject Viva 60 marks
 - Pedagogy 20 marks
- Pedagogy to be assessed using a checklist by each examiner separately and finally tabulated.
 - At the viva, there should be presentation of the dissertation work for 10 minutes by the candidate

Dissertation Viva: Evaluation should consist of:

- 1) Sending the thesis to **FOUR** examiners 6 months before the Theory exam
 - 1) Evaluation by 4 examiners excluding the guide. To send their comments/ report.

2) The thesis evaluated and the following grades will be assigned:

A	:	Excellent > 70%
B	:	Good 60 - 70%
C	:	Satisfactory 50-60 %
D	:	Not acceptable < 50%

Could be accepted if there is possibility to provide corrections within the next 2 months and submit. **If not accepted:** candidate to take up Theory exam after 6 months with submission of thesis. To be informed to the candidate before the exam fees is paid. The thesis evaluation report of the students to be sent to the college from the university before student writes the university theory exam.

Question Paper setting: Following changes to be implemented

1. On each theory paper the topics have to be mentioned.
2. The questions should be structured. Open ended questions should be avoided.

	Theory	Practicals	Viva – Voce	Total
Maximum marks for M.D. Physiology Examination	400	200	100	700

Y. Recommended Text, Reference books and Journals

The Edition and Year of Publication listed here is current and latest, to a large extent.

TEXTBOOKS

1. Keele, Samson & Wright's, **Applied Physiology**
2. J B West, Best & Taylor, **Physiological basis of Medical Practice**
3. Guyton, **Text Book of Medical Physiology**
4. Ganong, **Review of Medical Physiology**
5. Vernon B Mount Castle, **Medical Physiology, vol. 1 & vol. 2**
6. Hand book of Physiology - **American Physiological Society Publication** (series publication - system wise)
7. Principles of neural sciences - **Kandel, Schwartz, Jessel**
8. Williams - **Text book of Endocrinology**
9. Wintrobres - **Clinical Haematology**

JOURNALS:

1. **Journal of Applied Physiology** By American Physiological Society,
2. **Physiological Reviews** by American Physiological Society,
3. **Annual Review of Physiology** by American Physiological Society,
4. **Advances in Physiology Education** by American Physiological Society,
5. **Journal of Physiology** British Publication,
6. **Indian Journal of Physiology & Pharmacology - IJPP** by Association of Physiologists & Pharmacologists of India,
7. **Indian Journal of Medical Research** by Indian council of Medical Research -
8. News in Physiological sciences
9. New England Journal of Medicine
10. British Medical Journal
11. Science
12. Nature
13. Lancet

Additional Reading

1. Compendium of recommendations of various committees on Health and Development (1943 - 1975). DGHS, 1985 Central Bureau of Health Intelligence, Directorate General of Health Services, min. of Health and Family Welfare, Govt, of India, Nirman Bhawan, New Delhi. P - 335.
2. National Health Policy, Min. of Health & Family Welfare, Nirman Bhawan, New Delhi, 1983.
3. Santosh Kumar, The elements of Research, writing and editing 1994, Dept. of Urology, JIPMER, Pondicherry.
4. Srinivasa D K et al, Medical Education Principles and Practice, 1995. National Teacher Training Centre, JIPMER, Pondicherry
5. Indian Council of Medical Research, "Policy Statement of Ethical considerations involved in Research on Human Subjects", 1982, I.C.M.R., New Delhi.
6. Code of Medical Ethics framed under section 33 of the Indian Medical Council Act, 1956. Medical Council of India, Kotla Road, New Delhi.
7. Francis C. M, Medical ethics, J P Publications, Bangalore, 1993 Indian National Science Academy, Guidelines for care and use of animals in Scientific Research, New Delhi, 1994
8. Internal National Committee of Medical Journal Editors, Uniform requirements for manuscripts submitted to biomedical journals, N Engl J Med 1991 ; 424-8.
9. Kirkwood B R, Essentials of Medical Statistics, 1st Ed., Oxford: Blackwell Scientific Publications 1988.
10. Mahajan B K, Methods in Bio statistics for medical students, 5th Ed. New Delhi, Jaypee Brothers Medical Publishers, 1989.
12. Raveendran B Gitanjali, A Practical approach to PG dissertation, New Delhi, JP Publication, 1998.

Chapter IV

Monitoring Learning Progress

It is essential to monitor the learning progress of each candidate through continuous appraisal and regular assessment. It not only also helps teachers to evaluate students, but also students to evaluate themselves. The monitoring be done by the staff of the department based on participation of students in various teaching / learning activities. It may be structured and assessment be done using checklists that assess various aspects. Model Checklists are given in this Chapter, which may be copied and used.

The learning out comes to be assessed should included: (i) Personal Attitudes, (ii) Acquisition of Knowledge, (iii) Clinical and operative skills, and (iv) Teaching skills.

i) **Personal Attitudes.** The essential items are:

- Caring attitudes
- Initiative
- Organisational ability
- Potential to cope with stressful situations and undertake responsibility
- Trust worthiness and reliability
- To understand and communicate intelligibly with patients and others
- To behave in a manner which establishes professional relationships with patients and colleagues
- Ability to work in team
- A critical enquiring approach to the acquisition of knowledge

The methods used mainly consist of observation. It is appreciated that these items require a degree of subjective assessment by the guide, supervisors and peers.

ii) **Acquisition of Knowledge:** The methods used comprise of 'Log Book' which records participation in various teaching / learning activities by the students. The number of activities attended and the number in which presentations are made are to be recorded. The log book should periodically be validated by the supervisors. Some of the activities are listed. The list is not complete. Institutions may include additional activities, if so, desired.

Journal Review Meeting (Journal Club): The ability to do literature search, in depth study, presentation skills, and use of audio- visual aids are to be assessed. The assessment is made by faculty members and peers attending the meeting using a checklist (see Model Checklist – I, Chapter IV)

Seminars / Symposia: The topics should be assigned to the student well in advance to facilitate in depth study. The ability to do literature search, in depth study, presentation skills and use of audio- visual aids are to be assessed using a checklist (see Model Checklist-II, Chapter IV)

Clinico-pathological conferences: This should be a multidisciplinary case study of an interesting case to train the candidate to solve diagnostic and therapeutic problems by using an analytical approach. The presenter(s) are to be assessed using a checklist similar to that used for seminar.

Medical Audit: Periodic morbidity and mortality meeting be held. Attendance and participation in these must be insisted upon. This may not be included in assessment.

iii) Clinical skills

Day-to-Day work: Skills in outpatient and ward work should be assessed periodically. The assessment should include the candidates' sincerity and punctuality, analytical ability and communication skills (see Model Checklist III, Chapter IV).

Clinical meetings: Candidates should periodically present cases to his peers and faculty members. This should be assessed using a checklist (see Model checklist IV, Chapter IV).

Clinical and Procedural skills: The candidate should be given graded responsibility to enable learning by apprenticeship. The performance is assessed by the guide by direct observation. Particulars are recorded by the student in the logbook. (Table No.3, Chapter IV)

iv) Teaching skills: Candidates should be encouraged to teach undergraduate medical students and paramedical students, if any. This performance should be based on assessment by the faculty members of the department and from feedback from the undergraduate students (See Model checklist V, Chapter IV)

vi) Periodic tests: Three tests may be conducted, two of them be annual tests, one at the end of first year and the other in the second year. The third test may be held three months before the final examination. The tests may include written papers, practicals / clinicals and viva voce.

vii) Work diary / Log Book- Every candidate shall maintain a work diary and record his/her participation in the training programmes conducted by the department such as journal reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of clinical or laboratory procedures, if any conducted by the candidate.

viii) *Records:* Records, log books and marks obtained in tests will be maintained by the Head of the Department and will be made available to the University or MCI.

Logbook

The logbook is a record of the important activities of the candidates during his training, Internal assessment should be based on the evaluation of the log book. Collectively, log books are a tool for the evaluation of the training programme of the institution by external agencies. The record includes academic activities as well as the presentations and procedures carried out by the candidate.

Format for the logbook for the different activities is given in Tables 1,2 and 3 of Chapter IV. Copies may be made and used by the institutions.

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

CHAPTER IV (Contd.)

Format of Model Check Lists

Check List -I. MODEL CHECK-LIST FOR EVALUATION OF JOURNAL REVIEW PRESENTATIONS

Name of the Student:

Name of the Faculty/Observer:

Date:

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

Check List - IV**EVALUATION FORM FOR CLINICAL PRESENTATION**

Name of the Student:

Name of the Faculty:

Date:

Sl. No.	Points to be considered	Poor 0	Below Average 1	Average 2	Above Average 3	Very Good 4
1.	Completeness of history					
2.	Whether all relevant points elicited					
3.	Clarity of Presentation					
4.	Logical order					
5.	Mentioned all positive and negative points of importance					
6.	Accuracy of general physical examination					
7.	Whether all physical signs elicited correctly					
8.	Whether any major signs missed or misinterpreted					
9.	Diagnosis: Whether it follows logically from history and findings					
10	Investigations required					
	▪ Complete list					
	▪ Relevant order					
	▪ Interpretation of investigations					
1.	Ability to react to questioning Whether it follows logically from history and findings					
2.	Ability to defend diagnosis					
3.	Ability to justify differential diagnosis					
4.	Others					
	Grand Total					

Check List - V**MODEL CHECK LIST FOR EVALUATION OF TEACHING SKILL PRACTICE**

Sl. No.		Strong Point	Weak Point
1.	Communication of the purpose of the talk		
2.	Evokes audience interest in the subject		
3.	The introduction		
4.	The sequence of ideas		
5.	The use of practical examples and/or illustrations		
6.	Speaking style (enjoyable, monotonous, etc., specify)		
7.	Attempts audience participation		
8.	Summary of the main points at the end		
9.	Asks questions		
10.	Answers questions asked by the audience		
11.	Rapport of speaker with his audience		
12.	Effectiveness of the talk		
13.	Uses AV aids appropriately		

Checklist VI**MODEL CHECK LIST FOR DISSERTATION PRESENTATION**

Name:

Faculty/Observer:

Date:

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

Checklist-VII**CONTINUOUS EVALUATION OF DISSERTATION WORK BY GUIDE / CO-GUIDE**

Name of the Student:

Name of the Faculty/Observer:

Date:

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

LOG BOOK

Table 3: Diagnostic and Operative procedures performed

Name:

Admission Year:

College:

Date	Name	ID No.	Procedure	Category O, A, PA, PI*

- * Key:**
- O - Washed up and observed
 - A - Assisted a more senior Surgeon
 - PA - Performed procedure under the direct supervision of a senior surgeon
 - PI - performed independently

Model Overall Assessment Sheet

Name of the College:

Academic Year:

Sl. No	Particulars	Name of Student* and Mean Score									
		A*	B*	C*	D*	E*	F*	G*	H*	I*	J*
1	Journal Review Presentations										
2	Seminars										
3	Clinical work in wards										
4	Clinical presentation										
5	Teaching skill practice										
Total Score											

Note: Use separate sheet for each year.

Signature of HOD

Signature of Principal

The above overall assessment sheet used along with the logbook should form the basis for certifying satisfactory completion of course of study, in addition to the attendance requirement.

KEY:

Mean score: Is the sum of all the scores of checklists 1 to 7.

A, B,....: Name of the trainees.

Chapter V

Medical Ethics Sensitisation and Practice

Introduction

There is now a shift from the traditional individual patient, doctor relationship, and medical care. With the advances in science and technology and the needs of patient, their families and the community, there is an increased concern with the health of society. There is a shift to greater accountability to the society. Doctors and health professionals are confronted with many ethical problems. It is, therefore necessary to be prepared to deal with these problems. To accomplish the Goal (i), General Objective (ii) stated in Chapter II, and develop human values, it is urged that *ethical sensitisation* be achieved by lectures or discussion on ethical issues, clinical case discussion of cases with an important ethical component and by including ethical aspects in discussion in all case presentation, bedside rounds and academic postgraduate programmes.

Course Contents

1. *Introduction to Medical Ethics*
 - What is Ethics
 - What are values and norms
 - Relationship between being ethical and human fulfillment
 - How to form a value system in one's personal and professional life
 - Heteronomous Ethics and Autonomous Ethics
 - Freedom and personal Responsibility
2. *Definition of Medical Ethics*
 - Difference between medical ethics and bio-ethics
 - Major Principles of Medical Ethics 0

Beneficence	=	fraternity
Justice	=	equality
Self determination (autonomy)	=	liberty
3. *Perspective of Medical Ethics*
 - The Hippocratic oath, The Declaration of Helsinki, The WHO Declaration of Geneva
 - International code of Medical Ethics (1993)
 - Medical Council of India Code of Ethics
4. *Ethics of the Individual*
 - The patient as a person, The Right to be respected, Truth and Confidentiality
 - The autonomy of decision, The concept of disease, health and healing
 - The Right to health
 - Ethics of Behaviour modification
 - The Physician – Patient relationship
 - Organ donation
5. *The Ethics of Human life*
 - What is human life
 - Criteria for distinguishing the human and the non-human

- Reasons for respecting human life
 The beginning of human life
 Conception, contraception, Abortion
 Prenatal sex-determination
 In vitro fertilization (IVF), Artificial Insemination by Husband (AIH)
 Artificial Insemination by Donor (AID),
 Surrogate motherhood, Semen Intrafallopian Transfer (SIFT),
 Gamete Intrafallopian Transfer (GIFT), Zygote Intrafallopian Transfer (ZIFT),
 Genetic Engineering
6. *The Family and Society in Medical Ethics*
 The Ethics of human sexuality
 Family Planning perspectives
 Prolongation of life
 Advanced life directives – The Living Will
 Euthanasia
 Cancer and Terminal Care
7. *Profession Ethics*
 Code of conduct
 Contract and confidentiality
 Charging of fees, Fee-splitting
 Prescription of drugs
 Over-investigating the patient
 Low – Cost drugs, vitamins and tonics
 Allocation of resources in health cares
 Malpractice and Negligence
8. *Research Ethics*
 Animal and experimental research / humanness
 Human experimentation
 Human volunteer research – Informed Consent
 Drug trials
9. *Ethical workshop of cases*
 Gathering all scientific factors
 Gathering all human factors
 Gathering all value factors
 Identifying areas of value – conflict, Setting of priorities,
 Working out criteria towards decisions
10. Law & Medicine
 - Medical Council Act
 - Consumer Protection Act
 - Statutory Laws
 a). Article 21 of the Constitution – Right to life
 b). 304 IPC (Indian Penal Code)
 c). Drug Act

Recommended Reading

1. Francis C.M., Medical Ethics, 11 Ed, 2004, Jaypee Brothers, New Delhi, Rs. 150/-
2. Ethical Guidelines for Biomedical Research on Human Subjects, Indian Council of Medical Research (ICMR), New Delhi, 2000.
3. ICMR Guidelines on Animal Use, 2001, ICMR, New Delhi.