



SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH

(A Deemed to be University Declared under Section 3 of UGC Act, 1956)

Comprising Sri DevarajUrs Medical College

[Constituent Unit of Sri DevarajUrs Educational Trust for Backward Classes (Regd.)]

TAMAKA, KOLAR-563103, KARNATAKA, INDIA

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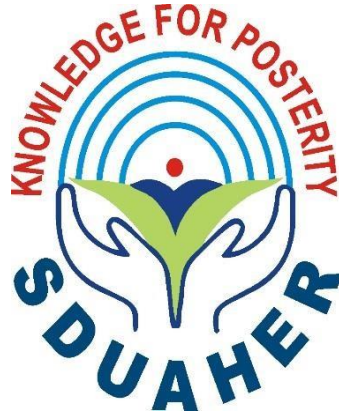
(With effect from 2019-2020 batches)

Competency Based Postgraduate Curriculum for Doctor of Medicine Biochemistry


Dean Faculty Of Medicine
Sri Devaraj Urs Academy of Higher
Education & Research, Tamaka, Kolar.

Approved as per BOM-56-2019, (Resolution No-LVI.06) Dated-20/12/2019

REGULATIONS GOVERNING
POST GRADUATE DEGREE PROGRAMMES
CURRICULUM 2019-2020

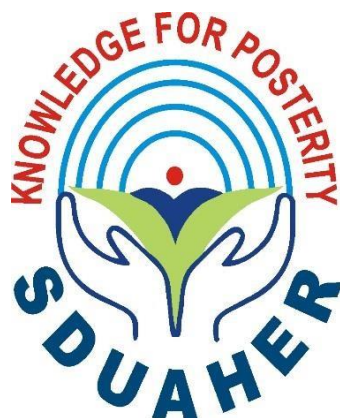


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Comprising Sri Devaraj Urs Medical College
A Deemed To Be University

Declared under section 3 of UGC, Act,1956,
MHRD GOI NO.F,9-36/2006-U.3(A), Dt.25th may 2007
Post box No.62, Tamaka, Kolar-563101, Karnataka, INDIA
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REGULATIONS AND CURRICULA
FOR
POST GRADUATE DEGREE PROGRAMMES
IN
MEDICAL SCIENCES
2019-2020



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Edition Year: 2020

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VISION:

“UNIVERSITY OF EXCELLENCE - KNOWLEDGE FOR POSTERITY”

MISSION:

1. To be a global centre of excellence for Teaching, Training and Research in the field of Higher education.
2. To inculcate scientific temper, research attitude and social accountability amongst faculty and students.
3. To promote with value based education for the overall personality development and leadership qualities to serve the humanity.

OBJECTIVES:

1. To provide need based infrastructure and facilities to students to become responsible professionals with social commitment and accountability.
2. To implement effectively innovative programs in teaching learning and evaluation.
3. To impart scientific and socio cultural temperament among students to forge national identity and needs.
4. To provide instruction and training in Basic and advanced branches of learning.
5. To provide facilities for research for the advancement and dissemination of knowledge.
6. To undertake extra mural studies, consultancy, extension programmes and field outreach services for the development of society.
7. To collaborate with other Universities, Institutions of excellence and research organizations within the country and outside for the purpose of teaching, training and research.
8. To undertake need based activities for the betterment of socially and educationally backward society.

At a glance this logo is abstract, yet it contains the vital ingredients for an institution like Sri Devaraj Urs Academy of Higher Education and Research, Tamaka, Kolar.

The institution's medical background, Humanitarian values, Compassion,

Approachability, Social Commitment and the subsequent research towards the most precious thing, the human life, is the core theme.

The graphic form of a person in the centre of a bud represents the humanity. It denotes the growing process of life and its existence. And the two hands safeguarding them show the care and a sense of security. It is also capable of holding something within the vast expanse of knowledge by the University for the People's benefit. Hence, the motto "Knowledge for Posterity" is very appropriate and gives a punch in Red. The four light blue half circles (smaller to bigger) depict the unending quest for knowledge and imparting it to a wider horizon, growing higher and higher.

And finally, the whole unit is embedded in a "D" shaped graphic template as background to give it a corporate identity.

COLORS USED:

Deep Blue: Credible, Confident and Dependable. Represents Peace, Tranquility, Stability, Harmony, Trust, Security, Cleanliness and Loyalty

Light Blue: For Sky and Water (color scheme for 4 half circles)

Red: A dominant color for strengths.

Green: For Nature, Health and Generosity. It is cool quality soothes and has great healing powers



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No. SDUAHER/KLR/ ADMN/1322/2020-21

Date:12/10/2020

NOTIFICATION

Sub: Regulations, curricula and syllabi of Postgraduate medical degree programmes in Preclinical, Paraclinical and clinical subjects- reg

Ref.

- I. Proceedings of the Academic Council meetings**
- II. Proceeding of the Board of Management meetings**
- III. MCI notifications**
- IV. SDUAHER notification:**

| Academic Council Meetings | | Board of Management Meetings | |
|----------------------------------|------------|-------------------------------------|------------|
| 19 th | 17.11.2014 | 34 th | 19.06.2015 |
| 21 st | 25.04.2015 | 36 th | 04.12.2015 |
| 22 nd | 18.11.2015 | 44 th | 23.06.2017 |
| 27 th | 29.04.2017 | 45 th | 09.11.2017 |
| 28 th | 04.11.2017 | 48 th | 20.06.2018 |
| 30 th | 05.05.2018 | 50 th | 22.12.2018 |
| 31 st | 03.11.2018 | 54 th | 06.07.2019 |
| 33 rd | 04.06.2019 | 56 th | 20.12.2019 |
| 34 th | 15.11.2019 | 59 th | 09.10.2020 |
| 36 th | 30.09.2020 | | |

Agenda discussed:

- Objectives of external postings of Post Graduates
- Internal & External postings of PG's with assessment tools
- Minimum marks to be scored in PG theory examinations
- Topics to be included in Forensic medicine and toxicology in paper 4 for PG students
- Work placed based assessment for PG students
- Introduction of Assessment of AETCOM in formative/summative assessment
- Design and development of E-portfolio for all PG's
- Patient handover as common EPA for all departments
- Preparation of Question paper from question bank using software

- Coding of answer booklet by software enabled barcoding
- Development of CBME in PG programmes
- Quarterly formative assessment as an assessment tool for all PGs
- Start course in MD psychiatry
- Implement E- Portfolio of PG's
- Discontinuation of practice for 5th evaluation in PG exam
- Post graduate training programme MCI-PG Medical Education Regulations 2000, amended upto May 2018
- Approval of EPA's as competency based medical training for PG's
- Work placed based assessment as part of quarterly assessment for PG's
- PLO's for all programmes

V. MCI Notifications

- MCI Notification dated 09-12-2009, vide No.MCI.18(1)/2009-Med.55455
- No. MCI-23(1)/2014/Med/153433 Dated 28-01-2015
- MCI Guidelines 2017(CBME based)
- MCI postgraduate medical education regulations 2000 amended upto 2018 (clause 13.2,gazette notification dated 05/04/2018)
- Basic Programme in Biomedical Research(MCI-23(1)/2019-Med./141602 dated 27-08-2019).
- MCI-12(2)/2019-Med.Misc./189334.- Dated:12th February 2020
- MCI-18(1)/2020-Med./121415.-date 16/09/2020- (District Residency Programme' (DRP)

VI. Office Memorandum No. SDUAHER / KLR/ ADMN /8071/2019- 20 Dated 22/06/2019

VII. SDUAHER / KLR/ ADMN /1571/2019-20 dated 12/09/2019

REGULATIONS FOR POST GRADUATE DEGREE PROGRAMME IN MEDICAL SCIENCES

CHAPTER- I

1. Branches of Study

1.1 Postgraduate Degree Programme

The following programmes may be pursued.

A. M.D. (Doctor of Medicine)

1. Anatomy
2. Physiology
3. Biochemistry
4. Pharmacology
5. Pathology
6. Microbiology
7. Forensic Medicine
8. Community Medicine
9. General Medicine
10. Dermatology, Venereology and Leprosy
11. Anesthesiology
12. Paediatrics
13. Radio-Diagnosis
14. Psychiatry

B. M.S. (Master of Surgery)

1. General Surgery
2. Obstetrics and Gynecology
3. Orthopedics
4. Ophthalmology
5. OTO-Rhino-Laryngology

1.2. Eligibility for Admission

1.2.1 MD / MS Degree Programme: A candidate affiliated to this academy 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 Academy 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 will be eligible for admission.

1.2.2 A Candidate seeking admission should have successfully cleared the qualifying examination - NEET (National Eligibility cum Entrance Test) conducted by NBE (National Board of Examination).

1.3. Obtaining Eligibility Certificate by the Academy before making Admission

No candidate will be admitted for any postgraduate degree programme unless the candidate has obtained and produced the eligibility certificate issued by the Academy. The candidate has to make an application to the Academy with the following documents along with the prescribed fee:

1. S.S.L.C Marks card
2. 10+2 Certificate
3. All MBBS Marks Cards
4. Internship Completion Certificate
5. Attempt / Academic certificate
6. Degree Certificate
7. Transfer Certificate
8. Migration Certificate
9. Study/ Bonafide Certificate
10. Character & Conduct certificate
11. MCI Recognized Certificate by college
12. Karnataka Medical Council/State medical council
13. MCC Allotment Letter
14. NEET Admission Ticket
15. NEET Rank card
16. Caste (SC/ST) /OBC certificate (domicile) & Income Certificate
17. Aadhar card of both candidate and parents / sponsors
18. Bond for SR Ship
19. Remaining years fee bond

NOTE: The NRI/NRI Sponsor students have to submit the documents as per the MCC/DGHS Criteria for NRI status

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

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

1.4. Intake of Students

The intake of students to each programme will be in accordance with the ordinance in this behalf.

1.5. Duration of Study

a) M.D/M.S Degree Programme

The programme of study will be for a period of 3 years consisting of 6 academic terms.

1.6. Method of training

The training of postgraduate for degree will 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 participate in seminars, group discussions, grand rounds, case demonstration, clinics, journal review meetings, CPC and clinical meetings. Every candidate should participate in the teaching and training programme of undergraduate students. Training includes involvement in laboratory and experimental work and research studies.

1.6.1. Teaching methodology

1.6.1.1 Includes Didactic lectures, small group discussion such as seminars, journal clubs, symposia, reviews and guest lectures for acquiring theoretical knowledge.

1.6.1.2 Bedside teaching, grand rounds, structured interactive group discussions and clinical demonstrations should be the hallmark of clinical/practical learning with appropriate emphasis on e-learning. Student should have hand-on training in performing various procedures and ability to interpret various tests/investigations.

1.6.1.3 Exposure to newer specialized diagnostic/therapeutic procedures concerning her/his subject should be given.

1.6.4 Self-learning tools like assignments and case-based learning should be promoted.

1.6.2. Clinical postings and Rotation of posting

Basic medical sciences students will be posted to allied and relevant clinical departments or institutions. Students working in clinical departments will be posted to basic medical sciences and allied speciality departments or institutions. It should be done as concurrent studies during the 1st year of training Similarly Inter-unit rotation in the department should be done for a period of up to one year. Rotation in appropriate related subspecialties **should not extend for a period exceeding 06 months.** Postings to other specialty departments will be during the second year.

All postgraduates' students pursuing MD/MS in broad specialities shall undergo a compulsory residential rotation of three months in District Hospital / District Health system as a part of the course curriculum. Such rotation shall take place in the 3rd or 4th or 5th semester of the postgraduates programme. This rotation shall be termed as District residency programme and the postgraduate medical student undergoing training shall be termed as a District Resident.

Satisfactory completion of the District Residency shall be an essential condition before the candidate is allowed to appear in the final examination of the respective postgraduate course. The District Residency Programme Coordinator (DRPC) shall issue certificate of satisfactory completion of DRP and report on the performance of the District Resident on a prescribed format to the concerned Medical College and the Government of State/Union Territory. No. MCI-18(1)/2020-Med./121415. – date 16/09/2020

1.6.3. Clinical meetings:

Clinical meetings will be conducted within the department weekly and also inter departmental meetings will be conducted monthly to discuss uncommon/interesting cases.

1.6.4 Log book:

Each student should maintain a logbook and document day to-day activities like documentation of ward work, teaching and learning activities , clinical case discussion, procedures performed , seminars, journal clubs, symposium ,CPC meets, inter-unit/interdepartmental teaching sessions, mortality meets, workshops, CME/conferences .The Log books will be checked and assessed periodically by the faculty members imparting the training. This will in turn be evaluated/assessed by an external reviewer appointed by the Director of PG Studies biannually during the months of July and January. The log book should be preserved and presented at the time of summative examinations conducted by the Academy.

1.6.5 Research activities:

- 1.6.5.1 The student should know the basic concepts of research methodology plan a research project and be able to retrieve information from the library. The student should have a basic knowledge of statistics.
- 1.6.5.2 A postgraduate student of a postgraduate degree programme in broad specialities should present one poster presentation, read one paper at a national/state conference and publish one research paper which should be published /accepted for publication/sent for publication during the period of his postgraduate studies so as to make him eligible to appear at the postgraduate degree examination. MCI Notification No.18(1)/2009/medicine/55455 Dated:09-12-2009
- 1.6.5.3 Department should encourage e-learning activities.

1.6.6 Basic Programme in Biomedical Research:

In order to improve the research skills of post-graduate students, the Board of Governors (BoG) has recommended a uniform research methodology programme across the country, the online programme, “Basic programme in Bio-medical Research”, will be offered by ICMR-National Institute of Epidemiology (ICMR-NIE), Chennai (www.nie.gov.in). The programme will explain fundamental concepts in

Research methodology. This programme is being offered through SWAYAM programme of ministry of human resource development through SWAYAM NPTEL (http://swayam.gov.in/nc_details/NPTEL)

1.6.7 Synopsis and Dissertation:

Every candidate will submit to the Registrar of the Academy in the prescribed proforma, a synopsis containing particulars of proposed dissertation work within six months from the date of commencement of the programme on or before the dates notified by the Academy. The synopsis will be sent through the proper channel.

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

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

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

The dissertation should be written under the following headings:

- Introduction
- Aims or Objectives of study
- Review of Literature
- Material and Methods
- Results
- Discussion
- Conclusion
- Summary
- References
- Tables
- Annexures

The written text of dissertation will be not less than 50 pages and will 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. The dissertation will be certified by the guide, Head of the department and Head of the Institution.

Six hard copies of dissertation and one soft copy thus prepared will be submitted to

the Controller of Examination (CoE), six months before final examination on or before the dates notified by the Academy.

The dissertation will be valued by examiners appointed by the Academy. Approval of dissertation work is an essential precondition for a candidate to appear in the Academy examination.

Guide: The academic qualification and teaching experience required for recognition by this Academy 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 four years teaching experience as Assistant Professor with at least one research publication in indexed journals gained after obtaining post graduate degree will be recognized as post graduate teachers. (No.MCI- 12(2)/2019-Med.Misc./189334.- Dated: 12th February 2020)

Co-guide: may be included provided the work requires substantial contribution from a sister department or from another medical institution recognized for teaching/training by Sri Devaraj Urs Academy /Medical Council of India. The co- guide will be a recognized post graduate teacher of Sri Devaraj Urs Academy.

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 academy.

1.6.8 Journal Club:

Journal club will be conducted once a week. All the PG students are expected to attend and actively participate in discussion and enter the relevant details in the log book. Further, every candidate must make a presentation from the allotted journal(s), selected articles, at least four times a year and a total of 12 presentations in three years. The presentations would be evaluated using check lists and would carry weightage for internal assessment (See checklist - I in Chapter V). A time table with names of the student and the moderator should be announced periodically, (Quarterly).

1.6.9 Subject Seminar:

Subject seminar will be conducted once a week. All the PG students are expected to attend and actively participate in discussion and enter the relevant details in the log book, Further, every candidate must present selected topics at least four times a year and a total of 12 seminar presentations in three years. The presentations would be evaluated using check lists and would carry weightage for internal assessment (See checklist-II in Chapter V). A timetable for the subject with names of the student and the moderator should be announced periodically, (Quarterly).

1.6.10 Student Symposium:

Student Symposium as an additional inter departmental programme will be conducted periodically, once in three months. The evaluation may be similar to that described for subject seminar.

1.6.11 Ward Rounds:

Ward rounds are service or teaching rounds.

- i. *Service Rounds:* Postgraduate students and Interns will do every day for the care of the patients. Newly admitted patients should be worked up by the PGs and presented to the seniors the following day.
- ii. *Teaching Rounds:* Every unit will have 'grand rounds' for teaching purpose. A diary should be maintained for day to day activities by the students. Entries of (i) and (ii) should be made in the Log book.

1.6.12 Clinico-Pathological Conference:

CPC will be conducted once in two months for all post graduate students. Presentation will be done by rotation. If cases are not available due to lack of clinical postmortems, it could be supplemented by published CPCs.

1.6.13 Inter Departmental Meetings:

These will be conducted once a month. These meetings will be attended by post graduate students and relevant entries must be made in the Log Book.

1.6.14 Teaching & Learning Skills:

Post graduate students must teach under graduate students (Eg. medical, nursing) by taking demonstrations, bed side clinics, tutorials, lectures etc.

Assessment is made using a checklist by surgery faculty as well as students. (See model checklist -III in Chapter V). Record of their participation should be documented in the Log book. Training of post graduate students in Educational Science and Technology is recommended.

Further, all postgraduate students are required to attend at least about 35 hours of didactic lecture as notified by the individual departments.

1.6.15 Entrustable Professional Activity:

EPAs are units of professional practice, defined as tasks or responsibilities to be entrusted to the unsupervised execution by a trainee once he or she has attained sufficient specific competence. EPAs are independently executable, observable, and measurable in their process and outcome, and therefore, suitable for entrustment decisions. The Entrustable professional activity (EPA) concept allows faculty to make competency-based decisions on the level of supervision required by trainees. The Academy has identified few such EPA's for all students in various degree programme. These are:

1. EPA 1: Gather a history and perform a physical examination

2. EPA 2: Prioritize a differential diagnosis following a clinical encounter
3. EPA 3: Recommend and interpret common diagnostic and screening tests
4. EPA 4: Obtain informed consent for tests and / or procedures
5. EPA 5: Recognize a patient requiring urgent or emergent care and initiate evaluation and management
6. EPA 6: Give or receive a patient handover to transition care responsibility
7. EPA 7: Undertake complete patient monitoring including the preoperative and post-operative care of the patient.
8. EPA 8: Provide basic and advanced lifesaving support services in emergency situations
9. EPA 9: Collaborate as a member of an inter-professional team
10. EPA 10: Perform general procedures of a physician
11. EPA 11: Enter and discuss orders and prescriptions
12. EPA 12: Prepare a comprehensive discharge summary.
13. EPA 13: Form clinical questions and retrieve evidence to advance patient care.

However in addition to these common EPA's individual departments are advised to develop their own EPA's.

1.7. Continuing Medical Education (CME):

Every PG student must attend at least 2 CME programmes either at state/regional /zonal/national levels.

1.8. Conferences:

Attending conferences is optional. However it has to be encouraged. All students are encouraged to attend conferences (at state/national/international levels) to enable them to make paper/poster presentations, which is a mandatory requirement to fulfill before appearing for final examinations.

1.9. Attendance, Progress and Conduct:

- A candidate pursuing degree programme will 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 programme.
- Academic term of 6 months will be taken as a unit for the purpose of calculating attendance. The candidate should have 80% attendance in each academic term of 6 months.

- Every student will 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.
- Every candidate is required to attend a minimum of 80% of the training during each academic term of the post graduate programme. Provided further, leave of any kind will not be counted as part of academic term without prejudice to minimum 80% attendance of training period every term.
- All the candidates joining the Post Graduate training programme will work as 'Full Time Residents' during the period of training and will attend not less than 80% (Eighty percent) of the imparted training during each academic term. Including assignments, full time responsibilities and participation in all facets of the education process.
- Any student who fails to complete the programme in the manner stated above will not be permitted to appear for the Academy Examinations.
- A Postgraduate student of a postgraduate degree programme would be required to present one poster presentation, to read one paper at a national/state conference and to present one research paper which should be published / accepted for publication/sent for publication during the period of postgraduate studies so as to make him eligible to appear at the postgraduate degree examination.

Ref: As MCI Notification dated 09-12-2009, vide No.MCI.18 (1)/2009- Med.55455 and Para No.4.

Procedure for defaulters:

Every department will have a committee containing Head of the department and PG guides to review such situations. The defaulting candidate is counseled 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 fulfill the, requirements in spite of being given adequate chances to set himself or herself right.

2 Monitoring Progress of Studies:

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

The learning outcomes to be assessed should include:

- Personal Attitudes,
- Acquisition of Knowledge,
- Clinical and operative skills,
- Teaching skills and
- Dissertation.

a. Personal Attitudes:

The essential items are:

- Caring attitudes
- Initiative
- Organisational ability
- Potential to cope with stressful situations and undertake responsibility
- Trustworthiness 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, self, peers, faculty from the unit and nurses. (Multi source feedback MSF) checklist XII

b. Acquisition of Knowledge:

The methods used comprise of

2.1 Log book: (Check List - XIII Chapter - V)

'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 must be recorded. The log book will periodically be validated by the supervisors. Some of the activities are listed. During the training period, the post graduate student should maintain a Log Book indicating various teaching / learning activities, duration of the postings/work done in Wards including super specialty, OPDs and Casualty. This should indicate the specified number of cases for clinical discussion, procedures and operations observed, assisted and performed / presented seminars and review articles from various journals in inter- unit/inter departmental teaching sessions.

The purpose of the Log Book is to:

- Help maintain a record of the work done during training,
- Enable Consultants to have direct information about the work; intervene if necessary,
- Use it to assess the experience gained periodically.

The log book will be used to aid the internal evaluation of the student.

The Log books will be checked and assessed periodically, monthly basis by guide / head of the unit/ head of the department and biannually by external reviewer.

Procedure for defaulters:

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

2.2 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, in Chapter V)

2.3 Seminars/Symposia:

The topics will 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 will be assessed using a checklist (see Model Checklist -II, Chapter V)

2.4 Clinico'-Pathological conferences:

This will 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 check list similar to that used for seminar.

2.5 Surgical Audit:

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

2.6 Clinical skills

Day to Day work: Skills in outpatient and ward work will be assessed periodically. The assessment should include the candidates' sincerity and punctuality, analytical ability and communication skills (see Model Checklist -V, Chapter V). – Mini CEX (Model check list VII, Chapter V)

2.7 Clinical meetings (Clinical Presentations) :

Candidates should periodically present cases to his peers and faculty members. This should be assessed using a check list (see Model checklist V, Chapter V).

2.8 Clinical and Operative skills:

The candidate will be given graded responsibility to enable learning by apprenticeship. The performance is assessed by the guide by DOPS (Model check list VI, Chapter V). Particulars are recorded by the student in the log book.

2.9 Teaching skills:

Post graduates are required to teach undergraduate medical students and paramedical students, if any (*as a part of Post graduate training*). This performance should be based on assessment by the faculty members of the department and from feedback from the undergraduate students (See Model checklist III, Chapter V) - Microteaching Pedagogy (Model check list VIII, Chapter V)

2.10 Dissertation in the Department:

Periodic presentations must be made in the department. Initially the topic selected is to be presented before submission to the Academy for registration and again before finalization for critical evaluation and before final submission of the completed work (See Model Checklist IX & X, Chapter V)

2.11 Periodic tests:

The concerned departments will conduct quarterly tests. The final test will be held three months before the final examination. The tests may include written papers, practical's / clinical and viva voce. Records and marks obtained in such tests will be maintained by the Head of the Department and sent to the Academy, when called for.

2.12 Work diary / Log Book-

Every candidate will 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 must be made of the presentations by the candidate as well as details of clinical or laboratory procedures, if any conducted by the candidate.

2.13 Records:

Monthly and quarterly reviews of records, log books and marks obtained in tests will be maintained by the Head of the Department and will be made available to the Academy, when called for.

3. ASSESSMENT:

3.1 Formative Assessment

It is essential to monitor the learning progress of each candidate through **continuous appraisal and regular assessment**. It not only helps teachers to evaluate students, but also students to evaluate themselves. The monitoring to 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. This includes assessment of patient care, procedural & academic skills, interpersonal skills, professionalism, self-directed learning and ability to practice in the system.

Checklists are given in Chapter-V

Assessment during the MS/MD training should be based on:

Assessment at end of rotation (Quarterly Postgraduate Student's Appraisal Form) by the Unit Head. The student to be assessed periodically as per categories listed in **Postgraduate Student Appraisal Form** (See Model checklist-X, Chapter V).

Multisource Feedback (MSF) - Quarterly

MSFs should be obtained quarterly from:- 2 from faculty of the unit/department; 2 from peers posted in the unit; 2 from interns, 2 from staff nurses from the areas attached to the unit, 2 from patient/patient relative. (Checklist XII - Chapter V)

Periodic assessment -The Quarterly tests may include written papers (theory), practical's / clinical and viva voce.

Quarterly Postgraduate Student's Appraisal Form (See Model checklist-X I, Chapter V).

- Journal based/ recent advances learning
- Patient based or Skill based learning
- Self-directed learning and teaching
- Departmental & interdepartmental learning activity
- External & Outreach activities/ Continuing Medical Education (CME)
- Attendance, Progress and Conduct

A candidate pursuing degree programme 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 programme.

Academic term of 6 months will be taken as a unit for the purpose of calculating attendance. Every student will 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.

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

All the candidates joining the Post Graduate training programme will work as 'Full Time Residents' during the period of training and will attend not less than 80% (Eighty percent) of the imparted training during Academic Term of 6 months including assignments, full time responsibilities and participation in all facets of the education process.

Any student who fails to complete the programme in the manner stated above will not be permitted to appear for the Academy Examinations.

A Postgraduate student of a postgraduate degree programme in broad specialities/super specialities would be required to present one poster presentation, to read one paper at a national/state conference and to present one research paper which should be published / accepted for publication/sent for publication during the period of postgraduate studies so as to make him eligible to appear at the postgraduate degree examination.

Ref: As MCI Notification dated 09-12-2009, vide No.MCI.18 (1)/2009-Med.55455 and Para No.4.

Procedure for defaulters:

Every department should have a committee containing Head of the department and PG guides to review such situations. The defaulting candidate is counseled 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 fulfill the, requirements in spite of being given adequate chances to set himself or herself right.

3.2 Scheme of examinations

Summative assessment

The summative examination would be carried out as per the Rules given in POSTGRADUATE MEDICAL EDUCATION REGULATIONS, 2000 and amended up to 2018. (The Clause 14 under the heading "EXAMINATION" shall be substituted in terms of Gazette Notification published on 05.04.2018).

The examination will be in three parts:

3.2.1 DISSERTATION

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

least six months before the Theory and Clinical / Practical examination. The dissertation will be examined by a minimum of three examiners; one internal and two external examiners, who will not be the examiners for Theory and Clinical examination. A candidate will be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the dissertation by the examiners.

3.2.2. THEORY

There will be four question papers, each of three hours duration. Each paper will consist of ten questions each question carrying 10 marks, so the total marks for each paper will be 100. Questions on recent advances maybe asked in any or all the papers. The examinations will be organised on the basis of 'Grading' or 'Marking system' to evaluate and to certify candidate's level of knowledge, skill and competence at the end of the training. The Clause 14 under the heading "EXAMINATION" shall be substituted in terms of Gazette Notification published on 05.04.2018 and the same is as under:-

Obtaining a minimum of 40% marks in each theory paper and not less than 50% cumulatively in all the four papers for degree examinations and three papers in diploma examination. Obtaining of 50% marks in Practical examination shall be mandatory for passing the examination as a whole in the said degree/diploma examination as the case may be. Obtaining a minimum of 50% marks in 'Theory' as well as 'Practical' separately will be mandatory for passing examination as a whole. The examination for MS/MD will be held at the end of 3rd academic year.

3.2.3. Clinical / Practical and viva voce Examination

Clinical examination will be conducted to test the knowledge, skills, attitude and competence of the post graduate students for undertaking independent work as a specialist/Teacher, for which post graduate students will examine a minimum one long case and two short cases.

The Oral examination will be thorough and will aim at assessing the post graduate student's knowledge and competence about the subject, investigative procedures, therapeutic technique and other aspects of the specialty, which form a part of the examination.

Assessment may include Objective Structured Clinical Examination (OSCE) Oral/Viva-voce examination needs to assess knowledge on X-rays, instrumentation, operative procedures. Due weightage should be given to Log Book Records and day to-day observation during the training.

ALLOTMENT OF MARKS

| THEORY | MARKS ALLOTMENT | MAXIMUM MARKS | |
|-----------|-----------------|---------------|-----|
| PAPER-I | 10 X 10 | 100 | 400 |
| PAPER-II | 10 X 10 | 100 | |
| PAPER-III | 10 X 10 | 100 | |
| PAPER-IV | 10 X 10 | 100 | |

| | | |
|------------------------------|-----------|------------|
| <u>CLINICALS/ PRACTICALS</u> | | 200 |
| <u>VIVA VOCE</u> | <u>80</u> | 100 |
| <u>PEDAGOGY</u> | <u>20</u> | |
| TOTAL | | 700 |

3.2 Examiners:

There will be at least four examiners in each subject. Out of them two will be external examiners and two will be internal examiners. The qualification and teaching experience for appointment as an examiner will be as laid down by the Medical Council of India. No person will be appointed as internal examiner in any subject unless he/she has three years' experience as recognized PG teacher in the concerned subject. For external examiners he/she should have minimum six years of experience as recognized PG teacher in the concerned subject.

3.2.4 Criteria for declaring as pass in Academy Examination:

A candidate should score minimum 40% marks in each theory paper and not less than 50% marks cumulatively in all the papers in postgraduate degree/diploma, to be declared as pass in the examinations. 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. (No. MCI-23(1)/2014/Med/153433 Dated 28-01-2015) A failed candidate may appear in any sub-subsequent examination upon payment of fresh fee to the Registrar of the University.

3.2.5 Declaration of distinction:

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

3.2.6 Number of Candidates per day.

The maximum number of candidates for practical/clinical and viva-voce examination will be as under: MD / MS Programme: Maximum of 8 per day

4. ELIGIBILITY CRITERIA FOR APPEARING FOR EXAMINATIONS 4.1 ATTENDANCE

All the candidates joining the Post Graduate training programme will work as 'Full Time Residents' during the period of training and will attend not less than 80% (Eighty percent) of the imparted training during Academic Term of 6 months including assignments, full time responsibilities and participation in all facets of the education process.

- Every student will attend all teaching programmes during each year as prescribed by the department and not absent himself / herself from work without valid reasons
- Every candidate is required to attend a minimum of 80% of the training during each academic year of the post graduate programme. Provided further, leave of any kind will not be counted as part of academic term without prejudice to minimum 80% attendance of training period every term.
- Any student who fails to complete the programme in the manner stated above will not be permitted to appear for the Academy Examinations.

4.2. PROGRESS AND CONDUCT

- Every student will attend symposia, seminars, conferences, journal review meetings, grand rounds, CPC, case presentation, clinics and lectures during each term as prescribed by the department and not absent himself / herself from work without valid reasons.
- Every candidate is required to attend a minimum of 80% of the training during each academic term of the post graduate programme. Provided further, leave of any kind will not be counted as part of academic term without prejudice to minimum 80% attendance of training period every term.

4.3. RESEARCH ACTIVITIES-PAPER/POSTER/PUBLICATIONS

- A Postgraduate student of a degree programme in broad speciality would be required to present one poster presentation, to read one paper at a national/state conference and to present one research paper which should be published / accepted for publication/sent for publication during the period of postgraduate studies so as to make him eligible to appear at the postgraduate degree examination. Ref: As MCI Notification dated 09-12-2009, vide No.MCI.18 (1)/2009-Med.55455 and Para No.4.
- It is mandatory for all postgraduate students to undergo training in online programme in "Basic Programme in Biomedical Research" Which should be completed by the end of second semester .Not completing the programme will make them ineligible for appearing for the final academy examinations.(MCI-23(1)/2019-Med./141602 dated 27-08-2019).

4.4 DISSERTATION

Every post graduate student will carry out work on an assigned research project under the guidance of a recognised Post Graduate Teacher, the result of which will

be written and submitted in the form of a dissertation. Dissertation will be submitted at least six months before the Theory and Clinical / Practical examination. The dissertation will be examined by a minimum of three examiners; one internal and two external examiners, who will not be the examiners for Theory and Clinical examination. A candidate will be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the dissertation by the examiners.

4.5 District Residency Programme

All postgraduates students pursuing MD/MS in broad specialties shall undergo a compulsory residential rotation of three months in District Hospital / District Health system as a part of the course curriculum. Such rotation shall take place in the 3rd or 4th or 5th semester of the postgraduates programme. This rotation shall be termed as District residency programme and the postgraduate medical student undergoing training shall be termed as a District Resident.

Satisfactory completion of the District Residency shall be an essential condition before the candidate is allowed to appear in the final examination of the respective postgraduate course. The District Residency Programme Coordinator (DRPC) shall issue certificate of satisfactory completion of DRP and report on the performance of the District Resident on a prescribed format to the concerned Medical College and the Government of State/Union Territory. No. MCI-18(1)/2020-Med./121415. – date 16/09/2020

Procedure for defaulters:

Every department should have a committee containing Head of the department and PG guides to review such situations. The defaulting candidate is counseled 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 fulfill the, requirements in spite of being given adequate chances to set himself or herself right.

CHAPTER II
**GOALS AND GENERAL OBJECTIVES OF POSTGRADUATE MEDICAL
EDUCATION PROGRAM**

GOALS:

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

- i. Who will recognize 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 will have mastered most of the competencies, relating to the specialty, that are required to be practiced at the secondary and the tertiary levels of the health care delivery system;
- iii. Who will be aware of the contemporary advances and developments in the discipline concerned;
- iv. Who will have acquired a spirit of scientific inquiry and is oriented to the principles of research methodology and epidemiology; and
- v. Who will 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 will be able to:

- i. Recognize the importance of the concerned specialty in the context of the health need of the community and the national priorities in the health sector.
- ii. Practice the specialty concerned ethically and in step with the principles of primary health care.
- iii. Demonstrate sufficient understanding of the basic sciences relevant to the concerned specialty.
- 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 specialty 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 specialty.
- vii. Demonstrate skills in documentation of individual case details as well as morbidity and mortality data relevant to the assigned situation,
- viii. Demonstrate empathy and humane approach towards patients and their families and exhibit interpersonal behavior in accordance with the societal norms and expectations.
- ix. Play the assigned role in the implementation of national health programmes, effectively and responsibly.

- x. Organize 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, recognize 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 will aim at development of specific competencies, which will be defined and spelt out in clear terms. Each department will 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 will 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, 2006 and 2008.

COMPETENCY BASED POSTGRADUATE TRAINING PROGRAMME FOR M.D. BIOCHEMISTRY

Preamble

The purpose of PG education is to create specialists who would provide high quality health care and advance the cause of science through research & training.

The student who has obtained MD degree in Biochemistry should be well-versed in basic concepts and recent advances in the subject and should have acquired skills and expertise in various laboratory techniques applicable to metabolic and molecular aspects of medicine and in research methodology. Training during the course should equip the student with skills to become an effective teacher, able to plan and implement teaching programmes for students in medical and allied health science programmes, set up/manage a diagnostic laboratory, generate, evaluate and interpret diagnostic laboratory data, interact with clinicians to contribute to more effective patient care and carry out a research project and publish its results.

The purpose of this document is to provide teachers and learners illustrative guidelines to achieve defined outcomes through learning and assessment. This document was prepared by various subject-content specialists. The Reconciliation Board of the Academic Committee has attempted to render uniformity without compromise to purpose and content of the document. Compromise in purity of syntax has been made in order to preserve the purpose and content. This has necessitated retention of “domains of learning” under the heading “competencies”.

Goal:

- The post graduate course in M.D. Biochemistry shall 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 shall gain knowledge and expertise in biochemistry so that he/ she will be equipped to pursue their career in one or more of the following facets of biochemistry teaching, diagnostic work, research and community health.

Programme outcomes:

At the end of the program an MD Biochemistry student shall gain knowledge in the following key areas of the subject

| | |
|---|---|
| 1 | The chemical and three dimensional structures of the various biomolecules such as carbohydrates, proteins, lipids and nucleic acids as a prelude to understanding the correlation between structure and their function. |
| 2 | An in depth insight into the metabolic pathways of the major classes of biomolecules, regulatory mechanisms, interactions, significance and alterations in disease conditions. |
| 3 | Role of micro and macro nutrients like vitamins and minerals in health and their pathophysiological aspects in nutritional disorders |
| 4 | Mechanism of energy release, conservation, utilization and derangements thereof. |
| 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 biochemical test and interpreting the data. |
| 8 | Develop skill in performing and gain knowledge in interpretation of data generated with advanced biochemical techniques. |

SPECIFIC LEARNING OBJECTIVES

At the end of the MD training programme in Biochemistry, the post graduate student should have acquired competencies in the following areas, as detailed below.

Acquisition of knowledge

The student should be able to explain clearly concepts and principles of biochemistry and cell biology, including correlations of these with cellular and molecular processes involved in health and disease.

Teaching and training

The student should be able to effectively teach undergraduate students in

medicine and allied health science programmes so they become competent health care professionals and able to contribute to training of postgraduate post graduate students.

Diagnostic services

The student should be able to set up/supervise/manage a diagnostic laboratory in Biochemistry in a hospital, ensuring quality control, and providing a reliable support service. The student should be able to provide clinicians with consultation services for diagnostic tests in biochemistry and in interpretation of laboratory results.

Research

The student should be able to carry out a research project from planning to publication and be able to pursue academic interests and continue life-long learning to become more experienced in all the above areas and to eventually be able to guide postgraduates in their thesis work.

Community Health

Identification of common health problems of the community and provide diagnostic services for their management.

SUBJECT SPECIFIC COMPETENCIES

The student during the training programme shall acquire the following competencies:

A. Cognitive domain

1. Describe and apply biochemical principles to explain the normal state, abnormal disease conditions and mechanism of action used in the perception, diagnosis and treatment of diseases.
2. Explain energy transactions in a living system and describe importance of biomolecules in sustaining the life process.
3. Describe pathways of the intermediary metabolism along with their individual and integrated regulation and apply that in understanding the functioning of the body.
4. Describe and apply the concept of nutrition in health and disease, micro- and macro-nutrition and essential nutrients and interlinks of nutrients with metabolism and functions of a living system.
5. Apply and integrate knowledge of molecular and metabolic conditions in normal and disease states for clinical problem solving and research
6. Acquire knowledge on application of various aspects of genetic engineering in medicine
7. Acquire knowledge and apply the principle of statistics, biostatistics and epidemiology to the evaluation and interpretation of molecular and metabolic disease states.
8. Evaluate, analyze and monitor disease states by applying relevant biochemical investigations and interpreting the clinical and laboratory data.

9. Able to integrate principles of immunology in biochemistry
10. Demonstrate knowledge of basics of research methodology, develop a research protocol, analyze data using currently available statistical software, interpret results and disseminate these results and to have the potential ability to pursue further specializations and eventually be competent to guide students.
11. Describe the principles of teaching - learning technology towards application and take interactive classroom lectures, prepare modules for PBL, organize and conduct PBLs, case discussions, small group discussions, Seminars, Journal club and research presentations
12. Demonstrate knowledge of principles of Instrumentation.
13. Demonstrate knowledge about recent advances and trends in research in the field of clinical biochemistry.

B. Affective domain

1. Effectively explain to patients from a variety of backgrounds, the molecular and metabolic basis of disease states and life style modifications.
2. Communicate biochemical reasoning effectively with peers, staff and faculty, and other members of the health care team.
3. Demonstrate empathy and respect towards patients regardless of the biochemical nature of their disease.
4. Demonstrate respect in interactions with patients, families, peers, and other health care professionals.
5. Demonstrate ethical behavior and integrity in one's work.
6. Demonstrate effective use of nutrition, lifestyle and genetic counseling.
7. Be aware of the cost of diagnostic tests and economic status of patients.
8. Acquire skills for self-directed learning to keep up with developments in the field and to continuously build to improve on skills and expertise.

C. Psychomotor domain

1. Able to select, justify and interpret the results of clinical tests in biochemistry.
2. Develop differential diagnosis for molecular and metabolic causes of diseases.
3. Suggest preventive, curative and /or palliative strategies for the management of disease.
4. Predict effectiveness and adverse effects associated with disease intervention.
5. Demonstrate skills for clinical diagnosis, testing, understanding of biochemical conditions and diagnostic service.
6. Perform important biochemical, immunological and molecular biology techniques.
7. Observed working of important advanced techniques.
8. Demonstrate standard operating procedures of various methods and techniques used in clinical biochemistry.
9. Determination of enzyme activity and study of enzyme kinetics. Ideally it should be accompanied by purification (partial) of the enzyme from a crude homogenate to emphasize the concepts of specific activity, yield and fold purification

10. Demonstrate and report routine investigations in hematology and microbiology
11. Demonstrate presentation skills at academic meetings and publications.

By the end of the course, the post graduate student should have acquired practical skills in the following:

- ❖ Performance of reactions of carbohydrates, amino acids and proteins and lipids
- ❖ Experiments to demonstrate constituents of milk
- ❖ Experiments to demonstrate normal and abnormal constituents of urine
- ❖ Determination of iodine number and saponification number of fats
- ❖ Estimation of ammonia and amino acids by Sorenson formal titration
- ❖ Estimation of nitrogen estimation in a given amino acid solution by micro Kjeldahl method
- ❖ Estimation of phosphorus by Fiske Subbarow method
- ❖ Estimation of ascorbic acid in lime
- ❖ Estimation of calcium content in milk
- ❖ Estimation of proteins by Folin's method and dye binding method.
- ❖ Two-dimensional paper chromatography for separation of amino acids
- ❖ Preparation and estimation of starch, glycogen, cholesterol, casein (phosphorus in casein) and hemoglobin from biological samples
- ❖ Determination of enzyme activity and study of enzyme kinetics, using any 2 suitable enzymes (eg, catalase from rat liver and acid phosphatase from potatoes).
- ❖ Estimation of clinical analytes as detailed below:
 - blood glucose, glycated haemoglobin; performance of glucose tolerance test
 - electrolytes, arterial blood gas analysis
 - cholesterol, triglycerides, free fatty acids, phospholipids, Lp (a), urea, creatinine, uric acid, ammonia, microalbuminuria
 - parameters of liver function tests (bilirubin, hepato-biliary enzymes such as AST, ALT, ALP, GGT, serum proteins/albumin and prothrombin time)
 - Calcium, magnesium, copper (and ceruloplasmin), serum iron, TIBC and ferritin
 - markers of myocardial damage (CK, CK MB, troponins, LDH)
 - other enzymes of diagnostic relevance (eg. phosphatases, amylase)
 - vitamins D and B12 and folate
- ❖ Electrophoresis of serum proteins
- ❖ Electrophoresis of lipoprotein (Optional)
- ❖ Electrophoretic separation of LDH isozymes or any other isoenzymes
- ❖ Clearance tests
- ❖ CSF analysis
- ❖ Thyroid function tests and other hormone assays by ELISA/RIA
- ❖ Preparation of buffers.

Clinical Laboratory

- ❖ Taking any one parameter, students should prepare a Levy Jennings chart and plot inter-assay and intra-assay variation for the laboratory.

- ❖ Implementation of Westgard rules.

Optional:

- ❖ Determination of reference values for any one parameter for the clinical laboratory

In addition, all efforts should be made to ensure that students at least see a demonstration of the following techniques.

- ❖ Separation of peripheral blood lymphocytes using Ficoll Hypaque
- ❖ Subcellular fractionation/marker enzymes for organelles to demonstrate fractionation
- ❖ Ultracentrifugation
- ❖ Isolation of high molecular weight DNA from tissues/blood
- ❖ Isolation of RNA; synthesis of cDNA by reverse transcription; PCR (both conventional and real-time)
- ❖ Isolation of plasmids and agarose gel electrophoresis for proteins and nucleic acids
- ❖ Basic techniques in cell culture
- ❖ High performance liquid chromatography(HPLC)

SYLLABUS

The course contents are outlined:

Paper I

Biomolecules, cell biology, biochemical techniques, biostatistics and research methodology, basics of medical education in teaching and assessment of biochemistry.

Biomolecules:

Properties of water

- Concept of an acid, a base, pH, pK, buffer and buffering capacity
- Classification, structure and functions of amino acids and peptides
- Structural organization of proteins and relationship with their functions
- primary, secondary, tertiary and quaternary structure of proteins
- protein folding and denaturation Structure-function relationship of proteins
- Structure and functions of hemoglobin and myoglobin
- Structure and function of collagen
- Structure and function of immunoglobulins
- Classification, functions, properties and reactions of carbohydrates
- Classification, properties and importance of lipids
- Fatty acids - nomenclature, classification, properties, reactions
- Mono, di- and triacylglycerols
- Transfats
- Cholesterol - structure, properties and functions
- Phospholipids - definition, types, properties and importance
- Glycolipids - definition, types, functions, examples.

- Lipoproteins - definition, structure, types, functions, role of apoproteins, importance in health and disease
- Biological membranes - structure, function, properties and importance
- Micelles and liposomes **Nucleotides and nucleic acids**
- Purine and pyrimidine bases in DNA and RNA
- Nucleosides and nucleotides
- Physiologically important nucleotides
- Synthetic analogues of purine/pyrimidine bases and nucleosides used as therapeutic agents (anti-cancer drugs, anti-viral drugs)
- Watson and Crick model of DNA structure
- Structure and functions of different types of RNA.

Cell biology

- Structure of the cell and different subcellular organelles
- Structure and functions of cell membrane, solute transport across biological membranes
- Intracellular traffic and sorting of proteins
- Intracellular signaling pathways, membrane receptors and second messengers
Extracellular matrix: composition, importance and biomedical importance, cellular adhesion molecules and intercellular communication
- Cytoskeleton, muscle contraction and cell motility
- Cell cycle, mitosis, meiosis and mechanisms of cell death
- Red and white blood cells

Analytical techniques in biochemistry

- Spectrophotometry (UV and visible spectrophotometry),
- atomic absorption spectrophotometry
- Flame photometry
- Fluorometry
- Turbidimetry and nephelometry
- Gravimetry
- Electrochemistry (pH electrodes, ion-selective electrodes, gas-sensing electrodes)
- Chemiluminescence
- Water testing
- Electrophoresis (principle, types, applications; isoelectric focusing capillary electrophoresis; 2-Delectrophoresis)
- Chromatography (principle, types [including high performance liquid chromatography and gas chromatography])
- Techniques in molecular biology: Blotting techniques, polymerase chain reaction (PCR), DNA and protein sequencing, microarrays and DNA chip technology, cloning techniques, genomics, proteomics and metabolomics.

Nanotechnology and microfabrication

Techniques to study in vivo metabolism - NMR, SPECT, PET scans, etc

Radioisotope-based techniques and its applications

Biostatistics and research methodology

- Basic concepts of biostatistics as applied to health science

- Statistical tests: t-test, analysis of variance, chi-square test, non-parametric tests, correlation and regression
- Statistical methods of validation of diagnostic tests
- Basics of epidemiological study designs and sampling methodologies
- Meta-analysis and systematic reviews

Basics of medical education in teaching and assessment of biochemistry

Principles of adult learning, taxonomy of learning, educational objectives, principles of assessment and question paper setting, methods of assessing knowledge, appropriate use of media, microteaching, small group teaching.

Environmental Biochemistry: Health and pollution.

Paper II:

Enzymes, bioenergetics, biological oxidation, intermediary metabolism and regulation, inborn errors of metabolism and nutrition

Enzymes:

Properties, classification, mechanism of action, coenzymes and cofactors, kinetics of enzyme activity, regulation of enzyme activity, isoenzymes, diagnostic and therapeutic enzymes, principles of assays of enzymes, enzymes as therapeutic targets of drugs.

Biological oxidation:

Basic concepts of thermodynamics and its laws, as applied to living systems, Exergonic and endergonic reactions and coupled reactions, redox potential
High energy compounds

Classification and role of oxidoreductases

Cytochromes; cytochrome P450 system

Respiratory chain and oxidative phosphorylation

- Components, complexes and functioning of the respiratory chain
- Process of oxidative phosphorylation
- Mechanisms of ATP synthesis and regulation
- Mitochondrial transport systems and shuttles
- Inhibitors, uncouplers and ionophores
- OXPHOS diseases
- Overview of metabolism and intermediary metabolism

Metabolism of carbohydrates

- Digestion and absorption
- Glycolysis and TCA cycle, including regulation
- Glycogen metabolism and its regulation
- Cori cycle, gluconeogenesis and control of blood glucose
- Metabolism of fructose and galactose
- Pentose phosphate and uronic acid pathways and their significance
- Polyol pathway

- Regulation of blood glucose levels
- Diabetes mellitus (including gestational diabetes mellitus) – classification, pathogenesis, metabolic abnormalities, diagnostic criteria, principles of treatment, pathogenesis of complications, laboratory tests
- Metabolism of ethanol

Metabolism of lipids

- Digestion and absorption, including role of bile salts
- Biosynthesis and oxidation of fatty acids
- Ketone bodies – formation, utilization and regulation
- Metabolism of unsaturated fatty acids and eicosanoids
- Metabolism of triacylglycerol; storage and mobilization of fats
- Metabolism of cholesterol
- Metabolism of lipoproteins
- Metabolism in adipose tissue
- Role of liver in lipid metabolism
- Role of lipids in atherogenesis
- Metabolism of phospholipids and associated disorders

Metabolism of amino acids and proteins

- Digestion and absorption
- Pathways of amino acid degradation - transamination, oxidative deamination
- Transport and metabolism of ammonia
- Metabolism of individual amino acids
- Plasma proteins

Metabolism of nucleotides

- De novo synthesis of purine nucleotides
- Salvage pathway for purines
- Degradation of purines
- De novo synthesis of pyrimidine nucleotides
- Degradation of pyrimidine
- Synthetic analogues of purine/pyrimidine bases and nucleosides used as therapeutic agents

Metabolism of heme

- Biosynthesis of heme and associated disorders
- Degradation of heme and associated disorders

Metabolism in individual tissues and in the fed and fasting states

- Liver, adipose tissue, brain, RBCs

Nutrition

- Principal food components
- General nutritional requirements
- Energy requirements
- Biological value of proteins
- Thermogenic effect of food
- Balanced diet, diet formulations in health and disease, mixed diet
- Nutritional supplements
- Food toxins and additives

- Parenteral nutrition
- Disorders of nutrition, obesity, protein and protein energy malnutrition, dietary fibers, under-nutrition, laboratory diagnosis of nutritional disorders
- National Nutrition Programme.

Vitamins

Classification, biochemical role, sources, RDA and deficiency state of each vitamin (including diagnostic tests for deficiency and treatment)

Minerals

Classification, biochemical role, sources, requirement and deficiency state of each mineral (including diagnostic tests for deficiency and treatment)

Metabolism of xenobiotic

Free radicals and anti-oxidant defense systems in the body and associations with disease processes

Paper III:

Molecular biology, molecular and genetic aspects of cancer, immunology and effects of environmental pollutants on the body

Structure and organization of chromosomes and chromatin re-modelling DNA replication

- DNA replication in prokaryotes and eukaryotes (including important differences between the two):
- Roles of DNA polymerase, helicase, primase, topoisomerase and DNA ligase
- Replication fork
- Okazaki fragments and its importance in replication.
- Overview of role of major DNA repair mechanisms – mismatch repair, base excision repair, nucleotide excision repair and double strand break repair.
- Diseases associated with abnormalities of DNA repair systems
- DNA recombination

Transcription

- Structure of a gene - exons and introns, promoter, enhancers/repressors and response elements.
- Process of transcription in prokaryotes and eukaryotes – initiation, elongation and termination (including important differences).
- Post-transcriptional processing – capping, tailing and splicing.

Genetic code and mutations

- Characteristics of the genetic code
- Molecular basis of degeneracy of the genetic code (Wobble hypothesis)
- Mutagens- examples of physical, chemical and biological mutagens.
- Types of mutations–point mutations and chromosomal mutations
- Relationship of mutations with specific diseases

Translation

- Basic structure of prokaryotic and eukaryotic ribosomes.
- Structure of tRNA (diagram of clover leaf model of tRNA structure) and its function in protein synthesis.

- Function of aminoacyl tRNA synthase.
- Process of protein synthesis (translation) – initiation, elongation and termination (including important differences between prokaryotic and eukaryotic translation).
- Inhibition of prokaryotic translation by antibiotics.
- Post-translational modifications

Regulation of gene expression in prokaryotes and eukaryotes

- The operon concept in prokaryotes
- Role of general and gene specific transcription factors
- Small interference RNA (siRNA) and micro RNA (miRNA).
- Other modes of regulation of gene expression: alternative splicing, alternative promoter usage, DNA methylation, Histone acetylation / deacetylation, RNA editing, alterations of RNA stability

Recombinant DNA technology and its applications in modern medicine

- Concepts of recombinant DNA, genetic engineering, biotechnology and cloning.
- Restriction endonucleases
- Vectors for cloning – plasmids and phages
- Genomic and cDNA libraries
- Applications of recombinant DNA technology in medicine
- Gene therapy
- Diagnosis of genetic diseases and genetic counseling
- DNA fingerprinting
- DNA sequencing
- Microarrays
- Fluorescent in situ hybridization(FISH)
- DNA vaccines
- Transgenic animals
- Application of molecular techniques in forensic investigation and medico- legal cases

Overview of Human Genome Project

Basics of bioinformatics Principles of human genetics

- Alleles, genotypes and phenotypes
- Patterns of inheritance: monogenic and polygenic inheritance
- Population genetics
- Genetic factors in causation of diseases
- Types of genetic diseases: Chromosomal, monogenic and polygenic disorders, mitochondrial disorders, nucleotide repeat expansion disorders, imprinting disorders
- Screening for genetic diseases and prenatal testing
- Ethical and legal issues related to medical genetics

Stem cells in clinical medicine

- Basic concepts regarding stem cells
- Types of stem cells: embryonic and induced pluripotent stem cells(IPSC)

- Potential applications in the clinical medicine
- Ethical and legal issues related to use of stem cells in medicine

Cancer

- Carcinogens: physical, chemical and biological
- Clonal origin of cancers Genetic basis of carcinogenesis
- Role of oncogenes and tumour suppressor genes
- Familial cancer syndromes
- Cancer stem cells
- Epigenetic regulation in cancer
- Gene expression profiling in cancer
- Cancer cell biology: cell cycle abnormalities, telomerase activity, proliferative capacity and decreased apoptosis
- Metastasis
- Tumor markers
- Biochemical basis of cancer chemotherapy and drug resistance
- New methods of anti-cancer therapy: targeted cancer therapy, cancer immunotherapy.

Immunology

- Innate and acquired immunity
- Humoral and cell-mediated immunity
- Cells and organs of the immune system - T and B cells, macrophages, dendritic cells, NK cells, granulocytes
- Antigens, epitopes and haptens
- Immunoglobulin classes, isotypes, allotypes, idiotypes, monoclonal antibodies, organization and expression of immunoglobulin genes, immunoglobulin gene rearrangement, class switching
- Antigen-antibody interaction – immunochemical techniques
- Major histocompatibility complex, antigen processing and presentation,
- T cell and B cell receptor, toll like receptors
- T cell maturation/activation/differentiation
- B cell generation/activation/differentiation
- Cytokines
- Complement system, cell
- Immune response to infections
- Hypersensitivity reactions
- Vaccines
- Immuno-deficiency syndrome
- Autoimmunity
- Transplantation immunology
- Cancer and immune system,
- Immunodiagnostics
- Immunotherapy

Paper IV:

Clinical biochemistry and molecular diagnostics related to different body systems/organs, endocrinology, and recent advances in biochemistry *Basic principles and practice of clinical biochemistry*

Units of measure, reagents, clinical laboratory supplies, basic separation techniques, laboratory calculations, specimen collection and processing, safety in the laboratory, clinical utility of laboratory tests (including sensitivity, specificity, ROC curves, etc), analysis in the laboratory, selection and evaluation of methods (including statistical techniques), evidence-based laboratory medicine, establishment and use of reference values, pre-analytical variables and biological variations, quality management, clinical laboratory informatics

Analytical techniques and instrumentation

Principles of basic techniques used in a clinical biochemistry laboratory (spectrophotometry, electrochemistry, electrophoresis, osmometry, chromatography, mass spectrometry, immunochemical techniques, molecular techniques, automation, point of care testing, *Clinical correlates and analytical procedures*

- Amino acids, peptides and proteins; non-protein nitrogenous compounds
- Enzymes
- Carbohydrates
- Lipids, lipoproteins and apolipoproteins and other cardiovascular risk factors
- Electrolytes
- Blood gases and pH
- Hormones and associated disorders
- Catecholamines and serotonin
- Vitamins; trace and toxic elements
- Hemoglobin, and bilirubin
- Porphyrins and associated disorders
- Bone and mineral metabolism
- Tumor markers
- Assessment of organ functions (hypothalamus and pituitary, adrenal glands, gonads, thyroid, parathyroid, liver, kidney, heart, stomach, pancreas, intestine) and associated disorders
- Pregnancy and maternal and fetal health
- Reproduction related disorders –infertility
- Newborn screening
- Inborn errors of metabolism
- Hemostasis
- Therapeutic drug monitoring
- Clinical toxicology
- Molecular diagnostics
- Body fluid analyses

Regulation of fluid and electrolyte balance and associated disorders ***Regulation of acid-base balance and associated disorders*** ***Biochemistry of the endocrine system***

- Classification and general mechanism of action of hormones
- Biosynthesis, secretion, regulation, transport and mode of action of hypothalamic peptides, adenohipophyseal and neurohipophyseal hormones, thyroid and parathyroid hormones, calcitonin, pancreatic

hormones, adrenocortical and medullary hormones, gonadal hormones, gastrointestinal hormones, opioid peptides, parathormone.

- Biochemistry of conception, reproduction and contraception
- Endocrine interrelationship and their involvement in metabolic regulation
- Neuro-modulators and their mechanism of action and physiological significance
- Biochemical aspects of diagnosis and treatment of endocrinal disorders:

Hematopoietic disorders

- Iron deficiency and other hypoproliferative anaemias - iron metabolism, laboratory tests of iron status, iron therapy
- Anaemia of chronic disease, anaemia of renal disease
- Hemoglobinopathies - sickle cell anaemia, methaemoglobinemias, thalassemia syndromes, Megaloblastic anaemia
- RBC membrane and metabolism
- Hemolytic anaemia - inherited defects in RBC membrane and enzymes (G6PD deficiency), immunologic causes of hemolysis
- ABO blood group system - biochemical basis, transfusion biology.
- Plasma cell disorders – multiple myeloma.

Hemostasis and thrombosis

Biochemical mechanisms, related laboratory tests, antiplatelet /anticoagulant/fibrinolytic therapy

Cardiovascular system

Atherosclerosis - pathogenesis, risk factors, prevention and treatment Cardiac failure, acute coronary syndrome, cardiac biomarkers

Respiratory system

Gaseous exchange in lungs - physiological features and disturbances, arterial blood gases Pathogenesis of cystic emphysema, alpha-1 anti-trypsin deficiency

Kidney

Kidney function tests; pathophysiology, biochemistry, laboratory findings and management in acute kidney injury and chronic kidney disease; estimation of GFR; glomerular diseases - pathogenesis and mechanisms of glomerular injury, nephrotic syndrome, diabetic nephropathy; tubular disorders - renal tubular acidosis, proteinuria, nephrolithiasis, kidney transplant; biochemical aspects of renal stones.

Gastrointestinal system

- Gastric physiology
- Pathophysiology of peptic ulcer disease, including role of *H. pylori*; gastric function tests; Zollinger- Ellison syndrome
- Digestion and absorption of nutrients; evaluation of malabsorption (steatorrhea, lactose intolerance)
- Celiac disease
- Inflammatory bowel disease

- Protein losing enteropathy
- Regulatory peptides in the gut
- Neuroendocrine tumours

Liver

- Liver function tests
- Hyperbilirubinemias
- Viral hepatitis
- Serologic/virologic markers
- Alcoholic liver disease, fatty liver, chronic liver disease, cirrhosis and its complications
- Pathogenesis of ascites
- Hepatic encephalopathy
- Metabolic diseases affecting liver
- Reye's syndrome
- Diseases of gall bladder/bile ducts - pathogenesis of gallstones
- Pancreas - acute and chronic pancreatitis, cystic fibrosis, pancreatic function tests.

Bone and mineral metabolism

Bone structure and metabolism; metabolism of calcium, phosphate and magnesium; regulation and abnormalities of bone metabolism; vitamin D; parathyroid hormone; calcitonin; parathyroid hormone-related (PTHrP); osteoporosis – pathophysiology; markers of bone turnover

Nervous system

- Neurotransmitters and their receptors
- Ion channels and channelopathies
- Neurotrophic factors
- Protein aggregation and neurodegeneration
- Alzheimer's disease, Parkinson's disease, Huntington's disease, multiple sclerosis
- Prions and prion diseases
- Guillain-Barre syndrome –immunopathogenesis
- Myasthenia gravis –pathophysiology
- Hereditary myopathies – Duchenne muscular dystrophy
- Inherited disorders of muscle energy metabolism
- Mitochondrial myopathies
- Pathophysiology of psychiatric disorders such as anxiety, depression and schizophrenia.

Training in clinical Biochemistry:

The post graduate students should receive hands-on training in a diagnostic laboratory in Biochemistry; such training should be extensive and rigorous enough for each post graduate student to acquire adequate skills and expertise to manage and supervise such a laboratory. The post graduate students should be posted in all

sections of the laboratory in the institution, starting from sample collection and processing. They should become proficient in working with the auto analyzers in the laboratory, in quality control methods, setting up of a clinical biochemistry laboratory, specialized assays and statistical analysis of data. It would also be desirable for them to acquire experience in running a 24-hours diagnostic laboratory; towards this end, it would help if they are posted in the laboratory out of regular hours as well.

Rotation in clinical department

Annexure 2

The EPAs are units of professional practice, defined as tasks or responsibilities to be entrusted to the unsupervised execution by a trainee once he or she has attained sufficient specific competence. EPAs are independently executable, observable, and measurable in their process and outcome, and therefore, suitable for entrustment decisions.

The Entrustable Professional Activity (EPA) concept allows faculty to make competency-based decisions on the level of supervision required by trainees.

| Subject/ Specialty | Duration of postings |
|---|----------------------|
| Pathology(Hematology) | 1 month |
| Microbiology | 1 month |
| Medicine including Endocrinology Cardiology & ICU | 1 month |
| Pediatrics | 15 days |
| Nephrology | 08 days |
| Gastroenterology | 07 days |
| Cell biology and Molecular Genetics | 30days |
| Peripheral postings- NIMHANS | 15 days |
| Peripheral postings-Indian Institute of Sciences | 15days |
| Total | 6 months |

SUMMATIVE ASSESSMENT

There shall be four papers of 100 marks each. Each paper shall be of three hours duration. Each paper shall have ten long essay questions of 10 Marks (10 x 10 =100).

Paper I: Biomolecules, cell biology, biochemical techniques, biostatistics and research methodology, basics of medical education in teaching and assessment of biochemistry

Paper II: Enzymes, bioenergetics, biological oxidation, metabolism of biomolecules, intermediary metabolism and regulation, inborn errors of metabolism and nutrition

Paper III: Molecular biology, molecular and genetic aspects of cancer, immunology and effects of environmental pollutants on the body

Paper IV: Clinical biochemistry and molecular diagnostics related to different body systems/organs, endocrinology, and recent advances in biochemistry.

**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.*

Each theory paper will consist of 10 questions of 10 marks each

| Theory paper | Marks |
|---------------------|--------------|
| Paper-I | 100 |
| Paper-II | 100 |
| Paper-III | 100 |
| Paper-IV | 100 |
| Total | 400 |

Practical and oral/viva voce examination:

This shall be held over two days.

Practical examination (200 Marks)

The practical examinations will be held over 2 days; Day

one: Will be mainly for the practical exercises and Day two:

For the oral/ viva voce.

The practical examinations will have the following components:

1. A clinical case for which an actual patient or a paper-based case may be used, as per the facilities available in each institution running the course. The clinical features of the patient and relevant laboratory investigation of biochemical abnormalities present will be discussed
2. Identification the carbohydrate/amino acid provided and confirm of its identity by paper chromatography, Urine analysis.
3. Performance of an electrophoresis for serum proteins and discussion of electrophoretic pattern.
4. Quality Control, its interpretation and Method validation

| Components | Marks |
|--|--------------|
| A clinical case examination and discussion | 50 |
| Separation techniques : Electrophoresis/chromatography | 50 |
| <ul style="list-style-type: none"> • Standardization and quantitative estimation.(30) • Two Quantitative Estimation(10+10) | 50 |
| Qualitative analysis – Identification of Biological fluid | 50 |
| Quality Control, its interpretation and Method validation | |
| Total | 200 |

Viva-voce Examination (100 Marks)

- i. Thesis presentation (of about 15 minutes duration)
- ii. Pedagogy (20 minutes duration plus 10 minutes for questions)

| Components | Marks |
|--|--------------|
| Pedagogy | 20 |
| Presentation of dissertation | 10 |
| The Viva-Voce would be on all components of syllabus | 70 |
| Total | 100 |

Maximum marks for Passing

| | Theory | Practicals | Viva-voce | Total |
|-----------------------------|---------------|-------------------|------------------|--------------|
| MD Biochemistry Examination | 400 | 200 | 100 | 700 |
| Passing Criteria 50% | 200 | 150 | | 350 |

Suggested reading material: Books (latest edition)

1. Lehninger Principles of Biochemistry, David L. Nelson, Michael M. Cox. W H Freeman & Co (Sd).
2. Biochemistry (Stryer), Jeremy M. Berg , John L. Tymoczko , Lubert Stryer, W. H. Freeman.
3. Biochemistry (Voet&Voet), Donald Voet , Judith G. Voet, John Wiley & Sons Inc.
4. Textbook of Biochemistry with Clinical Correlations, Thomas M. Devlin, John Wiley & Sons.
5. Kuby Immunology, Judy Owen, Jenni Punt , Sharon Stranford, W. H. Freeman.
6. Clinical Chemistry: Principles, Techniques, and Correlations, Michael L Bishop, Edward P Fody, Larry E Schoeff, Lippincott Williams and Wilkins.
7. Tietz Textbook of Clinical Chemistry and Molecular Diagnostics, Carl A. Burtis, Edward R. Ashwood , Saunders.
8. Harpers Illustrated Biochemistry, Victor W. Rodwell , David Bender, Kathleen M. Botham, Peter J. Kennelly, P. Anthony Weil , McGraw-Hill Education / Medical.
9. Biochemistry (Lippincott's Illustrated Reviews), Denise R Ferrier , Lippincott Williams and Wilkins.
10. Harrison's Principles of Internal Medicine, Dennis L. Kasper, Anthony S.
11. Fauci, Stephen L. Hauser, Dan L. Longo, J. Larry Jameson, Joseph Loscalzo, McGraw-Hill Education / Medical.
12. Davidson's Principles and Practice of Medicine, Walker, Elsevier Health Sciences – UK.
13. Clinical Biochemistry: Metabolic and Clinical Aspects, William J. Marshall & Márta Lapsley & Andrew Day & Ruth Ayling, Imprint - Churchill Livingstone.
14. Biochemistry: A Case-oriented Approach, Rex Montgomery, Thomas W. Conway, Arthur A. Spector, David Chappell, Mosby.
15. Interpretation of Diagnostic tests, Jacques Wallach, Lippincott Williams & Wilkins.

Journals

1. Annual Review of Biochemistry.
2. Clinical Chemistry.
3. Trends in Biochemical Sciences.
4. Clinical Chemistry Reviews.
5. Medical Biochemistry
6. Recent Advances in Endocrinology and Metabolism.
7. Essays in Biochemistry, Biochemical Society, UK.
8. Indian Journal of Clinical Biochemistry (J).
9. Indian Journal of Medical Research (J).
10. Indian Journal of Biochemistry & Biophysics.

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. Ninnan Bhawan. New Delhi. P- 335.
2. National Health Policy, Min. of Health & Family Welfare, Ninnan 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, ICMR, 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, II edn., 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; 424-8
10. Kirkwood B R, Essentials of Medical Statistics, in Ed., Oxford: Blackwell Scientific Publications 1988.
11. Mahajan B K, Methods in Bio statistics for medical students, 5th Ed. New Delhi, Jaypee Brothers Medical Publishers, 1989.
12. Raveendran and B Gitajali, A Practical approach to PG dissertation, New Delhi, P Publications, 1998.

**ENTRUSTABLE PROFESSIONAL ACTIVITIES (EPA) FOR M.D.
BIOCHEMISTRY**

EPA 01: Making decision, design and implementation processes for a new analyte EPA

02: Evaluate and report critical values in the clinical laboratory

EPA 03: Interpretation of L J charts

EPA 04: Perform a test or assay validation and implementation EPA

05: Evaluate and choose a new instrument

MILESTONES

| Milestone | Level of Supervision | Timeline | Dreyfus Stage |
|------------------|---|---|----------------------|
| I | Observation but no execution, even with direct supervision – At the beginning of the Post-graduation | At the beginning of MD Biochemistry I year (first half) | Novice |
| II | Execution with direct, proactive supervision | I year (latter half) | Advanced Beginner |
| III | Execution with reactive supervision | II year of post-graduation | Competent |
| IV | Supervision at a distance and/or post hoc | III year of post-graduation | Proficient |
| V | Supervision provided by the trainee to more junior colleagues | Towards the completion of MD Biochemistry | Expert |

Mapping the entrustable professional activities to competencies

| EPA | Patient Care | Medical Knowledge | Practice Based Learning & Improvement | Interpersonal Communication skills | Professionalism | Systems Based Practice |
|---|---------------------|--------------------------|--|---|------------------------|-------------------------------|
| Making decision, design and implementation processes for a new analytic | + | + | + | + | + | + |
| Evaluate and report critical values in the clinical laboratory | + | + | + | + | + | + |
| Evaluate and choose a new instrument | + | + | + | + | + | + |
| Perform a test or assay validation and implementation | + | + | + | + | + | + |
| Interpretation of L- J charts | + | + | + | + | + | + |

SIX CORE COMPETENCIES FOR EPA

PATIENT CARE (PC):

Provide patient-centered care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health

PC1: Perform all medical, diagnostic, and surgical procedures considered essential for the area of practice

PC2: Gather essential and accurate information about patients and their condition through history taking, physical examination, and the use of laboratory data, imaging, and other tests

PC3: Organize and prioritize responsibilities to provide care that is safe, effective, and efficient

PC4: Interpret laboratory data, imaging studies, and other tests required for the area of practice

PC5: Make informed decisions about diagnostic and therapeutic interventions based on patient information and preferences, up-to-date scientific evidence, and clinical judgment

PC6: Develop and carry out patient management plans

PC7: Counsel and educate patients and their families to empower them to participate in their care and enable shared decision making

PC8: Provide appropriate referral of patients, including ensuring continuity of care throughout transitions between providers or settings and following up on patient progress and outcomes

PC9: Provide health care services to patients, families, and communities aimed at preventing health problems or maintaining health

PC10: Provide appropriate role modeling

PC11: Perform supervisory responsibilities commensurate with one's roles, abilities, and qualifications

MEDICAL KNOWLEDGE (MK): Demonstrate knowledge of established and evolving biomedical, clinical, epidemiological, and social-behavioral sciences, as well as the application of this knowledge to patient care

MK1: Demonstrate an investigatory and analytic approach to clinical situations

MK2: Apply established and emerging biophysical scientific principles fundamental to health care for patients and populations

MK3: Apply established and emerging principles of clinical sciences to diagnostic and therapeutic decision making, clinical problem solving, and other aspects of evidence-based health care

MK4: Apply principles of epidemiological sciences to the identification of health problems, risk factors, treatment strategies, resources, and disease prevention/health promotion efforts for patients and populations

MK5: Apply principles of social–behavioral sciences to provision of patient care, including assessment of the impact of psychosocial–cultural influences on health, disease, care-seeking, care compliance, and barriers to and attitudes toward care

MK6: Contribute to the creation, dissemination, application, and translation of new health care knowledge and practices

PRACTICE-BASED LEARNING AND IMPROVEMENT (PBLI): Demonstrate the ability to investigate and evaluate their care of patients, to appraise and assimilate scientific evidence, and to continuously improve patient care based on constant self- evaluation and lifelong learning

PBLI1: Identify strengths, deficiencies, and limits in one’s knowledge and expertise

PBLI2: Set learning and improvement goals

PBLI3: Identify and perform learning activities that address one’s gaps in knowledge, skills, or attitudes

PBLI4: Systematically analyzes practice using quality-improvement methods, and implements changes with the goal of practice improvement

PBLI5: Incorporate feedback into daily practice

PBLI6: Locate, appraises, and assimilates evidence from scientific studies related to patients’ health problems

PBLI7: Use information technology to optimize learning

PBLI8: Participate in the education of patients, families, students, trainees, peers, and other health professionals

PBLI9: Obtain and utilize information about individual patients, populations of patients, or communities from which patients are drawn to improve care

PBLI10: Continually identifies, analyze, and implement new knowledge, guidelines, standards, technologies, products, or services that have been demonstrated to improve outcomes

INTERPERSONAL AND COMMUNICATION SKILLS (ICS):

Demonstrate interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, their families, and health professionals

ICS1 Communicate effectively with patients, families, and the public, as appropriate, across a broad range of socioeconomic and cultural backgrounds

ICS2 Communicate effectively with colleagues within one's profession or specialty, other health professionals, and health-related agencies

ICS3 Work effectively with others as a member or leader of a health care team or other professional group

ICS4 Act in a consultative role to other health professionals

ICS5 Maintain comprehensive, timely, and legible medical records

ICS6 Demonstrate sensitivity, honesty, and compassion in difficult conversations (e.g., about issues such as death, end-of-life issues, adverse events, bad news, disclosure of errors, and other sensitive topics)

ICS7 Demonstrate insight and understanding about emotions and human responses to emotions that allow one to develop and manage interpersonal interactions

PROFESSIONALISM (P): Demonstrate a commitment to carrying out professional responsibilities and an adherence to ethical principles

PROF1: Demonstrate compassion, integrity, and respect for others

PROF2: Demonstrate responsiveness to patient needs that supersedes self-interest

PROF3: Demonstrate respect for patient privacy and autonomy

PROF4: Demonstrate accountability to patients, society, and the profession

PROF5: Demonstrate sensitivity and responsiveness to a diverse patient population, including but not limited to diversity in gender, age, culture, race, religion, disabilities, and sexual orientation

PROF6: Demonstrate a commitment to ethical principles pertaining to provision or withholding of care, confidentiality, informed consent, and business practices, including compliance with relevant laws, policies, and regulations

SYSTEMS-BASED PRACTICE (SBP): Demonstrate an awareness of and responsiveness to the larger context and system of health care, as well as the ability to call effectively on other resources in the system to provide optimal health care

SBP1: Work effectively in various health care delivery settings and systems relevant to one’s clinical specialty

SBP2: Coordinate patient care within the health care system relevant to one’s clinical specialty

SBP3: Incorporate considerations of cost awareness and risk–benefit analysis in patient and/or population-based care

SBP4: Advocate for quality patient care and optimal patient care systems

SBP5: Participate in identifying system errors and implementing potential systems solutions

SBP6: Perform administrative and practice management responsibilities commensurate with one’s role, abilities, and qualifications

EPA 01: Making decision, design and implementation processes for a new analyte

| | |
|--|--|
| <p>Description and Tasks</p> | <ul style="list-style-type: none"> • Decide the new analyte which need to be implemented • Decide the technique and method of examination • Validate if lab made test/ Verify if commercial test • Write the SOP which is specific for laboratory condition • Establish the infrastructure and allocate resources relevant for each test • Determine the requirements for pre-examination process and continuous process improvement activities • Determine the requirements for examination process and continuous process improvement activities • Determine the requirements for post-examination process and continuous process improvement activities |
| <p>Relevant Core Competencies and Milestones</p> | <p>Patient Care</p> <ul style="list-style-type: none"> • PC1, PC4 Medical Knowledge • MK1, MK2, MK3, MK6 Systems Based Practice • SBP1,SBP2, SBP3, SBP4, SBP5 Practice-based Learning & Improvement • PBLI1, PBLI2, PBLI3, PBLI4 Professionalism • PROF1, PROF2, PROF3, PROF4 Interpersonal & Communication Skills • ICS1,ICS2, ICS3, ICS4, ICS5 |

| | |
|--------------------|---|
| Assessment Methods | <ol style="list-style-type: none"> 1. Logbook review 2. Written test 3. OSPE |
|--------------------|---|

EPA 02: Evaluate and report critical values in the clinical laboratory

| | |
|---|--|
| Description and Tasks | <ul style="list-style-type: none"> • Properly identify tests to be evaluated ensuring appropriate patient identification • Evaluate quality control data for pre analytical variables • Correlate clinical history and biochemical findings • Obtain ancillary studies as needed for diagnosis of case (e.g., immunohistochemistry, special stains, and molecular studies) • Prepare a complete report impression, and documentation and interpretation of ancillary studies • Report any relevant clinical information or clinical correlations where indicated • Communicate and document critical values and urgent diagnoses directly with clinicians as indicated • Recognize when expert consultation is needed and obtain and document consultation in final report |
| Relevant Core Competencies and Milestones | <p>Patient Care</p> <ul style="list-style-type: none"> • PC1, PC2, PC4 Medical Knowledge • MK1, MK2 Systems-System based Practice • SBP1,SBP2, SBP3, SBP4, SBP5Practice-based Learning & Improvement • PBLI1, PBLI2, PBLI3, PBLI4 Professionalism • PROF1, PROF2, PROF3, PROF4 Interpersonal & Communication Skills • ICS1,ICS2, ICS3, ICS4, ICS5 |
| Assessment Methods | <ol style="list-style-type: none"> 1. Logbook review 2. 360 degree evaluation 3. Performance metrics (e.g., turnaround time statistics, other metrics from quality monitoring program) 4. MiniCEX |

EPA 03: Interpretation of L-J Chart

| | |
|-----------------------|---|
| Description and Tasks | <ul style="list-style-type: none"> • Decision making whether to use the control value for the center line on the Levey- Jennings chart or use the average calculated from the results of running the control in the lab test. • Decision making whether to have a known standard deviation for the lab test or use the calculated standard deviation from the results from running the control in the lab |
|-----------------------|---|

| | |
|---|---|
| | <p>test.</p> <ul style="list-style-type: none"> • Select the numbers of data points to be collected before control limits are calculated (at least twenty). • Run the control in the lab test and record the individual results. • Plot the results (X) on the Levey- Jennings chart. • Calculate the overall process average (if the control value is not being used for the center line): average for Levey- Jennings chart • Calculate the standard deviation (if a known standard deviation is not being used): standard deviation equation • Plot the center line as a solid line on the Levey- Jennings chart and label. Plot the control limits on the Levey- Jennings chart and label. If you are using the Westgard rules (described below), you will also need to plot the lines at +1s, +2s, -1s and -2s from the center line. • Interpret the chart • To detect whether results are “in control” or not. • Apply of Westgard rule(single rule and multirules) to detect the errors • Detect the type of error-Random ,Systematic error and change in patterns for trend and shift • Suggest the Root cause analysis and Corrective and preventive action |
| Relevant Core Competencies and Milestones | <p>Patient Care</p> <ul style="list-style-type: none"> • PC1, PC2, PC4 Medical Knowledge • MK1, MK2 , MK3 Systems based Practice • SBP1,SBP2, SBP3, SBP4, SBP5 Practice-based Learning & Improvement • PBLI1, PBLI2, PBLI3, PBLI4 Professionalism • PROF1, PROF2, PROF3, PROF4 Interpersonal & Communication Skills • ICS1,ICS2, ICS3, ICS4, ICS5 |
| Assessment Methods | <ol style="list-style-type: none"> 1. Logbook review 2. Written test 3. Performance metrics (e.g., turnaround time statistics, other metrics from quality monitoring program) |

EPA 04: Perform a test or assay validation and implementation

| | |
|-----------------------|---|
| Description and Tasks | <ul style="list-style-type: none"> • Define Validation • Define Verification • Describe the need for Assay validation during introduction of a testing process in the Clinical Laboratory. |
|-----------------------|---|

| | |
|---|---|
| | <ul style="list-style-type: none"> • List the Experimental parameters included in the process of assay validation • Describe the steps needed to complete Assay validation. • Documentation of steps included to complete the assay validation. • Define Goals - Acceptable performance with regards to: Accuracy, Precision, Sensitivity and analytical measurement range • Error Assessment - Type of error, Magnitude of error, Clinical Significance of error. • Compare error vs. analytical goal: • Reportable Range – Perform Linearity check , • Precision check – <ul style="list-style-type: none"> ○ Within-run precision ○ Total precision and QC ranges ○ Calculate: mean, SD, CV% • Accuracy Comparison of methods – Prepare a create scatter plot with X –results of reference, Y – results of new method, Analyze data, identify outliers. • Check Reference intervals. |
| Relevant Core Competencies and Milestones | <p>Patient Care</p> <ul style="list-style-type: none"> • PC1, PC4 Medical Knowledge • MK1, MK2, MK3, MK6 Systems Based Practice • SBP1,SBP2, SBP3, SBP4, SBP5 Practice-based Learning & Improvement • PBLI1, PBLI2, PBLI3, PBLI4 Professionalism • PROF1, PROF2, PROF3, PROF4 Interpersonal & Communication Skills • ICS1,ICS2, ICS3, ICS4, ICS5 |
| Assessment Methods | <ol style="list-style-type: none"> 1. Logbook review 2. Written Tests 3. OSPE 4. DOPS |

EPA 05: Evaluate and choose a new instrument

| | |
|-----------------------|--|
| Description and Tasks | <ul style="list-style-type: none"> • Define the need - Tabulating current and future needs, and making a wish list, if applicable. Checklist preparation for selection of vendors ISO 15189:2012 Clause 4.6 • Prepare Information review and comparison between different analyzers –Including Essential criteria, Desirable criteria, Information review outcome, and Additional not essential criteria if any. • Preparation of Checklist Describing – Subjective evaluation criteria - a. Analytical principle, instruments and reagents b. Specimen type c. Sample volume, d. |
|-----------------------|--|

| | |
|--|--|
| | <p>Specimen handling options. e. Reflex testing. f. On board dilution. g. Maintenance requirements. h. Operational throughput and turnaround time. i. Consumables. j. Staff requirements. k. Instrument cost. l. Average cost per assay. m. Maintenance contract. n. Warranty. o. Correlation between current analyser and the proposed analyser, if applicable. o. Manuals, p. Power requirements, q. Plumbing requirements, r. Water requirement, s. Air conditioning, t. Instrument construction and design, u. Space requirement, v. Training, w. Software, IT requirements and data processing, x. Safety.</p> <ul style="list-style-type: none"> • Precision Check – As Claimed by the manufacturer. • Accuracy check • Linearity - response of the instrument to the readings undertaken and make a graph of the readings using software. Interpret the data obtained. • Carryover determination • Specificity • Recovery • Correlation - proposed analyser should be correlated with the current assays being run on the current analyser. • Financial aspects (purchase outright or reagent rental) |
| <p>Relevant Core Competencies and Milestones</p> | <p>Patient Care</p> <ul style="list-style-type: none"> • PC1, PC2, PC4 Medical Knowledge • MK1, MK2 , MK3 Systems based Practice • SBP1,SBP2, SBP3, SBP4, SBP5 Practice-based Learning & Improvement • PBLI1, PBLI2, PBLI3, PBLI4 Professionalism • PROF1, PROF2, PROF3, PROF4 Interpersonal & Communication Skills • ICS1,ICS2, ICS3, ICS4, ICS5 |
| <p>Assessment Methods</p> | <ol style="list-style-type: none"> 1. Logbook review 2. Written Tests 3. OSPE 4. DOPS |

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OBJECTIVES FOR PG EXTERNAL POSTINGS

Annexure 3

MEDICINE

The Post Graduates of the department of Biochemistry will be posted to Department of Medicine, R.L Jalappa Hospital, Tamaka, Kolar for a period of 30 days during II year of the M.D course.

A. **Subject Area :Diabetes**

At the end of the 10 days of postings in the diabetic clinic of department of Medicine, the students should be able to:

1. Recognize the type of diabetes in patients
2. Describe the etiology, pathophysiology and biochemical alterations in diabetes mellitus
3. Prescribe the investigations , interpret the diagnostic tests, recognize the limitations of the tests used in the evaluation of diabetes mellitus
4. Prescribe a dietary plan and institute treatment of diabetes mellitus.
5. Construct a follow up plan for diabetes mellitus.

B. **Subject Area: Anemia**

At the end of the 05 days of postings in the department of Medicine, the students should be able to:

1. Define and understand the causes of anemia
2. Describe the etiology, pathophysiology and biochemical alterations in anemia
3. Prescribe the investigations, interpret the diagnostic tests, recognize the limitations of the tests used in the evaluation of anemia
4. Prescribe the treatment and follow up patients with anemia

C. **Subject Area: Jaundice**

At the end of the 05 days of postings in department of Medicine, the students should be able to:

1. Define and classify Jaundice
2. Describe the etiology, pathophysiology and biochemical alterations in various types of Jaundice
3. Prescribe the investigations, interpret the diagnostic tests, recognize the limitations of the tests used in the evaluation of jaundice
4. Prescribe the treatment and follow up patients with jaundice

ENDOCRINOLOGY

The post graduates of the department of Biochemistry will be posted to Department of Endocrinology, R.L Jalappa Hospital, Tamaka, Kolar for a

period of 05 days during II year of the M.D course. At the end of their postings, the students should be able to:

A. Subject Area: Pituitary Hormones

1. Describe the synthesis, functions and regulation of pituitary hormones
2. Classify pituitary disorders and list the causes for each type.
3. Describe the biochemical basis and clinical manifestations of pituitary disorders
4. Describe the laboratory evaluation of pituitary disorders- sample collection, preanalytical errors, interpretation of results, advantages and disadvantages of hormonal assays in a patient with pituitary disorders.
5. Prescribe the treatment plan and follow up of a patient with pituitary disorders.

B. Subject Area: Thyroid and parathyroid Hormones

1. Describe the synthesis, functions and regulation of thyroid and parathyroid hormones
2. Classify thyroid and parathyroid disorders and list the causes for each type
3. Describe the biochemical basis and clinical manifestations of thyroid and parathyroid hormone disorders.
4. Describe the laboratory evaluation of thyroid and parathyroid disorders - sample collection, preanalytical errors, and interpretation of results, advantages and disadvantages of hormonal assays.
5. Describe the treatment plan and follow up of patient with thyroid and parathyroid hormone disorders.

C. Subject Area: Adrenal Hormones

1. Describe the synthesis, functions and regulation of adrenal hormones
2. Classify adrenal disorders and list the causes for each type
3. Describe the biochemical basis and clinical manifestations of adrenal disorders
4. Describe the laboratory evaluation of adrenal disorders - sample collection, preanalytical errors, interpretation of results, advantages and disadvantages of hormonal assays.
5. Prescribe the treatment plan and follow up of patient with Adrenal Hormone disorders.

D. Subject Area: Gonadal Hormones

1. Describe the synthesis, functions and regulation of Gonadal hormones
2. Classify Gonadal hormones and list the causes for each type
3. Describe the biochemical basis and clinical manifestations of Gonadal disorders
4. Describe the laboratory evaluation of Gonadal hormones - sample collection, preanalytical errors, interpretation of results, advantages and disadvantages of hormonal assays
5. Prescribe the treatment plan and follow up of patient with the Gonadal hormone disorders.

E. Subject Area: Pancreatic Hormones

1. Describe the synthesis, functions and regulation of pancreatic hormones
2. Describe the biochemical basis and clinical manifestations of pancreatic diseases
3. Describe the laboratory evaluation of pancreatic diseases –sample collection, preanalytical errors, interpretation of results, advantages and disadvantages of pancreatic function tests
4. Prescribe the treatment plan and follow up of patient with Pancreatic Hormone disorders

CARDIOLOGY

The post graduates of the department of Biochemistry will be posted to Department of Cardiology, R.L Jalappa Hospital, Tamaka, Kolar for a period of 05 days during II year of the M.D course.

At the end of their postings, the students should be able to:

A. Subject Area: ECG :

1. Enumerate the indications for ECG
2. Describe the procedure & Interpret ECG changes in various biochemical diseases which alter ECG

B. Subject Area: Myocardial Infarction

1. Define myocardial infarction
2. Describe the etiology, pathophysiology of atherosclerosis and clinical manifestations of Myocardial infarction
3. Describe the laboratory evaluation of Myocardial infarction- including newer cardiac markers
4. Interpret ECG changes in Myocardial infarction
5. Plan the treatment with dietary chart and life style modifications for follow up of the patient with MI

PAEDIATRICS

The post graduates of the department of Biochemistry will be posted to Department of Paediatrics, R.L Jalappa Hospital, Tamaka, Kolar for a period of 15 days during II year of the M.D course. At the end of their postings, the students should be able to:

A. Subject Area: Neonatal Jaundice

1. Recognize the causes for neonatal jaundice
2. Differentiate pathological and physiological jaundice
3. Describe the biochemical basis and evaluate the laboratory findings in a child with Neonatal Jaundice
4. Plan the treatment and follow up of a patient with Neonatal Jaundice

B. Subject Area: Gastro enteritis

1. Describe causes for gastro enteritis
2. Describe the biochemical basis, fluid electrolyte imbalance and complications in gastro enteritis
3. Evaluate the laboratory findings in a patient with gastro enteritis
4. Plan the treatment and follow up of a patient with gastro enteritis.

C. Subject Area: Protein Energy Malnutrition

1. Classify and list the causes for Protein Energy Malnutrition

2. Describe the biochemical basis of Kwashiorkor and Marasmus
3. Compare and contrast Kwashiorkor and Marasmus with respect to etiology, precipitation factors, clinical manifestations , biochemical abnormalities and complications
4. Evaluate the laboratory findings in a patient with Protein Energy Malnutrition
5. Plan the treatment and follow up of a patient with Protein Energy Malnutrition

D. Subject Area: Infectious diseases

1. List common infectious diseases of newborn and those seen in pediatric age group
2. Describe the biochemical basis and clinical manifestations of common infectious diseases
3. Evaluate the laboratory findings in a patient with infectious disease
4. Plan the treatment and follow up of a patient with infectious disease

E. Subject Area: Meningitis

1. Describe the biochemical basis and clinical manifestations in meningitis
2. Evaluate the laboratory findings in a patient with meningitis
3. Plan the treatment and follow up of a patient with meningitis

F. Subject Area: Inborn Errors of Metabolism

1. Enumerate inborn errors of metabolism involving carbohydrates, lipids, proteins and nucleic acids
2. Describe the biochemical basis and clinical manifestations in inborn errors of metabolism
3. Evaluate the laboratory findings in a patient with inborn error of metabolism
4. Plan treatment and follow up of patients with inborn errors of metabolism.

MEDICAL GASTROENTEROLOGY

The post graduates of the department of Biochemistry will be posted to Department of Medicine (Endoscopy unit), R.L Jalappa Hospital, Tamaka, Kolar for a period of 07 days during II year of the M.D course. At the end of their postings, the students should be able to:

A. Subject Area: Malabsorption:

1. Enumerate the causes for malabsorption syndrome
2. Describe the biochemical basis and clinical manifestations of malabsorption syndrome
3. Plan the laboratory evaluation, interpretation of results and recognize limitations of the diagnostic tests
4. Prescribe the treatment along with dietary charts
5. Plan for the follow up of the patients with malabsorption syndrome.
6. List the indications of Total Parenteral Nutrition
7. Describe the procedure and complications of Total Parenteral Nutrition

8. Plan the follow up and preventive care of the patients on Total Parenteral Nutrition

B. Subject Area: Water & Electrolyte Balance and Imbalance:

1. Describe the regulation of water and electrolyte balance in the body
2. List the causes for water and electrolyte imbalance
3. Describe the biochemical abnormalities and complications of water and electrolyte imbalance
4. Evaluate the laboratory findings in a patient with water and electrolyte imbalance
5. Plan for treatment, follow up and preventive care in a patient with water and electrolyte imbalance

C. Subject Area: Acid- Base Balance and Imbalance:

1. Describe the regulation of Acid- Base balance in the body
2. List the causes for Acid-Base Imbalance
3. Describe the biochemical abnormalities and complications of Acid-Base Imbalance
4. Evaluate the laboratory findings in a patient with Acid-Base imbalance
5. Plan for treatment, follow up and preventive care in a patient with Acid-Base disorders

NEPHROLOGY

The post graduates of the department of Biochemistry will be posted to Department of Nephrology, R.L Jalappa Hospital, Tamaka, Kolar for a period of 08 days during II year of the M.D course. At the end of their postings, the students should be able to:

A. Subject Area: Renal Function tests

1. Classify and list indications of Renal function tests
2. Describe the procedure, advantages and disadvantages of various renal function tests
3. Calculation of eGFR using MDRD and Cockcroft-Gault formula, their advantages and disadvantages
4. List the newer biomarkers in Acute and chronic Kidney injury and describe their advantages and disadvantages

B. Subject Area: Diet Chart in renal diseases

1. Prescribe the diet chart for patients with Acute kidney injury and chronic renal failure
2. Evaluate renal failure cases with regular follow up

C. Subject Area: Dialysis

1. List the indications of Dialysis
2. Describe the procedure, advantages, disadvantages and complications in different types of dialysis.
3. Plan for treatment, follow up and preventive care in a patient with renal disease.

D. Subject Area: Water & Electrolyte Balance and Imbalance

1. Describe the regulation of water and electrolyte balance in the body
2. List the causes for water and electrolyte imbalance

3. Describe the biochemical abnormalities and complications of water and electrolyte imbalance
4. Evaluate the laboratory findings in a patient with water & electrolyte imbalance
5. Plan for treatment, follow up and preventive care in a patient with water & electrolyte disorders

E. Subject Area: Acid-Base Balance and Imbalance

1. Describe the regulation of Acid- Base balance in the body
2. List the causes for Acid-Base Imbalance
3. Describe the biochemical abnormalities and complications of Acid-Base Imbalance
4. Evaluate the laboratory findings with Arterial Blood gas analysis in a patient with Acid-Base disorders
5. Plan for treatment, follow up and preventive care in a patient with Acid-Base disorders.

PATHOLOGY

The post graduates of the department of Biochemistry will be posted to Department of Pathology, , R.L Jalappa Hospital, Tamaka, Kolar for a period of 01 month during II year of the M.D course .At the end of their postings, the students should be able to: **Hematology section**

A. Subject Area: Hemogram including reticulocyte and platelet counts

1. Perform and interpret hemogram with reticulocyte and platelet count
2. Clinical importance of hemogram

B. Subject Area: Hemolytic anemia profile: Hb electrophoresis

1. Define & classify Anemia.
2. List the causes of Anemia.
3. Hb electrophoresis:
4. Describe the principle, procedure, Importance, advantage, disadvantage, interpretation of Hb Electrophoresis.

C. Subject Area Coagulation profile including PT, APTT:

1. List the parameters under coagulation profile
2. Clinical importance of coagulation profile, PT, APTT

D. Subject Area: Tumor markers (Immunohistochemistry):

1. Define and classify Tumor markers.
2. Clinical importance of tumor markers in Diagnostic and therapeutic conditions.

E. Subject Area: Blood smear staining

1. Perform blood smear & stain the smear.
2. List the types & importance of stains

MICROBIOLOGY

The post graduates of the department of Biochemistry will be posted to Department of Microbiology, R.L Jalappa Hospital, Tamaka, Kolar for a period of 01 month

during II year of the M.D course. At the end of their postings, the students should be able to:

Subject Area: Isolation of RNA

- Shall be able to perform the Isolation of RNA

Subject Area: Synthesis of cDNA by reverse transcription;

- Perform the synthesis of cDNA by reverse transcription

Subject Area: PCR (both conventional and real-time)

- Perform the PCR (both conventional and real-time) & interpret the results

Subject Area: ELISA:

- Define & classify ELISA
- Write the Principle, procedure, applications, advantage, disadvantage & clinical importance
- Perform ELISA test & interpret the results

Subject Area: Culture: Media preparations

- Types of cultures
- To prepare different culture Medias

Subject Area: disinfection and sterilization

- Apply methods of disinfection and sterilization to control and
- Prevent hospital and community acquired infections.

Subject Area: Water Examination

- Laboratory investigations regarding bacteriological examination of water

Indian Institution of Sciences (IISc)

The post graduates of the department of Biochemistry will be posted to Indian Institution of Sciences, Bangalore, for a period of 15 days during II year of the M.D course.

At the end of their postings, the students shall at least see a demonstration of the following techniques.

- Separation of peripheral blood lymphocytes using Ficoll Hypaque
- Subcellular fractionation/ Marker enzymes for organelles to demonstrate
- Chromatography-gas chromatography
- Nanotechnology and microfabrication
- Proteomics: Protein purification & isolation

National Institution of Mental Health and Neuro Sciences, (NIMHANS)

The post graduates of the department of Biochemistry will be posted to National Institution of Mental Health and Neuro Sciences, Bangalore, for a period of 15 days during II year of the M.D course at the end of their postings, the students shall at least see a demonstration of the following techniques

1. Ultracentrifugation
2. HPLC, Tandem Mass spectrometry
3. New born screening for IEM
4. Neurochemistry: Basic Principles & Techniques

Cell Biology and Molecular genetics

Subject Area: Isolation of high molecular weight DNA from tissues/blood:

- Perform Isolation of high molecular weight DNA from tissues/blood

Subject Area: Agarose gel electrophoresis for proteins and nucleic acids

- Perform Agarose gel electrophoresis for proteins and nucleic acids
- Interpretation of electrophoretic band

Subject Area: Cell culture

- Perform basic techniques in cell culture

