BLDE
(DEEMED TO BE UNIVERSITY)

Choice Based Credit System (CBCS)

Curriculum

M.Sc. in Clinical Immunology

2020-21

Published by
BLDE
(DEEMED TO BE UNIVERSITY)
Declared as Deemed to be University u/s 3 of UGC Act, 1956

The Constituent College
SHRI B. M. PATIL MEDICAL COLLEGE, HOSPITAL & RESEARCH CENTRE, VIJAYAPURA
Smt. Bangaramma Sajjan Campus, B. M. Patil Road (Sholapur Road), Vijayapura - 586103, Karnataka, India.
BLDE (DU): Phone: +918352-262770, Fax: +918352-263303 , Website: www.bldedu.ac.in, E-mail:office@bldedu.ac.in
College: Phone: +918352-262770, Fax: +918352-263019, E-mail: bmpmc.principal@bldedu.ac.in

BLDE
(DEEMED TO BE UNIVERSITY)
Declared as Deemed to be University u/s 3 of UGC Act, 1956
The Constituent College
SHRI B. M. PATIL MEDICAL COLLEGE, HOSPITAL AND RESEARCH CENTRE

BLDE(DU)/REG/M.Sc.CI/2020-21/ 1872 May 12, 2020

NOTIFICATION

Sub: Curriculum for M.Sc. in Clinical Immunology with Semester Scheme

Ref: 1. Minutes of the meeting of the 5th Standing Committee Academic Council of the University held on 06- 05-2020.
2. Approval of Board of Management dtd. 08-05-2020
3. Approval of Hon'ble Vice-Chancellor vide order no.1834, dtd.09-05-2020

In accordance with the Rule-09 (ii) of the Memorandum of Association (MoA) of the Deemed to be University, the Board of Management (BoM) has approved the Curriculum for **'M.Sc. in Clinical Immunology'** following Choice Based Credit System (CBCS) with Semester Scheme.

The Curriculum shall be effective from the Academic Session 2020-21 onwards, in the Constituent College of the University viz. Shri B. M. Patil Medical College, Hospital and Research Centre, Vijayapura.

REGISTRAR
REGISTRAR
BLDE (Deemed to be University)
Vijayapura-586103. Karnataka

To,
The Dean, Faculty of Allied Health Sciences,
Shri B. M. Patil Medical College,
Hospital and Research Centre,
Vijayapura

Copy to:
- The Secretary, UGC, New Delhi
- The Dean, Faculty of Medicine & Principal
- The Controller of Examinations
- The Dean, Student Affairs
- The Prof. & HoDs of Pre, Para and Clinical Departments
- The Coordinator, IQAC
- PS to the Hon'ble Chancellor
- PS to the Hon'ble Vice-Chancellor

Vision:

- To be a leader in providing quality medical education, healthcare & to become an Institution of eminence involved in multidisciplinary and translational research, the outcome of which can impact the health & the quality of life of people of this region.

Mission:

- To be committed to promoting sustainable development of higher education, including health science education consistent with statutory and regulatory requirements.
- To reflect the needs of changing technology
- Make use of academic autonomy to identify dynamic educational programs
- To adopt the global concepts of education in the health care sector

SEMESTER-I						
Course Code.	**Course Name**	**Credits**	**Teaching hours**	**Marks**		
				Internal Assessment	**Semester Exam**	**Total**
Theory						
MCI1.1	Medical Anatomy	4	4	20	60	80
MCI1.2	Medical Physiology	4	4	20	60	80
MCI1.3	Medical Biochemistry	4	4	20	60	80
MCI1.4	Medical Pharmacology	4	4	20	60	80
MCI1.5	Medical Microbiology	4	4	20	60	80
Practical						
MCI1.1P	Medical Anatomy	1	2	20	50	70
MCI1.2P	Medical Physiology	1	2	20	50	70
MCI1.3P	Medical Biochemistry	1	2	20	50	70
MCI1.4P	Medical Pharmacology	1	2	20	50	70
MCI1.5P	Medical Microbiology	1	2	20	50	70
Total		**25**	**30**	**200**	**550**	**750**

SEMESTER-II						
Course Code.	**Course Name**	**Credits**	**Teaching hours**	**Marks**		
				Internal Assessment	**Semester Exam**	**Total**
Theory						
MCI2.1	Medical Anatomy	4	4	20	60	80
MCI2.2	Medical Physiology	4	4	20	60	80
MCI2.3	Medical Biochemistry	4	4	20	60	80
MCI2.4	Medical Pharmacology	4	4	20	60	80
MCI2.5	Medical Microbiology	4	4	20	60	80
MCI2.6	Research Methodology & Biostatistics (Core Course)	4	4	20	60	80
Practical						
MCI2.1P	Medical Anatomy	1	2	20	50	70
MCI22P	Medical Physiology	1	2	20	50	70
MCI2.3P	Medical Biochemistry	1	2	20	50	70
MCI2.4P	Medical Pharmacology	1	2	20	50	70
MCI2.5P	Medical Microbiology	1	2	20	50	70
MCI2.6P	Research Methodology & Biostatistics (Core Course)	1	2		50	70
Total		**30**	**36**	**240**	**660**	**900**

SEMESTER -III						
Course Code.	**Course Name**	**Credits**	**Teaching hours**	**Marks**		
				Internal Assessment	**Semester Exam**	**Total**
Theory						
MCI3.1	General Immunology	4	60	20	80	100
MCI3.2	Advance Clinical Immunology_1	4	60	20	80	100
MCI3.3	Advance Clinical Immunology_2	4	60	20	80	100
MCI3.4	Review Article	4	00	00	100	100
Practical						
MCI3.5P	Practical's	4	75	100	200	300
Total		**20**	**255**	**160**	**540**	**700**

SEMESTER -IV						
Course Code.	**Course Name**	**Credits**	**Teaching hours**	**Marks**		
				Internal Assessment	**Semester Exam**	**Total**
Theory						
MCI214.1	Research Project in an Immunology Lab	30	600	00	00	300

Outline of course curriculum

SEMESTER -I													
		Hrs/week				Hrs/semester					Exam Marks		
Curse Code	**Course Name**	**Lecture/ week**	**Tutorial/ week**	**Practical hrs/week**	**Total Hrs/ Week**	**Total Credits/week**	**Lecture/ semester**	**Tutorial/ semester**	**Practical/ semester**	**Total hours**	**I A**	**semester Exam**	**Total marks**
Theory													
MCI11	Anatomy	3	1		4	4	45	15		60	20	60	80
MCI12	Physiology	3	1		4	4	45	15		60	20	60	80
MCI13	Biochemistry	3	1		4	4	45	15		60	20	60	80
MCI14	Pharmacology	3	1		4	4	45	15		60	20	60	80
MCI15	Microbiology	3	1		4	4	45	15		60	20	60	80
Practical													
MCI11P	Anatomy			2	2	1			30	30	20	50	70
MCI12P	Physiology			2	2	1			30	30	20	50	70
MCI13P	Biochemistry			2	2	1			30	30	20	50	70
MCI14P	Pharmacology			2	2	1			30	30	20	50	70
MCI15P	Microbiology			2	2	1			30	30	20	50	70
Total						**25**				**450**			**750**

Total Marks for IA	
Theory	Practical
20	20

Theory Internal Assessment	
Theory	15
Seminar	5
Total	20

Practical Internal Assessment	
Practical	15
Journal	5
Total	20

SEMESTER –II													
		Hrs/week					Hrs/semester				Exam Marks		
Curse Code	**Course Name**	**Lecture / week**	**Tutorial/ week**	**Practical hrs/ week**	**Total Hrs/ Week**	**Total Credits/ Week**	**Lecture/ semester**	**Tutorial/ semester**	**Practical/ semester**	**Total hours**	**IA**	**semester Exam**	**Total marks**
Theory													
MCI21	Anatomy	3	1		4	4	45	15		60	20	60	80
MCI22	Physiology	3	1		4	4	45	15		60	20	60	80
MCI23	Biochemistry	3	1		4	4	45	15		60	20	60	80
MCI24	Pharmacology	3	1		4	4	45	15		60	20	60	80
MCI25	Microbiology	3	1		4	4	45	15		60	20	60	80
MCI26	Research Methodology & Biostatistics	4			4	4	60			60	20	60	80
Practical													
MCI 21P	Anatomy			2	2	1			30	30	20	50	70
MCI 22P	Physiology			2	2	1			30	30	20	50	70
MCI 23P	Biochemistry			2	2	1			30	30	20	50	70
MCI 24P	Pharmacology			2	2	1			30	30	20	50	70
MCI 25P	Microbiology			2	2	1			30	30	20	50	70
MCI 26P	Research Methodology & Biostatistics			2	2	1			30	30	20	50	70
Total						**30**				**540**			**900**

Total Marks for IA	
Theory	Practical
20	20

Theory Internal Assessment	
Theory	15
Seminar	5
Total	20

Practical Internal Assessment	
Practical	15
Journal	5
Total	20

SEMESTER –III													
		Hrs/week					Hrs/semester				Exam Marks		
Curse Code	**Course Name**	**Lecture /week**	**Tutorial/ week**	**Practical hrs/ week**	**Total Hrs/ week**	**Total Credits/ week**	**Lecture/ semester**	**Tutorial/ semester**	**Practical/ semester**	**Total hours**	**IA**	**semester Exam**	**Total marks**
Theory													
MCI27	General Immunology	3	1		4	4	45	15		60	20	80	100
MCI28	Advance Clinical Immunology-1	4	0		3	4	60	00		60	20	80	100
MCI29	Advance Clinical Immunology_2	4	0		3	4	60	00		60	20	80	100
MCI30	Review Article	0	0		0	4	00	00		00	00	100	100
Practical													
MCI31	Immunology			5	3	4			75	225	100	200	300
Total						**20**				**405**	**160**	**540**	**700**

Total Marks for IA	
Theory	Practical
20	20

Theory Internal Assessment	
Theory	15
Seminar	5
Total	20

Practical Internal Assessment	
Practical	75
Journal	25
Total	100

ACADEMIC SYLLABUS FOR SEMESTER-IV

SEMESTER –IV													
		Hrs/week					**Hrs/semester**				**Exam Marks**		
Curse Code	**Course Name**	**Lectu re/ week**	**Tutoria l/ week**	**Practical hrs/ week**	**To tal Hrs/ Week**	**Tot al Cre dits/ Week**	**Lecture / semes ter**	**Tutoria l/ semes ter**	**Practi cal/ semes ter**	**Total hours**	**IA**	**seme ster Exa m**	**Total marks**
Theory													
MCI32	Dissertation& Presentation	0	0		0	4	00	00		00	00	300	300
Total						**04**				**00**			**300**

Name of the Degree: M.Sc. Clinical Immunology

AIMS OF THE PROGRAM

The most crucial components in enriching or strengthening a given subject at a national level are the appropriately trained, skilled and performing human resource and the money that supports the creation and nurturing of the potential performers who foster the growth of the subject in the country. For the following reasons, it was imperative to propose this post-graduate course in Clinical Immunology [Acronym CLIMM], which will enormously enhance the strength of Immunology in the country.

a) At present, there are no specialized post-graduate immunology courses in the country. This is the first of its kind and so, it will lead by example.
b) Often the qualified students are the "Records" that recapitulate the "theory" taught in their respective syllabi; thoughts that are reflections of the assimilated knowledge are missing. In other words, the orientation of syllabi is more towards theory than "Practical", where research-orientation of post-graduate students is a very far-fetched concept. In contrast, herein, the syllabus is designed to teach the "Theory" as a trend of coherent thoughts over the past hundred years of evolution of the concepts in Immunology. Thus, the students are provoked to think and to argue how we progressed over the past hundred years to deduce the current understanding of immunology.
c) Inasmuch as the students are provoked to think on the experiments performed to derive the fundamental principles of immunology, they become more research-oriented, at least, while attending the "Theory" classes. The students are then pushed to design experiments, which are hypothesis-driven but not conventional "Practicals". They learn the techniques that are used in modern day research, the concept of "controls" that reveals the significance of the experimental results, the statistical processing of the data and the finesse of designing an experiment. The students will also be provided classes on "Conscience and Ethics in Research". Thus, the students- while still in post-graduate classes- will be primed for research.
d) The students will thus learn to perform experiments in immunology using mice and rats, which will be housed in the experimental animal facility of the University, close to the Science Building where the course will be taught. They will learn to interpret their data against the backdrop of the existing literature. Therefore, the students are primed to perform experiments and not necessarily the conventional "Practical".
e) The students will be taken to clinics and diagnostic laboratories, as appropriate for classes and for the topics that the respective institution or laboratory specializes in. For example, the students will learn different diagnostic techniques- FACS, ELISA and so on- in the pathology laboratories whereas in hospitals and medical colleges, they will learn the immune system involvements in patients with different diseases, e.g., infectious diseases, transplantation, allergy and so on.

f) It is quite possible that working with the diagnostic laboratories, the difference between the need and the current provision in diagnosis will be revealed. Through collaborative projects between Diagnostic and Research Laboratories, many diagnostic tests which are currently non-existent may come to being. This will be an extraordinary contribution of the CLIMM to the field of Immunology. However, not all diagnostic Labs can enter into such agreements. Therefore, the Diagnostic Labs chosen here are also Research Foundations who have the provisions to enter into such research.

g) Of the twenty students, the best five to eight students in the last semester will be chosen for undergoing an uninterrupted training for six months in well-known immunology laboratories in the country. The project work will not only provide the glimpse of internationally competitive research but also instill a passion for research in Immunology in them.

h) The syllabus will evolve to match the trends in Immunology and the requirements for succeeding in National Entrance Test, ensuring that their two-year training in Immunology is not blocked by the failure to earn their own fellowship. The current syllabus is designed to cover the current syllabi of the National Entrance Tests.

i) It is expected that the students who will be M.Sc (Clinical Immunology) from here will be able to start the experiment from the very first day they join a Research Laboratory. Thus, the required one year orientation towards research will be brought down to zero. If ten such students join every year with the Indian Immunology, the savings translates to TEN MAN-YEAR, which is the only way we can compete with the other countries.

In essence, the proposed syllabus is very much a need-oriented, experiment-based, thought-provoking and a robust National Capacity-building and Faculty–strengthening program effected from the grass-root level.

Duration of Study: The duration of the study for M.Sc. Clinical Immunology will be of four semesters spread over two years.
Program pattern- Commencement of Semester

- **First Semester: August**
- **Second Semester: February**
- **Third Semester: August**
- **Fourth Semester: February**

Eligibility Criteria: As a minimum criterion of eligibility, aspiring candidates are needed to have attained a B.Sc. in any discipline of Life Sciences, Biosciences, Bachelor's degree in any of Physics, Biological Sciences, M.B.B.S, BDS, BAMS, BHMS, B.Pharm., B.Tech (Biotechnology), Bachelor’s Degree in Agricultural, Veterinary and Fishery Sciences, or equivalent examination with a minimum aggregate score of 50%.

Assessment Pattern

1. LETTER GRADES AND GRADE POINTS:

BLDEDU has adopted the UGC recommended system of awarding grades and CGPA under Choice Based Credit Semester System for MSc Medical courses.

1.1 BLDEDU would be following the absolute grading system, where the marks are compounded to grades based on pre-determined class intervals.

1.2 The UGC recommended 10-point grading system with the following letter grades will be followed:

Table 1: Grades and Grade Points

Letter Grade	**Grade Point**
O (Outstanding)	10
A+ (Excellent)	9
A (Very Good)	8
B (Good)	7
C (Above Average)	6
F (Fail)/ RA (Reappear)	0
Ab (Absent)	0
Not Completed (NC)	0
RC (<50% in attendance or in Internal Assessment)	

a. A student obtaining Grade RA shall be considered failed and will be required to reappear in the examination.

b. Candidates with NC grading are those detained in a course (s); while RC indicate student not fulfilling the minimum criteria for academic progress or less than 50% in attendance or less than 50% in internal assessments (IA). Registrations of such students for the respective courses shall be treated as cancelled. If the course is a core course, the candidate has to re-register and repeat the course when it is offered next time.

1.3 CBCS Grading System - Marks Equivalence

Table 2: Grades and Grade Points

Letter Grade	**Grade Point**	**% of Marks**
O (Outstanding)	10	86-100
A+ (Excellent)	9	70-85
A (Very Good)	8	60 -69
B (Good)	7	55 -59
C (Above Average)	6	50- 54
F (Fail)/ RA (Reappear)	0	Less than 50
Ab (Absent)	0	-
NC- not completed	0	-
RC- Repeat the Course	0	0

Table 3: Cumulative Grades and Grade Points

Letter Grade	**Grade Point**	**CGPA**
O (Outstanding)	10	9.01 - 10.00
A+ (Excellent)	9	8.01 – 9.00
A (Very Good)	8	7.01 – 8.00
B (Good)	7	6.00 - 7.00
C (Above Average)	6	5.01 - 6.00

a. **Assessment of a Course:** Evaluation for a course shall be done on a continuous basis. Uniform procedure will be adopted under the CBCS to conduct continuous internal assessments (IA), followed by one end-semester university examination (ES) for each course.

b. Courses in programs wherein Theory and Lab are assessed jointly, the minimum passing head has to be 50% Grade each for theory and practical's separately. RA grade in any one of the components will amount to reappearing in both components i.e. theory and practical.

2. Eligibility to appear for the end-semester examinations for a course includes:

2.1 Candidates having ≥ 75% attendance and obtaining the minimum 35% in internal assessments in each course to qualify for appearing in the end-semester university examinations.

2.2 The students desirous of appearing for university examination shall submit the application form duly filled along with the prescribed examination fee.

2.3 Incomplete application forms or application forms submitted without prescribed fee or application form submitted after due date will be rejected and student shall not be allowed to appear for examination.

3. Passing Heads

3.1 The minimum passing head shall be 50% in both Theory and practicals separately including the internal assessment.

4 Detention:

A student not meeting any of the above criteria may be detained (NC) in that particular course for the semester. In the subsequent semester, such a candidate improves in all, including attendance and/or IA minimum to become eligible for the next end-semester examination.

5 The maximum duration for completing the course will be 4 years (minimum duration of course x 2)

i.e. (2x2) = 4 years for PG Courses, failing which his/her registration will be cancelled. Full fees of entire course of three years may be liable to be paid by the students.

6 Carry over benefit:

6.1 A candidate who fails in any two main subjects of previous semester shall be permitted to carry over those subjects to the next semester.

6.2 A candidate shall not be allowed to appear in the final semester examination unless the candidate has cleared all the previous semester examinations.

7 Grace Marks for PG Courses: **No grace marks will be awarded for PG Exams.**

8. University End-Semester Examination

8.1 There will be one final university examination at the end of every semester.

8.2 A candidate must have minimum 75% attendance (Irrespective of the type of absence) in theory and practical in each subject to be eligible for appearing the University examination.

8.3 The Dean shall send to the university a certificate of completion of required attendance and other requirements of the applicant as prescribed by the university, two weeks before the date of commencement of the written examination.

8.4 A candidate shall be eligible to sit for the examination only, if she / he has secured minimum 35% in internal assessment of that subject. The internal examinations will be conducted at college/ department level.

8.5 Notwithstanding – anything in any examination, a deficiency of attendance at lectures or practical maximum to the extent of 10% - may be condoned by the Dean.

8.6 If a candidate fails either in theory or in practical, he/ she have to re-appear for both.

8.7 There shall be no provision of re- evaluation of answer sheets Candidates may apply to the university following due procedure for recounting of theory marks in the Presence of the subject experts.

8.8 Internal assessments shall be submitted by the Head of the Department to the university through the Dean BLDEU at least two weeks before commencement of University theory examination.

8.9 Supplementary examination: There shall be no supplementary examination

8.10 Re-Verification -There shall be provision of retotaling of the answer sheets, candidate shall be permitted to apply for recounting/retotaling of theory papers within 8 days from the date of declaration of results.

8.11 Scheme of University Exam Theory PG Program: General structure / patterns for setting up question papers for Theory / Practical courses, their evaluation weightages for PG programs are given in the following tables.

8.12 Theory Question Paper Pattern for Core Subjects in University Examinations Under CBCS – 80 Marks

Question Type	No. of Questions	Questions to be Answered	Questions X Marks	Total Marks
Brief Answer Questions	7	6	2 X 10 4 X 15	80

General Instructions (Theory):

A. Time duration of each Theory Paper will be of Three (3) Hrs .
B. Total Marks of each Theory Paper will be 80 Marks

8.13 Practical Question Paper Pattern For University Examinations Under CBCS - 50 Marks

Exercise	**Description**	**Marks**
Q No 1	Practical exercise – 1	1 x10=15 M
Q No 2	Station exercise	3x5M=75 M
Q No 3	VIVA	10 M
		Total = 100

General Instructions (Practical):

All the students have to remain present at the examination center 5 minutes before the scheduled time for examination.

A. Students have to carry with them certified journal, I-card or examination receipt, and other necessary requirements for examination.

B. Candidate should not leave the practical hall without the permission of examiner.

C. Use of calculator is allowed but the use of mobile phones is strictly prohibited.

D. The candidate has to leave the laboratory only after the submission of all the answer sheets of the exercises performed.

8.14 Internal examination pattern (Theory): 30marks

Question type	No. of Questions	Questions to be answered	Question X marks	Total marks
Brief Answer Questions	4	3	1X10	30

8.15 Breakup of theory IA calculation for 20 marks

Internal exam (Department - 30 Marks)	15 marks
Seminar	5 marks
	Total = 20 M

8.16 Internal Examination Pattern (Practical): 30 Marks

Practical Exercise	10marks
Station Exercise	10 marks
Viva	10 marks
Total practical	30 arks

8.17 Breakup of practical IA calculation:

Internal exam (Department -30 Marks)	15 marks
Journal	5 marks
	Total = 20 M

Internal Assessment marks should be submitted to the university by respective departments at least 15 days prior to onset of university examination.

Submission of Protocol of Dissertation: Students should undergo Online Course of research Methodology (MCI- PG) before submitting the protocol for their Dissertation.

SEMESTER-I

Course Objective (Teaching Objectives):

- To create keen interest in the molecular & genetic aspect of the existence & viability of a human body

Course Outcomes (Learning Objectives):

- The student should be able to develop curiosity & the ability to seek answers. They should be able to get an exposure to the teaching research & diagnostic fields, so that they are able to take an informed decision for their career ahead.

Unit No.	Theory Topics	Hours Allotted No. of hrs
1.	**Module 1**	4
	Cell Biology- Biophysical principles of Basic Sciences, Structure & function of different cell organelles, Separation of cell organelles, Markers for cell organelles, Structure & function of cell membrane, Cytoskeleton elements, Transport mechanism, Ion channels, Artificial membrane (liposome & its application)	
2.	**Module 2**	10
a)	Chemistry of Carbohydrate- Definition, Physiological functions, Classification, Monosaccharide, Disaccharide, Polysaccharides, Properties of Carbohydrates, Epimers, Isomers, Mutarotation	
b)	Chemistry of Lipids- Definition, Physiological functions, Classification of lipids, fatty acids, Essential fatty acids , Simple lipids , Compound Lipids, Derived Lipids	
3.	**Module 3**	10
a)	Chemistry of Protein- Amino acids & their Classification, various ways of Classification of protein, Structure of protein, Properties of proteins, Isoelectric pH, Denaturation, Biologically important peptides	
b)	Chemistry of Nucleic acids- Nucleosides, Nucleotides, Purine & Pyrimidine bases, Types & structure of DNA, Types & structure of RNA	

4.	**Module 4**	5
	Enzyme- Definition , Nomenclature & Classification- Systematic & recommended nomenclature, IUBMB Classification of enzymes only (names, definition, general reaction catalyzed and one example for each class). Properties of enzymes- Mechanism of action of an enzyme with regard to its effect on activation energy of a reaction. Concept of active sites in enzymes, Lock & key & induced fit models of enzyme- substrate binding, Specificity of enzymes- reaction & substrate specificity-definition & an example for each, Cofactors- metals & coenzymes (definition, examples of coenzymes) & examples of enzymes that require them . Factors that influence enzyme activity- Effect of pH (concept of optimal pH with examples). Effect of temperature (concept of optimal temperature). Overview of concept of effect of substrate concentration (Michaelis- Mention equation(no derivation required), basic concept of Km & Vmax). Effects of enzyme & product concentration Inhibition of enzymes- Types of enzyme inhibition – competitive, non-competitive, suicide inhibition, Examples of commonly used drugs that act by competitive inhibition of enzymes. Regulation of enzyme activity – Overview of mechanisms involved in regulating the activity of enzymes, Allosteric activation & inhibition .Covalent modification- (phosphorylation & de phosphorylation) Induction & repression , Concept of feedback inhibition. Isoenzymes , Therapeutic & diagnostic uses of enzymes	
5.	**Module 5**	15
a)	Vitamins- Sources , RDA, Functions & deficiency manifestation of Fat soluble. vitamins(A, D, E, K), Water soluble vitamins (B complex & Vitamin C)	
b)	Biological Oxidation- Role of ATP, The respiratory chain & oxidative phosphorylation, Role of brown fat (non-shivering thermogenesis & role of uncoupling protein / thennogenin).	
c)	Minerals- Sources, Functions & deficiency manifestation of Calcium, Phosphorus, Iron, Copper, Zinc, Magnesium, Maganese, Iodine, Sodium, Potassium, Fluoride, Selenium	
6.	**Module 6**	8
a)	Hb Chemistry- Structure & functions of Hb, Physiological Hb , Abnormal Hb, Hb derivatives	
b)	Hormone- Classification of hormones: Group 1 & Group 2 hormones	
c)	Signal Transduction – Mechanism of intracellular signaling of hormones, G protein coupled receptors. Second messengers in hormone action: cAMP, cGMP, Ca2+ & phosphatidyl inositol. Hoemone receptors as gene-specific transcription factors	
	Total	**45 hrs**

Unit No.	Tutorial Topics	Hours allotted No. of---hrs
1	Cell Biology	1
2	Chemistry of Carbohydrate	1
3	Chemistry of Lipids	1
4	Chemistry of Protein	2
5	Chemistry of Nucleic acids	1
6	Enzyme	1
7	Factors that influence enzyme activity	1
8	Inhibition of enzymes	1
9	Vitamins	2
10	Biological Oxidation	1
11	Minerals	1
12	Hb Chemistry	1
13	Hormone	1
	Total	**15 hrs**

Unit No	Practical Topics	Hours allotted No. of hrs
1	Test for Monosaccharides	2
2	Test for Disaccharides	2
3	Test for Polysaccharides & Osazone formation	2
4	Colour reaction of Proteins	2
5	Precipitation reaction of Proteins	2
6	Urine : Physical Characteristics & normal constituents	2
7	Urine report : Physical Characteristics & abnormal constituents	4
8	Chemistry of Bile	2
9	Tests for Vitamin A & Vitamin C	4
10	Estimation of Serum Calcium	2
11	Estimation of Serum Phosphorus (inorganic)	2
12	Revision Practicals	4
	Total	**30 hrs**

Reference Books:

1. Textbook of Medical Biochemistry (As per the revised curriculum of MCI, 2019), Dr. S K Gupta.
2. Textbook of Biochemistry for Medical Students (As per revised MCI curriculum), D M Vasudevan, Sreekumari S, Kannan Vaidyanathan .
3. Textbook of Medical Biochemistry, M.N. Chatterjee, Rama Shinde.
4. Textbook of Biochemistry, Debajyoti Das

SEMESTER-II

Course Objective (Teaching Objectives)

- To create keen interest in the molecular & genetic aspect of the existence & viability ofa human body

Course Outcomes (learning Objectives)

- The student should be able to develop curiosity & the ability to seek answers. They should be able to get an exposure to the teaching research & diagnostic fields, so that they are able to take an informed decision for their career ahead.

Unit No.	Theory Topics	Hours allotted No. of hrs
1.	**Module 7**	8
	Carbohydrate Metabolism- Digestion of carbohydrates, Glucose transporters, Glycolysis, Rapaport-Leubering cycle, Citric acid cycle/ Kreb's cycle/ tricarboxylic acid (TCA) cycle, Pentose phosphate pathway (PPP), Glycogenesis, Glycogenolysis, Glucogenesis, Uronic acid pathway, Metabolism of galactose, Metabolism of fructose, Minor pathways of Carbohydrate Metabolism, regulation of blood glucose levels, Diabetes mellitus, Glucose Tolerance Test (GTT)	
2.	**Module 8**	6
	Lipid Metabolism- Digestion of lipids, Fatty acid oxidation, Biosynthesis of Fatty acids, Metabolism in the adipose tissue, Metabolism of ketone bodies, Metabolism of cholesterol, Fatty liver, Atherosclerosis	
3.	**Module 9**	9
	Protein Metabolism – Digestion & absorption, General pathways of amino acid catabolism (Transamination, Deamination, Decarboxylation, Transdeamination), Ammonia Metabolism (Urea cycle, Glutamine formation), Metabolism of Glycine, Aromatic amino acids, Sulphur containing amino acids, Glutamic acid	

4	**Module 10**	
a) b) c)	Nucleic acid Metabolism- Overview of the pathway of de novo synthesis of purine nucleotides (starting material & end products only- AMP & GMP), Salvage pathway for purine bases & nucleotides. Lesch-Nyhan syndrome (cause & biochemical basis of clinical features). Overview of the pathway of degradation of purines to form uric acid, including role of the xanthine oxidase. Hyperuricemia & gout (causes, clinical features, principles of treatment, including mechanisim of action of allopurinol & probenecid). Overview of pathway of de novo synthesis of prrimidine nucleotides, showing only starting material, rate-limiting enzyme & end products. Hb Metabolism- Heme synthesis, Heme degradation, Porphyria, Important physiological & pathological causes of jaundice in the newborn. Genetic code- Characteristics (universal, umambiguous, degenerate, without punctuation [continous/commaless]). Basis of degeneracy of the genetic code (wobble hypothesis). Protein Biosynthesis- Prokaryotic & Eukaryotic Replication, Transcription, Translation (Initiation, elongation, Termination, Inhibitors of protein biosynthesis) in brief.	
5	**Module 11**	
a) b) c)	Detoxification- Definition & examples, Biochemical importance of the two phases of xenobiotic metabolism. The cytochrome P450 enzyme system. Water & Electrolyte balance- Distribution of water in various body compartments. Intra-extracellular fluid composition (sodium & potassium), Blood volume & osmolality, Hormonal regulation of water balance & its disorders. Acid & Base balance- Definition of acid, Base & buffer. Normal pH of body fluid &importance of maintaining normal pH, Sources of hydrogen ions in the body, Simple acid base disorders, Mechanisms of regulation of pH	
6	**Module 12**	
	Organ function test- LFT, RFT, TFT, PFT, GFT	
	Total	**45**

Unit No.	Tutorial Topics	Hours allotted No. of---hrs
1	Carbohydrate Metabolism	2
2	Lipid Metabolism	2
3	Protein Metabolism	2
4	Nucleic acid Metabolism	1
5	Hb Metabolism	2
6	Protein Biosynthesis	1
7	Detoxification	1
8	Water & Electrolyte balance	1
9	Acid & Base balance	1
10	Organ function test- LFT, RFT, TFT, PFT, GFT	2
	Total	**15**

Unit No.	MBC1.1P Practical Topics	Hours allotted No. of---hrs
1	Estimation of Blood Sugar	2
2	Estimation of Blood Urea	2
3	Estimation of Serum Creatinine	2
4	Estimation of Urine Creatinine	2
5	Estimation of Total protein, a lbumin & A/ G ratio	2
6	Estimation of Total Serum Bilirubin	2
7	Estimation of Serum Cholesterol	2
8	Estimation of Serum Uric acid	2
9	Estimation of Serum Electrolytes	2
10	Estimation of Serum S.G.O.T.	2
11	Estimation of Serum S.G.P.T.	2
12	Estimation of Serum Alkaline Phosphatse	2
13	Estimation of Serum Amylase	2
14	Revision	4
	Total	**30**

Syllabus for Research Methodology and Biostatistics		
I. Research Methodology:	No. of Hours	
	Theory	Practical
Scientific Methods of Research: Definition of Research, Assumptions, Operations and Aims of Scientific Research. Research Process, Significance and Criteria of Good Research , Research Methods versus Methodology, Different Steps in Writing Report, Technique of Interpretation, Precaution in interpretation, Significance of Report Writing, Layout of the Research Report	5	—
Research Designs: Prospective, retrospective, Observational Studies: Descriptive, explanatory, and exploratory, Experimental Studies: Pre-test design, post-test design, Follow-up or longitudinal design, Cohort Studies, Case Control Studies, Cross sectional studies, Intervention studies, Panel Studies.	5	—
Sampling Designs : Census and Sample Survey, Implications of a Sample Design, Steps in Sampling Design Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, Different Types of Sample Designs (Probability sampling and non probability sampling), How to Select a Random Sample?, Systematic sampling, Stratified sampling, Cluster sampling, Area sampling, Multi-stage sampling, Sampling with probability proportional to size, Sequential sampling.	4	
Measurement in research: Measurement Scales, Sources of Error in Measurement, Tests of Sound Measurement, Technique of Developing Measurement Tools, Scaling Meaning of Scaling, Scale Classification Bases, Important Scaling Techniques, Scale Construction Techniques, Possible sources of error in measurement, Tests of sound measurement	5	
Methods of Data Collection: Types of data, Collection of Primary Data, Observation Method, Interview Method, Collection of Primary Data	3	
Ethics and Ethical practice in research and plagiarism	1	
Sampling Fundamentals : Need and importance for Sampling, Central Limit Theorem, Sampling Theory, Concept of Standard Error, Estimation, Estimating the Population Mean Estimating Population Proportion, Sample Size and its Determination, Determination of Sample Size through the Approach Based on Precision Rate and Confidence Level.	5	

II. Biostatistics		
Data Presentation : Types of numerical data: Nominal, Ordinal, Ranked, Discrete and continuous. Tables: Frequency distributions, Relative frequency, Graph: Bar charts, Histograms, Frequency polygons, one way scatter plots, Box plots, two way scatter plots, line graphs	3	3
Measures of Central Tendency and Dispersion : Mean, Median, Mode Range, Inter quartile range, variance and Standard Deviation, Coefficient of variation, grouped mean and grouped standard deviation (including merits and demerits).	3	3
Testing of Hypotheses: Definition, Basic Concepts, Procedure for Hypothesis Testing, Normal distribution, data transformationImportant Parametric Tests, Hypothesis Testing of Means, Hypothesis Testing for Differences between Means, Hypothesis Testing for Comparing Two Related Samples, Hypothesis Testing of Proportions, Hypothesis Testing for Difference between Proportions, Testing the Equality of Variances of Two Normal Populations.	6	6
Chi-square Test: Chi-square as a Non-parametric Test, Conditions for the Application Chi-square test, Steps Involved in Applying Chi-square Test, Alternative Formula, Yates' Correction, and Coefficient by Contingency.	2	2
Measures of Relationship: Need and meaning, Correlation and Simple Regression Analysis	2	2
Analysis of Variance and Covariance: Analysis of Variance (ANOVA):Concept and technique of ANOVA, One-way ANOVA, Two-way ANOVA, ANOVA in Latin-Square Design Analysis of Co-variance (ANOCOVA), ANOCOVA Technique.	4	4
Nonparametric or Distribution-free Tests: Important Nonparametric or Distribution-free Test Sign test, Wilcoxon signed-Rank Test, Wilcoxon Rank Sum Test: Mann-Whitney U test Kruskal Walli's test, Friedman's test, and Spearman Correlation test.	3	3
Vital Health Statistics: Measurement of Population: rate, crude rate, specific rate, Measurement of fertility: specific fertility rate, Total fertility rate, Reproduction rate, Gross Reproduction Rate, Net Reproduction Rate, Measures related to mortality: Crude Death Rate (CDR) , Age-specific death Rate, Infant and child mortality rate, Measures related to morbidity.	4	3
Computer Application Use of Computer in data analysis and research, Use of Software and Statistical package.	0	2
Total hours	**55**	**35**

SEMESTER-III
MCI 3.1 General Immunology

About the course

This course will start from the basics of the immune system and will gradually move towards a more complex immune response. The students will also be taught about the types of immune cells, hematopoiesis and mediators of immune response such as cytokines, chemokines besides other related aspects.

Learning outcomes

After successfully completing this course, the students will be able to:

- Understand the components of immune system and improved methods to study it.
- Understand intricacies of hematopoiesis.
- Understand the different kinds of immune cells and their corresponding functions.
- Develop treatments for immune diseases such as autoimmune diseases and immune deficiency disorders such as asthma and COPD.

Unit No.	Topic	Faculty	Lecture
01	Hematology: The structural and functional organization of hematological systems; Hematopoietic stem cells; regulation of hematopoiesis; functions of the blood cells; diseases emerging from the malfunctions of these cells;		08
02	Basic Immunology: History of Immunology; Overview of Immunology; Organization of lymphoid organs; TLRs and Innate Immunity; Triggering of immune response, kinetic of immune response; Organ-specific immune response; Cells of the Innate Immune system and their functions; Immunogens and antigens; Classes of Immunoglobulin- IgA, IgG, IgD, IgM and IgE. Biological properties of Immunoglobulins; Antigen-Antibody reaction; B-Cell development-maturation – further classification B-Cell Receptor: B-cell activation, effector function. Complement system; MHC/HLA systems; Antigen processing and presentation; T cell development and T cell responses		24
03	Immunological techniques: Isolation of Cells: B cells, T cells, macrophages, dendritic cells, neutrophils, mast cells; Cell type specific assays: For B cells, T cells, neutrophils; mast		08

	cells, dendritic cells, monocytes-macrophages; Cell proliferation assay; Apoptosis assay; Oxidative burst assay; Cytokine assay; Colony forming unit assay; Gene expression assays; Immuno-labeled microscopy; Flow cytometry; Angiogenesis assay; Target cell cytotoxicity assay; Binding partner assays; Signal transduction assays; Biochemical assays		
04	Experimental Immunology models: Principles of making models; different animals used as models; Models for autoimmunity, immunodeficiency, hypersensitivity, infections, transplantation and tumors;		05
	Visits to Diagnostic Centers; Hospitals and clinics;		

MCI 3.2 Advanced Clinical Immunology_1

No.	Topic	Faculty	Lecture
05	Tumor immunology: Oncogene and cancer induction, Tumor antigens, Immune response to tumors, relation between tumor type and nature of immune response; Angiogenesis andtumor metastasis; anti-tumor drug resistance; immunotherapy;		10
06	Infection and Immunity: Classes of Pathogens; Structure-function correlation; Host-pathogen interaction; immunity to pathogens; immune evasion strategies; vaccines; adjuvants; limitations of vaccination. AIDS immunology: HIV Structure; anti-HIV immune response. Hospital-acquired infection (nosocomial), immune compromised states.		20
07	Transplantation immunology, Immunotherapy and Regenerative medicine: Types, mechanism of transplant rejection, prevention of graft rejection. Antigen and antibodies in blood, concept of titer. Concept of blood groups and its principle (ABO group, Rh-typing and MN group). Condition for blood transfusion. Basic principle followed for blood transfusion.		15
08	Auto immunity and auto immune disease: (a) Organs specific autoimmune disease- Hashimoto's thyroiditis, Good pastures syndrome, Insulin dependent diabetes mellitus, Grave's disease, Myasthenia gravis. (b) Systemic autoimmune disease- SLE, Multiple sclerosis, Rheumatoid arthritis.		10
09	Hypersensitivity reaction: IgE-mediated (type-I), Ab-mediated cytotoxic (type-II), Immune complex mediated (type-III), Delayed type hypersensitivity (type-IV).		05

MCI3.3 Advanced Clinical Immunology_2

No.	Topic	Faculty	Lecture
10	Genomics and Proteomics: Introduction of genomics: Review of literature. Data based in gene and genome analysis- data mining, inventories, sequence homology search. Classification of genomics. Introduction of proteomics: 2D- analysis of cell protein, analysis and sequencing individual spots by mass spectrometry and protein microarrays. Human Genome Project: Organization of the human genome. Brief history of the project. Repetitive DNA in human genome. Utility of the project in medicine and biotechnology. Genetic counseling. Introduction to Nutrigenomics, Pharmacogenomics and Toxicogenomics.		20
11	Immunopharmacology: Overview of drug discovery and development of immuno-drugs. Principles of basic and clinical pharmacokinetics and pharmacodynamics. Adverse drug reactions. Drug interactions, Bioassay of drugs and biological standardisation of immunoagents, Influence of stress, nutrition and environment on immunity; Neuro-endocrinology. Drug-immune interface: Vaccines and adjuvants, antibodies in therapy, antibody engineering, monoclonal antibodies, immunoconjugates - specific drug targeting, immuno-toxins; Sera and immunoglobulins; Drugs for the treatment of asthma and COPD; Cardiovascular Drugs and their immunopharmacological mechanism of action; Immuno-stimulants in cancer therapy; Immunopharmacological mechanism of action of anti-infective drugs; Immuno-suppressants and transplantation; Immuno-suppressants and autoimmunity		25
12	Immunological Disease Management:		08
13	Vaccine and Prophylaxis		07

MCI3.5P

Unit No.	Topic		Lecture
01	Experiments on Hematology:- Cytospin preparation of Bone marrow cells, Identification of cell types in Bone marrow, Histology of Bone marrow, Phenotyping of bone marrow stromal cells, Bone marrow cells Colony forming unit assay		09
02	Experiments on Molecular Biology:- Glassware decontamination, washing-sterilization, packing and Media and reagent preparation, sterility checks, DNA and RNA isolation; Restricted endonuclease digestion; DNA ligation and transformation of *E.coli* Horizontal Gel electrophoresis; Hybridization; DNAase sensitivity;		06
03	Experiments on Cell Biology: Subcellular fractionation (a) Mitochondria, nuclei etc. (b) Centrifugation- differential and density gradient (sucrose, percoll, CsCl). Cell cycle regulation Membrane anisotropy		15
04	Animal and Cell culture: Sterile handling for animal cell tissue culture. CO_2 incubator. Maintenance of cell cultures: Primary cells, Cell lines, Cell clones, Cell types in culture. Cell characterization- Karyotyping, Growth rates, Isoenzymes and differentiation, Normal and transformed cells.		10

05	Experiments on Immunology: Separation of different types of blood cells by Histopaque. Preparation of Antigen and Development of antibody Ouchterlony double diffusion (ODD), Single radial immune diffusion (SRID). Agglutination test. Cytology and Histology of lymphoid organs Haemolytic Plaque assay Identification of the B cells precursors in bone marrow Antibody isotyping by ELISA Complement in target cell lysis Identification of monocyte populations in bone marrow Identification of the T cell precursors in thymus T cell culture with macrophages Cytokine assay by ELISA		10
06	Instrumentation		05
07	Biostatistics and computer application in Biology		05
08	Histology and immuno-histochemistry		10
09	Conscience and Ethics in research: Philosophy and Practice		05

SEMESTER- IV

4th Semester: 300 marks

In the final semester, the students have to orientate themselves to one of the following modes of research:

1. Experimental: Model-based Research
2. Clinical: Patient-based Research
3. Diagnostics: Disease diagnosis in collaboration with Diagnostic Labs
4. Disease Management: Assess the problems, Formulate working principles, and model implementation
5. Theoretical: Bioinformatics and mathematical modeling

The students will be given five months' time to complete the project work. At the end of the project, the student will prepare the dissertation. Based on the students work, the supervisor will give marks out of 150.

During the presentation, the students will be assessed by a panel of examiners, who will average it out of the rest 150. It is expected that these divisions will normalize any bias in marking.