

# **KRISHNA INSTITUTE OF MEDICAL SCIENCES DEEMED TO BE UNIVERSITY.**

## **Krishna Institute of Medical Sciences, Karad**

**Programme Name : P.G. D.M.L.T CHOICE BASED CREDIT SYSTEM**

**Programme Code : 1303**

**Course Name: Pathology, Microbiology, Biochemistry Course Code – 11 To 13**

### **Preamble:**

There is need of trained man power – laboratory technicians for smooth working of laboratories so it was unanimously decided to recommend to Academic Council to start D.M.L.T Course of one year duration with 6 months apprenticeship in our university. Syllabus for the same in subject of Pathology Biochemistry & Microbiology was approved by respective Board of studies. It was recommended to give more importance to hands on training & acquiring skills by the candidates. Department of Pathology, Department of Biochemistry & Department of Microbiology will work in association with each other for conduction of this course.

### **Course Outcome:**

Candidate with D.M.L.T. qualification are expected to work as technicians in the laboratories attached to hospital under supervision of senior officer like Biochemist. Microbiologist or Pathologist. They may be employed in a small laboratory functioning independently or attached to a doctor's clinic.

Nature of their job dictates that candidates should give more emphasis on learning of practical skills and behavioral skills along with a basic Knowledge of the subject.

### **I) Eligibility:**

1. Candidate should have a B.Sc. degree of recognized university with Microbiology, Biochemistry, Chemistry, Botany or zoology as the subjects or an equivalent qualification.
2. Candidate offering E.L.T. as a subject at HSC (XII) level may be given preference.
3. Knowledge of computer is essential to the candidate.

**Fee :** As per University policy.

**Selection Method:-** As per University policy.

**Maximum number of Students:** 20

**Medium of Instruction:** English

## **II) Admission and Duration:**

1. The course will extend over one year, comprising of two academics semesters.
2. University examination for D.M.L.T will be conducted twice a year.
3. Every year twenty students shall be admitted for this course.
4. Training period shall be so divided that, candidates are rotated in three departments (Biochemistry, Pathology and Microbiology) for theoretical, practical and rotational training in laboratories according to syllabus .It is expected that candidate should be able to carry out various laboratory tests for diagnosis in urban and rural set-up.

## **III ) Laboratory training and rotation: in following areas :**

### **Pathology -**

- Histopathology, Autopsy & Museum
- Hematology
- Clinical Pathology
- Cytology
- Blood Bank

### **Biochemistry -**

- Stat investigation
- Lipid Profile
- Diabetic Profile
- Cardiac Profile
- Liver function Test
- Kidney function Test

### **Microbiology -**

- Bacteriology
- Serology
- Mycology
- Parasitology
- Virology
- Media preparation

Each candidate shall undergo training in laboratories, of all three subjects.

Minimum duration of training in each subject shall be of 3 months.

This period will be utilized to help the candidates in learning practical and behavioral skills. All the candidates will be divided into three batches. Each batch will undergo training in the three laboratories by rotation. Each candidate has to keep a record of his /her work during period. This period of training shall be utilized for helping the candidates to learn the following:

1. Preparation and preservation of various reagents, stocks standard solutions, buffer solutions, anticoagulants and bulbs/tubes for sample collection etc.
2. Use, care and maintenance of basic equipments, instruments and glass ware etc.
3. Collection of samples of patients, receiving and registering the samples from wards.
4. Processing, recording and reporting of results.
5. Interpersonal relations and communication with doctors, nurse, ward boys, patients, relatives, colleague and superior etc.
6. Quality control programme of laboratory.
7. Safety precautions and first aid measures etc.

**Semester I**

<b>Sr. No.</b>	<b>Course Code</b>	<b>Course Title Discipline Specific Course (DSC)</b>	<b>Number of Hours</b>	<b>Credits</b>
		<b>Theory</b>		
1	1303 -11	Pathology	30	2
2	1303 -12	Microbiology	30	2
3	1303 -13	Biochemistry	30	2
		<b>Practicals.</b>		
1	1303 -11	Pathology	60	2
2	1303 -12	Microbiology	60	2
3	1303 -13	Biochemistry	60	2
		<b>Rotational Posting in Laboratories</b>		
1	1303 -11	Pathology	90	3
2	1303 -12	Microbiology	90	3
3	1303 -13	Biochemistry	90	3
		<b>Total</b>	<b>540</b>	<b>21</b>

<b>Sr. No.</b>	<b>Course Code</b>	<b>Discipline Specific Elective (DSE)</b>	<b>Number of Hours 105</b>	<b>Credits 04</b>
		<b>Choose only one from below five</b>		
1	1303– 11 Pathology	1)Working in Immunohistochemistry laboratory for 3 breast markers. 2)Working on Cryostat for frozen sections. 3)Preparation of Blood Components in blood bank.	105 As below  (Theory 15 hrs )  (Practical & lab rotational posting Total 90 hrs)	04 As below  (01)  (03)
2	1303-12 Microbiology	1)Automation in Bacteriological techniques. 2)Molecular diagnostic techniques.	105 As below  (Theory 15 hrs )  (Practical & lab rotational posting Total 90 hrs)	04 As below  (01)  (03)

**Credits for Semester I = 21 + 4 = 25 credits**

**Semester II**  
**Core Subjects**

Sr. No.	Course Code	Course Title Discipline Specific Course (DSC)	Number of Hours	Credits
		<b>Theory</b>		
1	1303 -11	Pathology	30	2
2	1303 -12	Microbiology	30	2
3	1303 -13	Biochemistry	30	2
		<b>Practicals</b>		
1	1303 -11	Pathology	60	2
2	1303 -12	Microbiology	60	2
3	1303 -13	Biochemistry	60	2
		<b>Rotational Posting in Laboratories</b>		
1	1303 -11	Pathology	60	2
2	1303 -12	Microbiology	60	2
3	1303 -13	Biochemistry	60	2
		<b>Total</b>	<b>450</b>	<b>18</b>

Sr. No.	Course Code	Discipline Specific Elective (DSE)	Number of Hours 105	Credits 04
		<b>Choose only one from below four</b>		
1	1303- 13	<p><b><u>Biochemistry</u></b></p> <p>1) Information technology of automation.</p> <p>2) Accreditation in biochemistry.</p> <p>3) Marketing Strategy in Biochemistry laboratory services.</p> <p><b>OR</b></p>	<p>105 As below</p> <p>(Theory 15 hrs )</p> <p>(Practical &amp; lab rotational posting Total 90 hrs)</p>	<p>04 As below</p> <p>(01)</p> <p>(03)</p>
2	1303 -11,12,13	Quality Management System in medical laboratory as per National Accreditation Board of Laboratories.	<p>105 As below</p> <p>(Theory 15 hrs )</p> <p>(Practical &amp; lab rotational posting Total 90 hrs)</p>	<p>04 As below</p> <p>(01)</p> <p>(03)</p>

**Total Credits for Semester II = 18 + 4 = 22 credits**

## Paper I - Pathology

### Semester I

#### Core subject syllabus Theory and Practical

a) Theory

Credits: 02

Hours: 30

#### Hematology

- Medical Ethics & Duties of a laboratory Technician.
- Composition of blood, formation of blood cells & their function.
- Estimation of haemoglobin by various methods & calibration of haemoglobinometer.
- Measurements of blood cells, Red cells, White cells & platelets.
- Preparation of Peripheral smears, including thick & thin smears for malaria, Finger prick smears etc. Routine & special staining procedure of smears.
- ESR, PCV & absolute blood indices.
- Anemias & its morphological classification.
- Anemias - Investigations with reference to Reticulocyte count, osmotic fragility test & test for sickling.
- Bone Marrow examination – Preparation & staining of smears.
- Haemorrhagic disorders & coagulation studies. Technique of bleeding time, clotting time, Prothrombin time, platelet count, fibrinogen estimation.
- Leukemias.

#### Clinical Pathology

- Automation in haematology – Handling of haematology analyser, coagulometer, urine analyser.
- Examination of urine – Methods of physical, chemical & microscopic study of urine.
- Renal Function test.
- CSF examination
- Pleural, Peritoneal, body fluid.
- Semen analysis.
- Pregnancy test.
- Rapid Malaria test (RMT)

b) Practical & Rotational Posting in Lab. Credits 2 + 3 = 5 Hours 60 + 90 = 150

- General Technology & Microscopes.
- Specimen collection & Anticoagulants.
- Hemoglobin Estimation.
- Haemocytometer with W.B.C. Count.
- ESR, PCV & Red cell indices.
- Retic count & sickling test.
- R.B.C. Count & platelet count.
- Preparation of peripheral smears. Staining & DLC.
- Bone marrow Aspiration smears & staining.
- Bleeding time, Clotting time, Prothrombin time, APTT, PTTK etc.
- Absolute eosinophil count.
- Buffy coat & L.E. Cell phenomenon.



**b) Practical & Rotational Lab Posting      Credits: 2 + 2= 4    Hours: 60 + 60 = 120**

- Blood Grouping & blood transfusion.
- Fixatives, tissue processing & paraffin embedding.(Manual & Automation)
- Section cutting.
- H & E Staining with special stains in Histopathology.
- Cytology techniques with staining.
- Museum mounting.

**Paper II Microbiology**

**Semester I**

**Core subject syllabus Theory and Practical (Must know)**

**a) Theory -**

**Credits: 2**

**Hours: 30**

- Introduction & History,
- Classification of Microbes
- Physiology of bacteria
- Sterilization & Disinfection
- Culture Media & Methods
- Biochemical Reactions
- Collection & Transport of Specimen
- Specimen Processing
- Normal Flora & Host Parasite Relationship
- Bacterial Genetics
- Antigen, Antibody
- Serological Reactions
- Infection
- Immunity
- Staphylococci
- Streptococci, Pneumococci
- Neisseriae
- Corynebacterium
- Cl. perfringens
- Cl. tetani & Cl. botulinum
- Non sporing Anaerobes & Bacillus

**b) Practical & Rotational Posting in Lab**

**Credits: 2 + 3 = 5**

**Hours: 60 + 90 =150**

- Microscopy
- Staining – Gram
- Staining – ZeihlNeelson
- Media Preparation
- Biochemical
- Antimicrobial Susceptibility Testing
- Serological Reactions

**Paper – II Microbiology**  
**Semester II**

**a) Theory - Credits: 2 Hours: 30**

- E. coli- UTI, Diarrhoea
- Klebsiella Proteus, Pseudomonas
- Salmonella
- Shigella , Bacteriology of food, air, water,
- Vibrio
- Mycobacterium tuberculosis
- M. leprae& Atypical Mycobacteria
- Spirochetes
- Actinomycetes&Nocardia
- Rickettsia
- Chlamydia
- Morphology, Classification, lab diagnosis of fungi
- Superficial & Subcutaneous Mycoses
- Systemic & Opportunistic Mycoses
- Introduction to Parasitology
- Entamoebahistolytica& Giardia
- Malaria
- Leishmania
- Tape worm
- Round worm & Hook worm
- Filariasis
- General Virology
- Lab diagnosis Virology
- Hepatitis
- Herpes & Polio Virus
- Orthomyxovirus
- Arbovirus
- HIV
- Rabies
- Stock Culture, Preservation
- Laboratory infection& Biosafety
  
- Waste Management
- Quality control and Assurance
  
- Recent Advances in Diagnostic Techniques



- Other laboratory requirements –Chemical and general items. Specifications of all laboratory requirements and purchase procedures. Stock maintenance and inventory control.
- Chemistry & Metabolism of Carbohydrate
- Chemistry & Metabolism of Lipid
- Chemistry & Metabolism of protein
- Enzymes – Kinetics, Diagnostic & Therapeutic enzymes
- Vitamins- Classifications, sources, functions ,deficiency
- Mineral Metabolism –Special reference to calcium ,phosphorus ,Iodine, Iron, (TIBC)

### Paper III Biochemistry Semester I

**b) Practical & Rotational Posting in Lab      Credit: 2 + 3 = 5    Hours: 60 +90 =150**

- Introduction
- Laboratory glassware - Different types. Uses and care in handling, cleaning and disposal. Calibration of volumetric apparatus.
- Basic principles of laboratory work, personal safety against various accidents and hazards, knowledge of first - Aid, care to handle dangerous materials.
- Solvents & solutions –Normality, Molarity ,Molality, Preparation of standard solutions e.g. normal solution, molar solution, percent solution, Use of buffer, buffer preparation ,pH indicator & pH maintenance
- Qualitative Tests for carbohydrates
 

A) Molisch Test	B) Benedict's Test
C) Barfoed's Test	D) Mucic acid Test
- Qualitative Tests for Proteins ( Precipitation )
 

A) Heller's Test	B) Sulphosalysic Acid Test
C) Trichloro Acetic Acid Test	D) Heat coagulation Test
- Qualitative Tests for Proteins ( Colour Reactions )
 

A) Biuret Test	B) Ninhydrin Tests
C) Sulphur Test ( 'S' containing amino acids)	
- Normal urine analysis
- Abnormal urine analysis

- Demonstration of colorimeter, Spectrophotometer
- Estimation of Blood Sugar
- Estimation of Blood Urea
- Estimation of Serum Proteins & A:G ratio
- Estimation of Serum & Urine Creatinine
- Estimation of Serum Uric Acid
- Estimation of Serum Calcium
- Estimation of Serum Cholesterol
- Estimation of Serum Total Bilirubin, Direct Bilirubin, indirect Bilirubin
- Estimation of Serum Alkaline Phosphatase

**Paper III Biochemistry  
Semester II**

**a) Theory                      Credit : 2                      Hours : 30**

- Analytical instruments and techniques: Principle, types, use, care and maintenance of photoelectric colorimeters, spectrophotometers, ISE, electrophoresis, chromatography, Elisa and RIA isotopes
- Acid base balance, blood pH, electrolyte balance, acidosis , Alkalosis
- Hormones
- Blood: Composition, function and separation of plasma proteins. Blood coagulation. Chemistry and functions of hemoglobins including porphyrin and bilirubin metabolism

(In brief)

- Functional Tests - LFT,KFT,TFT, CFT

Other laboratory requirements – Chemical & reagents –solid & liquid,

Diagnostics kits for detection of metabolites, criteria for selection of kits & specifications ,purchasing & indenting procedure ,Inventory control and maintenance of stock ,

Periodic stock verifications & audit.

- Specimen collection : whole blood ,plasma, serum, urine, C.S.F & other body fluids etc. Preservation of specimens, anticoagulants etc.

- Organization and management in the laboratory, methods of labeling, collection of specimens. Maintenance of laboratory records – reports, indexing and cataloguing
- Interpersonal relations and communication with doctors, nurse, ward boys, patients, relatives, colleague and superior etc.

Methods of quality control, statistical concepts, ( various charts) knowledge of reference values for various laboratory tests and their interpretations.

Quality control: Role and importance of quality control. Accuracy, Reliability, Precision etc. Internal and external quality control measures, pre & para analytical errors, specificity & sensitivity, importance of accuracy & precision

- Laboratory waste disposal & bio safety : General laboratory protection methods
- Automation in clinical laboratory – Semi auto analyzers, discrete auto analyzers, batch auto analyzers, ISE analyzer
- Information systems – use of computer & networking in clinical labs

### **Paper III    Biochemistry** **Semester II**

**b) Practical & Rotational Posting in Lab    Credit : 2 + 2= 4    Hours :60 + 60 =120**

- Estimation of Serum Amylase
- Estimation of Serum OT / PT
- Estimation of Serum LDH
- Demonstration- Chromatography
- Demonstration- Electrophoresis
- Estimation of Serum Sodium & Potassium by ISE
- Estimation Acid phosphatase
- Estimation of Serum Triacylglycerol
- Estimation of Serum LDL ,HDL
- Estimation of Serum Iron & TIBC
- C.S.F.Analysis
- Estimation of Serum phosphorus
- CK-MB    Cardiac Profile

- Thyroid profile
- Lipid Profile
- Reagent making
- Standardization urea & glucose
- Standardization Creatinine & uric acid

## **Semester I**

### **Discipline Specific Elective (DSE) (Pathology or Microbiology)**

**Choose only one from below five**

#### **Course Code 1304 -11 Pathology**

- 1) Working in Immunohistochemistry laboratory for 3 breast markers.
- 2) Working on Cryostat for frozen sections.
- 3) Preparation of Blood Components in blood bank.

#### **Course Code 1304 -12 Microbiology**

- 1)Automation in Bacteriological techniques.
- 2)Molecular diagnostic techniques.

**Total Credits 04**

**Duration:- 3 ½ week.**

**Theory : 15 hrs. 01 Credit**

**Practical & Laboratory Rotational Postings in Special Lab – 90 hrs. 03 Credits**

## Semester II

### Discipline Specific Elective Courses:

Select any one from Biochemistry or Quality Management System. Total Credits 04

Duration:- 3 ½ week.

Theory : 15 hrs. 01 Credit

Practical & Laboratory Rotational Postings in Special Lab – 90 hrs. 03 Credits

#### Topics for Biochemistry:

- 1) Information technology of automation.
- 2) Accreditation in biochemistry.
- 3) Marketing Strategy in Biochemistry laboratory services.

Quality Management System in medical laboratory as per National Accreditation Board of Laboratories. 105 hrs 04 Credits.

Semester II 18 + 4 + 22 Credit hours.

In 555 hrs (105 hrs Theory + 450 hrs. Practicals & Lab Postings)

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Total Course PG DMLT 1200 hrs ( 210 Theory hours + 990 hours Practicals & Lab Postings)

Total Credits 47 = Semester I (25 Credits) Semester II (22 Credits)

### Examination Pattern-

Internal assessment examination will be converted to of 20 marks theory and 20 marks practical and will be added in End semester examination.

End semester examination:

Question Paper Pattern:

**Theory:** 80 Marks

Answer all the questions.

- I. Multiple Choice Question (MCQ) = 20 X 20 = 20
- II. Essay question : 20 x1 =20
- III. Long Answers(Answer 2 out of 3) = 2 X 10 = 20
- IV. Short Answers (Answers 4 out of 6) = 4 x 5 = 20

Total = 80 Marks

**Practical:**

Oral Examination: 30 Marks

Practical Examination 50 Marks

Total Marks : 80.

Total exam marks for end semester are 100 marks theory and 100 marks practical.

**1. Promotion and award of grades**

A student shall be declared PASS and eligible for getting he/she secures at least 50% marks in that particular course including internal assessment..

**2. Carry forward of marks**

In case a student fails to secure the minimum 50% in any Theory or Practical course as specified ,then he/she shall reappear for the end semester examination of that course. However his/her marks of the Internal Assessment shall be carried over and he/she shall be entitled for grade obtained by him/her on passing.

**3. Improvement of internal assessment**

A student shall have the opportunity to improve his/her performance only once in the Sessional exam component of the internal assessment. The re-conduct of the Sessional exam shall be completed before the commencement of next end semester theory examinations.

Grading of performances

**Letter grades and grade points allocations:**

Based on the performances, each student shall be awarded a final letter grade at the end of the semester for each course. The letter grades and their corresponding grade points are given in table I

Table –I Letter grades and grade points equivalent to Percentage of marks and performances

<b>Percentage of Marks Obtained</b>	<b>Letter Grade</b>	<b>Grade Point</b>	<b>Performance</b>
90.00 – 100	O	10	Outstanding
80.00 – 89.99	A	9	Excellent
70.00 – 79.99	B	8	Good
60.00 – 69.99	C	7	Fair
50.00 – 59.99	D	6	Average
Less than 50	F	0	Fail
Absent	AB	0	Fail

A learner who remains absent for any end semester examination shall be assigned a letter grade of AB and a corresponding grade point of zero. He/she should reappear for the said evaluation/examination in due course.

**17. The Semester grade point average(SGPA)**

The performance of a student in a semester is indicated by a number called 'Semester Grade Point Average' (SGPA). The SGPA is the weighted average of the grade points obtained in all the

courses by the student during the semester. For example, if a student takes five courses(Theory/Practical) in a semester with credits C1, C2, C3, C4 and C5 and the student's grade points in these courses are G1, G2, G3, G4 and G5, respectively, and then students' SGPA is equal to:

$$\text{SGPA} = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4G_4 + C_5G_5}{C_1 + C_2 + C_3 + C_4 + C_5}$$

The SGPA is calculated to two decimal points. It should be noted that, the SGPA for any semester shall take into consideration the F and ABS grade awarded in that semester. For example if a learner has a F or ABS grade in course 4, the SGPA shall then be computed as:

$$\text{SGPA} = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4 * \text{ZERO} + C_5G_5}{C_1 + C_2 + C_3 + C_4 + C_5}$$

### Cumulative Grade Point Average(CGPA)

The CGPA is calculated with the SGPA of all the VIII semesters to two decimal points and is indicated in final grade report card/final transcript showing the grades of all VIII semesters and their courses. The CGPA shall reflect the failed status in case of F grade(s), till the course(s) is/are passed. When the course(s) is/are passed by obtaining a pass grade on subsequent examination(s) the CGPA shall only reflect the new grade and not the fail grades earned earlier. The CGPA is calculated as:

$$\text{CGPA} = \frac{C_1S_1 + C_2S_2 + C_3S_3 + C_4S_4 + C_5S_5 + C_6S_6 + C_7S_7 + C_8S_8}{C_1 + C_2 + C_3 + C_4 + C_5 + C_6 + C_7 + C_8}$$

where C<sub>1</sub>, C<sub>2</sub>, C<sub>3</sub>,... is the total number of credits for semester I,II,III,... and S<sub>1</sub>,S<sub>2</sub>, S<sub>3</sub>,... is the SGPA of semester I,II,III,....

### 18. Declaration of class

The class shall be awarded on the basis of CGPA as follows:

First Class with Distinction = CGPA of 7.50 and above

First Class = CGPA of 6.00 to 7.49

Second Class = CGPA of 5.00 to 5.99

### 19. Award of Ranks

Ranks and Medals shall be awarded on the basis of final CGPA.

### 20. Award of degree

Candidates who fulfill the requirements mentioned above shall be eligible for award of degree during the ensuing convocation.

**Final Mark list Of University Examination**

<b>Sr.No.</b>	<b>Semester</b>	<b>Internal Assessment</b>		<b>End Semester Examination</b>		<b>Total</b>	
		<b>Theory 20 marks</b>	<b>Practical 20 marks</b>	<b>Theory 80 marks</b>	<b>Practical 80 marks</b>	<b>Theory 100 marks</b>	<b>Practical 100 marks</b>
1	<b>Semester I</b>						
2	<b>Semester II</b>						

**CBCS FOR PG DMLT**

**Program: PG DMLT**

**Department: KIMS**

**Subject: Pathology, Scheme: CBCS**

Microbiology & Biochemistry

Subject		Sem-I			Sem-II			Total		
		T	P	Total	T	P	Total	T	P	Total
<b>Core-I</b>	Hr	30	150	180	30	120	150	<b>60</b>	<b>270</b>	<b>330</b>
	Cr	2	5	7	2	4	6	<b>4</b>	<b>9</b>	<b>13</b>
<b>Core-II</b>	Hr	30	150	180	30	120	150	<b>60</b>	<b>270</b>	<b>330</b>
	Cr	2	5	7	2	4	6	<b>4</b>	<b>9</b>	<b>13</b>
<b>Core-III</b>	Hr	30	150	180	30	120	150	<b>60</b>	<b>270</b>	<b>330</b>
	Cr	2	5	7	2	4	6	<b>4</b>	<b>9</b>	<b>13</b>
<b>Elective DSE/AEC</b>	Hr	15	90	105	15	90	105	<b>30</b>	<b>180</b>	<b>210</b>
	Cr	1	3	4	1	3	4	<b>2</b>	<b>6</b>	<b>8</b>
<b>Grand Total</b>	<b>Hr</b>	105	540	645	105	450	555	<b>210</b>	<b>990</b>	<b>1200</b>
	<b>Cr</b>	7	18	25	7	15	22	<b>14</b>	<b>33</b>	<b>47</b>

**Discipline Specific Elective – Any One**

- Semester I-**
1. Working in Immunohistochemistry laboratory for 3 breast markers.
  - 2 Working on Cryostat for frozen sections.
  3. Preparation of Blood Components in blood bank.
  4. Automation in Bacteriological techniques
  5. Molecular diagnostic techniques

- Semester II-**
1. Information technology of automation
  2. Accreditation in biochemistry
  3. Marketing Strategy in Biochemistry laboratory services
  4. Quality Management System in NABL

