

FACULTY OF LIFE SCIENCES

Syllabus for

Bachelor of Science (Medical)

(SEMESTER: V-VI)

(Under Credit Based Continuous Evaluation Grading System)

Session: 2025-26



Kanya Maha Vidyalaya, Jalandhar (Autonomous)
The Heritage Institution

KANYA MAHA VIDYALAYA, JALANDHAR (AUTONOMOUS)
SCHEME AND CURRICULUM OF EXAMINATIONS OF THREE YEAR DEGREE

PROGRAM

Session-2025-26

Bachelor of Science (Medical) Semester -V										
Course Name	Program Name	Course Code	Course Type	Total Marks	Marks					
					Paper	Credits	Ext.			
						L-T-P	L	P	CA	EXAM TIME In Hrs
Zoology	Bachelor of Science (Medical)	BSMM-5483 (I)	C	75	Developmental Biology	3-0-0	60	-	15	3
		BSMM- 5483 (II)		50	Genetics	2-0-0	40	-	10	3
		BSMM- 5483 (P)		50	PRACTICAL– V (Related to Developmental Biology and Genetics)	0-0-2	-	40	10	3
Bachelor of Science (Medical) Semester -VI										
Zoology	Bachelor of Science (Medical)	BSMM-6483 (I)	C	75	Medical Zoology	3-0-0	60	-	15	3
		BSMM- 6483 (II)		50	Medical Laboratory Technology	2-0-0	40	-	10	3
		BSMM- 6483 (P)		50	PRACTICAL-VI (Related to Medical Zoology & Medical Laboratory Technology)	0-0-2	-	40	10	3

Bachelor of Science (Medical) Semester–V (Session 2025-26)
Course Title: Zoology (Development Biology)
Course Code: BSMM-5483 (I)
(THEORY)

Course Outcome

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

- CO1: Understand the key events in early embryological development like gametogenesis, fertilization and parthenogenesis.
- CO2: Explain the process of cleavage, gastrulation, determination and differentiation.
- CO3: Elaborate the development of frog, its metamorphosis and chick up to three germ layers.
- CO4: Describe the development of rabbit, formation of foetal membranes and placenta.

Bachelor of Science (Medical) Semester–V (Session 2025-26)

Course Title: Zoology (Development Biology)

Course Code: BSMM-5483 (I)
(THEORY)

Examination Time: 3 Hrs.

L-T-P: 3-0-0

Max Marks: 75

Theory: 60

CA: 15

Instructions for the Paper Setter

Eight questions of equal marks (12 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Gametogenesis with particular reference to differentiation of spermatozoa, vitellogenesis; role of follicle/sub testicular cells in gametogenesis

Egg maturation; egg membranes; polarity of egg

Parthenogenesis

Fertilization

UNIT-II

Cleavage and its patterns

Gastrulation

Determination and differentiation

Tissue interactions, basic concepts of organizers and inductors and their role

Embryonic development of Herdmania

UNIT-III

Development upto three germinal layers and their fate in frog and

chick Fate maps of chick and frog embryos

Metamorphosis in Frog

UNIT-IV

Embryonic development of Rabbit Fetal membranes, their formation and role Mammalian placenta– its formation, types, and functions

Suggested Readings:

1. Balinsky, B.I. (2007), An Introduction to Embryology, Saunders, Philadelphia.
2. Bellairs, R. (1971), Development Processes in Higher Vertebrates, University of Miami Press, Miami.
3. Berrill. N.J. (1971), Developmental Biology. McGraw Hill, New Delhi.
4. Gilbert, F. (2017), Developmental Biology, Sinaur.
5. Goel, S.C. (1984), Principles and Animal Developmental Biology, Himalaya, Bombay.
6. Karp. G. &Berrill, M.J. (1981), Development. McGraw Hill, New Delhi.
7. Pritchard, D.J. (1986), Foundation of Development Genetics, Taylor and Francis, London.
8. Saunders, J.W. (1982), Developmental Biology, Patterns, Principles, Problems, MacMillan, New York.
9. Waddington CH. (1966), Principles of Development and Differentiation, MacMillan, NewYork.
10. Miller, W.A. (1997), Developmental Biology Springer Verlag, New York.

Bachelor of Science (Medical) Semester–V (Session 2025-26)

Course Title: Zoology (Genetics)

Course Code: BSMM-5483 (II)
(THEORY)

Course Outcomes

After passing this course the student will be able to:

- CO1: Comprehensive and detailed understanding of genetic methodology and how quantification of heritable traits in families and populations provides insight into cellular and molecular mechanisms. Understanding the role of genetic mechanisms like linkage, crossing over and multiple alleles.
- CO2: Understand structure of nucleic acid, process of replication and translation, genetic code.
- CO3: Understanding of how genetic concepts of mutations, regulation of gene expression and extranuclear inheritance.
- CO4: Evolutionary and quantitative genetics including: the basis of genetic variation; heritability; Hardy-Weinberg Equilibrium and key concepts in population and how it affects broad societal issues including health and disease, food and natural resources, environmental sustainability, etc.

Bachelor of Science (Medical) Semester–V (Session 2025-26)

Course Title: Zoology (Genetics)

Course Code: BSMM-5483 (II)

(THEORY)

Examination Time: 3 Hrs

L-T-P: 2-0-0

Max Marks: 50

Theory: 40

CA: 10

Instructions for the Paper Setter

Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Modification of Mendelian Ratios: Non-allelic gene interaction, Modified F₂ ratios. (9:7; 9:3:4; 12:3:1; 13:3; 15:1; 9:6:1), Gene modifications due to incomplete dominance; lethal Factors (2:1); Pleiotropic genes.

Multiple Alleles: Blood group inheritance, eye colour in *Drosophila*, pseudoallelism.

Multiple Factors: Qualitative and quantitative characters, inheritance of quantitative traits (skin colour in man).

Linkage: Linkage, sex-linked characters

Crossing Over and Recombination: crossing over, frequency of crossing over, cytological basis of crossing over, synaptonemal complex. Recombination in Fungi (Tetrad analysis).

UNIT-II

Gene and Genetic Code: Structure of nucleic acids (DNA & RNA). Replication & transcription of DNA

Expression of gene (Protein synthesis in Prokaryotes and Eukaryotes).

Genetic code: Properties of genetic code, codon assignment, wobble hypothesis, split and overlapping Genes.

UNIT-III

Mutations: Spontaneous and induced mutations, physical and chemical mutagen. Detection of mutations in Maize and *Drosophila*. Inborn errors of metabolism in man (Phenylketonuria,

Alcaptonuria, Albinism). Somatic mutations and carcinogenesis.

Regulation of gene expressions in prokaryotes (Operon model) in eukaryotes.

Extranuclear inheritance: Chloroplast with special reference to *Mirabilis jalapa* and kappa particles in *Paramecium*.

UNIT-IV

Population genetics: Equilibrium of gene frequencies and Hardy-Weinberg law.

Genetic recombination in bacteria (conjugation, transduction and transformation) and in plasmids.

Applied Genetics: Recombination DNA, Genetic cloning and its applications in medicine and agriculture, DNA finger printing.

Suggested Readings:

1. Klug, Cummings, Spencer, Palladino, Killian (Twelfth edition), Concepts of Genetics
2. Gardener, E.J., Simmons, M.J. & Sunstad, Principles of Genetics, (8th ed), D.P. John Wiley & Sons, New York.
3. Benjamin A. Pierce, Genetics: a conceptual approach (6th edition)
4. P.S Verma and V.K Aggarwal, Genetics (9th edition) S. Chand publications.
5. Veer BalaRastogi, Genetics (4th edition), Kmrn publications.
6. Prof P. K. Gupta (5th revised edition 2018-19), Genetics Rastogi publications.
7. C. B. Powar (2018), Cell Biology Himalayan publishing house.
8. Miglani, G.S(2000), Basic Genetics, Narosa publishing house, New Delhi.
9. Weaver, R.F. and Hedrick, P.W. (1992), Genetics, Wm. C. Brown Publishers Dubuque.

Bachelor of Science (Medical) Semester–V (Session 2025-26)
Course Title: Zoology (Practical–V (Related to Developmental Biology and Genetics))
Course Code: BSMM-5483 (P)
(PRACTICAL)

Course Outcomes

CO1: Understanding of development patterns of frog, chick and Larva of *Herdmania*.

CO2: Knowledge of process of gametogenesis.

CO3: Understanding of pedigree analysis and preparation of family charts.

CO4: Understanding of inheritance of morphogenetic human characters and finger tip patterns.

Bachelor of Science (Medical) Semester–V (Session 2025-26)
Course Title: Zoology (Practical–V (Related to Developmental Biology and Genetics))
Course Code: BSMM-5483 (P)
(PRACTICAL)

Time: 3 hrs
L-T-P: 0-0-2

Max. Marks: 50
Practical: 40
CA: 10

Instructions for the Practical Examiners: Question paper is to set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

Guidelines for Conduct of Practical Examination:-

- | | |
|---|----|
| 1. Two Numericals based on Mendel/Hardy Weinberg Law. | 12 |
| 2. Perform the experiment for Dermatoglyphics/ Random mating/ Pod Length. | 6 |
| 3. Identification of given spots/slides. | 6 |
| 4. Make a pedigree chart from the given data. | 4 |
| 5. Chart/Assignment. | 4 |
| 6. Viva-voce and practical file. | 8 |

1. Demonstrate the Law of segregation and independent assortment (use of coloured beads capsules etc.).
2. Numericals for Segregation, Independent assortment, Epistasis & Hardy-Weinberg Law.
3. Demonstration of segregation in preserved material (Maize).
4. Demonstration of cytoplasmic inheritance in snails.
5. Inheritance of human characteristics.
6. Comparison of variance in respect of pod length and number of seeds/pods.
7. Calculation of gene frequencies and random mating (Coloured beads, capsules).
8. Pedigree analysis
9. Dermatoglyphics: Palm print and Finger tip patterns.
10. Study of the following permanent slides :
 - Polytene Chromosomes of *Chironomus*.
 - Stages of gametogenesis, structure of egg and sperm of a mammal.
 - Larva of *Herdmania*.

- Developmental stages of frog-upto tadpole, chick-upto 96 hr.
11. Preparation of slide for Barr body from cheek cells.
 12. **Assignment:** Preparation of charts showing developmental stages of any vertebrate.

Note:- Some changes can be made in the practicals depending on the availability of material.

Bachelor of Science (Medical) Semester–VI (Session 2025-26)

Course Title: Zoology (Medical Zoology)

Course Code: BSMM-6483 (I)
(THEORY)

Course Outcome

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

- CO1: Understand about various pathogenic microbes, life history of various pathogenic protozoans and helminths as well as diseases caused by them.
- CO2: Know about life history, diseases and control measures of arthropod vectors and awareness about epidemic diseases.
- CO3: Provide basics knowledge about immune responses, antigens, antibody structure and immunoglobulins.
- CO4: Understand antigen-antibody interactions and gain knowledge about vaccines.

Bachelor of Science (Medical) Semester–VI (Session 2025-26)

Course Title: Zoology (Medical Zoology)

Course Code: BSMM-6483 (I)

(THEORY)

Max. Time: 3 Hrs.

L-T-P: 3-0-0

Max Marks: 75

Theory: 60

CA: 15

Instructions for the Paper Setter

Eight questions of equal marks (12 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

1. Introduction of Parasitology (various terminologies in use).
2. Brief introduction to pathogenic microbes, viruses, Rickettsiae, spirochaetes and bacteria.
3. Brief accounts of life history, mode of infection and pathogenicity of the following with reference to man; prophylaxis and treatment:
 - a) Pathogenic protozoa: *Entamoeba*, *Trypanosoma*, *Leishmania*, *Giardia*, *Trichomonas* and *Plasmodium*.
 - b) Pathogenic helminthes: *Fasciola*, *Schistosoma*, *Echinococcus*, *Ancylostoma*, *Trichinella*, *Wuchereria*, *Dracunculus* and *Oxyuris*.

UNIT-II

4. Life cycle and control measures of arthropod vectors of human disease: Malaria (*Anopheles stephens*, *A. culicifacies*, Yellow fever, Dengue, Dengue haemorrhagic fever and Chickengunea. (*Aedes aegypti* *A. Albopictus*); Filariasis (*Culex pipien satigeans*) *Mansonia* sp. Japanese Encephalitis (*C. trinelorhynchus*); Plague (*Stenophalide cheopis*) and Epidemic Typhus (*Pediculus spp*).
5. Epidemic diseases, such as Typhoid, Cholera, Small pox; their occurrence and eradication programs.

UNIT-III

6. Brief introduction to human defence mechanisms.
7. Humoral and cell mediated immune response. Physical & chemical properties of antigens. Antibody structure and function of M, G, A, E and D immunoglobulins.

UNIT-IV

8. Antigen and antibody interactions-Serodiagnostic assays (Precipitation, agglutination immunodiffusion, ELISA, RIA)
9. Vaccines

Suggested Readings:

1. Baker, F.J. and Silverton, R.E. (1985) Introduction to Medical Laboratory Technology, (6th ed), Butlerworth and Co.Ltd.
2. Chatterjee, K.D. (2019), Parasitology, Protozoology and Helminthology (13thed).
3. Cheesborough, M. (1991), Medical Laboratory Technology for Tropical countries, Butlerworth and Co., Ltd.
4. Garcia, L.S. (2001), Diagnostic Medical Parasitology, (4th ed), ASM Press Washington.
5. Kimball, J.W. (1987), Introduction of Immunology, (2nd ed), MacMillian Publishing Co., NewYork.
6. Kuby, J. (2013), Immunology, 7th Edition W.H. Freeman & Co., USA.
7. Roitt, I. (2017), Essential Immunology, 13th Edition, Blackwell Scientific Publications, Oxford.
8. Talib, V.H. (2019), Essential Laboratory Manual, 2nd edition, Mehta Publishers, New Delhi.

Bachelor of Science (Medical) Semester–VI (Session 2025-26)

Course Title: Zoology (Medical Laboratory Technology)

Course Code: BSMM-6483 (II)

(THEORY)

Course Outcome

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

- CO1: Comply with safety regulations and universal precautions during lab investigations and perform basic laboratory techniques on biological specimens.
- CO2: Know about routine clinical laboratory investigations including collection of different samples and perform other routine hematological procedures.
- CO3: Describe basic scientific principles in learning new techniques and procedures in bacteriology and microbiology.
- CO4: Apply knowledge and technical skills associated histopathology, staining techniques and biochemical estimations.

Bachelor of Science (Medical) Semester–VI (Session 2025-26)

Course Title: Zoology (Medical Laboratory Technology)

Course Code: BSMM-6483 (II)

(THEORY)

Max. Time: 3 Hrs

L-T-P: 2-0-0

Max Marks: 50

Theory: 40

CA: 10

Instructions for the Paper Setter

Eight questions of equal marks (8 marks each) are to be set, two in each of the four Sections (A-D). Questions of Sections A-D should be set from Units I-IV of the syllabus respectively. Questions may be subdivided into parts (not exceeding four). Candidates are required to attempt five questions, selecting at least one question from each section. The fifth question may be attempted from any Section.

UNIT-I

Laboratory safety rules, hazards and precautions during sample collection and laboratory investigations.

Laboratory Techniques: Colorimetry, Microscopy, Autoclaving, Centrifugation and Spectrophotometry

UNIT-II

Collection, transportation and preservation of different clinical samples.

Haematology: collection of blood (venous and capillary), anticoagulants (merits and demerits), Romanowsky's stains, total RBC count, erythrocyte sedimentation rate, TLC, DLC, platelet count.

UNIT-III

Bacteriology: sterilization (dry heat, moist heat, autoclave, filtration), disinfection, staining techniques, (gram stain, AFB stain, etc), culture media (defined and synthetic media & routine laboratory media), bacterial culture (aerobic and anaerobic) and antibiotic sensitivity.

UNIT-IV

Histopathology: Common fixatives and staining techniques.

Biochemistry: Principal/theory and significance of estimation of urea, sugar, cholesterol, creatinine, enzymes (transaminase, phosphatase, amylase and lipase), uric acid in blood, estimation of proteins, sugar, bile salts, ketone bodies in urine and liver function test.

Suggested Readings:

1. Baker, F.J. and Silvertown, R.E. (1985) Introduction to Medical Laboratory Technology, (6th ed), Butterworth and Co.Ltd.
2. Chatterjee, K.D. (2019), Parasitology, Protozoology and Helminthology (13thed).
3. Cheesborough, M. (1991), Medical Laboratory Technology for Tropical countries, Butterworth and Co.,Ltd.
4. Garcia, L.S. (2001), Diagnostic Medical Parasitology, (4th ed), ASM Press, Washington.
5. Kimball, J.W. (1987), Introduction of Immunology, (2nd ed), MacMillan Publishing Co., New York.

6. Kuby, J. (2013), Immunology, 7th Edition W.H. Freeman & Co., USA.
7. Roitt, I. (2017), Essential Immunology, 13th Edition, Blackwell Scientific Publications, Oxford.
8. Talib, V.H. (2019), Essential Laboratory Manual, 2nd edition, Mehta Publishers, New Delhi.

Bachelor of Science (Medical) Semester–VI (Session 2025-26)
Course Title: Zoology (Practical–VI (Related to Medical Zoology & Medical Laboratory Technology))
Course Code: BSMM-6483 (P)
(Practical)

Course Outcomes

- CO1: Apply knowledge and technical skills associated with medical laboratory technology for delivering quality clinical investigations support.
- CO2: Perform basic clinical laboratory procedures using appropriate laboratory techniques and instrumentation in accordance with current laboratory safety protocol and quality patient health care.
- CO3: Understanding of sterilization techniques and will also learn about various histopathology techniques, handling and processing of tissue specimens as well as staining procedures.
- CO4: Understanding of estimation of protein & sugar

Bachelor of Science (Medical) Semester–VI (Session 2025-26)

Course Title: Zoology (Practical–VI (Related to Medical Zoology & Medical Laboratory Technology))

Course Code: BSMM-6483 (P)
(Practical)

Time: 3 hrs.
L-T-P: 0-0-2

Max. Marks: 50
Practical: 40
CA: 10

Instructions for the Practical Examiners: Question paper is to set on the spot jointly by the Internal and External Examiners. Two copies of the same should be submitted for the record to COE Office, Kanya Maha Vidyalaya, Jalandhar.

1. Demonstration of safety rules in laboratory like proper handling of patients, specimens and disposal of syringes, needles etc.
2. Demonstration of the use of autoclave, centrifuge and spectrophotometer.
3. Cleaning and sterilization of glass ware, using hot air oven, autoclave etc.
4. Physico-chemical examination of urine.
5. Preparation of thick and thin blood smear.
6. Counting of WBC, RBC and DLC.
7. Study of permanent slides and specimens of parasitic protozoans, helminthes and arthropods mentioned in the theory syllabus.
8. ESR and haematocrit.
9. Estimation of blood sugar, protein.
10. Demonstration of fixation, embedding, cutting of tissue sections, and their staining (routine haematoxylin and eosin).
11. Visit to a pathology Lab and preparation of report.

Guidelines for conduct of Practical Examination:

- | | |
|---|---|
| 1. Write down the principle and working of the given equipment. | 8 |
| 2. Write down the procedure, precautions and perform the experiment for physico-chemical examination of urine/ haematology. | 8 |
| 3. Identification, pathogenicity and host of parasitic organism. | 8 |
| 4. Estimation of blood sugar / protein in the given sample. | 8 |
| 5. Viva-voce and practical file | 8 |

(Note:- Some changes can be made in the practicals depending on the availability of material.)