**ALAGAPPA UNIVERSITY, KARAIKUDI**

**NEW SYLLABUS UNDER CBCS PATTERN (w.e.f.2017-18)**

**B.Sc. MICROBIOLOGY AND CLINICAL LAB TECHNOLOGY PROGRAMME STRUCTURE**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sem** | **Part** | **Course****Code** | **Title of the Course** |  **Cr.** | **Hrs./ Week** | **Max. Marks** |
| **Int.** | **Ext.** | **Total** |
| I | I | 711T | **Tamil/Other languages – I** | 3 | 6 | 25 | 75 | 100 |
| II | 712E | **English – I**  | 3 | 6 | 25 | 75 | 100 |
| III | 7BMC1C1 | **Core – I** –General Microbiology | 4 | 6 | 25 | 75 | 100 |
| 7BMC1P1 | **Core – II – Practical – I** – Lab in General Microbiology | 4 | 6 | **40** | **60** | 100 |
|  | **Allied – I** (Theory only) **(or)** **Allied – I** (Theory cum Practical) | 54 | 53 | 2515 | 7560 | 10075 |
|  | **Allied Practical – I**  | -- | 2\*\* | -- | -- | -- |
| IV | 7NME1A/7NME1B/7NME1C | **(1) Non-Major Elective – I** – **A)**jkpo; nkhopapd; mbg;gilfs;/ **B)** ,f;fhy ,yf;fpak; / **C)** Communicative English | 2 | 1 | 25 | 75 | 100 |
|  |  | **Total**(Allied-Theory only) | **21** | **30** | **--** | **--** | **600** |
|  |  | **Total**(Allied-Theory cum Practical) | **20** | **575** |
| II | I | 721T | **Tamil/Other languages – II** | 3 | 6 | 25 | 75 | 100 |
| II | 722E | **English – II** | 3 | 6 | 25 | 75 | 100 |
| III | 7BMC2C1 | **Core–III**–Clinical Biochemistry | 4 | 6 | 25 | 75 | 100 |
| 7BMC2P1 | **Core – IV** **- Practical II-** Lab in Clinical Biochemistry | 4 | 5 | **40** | **60** | 100 |
|  | **Allied – II** (Theory only) **(or)** **Allied – II** (Theory cum Practical) | 54 | 53 | 2515 | 7560 | 10075 |
|  | **Allied Practical – I**  | 2 | 2 | 20 | 30 | 50 |
| IV | 7BES2 | **(3) Environmental Studies** | 2 | 2 | 25 | 75 | 100 |
|  |  | **Total**(Allied-Theory only) | **21** | **30** | **--** | **--** | **600** |
|  |  | **Total**(Allied-Theory cum Practical) | **22** | **625** |
| III | I | 731T | **Tamil/Other languages – III** | 3 | 6 | 25 | 75 | 100 |
| II | 732E | **English – III** | 3 | 6 | 25 | 75 | 100 |
| III | 7BMC3C1 | **Core – V** –Clinical Immunology | 4 | 5 | 25 | 75 | 100 |
| 7BMC3P1 | **Core – VI – Practical – III** – Lab in Clinical Immunology | 4 | 5 | **40** | **60** | 100 |
|  | **Allied – III** (Theory only) **(or)** **Allied– III**(Theory cum Practical) | 54 | 53 | 2515 | 7560 | 10075 |
|  | **Allied Practical – II**  | -- | 2\*\* | -- | -- | -- |
| IV | 7NME3A/ 7NME3B/ 7NME3C | **(1) Non-major Elective – II** –**A)** ,yf;fpaKk; nkhopg;gad;ghLk;/ **(B)** goe;jkpo; ,yf;fpaq;fSk;  ,yf;fpa tuyhWk; /**(C)** Effective Employability Skills  | 2 | 1 | 25 | 75 | 100 |
| IV | 7SBS3A1/ 7SBS3A2/7SBS3A3 | **(2) Skill Based Subjects – I** | 2 | 2 | 25 | 75 | 100 |
| V | 7BEA3 | **Extension Activities** | 1 | -- | 100 | -- | 100 |
|  |  | **Total**(Allied-Theory only) | **24** | **30** | **--** | **--** | **800** |
|  |  | **Total**(Allied-Theory cum Practical) | **23** | **775** |
| IV | I | 741T | **Tamil/Other languages – IV** | 3 | 6 | 25 | 75 | 100 |
| II | 742E | **English – IV** | 3 | 6 | 25 | 75 | 100 |
| III | 7BMC4C1 | **Core – VII** – Molecular Biology and Microbial Genetics | 4 | 5 | 25 | 75 | 100 |
| 7BMC4P1 | **Core–VIII**–**Practical IV-**Lab in Molecular Biology and Microbial Genetics | 4 | 4 | **40** | **60** | 100 |
|  | **Allied – IV**(Theory only) **(or)** **Allied– IV**(Theory cum Practical) | 54 | 53 | 2515 | 7560 | 10075 |
|  | **Allied Practical – II**  | 2 | 2 | 20 | 30 | 50 |
| IV | 7SBS4B1/ 7SBS4B2/7SBS4B3 | **(2) Skill Based Subjects – II** | 2 | 2 | 25 | 75 | 100 |
| IV | 7BVE4/ 7BMY4/ 7BWS4 | **(4) Value Education / Manavalakalai Yoga /** **Women’s Studies** | 2 | 2 | 25 | 75 | 100 |
|  |  | **Total**(Allied-Theory only) | **23** | **30** | **--** | **--** | **700** |
|  |  | **Total**(Allied-Theory cum Practical) | **24** | **725** |
| V | III | 7BMC5C1 | **Core – IX** – Clinical Bacteriology | 4 | 5 | 25 | 75 | 100 |
| 7BMC5C2 | **Core – X** – Virology | 4 | 5 | 25 | 75 | 100 |
| 7BMC5P1 | **Core – XI -** **Practical V** – Lab in Clinical Bacteriology & Virology | 4 | 6 | **40** | **60** | 100 |
| 7BMC1E1/7BMC1E2 | **Elective – I -A)** Biostatistics **(or)** **B)** Molecular Based Diagnostics | 5 | 5 | 25 | 75 | 100 |
| 7BMC2E1/7BMC2E2 | **Elective–II- A)** Biomedical Ethics **(or)** **B)** Haematology | 5 | 5 | 25 | 75 | 100 |
| IV | 7SBS5A4/ 7SBS5A5/ 7SBS5A6/7SBS5A7 | **(2) Skill Based Subjects – I** | 2 | 2 | 25 | 75 | 100 |
| **(2) Skill Based Subjects – I** | 2 | 2 | 25 | 75 | 100 |
|  |  |  | **Total** | **26** | **30** | **--** | **--** | **700** |
| VI | III | 7BMC6C1 | **Core – XII** – Bio Instrumentation and Diagnostics | 4 | 5 | 25 | 75 | 100 |
| 7BMC6C2 | **Core – XIII** – Clinical Parasitology & Mycology | 4 | 5 | 25 | 75 | 100 |
| 7BMC6C3 | **Core – XIV** – Recombinant DNA Technology | 4 | 5 | 25 | 75 | 100 |
| IV | 7BMC6P1 | **Core–X-Practical VI**– Lab in Bio Instrumentation and Diagnostics, Clinical Parasitology & Mycology and Recombinant DNA Technology | 4 | 6 | **40** | **60** | 100 |
| V | 7BMC3E1/7BMC3E2 | **Elective – III****A)** Hospital Management **(or)** **B)** Environmental Microbiology | 5 | 5 | 25 | 75 | 100 |
| IV | 7SBS6B4/ 7SBS6B5/ 7SBS6B6/7SBS6B7 | **(2) Skill Based Subjects – II** | 2 | 2 | 25 | 75 | 100 |
| **(2) Skill Based Subjects – II** | 2 | 2 | 25 | 75 | 100 |
|  |  |  | **Total** | **25** | **30** | **--** | **--** | **700** |
|  |  |  | **Grand Total** | **140** | **180** | **--** | **--** | **4100** |

 **\*\* University Examinations will be held in the Even Semesters only.**

**B.Sc. MICROBIOLOGY AND CLINICAL LAB TECHNOLOGY**

**I YEAR – I SEMESTER**

**COURSE CODE: 7BMC1C1**

**CORE COURSE - I – GENERAL MICROBIOLOGY**

**Unit I**

Definition and scope of microbiology – History and recent development – Spontaneous generation. Contributions of Louis Pasteur, Leewenhoek, Lazaro Spallanzani, John Tyndall, Joseph Lister, Alexander Fleming and Kary B Mullis. Microbial Kingdoms- Haeckel’s Three Kingdom and Whittaker’s Five Kingdom concept.

**Unit II**

Microscope Principles and applications – Simple, compound light microscopy – Phase contrast – Fluorescence – Electron microscopy (TEM and SEM). Staining- Principles and techniques - Simple staining, Gram staining, Capsule staining, Spore staining and Acid fast staining.

**Unit III**

General characteristics and Ultra structure of bacteria: Subcellular structures- cell envelope, slim layer, capsule, cell wall composition (Gram positive and Gram negative) and cell inclusions. Bacterial reproduction. General characteristics of algae, fungi, Actinomycetes, protozoa and virus.

**Unit IV**

Principles and methods of Sterilization: Physical methods (Heat, Filtration and radiation) and Chemical methods. Chemotherapy – antibiotics – source – classification – mode of action – antimicrobial resistance, disinfectants. Culture media: Selective / differential media – enrichment media.

**Unit V**

Bacterial Growth curve – Lag Phase, Exponential Phase and decline Phase. Factors influencing and affecting microbial growth – pH, temperature and light. Nutritional groups of bacteria Transport of nutrients by active and passive transport.

**Books for Reference:**

1. Gerard J. Tortora and Berdell R. Funke (2016) Microbiology, An Introduction, 12th edition
2. Prescott, Harley, Klein, 2011, Microbiology – International Edition, eighth Edition, Published by McGraw- Hill Education , New York,
3. Pelczar M.J, Chang E.C.S, Krieg N.R. Microbiology, Fifth edition, McGraw Hill Company, Newyork.
4. Stanier, RY., et al., General Microbiology, 5th ed. Macmillan Press.

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**I YEAR – I SEMESTER**

**COURSE CODE: 7BMC1P1**

**CORE COURSE - II – PRACTICAL- I -LAB IN GENERAL MICROBIOLOGY**

1. Preparation & dispensing of Culture media

2. Isolation of bacteria from soil- Serial Dilution Technique

3. Pure culture techniques

1. Pour plate
2. Spread plate
3. Streak plate method

4. Bacterial Growth Curve

5. Test for Motility of bacteria - Hanging drop technique

6. Micrometry – Microscopic measurements of Bacterial cell

7. Bacterial Staining Techniques-

1. Simple staining
2. Gram Staining
3. Capsule Staining

8. Study of fungal Morphology- Lacto phenol cotton blue mounts and KOH mount

9. Physiological reaction of bacteria – Biochemical Test

1. Catalase test
2. Oxidase test
3. Nitrate test
4. Carbohydrate Fermentation test
5. Indole production test
6. Methyl Red Test
7. Voges-Proskaur Test
8. Citrate utilization Test
9. Triple Sugar Iron Agar Test
10. Urease Test

**Books for Reference:**

1. Monica C (1987). Medical Laboratory Manual for Tropical Countreis, Vol. 1 & Buttersworth.
2. Collect J.C, Duguids J.P, Fracer A.C, Marimon B.P, Mackie and Mc Cartney, (1996). Practical Medical Microbiology, Churchill Livingstone, U.S.A.
3. Gunesekaran P, (1996). Laboratory Manuel in Microbiology, New Age international, India.
4. Dr.S.Rajan and R.Selvi Christy- Experimental procedures in Life Sciences, Anjanaa Book house, Chennai, 2012.
5. Dr.S.Rajan – Mannual for Medical Laboratory Technology, Anjanaa Book house, Chennai, 2012.

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**I YEAR – II SEMESTER**

**COURSE CODE: 7BMC2C1**

**CORE COURSE-III – CLINICAL BIOCHEMISTRY**

**Unit I**

 Clinical sample Collection and preservation - Blood, Plasma, Serum, CSF, Urine and feces. Basic physiology, analytical procedures and clinical correlations - Blood , pH (acid base balance) and Buffer systems and Electrolytes (sodium, potassium, chloride, calcium, phosphorus and magnesium).

**Unit II**

 Carbohydrates: Definition and applications- Monosaccharides, Disaccharides, Oligosaccharides and polysaccharides. Disorders of carbohydrate metabolism- Hypo and hyperglycimea, Diabetes Mellitus- Types, Clinical features and metabolic changes. Glucose tolerance test (GTT) importance and principle and techniques of GTT.

**Unit III**

 Lipids: Definition, Classification and properties of lipids.Disorders of lipid metabolism- Lipidosis and Xanthomatosis. Atherosclerosis- aetiology, clinical features and complications.

**Unit IV**

 Aminoacids and Proteins: Aminoacids – classifications, structure and properties. Protein- Classification and structures (primary, secondary, tertiary & quaternary). Disorders in protein metabolism- Introduction, aetiology and clinical features of phenylketonuria and cystinuria. Clinical Significance of non-protein nitrogen- urea, uric acid & creatinine.

**Unit V**

 Vitamins: Deficiency disorders of vitamins. Function Test: Liver function test (Serum - Bilirubin SGPT, SGOT & Alakaline phosphatase and urine analysis – Bile salts, bile pigments and urobilinogen). Kidney function test (Urea, Uric acid, creatinine). Pediatric Clinical chemistry: Diseases of new born and their complications.

**Books for Reference:**

1. Zubay G.L. (1998). Biochemistry, W.M.C.Brown Publishers, New York.
2. Deb A.C, (2002). Fundamentals of biochemistry, Books and allied (P) Ltd.
3. Satyanarayanan U, (2002). Essentials of biochemistry, Books and allied (P) Ltd.
4. Campbell, P.N and A.D .Smith, (2010). Biochemistry Illustrated, 4th ed, Churchill

 Livingstone.

5. Murray, R. K., Granner, D. K., Mayes, P. A. and Rodwell, V. W. (2009). Harper’s

 Illustrated Biochemistry. XXVIII Edition. Lange Medical Books/McGraw-Hill.

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**I YEAR – II SEMESTER**

**COURSE CODE: 7BMC2P1**

**CORE COURSE IV – PRACTICAL – II-**

**LAB IN CLINICAL BIOCHEMISTRY**

1. Preparation of buffers – Phosphate buffer and trisHcl
2. Collection and preparation of blood for separation of plasma & serum
3. Qualitative test of urine (physical, chemical & microscopic examinations)
4. Test for urine sugar (Benedict’s method)
5. Estimation of blood glucose
6. Estimation of serum protein
7. Estimation of blood cholesterol
8. Estimation of blood iron
9. Kidney function tests: blood urea, creatinine & uric acid
10. Liver function tests: blood SGOT, SGPT & bilirubin

**Books for Reference:**

1. Dr.S. Rajan, Manual for Medical Laboratory Technology (2012), Anjanaa Book House, Chennai.
2. [Rao, N. Mallikarjuna](http://www.newagepublishers.com/servlet/nadispinfo?offset=0&searchtype=Author&text1=Rao,%20N.Mallikarjuna&ordby=Publication%20Year), (2007). Medical Biochemistry Laboratory Manual, ISBN.
3. [Kanai](http://www.tatamcgrawhill.com/cgi-bin/same_author.pl?author=Kanai), [L Mukherjee](http://www.tatamcgrawhill.com/cgi-bin/same_author.pl?author=+L+Mukherjee), (2010). Medical Laboratory Technology, ISBN.
4. David T. Phummer. Introduction of Practical Biochemistry (II Edition).
5. Dr.S.Rajan and R.Selvi Christy- Experimental procedures in Life Sciences, Anjanaa Book house, Chennai, 2012.

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**II YEAR – III SEMESTER**

**COURSE CODE: 7BMC3C1**

**CORE COURSE - V – CLINICAL IMMUNOLOGY**

**Unit I**

The Immune system: Introduction: Primary and Secondary Lymphoid organ, Lymphoid cells (B-lymphocytes, T-lymphocytes and Null cells), Mononuclear cells (Phagocytic cells and their killing mechanisms), granulocytic cells (neutrophils, eosinophils and basophils), mast cells and dendritic cells.

**Unit II**

Antigens – Types and properties, Haptens, Adjuvants. Immunoglobulins: Structure, types, properties and biological functions. Antigen – Antibody reactions: Precipitation, agglutination and complement fixation.

**Unit III**

Immunity: Types of immunity- Innate immunity and Acquired immunity. Immune response-Humoral and cell mediated immunity and their interaction. Complement – Pathways and their biological function.

**Unit IV**

Immunity to infection: Hypersensitivity reactions: types of hypersensitivity, mechanism of T-cell activation, macrophage activation and granuloma formation. Transplantation – Immunologic response graft rejection mechanism and prevention of graft rejection.

**Unit V**

Immunochemical techniques: Monoclonal antibody production, immunodiffusion, immunoelectrophoresis, immunofluorescence, complement fixation test. Principle, technique and applications of RIA and ELISA.

**Books for Reference:**

1. Ivan Roitt. Jonathan Brostoff and David Male. (2002). Immunology, 6th edition. Elsevier science Ltd., New York.
2. Janis Kuby (1994). Immunology. 2nd edition. W.H. Freeman and company, New York.
3. Tizard : Immunology; An introduction; 4 th Edition, Thomson Publication.
4. Immunology - Understanding of Immune System by Claus D. Elgert. 1996. WilLiss, New York.
5. Cellular and Molecular Immunology, 3rd Edition by Abbas.

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 **II YEAR – III SEMESTER**

**COURSE CODE: 7BMC3P1**

**CORE COURSE - VI – PRACTICAL – III**

**LAB IN CLINICAL IMMUNOLOGY**

1. Blood grouping and Rh typing.
2. Total erythrocyte count (RBC).
3. Total WBC count.
4. Differential count of blood cells.
5. Erythrocyte Sedimentation Rate (ESR).
6. Haemoglobin estimation Shalli’s method.
7. Immuno diffusion- single, double and radial immune diffusion
8. Pregnancy test using kit.
9. Widal test.
10. VDRL test.
11. Demonstration of
12. Complement fixation test
13. Immunofluorescence
14. ELISA

## Books for Reference:

1. Charles A Janeway, (2001). Immunobiology – 5th edition, Churchill livingstone, London.
2. Helen C, Mansel H, (1993). Essentials of Clinical Immunology – 3rd edition, Blackwell Scientific, London
3. Stefan HE Kaufmann, (2002). Immunology of Infectious Diseases, ASM Press.
4. Patrick R Murray, (2003). Manual of Clinical Microbiology, 8th edition, ASM Press., Washinton.
5. Manual of Clinical Laboratory and Immunology 6th Edition. 2002 by Noel R.Rose,

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**II YEAR – IV SEMESTER**

**COURSE CODE: 7BMC4C1**

**CORE COURSE - VII – MOLECULAR BIOLOGY AND MICROBIAL GENETICS**

**Unit I**

Gene: Structure and function (one gene/one enzyme hypothesis). DNA as a genetic material (Griffth, Avery and Mcleoid, Hershey and Chase experiments). DNA: Structure (Watson and Crick model) and types of DNA. RNA: Structure and types of RNA.

**Unit II**

Mutation: Definition and Types of mutations (Spontaneous & induced), Chromosomal mutations, Gene mutations. Mutagens: Mode of action of Physical and chemical mutagens. DNA damage and repair (Direct, Excision and recombination repair and SOS repair).

**Unit III**

DNA replication: Types of replication (Semiconcervative replication, experimental evidence for semi conservative replication), Enzymes involved in DNA replication. Replication in prokaryotes and eukaryotes. Inhibitors of DNA replication.

**Unit IV**

Transcription: Transcription in prokaryotes and eukaryotes, Inhibitors of transcription, Reverse transcription, RNA Polymerase. Translation: ribosomal cycle including phenomena of initiation, elongation, termination; role of aminoacyl tRNA synthetases.

**Unit V**

Regulation of gene in prokaryotes - Lac and Trp operon. Functional units in a typical eukaryotic gene-promoter, introns and exons.

**Books for Reference:**

1. Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). VIII editon Principles of Genetics. Wiley India.
2. Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. XI Edition.

 Benjamin Cummings.

1. Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin

Cummings.

1. Molecular Biology and Biotechnology. K.G. Ramawatt and Shaily Goel.2010. First edition. S.Chand Company, New Delhi.
2. R. H. Tamarin, (2004), “Principles of genetics”, Tata McGraw Hill.

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**II YEAR – IV SEMESTER**

**COURSE CODE: 7BMC4P1**

**CORE COURSE - VIII – PRACTICAL – IV**

 **LAB IN MOLECULAR BIOLOGY AND MICROBIAL GENETICS**

1. Isolation of DNA from bacteria
2. Isolation of plasmid DNA from bacteria
3. Principles and applications of agarose gel electrophoresis
4. Isolation of UV induced mutants of *E. coli*
5. Isolation of Auxotrophic mutants.
6. Separation of protein by SDS-PAGE
7. Isolation of RNA (demonstration only)

**Books for Reference:**

1. Murray PR. (2003). Manual of Clinical Microbiology 8th edition, Volume 1, ASM Press, Washinton, D.C.
2. Gupta, P.K (2005). Molecular biology and genetic engineering, Rastogi Publications, Meerut India.
3. Ausubel FM, Brent R, Kingston RE, Moore DD, Seidman JG, Smith JA and Struhl K,(1994).Current protocols in molecular biology,Vol.1& 2. John Wicey & Sons Inc.
4. Dr.S.Rajan and R.Selvi Christy- Experimental procedures in Life Sciences, Anjanaa Book house, Chennai, 2012.
5. Sambrook J and Russell DW, (2001). Molecular cloning – A laboratory manual, 3rd edition, Vol. I – III, Cold Spring Laboratory Press, New York.

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**III YEAR – V SEMESTER**

**COURSE CODE: 7BMC5C1**

**CORE COURSE - IX – CLINICAL BACTERIOLOGY**

**Unit I**

Normal microbial flora of the human body**:** Skin, mouth, upper respiratory tract, intestinal tract, urino-genital tract, eye.General characteristics,epidemiology, pathogenicity, Laboratory diagnosis and treatmentof *Staphylococcus aureus, Streptococcus pyogenes, Corynebacterium diphtheria.*

**Unit II**

General characteristics,Epidemiology, Pathogenicity, Laboratory diagnosis and Treatmentof *Neisseria meningitidis, Neisseria gonorrhoeae, E.coli, Salmonella typhi, Shigella dysenteriae, Vibrio cholera, Yersinia pestis* and *Pseudomonas aeruginosa.*

**Unit III**

General characteristics,Epidemiology, Pathogenicity, Laboratory diagnosis and Treatmentof *Clostridium perfringens, Clostridium tetani, Clostridium botulinum, Haemophilus influenzae,* and *Bacillus anthracis.*

**Unit IV**

 General characteristics,Epidemiology, Pathogenicity, Laboratory diagnosis and Treatmentof Spirochetes- *Treponema pallidum.* Acid fast bacteria- *Mycobacterium tuberculosis* and *M.lepreae*.

**Unit V**

 General characteristics,Epidemiology, Pathogenicity, Laboratory diagnosis and Treatmentof *Mycoplasma*, *Rickettsiae prowazekii* and *Chlamydiae trachomatis.*

**Books for Reference:**

1. Jawetz and Melnick, (2004). Review of Medical Microbiology, Lange, New York
2. Morag C Timbury (2002). Notes on Medical Microbiology and Immunology, 3rd edition, Churchill Livingstone, London.
3. David Greenwood, Richard Slack, John F Peutherer, (2002). Medical Microbiology, 16th edition, Churchill Livingstone, London
4. Lisa Anne Shimeld, (1999). Essential of Diagnostic Microbiology, 3rd edition, Mosby, London
5. Salle, AJ. Fundamental Principles of Bacteriology, 7th Ed., Tata-McGraw Hill

Publishing Co.

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**III YEAR – V SEMESTER**

**COURSE CODE: 7BMC5C2**

**CORE COURSE - X – VIROLOGY**

**Unit I**

 Viral architecture: Capsid, viral genome and envelope, Structure of TMV, T4, Influenza virus, HIV and Viral classification.

**Unit II**

 Life cycle of virus: Lytic and lysogenic cycle of T4 phage and Lambda phage. Life cycle of TMV and CMV.

**Unit III**

 Cultivation of viruses: Cell culture techniques, embryonated egg, laboratory animals, CPE, inclusion bodies.

**Unit IV**

Visualization and enumeration of virus particles:

1. Measurement of infectious units:

 Plaque assay, Fluorescent focus assay, Infectious center assay, Transformation assay, Endpoint dilution assay.

1. Measurement of virus particles and their components:

 Electron microscopy, Atomic force microscopy, Haemagglutination.

1. Measurement of viral enzyme activity.

**Unit V**

 Viral diseases: causative agent, symptoms, pathogenesis, treatment and prevention of Polio, rabbies, yellow fever, mumps, influenza, measles, encephalitis, hepatitis and AIDS. Role of viruses in cancer, Prions and viroids.

**Books for Reference:**

1. Peter J. Russell (2006), “Genetics – A molecular approach”, 2nd / 3rd ed.
2. Benjamin A. Pierce (2008), “Genetics a conceptual approach”, 3rd ed., W.H.Freeman and company.
3. D.Nelson and M.Cox (2005), “Lehninger’s Principles of biochemistry”, 4th ed., Macmillan worth Publishers. Page 7 of 24
4. M.Madigan, J.Martinko, J.Parkar, (2009), “Brock Biology of microorganisms”, 12th ed., Pearson Education International.
5. Principles of Virology. 2000 by Edward Arnold.

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**III YEAR – V SEMESTER**

**COURSE CODE: 7BMC5P1**

**CORE COURSE - XI –PRACTICAL – V**

**LAB IN CLINICAL BACTERIOLOGY & VIROLOGY**

1. Isolation and identification of normal flora of skin.
2. Preparation of blood agar and demonstration of hemolysis.
3. Antibiotic sensitivity tests.
4. Assessment of minimum inhibitory concentration.
5. Isolation and Identification of *E. coli*
6. Isolation and Identification of *Pseudomonas*
7. Isolation and Identification of *Vibrio*
8. Demonstration
9. Cultivation of virus in chick embryo method.
10. Cultivation of virus in cell culture.
11. Plaque assay

## Books for Reference:

1. Jawetz and Melnick, (2002). Review of Medical Microbiology, Lange, New York,
2. Morag C Timbury, (2002). Notes on Medical Microbiology and Immunology, Churchill Livingstone, London
3. David Greenwood, Richard Slack, John F Peutherer, (2002). Medical Microbiology, 16th edition, Churchill, Livingstone, London
4. Lisa Anne Shimeld, Delmar, (1999). Essential of Diagnostic Microbiology, New York.
5. Bailey & Scott’s Diagnostic Microbiology – 12th Edn

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**III YEAR – V SEMESTER**

**COURSE CODE: 7BMC1E1**

**ELECTIVE COURSE - I (A) – BIOSTATISTICS**

**Unit I**

Use of statistics in biology. Measures of central tendancy – mean, median, mode. Geometric mean, Harmonic mean.

**Unit II**

 Measure of dispersion – range, inter quartile range, quartile deviation, mean deviation, standard deviation.

**Unit III**

Probability theory: terminology, permutation, combination, types of probability, probability measure.

**Unit IV**

Theoretical distributions: binomial distribution, poisson distribution, normal distribution.

**Unit V**

Sampling and test of significance: standard error, test of significance for attributes, test of significance of large samples**.**

**Books for Reference:**

1. Agarwal, B.S, (1996). High Engineering Mathematics. Khanna Publishers.
2. Sokal and Rohif, (1973). Introduction to Biostatistics, Toppan Co., Japan.
3. Belsey, D.A., E. Kuh and R.E. Welsch. (1980). Regression Diagnostics: Identifying Influential Data and Sources of Collinearity. New York: Wiley.
4. Cook, R.D. and S. Weisberg. (1982). Residuals and Influence in Regression. New York: Chapman Hall.

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**III YEAR – V SEMESTER**

**COURSE CODE: 7BMC1E2**

**ELECTIVE COURSE - I (B) –MOLECULAR BASED DIAGNOSTICS**

**Unit I**

 Polymerase Chain Reaction (PCR): History, definition, types and applications.

**Unit II**

Isolation of DNA, RNA and Plasmid DNA. Nucleic acid blotting techniques: Southern blotting, Northern blotting, Dot- blotting, Western blotting, Colony and plaque blotting and Autoradiography.

**Unit III**

DNA sequencing: Maxam and Gilbert technique, Dideoxynucleotide method, DNA sequencing by primer walking and chromosome walking and Automated DNA sequencing. Next generation sequencing.

**Unit IV**

RAPD, RFLP techniques, DNA Finger Printing and DNA Foot Printing techniques. Microarray. Fluorescence In-Situ Hybridization(FISH).

**Unit V**

Diagnosis of diseases: Tuberculosis, Malaria, AIDS, Cystic fibrosis, Sickle cell anemia and Cancer.

**Books for Reference:**

1. Glick BR, Pasternak JJ, (1998). Molecular biotechnology, 2nd edition, ASM press Washington.
2. Murray PR. (2003). Manual of Clinical Microbiology 8th edition, Volume 1, ASM Press, Washinton, D.C.
3. Gupta, P.K (2005). Molecular biology and genetic engineering, Rastogi Publications, Meerut India.
4. Sambrook, J, (2001). Molecular cloning, 3rd edition, Cold Spring Harbor New York
5. Principles of Gene Manipulation and Genomics - Primrose, S.B. and Twyman,R.M. 2006. 7th Edition. Blackwell Publishing Company.

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**III YEAR – V SEMESTER**

**COURSE CODE: 7BMC2E1**

**ELECTIVE COURSE - II (A) – BIOMEDICAL ETHICS**

**Unit I**

Introduction to bioethics – Framework for ethical decision making; biotechnology and ethics – biotechnology in agriculture and environment. Benefits and risks of genetic engineering. Ethical aspects of genetic testing and biowarfare.

**Unit II**

Ethical implications of cloning: Reproductive cloning, therapeutic cloning; Ethical, legal and socio-economic aspects of gene therapy, germ line, somatic, embryonic and adult stem cell research – GM crops and GMO’s – biotechnology and biopiracy – ELSI of human genome project.

**Unit III**

Introduction to biosafety – biosafety issues in biotechnology – risk assessment and risk management – safety protocols: risk groups – biosafety levels – biosafety guidelines and regulations (National and International) – operation of biosafety guidelines and regulations – types of biosafety containments.

**Unit IV**

Introduction to intellectual property and intellectual property rights – types: patents, copy rights, trade marks, design rights, geographical indications.

**Unit V**

Importance of IPR – patentable and non patentables – patenting life – legal protection of biotechnological inventions – world intellectual property rights organization (WIPO), WTO, GATT.

**Books for Reference:**

1. Jose Cibelli, Robert P. lanza, Keith H. S. Campbell, Michael D, (2002). Principles of cloning, West, Academic Press.
2. Martin. M.W. and Schinzinger.R (2003). Ehics in engineering, 3rd edition, Tata McGraw-Hill, New Delhi.
3. http://books.cambridge.org/0521384737.htm
4. http://online.sfsu.edu/%7Erone/GEessays/gedanger.htm
5. http://www.actahort.org/members/showpdf?booknrarnr=447\_125

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**III YEAR – V SEMESTER**

**COURSE CODE: 7BMC2E2**

**ELECTIVE COURSE - II (B) – HAEMATOLOGY**

**Unit I**

**Composition of Blood and its function.** Common anticoagulants - composition, amount and mechanism of action. **Haemopoietic system of the body (Leucopoiesis, erthropoiesis and thrombopoiesis).**

**Unit II**

Hemostasis - Definition, Basic concept and principle, Basic steps involved in Hemostasis. Coagulation - Basic Physiology, coagulation factors and Mechanism of blood coagulation -Extrinsic Pathway and Intrinsic Pathway.

**Unit III**

Laboratory diagnosis of bleeding disorders: basic screening test - Bleeding time and Clotting time, Coagulation tests - Prothrombin time, Activated partial thromboplastin time. Test for FDP protamine sulphate test.

 **Unit IV**

**Anaemia:** Definition and types (Iron deficiency, Vitamin B12 and folic acid, haemolytic, aplastic and genetic disorders). Haemogram: **Haemoglobin, PCV, ESR, RBC count. Calculation of anemia using MCH, MCV and MCHC**

**Unit V**

Special haematological test: Screening test for sickle anemia, osmotic fragility - Heinz body preparation. Laboratory diagnosis of Blood parasites – Malaria, Trypanosomiasis and Leishmaniasis. Lupus Erythematosus (LE) cell preparation.

**Books for Reference:**

1. Kanai L. Mukherjee, (1996). Medical Laboratory Technology, Volume-I. Tata Mc Graw Hill, New Delhi.
2. Sabitri sanyal, (2000). Clinical pathology, B. I. Churchill Livingstone ( p) Ltd, New Delhi.
3. Judith Ann Lewis, (1994). Illustrated guide to diagnostic tests – students version, Springhouse corporation.
4. Praful. B. Godkar, et al., (1996). Extbook of Medical Laboratory Technology, 2nd  edition, Bhalani publication House.
5. Fischbach F.T., Dunning, M.B, (2002). A Manuel of Laboratory and Diagnostic Tests. Lippinocott Williams and Wilkins, Baltimore.

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**III YEAR – VI SEMESTER**

**COURSE CODE:7BMC6C1**

**CORE COURSE - XII – BIO INSTRUMENTATION AND DIAGNOSTICS**

**Unit I**

Preparation of solutions: Molar, Normal, Percent solutions, PPM, PPB. Dilutions – serial dilutions. Preparation of different stains: Methylene blue, Eosin, Haematoxylin,

Janus green – B.

**Unit II**

Spectroscopy – Basic principles, Instrumentation and application of Visible, ultraviolet (UV) and Infra red (IR). X-Ray Crystallography – X-ray diffraction, NMR techniques.

**Unit III**

Chromatography: Basic principles, Instrumentation and application of Paper Chromatography, Adsorption Chromatography, TLC, GC, Ion Exchange Chromatography, Gel Chromatography, HPLC, Affinity Chromatography.

**Unit IV**

Centrifugation – Basic Principle of Centrifugation, Types of centrifuge and rotors. Instrumentation of Ultracentrifuge (Preparative, Analytical) and Rate-Zonal centrifugation.

**Unit V**

Diagnostic Methods: Histopathology, Immunohistochemistry, ECG, ECHO, Angiogram, X-ray, CT, MRI and Ultrasound

**Books for Reference:**

1. Praful.B. Godkar, et al., (1996). Textbook of Medical Laboratory Technology, 2nd edition, Bhalani
Publication House
2. Kanai Mukherjee, (2000). Medical Laboratory Technology, Volume – I, II, III, Tata McGraw Hill
3. Mukherjee, L., (1998). Medical Laboratory Technology – Vol. I, II, III. Tata Mcgraw-Hill Publishing Company Limited
4. An Introduction to practical Biochemistry by David. T. Plummer Biological physics(2013) by Philip Nelson

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**III YEAR – VI SEMESTER**

**COURSE CODE: 7BMC6C2**

**CORE COURSE - XIII – CLINICAL PARASITOLOGY & MYCOLOGY**

## Unit I

## Introduction and definitions, common pathogenic effects of human parasites - host parasite relationship. General diagnostic procedures for parasitic infections (direct methods and indirect methods). Immunology of parasitic infections, and Prophylaxis.

**Unit II**

Protozoology: General characters, morphology, life cycle, epidemiology, pathogenesis - clinical sign, and control measures of amoebae (*Entamoeba histolytica),* Flagellates (Haemoflagellates-I – Leishmania, Haemoflagellates-II – Trypanosomes), Sporozoites (Plasmodium,) and ciliates (Balantidium).

**Unit III**

Helminthology and Nematodology: General characters, morphology, life cycle, epidemiology, pathogenesis - clinical sign, and control measures of Platyhelminthes (flat warm- *Taenia solium*, trematode), Nemathelminthes (round worm- *Ascaris lumbricoides*,). Nematodes (*Wuchereria bancrofti*,).

**Unit IV**

Medical Mycology: General properties structure and classification of fungi, structure and applications. Mycotic infections such as superficial mycosis, cutaneous mycosis, subcutaneous mycosis, systemic mycosis (dimorphic, endemic mycosis).

**Unit V**

Actinomycetes infections, hypersensitivity to fungi, mycotoxins, and antifungal chemotherapy. Lab diagnosis and treatment of fungal infections.

**Books for Reference:**

1. Cook GC, (1996). Manson’s Tropical Diseases, 20th edition, WB Saunders.
2. Chiodini PL, (2000). Atlas of Medical Helminthology and Protozoology – 4th Edition, Churchill Livingstone, London.
3. Chatterjee, K.D, (1890). Parasitology, 12 Edition, Chatterjee Medical Publishers, Calcutta
4. Murray, Patrick R. Baron. Jorgensen. Pfaller. Yolken, Robert H. (2003). Manual of clinical microbiology, ASM Press, Washington.
5. A.Ballows et al., (1998). Laboratory diagnosis of infectious diseases, Volume 1, Springer-Vertlag, New York.

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**III YEAR – VI SEMESTER**

**COURSE CODE: 7BMC6C3**

**CORE COURSE - XIV – RECOMBINANT DNA TECHNOLOGY**

**Unit I**

History of rDNA Technology - Enzymes in rDNA Technology – Ribonuclease-H (RNase-H), Klenow enzymes or klenow Fragment, SI Nuclease, Taq DNA Polymearse, Restriction Endonucleases, Terminal Nucleotidyl Transferase, Alkaline Phosphatase, Polynucleotide Kinase, DNA ligases and Methyl transferase. Coupling Tools – Linkers and Adaptors. Construction and of Applications rDNA.

**Unit II**

Gene cloning: Strategies in gene cloning. Plasmids – Introduction and classification. Gene cloning vectors: pBR322, pUC, ColE1 plasmid. Cosmids and phagemid as vectors. Shuttle vectors, Expression vectors.

**Unit III**

Gene transfer techniques: Microinjection, Electroporation, Microprojectile, Shot Gun method, Ultrasonication and Liposome fusion. Selection of recombinant Bacteria - Direct selection, Antibiotic resistance and lacZ complementation (Blue-white selection).

**Unit III**

Construction of genomic and cDNA libraries. Site directed mutagenesis, Chromosome jumping. Safety regulations in rDNA techniques.

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**Unit V**

Genetically Engineered Microorganisms(GEMOs). Production of Healthcare products from GEMOs-Insulin, Human growth hormone, Interferons, Blood products and Vaccines. ``

**Books for Reference:**

1. Principles of Gene Manipulation and Genomics - Primrose, S.B. and Twyman,R.M.

 2006. 7th Edition. Blackwell Publishing Company.

2. Recombinant DNA Second Edition - James D. Watson, Micheal Gilman, Mark Zoller,

 2001. W.H. Freeman and Company, New York.

3. Biotechnology, Satyanarayana. U, (2008), Books and Allied (p) Ltd.

4. A Text Book of Biotechnology. R.C. Dubey. S.Chand& Co Ltd, New Delhi.

5. Genomes 3 by T.A.Brown, Third Edition (Garland Science Publishing), 2007.

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**III YEAR – VI SEMESTER**

**COURSE CODE: 7BMC6P1**

**CORE COURSE XV – PRACTICAL – VI**

**LAB IN BIOINSTRUMENTATION AND DIAGNOSTICS, CLINICAL PARASITOLOGY & MYCOLOGY AND RECOMBINANT DNA TECHNOLOGY**

1. Preparation of solutions - Molar, Normal, Percent solutions, PPM, PPB
2. Separation of sugar by paper chromatography
3. Separation of amino acids by paper chromatography
4. Microscopic examination of stool specimens for ova & parasites
5. Dip stick test for Malaria
6. Isolation and identification of common pathogenic fungi from clinical specimens
7. Slide culture techniques
8. Restriction digestion of DNA
9. Demonstration
10. PCR Amplification
11. Competent cell preparation

**Books for Reference:**

1. Arti Nigam-Lab manual in Biochemistry, Immunology & Biotechnology.
2. Sambrook J and Russell DW, (2001). Molecular cloning – A laboratory manual, 3rd edition, Vol. I – III, Cold Spring Laboratory Press, New York.
3. Ausubel FM, Brent R, Kingston RE, Moore DD, Seidman JG, Smith JA and Struhl K,(1994).Current protocols in molecular biology,Vol.1& 2. John Wicey & Sons Inc.
4. Kanai Mukherjee, (2000). Medical Laboratory Technology, Volume – I, II, III, Tata McGraw Hill.

 5. A.Ballows et al., (1998). Laboratory diagnosis of infectious diseases, Volume 1,

 Springer-Vertlag, New York.

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**III YEAR – VI SEMESTER**

**COURSE CODE: 7BMC3E1**

**ELECTIVE COURSE - III (A) – HOSPITAL MANAGEMENT**

**Unit I**

Principles of Hospital Management:- Role of Administrator – Hospital planning – Organization of O.P & I.P., Ancillary services, Emergency services, Operation theaters. Management of nursing services, Paramedical Staff, Hospital statistics, Evaluation of patient care, Resource mobilization, Public Relations in Hospital.

**Unit II**

Human Resource Management:-Manpower planning – Recruitment procedures – Training and Development, Educational institutions and consultants – Principles and methods of executive development programmes – Performance appraisals, Job satisfaction.

**Unit III**

Inventory management:-Need for adopting materials management concept, Norms for inventory, Inventory carrying cost, Understocking, Overstocking – ABC analysis – Inventory reports – Materials handling, Store keeping and warehousing management method, tube method, Rh typing, Forward and Reverse grouping techniques, Cross matching (Major and Minor types), Separation of Blood components, Coombs test

**Unit IV**

Social responsibilities of management:- Management and society, culture and management, management ethics, social objectives and responsibilities of management, corporate social responsibility – hospitals and social responsibility

**Unit V**

Screening Test:-HbsAg, HCV, HIV (ELISA, Western Blot tests), TPHA *(Treponema pallidum* haemagglutination), malarial parasites.

**Books for Reference:**

1. Henry, Bernard, J., Sanford, T and Davidson, (2002). Clinical diagnosis and Management, laboratory methods. W.B. Saunders, New York.
2. Gradwohls, (2000). Clinical Laboratory Methods and Diagnosis, M.D.B.I. Publications, New Delhi.
3. Richard R, (1989). Clinical Laboratory Medicine, Medical Publi, Chicago.
4. Williams and J. William, (1990). Haematology. Mc Graw Hill, New York.

 5. Kanai L. Mukherjee, (1996). Medical Laboratory Technology, Volume-I. Tata Mc

Graw Hill, New Delhi.

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**III YEAR – VI SEMESTER**

**COURSE CODE: 7BMC3E2**

**ELECTIVE COURSE - III (B) – ENVIRONMENTAL MICROBIOLOGY**

**Unit I**

**Air microbiology: Different types of microorganism in the air, Droplet nuclei, aerosol, assessment of air quality, airborne diseases and their control, sampling techniques.**

**Unit II**

**Aquatic Microbiology: Ecosystems - fresh water (ponds, lakes, Streams) and Marine (estuaries, Mangroves, deep, sea). Microbial assessment of water quality (Coliform test - detection of faecal and non-faecal coliform and** MPN**). Water borne diseases.**

**Unit III**

**Sewage treatment- primary treatment, secondary treatment tertiary treatment and anaerobic digestion. Reuse of sewage. Solid waste management-** composting, vermiform composting, silage, Pyrolysis and scarification.

 **Unit IV**

Degradation of Xenobiotic compounds: Simple aromatics, chlorinated polyaromatic petroleum products, pesticides and surfactants. Biofouling and Bioleaching.

 **Unit V**

Global environmental problems: Green house effect, Global warming, acid rain - their impact and biotechnological approaches for management.

**Books for Reference:**

1**.** Bioremediation by Baker K.H. And Herson D.S. 1994.. MacGraw Hill Inc. N.Y.

2. Waste Water Engineering - Treatment, Disposal and Re-use by Metcalf and Eddy, Inc.,

 Tata MacGraw Hill, New Delhi.

3. Pollution: Ecology and Biotreatment by Ec Eldowney, S. Hardman D.J. and Waite S.

4. A Manual of Environmental Microbiology. 2nd Edition. 2001 by Christon J. Hurst

5. Environmental Biotechnology- Basic concept and applications (2011) by Indushekar

 thakur, IK International publishing House, Pvt.Ltd.

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