



ख़्वाजा मुईनुद्दीन चिश्ती भाषा विश्वविद्यालय, लखनऊ, उत्तर प्रदेश (भारत)
Khwaja Moinuddin Chishti Language University, Lucknow, U.P. (India)

U.P. STATE GOVERNMENT UNIVERSITY,
(Recognised Under Section 2(f) & 12(B) of the UGC Act, 1956 & B.Tech. Approved by (AICTE)

Revised and Approved syllabus for B.Sc (Bachelor of Science) Department of Biotechnology



**B.Sc 2 Year (Semester3) Biotechnology Paper1
Biochemistry and Biochemical tools (Theory)**

Programme/Class: Diploma	Year:2	Semester:3
Subject: Biotechnology		
Course Code:B100301T	Course Title: Biochemistry and Biochemical tools (Theory)	
Course outcomes: The student at the completion of the course will be able to:		Bloom's taxonomy
● CO1-Learnaboutthesignificanceof Biochemistry.		K1, K2
● CO2-Learningthechemistryofcarbohydrates,lipids,proteinsand amino acids.		K2, K3
● CO3-Understandingthe basicsofenzymes.		K4, K5
● CO4-Tounderstandthemetabolismofcarbohydrateandproteins		K3, K6
● CO5-Knowthechemicalstructureofnucleotidesincludingtheir		K4, K6
● CO6-components , describe primary, SecondarystructureofDNAandRNA.		K2,K5
Credits:4		CoreCompulsory
Max.Marks:25+75		Min.PassingMarks:33
TotalNo.ofLectures-60		
Unit	Topic	No of Lectures
I	AminoacidsandProtein: ● ZwitterionicformofAminoacids ● PvalueofAmino acids. ● Electrophoresisofproteins.SDSandNative PAGE. ● IEF,2DE,Western Blotting.	07
II	Carbohydrates: ● Structure,FunctionandpropertiesofMonosaccharides, Disaccharides and Polysaccharides. ● Diabetes,typesof Diabetes. ● Diabetesdiagnosisand cure.	07



III	Nucleotidebiosynthesis: ● PurinesNucleotidebiosynthesis: ● Pyrimidines,biosytheis. ● Nucleotidecatabolismandrelateddisorders. ● GOUT,anditsdiagnosisistools.	7
IV	Lipids: ● Structure andfunctionsof Lipids ● Classification, nomenclature and properties of fatty acids, essential fatty acids. ● LDL,HDL. ● Gacher disease and its diagnosis tool and symptom and cure, ● TaySachsDiseaseanditsdiagnosisistooland symptom and cure.	6
	PARTB	
V	● Chromatography (Columnchromatography,Ion-exchange chromatography,Gel-permeation(molecular sieve,chromatography,Affinitychromatography,Paper chromatography,Thin-layerchromatography,Gas chromatography and HPLC) ●	8
VI	● Introduction, Nature of electromagnetic Radiations. Principlesandapplicationsofthefollowingspectroscopic techniques in biochemical investigations Visible and Ultraviolet spectroscopy.	9
VII	Centrifugation Techniques: Introduction, basic principles, and applicationsofsedimentation.Centrifugesandtheiruse-small bench centrifuges, large capacity refrigerated centrifuges, high speed refrigerated centrifuges, continuous flow centrifuges, Preparative ultra- centrifuges, analytical ultracentrifuges, and density gradient centrifugation.	8



VIII	Microscopy:Different types of microscopes–electron microscopes–TEM, SEM. Fluorescence and confocal microscopes used in fine structure studies	8
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Suggested Readings:

1. Berg, J.M. Tymoczko, J.L. Gatto, G.J., Stryer, L. (2015). Biochemistry. (8th ed.) W.H. Freeman and Company New York.
2. Nelson D.L. Cox M.M. (2017) Lehninger Principles of Biochemistry (7th ed.). W.H. Freeman New York.
3. Voet, D., & Voet, J.G. (2016). Biochemistry (5th ed.). Hoboken, NJ: J. Wiley & Sons.
4. Rodwell V.W., Bender D., Botham K.M., Kennelly P.J., Weil P.A. (2018). Harper's Illustrated Biochemistry. (31st edition) McGraw-Hill Education
5. Hofmann A., Cloukie S., Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology. (2018) (8th edition) Cambridge University Press
6. Boyer R.F. (2012) Biochemistry laboratory: modern theory and techniques (2nd Edition). Pearson Education, Inc
7. Jain J.L., Jain S., Jain N. (2005). Fundamentals of Biochemistry. (6th edition). S. Chand and Company Ltd.
8. Satyanarayana U., Chakrapani U. (2013). Biochemistry. (4th edition). Elsevier and Books and Allied (P) Ltd

Suggested link

- <https://ocw.mit.edu/courses/find-by-topic/#cat=healthandmedicine&subcat=spectroscopy>
- <https://ocw.mit.edu/courses/chemistry/5-07sc-biological-chemistry-i-fall-2013/module-i/session-4/>
- <https://ocw.mit.edu/courses/biology/7-016-introductory-biology-fall-2018/lecture-videos/lecture-4-enzymes-and-metabolism/>
- <https://ocw.mit.edu/courses/chemistry/5-07sc-biological-chemistry-i-fall-2013/module-i/session-3/>
- <https://nptel.ac.in/courses/104/105/104105076/>
- <https://nptel.ac.in/courses/102/106/102106087/>

Suggested Continuous Evaluation Methods:

- Seminar on any topic of the above syllabus.
- Test with multiple choice questions/short and long answer questions.
- Attendance

Course prerequisites: The candidates should have passed (10+2) examination in science stream with PCB (Physics, Chemistry, Biology and/or Biotechnology) or PCM (Physics, Chemistry and Math) or any other science subject/certificate/diploma.



Suggested equivalent online courses:

- IGNOU and other centrally/state operated Universities/MOOC platformssuchas“SWYAM” in India and abroad

Further Suggestions:

It widens the scope for students to join Government and Non-Government organization upskilling the people at different levels as per their socio-economic structure.

Programme/Class: Certificate		Year: 1	Semester: 3
Subject: Biotechnology			
Course Code:		Course title (minor-i): Communicable diseases (theory)	
Course outcomes:			Bloom's taxonomy
CO1- Understand the importance and become aware of the common communicable diseases in our country and understand the importance of hygiene, prevention and cure of such diseases.			K1, K3
CO2- Gain knowledge about the major endemic/pandemic of the country and their importance in a developing country like ours.			K4, K5
CO3- Learn about the spread of the communicable diseases and the importance of personal care and hygiene for preventing the diseases.			K2, K6
CO4- Gain knowledge about symptoms, risk factors, prevention & interventional strategies of the diseases			K3, K5
Credits: 4			Minor
Max. Marks: 25+75			Min. Passing Marks: 33
Total No. of Lectures-60			
Unit	Topic		No. of Lectures
	PART A		
I	Introduction to communicable diseases, communicable diseases vs non communicable diseases, examples of each		7



II	AIDS: Overview, symptoms, causes, risk factors, complications, prevention strategies	8
III	Influenza: Common cold and flu, symptoms, management strategies	8
IV	COVID 19: Structure and mode of infection of coronavirus, RT PCR diagnosis, antibody assay diagnosis, treatment, preventive and prophylaxis strategies	7
V	Hepatitis: Hepatitis A, B, C infections, causes, symptoms, diagnosis, treatment strategies	8
VI	Tuberculosis: Overview, symptoms, causes, risk factors, complications, prevention strategies	7
VII	Malaria: Overview, symptoms, causes, risk factors, complications, prevention strategies	8
VII	Typhoid: Overview, symptoms, causes, risk factors, complications, prevention strategies	7



Suggested Readings:

1. Carson, R. 2002. *Silent Spring*. Houghton Mifflin Harcourt.
2. Gadgil, M., & Guha, R. 1993. *This Fissured Land: An Ecological History of India*. Univ. of California Press.
3. Gleeson, B. and Low, N. (eds.) 1999. *Global Ethics and Environment*, London, Routledge.
4. Gleick, P. H. 1993. *Water in Crisis*. Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute, Oxford Univ. Press.
5. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. *Principles of Conservation Biology*. Sunderland: Sinauer Associates, 2006.
6. Grumbine, R. Edward, and Pandit, M. K. 2013. Threats from India's Himalayadams. *Science*, 339:36-37.
7. McCully, P. 1996. *Rivers no more: the environmental effects of dams* (pp. 29-64). Zed Books.
8. McNeill, John R. 2000. *Something New Under the Sun: An Environmental History of the Twentieth Century*.
9. Odum, E. P., Odum, H. T. & Andrews, J. 1971. *Fundamentals of Ecology*. Philadelphia: Saunders.

Programme/Class:Certificate	Year:1	Semester:III
Subject:Biotechnology		
CourseCode:	CoursetitleSEC:Industrial fermentation	
Courseoutcomes:	Bloom'staxonomy	
CO1-Thestudentswillgetaninsightintotheprinciplesof fermentation,itsypesandimportance.	K1, K3	
CO2- In depth knowledge about the various aspects of fermentation,preparationoffermentedfoodsandbeveragesat home using organic materials will be gained.	K4, K5	
CO3-thestudentswillgainknowledge aboutthe sensory evaluationofthepreparedfermentedproductsforsensory quality analysis.	K2,K6	
CO4- To give an insight into the basic skills and learning of the applicationoffermentationtechnologyofresearchdevelopmentin various fields.	K3, K5	
Credits:4	Minor	
Max.Marks:25+75	Min.Passing Marks:33	
TotalNo.of Lectures-60		
Unit	Topic	No.of Lectures



	PART A	
I	Introduction to fermentation technology, history and development of fermentation industry and insights into the industrial fermentation, types of fermentation	7
II	Fermented beverages: wine and kombucha-Principle, methods for preparation and sensory evaluation	8
III	Organic vinegar and soy sauce: Principle, protocol and sensory evaluation with appropriate accompaniments.	8
IV	Fermented pickles: Kimchi and Sauerkraut-Principle, methods of preparation and sensory evaluation.	7
V	Breads and confectionaries: Basic principle, preparation and sensory evaluation.	8
VI	Enzyme and cell immobilization techniques, enzymes in organic synthesis, proteolytic and hydrolytic enzymes	7
VII	Upstream and downstream processing, definition, concept and differences	8
VII	Concept of secondary metabolism, its significance and products, metabolic engineering of secondary metabolism for highest productivity	7

Suggested Readings:

1. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.
2. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.
3. Patel AH. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.
4. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.
5. Salisbury, Whitaker and Hall. Principles of fermentation Technology

At the End of the whole syllabus any remarks/suggestions:

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**B.Sc2Semester3BiotechnologyPaper2 Biochemistry
and biochemical tools lab
(Practical)**

Programme/ Class:Diploma	Year: 2	Semester: 3
Subject:Biotechnology		
CourseCode:B100302P	CourseTitle:BiochemistryandbiochemicaltoolsLab (Practical)	
Courseoutcomes(COs):		Bloom'sTaxonomy
• CO1-Studentsgetfamiliarouseinstrumentslike calorimeter, pH meter etc.		K3, K5
• CO2-Introduce the primarysteps in biomolecules (focus onproteins)purificationwhichincludesvariousmethods inisolationandquantitationofproteins.		K2, K6
• CO3-Learnhowtoseparateproteinsfromaheterogenous mixture.		K4, K5
• CO4-Learntoapplyimportantchromatographic techniques to purify biomolecules		K1, K6
• CO5-Familiarizetheworkingprinciplesofelectrophoresis and UV/Vis and fluorescence spectroscopictechniquesandapplicationoftheknowledge to get basic structural informationof proteins		K2, K3
Credits: 2		CoreCompulsory
Max.Marks:25+75		Min.PassingMarks:40
TotalNo.oflab.periods-30(60hours)		
	Topic	No.of lab.periods



	1. Preparation of normal and molar solutions 2. Preparation of buffers. 3. To study activity of any enzyme under optimum conditions. 4. To study the effect of pH, temperature on the activity of salivary amylase enzyme. 5. Estimation of blood glucose by glucose oxidase Method. 6. Spectrophotometer/colorimeter (Beer-Lambert's law) Estimation of Protein by UV-vis Spectrometer (i) Lowry et al. method for estimation of protein (ii) Biuret method for estimation of protein 7. Spectroscopic estimation of DNA (UV) 8. Electrophoresis (a) Electrophoresis of red blood cell proteins (b) Electrophoresis of DNA 9. Separation of Amino acids by paper chromatography. 10. Qualitative tests for Carbohydrates, lipids and proteins 11. Estimation of DNA by Diphenylamine and RNA by Orcinol methods. 12. Estimation of reducing and total sugar by DNS and H₂SO₄-phenol methods. 13. Effect of pH and temperature on enzyme activity. 14. Determination of pK_a value of a weak acid by titrating with strong base.	60
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Suggested Readings:

1. Berg, J.M. Tymoczko, J.L. Gatto, G.J. Jr. Stryer, L. (2015). Biochemistry. (8th ed.) W.H. Freeman and Company New York.
2. Nelson D.L. Cox M.M. (2017) Lehninger Principles of Biochemistry (7th ed.). W.H. Freeman New York.
3. Voet, D., & Voet, J.G. (2016). Biochemistry (5th ed.). Hoboken, NJ: J. Wiley & Sons.
4. Rodwell V.W. Bender D. Botham K.M. Kennelly P.J. Weil P.A. (2018). Harper's Illustrated Biochemistry. (31st edition) McGraw-Hill Education
5. Hofmann A. Clokie S. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology. (2018) (8th edition) Cambridge University Press
6. Boyer R.F. (2012) Biochemistry laboratory: modern theory and techniques (2nd Edition). Pearson Education, Inc
7. Jain J.L. Jain S. Jain N. (2005). Fundamentals of Biochemistry. (6th edition). S. Chand and Company Ltd.
8. Satyanarayana U. Chakrapani U. (2013). Biochemistry. (4th edition). Elsevier and



Books and Allied(P)Ltd

9. R.K. Practical Biochemistry–David Plummer. Pub: Tata McGraw Hill

10. Roskam's J. Rodgers L. (2002). Lab Ref: A Handbook of Recipes, Reagents, and other reference tools for use at the Bench. Cold Spring Harbor Laboratory Press. USA.

Suggested digital platform web links-ePG-Pathshala, inflibnet, IGNOU & UPRTOU online study material.

Svayam Portal <http://heecontent.upsdc.gov.in/Home.aspx>

This course can be opted as an elective by the students of following subjects: To study this course, student must have passed semester II.

Suggested Continuous Evaluation Methods:

- Assessment of observation report.
- Preparation of questionnaire.
- Visits Records.
- Attendance.

Course prerequisites: The candidates should have passed (10+2) examination in science stream with PCB (Physics, Chemistry, Biology and/or Biotechnology) or PCM (Physics, Chemistry and Maths) or any other science subject.



B.Sc2Year(Semester4)BiotechnologyPaper1
Microbiology and Immunology (Theory)

Programme/ Class:Diploma	Year: 2	Semester: 3
Subject:Biotechnology		
CourseCode:B100401T	CourseTitle:MicrobiologyandImmunology (Theory)	
Courseoutcomes(COs):		Bloom'sTaxonomy
CO1-Thepioneersinmicrobiologyand their contributions Understandingthephysicalandchemicalmethodof sterilization		K3, K5
CO2-Analyzingthemediacompositionandgrowthe desired microbe. Understandingthemethodsofcultivationof microorganisms		K2, K6
CO3-Understandingdifferentstainingmethods Understandinganddifferentiatethedifferenttypesof microbes.		K4, K5
CO4-Understandingthe principlesofimmunology Learn aboutstructuralfeaturesofcomponentsof immunesystemaswellastheir functionand developmentofimmunesystemandmechanismsby whichourbodyelicitsimmuneresponse		K1, K6
CO5- Predict aboutnatureofimmuneresponsethat developsagainstbacterial,viralorparasiticinfection,and prove it by designing new experiments. Understandingdifferenttoolsandtechniquesof immunology.		K2, K3
CO6- Predict aboutnatureofimmuneresponsethat developsagainstbacterial,viralorparasiticinfection,and prove it by designing new experiments. Understandingdifferenttoolsandtechniquesof immunology.		



Understanding the biology of different vaccines against infectious agents.		
Credits: 4	Core Compulsory	
Max. Marks: 25+75	Min. Passing Marks: 33	
Total No. of Lectures-60		
Unit	Topic	No. of Lectures
I	Diversity and classification of microbes: - Fundamentals, History and Evolution of Microbiology. - Classification of microorganisms: Microbial taxonomy, criteria used including molecular approaches, Microbial phylogeny and current classification of bacteria. - Microbial Diversity: Distribution and characterization Prokaryotic and Eukaryotic cells, - Morphology and cell structure of major groups of microorganisms - Viruses, Bacteria, Algae, Fungi, and Protozoa.	7
II	Microbial growth: - Growth curve, Generation time, synchronous batch and continuous culture, measurement of growth and factors affecting growth of bacteria. - Microbial Metabolism: Metabolic pathways, amphotrophic and biosynthetic pathways - Bacterial Reproduction: Transformation, Transduction and Conjugation. Endospores and sporulation in bacteria.	8
III	Pathogen contamination and infectious diseases: - Water Microbiology: Bacterial pollutants of water, coliforms and non coliforms. Sewage composition and its disposal. - Food Microbiology: Important microorganisms in food Microbiology: Moulds, Yeasts, bacteria. - Major foodborne infections and intoxications, Preservation of various types of foods. Fermented Foods. - Bacterial diseases of human- Tuberculosis, Tetanus, Typhoid, Cholera - Viral diseases of human- Hepatitis B and C, AIDS	8



IV	Sterilization,cultivationandstaining: ● Principalsandapplicationsofdifferentmethods of sterilization ● CultivationandMaintenanceof microorganisms: Nutritionalcategoriesofmicro-organisms ● Methodsofisolation,Purificationand preservation. ● Principalsofstainingandtypesofstaining	7
	PART B	
V	Introductiontoimmune system: ● IntroductiontoImmunology,Componentsof mammalianimmunesystem(cellandorgans), Innate and Adaptive immunity ● Humoralandcellmediatedimmuneresponse, Clonal selection theory ● Anoverviewofprimaryandsecondaryimmune responses	8
VI	AntigenandAntibodystructureanddiversity: ● Antigen,epitopesand Adjuvants ● StructureandisotypesofImmunoglobulins allotypes and idiotypes ● B-and T-cell receptors ● BandTcellmaturation ● Antibodydiversitygeneration,somatic gene rearrangementsduringB-lymphocyte differentiation, allelic exclusion,affinity maturation,classswitching,somatic hypermutation	8
VII	MHC,antigenprocessingandpresentation: ● MajorHistocompatibilitycomplexes–classI&class II MHC antigens, antigen processing. ● Antigenprocessingand presentation ● Autoimmunediseases,Immunodeficiency-AIDSand SCID.	7
VIII	ImmunologicalTechniquesandVaccines: ● Introductiontoimmunodiagnostics–Precipitation, Agglutination,RIA,ELISAandImmunofluorescence. ● Passive&activeimmunization. ● Typesofvaccines-DNAvaccines,recombinant vaccines, inactivated vaccine ● Commonindigenousandvaccines	7



Suggested Readings:

1. Pelczar MJ, Reid RD, and Chan EC. (2001). Microbiology (5th ed.). New York: McGraw-Hill.
2. Willey JM, Sherwood L, Woolverton CJ, Prescott LM, and Willey JM. (2011). Prescott's Microbiology. New York: McGraw-Hill.
3. Mattha, W, Berg CY, and Black JG. (2005). Microbiology, Principles and Explorations. Boston, MA: John Wiley & Sons.
4. Cappuccino JG, and Welsh, C. (2016). Microbiology: a Laboratory Manual. Benjamin-Cummings Publishing Company.
5. Collins CH, Lyne PM, Grange JM, and Falkinham III J. (2004). Collins and Lyne's Microbiological Methods (8th ed.). Arnold.
6. Levinson WE. (2020). Review of Medical Microbiology and Immunology (16th edition). McGraw Hill Education.
7. Ananthanarayana R, Panicker CKJ (2020). Ananthanarayana and Panicker's Textbook of Microbiology (11th edition) Universities Press (India) Pvt. Ltd
8. Punt J, Stranford S, Jones P., Owen JA, (2018). Kuby Immunology. (8th edition) New York: W.H. Freeman.
9. Delves PJ, Martin SJ, Burton DR, and Roitt IM. (2017). Roitt's Essential Immunology. (13th edition). Wiley- Blackwell.
10. Murphy K, and Weaver C, (2016). Janeway's Immunobiology. (9th edition) New York: Garland Science.

2. Suggestive digital platforms web links-

<http://heecontent.upsdc.gov.in/Home.aspx>

To study this course, student must have passed semester III.

Suggested Continuous Evaluation Methods:

- Seminar/presentation on any topic of the above syllabus.
- Test with multiple choice questions/short and long answer questions.
- Preparation of Audio-visual aids.
- Attendance.

Course prerequisites: The candidates should have passed (10+2) examination in science stream with PCB (Physics, Chemistry, Biology and/or Biotechnology) or PCM (Physics, Chemistry and Maths) or any other science subject.

Suggested equivalent online courses:

- IGNOU & Other centrally/state operated Universities/MOOC platformss such as "SWAYAM" in India and Abroad.

Further Suggestions:



At the End of the whole syllabus any remarks/suggestions:

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B.Sc2Year(Semester4)Biotechnology
Paper 2Microbiology and Immunology
Lab(Practical)

Programme/Class: Diploma	Year:2	Semester:4
Subject:Biotechnology		
CourseCode:B100402P	CourseTitle:Microbiologyand Immunology Lab (Practical)	
Courseoutcomes(COs):		Bloom'sTaxonomy
CO1 -Understandmethodsofcleaningandsterilizationof plastic wares and glass wares.		K3, K5
CO2 -Understandandperformpureculturetechniques which includes, pour plate and spread plate		K2, K6
CO3 -Understandthepreparationanduseofdifferential, selective and special media. Understandandidentifythemorphologyofcellsofthe immune system.		K4, K5
• CO4 -Understandthebasicconceptsofbloodgrouping.		K1, K6
• CO5 -Understandthepreparationanduseofdifferential, selective and special media. • Understandandidentifythemorphologyofcellsofthe immune system. Understand antigen antibodyinteractionsandthus quantitatethepresenceofantigenandorantibodiesin biologicalsamples.		K2, K3
Credits: 2		CoreCompulsory
Max.Marks:25+75		Min.PassingMarks:40
TotalNo.oflab.periods-30(60hours)		
	Topic	No.of lab.periods



	1. Safety measures in microbiology laboratory 2. Study of instruments: Compound microscope, Autoclave, Hot air oven, PH meter, and Laminar airflow 3. Introduction to different sterilization techniques 4. Isolation of bacteria & their biochemical characterization. 5. Staining methods: simple staining, Gram staining, spore staining, negative staining, hanging drop. 6. Preparation of media and sterilization, 7. Methods of isolation of bacteria from different sources. 8. Determination of bacterial cell size by micrometry. 9. Enumeration of microorganism - total & viable count. 10. Differential leucocytes count 11. Total leucocytes count 12. Total RBC count 13. Haemagglutination assay 14. Separation of serum from blood 15. Double immunodiffusion test using specific antibody and antigen. 16. ELISA demonstration	60
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Suggested Readings:

1. Pelczar MJ, Reid RD, and Chan EC. (2001). Microbiology (5th ed.). New York: McGraw-Hill.
2. Willey JM, Sherwood L, Woolverton CJ, Prescott LM, and Willey JM. (2011). Prescott's Microbiology. New York: McGraw-Hill.
3. Mattha, W, Berg CY, and Black JG. (2005). Microbiology, Principles and Explorations. Boston, MA: John Wiley & Sons.
4. Cappuccino JG, and Welsh, C. (2016). Microbiology: a Laboratory Manual. Benjamin-Cummings Publishing Company.
5. Collins CH, Lyne PM, Grange JM, and Falkinham III J. (2004). Collins and Lyne's Microbiological Methods (8th ed.). Arnold.
6. Levinson WE. (2020). Review of Medical Microbiology and Immunology (16th edition). McGraw Hill Education.
7. Ananthanarayana R, Panicker CKJ (2020). Ananthanarayana and Panicker's Textbook of Microbiology (11th edition) Universities Press (India) Pvt. Ltd
8. Punt J, Stranford S, Jones P., Owen JA, (2018). Kuby Immunology. (8th edition) New York: W.H. Freeman.
9. Delves PJ, Martin SJ, Burton DR, and Roitt IM. (2017). Roitt's Essential Immunology. (13th edition). Wiley- Blackwell.
10. Murphy K, and Weaver C, (2016). Janeway's Immunobiology. (9th edition) New York: Garland Science.

This course can be opted as an elective by the students of following subjects: To study this course, student must have passed semester III.

Suggested Continuous Evaluation Methods:

- Assessment of Time-Energy, Budget & House Plans.
- Assessment of Market Survey Records.
- Assessment of Flower Arrangements and Rangoli.
- Attendance.

Course prerequisites: The candidate should have passed (10+2) examination in science stream with PCB (Physics, Chemistry, Biology and/or Biotechnology) or PCM (Physics, Chemistry and Maths) or any other science subject.

Suggested equivalent online courses:

IGNOU & Other centrally/state operated Universities/MOOC platformssuchas "SWAYAM" in India and Abroad

Further Suggestions:



At the End of the whole syllabus any remarks/suggestions:

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Programme/Class: Certificate		Year: 2	Semester 4
Subject: Biotechnology			
Course Code:		Course Title (SEC-IV): Basic of forensic science	
Course outcomes:			Bloom's taxonomy
CO1- Knowledge of various aspects of DNA fingerprinting in solving paternity disputes.			K4, K5
CO2- Knowledge of various aspects of personal identification			K1, K4
CO3- Knowledge of various aspects of criminal cases.			K3, K4
CO4- Knowledge of various aspects of issues in cyber security.			K2, K5
Credits: 4			SEC-IV
Max. Marks: 60+40			Min. Passing Marks: 33
Total No. of Lectures-60			
Unit	Topic		No. of Lectures
	PART A		
I	Introduction and principles of forensic science, branches of forensic science, forensic science laboratory and its organization.		7
II	Service, tools and techniques in forensic science		8
III	Classification of firearms and explosives, Chemical evidence for explosives,		8
IV	General and individual characteristics of handwriting, examination and comparison of handwritings and analysis of ink various samples		7



V	Significance of toxicological findings, Fundamental principles of fingerprinting,	8
VI	classification of fingerprints, development of finger print as science for personal identification,	7
VII	Principle of DNA fingerprinting, Investigation Tools, eDiscovery,	8
VIII	Evidence Preservation, Search and Seizure of Computers, Introduction to Cyber security.	7

SUGGESTED READING

1. Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
2. B.B. Nanda and R.K. Tiwari, Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi (2001).
3. M.K. Bhasin and S. Nath, Role of Forensic Science in the New Millennium, University of Delhi, Delhi (2002).
4. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).
5. W.G. Eckert and R.K. Wright in Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (ED.), CRC Press, Boca Raton (1997).
6. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
7. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).

