"Education through self-help is our motto" - KARMAVEER
Rayat Shikshan Sanstha's
DAHIWADI COLLEGE, DAHIWADI
Tal. Man, Dist. Satara : 415 508
[Arts, Science, Commerce, BCA, B.Voc.Agri.,
Bank Management, Defence Studies & Vocational Education]
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[NAAC Third Cycle Reaccredited 'A' Grade (with CGPA 3.25)]
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Bachelor of Science (B.Sc.)

(Department of Microbiology)

Programme Outcomes (PO's)

After completing B.Sc. programme the student will be able to:

PO1: Bachelor of Science offers theoretical as well as practical knowledge about different special subject areas.

PO2: This course forms the basis of science for coherent understanding of the academic field to pursue multi and interdisciplinary science careers in future. These subject areas include, Chemistry, Physics, Botany, Zoology, Mathematics, Microbiology and Computer Science.

PO3: Able to plan and execute experiments or investigations, analyze and interpret data information collected using appropriate methods.

PO4: It helps to develop scientific temper, attitude and thus can prove to be more beneficial for the society as the scientific developments and make a nation or society to grow at a rapid pace through research.

PO5: Think critically, follow innovations and developments in science and technology.

PO6: Understand the issues of environmental contexts and sustainable development.

PO7: Acquire the skills and ability to engage in independent and life-long learning in the broadest context socio technological changes.

PO8: To demonstrate professional and ethical attitude with enormous responsibility to serve the society.

Programme Specific Outcomes(PSO's)

PSO1: To make the students knowledgeable with respect to the subject and its practicable applicability.

PSO2: To promote understanding of basic and advanced concepts in Microbiology.

PSO3: To expose the students to various emerging areas of Microbiology.

PSO4: To prepare students for further studies, helping in their bright career in the subject.

PSO5: To develop their ability to apply the knowledge of Microbiology in day to day life.

PSO6: To prepare the students to accept the challenges in life sciences.

PSO7: To develop skills required in various industries, research labs and in the field of human health.

PSO8: Learners will understand the scope and historical development in microbiology.

PSO9: Student will be deal with broad applied areas of microbiology that are interactive with higher living forms,four such areas are virology, immunology,food and industrial microbiology, agricultural microbiology.

PSO10: To enrich students knowledge and train them in the pure microbial sciences.

PSO11: To prepare students for further studies, helping in their bright career in the subject.

PSO12: To inculcate sense of scientific responsibilities and social and environment awareness.

PSO13: To help students build up a progressive and successful career.

Course Outcomes (CO's)

BSc -I Course I Introduction to Microbiology

CO1: To understand History and contribution of different scienticest in field of microbiology (a) Antony von Leeuwenhoek b) Edward Jenner c) Louis Pasteur d) Robert Koch e) Ivanowsky f) Joseph Lister g)Alexander Fleming i) Martinus W. Beijerinck j) Sergei N. Winogradsky.)

CO2: To study beneficial and harmful activities of microorganism.

CO3: Student able to classify microorganism. Student know about general principles of bacterial nomenclature(taxonomical rank, command and vernacular name of microorganism)

CO4: To understand overview of scope of microbiology (air, water, sewage, soil, etc)

CO5: Student get knowledge about stains and staining procedures(simple, negative, differential , special Staining)

CO6: Student know about Microscopy

Course II Microbial Diversity

CO7: Student know acellular and cellular microorganism.

CO8: To study control of microorganism (sterilization, disinfection, antiseptic, etc.), Physical and chemical agents for control of microorganism.

CO9: To study Nutritional requirements of microorganism (water, micronutrient, Macronutrient, carbon, energy source etc.)

CO10: To understand nutritional types of microorganism based on carbon and energy sources (autotrophs, heterotrophs, phototrophs, etc.)

CO11: Student know about type of culture media (components of media, natural, Synthetic culture media.)

Course II Bacteriology

CO12: Student know Bacterial cell organization, cytology of bacteria, Structure and function of cytoplasmic components.

CO13: Study Isolation technique (streak plate, spread plate, pour plate)

CO14: To study Preservation of microbial cultures (a) Sub-culturing b) overlaying cultures with mineral oils)

CO15: To study systematic study of pure cultures: (morphological character, cultural character, biochemical character)

Course IV Microbial biochemistry

CO16: Student Bio molecules (proteins, carbohydrates, lipids, enzymes, Nucleic acid)

CO17: Study metabolism in bacteria (catabolism and anabolism, fundamental principles of energetics)
CO18: To study Mode of ATP generation (Substrate level phosphorylation, oxidative phosphorylation, bacterial phosphorylation, etc.)

Practical Course

CO19: Student able to prepared stains, reagents (phosphate buffer), physiological saline.
CO20: Study know about biosafety.
CO21: Student may able to handle microscope.
CO22: Student can do monochrome, negative, gram's, cell wall, capsule,volutine granule staining procedures
CO23: Student get know application of instruments.
CO24: Prepared simple media, selective media, differential media
CO25: Student Demonstrate of presence of microflora in water and air by solid impaction technique on nutrient agar plates and in water by direct cultivation method.
CO26: Student Isolate (*Escherichia coli , Bacillus species , Staphylococcus aureus*)
CO27: Student can do biochemical tests : a) Detection of production of indole b) excess acid c) Acetoin d) utilization of citrate as a carbon source by IMViC test e) Detection of H2S production ability of bacteria
CO28: Student able of detect ability of enzyme production of bacteria (Amylase, catalase, caseinase)

BSc II June 2019 onward syllabus (CO's)
Course V : Microbial Physiology & Metabolism
CO29: Student Know about Growth and phases of growth , type of growth (Continuous, synchronous, diauxic growth)
CO30: Student knew about effect of environmental factors on microbial growth (temperature, pH, Osmotic pressure, Heavy metals.)
CO31: Study transport across the cell membrane (diffusion, active transport and group translocation)
CO32: Student get Know microbial metabolism (catabolism of glucose EMP, TCA cycle)
CO33: Learn Mode of ATP generation (Oxidative phosphorylation, Bacterial Photophosphorylation)

Course VI: Applied microbiology
CO34: Student Know about Air microbiology, water microbiology, Milk microbiology
CO35: Student knew about basic concept of primary and secondary metabolism.
CO36: Study type of fermentation (batch , continuous, dual and multiple)
CO37: Student get Know)Fermentation Media - Water, carbon source, nitrogen source, precursors, growth factors , antifoam agents & chelating agents.

Course VII: Microbial genetics and molecular biology
CO38: Know about Basic concepts in genetics (gene, genotype, phenotype, mutagen, and recon).
CO39: Student get basic concepts of mutation (Base pair substitutions, frame shift , missense, nonsense, neutral, silent , pleiotropic and suppressor mutations)
CO40: Student get differentiate between spontaneous mutation and induced mutation and factors involved in this mutation.
CO41: Student know about Mutagens that distort DNA (acridine dyes, UV)

CO42: Student know modes of gene transfer (Transformation, Conjugation, Transduction)
CO43: Student Know about DNA repair system (i) Photo reactivation ii) Dark repair mechanism (Excision repair)
CO44: Study Gene transfer in bacteria. (Fate of exogenote in recipient cell, Modes of gene transfer - Transformation, Conjugation, Transduction)
CO45: Study Lac operon – structure and working

Course VII: Basic in medical Microbiology and Immunology
CO46: Know about the basic concept of Host, Parasite and saprophytes.
CO47: Student know about what disease is and how disease transfer from pathogen.
CO48: Student know about Opportunistic pathogen, True pathogen, Virulence, Pathogenicity, Fomite, Incubation period, Carriers, Morbidity rate, Mortality rate.
CO49: Student know about Virulence factors (production of endotoxins, exotoxins, enzymes, escaping of phagocytosis)
CO50: Student perceive the knowledge about the disease transferred from Transmission of air, water & food.
CO51: Student aware about Contact transmission and Vector borne transmission.
CO52: Student know about innate immunity and Acquired immunity.
CO53: Student know about Antigen and its Chemical nature, types of antigens, factors affecting antigenicity.
CO54: Student Perceive knowledge about Immune Response Primary and secondary immune responses.
CO55: Student aware about Mechanism of antigen – antibody reaction.

PRACTICAL COURSE Outcome:
CO56: Student do spore, flagella, nucleus staining.
CO57: Prepare media Gelatin agar, Amino acid decarboxylation medium, Amino acid deamination medium, Arginine broth, Christensen's medium, Peptone nitrate broth, Hugh and Leifson's medium.
CO58: Student can do biochemical test Gelatin hydrolysis test. Amino acid decarboxylation test, Amino acid deamination test , Urea hydrolysis test , Nitrate reduction test , Huge and Leifson's test , Arginin hydrolysis.
CO59: Student analysis bacteriological analysis of water qualitative, quantitative, primary screening of antibiotic producers, amylase producers.
CO60: Student Isolate of lac negative mutants of *E.coli* by visual detection method.
CO61: Determine of Blood groups – ABO and Rh.
CO62: Student can do Serological tests -Widal test – qualitative slide test.

BSc III June 2020 onward syllabus (CO's)

Course IX Virology:
CO63: To get an insight into one of the most important acellular entity lying at the borderline of living and dead called virus and its allied groups including viroids, and prions. It also deals with the nomenclature, classification of viruses and other aspects related to virus and its allied groups.

CO64: To have an idea about the general features, morphology, ultra-structure, composition and arrangements of structural components in virus. To familiarize with the concept and

important aspects (types, structural organization, multiplication cycle and therapeutic application) of bacteriophages i.e. the virus of bacteria.

CO65: To get an insight into the cultivational, diagnostic and serological (haemagglutination, immuno-fluorescence ELISA) methods concerned with the characterization and identification of virus.

CO66: To have the basics of salient features, multiplication and replication strategies among important types of plant and animal viruses with special reference to the nature of their nucleic acid.

CO67: To get an insight into the concept of oncogenic viruses i.e. viruses responsible for cancer. It also deals with the concept of antiviral compounds, interferon and viral vaccines with special reference to their mode of action. It also gives an idea about the application of virus specifically viral vectors in cloning and expression and gene therapy.

Course X : Immunology and Serology

CO68: To familiarize with the concept of non-specific (innate) and specific (acquired) resistance mechanism developed in man against pathogens and other non-self factors which is the basis of this course.

CO69: To get an insight into the formation, types, organization and functional specificity of different cellular and organ level components conferring resistance in man.

CO70: To familiarize with the nature, types and function of antigens that induce immunological response in man and how the product of this response (antibody, B and T cells) help in neutralizing them (agglutination and precipitation reactions).

CO71: To have the concept of different mediators/cell signaling molecules (complement, cytokines: interferons, Interleukins, heamatopoetins and chemokines) associated with immunological responses as well as their biological consequences.

CO72: To understand the immune disorders (hypersensitivity, autoimmune disorders, oncogenesis etc.) and induced immunity (vaccination) to overcome such abnormalities.

Course XI: Food and Industrial Microbiology

CO73: Students will be able to define and analyse the role of microorganisms in dairy, food, and environment.

CO74: Students will be able to define fermentation.

CO75: They will be able to describe the process of industrial fermentation

CO76: They will be able to understand the role of bioreactor in fermentation

CO77: They will understand strain improvement and microbiological assays.

CO78: They will be able to describe and apply the process of food preservation.

Course XII: Agricultural Microbiology

CO79: To develop the idea about the formation, stratification and physico-chemical properties of soil. It also deals with how the microorganisms are affected/ induced in a terrestrial ecosystem.

CO80: To get an insight in to the chemical transformation carried out by microbes during organic matter decomposition wherein mineralization and immobilization of important nutrient occurs resulting in enhancement of soil nutrient profile.

CO81: To familiarize with the concept of diseases of agricultural commodities caused by microbial agents, different terminology associated with such disease and at the same time some of the important measures for controlling/eradicating diseases from crop fields.

CO82: To get an insight into the significance of microorganisms in terms of formulation of biofertilizers, phytostimulators, bioinsecticides which are eco-friendly alternative to their chemical counterparts.

CO83: To have the concept of microbes as a source of bio-fuels and biogas, alternative to non-renewable fossil fuels. It also highlights the issues associated with the development of GM crops and transgenic animals.

Course XIII: Microbial genetics

CO84: Student get Basic concepts of bacterial genome there structural organization and molecular mexhanism of gene regulation by operon concept.

CO85: Student get Knowledge about different type of mutations and methods of isolation and detection of mutants on the basis of relative survival, growth and visual detection

CO86: To have concept about the most versatile molecular technique of Polymerized Chain Reaction (PCR), DNA finger printing, DNA Sequencing

CO87: To have the basic concept of genetic engineering and r-DNA technology laying the basis of genetic modification of cellular organisms.

CO88: To develop the concept about the types, nature and functions of restriction enzymes that act as the mediators of DNA modification during genetic manipulation process.

CO89: To get an insight into the concept of different vectors (plasmids, cosmids, and artificial chromosome vectors) that act as carrier of DNA fragment between cellular organisms during genetic modification.

CO90: To understand the different Isolation techniques of desired DNA (Shortgun method, cDNA Synthesis, Chemical Synthesis)

CO91: Student get well know the application of genetic engineering in medicine, agriculture, Industry, Environment

Paper XIV: Microbial Biochemistry

CO92: Students will be able to extend their study in enzymology with respect to identification and purification of enzyme.

CO93: They will be able to describe and generalize the role of coenzyme in enzyme catalysis.

CO94: Students will be able to interrelate between anabolism and catabolism.

CO95: Students will be able to elaborate their study about bioenergetics

Paper XV: Environmental Microbiology

CO96: Students will be able to extend their study in Sewage microbiology, treatment of waste, biological safety in laboratory, environmental Monitoring, Bioremediation

and Bioleaching.

CO97: Student able to characterized and treat waste generated by different streams

CO98: Known about Eutrophication

CO99: Get knowledge about biological safety in laboratory

CO100.: Know about bioremediation and bioleaching

Paper XVI: Clinical Microbiology

CO101: Students will be able to organize diseases with respect to the system..

CO102: They will be able to categorize disease causing organisms like bacteria, fungal, viral etc.

CO103: They will be able to match diseases and their causative agents

CO104: Know about mode of action of antimicrobial agents

CO105: Learn about immunoprophaylaxis and drug resistance

T. Y. B. Sc. Practical:

CO106: Isolation of coliphages from sewage. Effect of U.V. light on bacteria and graphical presentation of results.

CO107: Isolation of auxotrophic mutants by replica plate technique

CO108: Transfer of genetic material by transformation in *E.coli*

CO109: Isolation of chromosomal DNA from bacteria (J. Marmurs method or by phenol chloroform method)

CO110: Electrophoretic separation of DNA

CO111: Student isolate streptomycin resistant mutants(gradient plate Technique)

CO112: Testing of carcinogenicity of a substance by Ame's test.

CO113: Assay of amylase by DNSA method (graphical estimation)

CO114: Bioassay of vitamin B12, Bioassay of penicillin

CO115: Production of wine and examination for pH, color and alcohol content.

CO116: Citric acid fermentation, recovery and estimation by titration.

CO117: Isolation of *Azotobacter* form soil, *Xantomonas, Rhizobium*, Phosphate Solubilizing Bacteria.

CO118: Student determine the BOD and COD , calcium and magnesium (EDTA method), organic carbon (Walkley and Black method)

CO 119: Isolation of following pathogens from clinical samples (wherever possible) and identification of the same by morphological, cultural and biochemical characteristics. *Pseudomonas aeruginosa* b) *Staphylococcus aureus c)Candida albicans*

CO120: Determination of MIC of streptomycin against *E.coli* by broth method Determination of sensitivity of common pathogens to antibiotics by paper disc method.