COURSE CURRICULUM FOR FIRST PROFESSIONAL BSMS
(PRESCRIBED BY NCISM)

"தொட்டனைத் தூறும் மணற்கேணி மாந்தர்க்குக்
கற்றனைத் தூறும் அறிவு"

(AS DEEP YOU DIG THE SAND SPRING FLOWS; AS DEEP YOU LEARN THE KNOWLEDGE GROWS-

NUNNUYIRIYAL
SUBJECT CODE: SIDUG-NU
MICROBIOLOGY

(Applicable from 2021-2022 batch onwards for five years or until further notification by NCISM, whichever is earlier)

ncism
प्राणाभिसरः प्राणायतनानाम्

BOARD OF UNANI, SIDDHA AND SOWA RIGPA
NATIONAL COMMISSION FOR INDIAN SYSTEM OF MEDICINE
NEW DELHI- 110058

SCAN ME

SIDUG-NU

NCISM

I – PROFESSIONAL SIDDHA MARUTHUVA ARIGNAR (BSMS)

SUBJECT CODE: SIDUG – NUNNUYIRIAL (MICROBIOLOGY)

KEY POINTS

Total number of Teaching hours: 210			
Lecture hours (LH) - Theory		**70 Hours**	**70 Hours (LH)**
Paper I	70 Hours		
Non-Lecture hours (NLH) – Theory		**40 Hours**	**140 Hours (NLH)**
Paper I	40 Hours		
Non-Lecture hours (NLH) - Practical		**100 Hours**	

Examination (Papers & Mark Distribution)					
Item	**Theory Component Marks**	**Practical Component Marks**			
		Practical	**Viva**	**Elective**	**IA**
Paper I	**100**	**100**	**30**		**20**
Sub-Total	**100**	**150**			
Total marks	**250**				

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Course outcome and Program outcomes

SN	Course code	Name of Course
1.	SIDUG-NU	NUNNUYIRIAL

Table 1- Course learning outcomes and matched PO.

CO No	A1 - Course Outcome	B1 – Course outcome matched with Program Outcome
At the end of the course the student should be able to-		
CO1	Comprehend the historical pathway of developments in Microbiology and remember the contributions of eminent scientists in the field.	**PO1, PO9**
CO2	Understand and Comprehend the basics of the fine structure & function of Bacteria, Viruses and Fungi	**PO9**
CO3	Analyze the principle of immunology, associate with protection and disorders, and apply the knowledge in vaccination.	**PO8, PO9**
CO4	Classify the bacterial pathogens based on the disease pattern in a systematic way and understand the pathogenesis, laboratory diagnosis and prophylaxis.	**PO1, PO9, PO8**
CO5	Comprehend the pathogenesis of various viral pathogens, its laboratory diagnosis and prophylaxis.	**PO9**
CO6	Interpret the etiology of clinical conditions and conclude on the treatment and prophylaxis pattern, vaccines, Bio-war and Biomedical waste management.	**PO8. PO9**
CO7	Handle instruments and diagnostic tools related to infectious disease and immunological profile.	**PO9, PO12**

Table 2 – Contents of Course

NUNNUYIRIAL (MICROBIOLOGY)

SN	A2 List of Topics (Theory)	B2 Term	C2 Marks	D2 Lecture hours	E2 Non-Lecture hours
1	**General Bacteriology** ● Introduction and History ● Morphology of Bacteria ● Nutritional requirement, growth and metabolism of Bacteria ● Classification and identification of Bacteria ● Culture media and cultivation methods ● Sterilization and disinfection ● Antimicrobial chemotherapeutic agents ● Antimicrobial Sensitivity Testing methods ● Bacterial Genetics	I	20	14	6
2	**Mycology** ● Introduction to Mycology ● Opportunistic Mycosis ● Dermatophytes ● Cryptococcus, Rhinosporidium & Histoplasma spp. ● Mycotoxicosis and Mycetism	III	10	6	3
3	**Immunology** ● Infection ● Structure and function of immune system ● Immunity ● Antigens & Antibodies ● Antigen – Antibody reactions – Agglutination, Precipitation ● Immunofluorescence, Coomb's test, ELISA & Western blot ● Complement system ● Hypersensitivity ● Autoimmunity ● Immunodeficiency	I	20	13	5
4	**Systematic Bacteriology** ● Gram positive Cocci – Staphylococcus, Streptococcus, Pneumococcus & Enterococcus ● Gram Negative Cocci - Meningococci and Gonococci	II	20	22	9

	• Enterobacteriaceae - Escherichia, Klebsiella, Proteus, Salmonella & Shigella • Yersinia pestis • Vibrio cholerae, Pseudomonas & Haemophilus • Clostridium tetani, C. perfringens, C.botulinum • Bacillus anthracis, Corynebacterium diphtheriae • Mycobacterium - Tuberculosis and Leprosy • Spirochaetes - Treponema, Leptospira and Borrelia • Mycoplasma, Chlamydia and Rickettsia				
5	**<u>Virology</u>** • General properties and cultivation of viruses • Bacteriophage • Varicella virus • Herpes virus - HSV I & II & Epstein Barr Virus • Myxovirus - H1N1, Avian flu • Mumps & Measles • Coronavirus, Marburg, Ebola & Nipah virus • Poliovirus & Rotavirus • Rabies virus • Hepatitis virus – HBV • Arbovirus - Chikungunya, Dengue & Rubella • Retrovirus – HIV • Human Papillomavirus (HPV)	**II**	**20**	**15**	**9**
6	**<u>Clinical Microbiology</u>** • Nosocomial infection • UTI • Meningitis • Bacterial food poisoning • PUO • Bio-War • Biomedical Waste Management • Vaccines (Bacterial & Viral)	**III**	**10**	**--**	**8**
TOTAL			**100**	**70**	**40**

Table 3 – Learning Objectives (Theory) of course SIDUG-NU									
Course outcome	**Learning Objective** **(At the end of the session, the students should be able to)**	**Domain/Sub**	**Must to know/desirable to know/Nice to know**	**Level Does/ shows/Knows how/knows**	**T-L method**	**Assessment**	**Formative/ Summative**	**Term**	**Integration**
Topic 1 - General Bacteriology - Time (Lecture: - 14 hours; Non lecture 6 hours)									
1 - History of Microbiology									
CO1	List the contribution of Louis Pasteur	Cognitive /Knowledge	MK	Knows	Lecture / Role play	Written	F&S	1	
CO1	Describe the contributions of Robert Koch	Cognitive /Knowledge	MK	Knows	Lecture / Role play	Written	F&S	1	
CO1	Elaborate the contributions of Paul Ehrlich	Cognitive /Knowledge	DK	Knows	Lecture / Role play	Written	F&S	1	
CO1	Describe the works of Edward Jenner	Cognitive /Knowledge	DK	Knows	Lecture / Role play	Written	F&S	1	
CO1	Enlist the works of Alexander Fleming	Cognitive /Knowledge	DK	Knows	Lecture / Role play	Written	F&S	1	
2 - Morphology of Bacteria									
CO1	Explain and illustrate the various shapes of bacteria	Cognitive /Knowledge	MK	Knows	Lecture/ Demonstration under microscope / Video presentations	Written/ Practical	F&S	1	

CO1	Define and demonstrate Bacterial Cell wall	Cognitive /Knowledge	MK	Knows	Lecture/ Demonstration under microscope / Video presentations	Written/ Practical	F&S	1	
CO1	Explain and illustrate Bacterial Capsule	Cognitive /Knowledge	MK	Knows	Lecture/ Demonstration under microscope / Video presentations	Written/ Practical	F&S	1	
CO1	Describe and demonstrate Flagella	Cognitive /Knowledge	MK	Knows	Lecture/ Demonstration under microscope / Video presentations	Written/ Practical	F&S	1	
CO1	Illustrate and appraise the importance of bacterial spore	Cognitive /Comprehension	MK	Knows	Lecture/ Demonstration under microscope / Video presentations	Written/ Practical	F&S	1	
3 - Nutritional requirements, growth and metabolism of Bacteria.									
CO1	Explain Bacterial Cell division	Cognitive /Knowledge	MK	Knows	Lecture	Written/ Viva	F&S	1	
CO1	Describe the bacterial Growth Curve	Cognitive /Knowledge	MK	Knows	Lecture	Written/ Viva	F&S	1	
CO1	Explain Bacterial nutrition	Cognitive /Knowledge	MK	Knows how	Lecture	Written/ Viva	F&S	1	
CO1	Explain Bacterial Metabolism	Cognitive /Knowledge	MK	Knows how	Lecture	Written/ Viva	F&S	1	

4 - Classification and identification of Bacteria									
CO1	Explain the morphology of bacterial colony	Cognitive /Knowledge	MK	Knows	Lecture/Demonstration	Written/ Practical	F&S	1	
CO1	Explain indole and Methyl Red test	Cognitive /Knowledge	MK	Knows how	Lecture/Demonstration	Written/ Practical	F&S	1	
CO1	Explain Urease and Citrate Utilization test	Cognitive /Knowledge	MK	Knows how	Lecture/Demonstration	Written/ Practical	F&S	1	
CO1	Explain Catalase and Oxidase test	Cognitive /Knowledge	MK	Knows how	Lecture/Demonstration	Written/ Practical	F&S	1	
CO1	Explain PPA and Voges-Proskauer test	Cognitive /Knowledge	MK	Knows how	Lecture/Demonstration	Written/ Practical	F&S	1	
CO1	Explain Nitrate reduction and triple sugar iron test	Cognitive /Knowledge	MK	Knows how	Lecture/Demonstration	Written/ Practical	F&S	1	
5 - Culture media and cultivation methods									
CO1	Describe Simple Media	Cognitive /Knowledge	MK	Knows	Lecture/Demonstration	Written/ Practical	F&S	1	
CO1	Define Enrichment Media	Cognitive /Knowledge	MK	Knows	Lecture/Demonstration	Written/ Practical	F&S	1	
CO1	Explain Selective media & Transport media	Cognitive /Knowledge	MK	Knows	Lecture/Demonstration	Written/ Practical	F&S	1	
CO1	Enlist Anaerobic Media	Cognitive /Knowledge	MK	Knows	Lecture/Demonstration	Written/ Practical	F&S	1	

CO1	Explain methods of Streak Culture and Lawn Culture	Cognitive /Knowledge	MK	Knows how	Lecture/Demonstration	Written/ Practical	F&S	1	
CO1	Explain the methods of anaerobic culture	Cognitive /Knowledge	MK	Knows how	Lecture/Demonstration	Written/ Practical	F&S	1	
CO1	Explain the methods of isolating pure culture	Cognitive /Knowledge	MK	Knows how	Lecture/Demonstration	Written/ Practical	F&S	1	
6 - Sterilization and disinfection									
CO1	Explain Physical Methods of Sterilization	Cognitive /Knowledge	MK	Knows	Lecture	Written	F&S	1	
CO1	Define working Principle of Autoclave and Hot air Oven	Cognitive /Knowledge	MK	Knows how	Lecture/Demonstration	Written/ Practical	F&S	1	
CO1	Explain Chemical Methods of Sterilization	Cognitive /Knowledge	MK	Knows	Lecture	Written	F&S	1	
CO1	Define vapour phase disinfectant	Cognitive /Knowledge	MK	Knows	Lecture	Written	F&S	1	
7 - Antimicrobial chemotherapeutic agents									
CO1	Explain the mechanism of action of antibiotics	Cognitive /Knowledge	DK	Knows	Lecture	Written	F&S	1	
CO1	Describe various microbial drugs	Cognitive /Knowledge	DK	Knows	Lecture	Written	F&S	1	
CO1	Investigate the mechanism of Antibiotic resistance	Cognitive / Affective	DK	Knows how	Lecture / Field study	Written	F&S	1	

8 - Antimicrobial Sensitivity Testing methods Time									
CO1	Explain stokes disc diffusion method, Kirby – Bauer Disc Diffusion method and Broth dilution method.	Cognitive /Knowledge	DK	Knows	Lecture/Demonstration /Practical	Written/ Viva	F&S	1	
9 - Bacterial Genetics									
CO1	Explain the basic principles of Bacterial genetics with special focus on latest diagnostic techniques including PCR & RFLP	Cognitive /Knowledge	DK	Knows	Lecture/Demonstration	Written/ Viva	F&S	1	
Topic 2- Mycology - Time (Lecture: - 6 hours; Non lecture 3 hours)									
10 - Introduction to Mycology									
CO2	Define Mycology and describe the general characteristics of fungi.	Cognitive /Knowledge	MK	Knows	Lecture	Written/ Viva	F&S	II I	
CO2	Evaluate the beneficial and harmful effects of fungi	Cognitive /Affective	DK	Knows how	Lecture	Viva - voce	F&S	II I	

CO2	Differentiate fungi and bacteria, Classify Fungi based on its morphology.	Cognitive /Knowledge	MK	Knows how	Lecture	Written/ Viva	F&S	II I	
CO2	Comprehend various culture and staining methods of fungi	Cognitive /Comprehension	MK	Knows how	Lecture/ Demonstration	Written	F&S	II I	
CO2	Demonstrate different morphology of fungus in LPCB Mount.	Cognitive /Comprehension	MK	Knows how	Lecture/ Demonstration	Written	F&S	II I	
CO2	Describe different types of Mycoses	Cognitive /Comprehension	MK	Knows	Lecture	Written/ Viva	F&S	II I	
11 - Dermatophytes									
CO2	Enlist different types of superficial mycoses and describe the aetiology, pathogenesis, types of infection and lab diagnosis of Dermatophytosis.	Cognitive /Knowledge	MK	Knows how	Lecture/ Demonstration	Written/ Viva	F&S	II I	
12 - Rhinosporidium & Histoplasma spp.									
CO2	Comprehend subcutaneous Mycosis with a briefing on	Cognitive /Comprehension	MK	Knows	Lecture/ Demonstration	Written/ Viva	F&S	II I	

	Mycetoma and Rhinosporidiosis								
CO2	Enlist Systemic mycoses and elaborate on Histoplasmosis.	Cognitive /Knowledge	MK	Knows how	Lecture	Written/ Viva	F&S	II I	
13 - Opportunistic Mycosis									
CO2	Elaborate on the Opportunistic mycoses and it's predisposing factors – Candidiasis, Cryptococcosis, Zygomycosis, Aspergillosis, Penicilliosis , Pneumocystosis & Fusariosis	Cognitive /Comprehension	MK	Knows	Lecture	Written/ Viva	F&S	II I	
14 - Mycotoxicosis and Mycetism									
CO2	Annotate Fungal food poisoning.	Cognitive/ Affective	MK	Knows how	Lecture	Written/ Viva	F&S	II I	
CO2	Exemplify and differentiate Mycotoxicosis & Mycetism.	Cognitive/ Affective	MK	Knows how	Lecture	Written	F&S	II I	

Topic 3- Immunology - Time (Lecture: - 13 hours; Non lecture 5 hours)									
15 – Infection									
CO3	Define Infection and enlist the types of infection. Describe the sources & methods of transmission of infection and factors predisposing to microbial pathogenicity.	Cognitive /Knowledge	MK	Knows	Lecture/ Demonstration	Written	F&S	I	
16 - Structure and function of immune system									
CO3	Describe the structure & functions of the organs and cells of the immune system.	Cognitive /Knowledge	MK	Knows	Lecture/ Video presentation	Written	F&S	I	
17 – Immunity									
CO3	Define and detail the mechanism and types of immunity and its applications.	Cognitive /Knowledge	MK	Knows how	Lecture/ Demonstration/ Peer learning	Written	F&S	I	
18 - Antigens & Antibodies									
CO3	Define antigen & describe the determinants of antigenicity. Describe the structure and classification of Immunoglobulins and their functions.	Cognitive /Knowledge	MK	Knows	Lecture/ Video presentation	Written	F&S	I	

19 - Antigen – Antibody reactions – Agglutination, Precipitation									
CO3	Define Precipitation and Agglutination. Explain the principle, procedure and applications in detail.	Cognitive /Knowledge	MK	Knows how	Lecture/ Demonstration	Written/ Viva	F&S	I	
20 - Immunofluorescence, Coomb's test, ELISA & Western blot									
CO3	Explain the principle, procedure and application of Immunofluorescence, Coomb's test, ELISA & Western Blot.	Cognitive /Knowledge	MK	Knows how/ Shows	Lecture/ Video presentation	Written/ Viva	F&S	I	
21 - Complement system									
CO3	Define Complement. Describe the function of Complements in immunity and various modes of Complement cascades.	Cognitive /Knowledge	MK	Knows	Lecture	Written	F&S	I	
22 - Hypersensitivity									
CO3	Define and classify hypersensitivity. Elaborate the mechanisms in detail.	Cognitive /Knowledge	MK	Knows	Lecture/ Video presentation	Written	F&S	I	
23 - Autoimmunity									
CO3	Describe in detail about the mechanisms and types of various Autoimmune disorders.	Cognitive /Knowledge	MK	Knows	Lecture/ Peer learning/ Group project	Written	F&S	I	

24 - Immunodeficiency									
CO3	Define Immunodeficiency & describe the various types of Immunodeficiency disorders.	Cognitive	MK	Knows	Lecture/ Assignment	Written	F&S	I	
Topic 4- Systematic Bacteriology - Time (Lecture: - 22 hours; Non lecture 9 hours)									
25 - Gram positive Cocci – Staphylococcus, Streptococcus, Pneumococcus & Enterococcus									
CO4	Describe the morphology, cultural characteristics, pathogenesis, laboratory diagnosis, treatment and prophylaxis of pathogenic GPC.	Cognitive /Knowledge	DK	Knows	Lecture	Written	F	II	
26 - Gram Negative Cocci - Meningococci and Gonococci									
CO4	Describe the morphology, cultural characteristics, pathogenesis, laboratory diagnosis, treatment and prophylaxis of pathogenic GNC.	Cognitive /Knowledge	MK	Knows	Lecture	Written	F	II	
27 - Enterobacteriaceae - Escherichia, Klebsiella, Proteus, Salmonella & Shigella									
CO4	Describe the morphology, cultural characteristics, pathogenesis, laboratory diagnosis, treatment and	Cognitive /Knowledge	MK	Knows how	Lecture	Written	F	II	

	prophylaxis of pathogenic GNB classified under Enterobacteriaceae.								
28 - Yersinia pestis									
CO4	Describe the morphology, cultural characteristics, pathogenesis, laboratory diagnosis, treatment and prophylaxis of Yersinia pestis.	Cognitive /Knowledge	MK	Knows/ show	Lecture/ Video presentation	Written/ Viva	F&S	II	
29 - Vibrio cholerae, Pseudomonas & Haemophilus									
CO4	Describe the morphology, cultural characteristics, pathogenesis, laboratory diagnosis, treatment and prophylaxis of non-Enterobacteriaceae GNB.	Cognitive /Knowledge	MK	Knows/ show	Lecture/ Video presentation	Written/ Viva	F&S	II	
30 - Clostridium tetani, C. perfringens, C. botulinum									
CO4	Describe the morphology, cultural characteristics, pathogenesis, laboratory diagnosis, treatment and prophylaxis of pathogenic Clostridium species.	Cognitive /Knowledge	MK	Knows	Lecture/ Demonstration	Written	F	II	
31 - Bacillus anthracis									
CO4	Describe the morphology, cultural characteristics, pathogenesis, laboratory diagnosis, treatment and	Cognitive /Knowledge	MK	Knows	Lecture	Written	F	II	

	prophylaxis of Anthrax bacillus.								
32 - Corynebacterium diphtheriae									
CO4	Describe the morphology, cultural characteristics, pathogenesis, laboratory diagnosis, treatment and prophylaxis of Corynebacterium diphtheriae.	Cognitive /Knowledge	MK	Knows	Lecture/ Video presentation	Written	F	II	
33 - Mycobacterium - Tuberculosis and Leprosy									
CO4	Describe the morphology, cultural characteristics, pathogenesis, laboratory diagnosis, treatment and prophylaxis of Mycobacterium tuberculosis and Mycobacterium leprae.	Cognitive /Knowledge	MK	Knows how	Lecture/ Peer learning	Written	F	II	
34 - Spirochaetes - Treponema, Leptospira and Borrelia									
CO4	Describe the morphology, cultural characteristics, pathogenesis, laboratory diagnosis, treatment and prophylaxis of various pathogenic spirochaetes causing Syphilis, Leptospirosis and Recurrent fever.	Cognitive /Knowledge	MK	Knows	Lecture/ Video presentation	Written	F&S	II	

35 - Mycoplasma, Chlamydia and Rickettsia									
CO4	Describe the morphology, cultural characteristics, pathogenesis, laboratory diagnosis, treatment and prophylaxis of Mycoplasma, Chlamydia and Rickettsia	Cognitive /Knowledge	MK	Knows	Lecture/ Group project work/ Peer learning	Written	F	II	
Topic 5- Virology - Time (Lecture: - 15 hours; Non lecture 9 hours)									
36 - General properties and cultivation of viruses									
CO1 & CO5	Identify the size, shape and symmetry of virus	Cognitive /Knowledge	MK	Knows	Lecture/ Demonstration/ Video presentation	Written/ Viva	F	II	
CO1 & CO5	Explain cultivation of virus	Cognitive /Knowledge	MK	Knows	Lecture/ Video presentation	Written	F&S	II	
CO1 & CO5	Enlist various cell cultures	Cognitive /Knowledge	DK	Knows	Lecture	Written	F&S	II	
CO1 & CO5	Detection of CPE in cell culture	Cognitive /Knowledge	DK	Knows	Lecture/ Demonstration/ Video presentation	Written	F&S	II	
CO1 & CO5	Explain viral Haemagglutinin	Cognitive /Knowledge	MK	Knows	Lecture/ Video presentation	Written	F&S	II	

37 - Bacteriophage									
CO5	Describe the morphology, life cycle and applications of bacteriophage	Cognitive /Knowledge	MK	Knows	Lecture/ Demonstration/ Video presentation	Written/ Viva	F&S	II	
38 - Varicella virus									
CO5	Describe the pathogenesis, clinical manifestation and prophylaxis of Varicella virus.	Cognitive /Knowledge	MK	Knows	Lecture	Written/ Viva	F&S	II	
39 - Herpes virus - HSV I & II & Epstein Barr Virus									
CO5	Classification of human herpes virus.	Cognitive /Knowledge	DK	Knows	Lecture	Written/ Viva	F	II	
CO5	Describe the pathogenesis, clinical manifestation and prophylaxis of HSV I & II and Epstein Barr Virus	Cognitive /Knowledge	MK	Knows	Lecture	Written	F&S	II	
40 - Myxovirus - H1N1, Avian flu									
CO5	Describe the General properties of Ortho & Paramyxovirus.	Cognitive /Knowledge	MK	Knows	Lecture	Written/ Viva	F	II	

CO5	Describe the transmission, pathogenesis, clinical manifestation, laboratory diagnosis, and prophylaxis of H1N1	Cognitive /Knowledge	MK	Knows	Lecture	Written	F&S	II	
CO5	Describe the transmission, pathogenesis, clinical manifestation, laboratory diagnosis, and prophylaxis of Avian flu virus.	Cognitive /Knowledge	MK	Knows	Lecture	Written	F&S	II	
41 - Mumps & Measles									
CO5	Describe the transmission, pathogenesis, clinical manifestation, laboratory diagnosis, and prophylaxis of mumps virus	Cognitive /Knowledge	MK	Knows	Lecture	Written/ Viva	F&S	II	
42 - Coronavirus, Marburg, Ebola & Nipah virus									
CO5	Describe the transmission, pathogenesis, laboratory diagnosis, clinical manifestation and prophylaxis of Coronavirus.	Cognitive /Knowledge	MK	Knows	Lecture/ Peer learning/ Video presentation	Written/ Viva	F&S	II	

CO5	Describe the transmission, pathogenesis, laboratory diagnosis, clinical manifestation and prophylaxis of Marburg, Ebola & Nipah virus	Cognitive /Knowledge	MK	Knows	Lecture/ Group project	Written	F&S	II	
43 - lio virus & Rota virus									
CO5	Describe the transmission, pathogenesis, clinical manifestation, laboratory diagnosis, and prophylaxis of Polio virus	Cognitive /Knowledge	MK	Knows	Lecture	Written	F&S	II	
CO5	Describe the transmission, pathogenesis, clinical manifestation, laboratory diagnosis, and prophylaxis of Rotavirus	Cognitive /Knowledge	MK	Knows	Lecture	Written	F&S	II	
44 - Rabies virus									
CO5	Describe the pathogenesis, clinical manifestation and prophylaxis of rabies virus	Cognitive /Knowledge	DK	Knows	Lecture/ Video presentation/ Creating model	Written	F&S	II	

45 - Hepatitis virus – HBV									
CO5	Describe the transmission, pathogenesis, clinical manifestation, laboratory diagnosis, and prophylaxis of hepatitis B virus.	Cognitive /Knowledge	MK	Knows	Lecture/ Peer learning	Written	F&S	II	
46 - Arbovirus - Chikungunya, Dengue & Rubella									
CO5	Classify Arboviruses	Cognitive /Knowledge	DK	Knows	Lecture/ Group project	Written	F&S	II	
CO5	Enlist various vectors and Vector-borne diseases.	Cognitive /Knowledge	MK	Knows	Lecture	Written	F&S	II	
CO5	Describe the pathogenesis, clinical manifestation laboratory diagnosis and prophylaxis of Dengue and Chikungunya and Rubella.	Cognitive /comprehension	MK	Knows	Lecture/ Journal club	Written/ Viva	F&S	II	
47 - Retrovirus – HIV									
CO5	Describe the transmission, pathogenesis, clinical manifestation, laboratory	Cognitive /Knowledge	MK	Knows	Lecture/ Peer learning/ Video presentation	Written/ Viva	F&S	II	

	diagnosis, and prophylaxis of HIV								
CO5	Explain the opportunistic infections associated with HIV infection	Cognitive /Knowledge	MK	Knows	Lecture/ Assignment	Written	F&S	II	
48 - Human Papilloma Virus (HPV)									
CO5	Describe the transmission, pathogenesis, clinical manifestation, laboratory diagnosis, and prophylaxis of papilloma virus.	Cognitive /Knowledge	MK	Knows	Lecture	Written	F&S	II	
CO5	Advocate the importance of HPV Vaccine.	Cognitive/ Affective	MK	Knows	Lecture/ Field study	Written	F&S	II	
Topic 6- Clinical Microbiology - Time (Lecture: -Nil hours; Non lecture 8 hours)									
49 - Nosocomial infection									
CO6	Define and describe Nosocomial infection.	Cognitive /Knowledge	MK	Knows how	Pedagogy/ Field study	Written/ Viva	F&S	II I	
CO6	Mention the source and mode of transmission	Cognitive /Knowledge	MK	Knows	Peer learning	Written/ Viva	F&S	II I	
CO6	Derivatives to control Hospital Acquired Infection	Cognitive /Knowledge	MK	Knows how	Peer learning/ Field study	Written/ Viva	F&S	II I	

50 - UTI									
CO6	Define UTI and enlist the etiological agents of UTI	Cognitive /Knowledge	MK	Knows	Pedagogy/ Journal club	Written/ Viva	F&S	II I	
CO6	Describe the clinical manifestations, pathogenesis, laboratory diagnosis, prophylaxis and management of UTI	Cognitive /Knowledge	MK	Knows	Group Project work	Written/ Viva	F&S	II I	
51 - Meningitis									
CO6	Define meningitis and meningism. Describe the clinical manifestations, Pathogenesis, laboratory diagnosis, prophylaxis and management of Meningitis	Cognitive /Knowledge	MK	Knows	Pedagogy/ Peer learning	Written/ Viva	F&S	II I	
52 - Bacterial food poisoning									
CO6	Describe and discuss various clinical presentations of bacterial food poisoning. Elaborate on the causative agents and the toxins produced.	Cognitive /Knowledge	MK	Knows	Pedagogy/ Roleplay/ Peer learning	Written/ Viva	F&S	II I	
CO6	Suggest the significance of prevention of bacterial food poisoning.	Cognitive/ Affective	MK	Knows how/	Roleplay/ Field study	Written/ Viva	F&S	II I	

53 - PUO									
CO6	Define PUO. Discuss different types of laboratory diagnostic techniques with latest tools and management of PUO.	Cognitive /Knowledge	MK	Knows	Assignment	Written/ Viva	F&S	II I	
54 - Bio-War									
CO6	Express bio-war. Enlist and investigate various bio-weapons and its route of transmission. Understand the epidemiologic spread and emergency management safety measures including immuno and chemoprophylaxis. Challenge the consequences of bio-war.	Cognitive/Affective	MK	Knows	Pedagogy/ Roleplay/ Peer learning	Written/ Viva	F&S	II I	
55 - Biomedical waste management									
CO6	Characterize Bio-medical waste. Describe the strategies involved in effective Bio-medical waste management.	Cognitive /Knowledge	MK	Knows how	Demonstration/Role play /Field study	Written/ Viva	F&S	II I	

P56 - Vaccines (Bacterial & Viral)									
CO6	Describe and differentiate Vaccines. Enlist available potent bacterial and viral vaccines and its schedule in India.	Cognitive /Knowledge	MK	Knows	Pedagogy/ Peer learning	Written/ Viva	F&S	II I	

PRACTICAL – NUNNUYIRIAL (MICROBIOLOGY)

Marks: 100

Hours: 100

SN	Name of Topics (Practical)	Term	Hours
P1	Safety guidelines	I	3
P2	General Microbiological techniques	I	3
P3	Instruments & equipment handling	I	6
P4	Microscopy Principle and handling of Student microscope	I	3
P5	Hanging drop technique	I	3
P6	Smear preparation & Staining methods - Simple stain	I	3
P7	Negative staining(Indian Ink stain) and Special stain(Albert's stain)	I	3
P8	Gram's staining – GPC, GPB, GNB, Mixed Smear.	II	9
P9	AFB staining – M.tuberculosis & M.leprae	II	6
P10	Culture Media Preparation	II	6
P11	Culture methods	II	6
P12	Anaerobic culture (Anaerobic Jar & RCMB)	II	3
P13	Antimicrobial sensitivity test methods – Diffusion and Dilution	I	6
P14	Microbiological sample collection, transport and storage methods.	III	4
P15	Sampling and Processing (Throat Swab, high nasal swab)	III	3

P16	Bacterial Identification with case report – Staphylococcus aureus , Corynebacterium diphtheriae, Salmonella spp.	III	3
P17	Escherichia coli, Klebsiella pneumoniae , Pseudomonas aeruginosa	III	3
P18	Serology – WIDAL, RPR, HBsAg Card Test/ HIV Card Test	I	9
P19	Immunology – ELISA, Latex Agglutination Test	I	6
P20	Mycology – KOH & LPCB mounting	III	6
P21	Mycology – Slide culture	III	3
P22	Virology – Rabies, HIV, Orthomyxo, Paramyxo and Adenovirus models and clinical illustration.	II	3
Total Practical class hours			**100**

Table 4. Learning Objectives (Practical) of course SIDUG-NU

NUNNUYIRIAL (MICROBIOLOGY)

Practical

A4 Course outcome	**B4 Learning Objective (At the end of the practical/ clinical session the Students should be able to)**	**C4 Domain/Sub**	**D4 Must to know/desirable to know/Nice to know**	**E4 Level Does/ shows/Knows how/knows**	**F4 T-L method**	**G4 Assessment**	**H4 Formative / Summative**	**I4 Term**	**J4 Integration**
Practical Topic – 1; Time (3 Practical hours)									
CO7	Safety guidelines	Cognitive / Affective	MK	Knows/Shows	Non-Lecture / Demonstration/ Practical	Write / Viva-voce	F	I	
Practical Topic – 2; Time (3 Practical hours)									
CO7	General Microbiological techniques	Cognitive / Psychomotor	MK	Knows how/ Shows	Non-Lecture / Practical	Write / Viva-voce	F	I	

Practical Topic – 3; Time (6 Practical hours)									
CO7	Instruments & equipment handling	Cognitive / Psychomotor	NK	Knows how/ Shows	Non-Lecture / Practical	Write / Viva-voce	F	I	
Practical Topic – 4; Time (3 Practical hours)									
CO7	Microscopy Principle and handling of Student microscope	Cognitive / Psychomotor	MK	Knows how/ Shows	Non-Lecture / Practical	Write / Viva-voce	F	I	
Topic – 5; Time (3 Practical hours)									
CO7	Hanging drop technique	Cognitive / Psychomotor	NK	Knows how/ Shows	Non-Lecture / Practical	Write / Viva-voce	F	I	
Practical Topic – 6; Time (3 Practical hours)									
CO7	Smear preparation & Staining methods - Simple stain	Cognitive / Psychomotor	MK	Knows/ Shows	Non-Lecture / Practical	Write / Viva-voce	F	I	
Practical Topic – 7; Time (3 Practical hours)									
CO7	Negative staining(Indian Ink stain) and Special stain(Alberts stain)	Cognitive / Psychomotor	DK	Knows how/ Shows	Non-Lecture / Practical	Write / Viva-voce	F	I	
Practical Topic – 8; Time (9 Practical hours)									
CO7	Gram's staining – GPC, GPB, GNB, Mixed Smear.	Cognitive / Psychomotor	MK	Knows/ Shows	Non-Lecture / Practical	Write / Viva-voce	F & S	II	

Practical Topic – 9; Time (6 Practical hours)									
CO7	AFB staining	Cognitive / Psychomotor	MK	Knows/ Shows	Non-Lecture / Practical	Write / Viva-voce	F & S	II	
Practical Topic – 10; Time (6 Practical hours)									
CO7	Culture Media Preparation	Cognitive / Psychomotor	DK	Knows how/ Shows	Non-Lecture / Practical	Write / Viva-voce	F	I	
Practical Topic – 11; Time (6 Practical hours)									
CO7	Culture methods	Cognitive / Psychomotor	DK	Knows/ Shows	Non-Lecture / Practical	Write / Viva-voce	F	I	
Practical Topic – 12; Time (3 Practical hours)									
CO7	Anaerobic culture (Anaerobic Jar & RCMB)	Cognitive / Psychomotor	DK	Knows how/ Shows	Non-Lecture / Practical	Write / Viva-voce	F	I	
Practical Topic – 13; Time (6 Practical hours)									
CO7	Antimicrobial sensitivity test methods – Diffusion and Dilution	Cognitive / Psychomotor	MK	Knows how/ Shows	Non-Lecture / Practical	Write / Viva-voce	F	I	
Practical Topic – 14; Time (4 Practical hours)									
CO7	Microbiological sample collection, transport and storage methods.	Cognitive / Psychomotor	NK	Knows how/ Shows	Non-Lecture / Demonstration	Write / Viva-voce	F	III	

Practical Topic – 15; Time (3 Practical hours)									
CO7	Sampling and Processing (Throat Swab, high nasal swab)	Cognitive / Psychomotor	NK	Knows how/ Shows	Non-Lecture / Demonstration/ Practical	Write / Viva-voce	F	III	
Practical Topic – 16; Time (3 Practical hours)									
CO7	Bacterial Identification with case report – Staphylococcus aureus , Corynebacterium diphtheriae, Salmonella typhi	Cognitive / Psychomotor	MK	Knows how/ Shows	Non-Lecture / Practical	Write / Viva-voce	F & S	III	
Practical Topic – 17; Time (3 Practical hours)									
CO7	Escherichia coli, Klebsiella pneumoniae , Pseudomonas aeruginosa	Cognitive / Psychomotor	MK	Knows how/ Shows	Non-Lecture / Practical	Write / Viva-voce	F & S	III	
Practical Topic – 18; Time (9 Practical hours)									
CO7	Serology – WIDAL, RPR, HbsAg Card Test, HIV Card Test	Cognitive / Psychomotor	MK	Knows how/ Shows	Non-Lecture / Practical	Write / Viva-voce	F & S	I	
Practical Topic – 19; Time (6 Practical hours)									
CO7	Immunology – ELISA, ASO Test, RF Test	Cognitive / Psychomotor	MK	Knows how/ Shows	Non-Lecture / Practical	Write / Viva-voce	F & S	I	
Practical Topic – 20; Time (6 Practical hours)									
CO7	Mycology – KOH & LPCB mounting	Cognitive / Psychomotor	DK	Knows how/ Shows	Non-Lecture / Practical	Write / Viva-voce	F & S	III	

77 - Practical Topic – 21; Time (3 Practical hours)									
CO7	Mycology – Slide culture	Cognitive / Psychomotor	NK	Knows/ Shows	Non-Lecture / Practical	Write / Viva-voce	F	III	
Practical Topic – 22; Time (3 Practical hours)									
CO7	Virology – Rabies, HIV, Orthomyxo, Paramyxo and Adenovirus models.	Cognitive / Psychomotor	MK	Knows/ Shows	Non-Lecture / Practical	Write / Viva-voce	F & S	II	

Table 5. – List of Non-Lecture Teaching – Learning Methods

Nunnuyirial (Microbiology)

List non lecture Teaching-Learning methods	Term-I	Term-II	Term-III	No of Activities
Pedagogy	3	3	2	8
Group project work	2	2	2	6
Field studies	-	3	3	6
Problem based learning	2	2	2	6
Journal club	1	2	3	6
Creating models	2	2	2	6
Assignment	-	1	1	2
Total	**10**	**15**	**15**	**40**

Table 6. - Assessment Summary

6 A-Number of Papers and Marks Distribution

Subjects	Papers	Theory	Practical Assessment					Grand Total
			Practical	Viva	Electives	Internal Assessment	Total	
Nunnuyirial (Microbiology)	1	100	100	30	-	20	150	250

6 B - Scheme of Assessment (formative and Summative)

SN	Professional Course	Duration of Professional Course		
		First Term (1-6 Months)	Second Term (7-12 Months)	Third Term (13-18 Months)
1	First	3 PA & First TT	3 PA & Second TT	3 PA & UE

PA: Periodical Assessment; TT: Term Test; UE: University Examinations

6 C - Calculation Method for Internal Assessment Marks (20 Marks)

Term	Periodical Assessment*				Term Test**	Term Assessment	
	A	B	C	D	E	F	G
	1 (20)	2 (20)	3 (20)	Average (A+B+C/3) 20	(MCQ+SAQ+LAQ and practical) Converted to 20	Sub Total	Term Assessment
First						D+E	D+E/2

Second						D+E	D+E/2
Third					NIL		D
FINAL IA	Average of Three Term Assessment Marks As Shown in 'G' Column						
	* Select an Evaluation Methods which is appropriate for the objectives of Topics from the Table 6 D. Convert it to 20 marks. ** Conduct Theory (100 Marks) (MCQ (20×1 Marks), SAQ(8×5), LAQ(4×10) Then convert to 20 Marks.						

6 D - Evaluation Methods for Periodical Assessment

SN	Evaluation Methods for Periodical Assessment
1.	Practical / Clinical Performance
2.	Viva Voce, MCQs, MEQ (Modified Essay Questions/Structured Questions)
3.	Open Book Test (Problem Based)
4.	Summary Writing (Research Papers/ Samhitas)
5.	Class Presentations; Workbook Maintenance
6.	Problem Based Assignment
7.	Objective Structured Clinical Examination (OSCE), Objective Structured Practical Examination (OPSE), Mini Clinical Evaluation Exercise (Mini-CEX), Direct Observation of Procedures (DOP), Case Based Discussion (CBD)
8.	Extra-curricular Activities, (Social Work, Public Awareness, Surveillance Activities, Sports or Other Activities which may be decided by the department).
9.	Small Project
10	Other activities explained in Table 3 Column G3 as per indicated term and objective of the topic.

6 E Question paper pattern

First Professional BSMS Examination SIDUG-NU NUNNUYIRIAL

(MICROBIOLOGY)

Time: 3 hours Maximum Marks: 100

Instructions

All questions should be answered

		No. of Questions	Marks per Question	Total Marks
Q 1	Multiple Choice Questions (MCQ)	20	1	20
Q 2	Short Answer Questions (SAQ)	8	5	40
Q 3	Long Answer Questions (LAQ)	4	10	40
				100

6 F Distribution of Theory Exam

NUNNUYIRIAL (MICROBIOLOGY)

SN	List of Topics	Term	Marks	MCQ (1Mark)	SAQ (5 Marks)	LAQ (10 Marks)
I	**General Bacteriology**		**20**			
1	Introduction and History	**I**	**5**	**Yes**	**Yes**	**No**
2	Morphology of Bacteria	**I**	**10**	**Yes**	**Yes**	**Yes**
3	Nutritional requirement, growth and metabolism of Bacteria	**I**	**10**	**Yes**	**Yes**	**Yes**
4	Classification and identification of Bacteria	**I**	**5**	**Yes**	**Yes**	**No**
5	Culture media and cultivation methods	**I**	**10**	**Yes**	**Yes**	**Yes**
6	Sterilization and disinfection	**I**	**10**	**Yes**	**Yes**	**Yes**
7	Antimicrobial chemotherapeutic agents	**I**	**5**	**Yes**	**Yes**	**No**
8	Antimicrobial Sensitivity Testing methods	**I**	**5**	**Yes**	**Yes**	**No**
9	Bacterial Genetics	**I**	**10**	**Yes**	**Yes**	**Yes**
II	**Mycology**		**10**	**Yes**	**Yes**	**Yes**
10	Introduction to Mycology	**III**	**5**	**Yes**	**Yes**	**No**
11	Opportunistic Mycosis	**III**	**10**	**Yes**	**Yes**	**Yes**
12	Dermatophytes	**III**	**5**	**Yes**	**Yes**	**No**
13	Cryptococcus, Rhinosporidium & Histoplasma spp.	**III**	**5**	**Yes**	**Yes**	**No**
14	Mycotoxicosis and Mycetism	**III**	**5**	**Yes**	**Yes**	**No**
III	**Immunology**		**20**	**Yes**	**Yes**	**Yes**
15	Infection	**I**	**10**	**Yes**	**Yes**	**Yes**
16	Structure and function of immune system	**I**	**10**	**Yes**	**Yes**	**Yes**
17	Immunity	**I**	**10**	**Yes**	**Yes**	**Yes**
18	Antigens & Antibodies	**I**	**5**	**Yes**	**Yes**	**No**
19	Antigen – Antibody reactions – Agglutination, Precipitation	**I**	**10**	**Yes**	**Yes**	**Yes**
20	Immunofluorescence, Coomb's test, ELISA & Western blot	**I**	**10**	**Yes**	**Yes**	**Yes**
21	Complement system	**I**	**5**	**Yes**	**Yes**	**No**
22	Hypersensitivity	**I**	**10**	**Yes**	**Yes**	**Yes**
23	Autoimmunity	**I**	**5**	**Yes**	**Yes**	**No**

24	Immunodeficiency	**I**	**5**	**Yes**	**Yes**	**No**
IV	**Systematic Bacteriology**		**20**			
25	Gram positive Cocci – Staphylococcus, Streptococcus, Pneumococcus & Enterococcus	**II**	**10**	**Yes**	**Yes**	**Yes**
26	Gram Negative Cocci - Meningococci and Gonococci	**II**	**10**	**Yes**	**Yes**	**Yes**
27	Enterobacteriaceae - Escherichia, Klebsiella, Proteus, Salmonella & Shigella	**II**	**10**	**Yes**	**Yes**	**Yes**
28	Yersinia pestis	**II**	**5**	**Yes**	**Yes**	**No**
29	Vibrio cholerae, Pseudomonas & Haemophilus	**II**	**10**	**Yes**	**Yes**	**Yes**
30	Clostridium tetani, C. perfringens, C.botulinum	**II**	**10**	**Yes**	**Yes**	**Yes**
31	Bacillus anthracis, Corynebacterium diphtheriae	**II**	**10**	**Yes**	**Yes**	**Yes**
32	Corynebacterium diphtheriae	**II**	**10**	**Yes**	**Yes**	**Yes**
33	Mycobacterium - Tuberculosis and Leprosy	**II**	**10**	**Yes**	**Yes**	**Yes**
34	Spirochaetes - Treponema, Leptospira and Borrelia	**II**	**5**	**Yes**	**Yes**	**No**
35	Mycoplasma, Chlamydia and Rickettsia	**II**	**5**	**Yes**	**Yes**	**No**
V	**Virology**		**20**			
36	General properties and cultivation of viruses	**II**	**5**	**Yes**	**Yes**	**No**
37	Bacteriophage	**II**	**5**	**Yes**	**Yes**	**No**
38	Varicella virus	**II**	**5**	**Yes**	**Yes**	**No**
39	Herpes virus - HSV I & II & Epstein Barr Virus	**II**	**5**	**Yes**	**Yes**	**No**
40	Myxovirus - H1N1, Avian flu	**II**	**5**	**Yes**	**Yes**	**No**
41	Mumps & Measles	**II**	**5**	**Yes**	**Yes**	**No**
42	Coronavirus, Marburg, Ebola & Nipah virus	**II**	**5**	**Yes**	**Yes**	**No**
43	Poliovirus & Rota virus	**II**	**5**	**Yes**	**Yes**	**No**
44	Rabies virus	**II**	**10**	**Yes**	**Yes**	**Yes**
45	Hepatitis virus – HBV	**II**	**10**	**Yes**	**Yes**	**Yes**
46	Arbovirus - Chikungunya, Dengue & Rubella	**II**	**10**	**Yes**	**Yes**	**Yes**
47	Retrovirus – HIV	**II**	**10**	**Yes**	**Yes**	**Yes**
48	Human Papillomavirus (HPV)	**II**	**5**	**Yes**	**Yes**	**No**
VI	**Clinical Microbiology**		**10**			
49	Nosocomial infection	**III**	**5**	**Yes**	**Yes**	**No**
50	UTI	**III**	**5**	**Yes**	**Yes**	**Yes**
51	Meningitis	**III**	**10**	**Yes**	**Yes**	**Yes**
52	Bacterial food poisoning	**III**	**5**	**Yes**	**Yes**	**No**
53	PUO	**III**	**5**	**Yes**	**Yes**	**No**
54	Bio-War	**III**	**5**	**Yes**	**Yes**	**No**
55	Biomedical Waste Management	**III**	**5**	**Yes**	**Yes**	**No**
56	Vaccines (Bacterial & Viral)	**III**	**5**	**Yes**	**Yes**	**No**

6 G Question paper blue print

Question Sr. No	Type of Question	Question Paper Format
Q1	Multiple choice Questions (MCQ) 20 Questions 1 mark each All compulsory Must know part 15 MCQ Desirable to know 3 MCQ Nice to know 2 MCQ	1. Topic number 2 2. Topic number 3 3. Topic number 4 4. Topic number 6 5. Topic number 7 6. Topic number 12 7. Topic number 14 8. Topic number 17 9. Topic number 18 10. Topic number 21 11. Topic number 23 12. Topic number 25 13. Topic number 26 14. Topic number 27 15. Topic number 30 16. Topic number 37 17. Topic number 38 18. Topic number 40 19. Topic number 41 20. Topic number 42
Q2	Short answer Questions (SAQ) Eight Questions 5 Marks Each All compulsory 7 questions from must to know 1 questions from Desirable to know No Questions from Nice to know	1. Topic no.2/ Topic no.3/ Topic no.4/ Topic no.6 2. Topic no.7/ Topic no.9/ Topic no.18/ Topic no.20 3. Topic no.21/ Topic no.22/ Topic no.23/ Topic no.24 4. Topic no.25/ Topic no.26/ Topic no.28/ Topic no.29 5. Topic no.30/ Topic no.31/ Topic no.32/ Topic no.33 6. Topic no34 Topic no.35/ Topic no.36/ Topic no.37

		7. Topic no.39/ Topic no.40/ Topic no.42/ Topic no.44 8. Topic no.46/ Topic no.47/ Topic no.49/ Topic no.55
Q3	Long answer Questions (LAQ) Four Questions 10 marks each All compulsory All questions on must know. No Questions on Nice to know and Desirable to know	1. Topic no.5/ Topic no.6/ Topic no.17/ Topic no.22 2. Topic no.26/ Topic no.27/ Topic no.29/ Topic no.30 3. Topic no.31/ Topic no.32/ Topic no.33/ Topic no.44 4. Topic no.45/ Topic no.47/ Topic no.50/ Topic no.51

6 H Distribution of practical Examination **Nunnuyirial (Microbiology)**

SN	HEADS	MARKS
P8	Gram's staining	15
P9	AFB Staining Ziehl-Neelsen Method	15
P16	Bacterial Identification	10
P18	Serology	10
P19	Immunology	10
P22	Virology	10
P20 &21	Mycology	10
	Spotters	10
	Record	10
	Viva-voce	30
	Internal Assessment	20
	Total Marks	**150**

7. Reference Books / Resources

Textbook of Microbiology – Ananthanarayanan and C.K.Jayaram Paniker

Essentials of Medical Microbiology - Apurba S Sastry & Sandhya Bhat

Textbook of Microbiology - D.R. Arora & B.Arora

Textbook of Microbiology – Dr.C.P.Baveja

Textbook of Microbiology - Chakraborthy

Review of Medical Microbiology & Immunology McGraw Hill Pub, New Delhi – Jawetz

Medical Microbiology-Robert Cruik Shank

Essential Immunology, Blackwell Sci Newyork – Roitt

Clinical Microbiology and Infectious Diseases (Online Learning)
https://onlinelearning.hms.harvard.edu