



KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION
ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ



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NAAC Accredited
'A' Grade 2014

website: kud.ac.in

No. KU/Aca(S&T)/SSL-394A/2022-23/1056

Date: 23 SEP 2022

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2022-23ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸುಗಳಿಗೆ 3 ಮತ್ತು 4ನೇ ಸೆಮೆಸ್ಟರ್
NEP-2020 ಮಾದರಿಯ ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

- ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ
ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 260 ಯುಎನ್ಇ 2019(ಭಾಗ-1), ದಿ:7.8.2021.
2. ವಿಜ್ಞಾನ & ತಂತ್ರಜ್ಞಾನ ನಿಖಾಯ ಸಭೆಯ ಠರಾವುಗಳ ದಿನಾಂಕ: 06.09.2022
3. ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂ. 01, ದಿನಾಂಕ: 17.09.2022
4. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 22-09-2022

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2022-23ನೇ
ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ವಿಜ್ಞಾನ & ತಂತ್ರಜ್ಞಾನ ನಿಖಾಯದ ಎಲ್ಲ ಸ್ನಾತಕ ಕೋರ್ಸುಗಳ ರಾಷ್ಟ್ರೀಯ ಶಿಕ್ಷಣ ನೀತಿ
(NEP)-2020 ರಂತೆ 3 ಮತ್ತು 4ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗಾಗಿ ವಿಶೇಷ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ
ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಪ್ರಕಟಪಡಿಸಿದ್ದು, ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. www.kud.ac.in ಅಂತರ್ಜಾಲದಿಂದ ಡೌನ್‌ಲೋಡ
ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತಾ, ವಿದ್ಯಾರ್ಥಿಗಳು ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ ತಂದು ಅದರಂತೆ
ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ / ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ ಸೂಚಿಸಲಾಗಿದೆ.

ಅಡಕ: ಮೇಲಿನಂತೆ

Kud-2022/9/23
ಕುಲಸಚಿವರು.

ಗೆ,

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ
ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಮಂಡಳ (ಪಿ.ಜಿ.ಪಿ.ಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ
ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.



KARNATAK UNIVERSITY, DHARWAD

B.Sc. (Hons) Programme

DRAFT SYLLABUS FOR

MICROBIOLOGY

DISCIPLINE SPECIFIC COURSE (DSCC), OPEN ELECTIVE COURSE

(OEC) FOR SEM III & IV

UNDER

NATIONAL EDUCATION POLICY (NEP)

Effective from 2022-23

Karnatak University, Dharwad

B.Sc. Semester-III

Subject: Microbiology

Discipline Specific Course (DSCC)

Course No.MCB103T

Title of the Course: Microbial Diversity (Theory)

The course Microbiology in III semester has two papers (Theory Paper-I for 04 credits & Practical Paper-II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.

Course No./ Course code	Type of Course	Theory/Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours/Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
MCB103T/033MCB011	DSCC	Theory	04	04	56hrs.	2hrs	40	60	100

Course Outcome(CO):

After completion of course(Theory), students will be able to:

CO1: Knowledge about microbes and their diversity

CO 2: Study, characters, classification and economic importance of Prokaryotic and Eukaryotic microbes

CO 3: Knowledge about viruses and their diversity

GEN103T: Microbial Diversity (Theory)		Total Hrs:56
Unit-I		14hrs
Biodiversity and Microbial Diversity: Concept, definition, and levels of biodiversity; Biosystematics – Major classification systems- Numerical and Chemotaxonomy. Study and measures of microbial diversity; Conservation and Economic values of microbial diversity.		
Unit-II		14hrs
Diversity of Prokaryotic Microorganisms: General characters; Classification; Economic importance; Distribution and factors regulating distribution. Bacteria and Archaea: An overview of Bergey's Manual of Systematic Bacteriology. Escherichia coli, Bacillus subtilis, Staphylococcus aureus. Cyanobacteria- Nostoc, Microcystis Spirulina . Thermus aquaticus, Methanogens Actinomycetes: Streptomyces, Nocordia, Frankia. Rickettsiae- Rickettsia rickettsi Chlamydiae – Chlamydia trachomatis and Spirochaetes- Trepanema pallidum		

Unit-III	14hrs
<p>Diversity of Eukaryotic Microorganism: General characters; Classification and Economic importance</p> <p>Fungi: Ainsworth classification- detailed study up to the level of classes, Salient features and reproduction. Type study: <i>Rhizopus</i>, <i>Saccharomyces</i>, <i>Aspergillus</i>, <i>Agaricus</i>, <i>Fusarium</i></p> <p>Algae: Occurrence, distribution, and symbiotic association- Lichen; thallus organization and types. Type study: <i>Chlorella</i>, <i>Cosmarium</i>, Diatoms, <i>Gracilaria</i>,</p> <p>Protozoa: Classification up to the level of classes. Type study: <i>Amoeba</i>, <i>Euglena</i>, <i>Trichomonas</i>, <i>Paramecium</i>, <i>Trypanosoma</i></p>	
Unit-IV	14hrs
<p>Diversity of Virus: General properties and structure, Isolation and purification and assay of virus. Principles of Viral Taxonomy- Baltimore and ICTV and the recent trends. Capsid symmetry- Icosahedral, helical, complex</p> <p>Animal Viruses: HIV, Corona, Ortho and paramyxovirus, Oncogenic virus</p> <p>Plants viruses: TMV, Ring spot virus</p> <p>Microbial Viruses: T4/T7/lambda/cyano/mycophages.</p>	

Books recommended:

1. Black, J.G. 2002. Microbiology-Principles and Explorations. John Wiley and Sons, Inc. New York
2. Brock, T.D. and Madigan, M.T. 1988. Biology of Microorganisms, V Edition. Prentice Hall. New Jersey
3. Dimmock, N. J., Easton, A. J., and Leppard, K. N. 2001. Introduction to Modern Virology. 5th edn. Blackwell publishing, USA
4. Flint, S.J., Enquist, L.W., Drug, R.M., Racaniello, V.R. and Skalka, A.M. 2000. Principles of Virology- Molecular
5. Biology, Pathogenesis and Control. ASM Press, Washington, D.C
6. Prescott, Harley, Klein's Microbiology, J.M. Willey, L.M. Sherwood, C.J. Woolverton, 7th International, edition 2008, McGraw Hill
7. Vashishta B.R, Sinha A.K and Singh V. P. Botany – Fungi 2005, S. Chand and Company Limited, New Delhi
8. Kotpal R.L Protozoa 5th Edition 2008, Rastogi Publications, Meerut, New Delhi.
9. Brock Biology of Microorganisms, M.T. Madigan, J.M. Martinko, P. V. Dunlap, D. P. Clark- 12th edition, Pearson International edition 2009, Pearson Benjamin Cummings
10. Microbiology – An Introduction, G. J. Tortora, B. R. Funke, C. L. Case, 10th ed. 2008, Pearson Education
11. General Microbiology, Stanier, Ingraham et al, 4th and 5th edition 1987, Macmillan education limited

B.Sc.Semester-III

Subject: Microbiology

Discipline Specific Course (DSCC)

Course No.-MCB1033P

Title of the Course: Microbial Diversity (Practical)

CourseNo.	TypeofC ourse/ course code	Theory /Practica l	Credits	Instruction hourperwee k	Total No. ofLectures/Hours /Semester	Duration of Exam	FormativeA ssessmentM arks	Summative Assessme ntMarks	Total Marks
MCB1033P / 033MCB012	DSCC	Practical	02	04	52hrs	3hrs	25	25	50

Course Outcome(CO):

After completion of course(Practical), students will be able to:

CO1: Isolate microbes from different sources

CO 2:phenotypethe microbes by staining and microscopic observation

CO 3:Micrometry for scoring microbial cell dimensions

ListoftheExperimentsfor52hrs/Semesters

1. Study of morphology of bacteria
2. Isolation of bacteria from soil
3. Isolation of bacteria from air and water
4. Isolation of fungi from soil
5. Isolation of fungi from air and water
6. Cultivation of Cyanobacteria
7. Cultivation of Actinomycetes
8. Measurement of microbial cell size by Micrometry
9. Cyanobacteria Nostoc, Microcystis, Spirulina
10. Study of Algae-Chlorella, Diatoms, Gracilaria
11. Study of Fungi-Rhizopus, Saccharomyces, Agaricus
12. Study of Protozoa-Amoeba, Paramecium, Euglena
13. Study of Photographs or Models
14. HIV, TMV, Corona virus T4Phage
15. Paramyxovirus Oncogenic viruses

**Other practical may be added according to requirement and feasibility*

General instructions:

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination

1. Major Question ----- 6 Marks
2. Minor Question ----- 4 Marks
3. Identification (A-E) ----- 8 Marks
4. Viva ----- 2 Marks
5. Journal ----- 5 Marks

Total 25 marks

Note: Same Scheme may be used for IA (Formative Assessment) examination

B.Sc.Semester-III

Subject: Microbiology

Open Elective Course (OEC)

(OEC for other students)

Course No.: MCB103E

Title of the Course: Microbial Entrepreneurship

CourseNo. / Course code	TypeofCourse	Theory /Practical	Credits	Instruction hourperweek	Total No. ofLectures/Hours /Semester	Duration of Exam	FormativeAssessmentMarks	Summative Assessment Marks	Total Marks
MCB103E 003MCB051	OEC	Theory	03	03	42hrs	2hrs	40	60	100

Course Outcome(CO):

After completion of course ,students will be able to:

CO1:Demonstrate entrepreneurial skills

CO2:Acquire knowledge industrial entrepreneurship

CO3:Acquire knowledge about Healthcare Entrepreneurship

GEN103EMicrobial Entrepreneurship	Total Hrs:42
Unit-I	14hrs
General Entrepreneurship: Entrepreneurship and microbial entrepreneurship - Introduction and scope, Business development, product marketing, HRD, Biosafety and Bioethics, IPR and patenting, Government organization/ institutions/ schemes, Opportunities and challenges	
Unit-II	14hrs
Industrial Entrepreneurship: Microbiological industries – Types, processes and products, Dairy products, Fermented foods, Bakery and Confectionery, Alcoholic products and Beverages, Enzymes – Industrial production and applications. Biofertilizers and Biopesticides, SCP (Mushroom and Spirulina) etc.	
Unit-III	14hrs
Healthcare Entrepreneurship: Production and applications: Sanitizers, Antiseptic solutions, Polyphenols (Flavonoids),Alkaloids, Cosmetics, Biopigments and Bioplastics, vaccines, Diagnostic tools and kits.	

Books recommended:

1. Srilakshmi B, (2007), Dietetics. New Age International publishers. New Delhi
2. Srilakshmi B, (2002), Nutrition Science. New Age International publishers. New Delhi
3. Swaminathan M. (2002), Advanced text book on food and Nutrition. Volume I. Bappco
4. Gopalan.C.,RamaSastry B.V., andFoods.NIN.ICMR.Hyderabad. S.C.Balasubramania n (2009),Nutritive value of India
5. Mudambi S R and Rajagopal M V, (2008), Fundamentals of Foods, Nutrition & diet therapy by New Age International Publishers, New Delhi

**Details of Formative assessment (IA) for DSCC
theory/OEC:40%weightagefortotalmarks**

Pedagogy: Lecture, Assignments, Interactive Sessions, ICT, Group Discussion

Formative Assessment 40 (Weightage in Marks includes: Written Tests, Activities/Assignment/Seminar/Presentation & Attendance)			
Assessment Occasion/type	C1	C2	Total Marks
Written Test (2)	10	10	20
Seminar/Presentation/ Activity	10	---	10
Case work/Assignment/Field work/Project work etc	---	10	10
Total	20	20	40

**Faculty of Science
04-Year UG Honors programme: 2021-22**

**GENERAL PATTERN OF THEORY QUESTION PAPER FOR DSCC/OEC
(60 marks for semester end Examination with 2 hrs duration)**

Part-A

1. Question number 1-06 carries 2 marks each. Answer any 05 questions :10 marks

Part-B

2. Question number 07-11 carries 05 Marks each. Answer any 04 questions :20 marks

Part-C

3. Question number 12-15 carries 10 Marks each. Answer any 03 questions: 30 marks (Minimum 1 question from each unit and 10 marks question may have subquestions for 7+3 or 6+4 or 5+5 if necessary)

Total: 60 Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.

B.Sc.Semester–IV

Subject: Microbiology

Discipline Specific Course (DSCC)

CourseNo.: MCB104T

Title of the Course: Microbial Enzymology and Metabolism
(Theory)

The course Human Genetics and Genetic Counselling in IV semester has two papers (Theory Paper –I for 04 credits & Practical paper-II for 2 credits) for 06 credits: Both the papers are compulsory. Details of the courses are as under.

CourseNo. / Course code	Type of Course / course code	Theory / Practical	Credits	Instruction hour per week	Total No. of Lectures/Hours / Semester	Duration of Exam	Formative Assessment Marks	Summative Assessment Marks	Total Marks
MCB104T / 034MCB011	DSCC	Theory	04	04	56hrs	2hrs	40	60	100

Course Outcome(CO):

After completion of course (Theory), students will be able to:

- CO1:** Differentiating concepts of chemoheterotrophic metabolism and chemolithotrophic metabolism.
- CO2:** Describing the enzyme kinetics, enzyme activity and regulation
- CO3:** Differentiating concepts of aerobic and anaerobic respiration and how these are manifested in the form of different metabolic pathways in microorganisms

Syllabus-Course4(Theory): Microbial Enzymology and Metabolism	Total Hrs:56
Unit-I	14hrs
<p>Metabolism of Carbohydrates: Chemoheterotrophic Metabolism- Anaerobic respiration and fermentation. Concept of aerobic respiration, anaerobic respiration and fermentation. Sugar degradation pathways i.e. EMP, ED, Pentose phosphate pathway, Phosphoketolase pathway. TCA cycle.</p> <p>Fermentation - Fermentation balance, concept of linear and branched fermentation pathways. Fermentation pathways: Alcohol fermentation and Pasteur effect; Butyric acid and Butanol- Acetone Fermentation, Mixed acid and 2,3-butanediol fermentation, Propionic acid Fermentation (Succinate pathway and Acrylate pathway), acetate Fermentation Chemolithotrophic Metabolism: Chemolithotrophy - Hydrogen oxidation, Sulphur oxidation, Iron oxidation, Nitrogen oxidation.</p> <p>Anaerobic respiration with special reference to dissimilatory nitrate reduction and sulphate reduction</p>	

Unit-II	14hrs
<p>Metabolism of aminoacids, nucleotides and lipids</p> <p>1. Nitrogen Metabolism Introduction to biological nitrogen fixation Ammonia assimilation. Assimilatory nitrate reduction, dissimilatory nitrate reduction, denitrification</p> <p>2. Biosynthesis of ribonucleotides and deoxyribonucleotides The de novo pathway. Regulation by feedback mechanisms. Recycling via the salvage pathway</p> <p>3. Amino acid degradation and biosynthesis</p> <p>4. Lipid degradation and biosynthesis</p> <p>5. Metabolism of one carbon compounds: Methylootrophs :i. Oxidation of methane, methanol, methylamines; ii. Carbon assimilation in methylootrophic bacteria and yeasts Methanogens: i. Methanogenesis from H₂, CO₂, CHOH, HCOOH, methylamines; ii. Energy coupling and biosynthesis in methanogenic bacteria Acetogens: Autotrophic pathway of acetate synthesis</p> <p>6. Metabolism of two-carbon compounds: Acetate: i. Glyoxylate cycle. Acetic acid bacteria: Ethanol oxidation, sugar alcohol oxidation. Glyoxylate and glycolate metabolism: i.Dicarboxylic acid cycle, ii. Glycerate pathway iii. Beta hydroxyaspartate pathway Oxalate as carbon and energy source</p>	
Unit-III	14hrs
<p>Basics of Enzymes: Definitions of terms – enzyme unit, specific activity and turnover number, exo/ endoenzymes, constitutive/ induced enzymes, isozymes. Monomeric, Oligomeric and Multimeric enzymes.</p> <p>Multienzyme complex: pyruvate dehydrogenase; isozyme: lactate dehydrogenase. Ribozymes, abzymes</p> <p>Structure of enzyme: Apoenzyme and cofactors, prosthetic group-TPP, coenzyme, NAD, metal cofactors.</p> <p>Classification of enzymes, Mechanism of action of enzymes: active site, transition state complex and activation energy. Lock and key hypothesis and Induced Fit hypothesis. Multi substrate reactions -Ordered, Random, Ping-pong.</p> <p>Enzyme catalysis:Catalytic mechanisms with type examples, catalytic mechanisms and testing-Serine proteases and Lysozyme</p>	
Unit-IV	14hrs
<p>Enzyme Kinetics and Regulation: Enzyme Kinetics: Kinetics of one substrate reactions. i. Equilibrium assumptions ii. Steady state assumptions iii. Lineweaver-Burk, Hanes-Woolf, Eadie-Hofstee equations and plots. Kinetics of enzyme inhibition. Competitive, non-competitive and uncompetitive inhibition.Effect of changes in pH and temperature on enzyme catalysed reaction. Kinetics of two substrate reactions. Presteady state kinetics. Kinetics of immobilized enzymes</p> <p>Enzyme regulation:Allosteric enzyme - general properties, Hill equation, KoshlandNemethy and Filmer model, Monod Wyman and Changeux model. Covalent modification by various mechanisms. Regulation by proteolytic cleavage - blood coagulation cascade. Regulation of multi- enzyme complex- Pyruvate dehydrogenase. Feedback inhibition.HIV enzyme inhibitors and drug design</p>	

Books recommended:

1. Philipp. G. Manual of Methods for General Bacteriology.
2. David T. Plummer. An Introduction to Practical Biochemistry
3. Biochemistry- A Problem Approach, Wood W. B. Wilson J.H., Benbow R.M. and Hood L.E. 2nd ed., 1981, The Benjamin/ Cummings Pub.co
4. Biochemical calculations, Segel I.R., 2nd ed., 2004, John Wiley and Sons
5. Biochemical Calculations, Irwin H. Segel, 2nd Edition John Wiley & Sons

B.Sc. Semester – IV
Subject: Microbiology
Discipline Specific Course (DSCC)
Course No: MCB104P
Course Name: (Practical)

CourseNo. / Course code	TypeofCourse	Theory /Practical	Credits	Instruction hourperweek	Total No. ofLectures/Hours/Semester	Duration ofExam	FormativeAssessment Marks	Summative Assessment Marks	Total Marks
MCB104P /034MCB012	DSCC	Practical	02	04	52hrs.	3hrs	25	25	50

Course Outcome(CO):

After completion of course (Practical), students will be able to:

CO 1 : To perform biochemical estimations

CO 2 : Understand the process of fermentation for alcohol production

CO 3 : analyze effect of various factors on enzyme reactions

ListoftheExperimentsfor52hrs./Semesters

1. Handling of micropipettes and checking their accuracy
2. Isolation of cholesterol and lecithin from egg yolk
3. Identification of fatty acids and other lipids by TLC/GC
4. Determination of degree of unsaturation of fats and oils
5. Isolation of lactose from bovine milk
6. Estimation of total sugars by the phenol-sulphuric acid method
7. Estimation of DNA - DPA method & UV absorbance method
8. Estimation of RNA (Orcinol method)
9. Isolation of glutamic acid from gluten
10. Determination of molar absorption coefficient (ϵ) of l-tyrosine
11. Determination of the isoelectric point of the given protein
12. Estimation of polyphenols/ tannins by Folin- Denis method
13. Chemotaxis of Pseudomonas
14. Demonstration of alcoholic fermentation
15. Effect of variables on enzyme activity (amylase): a. Temperature b. pH c. substrate concentration d. Enzyme concentration e. Determination of K_m of amylase (Lineweaver-Burke plot; Michaelis- Menton graph)

General instructions:

Scheme of Practical Examination (distribution of marks): 25 marks for Semester end examination

1. Major Question ----- 6Marks
2. Minor Question ----- 4Marks
3. Identification(A-E) ----- 8Marks
4. Viva ----- 2Marks
5. Journal ----- 5Marks

Total 25 marks

Note: Same Scheme may be used for IA (Formative Assessment) examination

Books recommended :

1. Satyanarayana, U. (2021). *Biochemistry, 6e-E-book*. Elsevier Health Sciences.
2. Walker, J. M. (2000). *Principles and techniques of practical biochemistry*. Cambridge University Press.
3. Mu, P., & Plummer, D. T. (2001). *Introduction to practical biochemistry*. Tata McGraw-Hill Education.
4. Chawla, R. (2014). *Practical clinical biochemistry: methods and interpretations*. JP Medical Ltd.
5. Wilson, K., Hofmann, A., Walker, J. M., & Clokie, S. (Eds.). (2018). *Wilson and Walker's principles and techniques of biochemistry and molecular biology*. Cambridge University Press.
6. Jain, A., Jain, R., & Jain, S. (2020). *Basic techniques in biochemistry, microbiology and molecular biology* (pp. 9-10). New York, NY, USA: :

B.Sc.Semester-IV

Subject: Microbiology

Open Elective Course (OEC for other students)

Course No.: MCB104E

Title of the Course: Human Microbiome

CourseNo /Course code	TypeofCourse /Course code	Theory /Practical	Credits	Instruction hourperweek	Total No. ofLectures/Hours/ Semester	Duration ofExam	FormativeAssessment Marks	Summative Assessment Marks	Total Marks
MCB104E / 004MCB051	OEC	Theory	03	03	42hrs.	2hrs	40	60	100

Course Outcome(CO):

After completion of course, students will be having basic knowledge of:

CO 1 : Articulate a deeper understanding on biological complexities of human micro biome.

CO 2 : Understand broader goals of biological anthropology

CO3: Compare and contrast the microbiome of different human body sites and impact human health promotion

Syllabus-OEC4:Title-HumanMicrobiome	Total Hrs:42
Unit-I	14hrs
Introduction to microbiome: Evolution of microbial life on Earth, Symbiosis host-bacteria . Microbial association with plants and animals, Symbiotic and parasitic, Normal human microbiota and their role in health. Microbiomes other than digestive system.	
Unit-II	14hrs
Microbiomes and human health: Microbiome in early life, Nutritional modulation of the gut microbiome for metabolic health- role of gut microbiomes in human obesity, human type 2 diabetes and longevity. Probiotics: Criteria for probiotics, Development of Probiotics for animal and human use; Pre and synbiotics. Functional foods-health claims and benefits, Development of functional foods.	
Unit-III	14hrs
Culturing of microbes from microbiomes: Culturing organisms of interest from the microbiome-bacterial, archaeal, fungal, and yeast, viral.Extracting whole genomes from the microbiome to study microbiome diversity Microbiomes and diseases: Microbiome and disease risks: The gut microbiome and host immunity, bacteriocins and other antibacterials. Human microbiome research in nutrition	

Books recommended :

1. Fundamentals of Microbiome Science – how microbes shape animal biology, Princeton University Press, New Jersey, United States. Rob DeSalle and Susan L. Perkins (2015).
2. Welcome to the microbiome. getting to know the trillions of bacteria and other microbes in, on, and around you. Yale University Press. Suggested Readings Rodney Dietert (2016).
3. The Human Superorganism: how the microbiome is revolutionizing the pursuit of a healthy life. Dutton Books. Justin Sonnenburg and Erica Sonnenburg (2014).
4. The good gut: taking control of your weight, your mood, and your long-term health. Penguin Press. Emeran Mayer (2016).
5. The Mind-Gut Connection: How the Astonishing Dialogue Taking Place in Our Bodies Impacts Health, Weight, and Mood. eBook, Harper Wave Books. Martin J. Blaser (2014).
6. Cox, L.M., et al., Altering the intestinal microbiota during a critical developmental window has lasting metabolic consequences. *Cell*, 2014. 158(4): p. 705-21.
7. Douglas, A., Fundamentals of Microbiome Science: How Microbes Shape Animal Biology. 2018, 41 William Street, Princeton, New Jersey 08540: Princeton University Press.
8. HMP,C., Structure, function and diversity of the healthy human microbiome. *Nature*, 2012. 486(7402):p.207-14.
9. Diaz Heijtz, R., et al., Normal gut microbiota modulates brain development and behavior. *Proc Natl Acad Sci U S A*, 2011. 108(7): p. 3047-52.
10. Sonnenburg, E.D., et al., Diet-induced extinctions in the gut microbiota compound over generations. *Nature*, 2016. 529(7585): p. 212-5.
11. Zou, J., et al., Fiber-Mediated Nourishment of Gut Microbiota Protects against Diet-Induced Obesity by Restoring IL-22-Mediated Colonic Health. *Cell Host Microbe*, 2018. 23(1): p. 41-53 e4.
12. Yassour, M., et al., Strain-level analysis of mother-to-child bacterial transmission during the first few months of life. *Cell Host Microbe*, 2018. 24(1): p. 146-154 e4. *Microbiomes and Health – 11:680:475*
13. Dominguez-Bello, M.G., et al., Partial restoration of the microbiota of cesarean-born infants via vaginal microbial transfer. *Nat Med*, 2016. 22(3): p. 250-3.
14. Moeller, A.H., et al., Rapid changes in the gut microbiome during human evolution. *Proc Natl Acad Sci U S A*, 2014. 111(46): p. 16431-5.
15. Prescott's Microbiology, 11th Edition By Joanne Willey and Kathleen Sandman and Dorothy Wood
16. Henderson Gemma et al. (2015), Rumen microbial community composition varies with diet and host, but a core microbiome is found across a wide geographical range, *Scientific Reports*,
17. Salle, A.J. (1992). *Fundamental Principles of Bacteriology*. 7th Edition, Mc. Graw Hill Publishing Co. Ltd., NewYork.

**Details of Formative assessment (IA)for DSCC
theory/OEC:40%weightagefortotalmarks**

Pedagogy: Lecture, Assignments, Interactive Sessions, ICT, Group Discussion

Formative Assessment 40 (Weightage in Marks includes: Written Tests, Activities/Assignment/Seminar/Presentation &Attendance)			
Assessment Occasion/type	C1	C2	Total Marks
Written Test (2)	10	10	20
Seminar/Presentation/ Activity	10	---	10
Case work/Assignment/Field work/Project work etc	---	10	10
Total	20	20	40

**FacultyofScience
04-YearUGHonorsprogramme:2021-22**

**GENERALPATTERNOFTHEORYQUESTIONPAPERFOR DSCC/OEC
(60marksforsemesterendExaminationwith2hrsduration)**

Part-A

1. Questionnumber1-06carries2markseach.Answerany05questions :10marks

Part-B

2. Questionnumber07-11carries05Markseach.Answerany04questions :20marks

Part-C

3. Questionnumber12-15carries10Markseach.Answerany03questions
:30marks

(Minimum1questionfromeachunitand10marksquestionmayhavesub
questionsfor7+3or6+4or5+5ifnecessary)

Total:60Marks

Note: Proportionate weightage shall be given to each unit based on number of hours prescribed.
