

CAUVERYCOLLEGE FOR WOMEN(AUTONOMOUS)

Nationally Accredited with 'A' Grade by NAAC

ISO 9001:2015 Certified

TIRUCHIRAPPALLI

PG AND RESEARCH DEPARTMENT OF MICROBIOLOGY



B.Sc., MICROBIOLOGY

SYLLABUS

2023 -2024 and Onwards



**CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS)
PG AND RESEARCH DEPARTMENT OF MICROBIOLOGY**

VISION

Our vision is to encourage eminent research work through the conception of an attractive and vibrant environment to achieve goals of our department.

MISSION

- To impart relevant, ultimate, principle-oriented education and practical expertise in the field of Microbiology.
- To strive to provide quality education conjugated with innovative technology so as to be able to gain technical and educational expertise locally, nationally, internationally.
- Our prime focus is to enrich the ambitions of our students, staff and steer with constructive collaboration towards excellence.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs	Statements
PEO1	LEARNING ENVIRONMENT To facilitate value-based holistic and comprehensive learning by integrating innovative learning practices to match the highest quality standards and train the students to be effective leaders in their chosen fields.
PEO2	ACADEMIC EXCELLENCE To provide a conducive environment to unleash their hidden talents and to nurture the spirit of critical thinking and encourage them to achieve their goal.
PEO3	EMPLOYABILITY To equip students with the required skills in order to adapt to the changing global scenario and gain access to versatile career opportunities in multidisciplinary domains.
PEO4	PROFESSIONAL ETHICS AND SOCIAL RESPONSIBILITY To develop a sense of social responsibility by formulating ethics and equity to transform students into committed professionals with a strong attitude towards the development of the nation.
PEO5	GREEN SUSTAINABILITY To understand the impact of professional solutions in societal and environmental contexts and demonstrate the knowledge for an overall sustainable development.

PROGRAMME OUTCOMES FOR B.Sc., MICROBIOLOGY PROGRAMME

PONO.	On completion of B.Sc., Microbiology, the students will be able to
PO1	Academic Excellence and Competence: Elicit firm fundamental knowledge in theory as well as practical for coherent understanding of academic field to pursue multi and inter disciplinary science careers in future.
PO2	Holistic and Social approach: Create novel ideas related to the scientific research concepts through advanced technology and sensitivity towards sustainable Environmental practices as well as social issues.
PO3	Professional ethics and Team Work: Explore professional responsibility through projects, internships, field trip/industrial visit and mentorship Programmes to transmit communication skills.
PO4	Critical and Scientific thinking: Equip training skills in Internships, Research Projects to do higher studies in multidisciplinary path with higher level of specialization to become professionals of high-quality standards.
PO5	Social Responsibility with ethical values: Ensure ethical, social and holistic values in the minds of learners and attain ender parity for building a healthy nation.

PROGRAMME SPECIFIC OUTCOMES FOR B.Sc., MICROBIOLOGY

PSO NO.	Students of B.Sc., Microbiology will be able to	Pos Addressed
PSO1	Improve their knowledge on the basic concepts for retaining competence and confidence which enables them to develop interest in the new arena of Microbiology	PO1, PO5
PSO2	Acquire expertise in practical work within dependent equipment Handling skill along with collection and interpretation of scientific data	PO2, PO3
PSO3	Legitimize knowledge by emerging multiple aspects of current research.	PO3, PO5
PSO4	Pursue the importance of substantial original Research to meet the current and future expectation.	PO4, PO1
PSO5	Beware of the ethical issues for the benefit of the society by adding skilled scientific work for across the country.	PO5, PO2



Cauvery College for Women (Autonomous)

PG & Research Department of Microbiology B.Sc., Microbiology

Learning Outcome Based Curriculum Framework (CBCS-LOCF)

(For the Candidates admitted from the Academic year 2023-2024 and onwards)

Semester	Part	Course	Title	Course Code	Inst. Hrs.	Credits	Exam			Total
							Hrs.	Marks		
								Int	Ext	
I	I	Language Course-I (LC) Tamil / other languages	பொதுத்தமிழ் - I	23ULT1	6	3	3	25	75	100
			Poetry, Grammar and History of Sanskrit Literature	23ULS1						
			Hindi Ka Samanya Gyan aur Nibandh	22ULH1						
			Foundation Course: PaperI- French-I	22ULF1						
	II	English Language Course- I (ELC)	General English -I	23UE1	6	3	3	25	75	100
	III	Core Course – I (CC)	Fundamentals of Microbiology and Microbial Diversity	23UMB1CC1	5	5	3	25	75	100
		Core Practical - I (CP)	Fundamentals of Microbiology and Microbial Diversity (P)	23UMB1CC1P	3	3	3	40	60	100
		First Allied Course- I (AC)	Biochemistry I	23UMB1AC1	4	3	3	25	75	100
		First Allied Course- II (AC)	Biochemistry I (P)	23UMB1AC1P	4	3	3	40	60	100
	IV	Ability Enhancement Compulsory Course-I (AECC)	UGC JeevanKaushal life skills - Value Education	23UGVE	2	2	-	100	-	100
	TOTAL			30	22				700	
II	I	Language Course- II (LC)Tamil / Other languages	பொதுத்தமிழ்- II	23ULT2	6	3	3	25	75	100
			Prose, Grammar and History of Sanskrit literature	23ULS2						
			Hindi Literature & Grammar -II	22ULH2						
			Basic French-II	22ULF2						
	II	English Language Course- II (ELC)	General English - II	23UE2	6	3	3	25	75	100
	III	Core Course – II (CC)	Microbial Physiology	23UMB2CC2	4	4	3	25	75	100
		Core Course -III (CC)	Molecular Biology	23UMB2CC3	3	3	3	25	75	100
		Core Practical - II (CP)	Microbial Physiology and Molecular Biology (P)	23UMB2CC2P	4	3	3	40	60	100
		First Allied Course – III (AC)	Biochemistry II	23UMB2AC2	3	3	3	25	75	100
		Ability Enhancement Compulsory Course-II (AECC)	Environmental Studies	22UGEVS	2	2	-	100	-	100
IV	Ability Enhancement Compulsory Course-III (AECC)	Innovation and Entrepreneurship	22UGIE	2	1	-	100	-	100	
	Extra Credit Course	SWAYAM	As Per UGC Recommendation							
	TOTAL			30	22				800	

Semester: I	Internal Marks : 25		External Marks : 75	
COURSE CODE	COURSE TITLE	CATEGORY	Hrs./ Week	CREDITS
23UMB1CC1	FUNDAMENTALS OF MICROBIOLOGY AND MICROBIAL DIVERSITY	CORE	5	5

Course Objective

- This subject aims to introduce the history and development of Microbiology. The contents of this course will help students understand history, biology of microorganisms, growth and control of microbes.
- Thus, the beginners are rightly exposed to foundation of Microbiology which would lead them towards progressive advancement of the subject.

Course Outcome and Cognitive level Mapping

CO Number	CO Statement	Cognitive level
CO 1	Remember and understand the Development of Microbiology	K1, K2
CO 2	Analyze the Size and Shape of Microorganisms using Microscope	K3
CO 3	Evaluate the knowledge about Bacteria and Viruses	K4
CO 4	Compare the various Preservation Methods for preserving Microbes.	K5
CO 5	Summarize various modes of classification of microbes	K5

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	1	2	3	3	3	3	2	3
CO2	3	2	3	3	2	2	3	2	3	3
CO3	3	2	2	3	3	3	2	3	3	2
CO4	2	3	3	2	3	3	3	2	3	2
CO5	3	3	2	3	2	3	3	3	2	2

“1” – Slight (Low) Correlation

“3” – Substantial (High) Correlation

“2” – Moderate (Medium) Correlation

“-” indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	History and scope of Microbiology - Contributions of Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Flemming. Role of microorganisms in fermentation, Germ theory of disease, Development of various microbiological techniques and golden era of microbiology. Microscopy: Principles and applications of bright field, dark field, phase contrast, fluorescent SEM and TEM.	15	CO1, CO2, CO3, CO4, CO5.	K1, K2, K3, K4, K5.
II	General characteristics of cellular microorganisms (Bacteria, Algae, Fungi and Protozoa) and acellular microorganisms - (Viruses, Viroids, Prions), Differences between prokaryotic and eukaryotic microorganisms. Structure of Bacterial cell wall, cell membrane, capsule, flagella, pili, mesosomes, spores, and gas vesicles.	15	CO1, CO2, CO3, CO4, CO5.	K1, K2, K3, K4, K5.
III	Sterilization: Principles and methods – physical methods- moist heat, dry heat, filtration and media preparation. Cultivation of microbes- Types of culture media-Stab, slant, broth, semisolid, solid media. Aerobic and Anaerobic culture techniques- Pure culture techniques – Maintenance and preservation of microbes. Principles and types of staining– Simple, differential, Capsule staining.	15	CO1, CO2, CO3, CO4, CO5.	K1, K2, K3, K4, K5.
IV	Introduction to microbial biodiversity-. Classification – Three kingdom, five kingdom, six kingdom and eight kingdom. Ecological niche. Basic concepts of Eubacteria, Archaeobacteria and Eucarya. Conservation biodiversity	15	CO1, CO2, CO3, CO4, CO5.	K1, K2, K3, K4, K5.
V	International codes of nomenclature. Binomial nomenclature – species concept – Kingdom, division, class, order, family, and genus. Principles of classification – morphological, physiological biochemical basis of classification. Molecular basis of classification – chemotaxonomy & numerical taxonomy.	15	CO1, CO2, CO3, CO4, CO5.	K1, K2, K3, K4, K5.

VI	Self Study for Enrichment (Not to be included for External Examination) Microscopic operations, Criteria for Classification of Microorganisms, cellular organizations, Isolation and identification of Microorganisms,	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
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Text Books

1. Dubey RC and Maheswari DK. (2015). *A Text Book of Microbiology*. 5th Edition. SChand, NewDelhi.
2. Ananthanarayan Paniker (2020). *A Text book of Microbiology*. 11th Edition. University Press. Singapore.
3. Madigan MT, Martinko JM, and Parker J. (2019). *Biology of Microorganisms*. 12th Edition, MacMillan Press. England.
4. Pelczar MJ, Chan ECS and Kreig NR. (2015). *Microbiology*, 5th edition. McGraw-Hill. BookCo. Singapore.
5. Atlas RA and Bartha R. (2019). *Microbial Ecology. Fundamentals and Application*. 4th edition Benjamin Cummings, New York.

Reference Books

1. Prescott L. M, Harley, J.P. and Helin, D.A. (2017). *Microbiology*, 5th Edition. McGraw Hill.
2. Tortora GJ, Funke BR and Case CL. (2020). *Microbiology: An Introduction*. 9th Edition, Pearson Education, Singapore.
3. Black JG. (2018). *Microbiology-principles and explorations*, 6th edition. John Wiley and Sons, Inc. New York.
4. Moselio Schaechter and Joshua Leaderberg (2019). *The Desk encyclopedia of Microbiology*. 2nd edition. Elsevier Academic press, California.
5. Madigan MT, Martinko JM, and Parker J. (2019). *Biology of Microorganisms*, 12th Edition. MacMillan Press, England.

Web Reference

1. <https://microbenotes.com/history-of-microbiology/>
2. <https://byjus.com/biology/prokaryotic-and-eukaryotic-cells/>
3. <https://byjus.com/biology/archaeobacteria/>
4. <https://thebiologynotes.com/sterilization-physical-and-chemical-methods/>
5. <https://microbenotes.com/microbiology-of-extreme-environments/>

Pedagogy

Chalk and talk, PPT, Discussion, Assignment, Demo, Quiz, Seminar.

Course Designer

Dr.P.Bhuvaneswari

Semester : I	Internal Marks: 40		External Marks: 60	
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
23UMB1CC1P	FUNDAMENTALS OF MICROBIOLOGY AND MICROBIAL DIVERSITY (P)	CORE PRACTICAL	3	3

Course Objective

- To understand the rules and procedures to be observed in a laboratory.
- To know and familiarize with equipment and apparatus used in microbiology practical exercises.
- To familiarize and understand the parts and use of microscopes.
- To appreciate the abundance and diversity of microorganisms in different habitats

Course Outcome and Cognitive Level Mapping

On the successful completion of the course, students will be able to

CO Number	CO Statement	Cognitive Level
CO1	Recall the safety practice in microbiological laboratory	K1
CO2	Demonstrate the pure culture technique	K2
CO3	Develop the microscopic techniques and staining methods	K3
CO4	Determine about preparation of different media	K4
CO5	Discuss different microorganisms in different media	K6

Mapping of CO with PO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	2	3	3	3	3	3	3	2	3
CO2	2	3	2	2	2	3	3	2	3	3
CO3	3	2	3	3	2	2	3	3	3	2
CO4	3	3	3	3	3	3	3	2	2	3
CO5	2	3	2	2	3	3	2	3	2	2

“1”–Slight (Low) Correlation

“2” – Moderate(Medium) Correlation

“3”–Substantial (High) Correlation

“-“indicates there is no correlation

Syllabus

1. Cleaning of glass wares, Microbiological good laboratory practice and safety. Sterilization and assessment of sterility – Autoclave, hot air oven, and membrane filtration.
2. Media preparation: liquid media, solid media, semi-solid media, agar slants and agar plates.
3. Preparation of basal, differential, enriched, enrichment, transport, and selective media preparation-quality control of media, growth supporting properties, sterility check of media.
4. Pure culture techniques: Spread plate, streak plate and pour plate, decimal dilution.
5. Culture characteristics of microorganisms: growth on different media, growth characteristics, and description. Demonstration of pigment production.
6. Microscopy: light microscopy and bright field microscopy.
7. Staining techniques: smear preparation, simple staining, Gram's staining and endospore staining.
8. Study on Microbial Diversity using Hay Infusion Broth-Wet mount to show different types of microbes, hanging drop method.

Text Books

1. Saha, R (2022).Microbiology Practical Manual (2nd edition) CBS Publishers & Distributors Pvt. Ltd. India.
2. Das, S (2020).Microbiology Practical Manual (1st edition) CBS Publishers & Distributors Pvt. Ltd. India.
3. Gunasekaran, P. (2018). Laboratory manual in Microbiology. New Age International Ld., Publishers, New Delhi.
4. R C Dubey and D K Maheswari (2010). Practical Microbiology. S. Chand Publishing.
5. James G Cappucino and N. Sherman MB(2013). A lab manual Benjamin Cummins, New York.

Reference Books

1. Atlas.R (1997). Principles of Microbiology, 2nd Edition, Wm.C. Brown publishers.
2. Amita J, Jyotsna A and Vimala V (2018). Microbiology Practical Manual. (1st Edition). Elsevier India
3. Talib VH (2019). Handbook Medical Laboratory Technology. (2nd Edition). CBS
4. Wheelis M, (2010). Principles of Modern Microbiology, 1st Edition. Jones and BartlettPublication.
5. Lim D. (1998). Microbiology, 2nd Edition, WCB McGraw Hill Publications.

Web References

1. <http://www.biologydiscussion.com/micro-biology/sterilisation-and-disinfection-methods-and-principles-microbiology/24403>.
2. <https://www.ebooks.cambridge.org/ebook.jsf?bid=CBO9781139170635>
3. https://www.grsmu.by/files/file/university/cafedry//files/essential_microbiology.pdf
4. <https://microbiologyinfo.com/top-and-best-microbiology-books/>

Pedagogy

Chalk and talk, Power Point Presentation and Group Discussions

Course Designer

Dr. E.Priya

Semester : I	Internal Marks:25		External Marks:75	
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
23UMB1AC1	BIOCHEMISTRY I	FIRST ALLIED COURSE - I	4	3

Course Objective

- To understand the structure, functions of various biomolecules and consequences of deviation from normal

Course Outcome and Cognitive Level Mapping

On the successful completion of the course, students will be able to

CO Number	CO Statement	Cognitive level
CO1	Remember and understand the concept of macromolecules	K1,K2
CO2	Illustrate an idea about structure and function macromolecules	K2,K3
CO3	Categorize the sources of macromolecules	K4
CO4	Classify and relate properties o macromolecules	K3,K4
CO5	Recommend the daily allowances of vitamins and its Significance	K5

Mapping of CO with PO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	3	3	3	2	2	3	2	3
CO2	3	3	2	3	3	2	2	3	3	3
CO3	2	3	3	2	3	3	3	2	3	3
CO4	2	3	3	3	2	3	2	3	3	3
CO5	3	3	2	3	3	3	3	2	3	3

“1”–Slight (Low) Correlation

“2” – Moderate(Medium) Correlation

“3”–Substantial (High) Correlation

“-“indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	Carbohydrates: Definition, sources, classification- monosaccharide, disaccharide, oligosaccharide and Polysaccharide, biological significance, digestion and absorption of carbohydrates	12	CO1, CO2, CO3, CO4	K1, K2, K3, K4
II	Proteins: Definition, sources, classification and structure of proteins - structural and nonstructural proteins, Amino acids-structure classification - essential and nonessential, protein and non-protein amino acids. Biological Significance of Proteins.	12	CO1, CO2, CO3, CO4	K1, K2, K3, K4
III	Lipids: Definition, Properties, Sources, Classification of lipids and fatty acids- saturated, unsaturated and polyunsaturated. Compound lipids - Structure and functions of phospholipids and glycolipids. Biological significance of lipids	12	CO1, CO2, CO3, CO4	K1, K2, K3, K4
IV	Vitamins: Definition, sources and functions of Fat soluble vitamins (A, D, E and K) and Water soluble vitamins (B complex and C).	12	CO1, CO2, CO3, CO4	K1, K2, K3, K4
V	Disorders of Metabolism: Disorders of carbohydrate metabolism: diabetes mellitus, hypoglycemia, Disorders of amino acid metabolism: alkaptonuria, phenylketonuria, Disorders of lipid metabolism: hyperlipidemia, hyperlipoproteinemia and hypercholesterolemia. Disorders of vitamin metabolism – Night blindness, Rickets, Scurvy, sterility, beriberi and anemia	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
VI	Self Study for Enrichment (Not to be included for External Examination) Lactose intolerance - Inborn errors in amino acid metabolism- Atherosclerosis – Myocardial infarction	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

Text Books

1. Ambika Shanmugam (2016). Fundamentals of Biochemistry for Medical students. 8th Edition, Wolters Kluwer (India) Pvt Ltd.
2. Rafi MD, (2014) Textbook of Biochemistry for medical students, 2nd edition, Universities Press, (India) Pvt. Ltd, Hyderabad, India.
3. Charlotte W Pratt and Sathya narayana U and Chakrapani U (2013) Biochemistry, 4th edition, Elsevier publishers.
4. Deb AC (2011). Fundamentals of Biochemistry, 10th edition, New Central Book Agency (p) ltd, London
5. Rajagopal G (2010). Concise textbook of biochemistry, 2nd edition, Ahuja Publishing House.

Reference Books

1. Lubert Stryer; Jeremy Berg; John Tymoczko; Gregory Gatto (2019). *Biochemistry*, 9th Edition. Macmillon Publication.
2. Denise R Ferrier, (2013) *Biochemistry*, 6th edition, LWW publishers.
3. Reginald H Garrett and Charles M Grisham (2012). *Biochemistry*, 5th edition. Brooks Colepublishers.
4. Albert L Lehninger, David L Nelson and Michael MCox, (2010). *Lehninger Principles of Biochemistry*, 2nd edition, Wiley publisher

Web References

1. <https://www.slideshare.net/namarta28/monosaccharides>
2. <https://www.tuscany-diet.net/proteins/classification/#:~:text=egg%20yolk%20phosvitin.>
3. <http://www.Protein%20classification%20based%20on%20shape,two%20classes%3A%20fibrous%20and%20globular.>
4. <https://byjus.com/biology/lipids/#:~:text=There%20are%20two%20major%20types,than%20alcohol%20and%20fatty%20acids.>
5. <https://www.thoughtco.com/dna-versus-rna-608191>

Pedagogy

Chalk and talk, PPT, Discussion, Assignment, Quiz, Seminar

Course Designer

Dr.B.Thamilmaraiselvi

Semester I	Internal mark:40		External mark:60	
COURSECODE	COURSE TITLE	CATEGORY	HRS/WEEKS	CREDITS
23UMB1AC1P	BIOCHEMISTRY I (P)	ALLIED	4	3

Course Objective

- This course enables the students to explore the basic biochemistry practical skills.

Course Outcome and Cognitive Level Mapping

On the successful completion of the course, students will be able to

CO NUMBER	CO STATEMENT	Cognitive Level
CO 1	Acquire knowledge about preparation of Buffer, principle of colorimeter	K4
CO 2	Analyse the constituents of carbohydrates and proteins	K1
CO 3	Analyse the constituents of lipids, Titrimetric estimation of Glucose	K6
CO 4	Titrimetric estimation Ascorbic acid and colorimetric estimation of DNA	K6
CO 5	Determination of Amino acids by Paper chromatography & Thin layer chromatography	K5

Mapping of CO with PO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO 1	3	3	3	3	3	3	3	3	3	3
CO 2	3	3	3	3	2	1	3	3	3	3
CO 3	3	3	1	3	3	3	2	2	2	3
CO 4	3	3	2	3	3	3	3	1	3	2
CO 5	3	3	3	2	2	3	3	2	2	3

“1” – Slight (Low) Correlation

“2” – Moderate (Medium) Correlation

“3” – Substantial (High) Correlation

“-“ indicates there is no correlation

Syllabus

1. Preparation of Buffer & estimation of pH
2. Verification of Beer Lambert's Law
3. Qualitative Analysis of Carbohydrates
4. Qualitative Analysis of Proteins
5. Qualitative Analysis of Lipids
6. Quantitative estimation of Glucose by Benedict's method
7. Quantitative estimation of Ascorbic acid
8. Qualitative estimation of DNA by Diphenyl amine method
9. Separation of Amino acids by paper chromatography (Demonstration)
10. Separation of Amino acids by Thin layer chromatography (Demonstration)

Text Books

1. Vasudevan and Sabir Kumar Doss (2022). Practical Text book of Biochemistry for Medical students.
2. Damodaran Geetha K.(2016), Practical Biochemistry, JB brother medical publisher.
3. Ranjna Chawla. (2014). Practical clinical Biochemistry, JB brother medical publisher.
4. Manipal manual of clinical Biochemistry.(2013), JB brother medical publisher.
5. Shawn O' Farrell and Ryan T Ranallo (2006). Experiments in Biochemistry: A Hands on Approach-A manual for the undergraduate laboratory, Thomson Learning, Inc., Australia.

Reference Books

1. Vasudevan and Sabir Kumar Doss (2022). Practical Text book of Biochemistry for Medical students.
2. Damodaran Geetha K.(2016), Practical Biochemistry, JB brother medical publisher.
3. Ranjna Chawla.(2014). Practical clinical Biochemistry, JB brother medical publisher.
4. Manipal manual of clinical Biochemistry.(2013), JB brother medical publisher.
5. Shawn O' Farrell and Ryan T Ranallo (2006). Experiments in Biochemistry: A Hands on Approach-A manual for the undergraduate laboratory, Thomson Learning, Inc., Australia.

Web References

1. <https://www.youtube.com/watch?v=wmhmAESv72E>
2. <https://www.youtube.com/watch?v=VzYDk4t97Ok>
3. <https://www.youtube.com/watch?v=JdXbTWfOc18>
4. https://www.youtube.com/watch?v=2LiA_yNMIVs

Pedagogy

Chalk and talk, PPT, Discussion, Assignment, Quiz, Seminar

Course Designer

Dr. N.Pushpa

Semester: II	Internal Marks: 25		External Marks: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
23UMB2CC2	MICROBIAL PHYSIOLOGY	CORE COURSE	4	4

Course Objective

- To impart among the learners the fundamental principles of microbial physiology.
- To understand the kinetics of microbial growth and influence of varied physio chemical parameters.
- To provide basic knowledge about metabolism and respiration.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive level
CO 1	State nutritional requirements and uptake of microorganisms.	K1, K2
CO 2	Explain phases and factors of growth	K3, K4
CO 3	Describe the Carbohydrate metabolism	K3, K4
CO 4	Compute the importance of Anaerobic Respiration and fermentation pathway.	K4, K5
CO 5	Impart knowledge about protein and lipid metabolisms.	K4, K5

Mapping of CO with PO and PSO

COS	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	3	3	3	2	2	3	2	3
CO2	3	3	2	3	3	2	2	3	3	3
CO3	2	3	3	2	3	3	3	2	3	3
CO4	2	3	3	3	2	3	2	3	3	3
CO5	3	3	2	3	3	3	3	2	3	3

“1” – Slight (Low) Correlation

“3” – Substantial (High) Correlation

“2” – Moderate (Medium) Correlation

“-“ indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	Metabolism and Nutrition: Introduction to Metabolism – Definition, types of metabolism and metabolic pathways. Nutrition – Micro and macro nutrient requirements of microorganisms. Nutritional Classification – Autotrophs, heterotrophs, photoautotrophs, chemoautotrophs, chemolithotrophs, oligotrophs. Transport mechanism – Passive diffusion, Facilitated diffusion, Active transport and group translocation.	12	CO1, CO2, CO3, CO4	K1, K2, K3, K4
II	Microbial Growth: Phases of Growth, Growth curve. Factors influencing the growth of microorganisms – temperature, pH, salt, Osmotic pressure, and radiations. Growth measurements – batch, continuous, synchronous and Diauxic culture.	12	CO1, CO2, CO3, CO4	K1, K2, K3, K4
III	Anaerobic Respiration: Nitrate, sulphate & Methane respiration. Fermentations – alcohol, mixed acid, lactic acid fermentation.	12	CO1, CO2, CO3, CO4	K1, K2, K3, K4
IV	Carbohydrate Metabolism: Embden Mayer– Hoff – Parnas (EMP) pathway, HMP Shunt, Krebs's cycle (TCA) cycle - Electron transport chain, Phosphorylation, oxidative and substrate level phosphorylation.	12	CO1, CO2, CO3, CO4	K1, K2, K3, K4
V	Protein, Lipid and Nucleic acid metabolism: Synthesis and degradation of amino acids (glycine and threonine), peptides, proteins. Biosynthesis and β Oxidation of fatty acids, Biosynthesis and degradation of purine and pyrimidine.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
VI	Self Study for Enrichment (Not to be included for End Semester Examination) Enzymes: classification & nomenclature, properties, Michaelis-Menton equation for simple enzymes, coenzymes and cofactors, isozymes.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

Text books

1. Dubey, R.C. and D.K. Maheshwari. (2022) A Text Book of Microbiology, S. Chand and Company Ltd., New Delhi.
2. Rani Gupta and Namita Gupta. (2022). Fundamentals of Bacterial Physiology and Metabolism, Springer Nature, Singapore.
3. Ananthanarayan Paniker. (2020). A Text book of Microbiology. 11th Edition. University Press.

Singapore.

4. Madigan M.T., Martinko J.M., and Parker J. (2019). Biology of Microorganisms. 12th Edition, MacMillan Press, England.
5. Atlas R.A. and Bartha R. (2019). Microbial Ecology. Fundamentals and Application. 4th edition, Benjamin Cummings, New York.

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1. Tortora G.J., Funke B.R. and Case C.L.(2020). Microbiology: An Introduction. 9th Edition, Pearson Education, Singapore.
2. Black J.G. (2018). Microbiology-principles and explorations, 6th edition. John Wiley and Sons, Inc. New York.
3. MoselioSchaechter and Joshua Leaderberg. (2019). The Desk encyclopedia of Microbiology. 2ndedition. Elsevier Academic press, California.
4. Madigan M.T., Martinko J.M. and Parker J.(2019). Biology of Microorganisms, 12th Edition. MacMillan Press, England.
5. Michel Mandigan, Kelly S.Bender, Daniel buckley, W Mathew Sattley and David Stahl. (2019). Borck biology of microorganisms, 15th Edition, Pearson.

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1. https://uomustansiriyah.edu.iq/media/lectures/6/6_2017_08_09!09_50_48_AM.pdf
2. <https://biologydictionary.net/anaerobic-respiration/>
- 3.[https://bio.libretexts.org/Bookshelves/Microbiology/Book%3AMicrobiology_\(Kaiser\)/Unit_7%3A_A_Microbial_Genetics_and_Microbial_Metabolism/18%3A_Microbial_Metabolism/18.3%3A_Aerobic_Respiration](https://bio.libretexts.org/Bookshelves/Microbiology/Book%3AMicrobiology_(Kaiser)/Unit_7%3A_A_Microbial_Genetics_and_Microbial_Metabolism/18%3A_Microbial_Metabolism/18.3%3A_Aerobic_Respiration)
- 4.[https://bio.libretexts.org/Bookshelves/Biochemistry/Fundamentals_of_Biochemistry_\(LibreTexts\)/02%3A_Unit_II-_Bioenergetics_and_Metabolism/22%3A_Biosynthesis_of_Amino_Acids_Nucleotides_and_Related_Molecules/22.02%3A_Biosynthesis_of_Amino_Acids](https://bio.libretexts.org/Bookshelves/Biochemistry/Fundamentals_of_Biochemistry_(LibreTexts)/02%3A_Unit_II-_Bioenergetics_and_Metabolism/22%3A_Biosynthesis_of_Amino_Acids_Nucleotides_and_Related_Molecules/22.02%3A_Biosynthesis_of_Amino_Acids)
5. <https://www.youtube.com/watch?v=9CPIs-Qhg-M>

Pedagogy

Chalk and talk, PPT, Discussion, Assignment, Quiz, Seminar

Course Designer

Dr. N.Jeenathunisa

SEMESTER:II	INTERNAL MARKS: 25		EXTERNAL MARKS: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDIT
23UMB2CC3	MOLECULAR BIOLOGY	CORE COURSE –III (CC)	3	3

Course Objective:

The paper Molecular Biology encompasses the basic study and understanding the central dogma. It helps in understanding the basic organization of the genome of prokaryotes and eukaryotes. It is followed by prokaryotic and eukaryotic replication, transcription, translation processes and regulation.

Prerequisites

Basic knowledge on function of various genes and proteins for better understanding of cellular life processes.

Course Outcomes and Cognitive Level Mapping

COs	CO Statement	Knowledge level
CO1	Define the basics Properties of DNA	K1
CO2	Recite the knowledge about replication of DNA	K1
CO3	Critique knowledge about central dogma of biology	K4
CO4	Generalize the basic idea of Gene transfer mechanisms	K6
CO5	Expand about mutation	K6

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	3	3	3	3	3	3	3
CO2	3	2	3	3	3	3	3	3	2	3
CO3	2	3	3	3	3	3	3	2	3	3
CO4	3	3	2	3	3	3	3	3	3	2
CO5	3	3	3	3	2	3	2	3	3	3

“1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation

“3” – Substantial (High) Correlation “–” indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	UNIT I: History and concepts in Molecular Biology Milestones in history–Definition of nucleic acids-Experimental proofs of DNA as the genetic material (Griffith and Hershey Chase) – Experimental proofs of RNA as the genetic material - Chemistry and molecular structure of DNA double helix – Discovery of DNA structure – Brief account on types and forms of DNA –Definition of a gene. Organization of DNA in eukaryotic cell; Palindromic DNA; Types of RNA-rRNA; mRNA, SnRNA the 5' cap, non- coding region, initiation, coding region, termination codon; Poly (A) region, post transcriptional modification. Brief note on plasmids: structure and its types.	9	CO1, CO2, CO4, CO5	K1, K2, K3, K4,
II	UNIT II : DNA Replication Watson and Crick's model of DNA replication (experimental evidence); Enzyme involved in DNA replication (DNA polymerase I, Pol II, Pol III, DNA ligase); Mechanism of DNA replication; Models of DNA replication, inhibitors of DNA replication. Exonuclease and endonuclease. Theta replication and Rolling circle replication. Replication of RNA – reverse transcriptase.	9	CO1, CO2, CO3, CO4,	K1, K2, K3, K4,
III	UNIT III : Transcription and Translation DNA Transcription: Definition – Brief account on transcriptional machinery and mechanism of transcription — RNA Translation: Definition – Brief account on translational machinery, mechanisms of translation and Splicing mechanism. Regulation of gene expression: Concept of Gene, Genetic code & its properties. Wobble concept, prokaryotic and eukaryotic ribosomes, detailed account of structure, function and regulation of <i>lac</i> operon, <i>trp</i> operon and <i>ara</i> operon.	9	CO1, CO2, CO3, CO4	K2, K3, K4, K5

IV	UNIT IV: Gene transfer mechanism Gene transfer mechanisms: Conjugation, Transformation and Transduction. Discovery of Transformation, Natural competence and its mechanism - Conjugation - Discovery, F+ v/s F-, Hfr+ v/sF. Transduction – Generalized and specialized transductions. Transposons – Structure, genetic organization and mechanism of transposition. Polymerase Chain Reaction & types.	9	CO1, CO2, CO3, CO4	K2, K4, K5, K6
V	UNIT V : Mutation Definitions of mutations, mutagenesis and mutants - types of mutations; Gene diversity; Split genes, overlapping gene; Molecular nature of Mutation, Spontaneous and Induced mutation; DNA damage repair – Types of damage (deamination, Oxidative damage, Alkylation, Pyrimidine dimmers. Hybridization techniques: Southern, Northern & Western Blotting. Physical and Chemical mutagens, Carcinogenicity testing (AMES Test)- Applications of Mutations.	9	CO1, CO4 , CO5	K1, K2, K3, K4, K5
VI	Self-Study for Enrichment (Not included for End Semester Examinations) Cancer- Types, properties, causes, treatment and Oncogenes and tumour suppressor genes.	-	CO1, CO2, CO3, CO4 CO5	K1, K2, K3, K4, K5

Text Books:

1. Clark David (2019) *Molecular Biology*, Academic Cell.
2. Gerald Karp , JanetIwasa and Wallace Marshall(2016) *Karp's Cell and Molecular Biology*, Wiley.
3. Joanne Willey, Linda Sherwood (2016) Prescott's Microbiology, Mc-Graw– Hill Publishing Company Ltd.
4. Veer BalaRastogi (2015) *Principles of Molecular Biology* Med tech.
5. Verma P S and Agarwal V K (2015) Cell biology, Genetics, Molecular Biology Evolution and Ecology, S. Chand and Company Ltd.

Reference Books

1. Tania A. Baker, Stephen P. Bell, Michael Levine and Richard Losick. (2013) *Molecular Biology of the Gene*. 7th Edition. Benjamin/Cummings Publ. Co., Inc., California.
2. Rosalee S. Hell berg T.A. Brown. (2011). *Introduction to genetics: A molecular approach*. 1st Edition. Garland Science.
3. Geoffrey M Cooper (2016) *Cell: A Molecular Approach*, Sinauer Associates Inc.
4. Bernard R Glick and Cheryl L Patten (2017)*Molecular Biotechnology: Principles and*

Applications of Recombinant DNA, ASM Press.

Web Links:

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2. https://www.fmed.uniba.sk/uploads/media/Introduction_to_Medical_and_Molecular_Biology.pdf
3. <https://www.aacb.asn.au/documents/item/3400>
4. https://molbiomadeeasy.files.wordpress.com/2013/09/fundamental_molecular_biology.pdf
<https://users.ugent.be/~avierstr/pdf/principles.pdf>
5. https://pages.jh.edu/rschlei1/Random_stuff/publications/molbiogene.pdf

Pedagogy

Power Point Presentations, Group Discussion, Seminar, Quiz, Assignment and Brain Storming Activity.

Course Designer

Ms.S.Sathya

Semester: II	Internal Marks: 40		External Marks: 60	
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
23UMB2CC2P	MICROBIAL PHYSIOLOGY AND MOLECULAR BIOLOGY (P)	CORE PRACTICAL	4	3

Course Objective

- To enable the students to understand the basic knowledge of
- To acquire adequate skill to handle microscope to visualize microbes.

Course Outcomes and Cognitive Level Mapping

CO Number	CO Statement	Cognitive level
CO 1	Develop the skills to grow microbes in the laboratory.	K1
CO 2	Illustrate effect of pH, temperature and salt on microbes.	K2
CO 3	Evaluate the growth of microbial cell.	K3
CO 4	Analyze enzymatic hydrolysis reactions.	K3
CO 5	Interpret biochemical test and results to identify bacteria	K4

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	3	3	3	2	2	2	3
CO2	3	2	3	3	2	3	2	2	3	3
CO3	3	3	3	2	3	3	3	3	3	2
CO4	3	3	2	3	2	3	2	2	3	2
CO5	3	3	3	2	3	3	3	3	3	2

“1” – Slight (Low) Correlation

“3” – Substantial (High) Correlation

“2” – Moderate (Medium) Correlation

“-“ indicates there is no Correlation

Syllabus

1. Effect of pH on the growth of microbes.
2. Effect of Temperature on the growth of microbes.
3. Effect of salt on the growth of microbes.
4. Determination of growth curve – direct count, viable count and spectrophotometric assay.
5. Enzymatic Hydrolysis of Starch, Gelatin, Casein.
6. Oxidase test.
7. Catalase test.
8. Biochemical test -Indole test, Methyl Red test, Voges Proskauer test, Citrate Utilization test, Triple Sugar Iron test and Carbohydrate fermentation test.
9. Isolation of Chromosomal DNA from bacteria.
10. Isolation of Plasmid DNA from bacteria.
11. Characterization of Plasmid DNA by Agarose gel electrophoresis.
12. Demonstration of PCR.

Reference Books

1. Bharti Arora, D.R. Arora, (2020). Practical Microbiology, CBS Publishers & Distributors.
2. Mudili J. (2020). Introductory Practical Microbiology, Narosa Publishers.
3. Das S (2020). Microbiology Practical Manual, CBS Publishers.
4. Swagat Kumar Dash, Hrudayanath Thatoi and Supriya Dash. (2020). Practical Biotechnology: Principles and Protocols, Dreamtech Press.
5. Saravanan R, D. Dhachinamoorthi and CH. MM. Prasada Rao. (2019). A Handbook of Practical Microbiology, LAP LAMBERT Academic Publishing.
6. Shukla Das and Rumpa Saha. (2019). Microbiology Practical Manual, 1st Edition, CBS Publishers and Distributors.
7. Michael J Leboffe and Burton E. (2019). Pierce Microbiology: Laboratory Theory & Application, Morton Publishing Company.
8. Ashwani Kumar, Gakhar S K and Monika Miglani. (2019). Molecular Biology: A Laboratory Manual, Dreamtech Press.
9. Siddra Ijaz and Imran Ul Haq. (2019). Recombinant DNA Technology, Cambridge Scholar UK.
10. Amita Jain, Jyotsna Agarwal and Vimala Venkatesh. (2018). Microbiology Practical Manual, 1st edition, Elsevier India.

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1. <https://www.youtube.com/watch?v=yDAcepSV-tU>
2. <https://www.youtube.com/watch?v=qGkpW5W25K0>
3. <https://www.jove.com/v/10511/growth-curves-generating-growth-curves-using-colony-forming-units>
4. [https://bio.libretexts.org/Courses/North_Carolina_State_University/MB352_General_Microbiology_Laboratory_2021_\(Lee\)/07%3A_Microbial_Metabolism/7.01%3A_Introduction_to_Biochemical_Tests_Part_I](https://bio.libretexts.org/Courses/North_Carolina_State_University/MB352_General_Microbiology_Laboratory_2021_(Lee)/07%3A_Microbial_Metabolism/7.01%3A_Introduction_to_Biochemical_Tests_Part_I)
5. <https://www.youtube.com/watch?v=gkZ1CMKeP0w>
6. <https://microbiologyinfo.com/category/biochemical-test/>
7. https://www.researchgate.net/publication/320508474_Molecular_Biology_Laboratory_manual

Pedagogy

Power point presentations, Group Discussion, Quiz, Brain Storming Activity.

Course Designer

Dr. N. Jeenathunisa

Semester: II	Internal Marks: 25		External Marks: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HRS / WEEK	CREDITS
23UMB2AC2	BIOCHEMISTRY II	FIRST ALLIED COURSE	3	3

Course objective

- To Learn about the Types of Blood cells, composition, function, deficiency diseases of RBC and WBC.
- To make the students to know about the structural features of plasma membrane, cellular transport mechanisms with specific examples.
- To acquire about the Endocrine glands and it's structure, classification of Hormones and it's biosynthesis, functions and deficiency diseases.

Prerequisites

To understand the knowledge about the structure and function of plant hormones and secondary metabolites-Alkaloids and flavonoids.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive level
CO 1	Evaluate the basic Concept of Blood and its components, Deficiency Diseases	K2
CO 2	Describe the various models of cell Membrane and transport mechanisms	K2
CO 3	Discuss the Endocrine Glands and their hormones with deficiency diseases	K3
CO 4	Compare the Plant pigments with their biosynthesis and significance	K4
CO 5	Explain the structure of Plant hormones with its structure and function	K5

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	3	3	2	3	2	2	3
CO2	2	2	3	2	2	3	2	3	3	3
CO3	3	2	1	3	2	2	2	3	2	2
CO4	2	2	3	2	3	3	3	2	3	2
CO5	3	3	2	3	2	3	2	3	2	3

“1” – Slight (Low) Correlation “2” – Moderate (Medium) Correlation

“3” – Substantial (High) Correlation “-“ indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	Cytochemistry: Cytochemistry –Plasma membrane-composition and functions–Danielli Davson Model- Fluid mosaic model, Trilaminar model. Mechanism of cell membrane transport – Active, Passive and Facilitated diffusion – Uni, sym and antiports – Na^+ - K^+ ATPase and iron transport	9	CO1, CO2, CO4, CO5	K1, K2, K3 ,K4,
II	Haematology : Blood and its components: Types of Blood cells – origin – Composition of Blood– Characterization and coagulation Significance of platelets–WBC-Types, structure and functions - Deficiency RBC–Structure, Formation-Functions– Anaemia – Sick cell - Aplastic-Hemolytic	9	CO1, CO2, CO3, CO4,	K1, K2, K3, K4,
III	Animal hormones: Hormones of pituitary, thyroids, parathyroid, pancreas, adrenal Glands-testis and ovarian Hormones –Structure, functions, deficiency diseases associated hormones	9	CO1, CO2, CO3, CO4	K2, K3, K4, K5
IV	Plant hormones: Plant hormones – Discovery, structure and functions of Auxins - chemistry, biological function and metabolism of Gibberellins-Functions and mode of action of Cytokinin– Structure and functions of Absciscic acid.	9	CO1, CO2, CO3, CO4	K2, K4, K5, K6
V	Plant pigments: Plant pigments – chlorophyll, carotenoids –Phycobilins and anthocyanin structure – Biosynthesis – functions	9	CO1, CO4 , CO5	K1, K2, K3, K4, K5
VI	Self Study for Enrichment (Not to be included for End Semester Examination) Hemophilin – Leucocytosis Polycythemia – Thalassemia – Van willebrand disease	-	CO1, CO2, CO3, CO4 CO5	K1, K2, K3, K4, K5

Text Books

1. William, J. Marshall and Stephan, K. Bangert.2014. 3rd Edition. Clinical Biochemistry – Metabolic and Clinical Aspects – Churchill Livingston, New York.
2. Ambika Shanmugam.2016. Biochemistry for Medical Students. 8th Edition. Wolters Kluwer India Pvt. Ltd.
3. Satyanarayana. 2020.Biochemistry. 5th Edition. Elsevier. RELX India Pvt. Ltd,
4. Seema Pavgi Upadhye.2020. Textbook of Biochemistry. 4th Edition. Dreamtech Press.
5. Harper's.2018. Illustrated Biochemistry. 31st Edition. McGraw Hill / Medical Publishers.

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1. Stryer, L.1995.Biochemistry. 4th Edition. W.H. Freeman and Company, New York.
Dinesh puri.2020. Textbook of Medical Biochemistry.4th Edition. Elsevier India
2. Donald voet and Judith voet.1990. Biochemistry. John Wiley and Sons, New York.
3. Hubert, Stryer, 1995. Biochemistry – Freeman and Company, New York.
4. Dawn, B.Markus, 1994. Biochemistry. Harwal Publishing, New York.

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1. <https://byjus.com/neet/plant-hormones/>
2. <https://www.hopkinsmedicine.org/health/conditions-and-diseases/hormones-and-the-endocrine-system>
3. <https://byjus.com/neet/types-of-blood-cells-notes/>

Pedagogy

Power point presentations, Group Discussion, Brain Storming Activity.

Course Designer

Dr. N. Pushpa

Semester: II	Internal Marks:100			
COURSE CODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
22UGEVS	ENVIRONMENTAL STUDIES	ABILITY ENHANCEMENT COMPULSORY COURSE	2	2

Course Objective

To train the students to get awareness about total environment and its related problems and to make them to participate in the improvement and protection of the environment.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Outline the nature and scope of environmental studies	K1, K2
CO2	Illustrate the various types of natural resources and its importance.	K2
CO3	Classify various types of ecosystem with its structure and function.	K2, K3
CO4	Develop an understanding of various types of pollution and biodiversity.	K3
CO5	List out the various types of social issues related with environment and explain protection acts	K4, K5

Mapping of CO with PO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	2	3	3	2	2	3	2	3
CO2	3	3	2	3	3	3	2	3	3	3
CO3	2	3	3	2	3	3	3	3	3	2
CO4	2	3	3	3	2	3	2	3	3	3
CO5	3	3	2	3	3	3	3	2	3	3

“1”–Slight (Low)Correlation

“2” – Moderate (Medium) Correlation

“3”–Substantial (High)Correlation

“-“indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	Introduction to environmental studies Definition, scope and importance. Need for public awareness	06	CO1, CO2, CO3, CO4	K1, K2, K3,
II	Natural Resources: Renewable and non-renewable resources: Forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems. Mineral resources: Use and exploitation ,environmental effects of extract incandescing mineral resources. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. Land resources: Land as resources, land degradation, man induced Landslides, soil erosion and desertification. Role of an individual in conservation of natural resources.	06	CO1, CO2, CO3, CO4	K1, K2, K3
III	Ecosystems Concept, Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flowing the ecosystem and Ecological succession. Food chains, food webs and ecological pyramids Introduction, types, characteristic features, structure and function of the following ecosystem: - Forest ecosystem, Grassland ecosystem and Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)	06	CO1, CO2, CO3, CO4	K1, K2, K3

IV	<p>Biodiversity and Environmental Pollution Introduction, types and value of biodiversity. India as a mega diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Definition, Causes, effects and control measures of:</p> <p style="padding-left: 40px;">a. Air Pollution b. Water Pollution c. Soil Pollution d. Noise pollution e. Nuclear hazards</p> <p>Solid waste Management: Causes, effects and control measures of urban and industrial wastes. E-Waste Management: Sources and Types of E-waste. Effect of E-waste on environment and human body. Disposal of E-waste, Advantages of Recycling E-waste. Role of an individual in prevention of pollution. Disaster management: floods, earthquake, cyclone and landslides.</p>	06	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	<p>Social Issues and the Environment Water conservation, rainwater harvesting, watershed management. Climate change, global warming, acid rain, ozone layer depletion, Wasteland reclamation. Environment Protection Act Wildlife Protection Act. Forest Conservation Act. Population explosion – Family Welfare Programmes Human Rights – Value Education. HIV/ AIDS - Women and Child Welfare. Role of Information Technology in Environment and human health.</p>	06	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
VI	<p>Self-Study for Enrichment (Not to be included for End Semester Examination) Global warming – climate change – importance of ozone – Effects of ozone depletion. Biogeography –history, ecology and conservation. International laws and policy</p>	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

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1. Sarita Kumar . 2021. Fundamentals of Environmental Studies for Undergraduate Courses (1st edition). Sultan Chand
2. Aruna Kumari Nakkella. 2022. Environmental Science (1st edition). Bharti Publications.
3. Pallabigoswami. 2023. Environmental studies (1st edition). Ashok publication.
4. Beard, J.M. 2013. Environmental Chemistry in Society(2ndedition). CRC Press.
5. Girard, J.2013. Principles of Environmental Chemistry (3rdedition). Jones & Bartlett.
6. Brebbia, C.A.2013. Water Resources Management VII. WIT Press.
7. Hites, R.A. 2012. Elements of Environmental Chemistry(2ndedition). Wiley & Sons.
8. Harnung, S.E. & Johnson, M.S. 2012. Chemistry and the Environment. Cambridge University Press.
9. Boeker, E. & Grondelle, R. 2011. Environmental Physics: Sustainable Energy and Climate Change. Wiley.
10. Forinash, K.2010. Foundation of Environmental Physics. Island Press.
11. Evans, G.G. & Furlong, J. 2010. Environmental Biotechnology: Theory and Application (2nd edition). Wiley-Blackwell Publications.
12. Williams, D.M., Ebach, M.C. 2008. Foundations of Systematics and Biogeography. Springer
13. Pani, B. 2007. Textbook of Environmental Chemistry. IK international Publishing House.

Pedagogy

Chalk and talk, PPT, Discussion, Assignment, Quiz, Seminar

Course Designer

Dr. B. Thamilmaraiselvi