**ANNAMALAI UNIVERSITY**

(Affiliated Colleges)

**210 - B.Sc. Biochemistry**

Programme Structure and Scheme of Examination (under CBCS)

(Applicable to the candidates admitted from the academic year 2023 -2024 onwards)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Part | Course Code | Study Components & Course Title | Credit | Hours/  Week | Maximum Marks | | |
| CIA | ESE | Total |
|  |  | SEMESTER – I |  |  |  |  |  |
| I | 23UTAML11/  23UHINL11/  23UFREL11 | Language– I  nghJ jkpo; - I  Hindi-I/  French-I | 3 | 6 | 25 | 75 | 100 |
| II | 23UENGL12 | General English - I | 3 | 6 | 25 | 75 | 100 |
| III | 23UBIOC13 | Core – I: Nutritional Biochemistry | 5 | 5 | 25 | 75 | 100 |
| 23UBIOP14 | Core – II: Practical – I: Nutritional Biochemistry Practical | 5 | 4 | 25 | 75 | 100 |
| 23UMICE15 | Elective – I  (General /Discipline Specific)  Fundamentals of Microbiology | 2 | 3 | 25 | 75 | 100 |
| 23UMICEP1 | Fundamentals of Microbiology Practical- I | 1 | 2 | 25 | 75 | 100 |
| IV | 23UTAMB16  23UTAMA16 | Skill Enhancement Course – I (NME-I) /\*  Basic Tamil – I /  Advanced Tamil - I | 2 | 2 | 25 | 75 | 100 |
| 23UBIOF17 | Foundation Course:  First Aid | 2 | 2 | 25 | 75 | 100 |
|  |  | Total | 23 | 30 |  |  | 800 |
|  |  | SEMESTER – II |  |  |  |  |  |
| I | 23UTAML21  23UHINL21/  23UFREL21 | Language– II  nghJ jkpo; - II  Hindi-II  French-II | 3 | 6 | 25 | 75 | 100 |
| II | 23UENCL22 | General English – II | 3 | 6 | 25 | 75 | 100 |
| III | 23UBIOC23 | Core – III: Cell Biology | 5 | 5 | 25 | 75 | 100 |
| 23UBIOP24 | Core – IV: Practical – II: Cell Biology Practical | 5 | 4 | 25 | 75 | 100 |
| 23UMICE25 | Elective – I  (General /Discipline Specific)  Applied Microbiology | 2 | 3 | 25 | 75 | 100 |
|  | 23UMICEP2 | Applied Microbiology Practical | 1 | 2 | 25 | 75 | 100 |
| IV | 23UTAMB26  23UTAMA26 | Skill Enhancement Course – II (NME-II) /\*  Basic Tamil – II /  Advanced Tamil - II | 2 | 2 | 25 | 75 | 100 |
| 23USECG27 | Skill Enhancement Course – III  Internet and its Applications  (Common Paper) | 2 | 2 | 25 | 75 | 100 |
|  |  | Total | 23 | 30 |  |  | 800 |

**List of Non – Major Electives offered to other Departments**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| IV | 23UBION16 | Health and Nutrition | 2 | 2 | 25 | 75 | 100 |
| 23UBION26 | Lifestyle Diseases | 2 | 2 | 25 | 75 | 100 |

\* PART-IV: NME / Basic Tamil / Advanced Tamil (Any one)

Students who have not studied Tamil upto 12th Standardand have taken any Language other than Tamil in Part-I, must choose Basic Tamil-I in First Semester & Basic Tamil-II in Second Semester.

Students who have studied Tamil upto 10th & 12th Standardand have taken any Language other than Tamil in Part-I, must choose Advanced Tamil-I in First Semester and Advanced Tamil-II in Second Semester.

|  |  |  |
| --- | --- | --- |
| **SEMESTER: I**  **CORE-I**  **PART: III** | **Core - I: Nutritional Biochemistry (**23UBIOC13**)** | **CREDIT: 5**  **HOURS: 4/W** |

**Learning Oobjectives**

The objectives of this course are to

* Create awareness about the role of nutrients in maintaining proper health
* Understand the nutritional significance of carbohydrates, lipids and proteins.
* Understand the importance of a balanced diet.
* Study the effect of additives, emulsifiers, and flavor enhancing substances in food.
* Study the significance of nutraceuticals.

**Unit I** : Concepts of food and nutrition. Basic food groups - energy yielding, body building and functional foods. Units of energy. Calorific and nutritive value of foods. Measurement of Calories by bomb calorimeter. Basal metabolic rate (BMR)- definition, determination of BMR and factors affecting BMR. Respiratory quotient (RQ) of nutrients and factors affecting the RQ. SDA-definition and determination- Anthropometric measurement and indices – Height, Weight, chest and waist circumference BMI. 12 Hrs

**Unit II:** Physiological role and nutritional significance of carbohydrates, lipids and protein. Evaluation of proteins by nitrogen balance method- Biological value of proteins- Digestibility coefficient, Protein Energy Ratio and Net Protein Utilization. Protein energy malnutrition – Kwashiorkor and Marasmus, Obesity-Types and preventive measures.

12 Hrs

**Unit III** : Balanced diet, example of low and high cost balanced diet- for infants, children, adolescents, adults and elderly people. ICMR classification of five food groups and its significance food pyramid. Junk foods- definition and its adverse effects .

12 Hrs

**Module IV** : Food additives: Structure, chemistry, function and application of preservatives, emulsifying agents, buffering agents, stabilizing agents, natural and artificial sweeteners, bleaching, starch modifiers, antimicrobials, food emulsions, fat replacers, viscosity agents, gelling agents and maturing agents. Food colors, flavors, anti-caking agent, antioxidants. Safety assessment of food additives.

12 Hrs

Unit **V**: Nutraceuticals and Functional Foods: Definition, properties and function of Nutraceuticals, food Supplements, dietary supplements prebiotics and probiotics, and functional Foods. Food as medicine. Natural pigments from plants – carotenoids, anthocyanins and its benefits.

12 Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Program outcomes** |
| CO1 | Cognizance of basic food groups viz. Carbohydrates, proteins and lipids and their nutritional aspects as well as calorific value | PO1,PO5 |
| CO2 | Identify and explain nutrients in foods and the specific functions in maintaining health. | PO1 |
| CO3 | Classify the food groups and its significance | PO1,PO2 |
| CO4 | Understand the effect of food additives | PO1,PO2 |
| CO5 | Describe the importance of nutraceuticals and pigments | PO1,PO5,PO6 |

**Text books**

1. Gaile Moe, Danita Kelley, Jacqueline Berning and Carol Byrd-Bredbenner. 2013. Wardlaw's Perspectives in Nutrition: A Functional Approach. McGraw-Hill, Inc., NY, USA.

2. M.Swaminadhan (1995) Principles of Nutrition and Dietics. Bappco.

3. Tom Brody (1998). Nutritional Biochemistry (2nded), Academic press, USA

4. Garrow, JS,James WPT and Ralph A (2000). Human nutrition and dietetics (10thed)

Churchill Livingstone.

5. Andreas M.Papas (1998). Antioxidant Status, Diet, Nutrition, and Health (1sted) CRC

**Reference Books**

1. Branen, A.L., Davidson PM &Salminen S. 2001. Food Additives. 2nd Ed. Marcel Dekker.

2. Gerorge, A.B. 1996. Encyclopedia of Food and Color Additives. Vol. III. CRC Press.

3. Advances in food biochemistry, FatihYildiz (Editor), CRC Press, Boca Raton, USA, 2010

4. Food biochemistry & food processing, Y.H. Hui (Editor), Blackwell Publishing, Oxford, UK, 2006.

5. Geoffrey Campbell-Platt. 2009. Food Science and Technology. Wiley-Blackwell ,UK.

**Web resources**

http://old.noise.ac.in/SecHmscicour/english/LESSON O3.pdf

https://study.com/academy/lesson/energy-yielding-nutrients-carbohydratesfat-protein.html.

<https://www.nhsinform.scot/healthy-living/food-and-nutrition/eatingwell/vitamins-and-minerals>

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 |  |  |  | 2 |  | 3 | 3 | 3 | 3 |
| **CO 2** | 3 |  |  |  |  |  | 3 | 3 |  | 3 |
| **CO 3** | 3 | 2 |  |  |  |  | 3 | 1 |  | 3 |
| **CO 4** | 3 | 2 |  |  |  |  | 3 | 3 |  | 3 |
| **CO5** | 3 |  |  |  | 2 | 2 | 3 | 3 |  | 3 |

**S-Strong (3) M-Medium (2) L-Low (1)**

|  |  |  |
| --- | --- | --- |
| **SEMESTER: I**  **CORE-II**  **PART: III** | **Core II-Practical 1- Nutritional Biochemistry (23UBIOP14)** | **CREDIT: 5**  **HOURS: 4/W** |

**Learning objectives**

The objectives of this course are to

* Impart hands-on training in the estimation of various constituents by titrimetric method
* Prepare Biochemical preparations
* Determine the ash content and extraction of lipid

**TITRIMETRY 20 hrs**

1. Estimation of ascorbic acid in a citrus fruit.

2. Estimation of calcium in milk.

3. Estimation of glucose by Benedict’s method in honey.

4. Estimation of phosphorous (Plant source)

**BIOCHEMICAL PREPARATIONS 15 Hrs**

Preparation of the following substances and its qualitative tests

5. Lecithin from egg yolk.

6. Starch from potato.

7. Casein and Lactalbumin from milk.

**GROUP EXPERIMENT 10Hrs**

8. Determination of ash content and moisture content in food sample

9. Extraction of lipid by Soxhlet’s method.

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Program outcomes** |
| CO1 | Estimate the important biochemical constituents in the food samples. | PO1,PO3 |
| CO2 | Prepare the macronutrients from the rich sources. | PO1,PO3 |
| CO3 | Determine the ash and moisture content of the food samples | PO1,PO3 |
| CO4 | Extract oil from its sources | PO1,PO3,PO6 |

**Text books**

1. Laboratory manual in Biochemistry, J. Jayaraman, 2nd edition, New Age International Publishers, 2011,

2. An Introduction to Practical Biochemistry, David T. Plummer, 3 rd edition, Tata McGraw-

Hill Publishing Company Limited, 2001.

**Reference books**

1. Biochemical Methods, Sadasivam S and Manickam A, 4h edition, NewAge International Publishers, 2016

2. Essentials of Food and Nutrition, Vol. I &amp; II, M.S. Swaminathan.

3 Bowmen and Robert M. 2006. Present Knowledge in Nutrition. 9th edition, International Life Sciences Publishers.

4. Indrani TK. 2003. Nursing Manual of Nutrition and Therapeutic Diet, 1st edition Jaypee Brothers medical publishers.

5. Martha H. and Marie A. 2012. Biochemical, Physiological, and Molecular Aspects of Human Nutrition. 3rd edition. Chand Publishers.

**Web resources**

1.https://www.elsevier.com/journals/clinical-biochemistry/0009-9120/guide-for-authors

2.http://rajswasthya.nic.in/RHSDP%20Training%20Modules/Lab.%20Tech/Biochemistry/ Dr.%20Jagarti%20Jha/Techniques%20In%20Biochemistry%20Lab.pdf

3.https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical\_biochemistrypdf.pdf?sequence=1&isAllowed=y

4.https://dspace.cuni.cz/bitstream/handle/20.500.11956/111493/Clinical\_biochemistrypdf.pdf?sequence=1&isAllowed=y

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 |  | 3 |  |  |  | 3 | 3 | 3 | 3 |
| **CO 2** | 3 |  | 3 |  |  |  | 3 | 3 | 3 | 3 |
| **CO 3** | 3 |  | 3 |  |  |  | 3 | 3 | 3 | 3 |
| **CO 4** | 3 |  | 3 |  |  | 3 | 3 | 3 | 3 | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

**Elective: FUNDAMENTALS OF MICROBIOLOGY**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Subject Code | L | T | P | S | Credits | Instructional Hours | Marks | | |
| CIA | External | Total |
| 23UMICE15 | 3 | 1 |  |  | 3 | 4 | 25 | 75 | 100 |
| **Course Outcomes** | | | | | | | | | |
| CO1 | Understand the classification of Microorganisms and structure of bacteria | | | | | | | | |
| CO2 | Understand the various microbiological techniques, different types of media, and techniques involved in culturing microorganisms. | | | | | | | | |
| CO3 | Categorize the methods of sterilization and identify the significance of culture media in the growth of different microbes. | | | | | | | | |
| CO4 | Understand the skills in working procedures of Microscopes. | | | | | | | | |
| CO5 | Understand about the nutritional requirements of Microorganisms. | | | | | | | | |
| **UNIT** | **Contents** | | | | | | | | **No.of Hours** |
| I | History and scope of Microbiology, Classification of bacteria, fungi, virus, protozoa and algae – classical and molecular approaches. Scope of microbiology – Role of microbes in biotechnology. | | | | | | | | 15 |
| II | Structure of bacteria - Bacterial growth and measurement of growth, Media – types and preparation- plating methods - staining methods (Gram’s, capsule, spore, LCB mount)- methods of preservation and storage of microbes. Culture of fungi, virus and algae. | | | | | | | | 15 |
| III | Sterilization methods - physical and chemical methods- Mode of action – Antibiotic in clinical use - Resistance to antibacterial agents - MRSA, ESBL. | | | | | | | | 15 |
| IV | Microscopy: Principle and applications of Bright field, Dark field, Phase contrast, Fluorescent Microscope, Electron microscope-TEM and SEM. | | | | | | | | 15 |
| V | Microbial metabolism: Nutritional requirements - macro and micro nutrients - Nutritional groups-Nutrient Transport: Active, passive and facilitated-Microbial Growth-Growth curve - Factors affecting growth (temperature, acidity, alkalinity, water availability and oxygen requirement) -measurement of growth,-Bacterial growth kinetics-Batch, continuous culture and synchronous growth. | | | | | | | | 15 |
| **Total** | | | | | | | | | **75** |
| **Text Books** | | | | | | | | | |
| 1 | Pelczar.M. J., Chan E.C.S. and Noel. R.K. (2007). Microbiology. 7th Edition.,McGraw –Hill, New York. | | | | | | | | |
| 2 | Dubey R.C. and Maheswari, S. (2003). A textbook of Microbiology, New Delhi: S. Chand & Co. | | | | | | | | |
| 3 | Prescott, Harley, Klein, Microbiology, 10th Edition, McGraw – Hill, 2016. | | | | | | | | |
| 4 | Gerhardt, P., Murray, R.G., Wood, W.A. and Kreig, N.R. (Editions) (1994) Methods for General and Molecular Bacteriology. ASM Press, Washington, DC | | | | | | | | |
| **Reference Books** | | | | | | | | | |
| 1 | Madigan, Martinko, Bender, Buckley, Stahl, Brock Biology of Microorganisms, 14th edition, 2017. | | | | | | | | |
| 2 | Boyd, R.F. (1998). General Microbiology,2nd Edition., Times Mirror, Mosby CollegePublishing, St Louis. | | | | | | | | |
| 3 | [Dr. C.B.Powar](https://www.amazon.in/s/ref=dp_byline_sr_book_1?ie=UTF8&field-author=Dr.+C.B.Powar&search-alias=stripbooks) (Author), [Dr.H.F. Daginawala](https://www.amazon.in/s/ref=dp_byline_sr_book_2?ie=UTF8&field-author=Dr.H.F.+Daginawala&search-alias=stripbooks). January 2010.General Microbiology Vol. I Vol.II. Himalalya Publishing home. | | | | | | | | |
| 4 | Tortora, G.J., Funke, B.R., Case,C.L. (2013). Microbiology. An Introduction 11th Edition., A La Carte Pearson. | | | | | | | | |

|  |  |
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| **Web Resources** | |
| 1 | Horst W. Doelle (2004). Microbial Metabolism and Biotechnology. Proceedings of an E-seminar organized by the International organization for Biotechnology and Bioengineering (IOBB) |
| 2 | <http://www> ejb.org/content. |
| 3 | www. Biotech.kth.se Electronic Journal of biotechnology |
| 4 | https://www.cliffsnotes.com/study guides/biology/microbiology/introduction-to- microbiology/a-brief-history-of-microbiology |
| 5 | <https://bio.libretexts.org/@go/page/9188> |

**MAPPING WITH PROGRAMME OUTCOMES**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO1 |  |  |  | M |  |  | L | M | L |  | M |
| CO2 |  |  |  | S |  |  | L | L | L |  |  |
| CO3 |  |  |  | S |  |  | M | M | L |  | M |
| CO4 |  |  |  | S |  |  | M | L | L |  |  |
| CO5 |  |  |  | S |  |  | M | L | L |  |  |

**Elective Practical I -Fundamentals of Microbiology Practical**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | | **Instructional Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
| 23UMICEP1 | |  |  | **4** |  | **2** | **4** | | **25** | **75** | | **100** |
| **Course Outcomes** | | | | | | | | | | | | |
| CO1 | Describe the general Laboratory safety & Sterilization Techniques | | | | | | | | | | | |
| CO2 | Develop Skills in Media Preparation, Isolation & Serial Dilution Techniques and Pure Culture Techniques | | | | | | | | | | | |
| CO3 | Microscopically analyze the morphological features of Bacteria and fungi and define various Staining Techniques. | | | | | | | | | | | |
| CO4 | Perform the Motility of organisms. | | | | | | | | | | | |
| CO5 | Able to characterize and identify bacteria using Biochemical tests. | | | | | | | | | | | |
| **UNIT** | **Contents** | | | | | | | | | | **No.of Hours** | |
| I | Sterilization techniques – Preparation of Media | | | | | | | | | | 9 | |
| II | Inoculation techniques- Pour plate, spread plate  Isolation of bacteria from various sources and dilution techniques. | | | | | | | | | | 9 | |
| III | Staining techniques: Simple, Gram’s, Capsule (Negative), Spores,  Preparation of temporary mounts- Lacto phenol cotton blue staining. | | | | | | | | | | 9 | |
| IV | Motility tests: Hanging drop technique. | | | | | | | | | | 9 | |
| V | Biochemical characterization - catalase, oxidase, IMVIC test and TSI.Antibiotic sensitivity test (demonstration). | | | | | | | | | | 9 | |
| **Total** | | | | | | | | | | | **45** | |
| **Text Books** | | | | | | | | | | | | |
| 1 | | James G Cappucino and N. Sherman MB(1996). A lab manual Benjamin Cummins, New York 1996. | | | | | | | | | | |
| 2 | | Kannan. N (1996). Laboratory manual in General Microbiology. Palani Publications. | | | | | | | | | | |
| 3 | | Sundararaj T (2005). Microbiology Lab Manual (1st edition) publications. | | | | | | | | | | |
| 4 | | Gunasekaran, P. (1996). Laboratory manual in Microbiology. New Age International Ld., Publishers, New Delhi. | | | | | | | | | | |
| 5 | | R C Dubey and D K Maheswari (2002). Practical Microbiology. S. Chand Publishing. | | | | | | | | | | |
| **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 Bartlett Publication. | | | | | | | | | | |
| 5 | | Lim D. (1998). Microbiology, 2nd Edition, WCB McGraw Hill Publications. | | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | |
| 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](https://www.grsmu.by/files/file/university/cafedry/files/essential_microbiology.pdf) | | | | | | | | | | |
| 4 | | <https://www.cliffsnotes.com/studyguides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology> | | | | | | | | | | |

**MAPPING WITH PROGRAMME OUTCOMES**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO1 | M |  |  |  |  |  |  |  |  |  |  |
| CO2 | M |  |  |  |  |  |  |  |  |  |  |
| CO3 |  |  |  | S | S | S |  |  |  |  |  |
| CO4 |  |  |  | S | S | S |  |  |  |  |  |
| CO5 |  |  |  |  | S | S |  |  | S |  |  |

|  |  |  |
| --- | --- | --- |
| **SEMESTER: II**  **Foundation Course:**  **PART: IV** | **23UBIOF17: First Aid**  **(Foundation Course)** | **CREDIT: 2**  **HOURS: 2/W** |

**Learning Objectives**

The main objectives of this course are to:

* Provide knowledge on the basics of first aid.
* Perform first aid during various respiratory issues.
* Demonstrate the first aid to treat injuries.
* Learn the first aid techniques to be given during emergency.
* Familiarize the first aid during poisoning.

**Unit I:** Aims and important rules of first aid, dealing with emergency, types and content of a first aid kit. First aid technique – Dressing and Bandages, fast evacuation technique, transport techniques.6 Hrs

**Unit II:** Basics ofRespiration – CPR, first aid during difficult breathing, drowning, choking, strangulation and hanging, swelling within the throat, suffocation by smoke or gases and asthma. 6 Hrs

**Unit III:**Common medical aid- first aid for wounds, cuts, head, chest, abdominal injuries, shocks, burns, amputations, fractures, dislocation of bones. 6Hrs

**Unit IV:**First aid related to unconsciousness, stroke, fits, convulsions- seizures, epilepsy6Hrs

**Unit V:**First aidin poisonous bites (Insects and snakes), honey bee stings, animal bites, disinfectant ,acid and alkali poisoning .6Hrs

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Program outcomes** |
| CO1 | Discuss on the rules of first aid, dealing during emergency and first aid techniques | PO1.PO4,PO5 |
| CO2 | Understand the first aid techniques to be given during different types of respiratory problems | PO1.PO4,PO5 |
| CO3 | Provide first aid for injuries, shocks and bone injury | PO1.PO4,PO5 |
| CO4 | Detail on the first aid to be given for unconsciousness, stroke, fits and convulsions | PO1.PO4,PO5 |
| CO5 | Gain expertise in giving first aid for insect bites and chemical poisoning | PO1.PO4,PO5 |

**Text books**

1) First aid and health Dr. Gauri Goel, Dr. Kumkum Rajput, Dr.ManjulMungali

1SBN-978-93-92208-19-5

2) Indian First Aid Mannual-https://www.indianredcross.org/publications/FA-manual.pdf

3) Red Cross First Aid/CPR/AED Instructor Manual

|  |  |  |
| --- | --- | --- |
| **SEMESTER: II**  **CORE-III**  **PART: III** | **Core-III: Cell Biology (23UBIOC23)** | **CREDIT: 5**  **HOURS: 4/W** |

**Learning Objectives**

The main objectives of this course are to

* Provide basic understanding of architecture of cells and its organelles.
* Understand the organization of prokaryotic and eukaryotic genome.
* Educate on the structural organization of bio membrane and transport mechanism
* Impart knowledge on cell cycle, cell division and basics of cells
* Familiarize the concept of mechanism of cell-cell interactions.

**Module I:** 12 Hrs

Architecture of cells- Structural organization of prokaryotic and eukaryotic cells microbial, plant and animal cells. The ultrastructure of nucleus, mitochondria, RER, SER, golgi apparatus, lysosome, peroxisome and their functions

**Module II:** 12 Hrs

Cytoskeleton- microfilament, microtubules and intermediary filament- structure, composition and functions. Organization of Genome - prokaryotic and eukaryotic genome. Organization of chromatin – histones, nucleosome concept, formation of chromatin structure. Special types of chromosomes – lamp brush chromosomes, polytene chromosomes.

**Module III:** 12Hrs

Biomembranes-Structuralorganizationofbilipidlayermodelandbasicfunctions- transport across cell membranes- uniport, symport and antiport. Passive and active transport.

**Module IV:** 12 Hrs

Cellcycle-DefinitionandPhasesofCellcycle-Celldivision-MitosisandMeiosis and its significance, Cancer cells- definition, types and characteristics of cancer cells.

**Module V:** 12 Hrs

Extracellular matrix – Collagen, laminin, fibronectin and proteoglycans- structure and biological role. Structure and role of cadherin, selectins, integrins, Cell -cell interactions- Types-gap junctions, tight junctions and Desmosomes

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programoutcomes** |
| CO1 | Explain the structure and functions of basic components of prokaryotic  and eukaryotic cells, especially the organelles. | PO1 |
| CO2 | Familiarize the cytoskeleton and chromatin | PO1,PO2 |
| CO3 | Illustrate the structure, composition and functions of cell membrane related to membrane transport | PO1,PO2 |
| CO4 | Elaborate the phases of cell cycle and cell division-mitosis and meiosis and characteristics of cancer cells. | PO1, PO2 |
| CO5 | Relate the structure and biological role of extracellular matrix in cellular interactions | PO1,PO2 |

**Text books**

1. Arumugam. N, Cellbiology.Saraspublication(10ed, paperback), 2019

2. Devasena.T.Cell Biology.OxfordUniversityPressIndia-ISBN: 9780198075516, 0198075510, 2012

3. Bruce Alberts and Dennis Bray. 2013, Essential Cell Biology. (4”ed). Garland Science.

**Referencebooks**

1. S.C,R.CellBiology.NewagePublishers -ISBN-10: 8122416888/ISBN-13: 978- 8122416886, 2008

2. Cooper, G.A. TheCell:AMolecularApproach.SinauerAssociates,Inc -ISBN10: 0878931066 / ISBN 13: 9780878931064, 2013

3...E.M.F.,D.R,Cell and Molecular Biology.LippincottWilliams&WilkinsPhiladelphia - ISBN: 0781734932 9780781734936, 2006

4. LodishH.A ,Berk C.A, Kaiser M, Krieger M.P, Scott A, Bretscher H, Ploegh and Matsudaira. 2007. Molecular Cell Biology, 6th Edition, WH. Freeman Publishers, New York, USA.

**Web resources**

https://nicholls.edu/biol-ds/bio1155/Lectures/Cell%20Biology.pdf

https://www.medicalnewstoday.com/article/320878.php

https://biologydictionary.net /cell

**Mapping with Program Outcome**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 |  |  |  |  |  | 3 |  |  | 3 |
| **CO 2** | 3 | 3 |  |  |  |  | 3 |  |  | 3 |
| **CO 3** | 3 | 3 |  |  |  |  | 3 |  |  | 3 |
| **CO 4** | 3 | 3 |  |  |  |  | 3 | 3 |  | 3 |
| **CO5** | 3 | 3 |  |  |  |  | 3 |  |  | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

|  |  |  |
| --- | --- | --- |
| **SEMESTER: II**  **Core-IV practical II**  **PART: III** | **Core-IV: Practical II: Cell Biology Practical (23UBIOP24)** | **CREDIT: 4**  **HOURS: 3/W** |

**Learning Objectives**

The main objectives of this course are to

* Learn the parts of microscope
* Investigate the cells under microscope.
* Image the cells using different stains
* Identify the cells, organelles and stages of cell division
* Identify the spotters

**I MICROSCOPYANDSTAININGTECHNIQUES**

1. Study the parts of light and compound microscope
2. Preparation of Slides and Micrometry
3. Examination of prokaryotic and eukaryotic cell
4. Visualization of animal and plant cell by methylene blue
5. Visualization of nuclear fraction by acetocarmine stain
6. Staining and visualization of mitochondria by Janusgreenstain

**II GROUP EXPERIMENT**

7. Identification of different stages of mitosis in onion root tip

8. Identification of different stages of meiosis in onion bulb

**III SPOTTERS**

9. a) **Cells**: Nerve, plant and Animal cell

b) **Organelles**: Mitochondria, Chloroplast, Endoplasmicreticulum,

c) **Mitosis stages** – Prophase,Anaphase,Metaphase,Telophase

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Program outcomes** |
| CO1 | Identify the parts of microscope. | PO1,PO2 |
| CO2 | Preparation of Slides | PO1,PO2 |
| CO3 | Identify the stages of mitosis & meiosis | PO1,PO2 |
| CO4 | Visualize nucleus and mitochondria by staining methods | PO1,PO2 |
| CO5 | Identify the spotters of cells, organelles and stages of cell division | PO1,PO2 |

**Text books**

1. Rickwood, Dand J.R.HarriscellBiology: EssentialTechniques, Johnwikey1996.

2. Davis, J.M. Basic Cell culture: A practical approach, IRL 1994.

3. Ganesh M.K. and Shivashankara A.R. 2012. Laboratory Manual for Practical Biochemistry Jaypee publications, 2ndEdn.

**Referencebooks**

1) Essential practical handbook of Cell biology ,Genetics andMicrobiology -A Practical manual- Debarati Das Academic publishers, ISBN, 9789383420599, 1st Edition 2017

2) CellbiologyPractical,Dr.VenuguptaISBN8193651219,Prestigepublisher,1stJan2018.

3) Cell and Molecular biology, DeRobertis, 8th edition, 1st June, 1987

**Web resources**

1.http://amrita.olabs.edu.in/?sub=79&brch=18&sim=237&cnt=1

2. https://www.microscopemaster.com/organelles.html

3. <https://www.pdfdrive.com/biochemistry-books.htm>

4.http://medcell.med.yale.edu/histology/cell\_lab.php#:~:text=The%20electron%20microscope%20is%20necessary,and%20small%20granules%20and%20vesicles.

5. http://amrita.olabs.edu.in/?sub=79&brch=18&sim=237&cnt=1

6.https://www.khanacademy.org/science/ap-biology/heredity/meiosis-and-geneticdiversity/a/phases-of-meiosis

7. https://www.microscopemaster.com/organelles.html

8. https://www.pdfdrive.com/biochemistry-books.html

**Mapping with Program Outcomes:**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 2 | 3 |  |  |  |  | 3 | 3 | 3 | 3 |
| **CO 2** | 2 | 3 |  |  |  |  | 3 | 3 | 3 | 3 |
| **CO 3** | 2 | 3 |  |  |  |  | 3 | 3 | 3 | 3 |
| **CO 4** | 2 | 3 |  |  |  |  | 3 | 3 | 3 | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**

**Elective II: APPLIED MICROBIOLOGY**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Instructional Hours** | **Marks** | | |
| **CIA** | **External** | **Total** |
| **23UMICE25** | | **3** | **1** |  |  | **3** | **4** | **25** | **75** | **100** |
| **Course Outcomes** | | | | | | | | | | |
| CO1 | | Understand beneficial role of microorganisms in dairy and food products. | | | | | | | | |
| CO2 | | Understand the various microbiological techniques, different types of media, and techniques involved in culturing microorganisms. | | | | | | | | |
| CO3 | | Categorize the methods of sterilization and identify the significance of culture media in the growth of different microbes. | | | | | | | | |
| CO4 | | Exhibit knowledge in analyzing the importance ofBio insecticides, Bio fertilizersprebiotics and probiotics. | | | | | | | | |
| CO5 | | Distinguish between normal flora and pathogens and describe the role of microbes in food intoxications. | | | | | | | | |
| **UNIT** | | **Contents** | | | | | | | | **No.of Hours** |
| I | | Microorganisms as food and feed: SCP, Mushroom-Oyster (Pleurotus) and Button (Agaricus) mushroom. Dairy products-cheese, yoghurt; Beverages-Beer and Wine. Probiotics. | | | | | | | | 15 |
| II | | Microorganisms in Agriculture: Bacterial Biofertilizers, Phosphate solubilizers, Vasicular Arbusucular Mycorrhizae, Algal Biofertilizers. | | | | | | | | 15 |
| III | | Biocontrol of microbial pathogens-Bio pesticide-Bactericide-*Bacillus thuringiensis*; Fungicide-*Trichoderma viridae-*Viral Biopesticides-CPV and NPV | | | | | | | | 15 |
| IV | | Microorganisms and Environment: liquid waste and solid waste-liquid waste management-water recycling- Industrial effluent treatment (sugar mill effluent, tannery effluent)- Solid waste management -Composting and vermicomposting. | | | | | | | | 15 |
| V | | Microbial Disease- host -pathogen interaction, clinical features, lab diagnosis and treatment of Airborne disease (Pneumonia, Chicken pox), food borne disease (Typhoid, Aspergillosis), Water borne disease (Cholera, Amoebiasis), Sexually transmitted disease (AIDS, Trichomoniasis), Vector borne disease (Dengue, Malaria). | | | | | | | | 15 |
| **Total** | | | | | | | | | | **75** |
| **Text Books** | | | | | | | | | | |
| 1 | | Rangaswami G and Bagyaraj DJ (2002). Agricultural Microbiology. Second edition, PHI Learning (P) Ltd., New Delhi | | | | | | | | |
| 2 | | Dubey R.C. and Maheswari, S. (2003). A textbook of Microbiology, New Delhi: S. Chand & Co. | | | | | | | | |
| 3 | | Prescott, Harley, Klein, Microbiology, 10th Edition, McGraw – Hill, 2016. | | | | | | | | |
| **Reference Books** | | | | | | | | | | |
| 1 | | . Adams, M.R and M.O. Moss (2005). Food Microbiology. 1st edition. Reprinted, Published byNew Age International (P) Ltd, Publishers-New Delhi. | | | | | | | | |
| 2 | | Gillespie, Bamford, Medical Microbiology and Infection at a Glance, 4th edition, 2012. | | | | | | | | |
| 3 | | Maier, R.M., Pepper, I.L. & Gerba, C.P. (2009). Environmental Microbiology. 2nd Ed. Academic Press. | | | | | | | | |
| 4 | | Ananthanarayanan, Paniker, Kapil, Textbook book of Microbiology, 9th edition, Orient BlackSwan, 2013. | | | | | | | | |
| **Web Resources** | | | | | | | | | | |
| 1 | <http://www> ejb.org/content. | | | | | | | | | |
| 2 | www. Biotech.kth.se Electronic Journal of biotechnology | | | | | | | | | |
| 3 | <https://bio.libretexts.org/@go/page/9188> | | | | | | | | | |

**MAPPING WITH PROGRAMME OUTCOMES**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO1 |  |  |  | M |  |  | L | M | L |  | M |
| CO2 |  |  |  | S |  |  | L | L | L |  |  |
| CO3 |  |  |  | S |  |  | M | M | L |  | M |
| CO4 |  |  |  | S |  |  | M | L | L |  |  |
| CO5 |  |  |  | S |  |  | M | L | L |  |  |

**ELECTIVE PRACTICAL II –APPLIED MICROBIOLOGY PRACTICAL**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Subject Code** | | **L** | **T** | **P** | **S** | **Credits** | **Instructional Hours** | **Marks** | | | |
| **CIA** | **External** | | **Total** |
| **23UMICEP2** | |  |  | **4** |  | **2** | **4** | **25** | **75** | | **100** |
| **Course Outcomes** | | | | | | | | | | | | |
| CO1 | Describe the techniques to estimate the quality of dairy products | | | | | | | | | | | |
| CO2 | Develop Skills in enzyme production | | | | | | | | | | | |
| CO3 | Microscopically analyze the morphological features of algae and root nodules bacteria | | | | | | | | | | | |
| CO4 | Learn the methods available to check the water quality | | | | | | | | | | | |
| CO5 | Understand the pathogenic bacteria in various sample | | | | | | | | | | | |
| **UNIT** | **Contents** | | | | | | | | | **No.of Hours** | | |
| I | Detection of bacteria in milk by SPC, Methylene Blue reduction test, Microscopic observation of curd | | | | | | | | | 9 | | |
| II | Demonstration of enzymes producing bacteria (lipase, amylase, protease) | | | | | | | | | 9 | | |
| III | Azolla- morphological study, Isolation of Rhizobium from root nodules, | | | | | | | | | 9 | | |
| IV | Enumeration of bacteria from water sample, test for coliforms by MPN method | | | | | | | | | 9 | | |
| V | Isolation of pathogenic bacteria from air, water, and food specimens | | | | | | | | | 9 | | |
| **Total** | | | | | | | | | | **45** | | |
| **Text Books** | | | | | | | | | | | | |
| 1 | | James G Cappucino and N. Sherman MB(1996). A lab manual Benjamin Cummins, New York 1996. | | | | | | | | | |
| 2 | | Kannan. N (1996). Laboratory manual in General Microbiology. Palani Publications. | | | | | | | | | |
| 3 | | Sundararaj T (2005). Microbiology Lab Manual (1st edition) publications. | | | | | | | | | |
| 4 | | Gunasekaran, P. (1996). Laboratory manual in Microbiology. New Age International Ld., Publishers, New Delhi. | | | | | | | | | |
| 5. | | Rajan. S and Selvi Christy (2015). Experiments Procedure in Life Science, Anjanaa book House Publisers, Chennai | | | | | | | | | |
| 6 | | R C Dubey and D K Maheswari (2002). Practical Microbiology. S. Chand Publishing. | | | | | | | | | |
| **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 Bartlett Publication. | | | | | | | | | |
| 5 | | Lim D. (1998). Microbiology, 2nd Edition, WCB McGraw Hill Publications. | | | | | | | | | |
| **Web Resources** | | | | | | | | | | | | |
| 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](https://www.grsmu.by/files/file/university/cafedry/files/essential_microbiology.pdf) | | | | | | | | | |
| 4 | | <https://www.cliffsnotes.com/studyguides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology> | | | | | | | | | |

**MAPPING WITH PROGRAMME OUTCOMES**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 |
| CO1 | M |  |  |  |  |  |  |  |  |  |  |
| CO2 | M |  |  |  |  |  |  |  |  |  |  |
| CO3 |  |  |  | S | S | S |  |  |  |  |  |
| CO4 |  |  |  | S | S | S |  |  |  |  |  |
| CO5 |  |  |  |  | S | S |  |  | S |  |  |

|  |  |  |
| --- | --- | --- |
| SEMESTER: I  NME- I  PART - IV | **23UBION16: Health and Nutrition**  **(NME- I)** | CREDIT: 2  HOURS: 2/W |

**Learning Objectives**

The main objectives of this course are to

* Gain basic knowledge about health.
* Understand about vitamins.
* Learn about functions of fat on health.
* Understand the types of minerals and its functions
* Know about the importance of carbohydrates and proteins on health

**Unit -I:** Health – definition, Factors affecting human health. Importance of health care of children, adults and elderly people. Balanced diet and calorific value**. 6Hrs**

**Unit -II:** Vitamins-definition, classification, sources, properties, functions and deficiency symptoms. Recommended daily allowances. **6Hrs**

**Unit -III:** Sources and functions of dietary fats, role of fats in health and diseases**. 6Hrs**

**Unit -IV:** Minerals- Role of minerals on human health, sources, biological functions, deficiency disorders with special reference to Calcium, Phosphorus, Potassium, Copper, Iron, Zinc and Selenium. Minerals in biological systems and their importance –Iron, Calcium, Phosphorus, Iodine, Copper, Zinc**. 6Hrs**

**Unit -V:** Role of proteins and carbohydrates in health. Functions of protein and carbohydrate and their calorific value. Dietary sources and deficiency disorders – Kwashiorkor and Marasmus – supplementation programs in India and their implications. **6Hrs**

**Course Outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of this course, students will be able to** | **Programoutcomes** |
| CO1 | Understand about the importance of health and diet | PO1 |
| CO2 | Discuss about the classification properties and deficiencies of vitamins | PO1 |
| CO3 | Understand about sources and functions of fats and lipids on health | PO1.PO4 |
| CO4 | Detail about the different types of minerals and its role in health | PO1,PO4 |
| CO5 | Relate the role of proteins and carbohydrates on health | PO1,PO4 |

**Text books**

1 **Davidson S and. Passmore JR**. Human Nutrition and Dietetics, (8th ed), Churchill Livingstone .1986

2. **Garrow JS, Philip W, James T, Ralph A** , Human Nutrition and Dietetics (10th ed), Churchill Livingstone .2000

3.**Swaminathan M.** Principles of Nutrition and Dietetics, Bappco, Banglore.1985

**Reference Books**

1**. Margaret Mc Williams**.Food Fundamentals (10th ed), Prentice Hall.2012

**Web Resources**

1. <https://www.universalclass.com/articles/health/nutrition/nutritional-needs-for-differentages>.

2. nhp.gov.in/healthyliving/healthydiet

3. [www.anme.com.mx/libros/PrinciplesofNutrition.pdf](http://www.anme.com.mx/libros/PrinciplesofNutrition.pdf)

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 3 |  |  |  |  |  | 3 | 3 |  | 3 |
| **CO 2** | 3 |  |  |  |  |  | 3 | 3 |  | 3 |
| **CO 3** | 3 |  |  | 2 |  |  | 3 | 3 |  | 3 |
| **CO 4** | 3 |  |  | 2 |  |  | 3 | 3 |  | 3 |
| **CO5** | 3 |  |  | 2 |  |  | 3 | 3 |  | 3 |

**S-Strong (3) M-Medium (2) L-Low (1)**

|  |  |  |
| --- | --- | --- |
| SEMESTER: II  NME- II  PART - IV | **23UBION26: Lifestyle Diseases**  **(NME- II)** | CREDIT: 2  HOURS: 2/W |

**Learning Objectives**

The objectives of this course are to

* Create awareness on lifestyle diseases among adolescents.
* List out the lifestyle diseases.
* Explain the common lifestyle diseases and their prevention.
* Acquaint in the disorders associated with women’s health.
* Impart life skills to prevent lifestyle diseases.

**Unit -I:** Lifestyle diseases: Definition, Factors contributing to lifestyle diseases – Physical inactivity, Poor food habits, disturbed biological clock, sleep deprivation. **6Hrs**

**Unit -II:** Top lifestyle diseases, Impact of Lifestyle diseases on family, society and economy of country**. 6 Hrs**

**Unit-III**: Causes, symptoms**,** types, preventive measures and treatment of Obesity, cardiovascular diiiseases, diabetes and cancer. **6 hrs**

**Unit -IV:** Women’s lifestyle diseases: Polycystic Ovarian Disease, Infertility, Breast and cervical cancer and Osteoporosis**. 6 hrs**

**Unit -V:** Prevention of lifestyle diseases: Balanced diet, sufficient intake of water, physical activity ,sleep-wake cycle, stress management and meditation. **6Hrs**

**Course outcomes**

|  |  |  |
| --- | --- | --- |
| **CO** | **On completion of the course the students will be able to** | **Program Outcomes** |
| CO1 | Define Lifestyle diseases and describe the contributing factors | PO1 |
| CO2 | Enumerate the top lifestyle diseases and its impact on life. | PO1,PO4,PO5 |
| CO3 | Elaborate the treatment and prevention measures of common lifestyle diseases. | PO1,PO4,PO5 |
| CO4 | Highlight the lifestyle diseases that affects the women’s health | PO1,PO4,PO5 |
| CO5 | Illustrate the various measures for prevention of lifestyle diseases | PO1,PO4,PO5 |

**Textbooks**

1. **James MR.** Lifestyle Medicine,2ndEdition,CRCPress,2013
2. **Akira Miyazaki.** .New Frontiers in Lifestyle-Related Disease,Springer,2008

**Reference books**

1. **Steyn K**, Lifestyle and related risk factors for chronic diseases. Disease and Mortality in Sub-Saharan Africa, The International Bank for Reconstruction and Development, The World Bank, Washington DC.2006.
2. **Willett WC**, Prevention of chronic disease by means of diet and lifestyle. Review article in Disease Control Priorities in Developing Countries. 2nd edition. Washington (DC): The International Bank for Reconstruction and Development / The World Bank; 2006. Chapter 44.
3. **Kumar M** and **Kumar R**,. Guide to prevention of life style diseases. Deep & Deep publications.2004

**Web resources**

1.https://youtu.be/jDdL2bMQXfE

2. https://youtu.be/7WnpSB14nDM

3. https://youtu.be/ollz9MqtW-U

**Mapping with Program Outcomes**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **PO 1** | **PO 2** | **PO 3** | **PO 4** | **PO 5** | **PO 6** | **PSO1** | **PSO2** | **PSO3** | **PSO4** |
| **CO 1** | 2 |  |  |  |  |  | 3 | 3 |  | 3 |
| **CO 2** | 2 |  |  | 2 | 3 |  | 3 | 3 |  | 3 |
| **CO 3** | 2 |  |  | 2 | 3 |  | 3 | 3 |  | 3 |
| **CO 4** | 2 |  |  | 2 | 3 |  | 3 | 3 |  | 3 |
| **CO 5** | 2 |  |  | 2 | 3 |  | 3 | 3 |  | 3 |

**S-Strong(3) M-Medium (2) L-Low (1)**