**BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI**

**SECOND SEMESTER 2021-22**

Dated: 17.01.22

**Course Handout Part II**

**Course No. :** **BIO G523**

**Course Title :** **Advanced & Applied Microbiology**

**Instructor In-charge : JAYATI RAY DUTTA**

**Instructors : Ruchi Jain Dey, Pranay, Naresh & Kalyani**

**1. Course Description**: Molecular taxonomy, Systematic Microbiology; Study of molecular diversity of microorganisms, Molecular tools employed in study of microbial ecology, clinical microbiology, human-microbe interaction, molecular plant-microbe interaction, applied microbiology, nanotechnology and synthetic microbiology.

**2.** **Scope & Objective of the Course:**

This course deals with in-depth study of microbial taxonomy and evolution as well as the molecular aspects of microbe-host interactions. In addition, it includes applied aspects of microbiology for in industry and human-health. It also emphasizes on recent developments in microbial genomics, nanotechnology and biotechnology.

**3.** **Text Book (TB):**

Madigan M.T., Martinko, J.M., Dunlap, P.V., Clark, D.P., Brock, Biology of Microorganism, 12th Ed., 2009, Pearson International Education.

**4.** **Reference Book (RB)**:

1. Wiley, J.M., Sherwood, L.M., Woolverton, C.J. Prescott, Harley, and Klein’s Microbiology, 7th Ed. McGraw-Hill International Edition.

2. Glazer, A.N. and Nikaido, H, Microbial Biotechnology, Fundamentals of applied Microbiology, 2nd Ed., Cambridge.

**5. Course Plan:**

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| **Lec. No.** | **Learning Objectives** | **Topic to be covered** | **Ref. to Chapters** |
| 1-4 | Bacterial Evolution and Systematics | Microbial Evolution, Microbiology Systematics, Microbial taxonomy | TB-14, RB1-19 |
| 5-7 | Molecular biology of Archaea | Molecular biology of Archaea, DNA replication, Transcription and RNA processing, protein synthesis, shared features of Bacteria and Archaea | TB-8 |
| 8-11 | Socio-microbiology | Quorum-sensing; prospective application of quorum-sensing mechanisms in medicine, biofilm | TB-9, 23 |
| 12-15 | Microorganisms for Sustainable Agriculture | Plant growth promoting microorganisms; Associative bacteria, Endophytic bacteria: mechanisms of colonization, various plant growth promoting properties; Biocontrol: Mycorrhiza | RB1-29 TB-24 |
| 16-18 | Molecular Plant-Microbe interaction-1 | Molecular basis of legume-rhizobia interaction, plant-pathogenic bacteria interaction | RB1-29 TB-24 |
| 19-20 | Molecular Plant-Microbe interaction-2 | Plant immune response: Molecular aspects | Reviews |
| 21-24 | Medical Microbiology | Microbial interactions: Microbe-human interaction, normal microbiota in human; Host-parasite/pathogen interaction; Pathogenicity of Microorganisms, Antimicrobial Chemotherapy, | TB-28, RB1-33  RB1-34  and relevant reviews |
| 25-26 | Microbial Biosensors | Biosensors and their applications | RB1-35 |
| 27-31 | Synthetic Microbiology | Synthetic/engineered microorganisms and their applications | Reviews |
| 32-34 | Industrial Microbiology | Microbial polysaccharides and Bioplastics | RB2-8 |
| 35-38 | Food Microbiology | Primary and secondary metabolites, fermented foods, beverages, Enzymes, Single-cell protein | TB-25 |
| 39-40 | Microbes & fuel generation | Biomass production, Bioethanol/biodiesel production from different microbial sources. | Reviews |

**List of experiments:**

1. Production & estimation of citric acid by calorimetry.
2. Production of wine from grapes and estimation of ethanol generation by GC.
3. Production, expression & confirmation of recombinant protein.
4. Production and estimation of Glutathione peroxidase in *L. plantarum*.
5. Antibiotic sensitivity test – Disc diffusion method
6. Antibiotic susceptibility test – Minimum inhibitory concentration
7. Study of the morphology of the given microbial strain using Microscopic techniques (Gram staining with Light Microscope; and Scanning Electron Microscope)
8. Molecular detection of the given microbial strain (PCR-RFLP method)

**7. Evaluation Scheme:**

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| --- | --- | --- | --- | --- | --- |
| **EC No.** | **Evaluation Component** | **Duration** | **Weightage (%)** | **Date, Time & Venue** | **Remarks** |
| 1. | Mid-semester | 90 min | 25 | As per Timetable | CB |
| 2. | Lab practical (Evaluation components include:  1. Laboratory quiz based on experiments conducted during class + Attendance  2.  Comprehensive written-test |  | 20 |  | OB |
| 3. | Presentations/assignments |  | 20 |  | OB |
| 4. | Comprehensive | 2 hours | 35 | As per Timetable | CB |

**8. Chamber consultation hour**: To be announced in the class.

**9. Notices:** All notices will be displayed on Course management system.

**10. Make-up policy:** Make-up decisions will be considered for only genuine cases and validated by proper evidence of illness. No make-up for Lab components and assignments.

**Academic Honesty and Integrity Policy**: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**Instructor-in-charge**

**BIO G523**