PG MICROBIOLOGY

PCMBB20: FOOD, AGRICULTURE AND ENVIRONMENTAL MICROBIOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: I	PCMBB20	Food, Agriculture and Environmental Microbiology	Theory	Core	6	5	100

Course Objective: To make the students familiarize on Food, Agriculture and Environmental aspects of Microbiology.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Analyse the principles in food preservation.

CO2: Communicate diseases associated with food.

CO3: Discuss the role of microorganisms in soil and microbial interaction.

CO4: Utilize the knowledge on biogeochemical cycles to produce biofertilizers.

CO5: Assess information about microbiological quality of air and water.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	L	H	M
CO2	H	L	L	M	L	H
CO3	H	H	M	H	L	H
CO4	H	L	L	M	M	H
CO5	H	H	M	H	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	M	L	H	M
CO2	H	M	M	L	L	H
CO3	H	H	M	H	L	H
CO4	H	L	L	L	M	H
CO5	H	H	M	H	L	H

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT-I: Food Microbiology. (15 hours)

1.1 Importance of studying Food microbiology- Primary sources of microorganisms in foods. (K1,K2)

1.2 Factors influencing microbial growth in foods - extrinsic and intrinsic.(K1,K2)

1.3 Principles of food preservation - preservation methods - irradiation - drying, heat processing, chilling and freezing, high pressure, modification of atmosphere and chemical preservatives. (K1,K2,K3,K4)

1.4 Nutritional value of fermented foods. (K2,K3,K4,K5,K6)

1.5 SCP and their uses. (K1,K2,K3)

1.6 Contamination, preservation and spoilage of fruits, vegetables, meat and poultry products. (K1,K2,K3)

UNIT-II: Dairy Microbiology. (15 hours)

2.1 Microbiology of fermented milk - Starter lactic cultures (K1,K2)

2.2 Fermented milk products (cheese, yoghurt, acidophilus milk, kefir, kumis). (K1,K2,K3)

2.3 Food sanitation in food manufacture and in the retail trade. (K1,K2,K3)

2.4 (HACCP) - Food control agencies and its regulations. (K1,K2,K3)

2.5 Food borne disease.(K1,K2)

2.6 Milk borne diseases. (K1,K2)

UNIT-III: Soil Microbiology. (15 hours)

3.1 Distribution of soil microorganisms in soil. (K1,K2)

3.2 Factors influencing the soil microflora. (K1,K2)

3.3 Role of microorganisms in soil fertility. (K1,K2)

3.4 Interactions among microorganisms, mutualisms, commensalism, competition, amensalism, parasitism, predation. (K1,K2)

3.5 Interactions between microbes and plants - rhizosphere, phyllosphere. (K1,K2)

3.6 Mycorrhizae, root nodule bacteria. (K1,K2,K3,K4)

UNIT-IV: Biogeochemical cycle and Biofertilizers. (15 hours)

4.1 Biogeochemical - carbon cycle - role of microbes in carbon cycle.(K1,K2)

4.2 Nitrogen cycle - mechanism of biological nitrogen fixation - ammonification - nitrification - denitrificatioin and microorganisms involved in such processes. .(K1,K2)

4.3 Phosphorous cycle. .(K1,K2)

4.4 Sulphur cycle. (K1,K2)

4.5 Biofertilizer for sustainable agriculture *Rhizobium, Azospirillium, Azotobacter*.(K1,K2,K3,K4)

4.6 *Azolla*, BGA -mass production methods - applications methods and crop response of biofertilizers.(K1,K2,K3,K4)

UNIT-V: Aero Microbiology and Aquatic Microbiology. (15 hours)

5.1 Droplet, Droplet nuclei and Aerosol. (K1,K2)

5.2 Assessment of air quality. (K2,K3,K4)

5.3 Airborne diseases, their symptoms and preventive measures, water borne disease.(K1,K2)

5.4 Types of water – Assessment of microbiological quality of water.(K2,K3,K4)

5.5 Treatment of municipal water (K4,K5)

5.6 Types of wastes, characterization of solid and liquid waste. Sewage treatment- composting. (K3,K4,K5)

TEXT BOOKS:

1. Frazier W.C. and West Hoff D.C (2008). Food Microbiology. 4th edition. Mc Graw Hill, New York.
2. Joseph C. Daniel (1999). Environmental aspects of Microbiology. 1st edition, Bright Sun publications, Chennai.
3. Subba Rao NS (2004). Soil Microbiology. 4th edition, Oxford and BH Publishing Co.Pvt. Ltd., New Delhi.

REFERENCE BOOKS:

1. Adam M.R. and Moss M.O (2004). Food Microbiology. 2nd edition, New international pvt. Ltd., publishers.UK.
2. Banwart G. J (2004). Basic Food Microbiology. 2nd edition, CBS Publishers and Distributors, New Delhi.
3. James M. Jay (2003). Modern Food Microbiology. 4th edition, CBS Publishers, New Delhi.
4. Vijaya Ramesh K (2004). Environmental Microbiology. 1st edition, MJP publishers. Chennai.
5. Singh D.P and Dwivedi S.K (2005). Environmental Microbiology and Biotechnology. 1st edition, New Age International (P) Ltd., New Delhi.
6. Mishra RR (2004). Soil Microbiology. 1st edition, CBS Publishers and distributors, New Delhi.
7. Rangaswami G and Mahadevan A (2002). Disease of Crop Plants in India. 4th edition, PHI Learning (P) Ltd., New Delhi.
8. Atlas R.M. and Bartha R (1992). Microbial Ecology, Fundamental and Application, 3rd edition, Bengamin and Cummings. United States.

OER:

1. http://www.loc.gov/
2. http://library.clark.edu/
3. http://www.dli.ernet.in/
4. http://www.loc.gov/education/

PCMBC20: IMMUNOLOGY AND IMMUNOTECHNOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: I	PCMBC20	Immunology and Immunotechnology	Theory	Core	5	5	100

Course Objective: To provide in depth knowledge on immune cells, immune system- its function and hybridoma technology

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Outline the types of immune response and discuss the role of lymphoid organs in immunity.

CO2: Compile immunoglobulins and antigens.

CO3: Communicate the importance of MHC in organ transplantation.

CO4: Analyse the allergic responses by the immune system leading to hypersensitive conditions and auto immune disorders.

CO5: Plan immunization schedule.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	L	M	M	H	H
CO2	H	L	H	L	M	H
CO3	H	L	H	L	M	H
CO4	H	L	M	M	H	H
CO5	H	M	M	L	M	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	L	H	M	H	H
CO2	H	L	H	M	M	H
CO3	H	L	H	L	M	H
CO4	H	L	H	M	H	H
CO5	H	M	H	L	M	H

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT-I: Immunity and Lymphoid Organs. (15 hours)

1.1 Introduction: Infection, immunity, types of immunity - innate and adaptive.(K1,K2)
1.2 Phagocytosis and extracellular killing, immunity to specific infection. (K1,K2)
1.3 Milestones in immunology - evolution of immunology. (K1,K2)
1.4 Immune Systems: Anatomy of the lympho - reticular system, primary lymphoid organs - bone marrow & thymus. (K1,K2)
1.5 Secondary lymphoid tissues - spleen, lymph nodes & gut associated lymphoid tissue. (K1,K2)
1.6 Immuno reactive cells - T and B lymphocytes, macrophages, granulocyte and NK cells. (K1,K2)

UNIT-II: Antigens and Major Histocompatibility Complex. (15 hours)

2.1 Antigens and Immunogenicity: Terminologies and definitions - antigen, immunogen, haptens, superantigens, tolerogen, epitope, paratope and antigenic determinants. (K1,K2)
2.2 Features associated with antigenicity and immunogenicity. (K1,K2)
2.3 Basis of antigen specificity. (K1,K2)
2.4 Antigen receptors: Cell surface proteins of Major Histocompatibility Complex (MHC): types, - class I, II and III distribution and function. (K1,K2)
2.5 MHC in relation to transplantation and HLA typing. (K1,K2)
2.6 T cell receptor complex (TCR). (K1,K2)

UNIT-III: Immunoglobulin and Complement System. (15 hours)

3.1 Antibodies - B cell receptors. Three dimensional structure of immunoglobulin molecule. (K1,K2)
3.2 Types of immunoglobulins. Biological and chemical properties of immunoglobulin. (K1,K2)
3.3 Antigen, antibody attraction - forces, affinity, avidity and specificity. (K1,K2,K3,K4,K5,K6)
3.4 Antibody synthesis and diversity - genetic basis. (K1,K2,K3)
3.5 Monoclonal and polyclonal antibody production - Hybridoma technology. (K1,K2,K3,K4)
3.6 Complement system: Basics of complement protein - different pathways of complement activation - the pathway of membrane attack (common pathway), classical and alternate. (K1,K2)

UNIT-IV: Hypersensitivity. (15 hours)

4.1 Acquired immune response. (K1,K2)
4.2 Humoral immune response - various phases of humoral immune response. (K1,K2)
4.3 Cell mediated immune response. (K1,K2)
4.4 Immune regulation - various events in induction of immune response. (K1,K2)
4.5 Hypersensitivity- Type I to IV (K1,K2)
4.6 Means of immunosuppression - physical, chemical and biological. (K1,K2,K3)

UNIT-V: Vaccines and Autoimmune Diseases. (15 hours)

5.1 Vaccines – Live attenuated and killed inactivated vaccine. (K1,K2)

5.2 rDNA vaccine, synthetic peptide vaccine, Plasma derived vaccine, anti - idiotypic vaccine and DNA vaccine. (K1,K2,K3,K4,K5,K6)

5.3 Active immunization - vaccines & toxoids – bacterial and viral. (K1,K2,K3,K4)

5.4 Immunization Schedule.(K1,K2,K3)

5.5 Passive immunization - antitoxins, immunoglobulin, specific immunoglobulin, hyper immune gamma globulin. (K1,K2,K3,K4)

5.6 Autoimmune diseases. (K1,K2)

TEXT BOOKS:

1. Kuby J Richard A. Goldsby, Thomas J. Kindt (2006). Immunology. 6th edition, W.H. Freeman and company, New York.
2. Richard M.Hyde (2011). Immunology. 3rd edition, Williams & Wilkins, *Philadelphia.*

REFERENCE BOOKS:

1. Bashir S.F (2011). Text Book of Immunology. 1st edition, PHI Learning Private limited, New Delhi.
2. Ananthanarayan R & Paniker C.K.J (2013). Text Book of Microbiology, 9th edition, Universities Press, Hyderabad
3. Tizard K (1995). Immunology. An Introduction. 1st edition, Saunders college publishing, Philadelphia.
4. Donal M. Weir, John Steward. (1993). Immunology. 7th edition. ELBS, London
5. Janeway Travers. (1997). Immuno biology - The immuno system in health and Disease. 3rd edition Current Biology Ltd., London, New York.
6. Clark WR (1991). The experimental foundations of modern immunology, 2nd edition. John Wiley and Sons Inc. New York.

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2. http://library.clark.edu/
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ELECTIVE I-A

PEMBA20: PETROLEUM MICROBIOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: I	PEMBA20	Petroleum Microbiology	Theory	Core Elective	3	3	100

Course Objective: To provide in depth knowledge about the microbial communities residing in the oil reservoirs and other hydrocarbon resource environments.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Outline the importance of petroleum Microbiology and predict the impact of the microbial communities in various petroleum fields.

CO2: Design the microbial solutions to the microbiology related problems in the petroleum industry.

CO3: Discuss solutions to enhance production of oil/energy by applying concepts of production related petroleum microbiology.

CO4: Utilize biotechnological aspects in remediation of oil spills.

CO5: Use apparatus for the detection of living microbial contaminants in petroleum products.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	L	M	H	H
CO2	H	M	M	L	H	H
CO3	M	H	H	L	H	H
CO4	H	H	H	H	H	H
CO5	M	H	H	L	M	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M	L	M	H	H
CO2	H	L	M	L	M	H
CO3	M	H	M	L	H	H
CO4	H	M	H	H	H	H
CO5	M	H	H	L	M	H

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS:

Unit–I: Microbiology of Oil Fields. (10 hours)

1.1 Introduction to oil fields, formation of oil reservoirs, oil production. (K1,K2)

1.2 Indigenous microbial communities in oil fields. (K1,K2)

1.3 Microbiology and molecular biology of sulfate-reducing bacteria. (K1,K2)

1.4 Hyperthermophilic archae in oil fields.(K1,K2)

1.5 Methanogenic archaea in oil fields. (K1,K2)

1.6 Fermentative, iron-reducing and nitrate-reducing microorganisms. (K1,K2)

UNIT–II: Detrimental Effects of Bacterial Activity. (8 hours)

2.1 Biodegradation of petroleum in subsurface geological reservoirs. (K1,K2)

2.2 Introduction to oil Reservoir souring. (K1,K2)

2.3 Mechanism and prevention of reservoir souring. (K1,K2,K3)

2.4 Microbial control of hydrogen sulfide production in oil reservoirs. (K1,K2,K3)

2.5 Microbial corrosion in the oil industry. (K1,K2)

2.6 Biofouling in the oil industry. (K1,K2)

UNIT–III: Application of Biotechnology in Oil Production. (9 hours)

3.1 Intoduction to application of Biotechnology in oil production. (K1,K2)

3.2 Microbially enhanced oil recovery. (K1,K2,K3)

3.3 Past present and future biotechnological upgrading of petroleum. (K1,K2)

3.4 Diversity in oil production. (K1,K2,K3)

3.5 Function of alkane oxygenases (K1,K2)

3.6 Biocatalytic applications of alkane oxygenases, (K1,K2,K3)

UNIT–IV: Microremediation of Oil Spills and Oil Resources. (9 hours)

4.1 Introduction to Microremediation. (K1,K2)

4.2 Marine oil spill bioremediation. (K1,K2,K3)

4.3 Metabolic indicators of anaerobic hydrocarbon biodegradation in petroleum-laden environments. (K1,K2,K3,K4)

4.4 Unconventional gas and oil resources- shale gas. (K1,K2,K3)

4.5 Unconventional oil resources- oil sands. (K1,K2,K3)

4.6 Coal bed methane (CBM). (K1,K2,K3)

UNIT–V: Geo Microbiological Exploration of Petroleum Products. (9 hours)

5.1 Introduction to GeoMicrobial Exploration of Petroleum products. (K1,K2)

5.2 Impact and Significance of GeoMicrobial Exploration of Petroleum products. (K1,K2)

5.3 Apparatus for the detection of living microbial contaminants in petroleum products. (K1,K2)

5.4 Microbiological Exploration for Petroleum Deposits. (K1,K2,K3,K4)

5.5 Geomicrobiological methods of ore exploration. (K1,K2,K3,K4)

5.6 Geomicrobiological methods Petroleum exploration. (K1,K2,K3,K4)

TEXT BOOK:

1. Bernard Ollivier, Mitchel Magot (2005). Petroleum Microbiology, ASM Press.

REFERENCE BOOKS:

1. Corinne Whitby, Torban Lund Skovhus (2011). Applied Microbiology and molecular biology in oil field systems, Springer.
2. Larry L. Barton, W. Allan Hamilton (2007). Sulphate-Reducing Bacteria: Environmental and Engineered Systems, Cambridge University Press.

OER:

1. http://www.ecomii.com/science/encyclopedia/petroleum-microbiology/
2. http://lizinan.wordpress.com/2010/06/24/microbial-enhanced-oil-recovery/
3. http://www.metamicrobe.com/petroleum-microbiology/

ELECTIVE I-B

PEMBB20: ECONOMIC MICROBIOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: I	PEMBB20	Economic Microbiology	Theory	Core Elective	3	3	100

Course Objective: To introduce entrepreneurial skills among students to become entrepreneurs and can decide to make the idea reality.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Utilize microorganisms as biofertilizers and for vermicomposting.

CO2: Analyse microbial cells as fermented products.

CO3: Use yeast in and as food and feed.

CO4: Demonstrate mushroom cultivation and its storage.

CO5: Discuss biotechnological applications of microalgae.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	H	H
CO2	H	M	L	M	M	H
CO3	H	M	L	M	M	H
CO4	H	M	H	H	H	H
CO5	H	L	M	L	H	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	M	L	M	L	H
CO3	H	M	L	M	L	H
CO4	H	M	H	H	L	H
CO5	H	L	M	L	H	H

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

Unit–I: Microbes in Agriculture. (8 hours)

1.1 Production and application of biofertilizers - *Rhizobium*, *Azospirillum*, *Azotobacter*. (K1,K2,K3,K4)
1.2 *Azolla* - *Anabaena*, BGA. (K1,K2,K3,K4)
1.3 Phosphate solubilizing – phosphobacterium and Mycorrhiza. (K1,K2,K3,K4)
1.4 Bacterial Biopesticides. (K1,K2,K3,K4)
1.5 Fungal Biopesticides. (K1,K2,K3,K4)
1.6 Role of microorganisms in vermicomposting. (K1,K2,K3,K4)

UNIT–II: Microbes in Industries. (10 hours)

2.1 Fermented beverages: wine, beer, whisky, brandy – health benefits and disadvantages. (K1,K2,K3,K4)
2.2 Organic acids- Citric acid, acetic acid. (K1,K2,K3,K4)
2.3 Organic solvents- Acetone, butanol, ethanol. (K1,K2,K3,K4)
2.4 Fermented foods- cheese, yoghurt, sauerkraut, bread, sweeteners, flavor enhancers. (K1,K2,K3,K4)
2.5 Traditional fermented foods- Dhokla, Appam, Churpa/Churpi, fermented bamboo shoot. (K1,K2,K3,K4,K5,K6)
2.6 Oriental fermented foods- soya sauce, koji & miso(K1,K2,K3,K4).

UNIT–III: Yeast Production. (9 hours)

3.1 Bottom and Top yeast- Baker's yeast. (K1,K2)
3.2 Food and feed yeasts. (K1,K2)
3.3 Alcohol yeasts. (K1,K2)
3.4 SCP: *Saccharomyces cerevisiae*, *Pichia pastoris*. (K1,K2)
3.5 *Candida utilis* and *Geotrichum candidum.* (K1,K2)
3.6 Other yeast products. (K1,K2)

UNIT–IV: Mushroom Cultivation. (9 hours)

4.1 Button mushroom (*Agaricus bisporus*) – composting, spawning (K1,K2,K3,K4,K6)
4.2 Button mushroom (*Agaricus bisporus*) – cropping, harvesting and marketing. (K1,K2,K3,K4,K6)
4.3 Oyster mushroom (*Pleurotus* sps.), - composting, spawning (K1,K2,K3,K4,K6)
4.4 Oyster mushroom (*Pleurotus* sps.), - cropping, harvesting and marketing (K1,K2,K3,K4,K6)
4.5 Paddy straw mushroom (*Volvariella volvacea*) – composting, spawning. (K1,K2,K3,K4,K6)
4.6 Paddy straw mushroom (Volvariella volvacea). cropping, harvesting and marketing. (K1,K2,K3,K4,K6)

UNIT–V: Microalgal Technology. (9 hours)

5.1 Cultivation methods of Spirulina (K1,K2,K3,K4,K6)
5.2 Biotechnological potentials of microalgae- food and feed. (K1,K2)

5.3 Fuel production from microalgae- Methane and Hydrocarbon. (K1,K2,K3,K4)
5.4 Pharmaceutically valuable compounds from microalgae (K1,K2,K3,K4)
5.5 Food and nutraceuticals of Algae: Cyanophyta, Rhodophyta, Heterokontophyta, Chlorophyta. (K1,K2,K3,K4)
5.6 Polysaccharides (Agar Agar, Carageenan and Alginic acid). (K1,K2,K3)

TEXT BOOKS:

1. Dubey R.C (2005). A Text of Biotechnology. Multicolour Illustrative edition, S.Chand and Company Ltd., New Delhi.
2. Subba Rao NS (2004). Soil Microbiology. 4th edition, Oxford and BH Publishing Co.Pvt. Ltd., New Delhi.
3. Patel A.H (2001). Industrial Microbiology. 3rd edition, Mac Millan India ltd, Chennai.
4. Ismail S.A (2005). The Earthworm Book, 2nd revised edition. Other India Press, Goa, India.
5. Vijaya Ramesh K (2007). Food Microbiology. 1st edition, MJP Publishers, Chennai.

REFERENCE BOOKS:

1. Casida J.E (1986). Industrial Microbiology, 1st edition. Wiley Eastern publishers.UK.
2. Frazier W.C. and West Hoff D.C (2008). Food Microbiology. 4th edition. Mc Graw Hill, New York.
3. Suman B.C and Sharma V.P (2005) Mushroom Cultivation, Processing and Uses. 1st edition, Agribios (India) Publishers, Jodhpur.
4. Lansing M. Prescott, John P. Harley., Donald A. Klein (2011) .Microbiology.8th edition. McGraw Hill Inc., New York.
5. McCandless, E.L. 1981. Polysaccharides of seaweeds. In The Biology of seaweeds, ed. C.S. Lobban and M.J. Wynne, pp. 559-88. Blackwell, Oxford.
6. Melanie N. Johansen. 2011. Microalgae_ Biotechnology, Microbiology and Energy (Marine Biology) --Nova Science Pub Inc
7. Tridevi, P. C. 2001. Algal Biotechnology. Point Publisher, Jaipur, India

OER:

1. http://www.loc.gov/
2. http://library.clark.edu/
3. http://www.dli.ernet.in/
4. http://www.loc.gov/education/

PCMBF20: INDUSTRIAL AND PHARMACEUTICAL MICROBIOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: II	PCMBF20	Industrial and pharmaceutical Microbiology	Theory	Core	5	4	100

Course Objective: To provide an in depth understanding about industrially important organisms, strain improvement and production of major products.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Outline the importance of production strain in industries.

CO2: Discuss on fermentors and fermentation process.

CO3: Describe the upstream and downstream processing.

CO4: Analyse the steps involved in vaccine, toxoid and antisera production and evaluate the standardization of antiseptics and disinfectants..

CO5: Assess good practice and regulation involved in utilizing microbial product for pharmaceutical applications**.**

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	M	H
CO2	H	M	M	L	H	H
CO3	H	M	M	L	H	H
CO4	H	M	M	L	H	H
CO5	H	H	H	L	H	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	M	H
CO2	H	M	M	H	H	H
CO3	H	M	M	H	H	H
CO4	H	M	M	H	H	H
CO5	H	H	H	H	H	H

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT- I: Introduction to Fermentation. (9 hours)

1.1 Introduction to fermentation – the range of fermentation process. (K1,K2)

1.2 The chronological development of the fermentation industry. (K1,K2)

1.3 The component parts of a fermentation process. (K1,K2)

1.4 Isolation of Industrially important organisms. (K1,K2,K3,K4)

1.5 Preservation of industrially important organisms. (K1,K2,K3,K4)

1.6 Strain improvement of industrially important microorganisms. (K1,K2,K3,K4, K5)

UNIT-II: Fermentors and Development of Inoculum. (9 hours)

2.1 Development of inoculum - Scale up (Pilot study). (K1,K2)

2.2 Upstream processing – media for industrial fermentation – formulation – sterilization – Microbial growth kinetics. (K1,K2,K3,K4)

2.3 Fermentation – types. (K1,K2)

2.4 Downstream processing. (K1,K2)

2.5 Fermentor/ Bioreactors – Parts and Design. (K1,K2)

2.6 Types of Bioreactors – Instrumentation and control.(K1,K2,K3)

UNIT- III: Microbial Productions. (12 hours)

3.1 Production of Organic acids (Citric acid, Acetic acid). (K1,K2,K3)

3.2 Production of Amino acids (L - Glutamic acid , L - Lysine). (K1,K2,K3)

3.3 Production of Antibiotics (Penicillin, Streptomycin, Tetracyclines). (K1,K2,K3)

3.4 Production of Enzymes (Amylases, Proteases and Pectinases). (K1,K2,K3)

3.5 Production of vitamins (B12, B2 and C). (K1,K2,K3)

3.6 Production of alcoholic beverages (wine and beer). (K1,K2,K3)

UNIT- IV: Vaccine Production and Pharmaceutical Standardisation. (8 hours)

4.1 Production of different types of vaccines. (K1,K2,K3)

4.2 Toxoid, antisera production and their standardization. (K1,K2,K3)

4.3 Preparation of Antiseptics and their uses. (K1,K2,K3)

4.4 Preparation of disinfectants and their standardization. (K1,K2,K3)

4.5 Types of water used in pharmaceutical industries (DM/Purified water). (K1,K2,K3)

4.6 Water for injection used in pharmaceutical industry and pyrogen testing. (K1,K2,K3,K5)

UNIT –V: Microbial Assay of Antibiotics. (7 hours)

1.1 Sub culturing and culture suspension preparation. (K2,K3,K4,K5)

1.2 Microbial assay of antibiotics and vitamins. (K2,K3,K4,K5)

1.3 Sterility testing. (K2,K3,K4,K5)

1.4 Bacterial Endotoxin Test (BET). (K2,K3,K4,K5)

1.5 Good Documentation Practice (GDP) – SOP – GLP. (K2,K3,K4,K5)

1.6 Failure investigation. (K1,K2,K3)

TEXT BOOKS:

1. Patel A.H (2001). Industrial Microbiology. 3rd edition, Mac Millan India ltd, Chennai.
2. Chisti, Y., (2006) Fermentation, Biocatalysis and bioseparation, Encyclopedia of Bioprocess Technology, Vol. 5, John Wiley and Sons, New York

REFERENCE BOOKS:

1. Casida J.E (1986). Industrial Microbiology, 1st edition. Wiley Eastern publishers.UK
2. Stanbury P.F., Whitaker A and Hall S.J (1995). Principles of Fermentation technology. 1st edition, Pergamon, UK.
3. Presscott and Dunn, S., (1982) Industrial Microbiology. 4th edition .The AVI Publishing Company Inc., USA.
4. Belter, P.A., Cussler, E.L. and Hu, W.S., (2005) Bioseparation: Downstream processing for Biotechnology,1st edition. John Wiley and Sons, N.Y

OER:

1. http://www.loc.gov/
2. http://library.clark.edu/
3. http://www.dli.ernet.in/
4. http://www.loc.gov/education/

PIMBA20: IEC- I: PUBLIC HEALTH MICROBIOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/ W	Credits	Marks
SEM: I	PIMBA20	Public Health Microbiology	Theory	Independent elective	-	2	100

Course Objective: To provide in depth knowledge about significance of public health at theoretical and practical levels.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Explain the significance of public health.

CO2: Communicate the mode of transmission of human diseases.

CO3: Discuss the role of medically important pathogens and the diseases caused.

CO4: Outline the vector complex interactions between the pathogens and host.

CO5: Create awareness on hospital-acquired infections, prevention and its control measures.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	L	H
CO2	H	H	H	H	L	H
CO3	H	H	M	M	M	H
CO4	H	H	M	M	M	H
CO5	H	H	L	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	H	H
CO2	H	L	M	H	L	H
CO3	H	L	M	H	L	H
CO4	H	L	M	H	L	H
CO5	H	M	H	M	M	H

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT–I: Water Borne Diseases.

1.1 Overview on common water borne diseases. (K1,K2)

1.2 Microbiology of causative agents, epidemiology, pathogenesis, laboratory diagnosis, prevention and control of hepatitis. (K1,K2,K3,K4)

1.3 Microbiology of causative agents, epidemiology, pathogenesis, laboratory diagnosis, prevention and control of cholera, typhoid. (K1,K2,K3,K4)

1.4 Microbiology of causative agents, epidemiology, pathogenesis, laboratory diagnosis, prevention and control of amoebiasis, giardiasis. (K1,K2,K3,K4)

1.5 Microbiology of causative agents, epidemiology, pathogenesis, laboratory diagnosis, prevention and control of poliomyelitis. (K1,K2,K3,K4)

1.6 Non Diarrhoeal diseeases (bacterial and viral). (K1,K2,K3,K4)

UNIT–II: Air Borne Diseases.

2.1 Overview on common air-borne diseases. (K1,K2)

2.2 Microbiology of causative agents, epidemiology, pathogenesis, laboratory diagnosis of pneumonia. (K1,K2,K3,K4)

2.3 Microbiology of causative agents, epidemiology, pathogenesis, laboratory diagnosis of diphtheria. (K1,K2,K3,K4)

2.4 Microbiology of causative agents, epidemiology, pathogenesis, laboratory diagnosis of tuberculosis. (K1,K2,K3,K4)

2.5 Microbiology of causative agents, epidemiology, pathogenesis, laboratory diagnosis of anthrax. (K1,K2,K3,K4)

2.6 Microbiology of causative agents, epidemiology, pathogenesis, laboratory diagnosis of influenza and measles. (K1,K2,K3,K4)

UNIT–III: Food Borne Diseases.

3.1 Concept on food borne infections and food intoxication. (K1,K2)

3.2 Microbiology of causative microorganisms, epidemiology, pathogenesis, laboratory diagnosis, prevention and control of Staphylococcal food intoxication. (K1,K2,K3,K4)

3.3 Microbiology of causative microorganisms, epidemiology, pathogenesis, laboratory diagnosis, prevention and control of Clostridial food poisoning. (K1,K2,K3,K4)

3.4 Microbiology of causative microorganisms, epidemiology, pathogenesis, laboratory diagnosis, prevention and control of Salmonellosis. (K1,K2,K3,K4)

3.5 Microbiology of causative microorganisms, epidemiology, pathogenesis, laboratory diagnosis, prevention and control of Shigellosis. (K1,K2,K3,K4)

3.6 Microbiology of causative microorganisms, epidemiology, pathogenesis, laboratory diagnosis, prevention and control of travelers' diarrhea. (K1,K2,K3,K4)

UNIT–IV: Vector Borne Diseases.

4.1 Overview on common vector-borne diseases and their vectors (K1,K2)

4.2 Microbiology of causative organisms, epidemiology, pathogenesis, laboratory diagnosis and prevention and control of visceral leishmaniasis. (K1,K2,K3,K4)

4.3 Microbiology of causative organisms, epidemiology, pathogenesis, laboratory diagnosis and prevention and control of malaria. (K1,K2,K3,K4)

4.4 Microbiology of causative organisms, epidemiology, pathogenesis, laboratory diagnosis and prevention and control of filariasis. (K1,K2,K3,K4)

4.5 Microbiology of causative organisms, epidemiology, pathogenesis, laboratory diagnosis and prevention and control of Japanese encephalitis and dengue. (K1,K2,K3,K4)

4.6 Microbiology of causative organisms, epidemiology, pathogenesis, laboratory diagnosis and prevention and control of West Nile fever and plague. (K1,K2,K3,K4)

UNIT–V: Hospital Acquired Infection

5.1 Concept on common nosocomial infections (K1,K2)

5.2 Disinfection procedures of hospital environment. (K1,K2,K3)

5.3 Equipments and materials used in hospitals. (K1,K2,K3)

5.4 Methods of disposal of infective hospital waste. (K1,K2,K3,K4)

5.5 Methods of disposal of laboratory materials. (K1,K2,K3,K4)

5.6 Monitoring of sanitation in hospital environment. (K1,K2,K3,K4)

TEXT BOOKS:

1. Ananthanarayan R & Paniker C.K.J. (2013). Text Book of Microbiology, 9th edition, Universities Press, Hyderabad.
2. Jawetz, Melnick, &Adelberg's. (2013). Medical Microbiology. 26th edition. McGraw-Hill, New York.
3. Mehrotra RS and Aneja KR (2006). An Introduction to Mycology. 1st edition, New age international publishers, Chennai.
4. Subhash Chandra Parija (2013). Text book of Medical Parasitology. 4th edition, All India Publishers and Distributors (Medical Books Publishers), New Delhi.
5. Dimmok N.J and Primrose S.B (1994). Introduction to modern virology 4th edition, Blackwell scientific company publications, United States.

REFERENCE BOOKS:

1. Tille P. Bailey and Scott (2013). Diagnostic Microbiology, 13th edition, Mosby Publishers, United States.
2. Satish Gupte (2005). The Short Textbook of Medical Microbiology. 8th edition, Jaypee Brothers, Medical publishers (P) Ltd., New Delhi.
3. Monica Cheesbrough (2003). District Laboratory Practice in Tropical Countries. Part 1 & 2, Cambridge University Press.
4. Jagadish Chander (1996). A text book of Medical Mycology. 1st edition. Interprint, New Delhi.
5. Chatterjee K.D (2016). Parasitology, Protozoology& Helminthology. 13th edition. Joe media Publishers. Calcutta.

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6. http://www.freebooks.com/ebooks/

PIMBD20: IEC -IV: FORENSIC SCIENCE

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/ W	Credits	Marks
SEM: II	PIMBD20	Forensic science	Theory	Independent elective	-	2	100

Course Objective: To provide students psychological understanding of the scientific principles of crime scene investigation and reconstruction, including evidence collection and preservation.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Outline the history, scope and development of forensic science.

CO2: Evaluate the methods underpinning forensic science, from crime scene investigation to report evidential value within a case.

CO3: Reflect on the use of various divisions of forensic science in the crime investigation.

CO4: Explain the theory of DNA fingerprints, blood pattern analysis, footwear and tool mark impression evidence, and drugs of abuse in the context of Forensic Science.

CO5: Utilize psychological principles in crime investigation.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	L	H	H	M	H	H
CO2	L	H	H	M	H	H
CO3	L	L	M	M	M	H
CO4	M	H	H	H	M	H
CO5	M	H	H	H	M	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	M	L	H
CO2	H	H	H	M	L	H
CO3	H	L	M	M	L	H
CO4	H	H	H	H	L	H
CO5	H	H	H	H	L	H

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT–I: History, Scope and Development of Forensic Science.

1.1 Definition of Forensic science (K1)

1.2 Development of Forensic science. (K1,K2)

1.3 Scope of Forensic Science.(K1,K2)

1.4 History of Forensic Science in India. (K1,K2)

1.5 Development and scope of Forensic Science in India. (K1,K2)

1.6 Growth of Core laboratories, set up in country. (K1,K2)

UNIT–II: Sociological and Scientific Aspects of Crime.

2.1 Introduction to crime, Sociological aspect in society. (K1,K2)

2.2 Types of crimes. (K1,K2)

2.3 Crimes in India. (K1,K2)

2.4 Crime Scene Management, Crime Scene procedures. (K1,K2,K3)

2.5 Protection of crime scene physical evidence - Scientific collection of physical evidence. (K1,K2,K3)

2.6 Crime scene management in manmade and natural disaster. (K1,K2,K3)

UNIT–III: Divisions of Crime Investigation.

3.1 Duties of forensic scientist. (K1,K2)

3.2 Introduction to various divisions of crime investigation. (K1,K2)

3.3 Crime investigation- Biology, Serology. (K1,K2,K3)

3.4 Crime investigation -Chemistry, Physics. (K1,K2,K3)

3.5 Crime investigation -Toxicology, Ballistics. (K1,K2,K3)

3.6 Crime investigation -Prohibition Document and other divisions. (K1,K2)

UNIT–IV: Forensic Science Laboratory Techniques.

4.1 Specialised facilities offered by forensic science laboratory – DNA fingerprinting. (K1,K2,K3)

4.2 Polygraph Narco analysis. (K1,K2,K3)

4.3 Brain electrical oscillation. (K1,K2,K3)

4.4 Signature proficiency (BEOSP) Cyber forensic. (K1,K2,K3)

4.5 Tape and video authentication. (K1,K2,K3)

4.6 Speaker identification. (K1,K2,K3)

UNIT–V: Investigative Psychology.

5.1 Concepts of psychology. (K1,K2)

5.2 History of psychology. (K1,K2)

5.3 Modern perspectives of Psychology. (K1,K2)

5.4 Types of psychology. (K1,K2)

5.5 Professionals psychology - The science and research methods. (K1,K2,K3)

5.6 Professional and ethical issues in psychology. (K1,K2)

REFERENCE BOOKS:

1. Dr.Rukmani Krishnamurty. 2011. Introduction to Forensic Science in Crime Investigation. 1st edition. Scientific Books publishers.India.
2. Richard Saferstein. 2016. Criminalistics - An Introduction to Forensic Science. 8thEdition Pearson Prentice Hall.
3. Morgan, King, Weiss and Schopler. 1989. Introduction to Psychology, 7th edition.McGraw Hill, India.
4. Carson RC & Butcher JN .2012. Abnormal psychology & modern life.10th Ed. Harper-Collins.
5. Patterson, Lewis E.&Welfel, Elizabeth Reynold. 2000. The Counseling process – Hilgard.publishers.

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PCMBJ20: ADVANCED MICROBIOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: III	PCMBJ20	Advanced Microbiology	Theory	Core	6	4	100

Course Objective: To provide the learners an overview on the advanced aspects of Microbiology**.**

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Utilize microorganisms in the preparation of cosmetics**.**

CO2: Evaluate the biological potential in samples return from satellites and solar system.

CO3: Discuss the role of antimicrobial fabrics, carpets, tiles and colorants.

CO4: Produce bacteriostatic sanitary napkins and towels.

CO5: Comprehend on paper, rubber and plastic Microbiology

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	L	H	M
CO2	H	L	L	M	L	H
CO3	H	H	M	H	L	H
CO4	H	L	L	M	M	H
CO5	H	H	M	H	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	M	L	H	M
CO2	H	M	M	L	L	H
CO3	H	H	M	H	L	H
CO4	H	L	L	L	M	H
CO5	H	H	M	H	L	H

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT–I: Cosmetic Microbiology. (15 hours)

1.1 Definition; Preparations of Skin whitening compositions from microbes like Ascomycetes and Black yeast. (K1,K2, K3)

1.2 Preparations of Skin whitening compositions- enzymes. (K1,K2, K3)

1.3 Preparations of Skin whitening compositions- Mineral yeast ferments. (K1,K2,K3)

1.4 Microbial Production of Alpha Arbutin. (K1,K2,K3)

1.5 Microbial production of Hyaluronic acid. (K1,K2,K3)

1.6 Kojic acid and their use in Cosmetics preparations. (K1,K2)

UNIT–II: Space Microbiology. (15 hours)

2.1 Introduction to Space Microbiology. (K1,K2)

2.2 Monitoring of astronauts microbial flora. (K1,K2,K3)

2.3 Alterations in the load of medically important microorganisms. (K1,K2)

2.4 ESA STONE experiment. (K1,K2,K3,K4)

2.5 Evaluating the Biological Potential in Samples Returned from Planetary Satellites. (K1,K2, K3,K4)

2.6 Evaluating the Biological Potential of Small Solar System Bodies. (K1,K2,K3,K4)

UNIT–III: Textile Microbiology. (15 hours)

3.1 Introduction to Textile Microbiology. (K1,K2)

3.2 Antimicrobial fabrics. (K1,K2)

3.3 Antimicrobial garments. (K1,K2)

3.4 Antimicrobial carpets. (K1,K2)

3.5 Antimicrobial colorants. (K1,K2)

3.6 Bacteriostatic sanitary napkins and towels. (K1,K2,K3)

UNIT–IV: Paper and Rubber Microbiology. (15 hours)

4.1 Paper Microbiology- Introduction & Definition. (K1,K2)

4.2 Antimicrobial papers and its production. (K1,K2)

4.3 Antimicrobial currency. (K1,K2)

4.4 Rubber Microbiology – Introduction & Definition. (K1,K2)

4.5 Note on Antimicrobial rubbers. (K1,K2)

4.6 Antimicrobial rubber compositions. (K1,K2)

UNIT–V: Plastic Microbiology. (15 hours)

5.1 Definition- Bacteriostatic plastics. (K1,K2)

5.2 Antimicrobial plastic composition and production. (K1,K2)

5.3 Antiseptic plastics. Fungistatic plastics: Definition and production. (K1,K2)

5.4 Production of plastics materials from microorganisms. (K1,K2,K3)

5.5 Methods for producing anti-microbial plastic product. (K1,K2,K3,K4)

5.6 Plastic article containing a metallic bactericidal agent. Casein plastic**.** (K1,K2,K3)

TEXT BOOKS:

1. Vimaladevi M (2015) Text book of Herbal Cosmetics.1st edition, CBS Publishers and Distributors, New Delhi.
2. Alfonso F Davila (2010). Astromicrobiology.1st edition, John Wiley & Sons, Inc. New Delhi.
3. Srikanth Pilla (2011). Handbook of Bioplastics and Biocomposites Engineering and Applications.1st edition, John Wiley and Sons Inc., New Delhi.
4. Nierstrasz V and Cavaco Paulo A (2010). Advances in Textile Biotechnology. 1st edition, Elsevier, London.

REFERENCE BOOKS:

1. Philip A. Geis (2006) Cosmetic Microbiology: A Practical Approach. 2nd edition, CRC Press, Taylor and Francis Group, New York, London.
2. David M. Klaus (2003). Space Microbiology: Microgravity and Microorganisms. 1st edition, John Wiley & Sons, Inc.New Delhi
3. Ashish Kumar Sen (2007). Coated Textiles: Principles and Applications. 2nd edition, CRC Press, New Delhi
4. Tappi (2007). Monograph on Microbiology of Papermaking systems. Tappi publishers, New York.
5. Roberts A.D (1988). Natural Rubber Science and Technology. 1st edition, Oxford University Press.UK.
6. Chen, George Guo- Qiang (2010). Plastics from Bacteria: Natural Functions and Applications. 1st edition, Springers, United States.

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PEMBF20: ELECTIVE III-B: FUNGAL BIOTECHNOLOGY AND BIOPROSPECTING

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: III	PEMBF20	Fungal biotechnology and bioprospecting	Theory	Core Elective	3	3	100

Course Objective: This paper is designed to provide an exposure to the students about the potential of fungi as food and in field of biotechnology as source of different enzymes, secondary metabolites,vitamins, polysaccharides, polyhydric alcohols, pigments, lipids, glycolipids, biofertilizers and biopesticides.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Perform screening and strain development for production of different bio-molecules.

CO2: Design a bioreactor with special emphasis on fungal systems.

CO3: Comprehend about different secondary metabolites of fungal origin.

CO4: Demonstrate methods of recombinant technology with special emphasis on fungal system.

CO5: Explain the role of fungi in food and feed industries.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	H	M	H
CO2	H	M	M	L	H	H
CO3	H	M	M	L	H	H
CO4	H	M	M	L	H	H
CO5	H	H	H	L	H	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	H	M	H
CO2	H	M	M	H	H	H
CO3	H	M	M	H	H	H
CO4	H	M	M	H	H	H
CO5	H	H	H	H	H	H

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT- I : Fungal diversity and industrial important fungal strains. (9 hours)

1.1 Fungal diversity; habitat relationship. (K1,K2)

1.2 Different ecological groups of fungi Ecotaxonomic approach in chemical screening. (K1,K2)

1.3 Primary and secondary products of metabolism; Screening of industrially useful fungal metabolites. (K1,K2)

1.4 Classification of secondary metabolites in fungi. (K1,K2)

1.5 Primary and secondary screening of antibiotic producers; auxanography; enrichment culture. (K1,K2, K3,K4)

1.6 Industrial important fungal strains. (K1,K2)

UNIT- II: Fungal Biotechnology. (9 hours)

2.1 Fungal Biotechnology: Fungal biotechnological processes, Principles of fermenter design and operation with respect to Fungal process. (K1,K2)

2.2 Types of fermenters used in Fungal Biotechnology, formulation of fermentation medium. (K1,K2,K3,K4,K6)

2.3 Analysis of fermentation products especially for fungal biotechnology. (K1,K2K3,K4)

2.4 Techniques for strain improvement and strain development. (K1,K2,K3,K4)

2.5 Recombinant technology in fungi: composition of the different types of fungal vectors, selection markers, transformation strategies. (K1,K2,K3,K4,K5,K6)

2.6 Gene replacement or inactivation, applications and future perspectives. (K1,K2,K3,K4)

UNIT- III: Edible fungi. (9 hours)

3.1 Introduction to Edible fungi; Mycoproteins. (K1,K2)

3.2 Advancement in mushroom cultivation technology. (K1,K2,K3)

3.3 Commercial mushroom species. (K1,K2)

3.4 Strain improvement and cultivation. (K1,K2, K3)

3.5 Tropical mushrooms and their cultivation; mushroom spawns. (K1,K2, K3, K4)

3.6 Nutritional and medicinal values of mushrooms. (K1,K2)

UNIT- IV: Fungi in food processing and agriculture application. (9 hours)

4.1 Introduction to food processing technology. (K1,K2)

4.2 Fungi in food processing, (K1,K2)

4.3 Fungus for Biomass pretreatment for ethanol production. (K1,K2)

4.4 Fungi in agriculture application. (K1,K2)

4.5 Fungal biofertilizers and Biopesticides. (K1,K2, K3)

4.6 Myconematicides . (K1,K2)

UNIT-V: Biotechnological application of fungi. (9 hours)

5.1 Biotechnological applications of fungi and their derivatives. (K1,K2,K3)

5.2 Production of Industrially important products from fungi-organic acids (citric acid). (K1,K2,K3)

5.3 Production of enzymes from fungi (cellulase xylanase, amylase, protease). (K1,K2, K3)

5.4 Applications of Fungi in medical and pharmaceutical products. (K1,K2,K3)

5.5 Production of antibiotic (Penicillin). (K1,K2,K3)
5.6 Vitamins and therapeutic peptides from fungi. (K1,K2)

TEXT BOOKS:

1. Poonam Singh & Ashok Pandey, Biotechnology for agro-Industrial residues utilisation. (2009), Springer.
2. Satyanarayana T. and Johri B.N. (2005). Microbial diversity, Current Perspectives and Potential Applications , IK international

REFERENCE BOOKS:

1. Nair, L. N. (2007). Topics in Mycology and Pathology, New Central Book agency, Kolkata.
2. Oliver R. P. and Michael Schweizer (1999). Molecular Fungal Biology, CUP.
2. Berry D. R. (1988). Physiology of industrial Fungi, Blackwell Scientific Publishers.
3. Zhingiang Ann (2005). Handbook of Industrial Mycology, CRC Press

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PCMBL20: MICROBIAL GENE TECHNOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: IV	PCMBL20	Microbial Gene Technology	Theory	Core	6	4	100

Course Objective: To provide the learners an insight on the concepts of genetic engineering and techniques employed in recombinant DNA technology.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Analyze the various techniques involved in identification and quantification of nucleic acids.

CO2: Utilize the tools and techniques of genetic engineering and the role of DNA manipulative enzymes.

CO3: Compile DNA sequencing methods.

CO4: Explain about genomic libraries and artificial chromosomes.

CO5: Discuss the modern tools and techniques of genomics and application of antisense technologies.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	L	M
CO2	H	H	H	L	L	M
CO3	H	H	H	M	M	L
CO4	H	H	H	H	M	M
CO5	H	H	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	L	M	H
CO3	H	H	H	L	M	M
CO4	H	H	H	M	L	H
CO5	H	H	H	L	M	M

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT-I: Gene Analysis and Techniques. (15 hours)

1.1 Isolation of DNA and RNA from microbes. (K1,K2, K3, K4)

1.2 Handling & Quantification of Nucleic acids.. (K1,K2,K3,K4)

1.3 Radiolabelling of Nucleic acids - End labeling - Nick translation - Labelling by primer extension. (K1,K2, K3,K4)

1.4 PAGE and its applications. (K1,K2)

1.5 Nucleic acid hybridization- colony and plaque hybridization. (K1,K2, K3)

1.6 Blotting techniques – Southern, northern and western blots. (K1,K2, K3)

UNIT-II: DNA manipulative enzymes (15 hours)

2.1 DNA manipulative enzymes - Restriction enzymes : Nomenclature - Classification - restriction and DNA Methylation . (K1,K2)

2.2 Type II restriction endonuclease - use of type II restriction endonucleases in gene cloning. (K1,K2)

2.3 Restriction mapping and its applications. (K1,K2)

2.4 DNA modifying enzymes, helicase, gyrase & topoisomerases. (K1,K2)

2.5 Polymerases – DNA polymerases, Klenow polymerase and Reverse Transcriptase. (K1,K2)

2.6 DNA ligases and its function. (K1,K2)

UNIT-III: DNA sequence analysis (15 hours)

3.1 DNA sequence analysis: Maxam - Gilbert (Chemical) sequencing - Sangar - Coulson (DiDeoxy/enzymatic) sequencing . (K1,K2, K3,K4)

3.2 Automated DNA sequencing. (K1,K2,K3)

3.3 Genome sequencing by Physical Mapping of genomes. (K1,K2)

3.4 PCR - methods and its application. (K1,K2, K3)

3.5 DNA fingerprinting in forensic application. (K1,K2)

3.6 RFLP - Microarray and its applications. (K1,K2)

UNIT-IV: Vectors and gene libraries (15 hours)

4.1 Vectors - nature - uses of vectors- types of vectors . (K1,K2)

4.2 Plasmids, Bacteriophages , Cosmid and Shuttle vectors - An introduction. (K1,K2)

4.3 Cloning strategies – Screening, selection and isolation of recombinants clones. (K1,K2,K3,K4)

4.4 Gene libraries - Genomic and cDNA. (K1,K2)

4.5 Artificial chromosomes – BAC. (K1,K2)

4.6 Artificial chromosomes - YAC. (K1,K2)

UNIT-V: Gene Annotations and Nanobiologics (15 hours)

5.1 Gene Annotations. (K1,K2)

5.2 Gene silencing. (K1,K2)

5.3 Human Genome Project. (K1,K2)

5.4 Legal aspects of rDNA technology and cloning. (K1,K2, K3)

5.5 Recombinant DNA products and applications – Humulin, Hepatitis B antigen vaccine, TPA. (K1,K2, K3, K4)

5.6 Nanobiologics - Bioactive peptides as hormones, antimicrobials, vaccines, drug carriers and therapeutics. (K1,K2, K3)

TEXT BOOKS:

1. Brown T. A (2016). Gene cloning and DNA analysis- An introduction. 7th edition, Black wiley, United States.
2. Old R.S and Primrose S.B (2001). Principles of Gene Manipulation: An introduction to Genetic Engineering. 6th edition, Blackwell Scientific publication, London.

REFERENCE BOOKS:

1. Jogdnand S.N (2005). Gene biotechnology. 2nd edition, Himalaya Publishing House, Mumbai.
2. Satyanarayana U (2005). Biotechnology. 1st edition, Books and Allied (P) Ltd., Kolkata.
3. Dubey R.C (2005). A Text of Biotechnology. Multicolour Illustrative edition, S.Chand and Company Ltd., New Delhi.
4. Bernad R Glick and Pasternak, J.J (2003). Molecular Biotechnology - Principles and Applications of Recombinant DNA.3rd edition, ASM Press, Washington, D.C.

OER:

VIDEOS/VIDEO LESSONS / E-CONTENT FOR LEARNING

1. http://www.learnerstv.com/
2. http://webcast.berkeley.edu/
3. http://cosmolearning.org/
4. http://www.world-lecture-project.org/
5. http://cec.nic.in/
6. http://epgp.inflibnet.ac.in/
7. http://www.co-learn.in/

PEMBH20: ELECTIVE IV-B: MICROBIAL NANOTECHNOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: IV	PCMBH20	Microbial Nanotechnology	Theory	Core Elective	3	3	100

Course Objective: To provide in depth knowledge on microbial bionanotechnology.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Outline the history of bionanotechnology.

CO2: Describe about molecular nanotechnology and microbial synthesis of nanoparticles.

CO3: Discuss on types, function and characterization of nanoparticles.

CO4: Comprehend the use of nanoparticles in cancer therapy and in biology.

CO5: Elaborate the advantages and disadvantages of nanoparticles.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	M	M	H
CO2	H	H	H	L	L	M
CO3	H	M	M	H	L	M
CO4	H	M	H	H	M	M
CO5	H	L	M	M	H	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	M	H
CO2	H	H	H	L	L	M
CO3	H	H	H	L	L	M
CO4	H	H	H	M	M	M
CO5	H	H	H	M	H	H

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT-I: History of Bionanotechnology. (9 hours)

1.1 Introduction and History of bionanotechnology. (K1,K2)

1.2 Concept and future prospects of bionanotechnology. (K1,K2)

1.3 Application of nanotechnology in Life Sciences. (K1,K2)

1.4 Terminologies – nanotechnology Vs bionanotechnology, (K1,K2)

1.5 Nanomedicine and Nanowires. (K1,K2,K3,K4)

1.6 Quantum Dots, nanocomposite, nanoparticles. (K1,K2,K3,K4)

UNIT- II: Molecular nanotechnology. (9 hours)

2.1 Molecular nanotechnology - nanomachines - collagen. (K1,K2)

2.2 Uses of nanoparticles - cancer therapy. (K1,K2)

2.3 Manipulation of cell and biomolecules. (K1,K2)

2.4 Cytoskeleton and cell organelles. (K1,K2)

2.5 Types of nanoparticles production - physical, chemical and biological. (K1,K2)

2.6 Microbial synthesis of nanoparticles. (K1,K2, K3,K4)

UNIT-III: Types and characterization of nanoparticles. (9 hours)

3.1 Nanoparticles - types, functions - Silver, Gold and Titanium. (K1,K2)

3.2 Physical and chemical properties of nanoparticles. (K1,K2)

3.3 Characterization of nanoparticles - UV-Vis spectroscopy. (K1,K2, K3,K4)

3.4 Characterization of nanoparticles Electron Microscopy - HRTEM, SEM. (K1,K2, K3,K4)

3.5 Characterization of nanoparticles AFM. (K1,K2, K3,K4)

3.6 Characterization of nanoparticles EDS and XRD. (K1,K2, K3,K4)

UNIT-IV: Uses of nanoparticles in biology. (9 hours)

4.1 Uses of nanoparticles in biology. (K1,K2)

4.2 Drug delivery - protein mediated and nanoparticle mediated. (K1,K2, K3)

4.3 Uses of nanoparticles in MRI, DNA and Protein Microarrays. (K1,K2, K3)

4.4 Nanotechnology in health sectors. (K1,K2, K3)

4.5 Toxicology in nanoparticles. (K1,K2)

4.6 Dosimetry. (K1,K2, K3)

UNIT-V: Advantaged and disadvantages of nanoparticles. (9 hours)

5.1 Advantages of nanoparticles. (K1,K2)

5.2 Drug targeting, protein detection and MRI. (K1,K2, K3,K4)

5.3 Development of green chemistry. (K1,K2)

5.4 Commercial viability of nanoparticles. (K1,K2)

5.5 Disadvantages - health risk associated with nanoparticles. (K1,K2)

5.6 Adequate and inadequate knowledge on nanoparticles research. (K1,K2)

TEXT BOOKS:

1. Elisabeth Papazoglou and Aravind Parthasarathy (2007). Bionanotechnology. Morgan & Claypool Publishers.
2. David E. Reisner, Joseph D. Bronzino (2008). Bionanotechnology: Global Prospects. CRC Press.

REFERENCES BOOKS:

1. Parthasarathy, B.K. (2007). Introduction to Nanotechnology, Isha Publication.
2. Bernd Rehm (2006). Microbial Bionanotechnology: Biological Self-assembly Systems and Biopolymer-based Nanostructures. Horizon Scientific Press.
3. Ehud Gazit (2006). Plenty of Room for Biology at the Bottom: An Introduction to Bionanotechnology. Imperial College Press.

OER:

DIGITAL LIBRARIES:

1. http://www.loc.gov/
2. http://library.clark.edu/
3. http://www.dli.ernet.in/
4. http://www.loc.gov/education/

PCMBM20 : BIOETHICS AND BIOSAFETY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: IV	PCMBM20	Bioethics and Biosafety	Theory	Core	6	4	100

Course Objective: To provide the learners knowledge about biosafety concerns at the level of individuals, institution, society, region, country and the world.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Outline the principles of bioethics and explain the biosafety concerns with safeguard measures.

CO2: Compile the BSA statement for the industrial production of pharmaceuticals.

CO3: Adapt the WHO quality standards in food process technology.

CO4: Discuss on the global scenario of patenting.

CO5: Comprehend the forms of patents, patentability and process of patenting.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	M	M	M	H
CO2	H	H	M	L	L	H
CO3	H	M	L	H	M	H
CO4	H	M	L	H	M	H
CO5	H	H	M	M	H	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	H	H
CO2	H	H	H	M	L	H
CO3	H	H	H	L	M	H
CO4	H	M	H	L	M	H
CO5	H	H	H	L	H	H

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT-I : Principles of Bioethics. (15 hours)

1.1 Definition- Bioethics. (K1,K2)

1.2 Legality, morality and ethics- An introduction (K1,K2)

1.3 Intoduction to the principles of Bioethics. . (K1,K2)

1.4 Principles of autonomy. . (K1,K2)

1.5 Human rights. . (K1,K2)

1.6 Beneficence and privacy justice equality. . (K1,K2)

UNIT-II : Biosafety concerns. (15 hours)

2.1 Introduction to Biosafety. . (K1,K2)

2.2 Concept and issues of Biosafety. . (K1,K2)

2.3 Rational Vs subjective perceptions of risks and benefits. . (K1,K2)

2.4 Relationship between risk hazard, exposure, and safe guard. . (K1,K2)

2.5 Biosafety concerns at the level of individuals, institutions, society, region, country and the world. . (K1,K2,K3)

2.6 Lab associated infections. . (K1,K2,K4)

UNIT-III: Statement of Ethical practice (15 hours)

3.1 Introduction to BSA. . (K1,K2)

3.2 History of BSA . . (K1,K2)

3.3 British Sociological Association (BSA) statement of ethical practices of biotechnology in the production of pharmaceutical products. . (K1,K2)

3.4 BSA statement ethical practices of biotechnology in the production of drugs. . (K1,K2,K3)

3.5 BSA statement ethical practices of biotechnology in the production vaccines . (K1,K2,K3)

3.6 BSA statement ethical practices of biotechnology in the production biomolecules. (K1,K2,K3)

UNIT-IV: WHO quality standards. (15 hours)

4.1 Introduction to WHO and its functions. (K1,K2)

4.2 WHO standards – Quality control. (K1,K2,K3)

4.3 Quality control in food process technology. (K1,K2,K3,K4,K5)

4.4 Quality control in dairy product technology. (K1,K2,K3,K4,K5)

4.5 Quality control for potable water. (K1,K2,K3,K4,K5)

4.6 Quality control measures in pharmaceutical industries. (K1,K2,K3,K4,K5)

UNIT-V : IPR and Patenting. (15 hours)

5.1 Introduction to IPR and Patenting. (K1,K2)

5.2 GATT and IPR, forms of IPR, IPR in India, WTO Act. (K1,K2,K3,K4,K5)

5.3 Convention on Biodiversity (CBD), Patent Co-operation Treaty (PCT). (K1,K2,K3,K4,K5)

5.4 Forms of patents and patentability, process of Patenting. (K1,K2,K3,K4,K5)

5.5 Indian and international agencies involved in IPR & patenting. (K1,K2,K3,K4,K5)

5.6 Global scenario of patents and India's position, patenting of biological material, GLP, GMP. (K1,K2,K3,K4,K5)

TEXT BOOKS:

1. Frederic H. Erbisch, Karim M. Maredia (2004). Intellectual Property Rights in Agricultural Biotechnology, CABI Publisher.
2. John Bryant (2002) Bioethics for Scientists. John Wiley and Sons Publisher.

REFERENCES BOOKS:

1. Mittal D.P. (1999). Indian Patents Law. Taxmann Allied Services (p) Ltd.
2. Christian Lenk, Nils Hoppe, Roberto Andorno (2007). Ethics and Law of Intellectual Property: Current Problems in Politics, Science and Technology, Ashgate Publisher (p) Ltd.
3. Felix Thiele, Richard E. Ashcroft (2005). Bioethics in a Small World. Springer.

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DIGITAL LIBRARIES:

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3. http://www.dli.ernet.in/
4. http://www.loc.gov/education/