

Department of Microbiology
Vikram University, Ujjain (MP)

Syllabus

Post Graduate Diploma in
Advanced Mycology (For UTD)
ONE YEAR (TWO SEMESTERS)

(Ordinance No. 63)

Course Scheme and Structure

2021-2022 ONWARDS

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POST GRADUATE DIPLOMA IN ADVANCED MYCOLOGY**PREAMBLE**

The new course has been prepared (Ordinance No. 63) keeping in view, the unique requirements of Post Graduate Diploma in Applied Mycology students. The objectives of the course are-

- Understand the importance of fungi in natural ecological systems as well as in the development and economics of human civilization, in the various industries in which they participate.
- To interpret the role of various fungi in the biomonitoring of environmental quality (fungi as bioindicators)
- Understand fungal biotechnological processes in different industries and applications.
- Obtain the importance of fungi as a source of alternative resources and renewable energy.
- Understand / visualize the diversity of fungal pathological processes, both from the animal and human.
- Understand / visualize the diversity of fungal pathological processes, both from the animal and human and vegetable aspects.
- Obtain the bases to develop systems of biocontrol with fungal agents.
- To capture the need for basic and applied mycology studies to allow the development of various applied disciplines, especially biomedical, pharmaceutical, agricultural and forestry sciences.
- Obtain a global vision of fungi, from the perspective of its "destructive" role as from its "creator" role.

Programme Mission:

The purpose of the programme is creation of knowledgeable human resources to work in Government, Semi- Government, Private and Public sector owned Mycology Laboratory and Hospitals and also to assume administration positions. With further progression in education, graduates should be able to undertake teaching and research in colleges and universities as well as in scientific organizations.

Competences:

1. Apply microorganisms or their components to the development of products of interest in health, industry and technology.
2. Apply suitable methodologies for taking samples and characterising and manipulating microbial populations and communities in natural and artificial ecosystems, and establish the relationships between these and those with other organisms.

3. Apply tools based on microorganisms to assess the environmental impact of human activity, and to recover contaminated environments.
4. Obtain, select and manage information.
5. Use bibliography or internet tools, specific to microbiology or other related disciplines, both in English and in the first language.
6. Work individually or in groups, in multidisciplinary teams and in an international context.

Objectives:

The subject of applied mycology must be understood as complementary to the subject of Mycology. The constant references that are made to groups and fungal species require a mycological basis that facilitates the understanding of the syllabus. We will develop several aspects of Applied Mycology, a very wide and varied field, and with numerous interconnections that often hamper the thematic partition.

Intended Learning Outcomes of the Programme:

The Intended Learning Outcomes (ILOs) are listed under four headings:

1. Knowledge and Understanding,
2. Cognitive Skills
3. Practical Skills and
4. Capability /Transferable Skills.
5. Recognize the role of fungi as causal agents of diseases in Human and animals
6. Describe the fungi that participate in production processes.
7. Evaluate the impact of different types of fungi on the final characteristics of the product.
8. Identify the origin of the principal fungi of importance in the industrial environment.
9. Know procedures and strategies based on fungi for pest and disease control.
10. Know the role of fungi in different production processes in order to improve these processes and ensure their success.
11. Obtain, select and manage information.
12. Recognize the role of fungi as causal agents of deterioration.
13. Use bibliography or internet tools, specific to microbiology or other related disciplines, both in English and in the first language.
14. Work individually or in groups, in multidisciplinary teams and in an international context.

General Information:

1. The course will be full time program to be covered in two semesters of six months each.
Total duration of the program would be one year.

VIKRAM UNIVERSITY, UJJAIN (MP)
SUBJECT- POST GRADUATE DIPLOMA IN ADVANCED MYCOLOGY
(Session – 2021-2022 Onwards)
SEMESTER – I PGDAM SCHEME

Paper Code	Title of Paper	External Marks		Internal Marks		Total Marks
		Max. Marks	Min. Pass Marks	Max. Marks	Min. Pass Marks	
PGDAM 1001	Introductory Mycology	70	25	30	11	100
PGDAM 1002	Bio molecules	70	25	30	11	100
PGDAM 1003	Cell Biology	70	25	30	11	100
PGDAM 1004	Tools and Techniques in Mycology	70	25	30	11	100
PDDAM 1005	Practical-I/Project work	70	25	30	11	100
Total		350		150		500

Minimum Pass Marks in each Paper (Theory) -36%
 Minimum Pass Marks in each Paper (Internal Assessment) -36%
 Minimum Pass Marks in Practical -36%

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**POST GRADUATE DIPLOMA IN ADVANCED MYCOLOGY
SEMESTER- II PGDAM SCHEME**

Paper Code	Title of Paper	External Marks		Internal Marks		Total Marks
		Max. Marks	Min. Pass Marks	Max. Marks	Min. Pass Marks	
PGDAM 2001	Advanced Mycology	70	25	30	11	100
PGDAM 2002	Fungal Diseases	70	25	30	11	100
PGDAM 2003	Diagnostic And Identification of Fungi	70	25	30	11	100
PGDAM 2004	Practical-II	70	25	30	11	100
PDDAM 205	Project Work	70	25	30	11	100
Total		350		150		500

Minimum Pass Marks in each Paper (Theory) -36%
 Minimum Pass Marks in each Paper (Internal Assessment) -36%
 Minimum Pass Marks in Practical -36%

The Division shall be awarded as follows:

First Division : 60% or above of the aggregate marks
 Second Division : 48% or above but less than 60% of the aggregate marks.
 Pass : Less than 48% but 36% and above in aggregate

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SYLLABUS**POST GRADUATE DIPLOMA IN ADVANCED MYCOLOGY (PGDAM)****PGDAM SEMESTER- I****Code No.: PGDAM 1001: INTRODUCTORY MYCOLOGY****Course Learning Outcome:**

Students in Mycology should have the following Expected Learning Outcomes (ELOs).

1. Learn how to collect fungi from the environment and how to preserve process and curate specimens in a fungus collection.
2. Learn how to isolate and manipulate fungal cultures on/in agar and liquid media using aseptic technique.
3. Learn how to interpret and discuss phylogenetic relationships of major groups within Fungi and of Fungi to other clades in the Tree of Life.
4. Learn how to identify fungi using a combination of morphological and molecular (DNAbased) techniques, including light microscopy, BLAST and basic phylogenetic analysis.
5. Learn the ecological roles of fungi and how these relate to ecosystem health and global carbon cycles.
6. Learn to use critical reading and thinking skills to interpret and critique research papers from the primary mycological literature.
7. Learn how to discuss the co-evolutionary interactions between fungi and other organisms, both mutualistic and antagonistic.
8. Demonstrate an appreciation of the diversity and importance of fungi to human well-being.

Unit -I: Brief history of Mycology, General features of fungi- Structure, Nutrition, Ecology, Physiology and Reproduction

Unit-II: Rules of Nomenclature (Code of Botanical Nomenclature) species concept (Morphological, Biological, Phylogenetic); Classification of fungi based on Morphological characteristics and conidial ontogeny.

Unit-III: Structure and organization of fungal genome, chemical composition of fungal cell walls of different groups, classification based on molecular and biochemical Characteristics of fungi.

Unit-IV: Myco-techniques-I: Collection, Isolation, and Purification of fungal culture, Micrometry; Camera Lucida; Microphotography; Microscopy; Maintenance, Preservation and Culture collection, Lyophilization.

Unit-V Myco-techniques-II: Morphological Characteristics and Cultural characteristics of Fungi, Molecular and biochemical approaches and the use of Electrophoresis (Agrose and PAGE), PCR and other molecular approaches to fungal taxonomy (RAPD, ITS-PCR-RFLP, Microsatellites etc.), Interpretation of molecular results.

Suggested Readings:

1. Webster, J. & Weber, R.W.S. 2007. Introduction to Fungi. 3rd Edition, J. Webster & R.W.S. Weber. Cambridge University Press.
2. Alexopolous CJ, Mims CW, & Blackwell MM. 1996. Introductory Mycology. 4th Edition. Wiley Press.
3. Esser, K. The mycota: a comprehensive treatise on fungi as experimental systems for basic and applied research. Multiple volume series. Springer Press

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Code No.: PGDAM 1002: BIOMOLECULES**Course Learning Outcome:**

After studying this Unit, you will be able to:

1. Classify carbohydrates, proteins, nucleic acids and vitamins on the basis of their structures;
2. Explain the difference between DNA and RNA;
3. Describe the role of biomolecules in biosystem.
4. Exposure to basic reactions of biomolecules.
5. Determine presence of biomolecules like carbohydrates, proteins, lipids, etc. in known and unknown samples.
6. Determine the extent of adulteration in samples containing biomolecules.
7. They will understand the methods of determination of amino acid and nucleotide sequence of proteins and DNA respectively.

Unit I: Types and significance of chemical bonds; Structure and properties of water; pH and buffers; Carbohydrates: Nomenclature and classification; Monosaccharides; Disaccharides; Oligosaccharides and polysaccharides.

Unit II: Lipids: Definition and major classes of storage and structural lipids; Fatty acids structure and functions; Essential fatty acids; Tri-acylglycerols structure, functions and properties; Phosphoglycerides.

Unit -III: Proteins: Structure of amino acids; Levels of protein structure-primary, secondary, tertiary and quaternary; Protein denaturation and biological roles of proteins.

Unit-IV:Nucleic acids: Structure of nitrogenous bases; Structure and function of nucleotides; Types of nucleic acids; Structure of A, B, Z types of DNA; Types of RNA; Structure of tRNA.

Unit V: Enzymes: Structure of enzyme: holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group; Classification of enzymes; Features of active site, substrate specificity, mechanism of action (activation energy, lock and key hypothesis, induced - fit theory), Michaelis - Menten equation, enzyme inhibition and factors affecting enzyme activity.

Suggestive Readings:

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1. Molecular Biology of the Cell by Alexander Johnson, Julian Lewis , Martin Raff , Keith Roberts , James D. Watson, 3 rd Edition, Garland Taylor and Francis.
2. The Lipid Handbook by Frank D. Gunstone, John L. Harwood, and Albert J. Dijkstra, 3 rd Edition, CRC Press.
3. Protein: Biotechnology and Biochemistry by Gary Walsh, Wiley.
4. Essentials of Carbohydrate Chemistry and Biochemistry By Thisbe K. Lindhorst, Wiley-VCH.
5. Gene IX by Benjamin Lewin, Jones and Barlett Publishers.
6. Principles and Techniques of Practical Biochemistry by K. Wilson and J. Walker, 5 th Ed, Cambridge University Press.
7. Biochemistry Laboratory: Modern Theory and Techniques by R.F. Boyer.

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Code No.: PGDAM 1003: CELL BIOLOGY**Course Learning Outcome:**

1. This course will provide an understanding of the structure of cell and function of various sub-cellular organelles.
2. Students will learn about cell theory, basic cell structure, cell fractionation and cell visualization techniques.
3. Besides, students will have an understanding of the composition of cytoskeleton and extracellular matrix.
4. Students will acquire knowledge of cell cycle, cell division and cell death mechanisms.

Unit I: The cell: Cell as a unit of structure and function; Characteristics of prokaryotic and eukaryotic cells; Origin of eukaryotic cell (Endo symbiotic theory).

Unit II: Cell wall and plasma membrane: Chemistry, structure and function of Plant cell wall. Overview of membrane function; fluid mosaic model; Chemical composition of membranes; Membrane transport – Passive, active and facilitated transport, endocytosis and exocytosis

Unit III: Cell organelles: Nucleus: Structure-nuclear envelope, nuclear pore complex, nuclear lamina, molecular organization of chromatin; nucleolus.
Cytoskeleton: Role and structure of microtubules, microfilaments and intermediary filament.

Unit: IV: Chloroplast, mitochondria and peroxisomes: Structural organization; Function

Unit V: Bioenergetics: Laws of thermodynamics, concept of free energy, endergonic and exergonic reactions, coupled reactions, redox reactions. ATP: structure, its role as a energy currency molecule.

Suggestive Readings:

1. The Cell: A Molecular Approach (2013) 6th ed., Cooper, G.M. and Hausman, R.E., ASM Press & Sunderland (Washington DC), Sinauer Associates, MA, ISBN:978-0-87893-300- 6. 2.
2. Cell and Molecular Biology: Concepts and Experiments. (2010). Karp, G., 6th ed. John Wiley and Sons. Inc. ISBN: 978-1-118-65322-7

3. Principles and Techniques of Biochemistry and Molecular Biology: - Ed. K. Wilson and J. Walker, Cambridge University Press.
4. Physical Biochemistry- Application to Biochemistry and Molecular Biology: Friefelder D. WH Freeman and Company.
5. Lehninger: Principles of Biochemistry (2017) 7th ed., Nelson, D.L. and Cox, M.M. W.H. Freeman & Company (New York), ISBN:13: 9781464126116 / ISBN:10-1464126119.
6. Molecular Biology of the Gene (2008) 6th ed., Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R., Cold Spring Harbor Laboratory Press, Cold Spring Harbor (New York), ISBN:0-321-50781 / ISBN: 978-0-321-50781-5

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Code No.: PGDAM 1004: TOOLS AND TECHNIQUES IN MYCOLOGY**Course Objectives:**

The objective of this course is to give the students basic idea about different instruments and techniques used in a biological science laboratory for research.

Course Outcomes: Upon successful completion of the course, the student:

1. Has developed understanding of principals, and applications of electrophoretic and spectrophotometric methods.
2. Has developed understanding of principals, and applications of different separation techniques especially chromatographic, and centrifugation techniques.
3. Has learnt about various techniques used for enzyme purification and assay.
4. Has developed basic concepts of statistics and their importance.
5. Developed skills to use computers for analysis of biological data and is acquainted with Genomics, Proteomics and Nanotechnology.

Unit I:- Microscopy – Light, phase contrast, electron, scanning and transmission electron microscopy, staining techniques for light microscopy, sample preparation for electron microscopy.

Unit II:- Common equipments of microbiology lab and principle of their working – autoclave, oven, laminar air flow, centrifuge.

Unit III:- Calorimetry and spectrophotometry, Electrophoretic techniques – proteins and nucleic acids, PCR.

Unit IV:- Chromatography techniques: adsorption, partition, ion exchange, gel filtration, HPLC, FPLC.

Unit V:- Cultivation of extraordinary microorganisms, techniques used for identification of microorganisms – biotyping, serotyping, molecular techniques.

References Books :

1. R M Atlas, A E Brown, K W Dobra and L Miller. Basic Experimental Microbiology. Prentice Hall.
2. Gunasekaran. Introduction to Microbial Techniques.

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Code No.: PGDAM 1005: PRACTICAL-I**Course Objective:**

To understand the General Morphology of Fungi and to develop skills related to Cultivation, purification and Identification and maintenance of various fungal techniques.

Course Learning Outcome:

The students shall acquire the practical skills for the cultivation of fungi and shall be able to carry out purification and identification. They will learn biochemical techniques for estimation of nutritional content in different type of fungi, Qualitative analysis of Bio molecules.

Practical Exercise:

1. Preparation of common laboratory media viz, Sabouraud's dextrose agar (Sab-Dex), Sabouraud's dextrose agar with chloramphenicol, Mycosel agar, Brain heart infusion slant (BHI), Potato-dextrose agar (PDA), Corn-meal agar; Special applications agar: Caffeic Acid Agar, Birdseed Agar, KT Medium & Kelley Agar, Modified Converse Liquid Medium (Levine's)
2. Preparation of Petri dish, Stab and Slant for Cultivation of fungi.
3. Preparation of synthetic medium for yeast and mould and inoculation with standard strains of yeasts and moulds
4. Collection of Sample viz, Medical, Food, Buildings, Storage grains and dry Fruits, Soil, water etc for Cultivation and isolation of fungi
5. Sample inoculation by Dilution and Plating by spread -plate and pour -plate techniques
6. Isolation of Keratinophilic fungi by Baits technique
7. Isolation of water moulds by Baits technique
8. Isolation of Coprophilic fungi by dung.
9. Isolation of Food fungi of Storage Grains, Dry fruits, Cereals, Rice etc by ISTA technique
10. Isolation of pure culture.
11. Sub culturing of a fungal strain in liquid and solid medium.
12. Study of a Simple Microscope and compound microscope.
13. Staining: Lactophenol Cotton Blue (LPCB), Periodic Acid - Schiff Stain (PAS), Gomori Methenamine Silver Stain, Gridley Stain, Mayer Mucicarmine Stain, Fluorescent Antibody Stain, Papanicolaou Stain, Gram Stain, Modified Acid-Fast Stain, Giemsa

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- Stain and India Ink Gram's staining,
14. Identification of fungi by Cultural and Morphological characteristics.
 15. Biochemical Characterization of fungi.
 16. Calibration of Measurement of Hyphen, spore and fungus by Micrometry.
 17. Measurement of fungal Growth by Dry Mycelial Weight.
 18. Calibration and draw the Structure of Hyphen, spore and fungus by Camera Lucida.
 19. Preservation and Maintenance of fungi
 20. Physiological and chemical study i.e. pH, Temperature, Time, Different Nutritional requirement of fungi

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**POST GRADUATE DIPLOMA IN ADVANCED MYCOLOGY (PGDAM)
PGDAM SEMESTER- II SCHEME**

Code No.: PGDAM 2001: ADVANCED MYCOLOGY

Course Learning Outcome:

1. Upon successful completion of the course, the student will be able to:
2. Understand the advanced concepts of Advanced Mycology.
3. Understand the most common fungal pathogens especially that of animal health impact.
4. Achieve competency in modern laboratory technology of fungal infections.
5. To acquaint with the latest advances in Mycology.

Unit-I: Fungi in Food: Mushroom, ISTA Technique; Fermentation: food, Alcoholic Beverage, Enzyme production, Vitamin, Organic acid and antibiotics Production.

Unit-II: Medical Mycology: Major diseases of human and animals caused by fungi and their diagnosis and treatments including dermatophytes, systemic pathogens viz. Aspergillosis, Candidiasis, Histoplasmosis, Blastomycosis, Ring worm and other opportunistic pathogens.

Unit-III: Plant Pathology: Major diseases of crop plants caused by fungi (Cereals, fruits, Vegetables, Ornamental and medicinal plants and their diagnosis and treatment.

Unit-IV: Environmental Mycology: Fungi in Biodeterioration of food and Leather, Biodegradation of Wool and Woods and Bioremediation of Environment

Unit-V: Biodegradation of wall Paints, scenery; Biodegradation of Heritage Buildings and Statue; Biodegradation of Cloths.

Suggestive Readings:

1. Alexopoulos CJ, Mimms CW & Blackwell M. 1996. Introductory Mycology. John Wiley & Sons, New York.
2. Dube HC. 2005. An Introduction to Fungi. 3rd Ed. Vikas Publ. House, New Delhi.
3. Kirk PM, Cannon PF, David JC & Stalpers JA. (Eds.). 2001. Ainsworth and Bisby's Dictionary of Fungi. 9th Ed., CABI, Wallington.

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4. Ulloa M & Hanlin RT. 2000. Illustrated Dictionary of Mycology. APS, St. Paul, Mennisota.
5. References: 1. Ainsworth et al., 1973. The fungi VI –A, VI – B, Academic press.
6. John Webster and Weber, 2007. Introduction to Fungi, Cambridge.
7. Deacon J. W. Fungal Biology (4th Edition) , Blackwell Publishing, ISBN 1405130660
8. Kendrick B., 1994. The Fifth Kingdom, North America, New York Publisher.
9. Mehrotra R.S. and Aneja K.R., 1990. An introduction to mycology, New Age Publication.
10. Miguel U., Richard H., and Samuel A. 2000. Illustrated dictionary of mycology Elvira Aguirre Acosta Publisher.
11. Webster J., and Rpland W. 2007. Introduction to fungi (3rd Edition), Cambridge University Press.
12. Dube H.C. 2010. An Introduction to fungi, Vikas Publication.
13. Vashista B. R. and Sinha A.K. 2008. Botany for Degree students- Fungi, S. Chand's Publication.

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Code No. PGDAM 2002: FUNGAL DISEASES**Course Objective:**

This course consists of a basic introduction to medical mycology and a comprehensive study of the fungi (yeasts and molds) and mycoses (fungal diseases) likely to be encountered in clinical settings by a physician, medical mycologist, or medical technologist. Attention will be distributed as equally as possible between emphasis on the biology of the fungal zoopathogen and on its disease

Course Outcome:

Upon completion of the course, students will be able to describe characteristics of fungi, laboratory diagnosis, fungal disease and antifungal agent and perform laboratory diagnosis of fungal infection.

Unit I:- Introduction to Subcutaneous, Deep mycoses and Opportunistic Mycoses, with emphasis on those caused by dematiaceous (black) fungi , Dermatophytes and Keratinophilic Fungi

Unit II- Chromoblastomycosis , Phaeohyphomycosis, Mycetoma, Other Diseases Caused by Black Fungi, Sporotrichosis

Unit III:- Introduction to the Pathogenic Yeasts , Candidiasis ,Cryptococcosis ,

Unit IV:- Histoplasmosis, Blastomycosis , Coccidioidomycosis

Unit V:- Aspergillosis , Penicillosis , Fungal Allergies, Mushroom Poisonings ,

References Book:

1. Clinical Mycology, Dismukes, Pappas and Sobel QR 245, C566, 2003
2. Medical Mycology, Kwon-Chung and Bennett QR 245, K86, 1992
3. Atlas of Clinical Mycology, deHoog et al., QR 245, K86, 2000.
4. Molecular Principles of Fungal Pathogenesis, Heitman et al., ed., QR 245, M65, 2006
5. Fungal Pathogenesis; Principles and Clinical Applications, Calderone & Cihlar, ed., RC117, f864, 2000 .
6. General Mycology Ainsworth & Bisby's Dictionary of the Fungi, 8th ed., Hawksworth, Krik, Sutton & Pegler QK 603, A5, 1995
7. Dictionary of the Fungi, 9th ed., Hawksworth et al., QK 600.35, A5 The Fifth Kingdom, 3rd ed., Kendrick QK 603, K46, 1992

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8. Introductory Mycology, 4th ed., Alexopoulos, Blackwell and Mims QK 603, A55, 1996
Fundamentals of the Fungi, 4th ed., Moore-Landecker QK 603, M62, 1996
9. Microbiology and Microbial Infections, Topley and Wilson's, 9th ed., Vol.
10. Medical Mycology, QR 46, T6, 1998 A Practical Guide to Medically Important Fungi and
The Diseases They Cause, Sugar and Lyman RC 117, S84, 1997
11. Dimorphic Fungi in Biology and Medicine, Vanden Bossche, Odds and Kerridge (eds) QR
245, D55, 1993
12. Medical Mycology: A Practical Approach, Evans and Richardson QR 248, M43, 1989
13. Medical Mycology and Human Mycoses, Beneke and Rogers QR 245, B46, 1996
14. Medical Mycology, 3rd ed., Rippon RC 117, R5, 1988
15. Fungal Dimorphism: With Emphasis on Fungi Pathogenic for Humans, Szanislo QR 245,
1985 Laboratory Handbook of Medical Mycology, McGinnis RC 117, E56,
16. 1980 Identifying Filamentous Fungi: a Clinical Laboratory Handbook, St. Germain and
Summerbell QR 248, F55, 1996

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Code No. PGDAM 2003: DIAGNOSTIC AND IDENTIFICATION OF FUNGI**Course Learning Outcome:**

1. To confirm the suspicion of fungal disease.
2. To identify the etiologic agent by isolating the causative fungal pathogen.
3. This course provides learning opportunities in the basic principles of medical microbiology and infectious fungal diseases.
4. The course provides the conceptual basis for understanding pathogenic fungi and the mechanisms by which they cause disease in the human body.
5. Student can safeguard himself & society and can work diagnostics and hospitals

Unit-I: Direct examination of Specimens: Wet mount, KOH Preparation; Staining: Lactophenol Cotton Blue (LPCB), Periodic Acid - Schiff Stain (PAS), Gomori Methenamine Silver Stain, Gridley Stain, Mayer Mucicarmine Stain, Fluorescent Antibody Stain, Papanicolaou Stain, Gram Stain, Modified Acid-Fast Stain, Giemsa Stain and India Ink .

Unit-II: Fungal Culturing: Media introduction, Types of Media, Sabouraud's dextrose agar (Sab-Dex), Sabouraud's dextrose agar with chloramphenicol, Mycosel agar, Brain heart infusion slant (BHI), Potato-dextrose agar (PDA), Corn-meal agar; Special applications agar: Caffeic Acid Agar, Birdseed Agar, KT Medium & Kelley Agar, Modified Converse Liquid Medium (Levine's)

Unit-III: Fungal growth requirements: Temperature, Atmosphere and Time; Techniques for Identification of Fungi & Laboratory ID: Inoculation (direct plate, dilution plate, Solid agar, Broth media, Slant and Petri dish; Incubation (Aerobic and Anaerobic); General considerations: Type of media used, Growth rate & age of the culture.

Unit-IV: Identification of the fungi: Colony Morphology (macroscopic features: Surface topography, Surface texture, Pigmentation and Mycelium; Microscopic evaluation: Methods, Hyphen structure, Spore bearing structures, Spores
Biochemical studies: generally used to ID yeast and yeast-like organisms: Carbohydrate fermentation, Nitrogen assimilation, Growth on specific agars (Christensen's urea agar, Caffeic acid medium (protect media from light); other tests: Germ tube, Demonstration of chlamydo spores



Unit-V: Hypersensitivity (sero-mycology; skin tests) and serological tests, Complement fixation, Agglutination tests, Precipitin tests, Immunofluorescence, Immunodiffusion techniques, Counter-immuno-electrophoresis
Antifungal susceptibility testing, Determining serum concentration of antifungal agents

Suggestive Readings:

1. Textbook of Microbiology- Ananthanarayan & Paniker (10th Ed)
2. Medical Microbiology-by Fritz H. Kayser et al
3. Fundamental medical mycology / Errol Reiss, H. Jean Shadomy, and G. Marshall Lyon III
4. Essential Medical Microbiology- by Rajesh Bhatia (4th Ed)
5. Clinical Microbiology Procedures Handbook- by Amy L. Leber (4th Ed)
6. The short text book of medical microbiology- by Satis Gupte (10th Ed)

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Code No.: PGDAM 2004: PRACTICAL-I**Course Objective:**

To understand the General Morphology of Fungi and to develop skills related to Cultivation, purification and Identification and maintenance of various fungal techniques.

Course Learning Outcome:

The students shall acquire the practical skills for the cultivation of fungi and shall be able to carry out purification and identification. They will learn biochemical techniques for estimation of nutritional content in different type of fungi, Qualitative analysis of Bio molecules.

Practical Exercise:

1. Physiological and chemical study i.e. pH, Temperature, Time, Different Nutritional requirement of fungi
2. Characterization of fungi by molecular biological technique viz, PCR, RAPD, ITS-PCR-RFLP, Microsatellites
3. Characterization of fungi by Electrophoresis (Agrose and PAGE),
4. Evaluation of pathogenicity of fungi
5. Determination of Culture sensitivity by Disc Diffusion (Kirbey- Borer Method), Well
6. Diffusion Methods and Dry Mycelial Weight
7. Qualitative analysis of carbohydrates
8. Qualitative analysis of Proteins
9. Analysis of lipids: acid value, iodine value, saponification value etc
10. Preparation of common laboratory media viz., Sabouraud's dextrose agar (Sab-Dex), Sabouraud's dextrose agar with chloramphenicol, Mycosel agar, Brain heart infusion slant (BHI), Potato-dextrose agar (PDA), Corn-meal agar; Special applications agar: Caffeic Acid Agar, Birdseed Agar, KT Medium & Kelley Agar, Modified Converse Liquid Medium (Levine's)
11. Preparation of Petri dish, Stab and Slant for Cultivation of fungi.
12. Preparation of synthetic medium for yeast and mould and inoculation with standard strains of yeasts and moulds
13. Collection of Sample viz, Medical, Food, Buildings, Storage grains and dry Fruits, Soil, water etc for Cultivation and isolation of fungi
14. Sample inoculation by Dilution and Plating by spread -plate and pour -plate

techniques

15. Isolation of Keratinophilic fungi by Baits technique
16. Isolation of water moulds by Baits technique
17. Isolation of Coprophilic fungi by dung.
18. Isolation of Food fungi of Storage Grains, Dry fruits, Cereals, Rice etc by ISTA technique
19. Isolation of pure culture.
20. Sub culturing of a fungal strain in liquid and solid medium.
21. Study of a Simple Microscope and compound microscope.
22. Staining: Lactophenol Cotton Blue (LPCB), Periodic Acid - Schiff Stain (PAS), Gomori Methenamine Silver Stain, Gridley Stain, Mayer Mucicarmine Stain, Fluorescent Antibody Stain, Papanicolaou Stain, Gram Stain, Modified Acid-Fast Stain, Giemsa Stain and India Ink Gram's staining.
23. Identification of fungi by Cultural and Morphological characteristics.
24. Biochemical Characterization of fungi.
25. Calibration of Measurement of Hyphen, spore and fungus by Micrometry.
26. Measurement of fungal Growth by Dry Mycelial Weight.
27. Calibration and draw the Structure of Hyphen, spore and fungus by Camera Lucida.
28. Preservation and Maintenance of fungi
29. Characterization of fungi by molecular biological technique viz, PCR, RAPD, ITS-PCR-RFLP, Microsatellites
30. Characterization of fungi by Electrophoresis (Agrose and PAGE),
31. Evaluation of pathogenecity of fungi
32. Determination of Culture sensitivity by Disc Diffusion (Kirbey- Borer Method), Well
33. Diffusion Methods and Dry Mycelial Weight
34. Qualitative analysis of carbohydrates
35. Qualitative analysis of Proteins
36. Analysis of lipids: acid value, iodine value, saponification value etc



Code No.: PGDAM 2005: PROJECT WORK

- 1- Project work and Presentation
- 2- Project Report Assessment and Viva voce

Course Objective:

Every student will be required to undertake a research project (minimum tenure three months) based on any of the areas of Mycology, proteomics, genomics, animal, plant, microbial technology, and bioinformatics or preferably related to major Mycological research. The project report will be submitted in the form of dissertation duly certified by the supervisor of the dissertation by any research organization, industry, national institutes and/or Universities in India, by seeking the placement. The student then shall have to appear for the viva voce examination.

Course Learning Outcome:

Provide students with theoretical knowledge and practical abilities required to work in the industry, research centers, and Medical, Pharmaceutical, Environmental, Plant and food related national and international organizations. Contribute to a healthier population by imparting education and understanding of nutritional science. Develop confident and competent individuals, able to adapt to the changing fabric of society through their professional expertise and personal traits.

Guidelines for Dissertations Report Layout:

The report should contain the following components:

Title or Cover Page: The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

Acknowledgements (optional): Acknowledgment to any advisory or financial assistance received in the course of work may be given.

Abstract: It should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to objectives. The abstract have to be concise summary of the scope and results of the project.



Table of Contents: Titles and subtitles are to correspond exactly with those in the text.

Introduction: A brief introduction to the problem that is central to the project and it should aim to catch the imagination of the reader, so excessive details should be avoided.

Materials and Methods: This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

Results and Discussion: Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

Note during writing, all figures & tables should as far as possible be next to the associated text, in same orientation as main text, numbered, & given appropriate titles.

Conclusion: This is the final section in which outcome of the work is mentioned briefly.

Future prospects (if applicable)

References / Bibliography: This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname.

Appendices: This contains material which is of interest to reader but not an integral part of the thesis and may be useful to document for future reference.

Assessment and Viva voce of the Project File:

Essentially, marking will be based on the following criteria: the quality of the report, the technical merit of the project and the project execution. Technical merit attempts to assess the quality and depth of the intellectual efforts put into the project

