SYLLABUS
of
Pre-Ph.D. Course Work
in
Microbiology/Botany

Department of Botany and Microbiology
Gurukula Kangri (Deemed to be University), Haridwar
(Deemed to be University u/s 3 of UGC Act 1956)

(w. e. f. Session 2021-22 onward)

17.4.2021

17/4/21

Syllabus of Pre-Ph.D. Course Work (Microbiology/ Botany)
Gurukula Kangri (Deemed to be University), Haridwar

(w. e. f. Session 2021-22 onward)

Pre-Ph.D. Course Work shall be arranged only for those candidates who intend to carryout research work in the subject Microbiology/botany and have qualified the CSIR NET/NET-JRF/SLET/GATE/RET of Gurukula Kangri (Deemed to be University). Pre-Ph.D. Course Work shall be of One Semester having three theory papers.

S.N	Paper Code	Paper Title	Period Per Week			Evaluation Scheme					Subject Total
							Sessional			ESE	
			L	T	P	Credit	CT	TA	Total		
Pre-Ph.D. Course Work in Microbiology/Botany											
1	PMI-C101	Research Methodology and Computer Application	3	1	-	4	20	10	30	70	100
2	PMI-C102	Instrumentation, Application and Methods for Quantitative Estimation	3	1	-	4	20	10	30	70	100
3	PMI-C103	Research and Publication Ethics	2	-	-	2	20	10	30	70	100
						10				**Total**	**300**

L = Lecture
T = Tutorial
P = Practical
CT= Cumulative Test
TA= Teacher Assessment
ESE= End Semester Examination

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Pre-Ph.D. Course Work

Subject: Microbiology/Botany

PMI-C101

Research Methodology and Computer Application

Maximum Marks: 70
Time: 3 Hours

L	T	Credits
3	1	4

Sessional : 30 marks
ESE : 70 marks
Pass marks: 40

Overview: *Objectives of this paper is to provide the students a comprehensive knowledge of Research methodology and Computer application, so that they must be aware of planning, designing and executing of research problems, and analysing the data by using computer software.*

UNIT-I

RESEARCH: Definition, its types and essential steps, Laboratory safety measures and experimentaldesigning. Aspects of safety measures, bio hazards agents, risk groups and bio safety levels, laboratory acquired infection, Safety measures personnel safety, nucleic acid quantification, protein determination, enzyme kinetics, turbidity and nepheiometry), polymerase chain reaction (PCR), techniques of DNA isolation, and types of fermenters.

(16 Lectures)

UNIT-II

MICROSCOPY:- Instrumentation: principles and function of microscopy- Bright field microscopy, Dark fieldmicroscopy, Phase contrast microscopy, Differential interference contrast (DIC) microscopy, flourescence, Confocal microscopy,Electron microscope,Scanning electron microscope. **(10 Lectures)**

UNIT-III

SPECTROPHOTOMETRY–Principle, colorimeter and spectrophotometer, construction of colorimeter, spectrophotometeric analysis, design of spectrophotometers, single beam, double beam, split beam, biological applications of UV visible spectrophotometers. **(13 Lectures)**

UNIT-IV

INTELLECTUAL PROPERTY RIGHTS (IPR): Intellectual property rights, protection- patent, plants varieties and farmer's right protection. Quantitative methods: Sampling theory, types of sampling, steps in sampling, sampling size, advantages and limitations of sampling. Collection of data: primary data, data collection methods, secondary data, limitations standard deviation, standard error, testing for significance of difference between means, variance and correlation and their co-efficient, chi-square tests, ANOVA, correlation, regression. **(12 Lectures)**

UNIT-V

COMPUTER APPLICATIONS: Basis of computer, operating system, window, hardware, software, internet, local area network (LAN);Wide area network (WAN); application of computer in microbiological research, Basic concepts of bioinformatics and its applications. **(9 Lectures)**

Subject: Microbiology/Botany

PMI-C102

Instrumentation, Application and Methods for Quantitative Estimation

Maximum Marks: 70
Time : 3 Hours

L	T	Credits
3	1	4

Sessional : 30 marks
ESE : 70 marks
Pass marks: 40

Overview: *The students who have to operate various instruments must learn the principles and operation of various tools and techniques such as chromatography, electrophoresis, centrifugation, microbial diversity, phylogenetic relationships, etc.*

UNIT-I

CHROMATOGRAPHY: Introduction, classification of chromatographic methods, nature of the phases, principle of separation, geometry of stationary phase, mode of operation, retention mechanism, paper chromatography (principle, mobile phase of paper chromatography, types of paper chromatography, detection, retardation, application of paper chromatography), thin layer chromatography (principle. stationary phase, mobile phase, sample application, plate development, detection, advantages over paper chromatography, application), column chromatography (introduction, column, plate concept of column, basic operation of column chromatography, detector, chromatogram), gas chromatography (carrier gas, sample injection system. column, oven, detection system, application of gas chromatography), liquid chromatography (reverse fluid chromatography, high performance liquid chromatography, supercritical fluid chromatography, ion exchange chromatography, affinity chromatography, preparative liquid chromatography). **(16 Lectures)**

UNIT-II

ELECTROPHORESIS: Introduction, principle, components of an electrophoresis unit, factors affecting homogenous buffers system, multiphasic buffer system, buffer additives), detection and assay, recording and storage. safety, types of electrophoresis and their applications, microelectrophoresis, paper electrophoresis (high voltage paper electrophoresis), cellulose acetate electrophoresis, gel electrophoresis (horizontal gel electrophoresis, vertical gel electrophoresis, its applications) specialized electrophoretic techniques, polyacrylarnide gel electrophoresis, agarose gel electrophoresis, isoelectric focusing, two-dimensional PAGE, immune-electrophoresis and immunofixation electrophoresis, denaturing gradient gel electrophoresis, capillary electrophoresis (capillary zone electrophoresis, capillary gel electrophoresis, capillary isoelectric focusing). **(16 Lectures)**

UNIT-III

CENTRIFUGATION: Introduction, centripetal and centrifugal forces, relative centrifugal force; factors affecting sedimentation Rate during centrifugation, sedimentation coefficient and sedimentation constant, centrifuge, gradient media, types of centrifuges, application of centrifugation (preparative centrifugation, analytical centrifugation).

(7 Lectures)

UNIT-IV

DIFFERENTIAL STAINS AND STAINING TECHNIQUES: Ingredients and preparation of various stains, Gram stains,fFlagella stain, endospore stain, acid fast stain, carbol fuschin stain, cotton blue stain, procedure for Staining (Gram staining, negative staining, flagella staining, acid fast staining, nucleoid staining, fungal staining).

(11 Lectures)

UNIT-V

BIOREMEDIATION AND MICROBIAL DIVERSITY: Sources of water pollution, methods for selection of sites, survey of the area, detection of sampling point, preparation of reagents, sampling program, types of sample to be collected, analysis for physical parameters (temperature, turbidity), chemical parameters (such as CO_2, nitrogen contents, DO, BOD, COD), MPN and SPC, etc.,probiotics, prebiotics and synbiotics- its application,*in-situ* and *ex situ* bioremediation, role of macrophytes and microbes in bioremediation,structural, functional and genomic diversity, determination of microbial diversity, phylogenetic relationships;types of dendrogram, software used in preparation of dendrogram (e.g. MVSP, NTSys, Mega Version-7), gene bank, NCBI. **(10 Lectures)**

Subject: Microbiology/Botany

PAPER III: PMI-C103

Research and Publication Ethics

Maximum Marks: 70
Time : 3 Hours
L T Credits
3 1 2

Sessional : 30 marks
ESE : 70 marks
Pass marks: 40

Overview: *Thispaper focuses on basics of science and ethics, research integrity and publication ethics. Hands on sessions are designed to identify research misconduct and predatory publications. Indexing and citation databases, open access publications, research matrics (citations, h-index, impact factor, etc.) and plagiarism tools will be introduced in this course.*

UNIT-I

PHILOSOPHY AND ETHICS: Introduction to philosophy, definition, nature and scope, concept, branches;ethics, definition, moral philosophy, nature of moral judgements, and reactions. **(03 Lectures)**

UNIT-II

SCIENTIFIC CONDUCT: Ethics with respect to science and research. Intellectual honesty and research integrity, scientific misconduct: falsification, fabrication and plagiarism (FFP);redundant publications, duplicate and overlapping publications, salami slicing;selective reporting and misrepresentation of data. **(05 Lectures)**

UNIT-III

PUBLICATION ETHICS: Definition, introduction and importance. Best practices/ standards, setting initiatives and guidelines, COPE, WAME, etc.; Conflicts of interest, publication misconduct: Definition, concept, problems that lead to unethical behaviour and vice-versa, types;violation of publication ethics, authorship and contributorship;identification of publication misconduct, complaints and appeals, pediatrie publishers and journals; use of plagiarism software like Turnitin, Urkund and other open source software tools.

(10 Lectures)

UNIT-IV

OPEN ACCESS PUBLISHING: Open access publications and initiatives; SHEPRA/RoMEO online resource to check publisher copyright and self-archiving policies,software tool to identify pediatrie publications developed by SPPU; Journal finder/journal suggestion tools viz., JANE, Elsevier journal finder, Springer journal suggester, etc.

(06 Lectures)

UNIT-V

DATABASES AND RESEARCH METRICS: Indexing databases, citation databases, Web of science, SCOPUS etc.; metrics-Impact factor of journal as per Journal Citation Report, SNIP, SJR, IPP, Cite Score;*h*-Index, *g*-index, i10 index, altmetrics.

(06 Lectures)