Progressive Education Society's

Modern College Of Arts, Science and Commerce, Ganeshkhind, Pune – 411 016

(Autonomous)

Syllabus for

F. Y. M.Sc. (Computer Applications)

Introduction:

The Master of Science in Computer Applications shape the next generation of tech innovators and leaders. Our program is designed to bridge theoretical knowledge with real-world application, ensuring our graduates are industry-ready. Students will delve into the depths of product development, machine learning, and Cloud Computing, with curriculum tailored to current and emerging tech trends. Our faculty are esteemed professionals and dedicated researchers who provide insights into cutting-edge technologies and mentorship. We offer labs and access to the latest tools and software, enhancing your learning experience. Collaborations with leading tech companies give you unique opportunities for internships and projects, preparing you for successful careers. This program is not just about mastering technology, but also about developing critical thinking and innovative problem-solving skills. By joining us, students will be part of a vibrant community that values creativity, diversity, and academic excellence..

Programme Objectives:

The main objectives of the Program are

- To produce trained software professionals with hands-on experience on state-of-the art technologies who will be able to handle software challenges in industry as well as academia
- To produce knowledgeable and skilled human resources that is employable in IT and ITES.
- To impart knowledge required for planning, designing and building Complex Application Software Systems as well as to provide support for automated systems or applications.

To produce entrepreneurs

Suggested internal assessment tools for courses:

The concerned teacher shall announce the units for which internal assessment will take place. A teacher may choose one of the methods given below for the assessment.

1. Library notes
2. Students Seminar
3. Short Quizzes / MCQ Test
4. Home Assignments
5. Tutorials/ Practical
6. Oral test
7. Research Project
8. Group Discussion
9. Open Book Test
10. Written Test
11. PPT presentation

12. Industrial Visit
13. Viva

Teaching Methodology:

1. Classroom Teaching
2. Guest Lectures
3. Group Discussions
4. Surveys
5. Power Point Presentations
6. Visit to Industries
7. Research Papers & Projects
8. E-content

Eligibility:

A Bachelor Degree in Science/Technology/Engineering with minimum 50% marks or equivalent for students belonging to Unreserved Category and minimum 45% or equivalent for students belonging to the Reserved Category.

Subject List

FY MSc (Computer Applications) Sem I

Course Type	Sr. No.	Course (Subject) Title	Course (Subject) code	Credits	Weightage for Internal Marks	Weightage For External Marks	Weightage for practical	Total Marks
Mandatory		Object Oriented Programming with C++	COMCA51101	4	40	60	-	100
Mandatory		Advance Databases	COMCA51102	4	40	60	-	100
Mandatory		Web Technology	COMCA51103	4	40	60	-	100
Mandatory		Web Technology Practical	COMCA51104	2	20	30	50	
Electives		Cloud Computing	COMCA51201	2	20	30		50
Electives		Cloud Computing Practical	COMCA51202	2	20	30	50	
RM		Research Methodology	COMCA51301	2	20	30		50
RM		Practical on Research Methodology	COMCA51302	2	20	30	50	
			Total	22			Total	550

FY MSc (Computer Applications) Sem II

Course Type	Sr. No.	Course (Subject) Title	Course (Subject) code	Credits		Weightage For	Weightage	Total Marks

					Weightage for Internal Marks	External Marks	for practical	
Mandatory		Java Programming	COMCA52101	4	40	60	-	100
Mandatory		Data Warehousing & Data Mining	COMCA52102	4	40	60	-	100
Mandatory		Computer Networking	COMCA52103	4	40	60	-	100
Mandatory		Principles of Product Management	COMCA52103	2	20	30		50
Electives		Python Programming	COMCA52201	2	20	30		50
Electives		Python Programming Practical	COMCA52202	2	20	30	50	-
OJT		On Job Training/Field Project	COMCA52401	4	40	60	100	-
			Total	22			Total	550

Credit Allocation: - DMM-Disciplinary Major Mandatory, DSE – Discipline Specific Elective RM – Research Methodology, OJT-On Job Training, FP- Field Project, RP – Research Project

Total - 44 Credits for First years Programme.

FY MSc (Computer Applications)
Semester I

Course Code: COMCA51101

Subject Name: Object Oriented Programming with C++

Total lectures: 60 hours **Total Credits: 4**

Prerequisites: - Student should have basic knowledge of:

- Procedural Language like C
- Basic Data Structures and Algorithms.

Course Objectives: To Prepare student to think about programming languages analytically to

- understand pillars of object oriented language
- implement types of inheritance

- learn need of operator overloading

Course Outcome:- After successfully completing this course, students will be able to:

- understand implementation of object oriented concepts
- implement inheritance, polymorphism, encapsulation
- implement operator overloading

Unit	Topic	No of lectures
1	**Chapter 1:- Introduction to C++** ● Basics of C++, ● Structure of C++ Program, keywords in C++, ● Data types hierarchy in C++, ● Operators in C++: Scope resolution operator, Insertion and Extraction operator New and Delete operators. ● Reference variable. ● Manipulators function: endl, setw, set fill, set precision.	7
2	**Chapter 2:- Classes and Objects** ● Object oriented Concepts ● Structure and class, Class, Object, Access specifiers, ● Class members, ● Defining member functions :Inside and outside the class definition ● Creating objects. String class, operation on string, Array of objects ● 'this' pointer.	8
3	**Chapter 3 :- Function in C++** ● Call by reference, Return by reference, ● Function overloading and default arguments ● Inline function ● Passing and returning objects from functions, Static class members Friend Concept – Function, Class	8
4	**Chapter 4:- Operator overloading** ● Introduction, rules of operator overloading ● Operator overloading: ● Unary and binary operators, ● Comparison, arithmetic assignment operator	5
5	**Chapter 5:- Operator overloading** ● Introduction, rules of operator overloading ● Operator overloading: ● Unary and binary operators, ● Comparison, arithmetic assignment operator	7
6	**Chapter 6:- Inheritance** ● Introduction ● Types of Inheritance: Single inheritance, Multiple inheritance, Multilevel inheritance Hierarchical inheritance Hybrid inheritance. ● Derived Class Constructors and Destructors	9

	● Ambiguity in multiple Inheritances, virtual base classes, Abstract base class	
7	**Chapter 7:- Virtual Function & Polymorphism** ● Introduction, ● Pointer to object, Pointer to derived class, ● Overriding member functions, ● Virtual function, ● Rules for virtual functions, ● Pure virtual function	7
8	**Chapter 8:- Working with files** ● File operations – Text files, Binary files ● File stream class and methods ● File Updation with random access	6
9	**Chapter 9:- Exception handling** ● Introduction to Exception ● Try and catch	4

Reference Books:

1. C++: The Complete Reference by Herbert Schildt, McGraw Hill Education; 4th edition
2. Object- Oriented Programming with C++ by E. Balaguruswamy, McGraw Hill Education; 8th edition
3. C/C++ Programmer's Reference by Herbert Schildt, McGraw Hill Education

Course Code: COMCA51102

Subject Name: Advance Databases

Total lectures: 60 hours **Total Credits: 4**

Prerequisites: -

- Basic Knowledge of file system, storing data in file system and Operations on sets

Course Objectives:

- To understand the fundamental concepts of databases.
- To understand user requirements and frame it in a data model.
- To understand creations, manipulation and querying of data in databases.

Course Outcome:-

After successful completion of course students will be able to:

- Solve real world problems using appropriate set, function, and relational models.
- Design E-R Model for given requirements and convert the same into database tables.
- Use Structured Query Language

Unit	Topic	No of lectures

1	**Chapter 1:- Procedural programming PL/PgSQL** ● Adding PL/PGSQL to database, language structure, using variables, controlling program flow, ● Stored functions, views, ● Exception handling, concept and creation of cursor and triggers, using transaction control statements, Locks.	4
2	**Chapter 2 :- Query processing and optimization** ● Overview of Query processing, measures of query cost, ● Selection, join, projection, evaluation of expression. ● Transformation of relational expressions, ● Estimating statistics of expression results, , choice of evaluation plans	10
	Chapter 3 :- Introduction to Transaction processing concepts & theory ● Introduction, transaction and system concepts, ● Desirable properties of transactions, characterizing schedules based on recoverability, ● Characterizing schedules based on serializability, transaction support in SQL	10
	Chapter 4 :- Concurrency control techniques ● Concept of Locking and lock manager component, binary locking mechanism, ● 2- phase locking techniques for concurrency control, ● C.C based on timestamp ordering, Multi-version concurrency control, Validation (optimistic) technique	8
	Chapter 5 :- Database recovery techniques ● Failure classification, recovery concepts, recovery techniques based on deferred updates & immediate updates, ● Shadow paging, the Aries recovery algorithm, Database backup & recovery	8
	Chapter 6 :- Database security ● Introduction, Discretionary access control based on Grant & Revoke ● Mandatory access control & role based access control for multilevel security, introduction to statistical database security ● Introduction to flow control, challenges in database security.	8
	Chapter 7 :-	6
	Chapter 8 :- Internet Databases ● The worldwide web ● Databases and web ● Architecture (application servers and server side scripting), Introduction to XML	6

Reference Books:

1. Database System Concepts by Henry F. Korth, Abraham Silberschatz, S. Sudarshan, Tata McGraw-Hill, 6th Edition

2. Database Systems by Shamkant B. Navathe, Ramez Elmasr, Pearson, 5th Edition
3. Database management systems by Raghu Ramakrishnan & Johannes Gehrke, 2nd Edition
4. Principles of Distributed Database Systems by M. Tamer Ozsu and Patrick Valduriez, Pearson, 2nd Edition
5. Database Management system, by Bipin Desai
6. An introduction to database system by C. J. Date
7. Practical Postgresql by JoshuaD. Drake, John C Worsley, O'reilly Publication

Course Code: COMCA51103
Subject Name: Web technology

Total lectures: 60 hours **Total Credits: 4**

Prerequisites: -

- **HTML**

Course Objectives:

- To comprehend the basics of the internet and web terminologies.
- To introduce scripting language concepts for developing client-side applications.
- To practice server-side programming features – PHP, JSP.
- To be familiar with database applications

Course Outcome:-
After successfully completing this course, students will be able to:

- Design and develop web applications.
- Understand client and server-side scripting and their applicability

Unit	Topic	No of lectures
1	**Chapter 1:- Introduction to Web Technologies** **● How Does the Website Work?** **● Software to create your website** **● What makes a good website?** **● Client-Server and its Communication** **● Client and Server Scripting Languages** **● Internet-Basic, Internet Protocols (HTTP, FTP, IP)** **● World Wide Web (WWW).** **● HTTP request message, HTTP response message** **● Types of Websites (Static and Dynamic Websites)**	8
2	**Chapter 2 :- ● Introduction to HTML** **● HTML tags and attributes** **● Working with Elements.** **● Inserting Image** **● Client Server image mapping**	8

	● List **● Tables** **● Text and Image links** **● Frames** **● Forms and controls** **● Introduction with text box, text area, buttons, List box,** **● radio, checkbox etc**	
3	**Chapter 3 :- CSS** **● Introduction to Style Sheet** **● Introduction to Responsive Website** **● Types of CSS CSS Border, margin, Positioning,** **● color, text, link, background, list, table, padding, image, display properties** **● Use of Id & classes in CSS** **● Use of &** **● Introduction of CSS3 : Gradients, Transitions,** **● Animations, multiple columns**	8
4	**Chapter 4 :- JavaScript** **● Concept of script, Types of Scripts, Introduction to JavaScript** **● Variables, identifier & operator, control structure.** **● Examples on JavaScript operators** **● Functions** **● Event Handling in Java Scripts** **● Concept of array, how to use it in JavaScript, types of an array, examples Event handling in JavaScript with examples** **● Math and date object and examples on it.** **● String object and examples on it, and some predefined functions** **● DOM concept in JavaScript, DOM objects** **● Validations in JavaScript, examples on it.**	8
5	**Chapter 5 :- XML** **● Introduction to XML** **● Uses of XML** **● Simple XML,** **● XML key components** **● DTD and Schemas,** **● Using XML with web applications.** **● Introduction to XSL, XSL elements, transforming with XSLT**	4

6	**Chapter 6 :- Introduction to PHP** **● Introduction to pup** **● How to install PHP Server on LINUX, WINDOWS.** **● Syntax** **● Echo, print** **● Variables, Data Types** **● Strings** **● Operators** **● Loops.**	8
7	**Chapter 7 :- PHP Functions** **● Introduction to Functions** **● Types of PHP Functions** **● Defining and Calling Functions** **● Default parameters, Variable parameters, Missing parameters** **● Variable Function** **● Anonymous Function**	8
8	**Chapter 8 :- PHP Arrays** **● Indexed Vs Associative arrays** **● Identifying elements of an array** **● Storing data in arrays** **● Multidimensional arrays** **● Extracting multiple values** **● Converting between arrays and variables** **● Traversing arrays** **● Sorting** **● Action on entire arrays**	8

Reference Books:

1. HTML Black Book by Steven Holzer, Kromtech press.
2. Web Technologies, Black Book, Dreamtech Press
3. Web Applications: Concepts and Real-World Design by Knuckles, Wiley-India
4. Internet and World Wide Web How to program by P.J. Deitel & H.M.Deitel, Pearson
5. Programming PHP by Rasmus Lerdorf and Kevin Tatroe, O'Reilly
6. PHP web services by Wrox publication

Course Code: COMCA51104

Subject Name: Web technology Practical

Total lectures: 30 hours **Total Credits: 2**

Prerequisites: -

- Basic knowledge of HTML Concepts.

Course Objectives:-

- To develop an ability to design and implement static and dynamic website

Course Outcome:-

The students will be able to:

- Design and implement dynamic websites with good aesthetic sense ofdesigning and latest technical know-hows.
- Have a Good grounding of Web Application Terminologies, InternetTools, E – Commerce and other web services.

Unit	Topic **Web technology Practical** **Practical Assignments (CSS, JavaScript, PHP)**	No of lectures
1	Write a JavaScript Program to read a number from the user, store its factors into the array and display that array. (Handle onClick Event)	2
2	Write a JavaScript program to read a character string from the user and perform the following functions: Accept acharacter from the user and count the number of occurrences of that character in the string. Accept a Positionfrom user and print the character at specified position	2
3.	Write a Java Script program to design Customer Account Details Form and perform validation on pan number field. (Pan number is of only 10 characters long, out of which first 5 characters are alphabets, next 4 characters are digitsand last character is alphabet)	**2**
4.	Write a PHP script to set selected images from ComboBox(DropDownList) to the background of Page.	**2**
5.	Design HTML form, accept student Name, Age, and Mobile No. from user. Using java Script validate for following Student Name should not be empty. Student Age must be between 1 to 20.	2
6.	Write a java Script that accepts a string from the user. Passthis string as a parameter to a function name ‘check_vowel’ on the button click event and return the count of the number vowels within the string.	2

7.	Write a Java Script to accept email addresses from users and count no. of @occurrences andnumber of DOT(.) occurrences	2
8.	Consider the following entities and their relationship.Doctor (doc_no, dname, address, city, area)Hospital (hosp_no, hname, hcity) Doctor-Hospital related with many-one relationship. Create a RDB in 3NF for above and solve the following.Using the above database write a script in PHP to print the Doctor visiting to the hospital in tabular format. Accept hospital name from user[Use PostgreSQL]	2
9.	Write a java script function to Accept First Name andLast Name from the user. Display users entered information. [Hint: use alert and prompt dialog box]	2
10.	Write a script to create an XML file as 'Employee.xml'.The element of this xml file are as follows: <Empdetails> <Employee EMPno= Empname=> <Salary> -------- </Salary> <Designation> -------- </Designation> </Employee> </Empdetails>	2
11.	Write a PHP script for the following. a) Design a form to accept the details of 5 different items such as Item code, Item Name, unit, sold and Rate. Display the bill in tabular format. Use only 4 textboxes. [Use explode]	2
12.	Design a HTML form to accept a string. Write a PHP script for the following. a) Write a function to count thetotal number of Vowels from the script. Show the occurrences of each Vowel from the script.	2
13.	Write a PHP script, which will return the followingcomponent of the URL 'http:// www.example.com/php-example/index.php' List of component: Scheme, Host, Path**Excepted o/p** Scheme: http Host: www.example.com Path:/php- example/index.php	2
14.	Write a menu driven program to perform variousfile operations. Accept filename from user. a) Display type of file.Delete a file.	2
15.	Write a PHP script to keep track of the number of times the web page has been accessed. [Use Session]	2

Subject Name: Cloud Computing

Total lectures:30 hours **Total Credits: 2**

Prerequisites: -

- Operating System concepts
- Fundamentals of Computer Networks
- Good Understanding of Object-Oriented Programming Concepts

Course Objectives:

- To understand the principles and paradigm of Cloud Computing
- To appreciate the role of Virtualization Technologies
- Ability to design and deploy Cloud Infrastructure
- Understand cloud security issues and solutions

Course Outcome:-

At the end of the course, the student should be able to:

- Appreciate the need for cloud computing and make decisions on usingspecific cloud service type and deployment models
- Identify virtualization technologies of a cloud platform.
- Make choices on selection of appropriate cloud service based on applicationrequirements.

Unit	Topic	No of lectures
1	**Introduction to Cloud Computing** ● Overview, Layers and Types of Cloud ● Desired Features of a Cloud ● Benefits and Disadvantages of Cloud Computing ● Cloud Infrastructure Management, ● Infrastructure as a Service Providers ● Platform as a Service Providers Multitenant Technology ● Cloud-Enabling Technology: Broadband Networks andInternet Architecture, Data Center Technology, Virtualization Technology. ● Infrastructure as a Service, Platform as a Service, Software as a Service, Cloud Deployment Models. Cloud economics and benefits,	8
2	**Abstraction and Virtualization** ● Introduction to Virtualization Technologies ● Load Balancing and Virtualization ● Understanding Hypervisors, ● Virtual Machines -Provisioning and ManageabilityVirtual Machine ● Provisioning in the Cloud Context ● Virtualization of CPU, Memory, I/O Devices Virtual Clusters and Resource management	7
3	**Programming**, **Environments and Applications** ● Features of Cloud and Grid Platforms ● Programming Support of Google App Engine ● Programming on Amazon AWS and Microsoft Azure,Emerging Cloud Software Environments ● Applications: Moving application to cloud	8

	● Microsoft Cloud Services ● Google Cloud Applications ● Amazon Cloud Services	
4	**Security In The Cloud Security Overview** ● Cloud Security Challenges and Risks ● Software-as-a-Service Security ● Security Governance Risk Management – SecurityMonitoring ● Security Architecture Design ● Data Security ● Application Security ● Virtual Machine Security	7

Reference Books:

1. Cloud Computing: Technologies and Strategies ofthe Ubiquitous Data Center By Brian J.S. Chee and Curtis Franklin, CRC Press, ISBN :9781439806128
2. Mastering Cloud Computing: Foundations and Applications Programming by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill, ISBN:978 1259029950, 1259029956
3. Distributed and Cloud Computing,From Parallel Processing to the Internet of Things by Kai Hwang, Geoffrey C Fox, Jack G Dongarra, Morgan KaufmannPublishers, 2012.
4. Cloud Computing by Dr. Satish Ambike, Dr. Rajesh K Dhumal, Nirali Publication ISBN: 9789354512520

Course Code: COMCA51202
Subject Name: Cloud Computing Practical

Total lectures: 30 hours **Total Credits: 2**

Prerequisites: -

- Basic knowledge of distributed computing system
- Knowledge of virtualization concept

Course Objectives:-

- To Obtain knowledge of cloud computing fundamentals and benefits ofcloud computing
- To Understand the various virtualization technologies in detail
- To Understand data center and cloud storage concept

Course Outcome:-

After successful completion of course students will be able to:

- Understand core issues in cloud computing such as security, privacy, andinteroperability.
- provide the appropriate cloud computing solutions and recommendationsaccording to the applications used.
- identify the architecture and infrastructure of cloud computing, includingSaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.
- identify problems, and explain, analyze, and evaluate various cloudcomputing solutions

Unit	Topic Assignment Names	No of lectures
1	Working and Implementation of Infrastructure as a service 1.Launching EC2 Instance(windows)- AWS Platform Prepare Screenshots file 2. Write down the steps to launch EC2 instance(windows)	3
2	Working and Implementation of Infrastructure as a serviceLaunching EC2 Instance(Linux)- AWS Platform .Prepare Screenshots file Write down the steps to launch EC2 instance(Linux)	3
3	Working and Implementation of Infrastructure as a service Create an EC2 Linux Instance and Install an Apache Web Serverand run hello World page (Use AWS Platform) Prepare Screenshots file and also write down the steps andcommands used.	3
4	Practical Implementation of Storage as a Service Create an S3 Bucket, Upload a file to S3 Bucket, Retrieve a Filefrom S3 Bucket, and Delete a File from S3 Bucket using AWS.	3
5	Implementation of Storage as a Service Hosting a static website inAWS using S3.	3
6	Working and Implementation of identity management.	3
7	Write a program for web feed. Using EC2 Service install Red-hatLinux instance and install python and run python program	3
8	Working and Implementation of Platform as a service . AWS Elastic Beanstalk: Use this tool to upload sample code for webapps. (AWS handles the deployment, provisioning and load balancing)	3
9	Virtual Private Cloud	3
10	Launch RDS Instance (AWS).	3

Course Code: COMCA51301

Subject Name: **Research Methodology**

Total lectures: 30 hours **Total Credits: 2**

Prerequisites:-

- Basic knowledge of distributed computing system
- Knowledge of virtualization concept

Course Objectives:

- To enable students to undertake independent research of a businessproblem, and to analyze and present their findings.
- To familiarize students with the basic techniques of collection, analysis,interpretation and presentation of data.
- To formulate a research proposal for a business project.
- To obtain knowledge of research methodology

Course Outcome:-

After successful completion of course students will be able to:

- Understand research terminology
- Be aware of the ethical principles of research, ethical challenges andapproval processes
- Describe quantitative, qualitative and mixed methods approaches toresearch
- Identify the components of a literature review process
- Critically analyze published research

Unit	Topic	No of lectures
1	Introduction to Research: Definition, meaning,characteristics of Research	2
2	Types of Research, Introduction Nature of qualitative andquantitative research, Research in functional areas of management, Process of Research, Formulation of Research Design	7
3	Meaning and sources of Research problem, characteristicsof good Research problem, Research process, outcomes, application of Research	3
4	Literature Review Process – Role, importance, sources, methods, software tools for literature review. Formulationof Research Problem	2
5	Research Design – Meaning, Need, Types of researchdesign – Exploratory, Descriptive, components of research design and features of good research design.	5

6	Sampling: Sampling design: Meaning, logic andapplication of sampling.	**8**
7	Data Collection Methods: Types and Sources of Data	**8**
8	Data Analysis: Organization and presentation of data, DataAnalysis Methods	**10**
9	Presentation and Publication of Research: Research Proposal, Research Paper, Research Thesis, ResearchReport, Report Writing,Format for writing reports, bibliography, and references	**4**

Reference Books:

1. Research methodology techniques and methods by CR Kothari, https://ccsuniversity.ac.in/bridge-library/pdf/Research-Methodology-CR-Kothari.pdf , New age Internationalpublishers
2. Probability and Statistics for Engineers andScientists" by Sheldon Ross, Elsevier AcademicPress
3. Research Methodology by R. Panneerselvam, I, NewDelhi 2005, PHI
4. Oates B J – Researching Information Systems andComputing, Sage Publications
5. https://onlinecourses.nptel.ac.in/noc22_ge08/preview

Course Code: COMCA51302

Subject Name: Practical on Research Methodology

Total lectures:30 hours **Total Credits: 2**

Prerequisites: -

- Basic knowledge of Computer Science Subjects

Course Objectives:-

- To enable students to publish research paper

Course Outcome:-

After successful completion of course students will be able to:

- Understand research terminology
- publish research paper/ research article

Unit	Topic	No of lectures
1	ICT Tools for Research Use of Internet in Research: Browsing the internet through standard features, Accessing and Downloading information, E- resources for research, Impact Factor: E - Information, H-Index,citation index, , e-journals etc	10

2	Identification of Research Problem and Literature Survey ,Various Referencing Styles	**10**
3	Publishing a research paper	**10**

FY MSc (Computer Applications)
Semester II

Course Code: COMCA52101
Subject Name: **Java Programming**

Total lectures: 60 **Total Credits: 4**

Prerequisites: -

Student should have basic knowledge of:

- basics of how to use a computer, and should be able to start acommand line shell

Course Objectives:

- To Prepare student to think about programming languagesanalytically to
- To identify Java language components and how they work togetherin applications.

- To design and program stand-alone Java applications
- To learn how to design a graphical user interface (GUI) with JavaSwing.

Course Outcome:-

After successfully completing this course, students will be able to:

- Understand the knowledge of java programming and object-orientedconcept
- The use of Java in a variety of technologies and on differentplatforms.

Unit	Topic	No of lectures
1	**Introduction to Java** ● History and Features of Java ● JDK,JRE,JIT , Bytecode and JVMSimple javaprogram ● Data Types Variable: final, static, abstract Array, Function.	4
2	**Objects and Classes** ● Definition of Class ● Access Specifiers, ConstructorsUse of "this"keyword ● String, String Buffer, and Wrapper class ● Inner classes, Nested classes, local classes,Anonymous classes (Anonymous object)Introduction to Packages Garbage Collection (finalize () Method)	8
3	**Inheritance and Collection** ● Inheritance Basics, Types of Inheritance, Use of'super' and 'Final' Keyword ● Usage of abstract class and abstract methodsInterface. Introduction to Collection	8
4	**Exception Handling and I/O** ● Introduction to Exception handlingException types ,Exception class ● User defined exception ● Introduction to Java.io package Byte streams, ● Character streamsFile IO basics Object serialization – Reader and Writer	6
5	**Swing, Applet programming** ● VC(Model View Controller) ArchitectureSwing ● Applet fundamentals, Applet life cycle, Creatingand running applets Applets: Event Handling using applets	12
6	**Database Programming** ● Introduction to JDBC: Architecture ● JDBC Drivers , Connectivity . JDBC statement, ● JDBC Result Set and types JDBC Metadata	8

7	**Servlets** ● Introduction to Servlet and Hierarchy of ServletLifecycle of servlet ● Handling HTTP Request and HTTP Response ● Http Servlet: Reading form data from servlet ● Servlet – Database communication Session tracking –User Authorization, URL Rewriting, Hidden Form fields,Cookies and HttpSession	8
8	**JSP** ● Simple first JSP programLife cycle of JSP ● Implicit Objects ● Scripting elements –Declarations, Expressions, Scriplets, Comments JSPDirectives –Page Directive, include directive ● Mixing Scriplets and HTML Example of forwarding contents from database to servlet , servlet to JSP and displaying it using JSP scriptlet tag	6

Reference Books:

Sr. No.	Title of the Book	Author/s	Publication
1	Complete reference Java	Herbert Schildt	McGraw Hill Education; 4th ed
2	Java 2 programming black books	Steven Horlzner	
3	Java EE Project using EJB 3, JPA and struts 2 for beginners	Sha h	SPD
4	Core Java Volume-II Advanced Features, Eighth Edition	Cay S.Horstmann, Gary Cornell	Prentice Hall, Sun Microsystems Press
5	Commercial web development usingjava 2.0	Ivan Byaross	BPB
6	Java Programming A practical Approach	C Xavier	McGraw Hill

Course Code: COMCA52102
Subject Name: Data Warehousing & Data Mining

Total lectures: 60 hours **Total Credits: 4**

Prerequisites: -

Student should have basic knowledge of:

- Databases, Programming Languages

Course Objectives:

- To Prepare student to think about programming languages analytically

Course Outcome:-

After successfully completing this course, students will be able to:

- Learn data pre-processing and its importance
- Understand basic data mining and warehousing tasks \
- Apply clustering and association rule algorithms to databases

Unit	Topic	No of lectures
1	**Introduction to Data Mining**. ● Basic Data Mining Tasks. ● DM versus Knowledge Discovery in Databases. ● Data Mining Issues. Overview of Applications of Data Mining.	4
2	**Introduction to Data Warehousing.** ● Architecture of DW ● OLAP and Data Cubes ● Dimensional Data Modeling-star, snowflake schemas ● Data Preprocessing – Need, Data Cleaning, DataIntegration & Transformation, Data Reduction Machine Learning	8
3	**Data Mining Tasks** ● Frequent item-sets and Association rule mining: Apriorialgorithm, ● Use of sampling for frequent item-set, FP tree algorithm Graph Mining: Frequent subgraph mining, Tree mining,Sequence Mining.	12
4	**Classification And Prediction** ● Decision tree learning Construction, performance,attribute selection ● Issues: Over-fitting, tree pruning methods, missing values, continuous classes Classification and RegressionTrees (CART) ● Bayesian Classification: Bayes Theorem, Naïve Bayesclassifier, ● Bayesian Networks Inference ● Parameter and structure learning • Linear classifiers. • Least squares, logistic, perceptron and SVMclassifiers ● Prediction • Linear regression ● Non-linear regression	16
5	**Accuracy Measures** ● Precision, recall, F-measure confusion matrix, cross-validation, bootstrap	4
6	**Clustering** ● k-means ● Expectation Maximization (EM) algorithm Hierarchical clustering, Correlation clustering	12

7	**Software for data mining and applications of data mining** R & Weka Tool	4

Reference Books:

Sr. No.	Title of the Book	Author/s	Publication
1	Data Mining: Concepts and Techniques,, ISBN:9789380931913	Han & Kamber	Elsevier
2	Data Mining – Introductory andAdvanced Topics	Margaret H. Dunham, S. Sridhar	Pearson Education
3	Machine Learning‖	Tom Mitchell	McGraw-Hill,
4	Pattern Recognition and Machine Learning‖	Christopher M. Bishop	Springer
5	Database Management Systems	Raghu Ramkrishnan, Johannes Gehrke	
6	Eibe Frank Data Mining: Practical Machine Learning Tools and Techniques	Ian H.Witten	Tata McGraw Hill
7	Data Mining & Data Science	Dr. Dipali Meher Dr Pallawi Bulakh	Nirali Publications

Course Code: COMCA52103
Subject Name: Computer Networks

Total lectures: 60 hours **Total Credits: 4**

Prerequisites: -

Student should have basic knowledge of:

- Fundamentals of Computers
- Basics of internet/ ICT

Course Objectives:

- Learning about computer network organization and implementation,
- obtaining a theoretical understanding of data communication and computernetworks,
- gaining practical experience in installation, monitoring, and troubleshootingof current LAN systems.

Course Outcome:-

After successfully completing this course, students will be able to:

- Understand the concepts of Data Communication.
- Understand the functions of OSI Layers.
- Familiarise with the Transmission Media, Flow Control and Error Detection &Correction.

Unit	Topic	No of lectures
1	**Introduction to Computer Networks** ● Characteristics of data communication, components, data representation, dataflow. ● Distributed processing, Physical Structure-Pointto Point, Broadcast, ● Categories of topology (mesh, star, ring, bus) ● LAN, WAN, MAN, INTERNET etc. ● Definition of protocol, key elements, ● Protocols, peers, interfaces, network architecture,protocol stack. ● design issues of the layers – addressing, error control, flow control multiplexing and demultiplexing, routing Connection-oriented and connectionless service. Service Primitives – listen, connect, receive, send, disconnect The Relationships of services to protocol	8
2.	**Network Models** ● OSI Reference model functionality of eachlayerTCP/IP model ● Introduction to IP,TCP & UDP TCP/IP Protocol Suite Addressing- Physical, Logical & Port addresses	4
3.	**The Physical Layer** ● The Basic Concepts of analog & digital signals ● Bit rate, bit length, baseband transmissionTransmission Impairments – attenuation, distortion, and noise Data Rate Limits – Nyquist's bit rate formula for noiseless channel and Shannon's law Problems on above concepts Performance of the Network ● Bandwidth, Throughput, Latency (Delay), ● Bandwidth –Delay Product, Jitter Problems ob above concepts ● Line Coding digital to digital conversion Characteristics, Line Coding Schemes Unipolar, NRZ, RZ, Manchester andDifferential Manchester ● Transmission Modes -Parallel Transmission Serial Transmission – Asynchronous and Synchronous ● Multiplexing- FDM, TDM, WDM. Switching -Circuit Switching, Message Switching andPacket Switching	8
4	**The Data Link Layer** ● Framing -Character Count, Byte Stuffing, ● Bit Stuffing and Physical Layer Coding Violations ● Error Control - Hamming Code and CRC ● Elementary data link protocols - Simplex stop & wait protocol, Simplex protocol for noisy channels. Sliding Window Protocols - 1-bit sliding windowprotocols, Pipelining – Go-Back N and Selective Repeat	8

5.	**The Medium Access Sub layer** ● Random Access Protocols ALOHApure and slotted, CSMA – 1-persistent, p persistent andNon-persistent CSMA/CD, CSMA/CA ● Controlled Access- Reservation, Polling and TokenPassing Channelization - FDMA, TDMA and CDMA	8
6.	**The Network layer** ● Design Issues ● Store-and-forward packet switching, Services Provided to the Transport Layer,Implementation of Connectionless Service, Implementation of Connection Oriented Service, Comparison of VirtualCircuit and Datagram ● Logical Addressing IPV4 Addresses – Address Space, Notations, Classful Addressing, ClasslessAddressing, Network Address Translation (NAT) IPV6 Addresses – Addressing Structure, Address Space 5. IPV4 Protocol - Datagram Format, Fragmentation, Checksum, Options ● IPV6 Protocol -Advantages, Packet Format, Extension Headers ● Transition From IPV4 to IPV6 - Dual Stack, Tunneling, Header Translation Routing Concepts - Properties of routingalgorithm, Comparison of Adaptive and Non- Adaptive Routing Algorithms.	8
7.	**The Transport layer** ● Process-to-Process Delivery ● Client Server Paradigm, Multiplexing and Demultiplexing, Connectionless VsConnection- Oriented Service, Reliable Vs Unreliable ● User Datagram Protocol UDP ● Datagram Format, Checksum, UDP operations, Use of UDP ● Transmission Control Protocol (TCP) TCP Services, TCP Features, TCP Segment,TCP Connection, Flow Control,Error Control TCP Congestion Control Slow Start Mechanism	8
8.	**The Application layer** ● Domain Name System (DNS) - Name Space, Domain Name Space, Distribution of Name Space, DNS in theInternet, Name – Address Resolution ● TELNET- Time Sharing Environment, Logging, NVT, Embedding, Options, Mode ofOperations ● E-MAIL - Architecture, User Agent, Message Transfer Agent-SMTP, Message AccessAgent- POP, IMAP, Web Based Mail ● File Transfer Protocol (FTP) - Communication overcontrol connection, Communication over ● DataConnection, Anonymous FTP ● WWW -Architecture, WEB Documents HTTP - HTTP Transaction, Persistent and Non-persistent Connection, Proxy Server	8

Reference Books:

Sr. No.	Title of the Book	Author/s	Publication
1	Computer Networks	A. Tanenbaum,	Pearson
2	Data Communication and Networking	Behrouz Forouzan	TATA McGrawHill.Fourth

Course Code: COMCA52104

Subject Name: Principles of Product Management

Total lectures: 60 hours **Total Credits: 4**

Prerequisites: -

Student should have basic knowledge of:

- Basic understanding of technology and the development process
- Being able to conduct market research, gather customer insights, and analyze data

Course Objectives:

- Understanding of business principles and strategy
- Understand the role of Product Manager

Course Outcome:-

After successfully completing this course, students will be able to:

- Think long-term and set a clear vision for the product's future.
- Learn about Product managers and their work with cross-functional teams, leadership and teamwork skills.
- Learn about listening actively to customer feedback.
- Think about their product plans with the company's overall goals and strategies.

Unit	Topic	No of lectures
1	**Introduction to Product Management** ● What is product management? ● The role of a product manager ● The product life cycle Key skills and qualities of a successful product manager.	5
2	**Market Research and Analysis** ● Customer segmentation and personas. ● Market trends and competitive analysis. Conducting surveys, interviews, and usability testing.	4
3	**Product Strategy** ● Defining the product vision and mission. ● Setting product goals and objectives. Creating a product roadmap.	4
4	**Ideation and Concept Development** ● Generating and evaluating product ideas ● Prioritizing features and concepts ● Building a business case	4

5	**Product Development and Lifecycle** • Agile and Scrum methodologies. • Minimum Viable Product (MVP) concept.	3
6	**Product Strategy** • Setting product goals and objectives. • Creating a product roadmap. • Defining the value proposition. Pricing and monetization strategies.	2
7	**User Experience (UX) and Design** • User interface (UI) design User testing and feedback	2
8	**Agile and Scrum Methodologies** • Introduction to Agile and Scrum. Agile project management tools	3
9	**Product Development and Engineering** • Working with development teams Agile project management	3

Reference Books:

Sr. No.	Title of the Book	Author/s	Publication
1	Fundamentals of Selling	Charles M. Futrell	Tata McGraw Hill 10th Edition
2	Product Leadership	Richard Banfield, Martin Eriksson, and Nate Walkingshaw	O'reilly
3	Inspired: How to Create Products Customers Love	Marty Cagan	Wiley

Course Code: COMCA52201
Subject Name: On Job Training

Total lectures: 60 hours **Total Credits: 4**

Prerequisites: -

Course Objectives:

Course Outcome:-

Unit	Topic	No of lectures
1	Selection of topic, basic reading and referencing	2 weeks
2	Finalisation of topic, Case study design to be ready, Field Work	4 weeks
3	Report Writing	4 weeks
4	**Assessment**	3 weeks

Reference :

Video 1 –APAV Part I "Topic Selection" IITB-UMA
Video 2 –APAV Part II "Case Study Design I" IITB-UMA
Video 3 –APAV Part II "Case Study Design II" IITB-UMA
Video 4 –APAV Part III "Field Work" IITB-UMA
Video 5 –APAV Part IV "Field Work and data Collection" IITB-UMA
Video 6 –APAV Part V "Analysis" IITB-UMA
Video 7 –APAV Part VI "Report writings" IITB-UMA

2	Andreas C. Müller, Sarah Guido	Introduction to Machine Learningwith Python: A Guide for Data Scientists	O'Reilly
3	Laura Igual Santi Seguí,	Introduction to Data Science	Springer
4	Pang-Ning Tan, Michael Steinbach, Vipin Kumar,	Introduction to Data Mining,	Pearson Education India

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Structure of the M. Sc. I Microbiology Syllabus

Under NEP

(To be implemented from 2023-2024)

Preamble:

The main theme of teaching microbiology course is the application of basic principles of life sciences to develop into technology. Modern biology combines the principles of chemistry and biological sciences (molecular and cellular biology, genetics, and immunology) with technological disciplines (engineering, computer science) to produce goods and services and for environmental management. Tools of molecular biology play an important role in preparation of an engineered clone, a recombinant or a genetically manipulated organism (GMO). The objective of the Master's Programme in Microbiology is to equip the students with updated knowledge of prokaryotic and eukaryotic cellular processes, microbial taxonomy, biostatistics, molecular biophysics, molecular biology and biochemistry.

The Board of Studies in Microbiology has identified the following thrust areas and prospective plans for syllabi reforms at postgraduate level:

· **Microbial diversity**: Facets of microbial diversity which includes morphological, structural, metabolic, ecological, behavioural and evolutionary aspects

· **Microbial diversity in extreme environments**: Properties and application of extremophiles and also includes collecting information of diversity, exploration and utilization of diversity to identify and harvest biomolecules for human health improvisation, micro-organisms from extreme environments, Archaebacteria, etc.

· **Mathematical approach for Biologists**: Numerical Microbiology Problem solving, Concept of mathematical models, Application of Mathematical models to microbiological processes

· **Advanced Biochemistry and Molecular Biology Techniques**: Chromatography techniques, next generation sequencing methods (Pyrosequencing, Ion torrent, Nanopore sequencing)

· **Morphogenesis and organogenesis in plants**

· **Research Methodology**: Use of search engines for scientific data mining, use of referencemanagement tools, statistical data analysis using software

In addition, we feel that the students should be well acquainted with research methodology which includes different skill developments in scientific writing, data handling and processing, development of research ideas and planning / designing of research projects. The skill sets thus evolved will help the students in academic and applied research. This syllabus aims to give the student a significant level of theoretical and practical understanding of the subject.

Introduction:

With the changing scenario at local and global level, we feel that the syllabus orientationshould be altered to keep pace with developments in the education sector. The need of the hour is proper syllabi that emphasize on teaching of technological as well as the

administrative aspects of modern biology. Theory supplemented with extensive laboratory expertise will help these students, to avail these opportunities. Both these aspects i.e. theory and more of practical needs to be stressed, such that a post-graduate student can start work directly in applied fields (industry or institutions), without any additional training.

The college itself will be developing trained and skilled manpower. We are restructuringthe syllabus with this viewpoint. The restructured syllabus will combine the principles of chemistry and biological sciences (molecular and cell biology, genetics, immunology and analytical tools, biochemistry, biostatistics and bioinformatics) with technological disciplines to produce goods and services and for environmental management.

Microbiology curricula are operated at two levels viz. undergraduate and postgraduate. The undergraduate curricula are prepared to impart basic knowledge of the respective subject from all possible angles. In addition, students are to be trained to apply this knowledge particularly in day-to-day applications of Microbiology and to get a glimpseof research.

Objectives to be achieved:

· To enrich students' knowledge and train them in the pure microbialsciences

· To introduce the concepts of mathematics in biology

· To inculcate research aptitude

· To inculcate sense of scientific responsibilities and social and environment awareness

· To help students build-up a progressive and successful career in Microbiology

A: Course Structure:

The students can do one year PG Diploma (44 Credits) after 3 Yr UG Degree or a 4 Semester PG Degree (88 Cr.) after 3 Yr UG Degree or 1 Yr- 2 Semester PG Degree (44 Cr) after 4 Yr. UG Degree.

B: Workload:

Each theory credit is equivalent to 15 clock hours of teaching (12 hrs classroom + 3 hrs of tutorials-active learning method) and each practical credit is equivalent to 30 clock hours of teaching in a semester.

1. For the purpose of computation of workload, the following mechanism may beadopted as per UGC guidelines:

i) 1 Credit = 1 Theory period of one-hour duration per week

ii) 1 Credit = 1 Tutorial period of one-hour duration per week

iii) 1 Credit = 1 Practical period of two-hour duration per week

2. Each theory lecture time is of 1hour=60min.

s

M.Sc Microbiology - Proposed Structure and Credit Distribution under NEP w.e.f. The academic Year 2023-2024

Year (2 yr PG)	Level	Sem	Disciplinary Major Mandatory	DSE Electives	RM	OJT/FP	RP	Cumulative Credits	Degree
I	6	I	MIC51101 Microbial systematics 2(Cr)(T) + MIC51102 Quantitative Biology 4(Cr)(T) + MIC51103 Biochemistry and Metabolism 4(Cr)(T) + MIC51104 Practicals based on Microbial systematics, Quantitative Biology, Biochemistry and Metabolism 4(Cr)(P) .	MIC51201 Bioremediation and biomass utilization 2(Cr)(T) + MIC51202 Practical based on Bioremediation and biomass utilization 2(Cr)(P)	MIC51301 Research Methodology 4(Cr)(T)			22	PG Diploma (after 3 yrs degree)
		II	MIC52101 Instrumentation and Molecular biophysics 2(Cr)(T)+ MIC52102 Molecular Biology 4(Cr)(T)+ MIC52103 Cell organization and biochemistry 4(Cr)(T)+ MIC52104 Practicals based on Instrumentation and Molecular biophysics, Molecular Biology, Cell organization and biochemistry 4 (Cr)(P)	MIC52201 Microbial communication, Membrane transport and signal transduction 2(Cr)(T)+ MIC52202 Practical based on Microbial communication, Membrane transport and signal transduction 2(Cr)(P)		MIC52301 OJT 4Cr		22	
Cum. Cr. For PG Diploma			28	8	4	4	0	44	
Exit Option : PG Diploma (44 Credits) After 3 Yr UG Degree									
II	6.5	III	MIC63101Advanced Immunology 4Cr(T) + MIC63102 OMICS and transgenic plants and animals 4Cr(T) + MIC63103 Clinical Microbiology 2Cr (T) + MIC63104 Practicals based on Advanced Immunology, OMICS and transgenic plants and animals and Clinical Microbiology 4Cr (P)	MIC63203 Industrial waste water treatment and industrial production of vaccines 2 Cr (T)+MIC63204 Practicals based on Industrial waste water treatment and industrial production of vaccines 2Cr (P)			MIC63301 Research Project 4(Cr)(P)	22	PG Degree (after 3 yrs degree) OR PG Degree (after 3 yrs degree
		IV	MIC64101Pharmaceutical microbiology 4Cr-(T)+ MIC64102 Microbial technology 4Cr-(T)+ MIC64103 Practical based on pharmaceutical microbiology and microbial technology 4Cr-(T)	MIC64201 Quality assurance and validation in Pharmaceutical industry and development of anti-infective 2Cr(T) + MIC64202 Practicals based on Quality assurance and validation in pharmaceutical industry and development of anti-infective 2Cr(P)			MIC64301 Research Project 6(Cr)(P)	22	
Cum. Cr. For 1 Yr PG Degree			26	8			10	44	
Cum. Cr. For 2Yr PG Degree			54	16	4	4	10	88	
2 Yr - 4 Sem (88 Cr.), after 3 Yr UG Degree or 1 Yr - 2 Sem PG Degree (44 Cr.) after 4 Yr UG Degree									

C. Course Outline for M. Sc. Microbiology programme

Semester I

Course Type	Course Code	Course Name	Credit
Major Mandatory Theory	**MIC51101**	Microbial Systematics	2
	MIC51102	Quantitative Biology	4
	MIC51103	Biochemistry and Metabolism	4
Major Mandatory Practical paper	**MIC51104**	Biochemical Techniques	4
Major elective Papers	**MIC51201**	Bioremediation and Biomass Utilization	2
	MIC51202	Practicals Based on Bioremediation and BiomassUtilization	2
RM Theory	**MIC51301**	Research Methodology	4

Semester II

Course Type	Course Code	Course Name	Credit
Major Mandatory Theory	**MIC52101**	Instrumentation and Molecular Biophysics	2
	MIC52102	Molecular Biology	4
	MIC52103	Cell Organization and Biochemistry	4
Major Mandatory Practical paper	**MIC52104**	Practicals based on Instrumentation and molecular Biophysics, Molecular biology, Cell organization and Biochemistry	4
Major elective Papers	**MIC52201**	Microbial communication, Membrane transport and signaltransduction	2
	MIC52202	Practicals Based on Microbial communication, Membrane transport and signal transduction	2
OJT	**MIC52301**	On job training	4

Semester III

Course Type	Course Code	Course Name	Credit
Major Mandatory Theory	**MIC63101**	Advanced Immunology	4
	MIC63102	OMICS and transgenic plants and animals	4
	MIC63103	Clinical Microbiology	2
Major Mandatory Practical paper	**MIC63104**	Practicals based on Advanced Immunology, OMICS and transgenic plants and animals and Clinical Microbiology	4
Major elective Papers	**MIC63203**	Industrial Waste Water Treatment and IndustrialProduction of vaccines	2
	MIC63204	Practicals based on Industrial Waste Water Treatmentand Industrial Production of vaccines	2
RP	**MIC63301**	Research project	4

Semester IV

Course Type	Course Code	Course Name	Credit
Major Mandatory Theory	**MIC64101**	Pharmaceutical Microbiology	4
	MIC64102	Microbial Technology	4
Major Mandatory Practical paper	**MIC64103**	Practical based on pharmaceutical microbiology and microbial technology	4
Major elective Papers	**MIC64201**	Quality assurance and validation in Pharmaceutical industry and development of anti-infective	2
	MIC64202	Practicals based on Quality assurance and validation in pharmaceutical industry and development of anti-infective	2
Research Project	**MIC64301**	Research project	6

MB: Microbiology; EP: Practical Elective; ET: Theory Elective; CP: Compulsory.
Theory and Practical Details of courses for Semester III and IV will be declared later.

Award of credits

- Each course having four credits shall be evaluated out of 100 marks and student should secure at least (40%) in continuous assessment as well as term end exam to earn full credits of that course.
- Each course having three credits shall be evaluated out of 75 marks as student should secure at least 30 marks (40%) in continuous assessment as well as term end exam to earn full credits of that course.

- Each course having 2 or 1.5 credits shall be evaluated out of 50 marks and students should secure at least 20 marks (40%) in continuous assessment as well as term and exam to on full credits of that course.
- Each course having one credit shall be evaluated out of 25 marks as student shall secure 10 marks in continuous assessment as well as terman exam to earn full credits of that course.
- GPA shall be calculated based on the marks obtained in the respective subject provided that student should have obtained credits for that course.

General Instructions

- The post-graduate degree will be awarded to students who obtain a total 88 credits (22 average credits per semester). One credit will be equivalent to 15 clock hours of teacher-student contact per semester.
- Assessment shall consist of a) In-semester continuous assessment (CIA) and b) End-semesterassessment.

- The teacher concerned shall announce the units for which each in-semester assessment will takeplace.

However, the end-semester assessment shall cover the entire syllabus prescribed for the course. An in-semester assessment of 40% marks should be continuous and at least two tests should be conducted for courses of 4 credits and a teacher must select a variety of procedures for examinations such as:

1. Written test and/or midterm test (not more than one or two for each course) **2.** Term paper
3. Journal/Lecture/Library notes
4. Seminar presentation
5. Short Quizzes
6. Assignments
7. Extension work
8. An open book test (with the respective subject teacher deciding what books are to be allowed for this purpose)
9. Mini research project by individual student or group of students

The concerned teacher in consultation with the Head of the PG Department shall decide the nature of questions for the CIA.

Semester end examination for remaining 60% marks will be conducted by the Examination department.

The student has to obtain 40% marks in In- semester assessment and Semester-End assessment so as to pass in each course.

If a student misses an internal assessment examination, he/she will have a second chance

with the permission of the Principal in consultation with the concerned teacher. Such a second chance shall not be the right of the student.

Internal marks will not change. A student cannot repeat internal assessment. In case he/she wants to repeat internal assessment he/she can do so only by registering for the said course during the 5th / 6th semester and onwards up to 8th semester.

Students who have failed semester-end exam may reappear for semester-end examination only twice in subsequent period. The students will be finally declared as failed if he/she does not pass in all credits within a total period of four years. After that, such students will have to seek fresh admission rules prevailing at that time.

A student cannot register for the third semester, if she/he fails to complete 50% credits of the total credits expected to be ordinarily completed within two semesters.

There shall be Revaluation of answer scripts of semester examination but not of internal assessment papers as per the Ordinance no. 134 A and B. While marks will be given for all examinations, they will be converted into grades. The semester end grade sheets will have only grades and final grade sheets and transcripts shall have grade points average and total percentage of marks (up to two decimal points). The final grade sheet will also indicate the PG center to which candidate belongs.

Each assessment/test will be evaluated in terms of grades. The grades for separate assignments and the final (semester-end) examination will be added together and then converted into a grade and later a grade point average. Result will be declared for each semester and the final examination will give total grades and grade point average.

Reference: Savitribai Phule University's circular on "Rules and Regulation for PG Choice Based credit system for Science Programme of Affiliated Colleges", from June 2019 and further amendments.

MIC51101: Microbial Systematics (2 credit Major Theory)	
CO. No.	**Course Outcomes**
1.	Explain Concept of speciation, Microbial diversity, Taxonomy of Bacteria
2.	Classification of bacteria by 5 kingdom and 3 domain system, the phenetic and phylogenetic approach for classification.
3.	Measurement of microbial diversity and Measures and indices of diversity
4.	Explain concept of 'unculturable' bacterial diversity and Strategies for culture of 'unculturable' bacteria.
5.	Describe Culture independent molecular methods for identifying unculturable bacteria
6.	Explain Methods of extracting total bacterial DNA from a habitat and metagenome analysis

Unit No.	Title and contents	No. of Lectures
1	**Bacterial Systematics** 1. Species concept in prokaryotes and eukaryotes 2. 5-Kingdom classification system 3. 3-Domain classification system 4. Determinative Bacteriology (Phenetic Approach) 5. Systematic Bacteriology (Phylogenetic Approach) 6. Polyphasic Approach 7. Molecular clocks, phylogeny and molecular distances	**(10)**
2	**Microbial Diversity** 1. Facets of microbial diversity: morphological, structural, metabolic, ecological, behavioral and evolutionary 2. Species divergence and measurement of microbial diversity 3. Measures and indices of diversity; alpha, beta and gamma diversity	**(10)**

3	**Exploration of Un-culturable microbial diversity:** 1. Concept of 'unculturable' bacterial diversity 2. Strategies for culture of 'unculturable' bacteria 3. Culture independent molecular methods for identifying unculturable bacteria (PCR, RFLP, ARDRA, DGGE, TGGE, RAPD, Microarray, FISH, RISA) 4. Methods of extracting total bacterial DNA from a habitat and Metagenomic analysis	**(10)**

Suggested References:

1. Microbial Diversity: Form and Function in Prokaryotes, Published Online: 30 NOV 2007.DOI: 10.1002/9780470750490.ch1 Copyright © 2005 by Blackwell Science Ltd
2. Carl R. Woese. The archaeal concept and the world it lives in: a retrospective. PhotosynthesisResearch 80: 361 – 372, 2004. Kluver Academic Publishers.
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4. Species Divergence and the measurement of microbial diversity. Catherine Lozupone and RobKnight. FEMS Microbiol. Rev. 32 (2008) 557 – 578.
5. Methods of studying soil microbial diversity. Jennifer Kirk et al, (2004). Journal ofMicrobiological Methods 58, 169 – 188.
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15. Michael S. Rappe and Stephen J. Giovannoni (2003). The Uncultured Microbial Majority.Annual Review of Microbiology, 57: 369 – 94.
16. Rakesh Sharma, Ravi Ranjan, Raj Kishor Kapardar and Amit Grover (2005). 'Unculturavble'bacterial diversity: An untappedurrent Science, 89 resource. C(1)
17. Sonia R. Vartoukian, Richard M. Palmer and William G. Wade (2010). Strategies for cultureof 'un-culturable' bacteria. Minireview, FEMS Microbiol Lett 309, 1 – 7.
18. James D. Oliver (2005). The Viable but Non-culturable State in Bacteria (2005). The Journalof Microbiology, 43, Special Issue, 93 – 100.
19. Lindell Bromham and David Penny (2003). The Modern Molecular Clock. www.nature.com/reviews/genetics. MARCH 2003 | VOLUME 4, Page. 216. Nature PublishingGroup.

20. Leo C. Vining (1992). Roles of secondary metabolites from microbes. Edited by Derek J.Chadwick, Julie. Whelm Copyright.

MIC51102: Quantitative Biology (4 credit Major Theory)	
CO. No.	**Course Outcomes**
1.	Define and explain the fundamental concepts like variable, data, sample, population etc.
2.	Statistically analyze and measure central tendency & dispersion for the given/experimental data
3.	Present the data using appropriate method amongst frequency distribution table, Bar diagram, histogram, pie chart, scatter diagram etc.
4.	Understand and apply the concepts of null hypothesis, Test statistics, P-value significance level, type I and type II errors, one tailed and two tailed tests, degrees of freedom, Parametric and nonparametric test.
5.	Perform Test of Significance, ANOVA One way and two way, Post Hoc test, Sign test, Wilcoxon's signed rank test and Mann-Whitney U test, for the data provided.

Unit No.	Title and contents	No. of Lectures
1	**Descriptive Statistics** 1. Fundamental concepts –Sample Statistics and Population parameter, data (qualitative and quantitative data, discrete and continuous series data), data sources, variables, measurement scales (nominal, ordinal, interval and ratio), variability and uncertainty in measurements 2. Measures of central tendency – Mean, Mode, median 3. Measures of dispersion – Mean deviation Standard deviation and Variance 4. Data presentation-Tables and Graphs (Histogram, bar, pie and line) 5. Simple linear Regression and correlation (significance testing not necessary) (Sr. No. 1:- only theory questions to be asked in exam. Sr. No. 2 – 5:- only problem solving questions to be asked in exam.)	**(15)**

2	**Inferential Statistics-1** 1. Uncertainty: Variation, Probability and inference 2. Central Limit Theorem, Standard deviation of the means standard error and confidence interval 3. The concepts of null hypothesis, Test statistics, P-value significance level, type I and type II errors, one tailed and two tailed tests, degrees of freedom, Parametric and nonparametric test, statistical decision tree, Parametric statistical test: Z-test, t-test and F-test (Sr. No 1 – 3:- only theory questions to be asked in exam except Z-test, T-test and F-test.)	**(15)**
3	**Inferential Statistics-2** 1. Test of Significance: Chi square test (Goodness of fit and Independence), 2. Comparison of 3 or more samples – ANOVA One way and two way, Post Hoc test (Tukey's) 3. Nonparametric Tests: comparison to parametric tests, Sign test, Wilcoxon's signed rank test and Mann-Whitney U test	**(15)**
4	**Probability and Probability Distribution** 1. Concept of experiment, event (mutually exclusive & non-exclusive events, dependent & independent events) 2. Laws of probability (addition and multiplication); 3. Probability distribution – Normal (x-scale and z-scale), Binomial and Poisson distributions	**(15)**

Suggested References:

1. Irfan Ali Khan and AtiyaKhanum, Fundamentals of Biostatistics. 3rd Ed. Ukaaz, Publications, Hyderabad.

2. Bernard Rosner Fundamentals of Biostatistics,5th Ed. Duxbury Thomson

3. Wayne Daniel (2007) Biostatistics A foundation for Analysis in the health sciences,wileyIn

4. Lindgren B.W. Statistical Theory, Macmillan Publishing Co.Inc.

5. Norman T. J. Bailey Statistical methods in biology, 3rd Ed. Cambridge University Press

6. Gupta S.P. Statistical methods, Sultan Chand & Sons Publisher, New Delhi

7. Montgomery D.C. Design and analysis of experiments, John Wiley & Sons

8. Stephen Newman, Biostatistical methods in Epidemiology. Wiley Interscience Publication,

9. Aviva Petrie and Carolene Sabin (2005) Medical Statistics at a glance, 2nd Edition, Blackwell

10. Haefner James W. (1996) Modeling Biological Systems: Principles and Applications,

Kluwer Academic Publications

11. David Brown & Peter Rothery. Models in biology: Mathematics, statistics, and computing John Wiley & Sons, USA

12. Practical Fermentation Technology Edited by Brian McNeil and Linda M. Harvey (2008) John Wiley & Sons, Ltd. ISBN: 978-0-470-01434-9

13. Bioprocess Engineering Principles by Pauline M. Doran (1995), Elsevier Science & Technology Books, ISBN: 0122208552

14. Peter J. Diggle, Amanda G. Chetwynd Statistics and Scientific Method: An Introduction for Students and Researchers, Publisher: Oxford University Press,

15. Veer Bala Rastogi, Fundamentals of Biostatistics, second edition, Ane's Books Pvt. Ltd.

MIC51103: Biochemistry and Metabolism (4 credit Major Theory)	
CO. No.	**Course Outcomes**
1.	Describe structural features of amino acids, classify amino acids and explain their use as buffers, determination of primary structure of polypeptide, structural classification of proteins with specific examples.
2.	Solve problems on primary structure determination, use of amino acids as buffers and behavior of amino acids, peptides and proteins in solutions at different pH values and under effect of electric field
3.	Explain biochemistry and molecular biology techniques such as chromatography, electrophoresis, PCR reaction and sequencing of DNA and RNA.
4.	Explain structural aspects of carbohydrates, mechanism and regulations of carbohydrate metabolism
5.	Explain structure, function and nomenclature of fatty acids in lipids, role of lipids as structural component of cell membrane and as signaling molecules

Unit No.	Title and contents	No. of Lectures
1	**Protein Chemistry:** 1.Structural features of amino acids, classification of amino acids Amino acids as buffers, Henderson Hasselbalch equation and its role in buffer formulation 2. Peptide linkage, partial double bond nature of peptide bond Determination of primary structure of polypeptide (N-terminal, C-terminal determination, method of sequencing of peptides), 3. Structural classification of proteins: primary, secondary, tertiary, quaternary structures of proteins, Super-secondary structures- Motifs & Domains, Non-covalent interactions, Conformational properties of proteins, Polypeptide chain geometry, Resonance forms of the peptide group, cis/trans isomers of peptide group 4. Ramachandran plot 5. Structure and Functions of Myoglobin, Haemoglobin and Fibrous proteins	**(15)**
2	**Biochemistry and Molecular Biology Techniques** 1.Chromatography: Principles and applications of gel filtration, Ion exchange, affinity chromatography 2.Electrophoresis: Agarose, Native PAGE, SDS PAGE 3.Polymerase chain reaction: Principle, variations of PCR (Hot start, Nested, Reverse transcription, real time PCR) and its Applications. 4.Sequencing methods: RNA-sequencing methods and applications, DNA sequencing: Classical and next generation sequencing methods (Pyro-sequencing, Ion torrent, Nano-pore sequencing)	**(15)**
3	**Carbohydrate Chemistry and Metabolism** 1. Mono, di, oligosaccharides and polysaccharides, with examples 2. Isomerism in sugars: asymmetric centres in sugars, dextro, leavo-rotatory, sugar anomers (reducing and non-reducing sugars), sugar epimers 3. Sugar derivatives such as sugar alcohols, amino sugars, sugar acids, deoxy sugars 4. Glycolysis and gluconeogenesis, Regulation of glycolysis and gluconeogenesis, 5. Synthesis of microbial exopolysaccharides (alginate) 6. Cellulose synthesis and breakdown 7. Regulation of Glycogen synthesis; breakdown, 8. Metabolic flux and its regulation by various metabolic intermediates, 9. TCA cycle- regulation, role in energy generation, Role in generating biosynthetic intermediates and glyoxylate cycle	**(15)**

4	**Lipid Chemistry and Metabolism** 1. Classification of lipids according to chemical structure, 2. Fatty acids, saturated, unsaturated, branched, nomenclature system, 3. Structure and function of: triglycerides, phospholipids, sphingolipids, terpenes, prostaglandins, waxes, and steroids. 4. Synthesis of storage lipids: Fatty acids and triacylglycerols, 5. Synthesis of membrane lipids: Glycerophospholipids, sphingolipids, sterols, 6. Degradation of fatty acids (beta oxidation and unsaturated fatty acid) and fats in animals 7. Lipids as signal molecules (eg. phosphatidyl inositol, eicosanoids).	**(15)**

Suggested References:

1. Nelson D. L. and Cox M. M. (2002) Lehninger's Principles of Biochemistry, 4th edition, Mac MillanWorth Pub. Co. New Delhi.

2. Segel Irvin H. (1997). Biochemical Calculations. 2nd Ed. John Wiley and Sons, NY.

3. Garrett, R. H. and Grisham, C. M. (2004) Biochemistry. 3rd Ed. Brooks/Cole, Publishing Company, California.

4. Moat Albert G. and Foster John W. (2002) Microbial Physiology 4th Ed. John Wiley and Sons New York.

5. Donald Voet (Author), Judith G. Voet (2011). Biochemistry, 4th Edition, Kindle Edition

6. Berg Jeremy, Tymoczko John, StryerLubert (2002) *Biochemistry* 5th Ed, W. H. Freeman, New York.

7. Carl Ivar Branden, John Tooze (1999) Introduction to Protein Structure, 2nd Edition, Garland science.

MIC51104: Biochemical Techniques (4 credit Major Practical)	
CO no.	Course outcomes
1	Prepare stock solutions and buffers
2	Enrich, isolate and identify extremophiles, lipase/cellulase/chitinases producing microorganisms from various samples
3.	Extract proteins and EPS from bacterial cultures, separate and estimate proteins and sugars by chromatography, electrophoresis and spectrophotometry.
4.	Interpret Ramachandran plot
Sr.No.	**Contents**
1.	**S**afety rules in Laboratory: Laboratory safety, hazard from chemicals, handling of chemicals, disposal of chemicals and cultures, recording of scientific experiments. Standardization of laboratory procedures, calibration and validation instruments, preparing / designing SOP for the same, maintenance of instruments
2.	Buffer: Determination of pKa of a monoprotic weak organic acid; Preparation of buffers using $KH_2PO_4$and K_2HPO_4, acetic acid and sodium acetate, K_2HPO_4 and H_3PO_4.
3.	Computer applications: Using data sheets, and sorting data with different parameters, plotting graphs – bar charts, line graphs, pie charts, adding error bars. (Using Microsoft Excel) Statistical analysis of data – Students t test, ANOVA, Chi square test, F test using computer softwares (Using Microsoft Excel)
4.	Enrichment, Isolation and identification of the following extremophiles from natural samples: Alkaliphiles and Thermophiles. Identification of the bacteria to at least the Genus level using the Bergey's Manuals is expected. The identification key must be designed for each isolated and identified bacterium.
5.	Isolation and characterization of lipase/ cellulose / chitinase producing microbe
6.	Extraction of Protein and Exo-polysaccharide from bacterial culture(may use TCA and ethanol method)
7.	Colorimetry and spectrophotometry: estimation of above sample: Bradford and UV Spectrophotometry (purity using A280 method).
8.	Chromatography: Separation of hydrolysed protein and EPS sample (above) using paper and thin layer chromatography. (Explain concept of two-dimensional chromatography and descending chromatography)
9.	Electrophoresis: SDS-PAGE of above proteins / To determine the ion-exchange capacity and nature of given resin using anion exchange chromatography
10.	Interpretation of Ramachandran Plot and study of conformations of protein molecule using Molecular Graphics Visualization Tool (e.g. Swiss PDB)

MIC51201: Bioremediation and Biomass Utilization (2 credit Major Elective)	
CO. **No.**	**Course Outcomes**
1.	Students will be able to: Explain Concept of bioremediation, different modes of bioremediation
2.	Describe use of genetic engineering technology to enhance bioremediation, plasmids useful in development of genetically engineered strains
3.	Explain conventional industrial processes of Alcohol, Fructose production and the improvements brought in to them
4.	Explain structure, arrangement and manipulation of Prokaryotic and eukaryotic cellulase genes

Unit No.	**Title and contents**	**No. of Lectures**
1	**Bioremediation** A. Microbial Degradation of xenobiotics, B. Engineered bio- degradative pathways: Camphor, octane, xylene, naphthalene degradation pathway C. Aromatic compound degradation: Manipulation by plasmid transfer Manipulation by gene alteration	(15)

2	**Biomass utilization** A. Utilization of starch and cellulose; *B.* Isolation of the prokaryotic and eukaryotic cellulase genes, manipulation of the cellulase gene, advantages of using *Zymomonas mobilis* C. Alcohol, fructose, and silage production; advantages of each D. Improvisation of the processes of alcohol production	(15)

Suggested References:

Bioremediation:

1. Glick B. R., Pasternak J. J., Cheryl L. and Patten C. L. (1998) Molecular Biotechnology: Principles and Applications of Recombinant DNA. Washington D C, ASM Press
2. Jaiswal S., Singh D. K. and Shukla P. (2019) Gene Editing and Systems Biology Tools for Pesticide Bioremediation: A Review. Front Microbiol. 10:87
3. Karpouzas D. G. and Singh B. K. (2006) Microbial degradation of organophosphorus xenobiotics: metabolic pathways and molecular basis. Adv Microb Physiol. 51:119-185.
4. .Ramos J. L., González-Pérez M. M. and Caballero A., van Dillewijn P. (2015) Bioremediation of polynitrated aromatic compounds: plants and microbes put up a fight. Curr Opin Biotechnol. 16(3): 275-281.
5. Weaver R. (2007) Molecular Biology. 4th Edition. Mc-Grew Hill Publication.

Biomass Utilization:

1. Glick B. R., Pasternak J. J., Cheryl L. and Patten C. L. (1998) Molecular Biotechnology: Principles and Applications of Recombinant DNA. Washington D C, ASM Press
2. Gupta G. V. (2016) New and Future Developments in Microbial Biotechnology and Bioengineering. *Aspergillus* System Properties and Applications. Elsevier Book Publication.
3. Lal P.B., Wells F.M., Lyu Y., Ghosh I.N., Landick R. and Kiley P.J. (2019) A markerless method for genome engineering in *Zymomonas mobilis* ZM4. Front.

MIC51202: Practicals Based on Bioremediation and Biomass Utilization(2 credit Major Elective)	
CO. No.	**Course Outcomes**
1.	Students will be able to: Perform microbial degradation of pollutant compound and detect biodegradation activity using analytical techniques
2.	Carry out experiment for plastic degradation
3.	Explain methodology and applications of DNA fingerprinting technique
4.	Design and standardize process for production of biodiesel using algal mass

5.	Employ microbial biomass for removal of organic or inorganic chemicals such as Dyes, metal ions etc., from effluent samples**.**
Sr. No.	**Contents**
1	**Bioremediation** *1.* Degradation of para nitrophenol using *Pseudomonas putida* 2. Low density plastic/bioplastic degradation using bacterial isolates 3. Demonstration of DNA finger-printing technique
2.	**Biomass utilization** 1. Biodiesel production using micro-algae 2. Isolation of bio-emulsifier producing organisms for degradation of aromatic compounds

MIC51301:Research Methodology (4 credit Theory)

Unit 1	Research	5
	1. Research: Meaning, Objectives, Types of research, Planning research project – Identifying Research problems, selection of problem – formulation of a problems. Literature review- Collection of literature- Books - Journals. Digital library and search of articles - Key words and search - Internet – Google Scholar – Pub med – Inflibnet – Medline 2. Data Collection: Meaning, Sampling methods, sampling errors, Tools of Data Collection, Hypothesis, Data Processing, Analysis and Interpretation of Data. 3. Laboratory notebook-layout, planning of work, recording results.	
Unit 2	Research design	15
	1. Research Design: Meaning and Objectives, Characteristics of good research design, components of the research design & steps in scientific research process. 2. Survey design, DOE in Agriculture (randomization, replication and local control), designs- CRD, RCBD and LSD 3. Factorial design (Full, Fractional and Plackett Burman) 4. Epidemiological Study designs: Case control, cohort, concurrent, cross-sectional, retrospective/prospective 5. Clinical/field trials-Randomization, Bias removal (Blinding single and double), controlled and uncontrolled trials	
Unit 3	Data analysis and presentation	10

	1. Computer applications: Using data sheets, and sorting data with different parameters, plotting graphs – bar charts, line graphs, pie charts, adding error bars. (*Using Statistical Packages other than Microsoft Excel)* 2. Statistical analysis of data – Students t test, ANOVA, Chi square test, F test using computer software (*Using Statistical Packages other than Microsoft Excel*)	
Unit 4	Scientific writing	20
	1. Technical writing skills: Types, Formats of scientific reports, scientific writing skills, Significance of communicating science, ethical issues, copyrights and plagiarism. 2. Dissertation structure –Components - Writing Introduction – review of literature – Materials & Methods – Presentation of results – Discussion of Results based on literature – Arriving conclusions – Briefing of Summary – Arrangement and how to quote reference in thesis - Appendix. 3. Publishing of Articles in National and International Journals - Selection of Journals – ISSN Number – Peer reviewed Journals – Science citation index – impact factor and its importance. 4. Components of a research paper, publishing scientific papers - peer review process and problems. 5. Use of search engines for scientific data mining, use of reference, use of reference management tools (e.g. Zotero). (Assignment/activity-based teaching method may be used) 6. Short communication, review articles, books. 7. Writing a project proposal	
Unit 5	Oral communication and presentation	10
	1. Concept of effective communication: Presentation skills, formal scientific presentation skills; Preparing power point presentation, Presenting the work 2. Scientific poster preparation and oral presentation; Participating in group discussions 3. Preparation of Visual Aids: Photomicrography, taking photographs of experimental results and using them in the reports 4. Scanning pictures.	

References:

1. Alley, M. 1996. The craft of scientific writing, 3rd edition. Prentice Hall, NJ. [and accompanying web site: http://filebox.vt.edu/eng/mech/writing/]
2. Anderson, Durston & Polle 1970: Thesis and assignment, writing. Wiley Eastern Limited

3. Cohen, L. Lawrence, M., & Morrison, K. (2005). Research Methods in Education (5th edition). Oxford: Oxford University Press.
4. Day, R. 1995. Scientific English: A guide for scientists and other professionals, 2nd edition. Orynx Press.
5. Day, R. 1998. How to write and publish a scientific paper, 5th edition. Orynx Press.
6. Dominowski, R.L. (1980): Research Methods, Prentice Hall Inc., New Jersey.
7. Farr A. D. (1985) Science writing for beginners. Blackwell Scientific publications, Oxford, London.
8. G. Vijayalakshmi and C. Sivapragasam. (2008) Research Methods –Tip & Techniques, MJP Publishers, Chennai. WWW.mjppublishers.com
9. Haaland P. D. (2020). Experimental Design in Biotechnology. United States: CRC Press.
10. Kothari, C.R. (1985): Research Methodology: Methods and Techniques, Wiley Eastern.
11. Leedy, P. D. (1980). Practical Research: Planning and design. Washington: Mc Millan Publishing Co., Inc.
12. Mishra, R.P. (1980): Research Methodology, Handbook Concept Publishing Company, New Delhi.
13. Montgomery D. C. (2013). Design and Analysis of Experiments. Italy: Wiley. ISBN: 9781118097939
14. Reid N., Reid N. and Cox D. (2000). The Theory of the Design of Experiments. United States: CRC Press.
15. Gurumani N. (2010). Scientific thesis writings and Paper presentations-. M.J.Publisher
16. Singh, Y. K. (2006). Fundamental of Research Methodology and Statistics. New Delhi. New International (P) Limited, Publishers.

SEMESTER II

MIC52101: Instrumentation and Molecular Biophysics (2 credit Major Theory)	
CO. No.	**Course Outcomes**
1.	Students will be able to: Explain biomolecular separation and detection by chromatography, electrophoresis and centrifugation
2.	Explain principles of operation, instrumentation of UV/Visible spectroscopy, Fluorescence spectroscopy, Infrared spectroscopy Circular Dichroism (CD) Mass spectroscopy
3.	Explain principles of operation, instrumentation of X-ray crystallography

4.	Explain principles of operation, instrumentation of NMR spectroscopy

Unit No.	Title and contents	No. of Lectures

1	**Separation and analysis of biomolecules** 1.Techniques for sample preparation: Dialysis, ultra-filtration, centrifugal vacuum concentration 2a. Chromatography- Partition Coefficient, Selectivity, Resolution, Column Efficiency, Van Deemter equation, Interpretation of chromatograms 2b.Principle, instrumentation and applications of High Performance Liquid Chromatography (HPLC), Fast Protein Liquid Chromatography (FPLC), Reversed Phase Chromatography and Gas chromatography. 3. Electrophoresis Methods: Pulse field gel electrophoresis, capillary electrophoresis, isoelectric focusing, 2-dimensional electrophoresis, immune-electrophoresis	(10)
2	**Spectroscopy** Introduction: Electromagnetic spectrum, Atomic orbitals, Molecular orbitals, Electronic, Rotational and Vibrational transitions in spectroscopy, Interpretation of spectra. 1. UV/Visible spectroscopy- Instrumentation, Molar Absorptivities, Beer and Lamberts Law, Bathochromic and hypochromic shifts. 2. Fluorescence spectroscopy- Instrumentation, Quantum Yield, Quenching, FRET, Binding and Folding studies, Flow cytometry and FACS 3. Infrared spectroscopy- Principle, Instrumentation, Absorption bands, FTIR and its applications 4.Mass spectroscopy- Principles of operation, Ionization, Ion fragmentation, Mass Analysers, GCMS, MALDI-TOF	(10)
3	**Biophysical Techniques** 1. NMR spectroscopy: Basic Principles of NMR, Chemical shift, Intensity, Line width, Relaxation parameters, Spin coupling, Nuclear Overhauser Effect Spectroscopy, Correlation Spectroscopy, Approach to structure determination by 2D-NMR 2. X-ray crystallography: Purification of proteins, Crystallization of proteins, Instrumentation, acquisition of the diffraction pattern, basic principles of x-ray diffraction, Crystal Structures (Bravais Lattices), Crystal planes and Miller Indices, Fourier Transform and Inverse Fourier, Direct Lattice and Reciprocal lattice, Ewald sphere, Electron density Maps, Phase determination	(10)

Suggested References

1. Clive Dennison (2002) *A guide to protein isolation*, Kluwer Academic Publishers
2. Pattabhi, V. and Gautham, N. (2002) *Biophysics.* Kluwer Academic Publishers, New York and Narosa Publishing House, Delhi.
3. David J Holme, Hazel Peck (1998) *Analytical Biochemistry*, 3rd Ed. Prentice Hall, Pearson Education Limited, Harlow England.
4. Rodney F. Boyer (2000*) Modern Experimental Biochemistry*3d edition., Benjamin Cummings.
5. Nölting, B. (2006) *Methods in modern biophysics.* Second Edition. Springer, Germany.
6. Wilson Keith and Walker John (2005) *Principles and Techniques of Biochemistry and Molecular Biology*, 6th Ed.Cambridge University Press, New York.
7. Rolf Ekman, Jerzy Silberring, Ann Westman-Brinkmalm, AgnieszkaKraj (2009) *Mass spectrometry: instrumentation, interpretation, and applications*, John Wiley &Sons,Inc.,Canada.
8. Irwin H. Segel (1976) *Biochemical Calculations: How to SolveMathematical Problems in General Biochemistry*, 2nd Edition.John Wiley & Sons.
9. Mount, D. W. (2001) *Bioinformatics: sequence and genomeanalysis.* Cold Spring Harbor Laboratory Press, New York.
10. David M Webster (2000) *Protein Structure Prediction-Methods and Protocols*, Methods In Molecular Biology Vol143 Humana Press.
11. Narayanan, P. (2000) Essentials of Biophysics. New Age International Publication, New Delhi.
12. Christof M. Niemeyer and Chad A. Mirkin (2006) *Nanobiotechnology*, John Wiley & Sons.
13. Daniel L. Feldheim and Colby A. Foss, Jr. *(2002) Metal nanoparticles synthesis and characterization and applications* Marcel Dekker, Inc.
14. MahendraRai and Nelson Duran (2011) *Metal nanoparticles in Microbiology*, Springer Verlag Berlin Heidelberg.
15. Sohier, J., Laurent, C., Chevigné, A., Pardon, E., Srinivasan, V., Wernery, U. Galleni, M. (2013). Allosteric Inhibition of VIM Metallo-β-Lactamases by a CamelidNanobody.Biochemical Journal, 450(3), 477-486. doi:10.1042/bj20121305.
16. Chakravarty, R., Goel, S., &Cai, W. (2014). Nanobody: The "Magic Bullet" for Molecular Imaging? Theranostics, 4(4), 386-398. doi:10.7150/thno.8006.

MIC52102: Molecular Biology (4 credit Major Theory)	
CO. No.	**Course Outcomes**
	Students will be able to:
1.	Describe the details of the process of RNA processing in eukaryotes.
2.	Explain molecular techniques like Chromatin Immuno-precipitation (ChIP), Designing probe, Epitope tagging, expressed sequence tags.
3.	Explain how to construct cDNA and genomic libraries.
4.	Explain the importance of various enzymes used in molecular techniques.
5.	Explain the use of vectors in cloning and gene expression.
6.	Describe the concept of genome projects and their applications.
7.	Describe the principle, working and applications of molecular diagnostic techniques

Unit No.	Title and contents	No. of Lectures
1	**RNA processing & Molecular Techniques** 1. RNA Processing: Eukaryotic - mRNA splicing (Spliceosome and auto splicing by Intron I and Intron II), rRNAprocessing,tRNAprocessing, RNA Editing, -Nuclear export of mRNA - Regulatory RNAs and noncoding RNAs : Si RNA, Micro RNA, RNAi - Pi RNA (PIWI interacting RNAs) **2. Molecular Techniques** Knockout mice, phage display, expressed sequence tags, Yeast two and three hybrid assay, Activity gel assay, DNA helicase assay, Chromatin Immuno-precipitation (ChIP), Designing probe, Epitope tagging	(15)

2	**Tools for Genetic engineering** 1. Restriction endonucleases and methylases; DNA ligase, klenow enzyme, T4 DNA polymerase, polynucleotide kinase, alkaline phosphatase; cohesive and blunt end ligation; linkers; adaptors; homopolymeric tailing; labeling of DNA: nick translation, random priming, radioactive and non-radioactive probes, hybridization techniques: northern, southern, south-western and far western and colony hybridization, fluorescence in situ hybridization. 2. Vectors for cloning and gene expression: Plasmids; Bacteriophages; M13 mp vectors; PUC19 and Blue script vectors, Baculovirus and Pichia vectors, plant-based vectors (Ti and Ri as vectors). Vectors for gene expression: types (pMal, GST, pET-based vectors), Protein purification (His-tag, GST-tag, MBP-tag) 3. Construction of cDNA and genomic libraries	(15)
3	**Genome Projects** 1. Concept and meaning of genome projects and their applications 2. Introduction to Genome projects of E. coli, yeast, Plasmodium, Mouse, Drosophila, and Rice and comparative genomics 3. Gene annotation 4. Human Genome project and its applications	(15)
4	**Molecular diagnostics and applications** 1. Protein arrays to detect polygenic diseases, Immunoassay for protein confirmation-specific disorders 2. Detection of diseases-associated changes in gene expression using microarray 3. Detection of RNA signatures of Antibiotic Resistance in Bacteria 4. Detection of miRNA signatures of Cancer	(15)
	Suggested References 1. Benjamin Lewin. (2008) Genes IX, Jones and Bartelett Publishers Inc. 2. S.B Primrose and R M Twyman 2006 7th edition. Blackwell publishing 3. James D. Watson, Tania Baker, Stephen P. Bell, Alexander Gann, 4. Michael Levine, Richard Loswick (2004) Molecular Biology of the Gene, 5th Edition, Pearson Education, Inc. 5. Molecular Biology of the Cell, Bruce Albert et. al., 6th Ed., Garland Sciences. 6. Molecular Biology, Loddish et. al., 7th Edn., W. H. Freeman, 2012 7. Weaver R., (2007) Molecular Biology, 4th Edition, McGrew Hill Science. 8. B. R. Glick, J.J. Pasterneck, Principles and applications of recombinant DNA, 3rd Ed., ASM press.	

MIC52103: Cell organization and Biochemistry (4 credit Major Theory)	
Sr. No.	**Course Outcomes**
1.	Students will be able to: Describe Purifications of enzyme, purification chart.
2.	Describe kinetics of and derive kinetic equations for single substrate enzyme catalyzed reaction and two substrate enzyme catalyzed, reversible inhibitions and allosteric inhibition reactions, models of allosteric enzymes and examples of allosteric enzymes with their significance in allosteric regulation
3.	Calculate kinetic constants Km, Vmax and Ki, Gibbs free energy using provided data.
4.	Explain Laws of thermodynamics, and basic concepts in thermodynamics
5.	Explain basic concepts of developmental biology such as commitment, determination, differentiation, pattern formation in body axis, Hox code, MPF.
6.	Describe morphogen gradients in developmental regulation, steps of embryogenesis in *Drosophila* and *Xenopus* model systems, morphogenesis and organogenesis in plants.
7.	Describe organization and function of eukaryotic cell organelles and protein trafficking among various cellular compartments, cell cycle and its regulation, mechanism and significance of apoptosis.

Unit No.	Title and contents	No. of Lectures
1	**Enzymology** 1.Purifications of enzyme, purification chart, 2. Kinetics of reversible inhibitions: Competitive, uncompetitive, non-competitive, mixed, substrate. Primary and secondary plots, Determination of Ki using secondary plots. Significance of inhibitors 3.King Altman approach to derive – two substrate enzyme catalysed reactions 4.Concept of allosterism, positive and negative co-operativity, models of allosteric enzymes (Monad, Wyamann and Changuax and Koshland, Nemethy and Filmer model), kinetics of allosteric enzyme, Hill plot, examples of allosteric enzymes and their significance in regulation.	(15)

2	**Bioenergetics** 1. Laws of thermodynamics, entropy, enthalpy, free energy, free energy and equilibrium constant Gibbs free energy equation with reference to biological significance. 2. Determination of free energy of hydrolytic and biological oxidation reduction reactions under standard and non-standard conditions 3. High energy compounds 4. Coupled reactions 5. Determination of feasibility of reactions 6. Problems based on 2 and 4. 7. Atkinson's energy charge.	(15)
3	**Cell biology** 1. Structural organization and function of Endoplasmic Reticulum, Golgi apparatus, Nucleus, Mitochondrion, chloroplast, Lysosomes, peroxisomes; Cytoskeleton and function of Molecular motors. 2. Protein trafficking among various cellular compartments (by secretory and cytosolic pathway: targeting to secretory vesicles, cell membrane, lysosomes, nucleus, mitochondria and peroxisomes) 3. Events in cell cycle, Regulation of cell cycle. Apoptosis	(15)
4	**Developmental Biology:** 1. Introduction to developmental biology. 2. Different model systems used to study developmental biology Conserved nature of development, Concepts of commitment, determination and differentiation 3. Morphogen gradients in developmental regulation, Hox code, MPF 4. Gastrulation and cellular movements involved in it, Organizer and its importance giving examples of invertebrates (Drosophilla) and vertebrate (Xenopus) model systems, pattern formation in body axis, antero-posterior and dorso-ventral polarity. 5. Morphogenesis and organogenesis in plants: Organization of shoot and root apical meristem; shoot and root development; transition to flowering, floral meristems and floral development in Arabidopsis.	(15)

Suggested References:

1. Nelson D. L. and Cox M. M. (2005) Lehninger's Principles ofBiochemistry, Fourth edition, W.H. Freeman & Co. New York.
2. Palmer Trevor (2001) Enzymes: Biochemistry, Biotechnologyand Clinical chemistry, Horwood Pub. Co. Chinchester, England.
3. Segel Irvin H. (1997) Biochemical Calculations 2nd Ed., JohnWiley and Sons, New York
4. Garrett, R. H. and Grisham, C. M. (2004) Biochemistry. 3rdEd. Brooks/Cole, Publishing Company, California
5. Michael T. Madigan, John M. Martinko, David A. Stahl, David P. Clark (2012) Brock Biology of Microorganisms, Thirteenthedition, Benjamin Cummings, San Francisco.
6. Moat Albert G. and Foster John W. (1988) MicrobialPhysiology 2nd Ed. John Wiley
7. Berg Jeremy, Tymoczko John, StryerLubert (2001)Biochemistry 4th Ed, W. H. Freeman, NY
8. White David (2000) Physiology and Biochemistry of Prokaryotes. 2nd Ed. Oxford University Press, New York. 2. Mandelstam Joel and McQuillen Kenneth (1976) Biochemistry ofBacterial Growth, Blackwell Scientific Publication London

Cell Biology

1. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. (2002) Molecular Biology of theCell, 4th edition,: Garland Science; New York
2. Metzler David E. (2001) Biochemistry: The chemical Reactions of Living Cells, Volume 1&2, Academic PressCalifornia.
3. H. Lodish, A. Berk, C. A. Kaiser, M. Krieger, M. P. Scott, A. Bretscher, H. Ploegh, and P. Matsudaira, (2007) Molecular Cell Biology, Sixth Edition W. H. Freeman and Company, New York,
, ISBN-13: 978-0-716-77601-7

Development and Differentiation

1. Gilbert Scott F. (2010). Developmental Biology. 9th Ed.Sinauer Associates Inc. Mass. USA.
2. Muller W.A. (1997) Developmental Biology, SpringlerVerlag,New York, Inc.
Lewis Wolpert, Cheryll Tickle, and Alfonso Martinez

MIC52104: Practical based on Molecular biology, enzymology and instrumentation Techniques (4 credit Major practical)	
CO no.	**Course Outcomes**
1.	Students will be able to: Design an experiment to study induction of beta galactosidase enzyme by lactose using colorimetric method and through diauxic growth curve
2.	Isolate, Quantify, Characterize and Cure plasmid from bacterial cells
3.	Use various online and off-line tools to annotate genes
4.	Purify enzyme and Determine kinetic parameters for the same.
5.	Determine molar extinction coefficients of various biomolecules
6.	Isolate Aflatoxin producing organism and extract & detect the same from food samples.
7.	Study mitosis and polyploidy in onion root tips.
8.	Isolate and characterize cell organells.
Sr. No.	**Contents**
1.	Concept of lac-operon: Lactose induction of Beta galactosidase; Glucose Repression; Diauxic growth curve of E. coli
2.	Plasmid DNA isolation, DNA quantitation and characterization by gel electrophoresis.
3.	Construction of restriction digestion map of plasmid DNA
4.	Curing of bacterial Plasmid
5.	Gene annotation
6.	Purification of enzymes (Amylase/Invertase): (ammonium sulphate precipitation, organic solvent precipitation, gel filtration, etc.) (Any two Methods)Establishment of enzyme purification chart
7.	Determination of Km, Vmax and Kcat values of enzyme
8.	Determination of molecular extinction coefficient of biomolecule
9.	Isolation of Aflatoxin producing organism. Extraction and Detection of Aflatoxin in

	food.
10.	Studying the stages mitosis in growing tip of onion root cells and to observe polyploidy induced by colchicine treatment on root tip.
11.	Isolation of chloroplast/mitochondria/lysosomes from tissue. Assay of specific organelle marker for chloroplast/mitochondria (eg. Succinate dehydrogenase)/lysosomes (eg. Acid phosphatase).
12.	Demonstration of mounting of embryos (frog and fruit fly) at various developmental stages on permanent slides.
13.	Virtual lab exercise to understand the instrumentation, experimentation and interpretation of data obtained using HPLC, FACS, FTIR, GC-MS, NMR, X-Ray crystallography MALDI- TOF, SEM, TEM, AFM, Confocal Microscope (representative websites)
14.	Visit to any lab or institute to understand the principle and working of the bio-analytical instrument studied in theory courses(optional)

MIC52201: Microbial communication, Membrane transport and signal transduction (2credit Elective Theory)	
CO. No.	**Course Outcomes**
1.	students will be able to: Describe Life cycle of *Dyctiostellium discoideum* and myxobacteria.
2.	Explain molecular mechanism of quorum sensing in slime moulds, myxobacteria and specific examples of gram positive and gram negative bacteria
3.	Describe biofilms formation and dispersal, significance of biofilms in pathogenic and nonpathogenic environments.
4.	Describe the composition and architecture of membranes, membrane dynamics, structure and significance of liposomes and model membranes, various modes of solute transport across membranes
5.	Explain signal transduction and mechanism of chemotaxis.

Unit No.	Title and contents	No. of Lectures
1	**Communication and Coordination among microorganisms** 1.Life cycle of *Dictyostelium discoideum,* Molecular mechanism of quorum sensing in slime moulds, 2. Life cycle of myxobacteria, Molecular mechanism of quorum sensing in myxobacteria. 3. Quorum sensing in Gram positive and Gram-negative bacteria, 4. Biofilms, their organization, signals involved in their formation and dispersal. Principle, construction and working of confocal microscope and its application in studying biofilms. 5. Applications of study on biofilms in pathogenic and non-pathogenic environments	**15**
2	**Membrane transport and signal transduction** 1.The composition and architecture of membranes, Membrane dynamics, 2. Solute transport across membranes: Passive diffusion, facilitated transport, primary and secondary active transport using P, V and F type ATPases, Ionophores, 3. Ion mediated transport, transport of ions across membranes (ion pumps), ligand and voltage gated ion channels, 4. Liposomes and model membranes, 5. Signal transduction pathways in bacteria, second messengers, regulation of signalling pathways, bacterial two-component systems, chemo taxis.	**15**

Suggested References

Communication and Coordination among microorganisms

1. Gilbert Scott F. (2010). Developmental Biology. 9th Ed. Sinauer Associates Inc. Mass. USA.
2. Martin Dworkin (1996) Recent advances in the social and developmental biology of the myxobacteria, Microbiological Reviews, , p. 70–102
3. Dale Kaiser, Mark Robinson and Lee Kroos (2010) Myxobacteria, Polarity, and Multicellular Morphogenesis, Cold Spring HarbPerspectBiol 2010;2:a000380
4. Toole 'O' George, H. B. Kaplan, R. Kolter,(2000) Biofilm formation as microbial development Annual Review of Microbiology, Vol. 54, 49-79 4.
5. Melissa B. Miller and Bonnie L. Bassler (2001) Quorum sensing in bacteria. Annu. Rev. Microbiol. Vol. 55, 165–99.
6. Christopher M. Waters and Bonnie L. Bassler (2005) Quorum sensing: cell-to-cell communication in bacteria. Annu. Rev. Cell Dev. Biol. Vol. 21, 319–46.

MIC52202: Practicals Based on Microbial communication, Membrane transport and signal transduction (2 credit Elective Practical)	
CO. No.	**Course Outcomes**
1.	students will be able to: Study and estimate development of biofilm
2.	Design an experiment to study the mechanism of quorum sensing in bacteria.
3.	Perform various methods to study chemotactic response of bacteria to various chemical stimuli
4.	Carry out cell disruption using different methods
5.	Explain and study the principle of osmosis and diffusion with the help of artificial membranes

Sr. No.	**Contents**
1.	**Communication And Coordination among microorganisms** Crystal violet assay for estimation of biofilm formation
2.	Isolation of myxobacteria and study of stages of lifecycle.
3.	Determination of chemo-taxis responses shown by bacteria using agar plate or capillary tube method. Membrane transport and signal transduction
4.	Study principles of osmosis and diffusion using artificial membranes (dialysis membrane) (explain how various physical and chemical factors affect the diffusion)
5.	Different methods of cell disruption.

Progressive Education Society's

Modern College of Arts, Science and Commerce, Ganeshkhind, Pune-411016 India

(Autonomous)

(Affiliated to Savitribai Phule Pune University)

DBT STAR Status **NAAC accredited A Grade**

M.Sc. Organic Chemistry

A Two Year Degree Program in Chemistry

As per

National Education Policy (NEP)

Syllabus

From

Academic Year 2023-24

Board of Studies Chemistry
Department of Chemistry

M.Sc. Organic Chemistry Program Outcomes (2023 Pattern)

Sr. No.	Program Objectives/ Outcomes
1	To enrich specific knowledge in areas like thermodynamics, kinetics, quantum chemistry, nuclear chemistry, spectroscopy, organometallics, bio-inorganics, reaction mechanisms, photochemistry, biochemistry, medicinal chemistry etc. which will give a bird's eye view to the scope of chemistry.
2	It would help students to learn applications of various facets of chemistry and their importance.
3	Problem solving will inculcate logical thinking to address a problem and become result oriented with a positive attitude.
4	Practical courses will refine the basic techniques and their use for analyses, syntheses, basic computer skills and research. It would develop analytical independent thinking required for academics, research and industrial work.
5	Literature reading and project work will help for strategic planning and execution, to know recent developments in chemistry, its interdisciplinary relevance and create interest for research.
6	The credit system would help them to be regular in performance, improvise their presentation skills, strive for excellence and create awareness of their social and environmental responsibilities.
7	To help students build up a progressive successful career.

M.Sc. Organic Chemistry 2023-24 NEP Pattern
M.Sc. I Organic Chemistry (Autonomous) Equivalence

P.E.S. Modern College of ASC, Ganeshkhind, Pune – 16 (2022-23)		P.E.S. Modern College of ASC, Ganeshkhind, Pune – 16 (NEP 2023-24)	
Semester I		**Semester I**	
22-CCTP-1	Physical Chemistry - I (Thermodynamics, Quantum Chemistry and Chemical Kinetics)	CHE51101	Thermodynamics, Quantum Chemistry and Chemical Kinetics
22-CCTP-2	Inorganic Chemistry – I (Molecular Symmetry and Main group Elements)	CHE51106	Molecular Symmetry and Main Group Elements
22-CCTP-3	Organic Chemistry – I (Basic Organic Chemistry)	CHE51102	Stereochemistry and Organic Synthesis
22-CBOP-1	General Chemistry – I Section - I: Theory Course (Any one option) Option A: Mathematics for Chemists Option B: Chemical Biology - 1	---	---
22-CBOP-1	Section - II: Inorganic Chemistry Practical - 1	CHE51104	Inorganic Chemistry Practical - 1
22-CCPP-1	Basic Practical Course – I Section I: Physical Chemistry Practical – 1	CHE51103	Physical Chemistry Practical - 1
22-CCPP-1	Section II: Organic Chemistry Practical - 1	CHE51105	Organic Chemistry Practical - 1

P.E.S. Modern College of ASC, Ganeshkhind, Pune – 16 (2022-23)		P.E.S. Modern College of ASC, Ganeshkhind, Pune – 16 (NEP 2023-24)	
Semester II		**Semester II**	
22-CCTP-4	Physical Chemistry - II (Molecular Spectroscopy, Nuclear and Radiation Chemistry)	CHE52106	Molecular Spectroscopy, Nuclear and Radiation Chemistry
22-CCTP-5	Inorganic Chemistry - II (Coordination and Bioinorganic Chemistry)	CHE52101	Coordination and Bioinorganic Chemistry
22-CCTP-6	Organic Chemistry - II (Photochemistry and Organic Spectroscopy)	CHE52102	Photochemistry and Organic Spectroscopy
22-CBOP-2	General Chemistry -II Section - I: Theory Course (Any one option) Option A: Advanced Analytical Techniques Option B: Chemical Biology - 2	---	---
22-CBOP-2	Section - II: Physical Chemistry Practical - 2	CHE52103	Physical Chemistry Practical - 2
22-CCPP-2	Basic Practical Course - I Section I: Inorganic Chemistry Practical -2	CHE52104	Inorganic Chemistry Practical - 2
22-CCPP-2	Section II: Organic Chemistry Practical - 2	CHE52105	Organic Chemistry Practical - 2

M.Sc.- I Organic Chemistry Course Structure (2023 NEP Pattern)
With Effect from 2023-24

Semester I		
Course Code	**Course Name**	**Credit**
CHE51101	Thermodynamics, Quantum Chemistry and Chemical Kinetics	4
CHE51102	Stereochemistry and Organic Synthesis	4
CHE51103	Molecular Symmetry and Chemistry of Main Group Elements	4
CHE51104	Physical Chemistry Practical – 1	2
CHE51105	Inorganic Chemistry Practical – 1	2
CHE51106	Organic Chemistry Practical – 1	2
CHE51207	Research Methodology (Theory)	2
CHE51208	Research Methodology (Practical)	2
Semester II		
Course Code	**Course Name**	**Credit**
CHE52101	Coordination and Bioinorganic Chemistry	4
CHE52102	Photochemistry and Organic Spectroscopy	4
CHE52106	Molecular Spectroscopy, Nuclear and Radiation Chemistry	4
CHE52103	Physical Chemistry Practical – 2	2
CHE52104	Inorganic Chemistry Practical – 2	2
CHE52105	Organic Chemistry Practical – 2	2
CHE52607	On Job Training	4
Total Subject Course credits for the M.Sc. – I		**44**

*** Any two topics given by the subject teacher from each credit course will be learned by the students through online mode (NPTEL/SWAYAM MOOCS). A test will be conducted on these topics as a part of Continuous Internal Assessment (CIA).**

Semester-I

CHE51101: Thermodynamics, Quantum Chemistry and Chemical Kinetics
(4 Credits, 60 L)

Course Outcomes

CO1: To study the concepts in thermodynamic to understand the thermodynamics of the mixtures.
CO2: To understand the concept of partition function and its applications in finding the thermodynamic parameters with reference to translational, rotational, vibrational and electronic energies
CO3: To understand the need of quantum chemistry and its application in understanding the particle in a box concept.
CO4: To understand the kinetics of elementary and complex reactions
CO5: To know the different techniques to study the fast reactions.
CO6: To understand the kinetics of catalytic reactions based on enzyme catalysis, autocatalysis.
CO7: To understand the surface chemistry concepts.

SECTION - I Thermodynamics and Quantum Chemistry
(2 Credits, 30 L)

1. Thermodynamics (10 L)

State function, path function, exact differential and inexact differential, internal energy and enthalpy, temperature dependent internal energy and enthalpy, Entropy and entropy change in an ideal gas with temperature and pressure, Clausius inequality, chemical potential, chemical potential of a substance in a mixture. Thermodynamics of Gibbs function of mixing,
colligative properties: Elevation in boiling point, depression in freezing point and osmosis.

2. Molecular Thermodynamics (10 L)

Molecular energy levels, Boltzmann distribution law, partition functions and ensembles, translational, rotational and vibrational partition function of diatomic molecule, obtaining energy, heat capacity, entropy and equilibrium constants from partition functions, Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

3. Quantum Chemistry (10 L)

Applications of quantum chemistry over failure of classical mechanics - blackbody radiation,

photoelectric effect, de Broglie hypothesis, uncertainty principle and its experimental evidence. Schrödinger wave equation, particle in one dimensional box, well behaved function, Normalization and orthogonality of wave function, particle in three-dimensional box, Shrodinger equation for one electron systems i.e. hydrogen like atoms (no derivation). Operators: algebra of operators, commutative property, linear operators, commutator operator, the operator ∇ and ∇2. Huckel theory applications to simple π-systems.

Learning Outcomes:

1) The student will understand the thermodynamics of mixtures and partial molar quantities based on the concepts in thermodynamics.
2) The student will understand the concept of partition function and its applications in finding the thermodynamic parameters with reference to translational, rotational, vibrational and electronic energies.
3) The student will understand failure of classical mechanics and the need of quantum chemistry.
4) The student will derive Schrödinger equation with reference to the concepts in quantum chemistry.
5) The student will draw the schematic diagram of Molecular orbital diagram of theory for di and tri atomic molecule based on Molecular Orbital Theory.
6) The student will apply Hückel theory to simple π –systems.
7) The student will be able to solve the related numerical problems.

SECTION - II Chemical Kinetics and Reaction Dynamics

(2 Credits, 30 L)

1. Kinetics of Complex Reactions (10 L)

Types of complex reactions:- parallel, opposing and chain. Steady state approximation in chain reactions - free radical polymerization reaction between H_2 and Br_2, degradation of ozone, decomposition of acetyldehyde, explosive reaction –formation of water. autocatalysis

2. Molecular Reaction Dynamics (10 L)

Collision theory of bimolecular gas phase reactions, diffusion controlled and activation controlled reaction in solution, activated complex theory of reaction rate, Eyrings equation

Techniques used to study the fast reactions: flow technique, stopped flow technique, relaxation method, flash photolysis, pulse radiolysis,

3. Enzyme Catalysis (10 L)

Modes of Enzyme-Substrate interaction, effect of pH and temperature on enzyme catalyzed reactions, Michaels mechanism for enzyme catalysis and enzyme inhibition, modes of enzyme inhibition- competitive inhibition and non- competitive inhibition. Lineweaver-Burk and Eadie plots for enzyme catalysis and enzyme inhibition

Learning Outcomes:

1) The students will be able to understand the difference between the elementary and complex reactions with reference to the concepts in chemical kinetics.
2) The student will derive the rate law for the different chain reactions.
3) The student will understand Collision and Activated complex theory.
4) The student will understand the kinetics of Enzyme catalysis
5) The student will understand the stopped flow technique and flash photolysis and Pulse radiolysis techniques to study the fast reactions.
6) The student will understand the kinetics of catalytic reactions based on enzyme catalysis, autocatalysis
7) The student will solve the numerical problems.

References:

1. Atkin's Physical Chemistry by P.W.Atkin and J. De Paula ; W. H. Freeman And Company Eighth edition (2006). ISBN: 0-7167-8759-8
2. Physical Chemistry by T.Engel and P. Reid
3. Physical Chemistry and molecular approach by D. Mequarie and J. Siman
4. Physical Chemistry for biological sciences by Raymond Chang (Universal books, 2000)
5. Physical Chemistry by Merron and C.F. Prouton
6. Physical Chemistry by G.M. Barrow
7. Quantum Chemistry by I. Levine
8. Quantum Chemistry by R.K. Prasad
9. Physical Chemistry through Problems by S.K. Dogra

CHE51102 Stereochemistry and Organic Synthesis

Course Outcomes (4 Credits, 60 L)

CO1: Understand fundamental aspects of organic chemistry, learn the concept of aromaticity and its types.

CO2: To understand the concept of nuclephilic and electrophilic substitution and elimination reactions.

CO3: understand concepts of stereochemistry and to be able to apply stereochemical aspects in organic chemistry

CO4: To study structure, formation, stability and related name reaction of carbon intermediates
; recognise neighbouringgroup participation

CO5: To study rearrangement reaction with specific mechanism and migratory aptitude of different groups

CO6: To study Ylides and their reactions.

CO7: To understand the basis of redox reactions; reagents and mechanism for selective oxidation/reduction reactions of organic compounds.

SECTION - I (2 Credits, 30L)

1. Chemical Structure and reactivity (8L)

Acidity and basicity

Acids and Bases examples, Factors affecting acidity and basicity: Electronegativity and inductive effect, resonance, bond strength, electrostatic effects, hybridization, aromaticity and solvation. Comparative study of acidity and basicity of organic compounds on the basis of pKa values

Benzenoid and non-benzenoid compounds, Huckel's rule, antiaromaticity, annulenes, azulenes, ring current concepts of aromaticity

2. Stereochemistry (12L)

Stereochemical principles, enantiomeric relationship, diastereomeric relationship, R and S, E and Z, D and L nomenclature in C, N, S, P containing compounds, conversion of projections (newmann to sawhorse and fischer)

Prochiral relationship, stereospecific and stereoselective reactions, optical activity in biphenyls, spiranes and allenes

3. A comparative study of Substitution and Elimination Reactions (10L)

Aromatic electrophilic substitution, Aliphatic nucleophilic substitutions:SN1, SN2, SN2' and SNi reactions; Effect of solvent and Leaving Group.

Eliminations: Mechanism and orientation, Reactivity, Pyrolytic Eliminations; E1, E2, E1CB reactions (in detail) Elimination vs Substitution with NGP

Learning Outcomes

1. Students will be able to understand the **c**riteria for aromaticity in non benzenoid molecules andother advanced polycyclic aromatics
2. Students will learn the concept stereochemistry and its importance; their rules and the concept of chirality.
3. Students will be able to concept of substitution and elimination reactions and will be able to write mechanism.

SECTION - II (2 Credits, 30L)

1. Structure, Stability and Reactions of Reactive Intermediates (8 L)

Carbocation, Carbanion, Free Radical, Carbenes and nitrenes
NGP: Neighbouring group participation

2. Rearrangements: (8 L)

Beckmann, Hofmann, Curtius, Schmidt, Wolff, Lossen, Bayer-villiger, Sommelet, Favorskii, Pinacol-pinacolone, Benzil-benzilic acid, Fries, Tiffeneau Demjanov.

3. Ylides: (4 L)

Phosphorus, Nitrogen and Sulphur ylides

4. Oxidation and Reduction Reactions: (10 L)

Oxidising agents: CrO3, PDC, PCC, KMnO4, MnO2, Swern, SeO2, Pb(OAc)4, Pd-C, RuO4, OsO4, m-CPBA, O3,NaIO4, HIO4, TEMPO, IBX, CAN, Dess-Martin, DDQ, Ag2O

Reducing agents: Boranes and hydroboration reactions,MPV reduction and reduction with H2/Pd-C, Raney-Ni, NaBH3CN, Wilkinson's catalyst, DIBAL and Wolff-Kishner reduction, Birch, Clemenson, Dissolving metal

References:

1. Organic Chemistry–by J. Clayden, N. Greeves, S. Warren and P. Wothers (Oxford)
2. Advanced Organic Chemistry –by J. March 6th Edition
3. Advanced Organic Chemistry (Part A) –by A. Carey and R.J. Sundberg
4. A guidebook to mechanism in organic chemistry – Peter Sykes 6th Ed.
5. Stereochemistry of carbon compound-by E.L. Eliel
6. Stereochemistry of organic compound-by Nasipuri
7. Stereochemistry conformations and mechanism by P.S. Kalsi
8. Modern Synthetic reactions- H.O. House
9. Organic Synthesis – M.B. Smith
10. Organic chemistry –by Cram, Hammond, Pine and Handrickson
11. Mechanism and structure in Organic Chemistry – E. S. Gould

Learning Outcomes

1. Students will be able to understand the role of various reaction intermediates like carbocation, carbanion, carbenes, radicals, and nitrenes in organic reactions; concept of NGP
2. Able to describe mechanism of different rearrangement reactions. Appreciates the various steps involved in the molecular rearrangements.
3. Students will be able to understand the chemistry of Ylides
4. Use synthetic reagent of oxidation and reduction for solving the problems

CHE51106 Molecular Symmetry and Chemistry of Main Group Elements

(4 credits, 60 L)

Course Outcomes

CO1: To visualize molecule in 3-D, understand the concept of molecular point groups with their symmetry elements, symmetry operations, GMTs, character tables and group representations.

CO2: To understand how to derive the SALCs for molecules using the Projection Operators and also how to construct molecular orbitals using various symmetry operations and their representations.

CO3: To correlate application of symmetry to spectroscopy and find possible IR active modes of vibration.

CO4: To understand the detail chemistry of s- and p- block elements w.r.t. their compounds, reactions, applications and organometalllic chemistry of some important elements.

CO5: To learn the advance chemistry of boranes, fullerenes, silicates including zeolites, carbon nanotubes, Polymers, etc.

SECTION-I Molecular Symmetry (2 Credits, 30 L)

- **Molecular Symmetry (12 L)**

Introduction, Symmetry elements and Symmetry operations: Identity, Rotational axis of Symmetry, Plane of Symmetry, Improper rotational axis and Inversion center. General relations among symmetry elements and symmetry operations, symmetry elements and optical isomerism. Mathematical requirement of a point group, Molecular point groups, identification of molecular point groups and systematic assignment of point groups to molecules, Products of symmetry operations, group multiplication tables, equivalent symmetry elements and equivalent atoms, isomorphic groups, subgroups, classes.

- **Representations of Groups (8 L)**

Matrix representation of symmetry elements and point groups, transformation matrices. The Great Orthogonality Theorem and its consequence, character tables (No mathematical part), wave function as basis for irreducible representations.

- **Symmetry Adapted Linear Combination (5 L)**

Projection operators and their use to construct normalised SALCs. Transformation properties of atomic orbital, MOs for sigma bonding ABn molecules.

- **Application of Group theory to Infrared Spectroscopy (5 L)**

Introduction, selection rules, polyatomic molecules, possible vibrations in linear molecules, modes, symmetry of vibrations and their IR activity. Group vibration concept and its limitations. IR spectra related to symmetry of some compounds. IR spectra of complex compounds.

References:

1) Chemical Applications of Group Theory by F. A. Cotton
2) Symmetry and spectroscopy of molecules by K. Veera Reddy
3) Group Theory and its Chemical Application, P.K. Bhattarcharya
4) Inorganic Chemistry by Shriver and Atkins
5) Concise Inorganic Chemistry by J. D. Lee
6) Inorganic chemistry: principle of structures and reactivity by Huheey, Keiter, Medhi

Learning Outcomes

1. Visualize/ imagine molecules in 3 dimensions, perform various symmetry operations on the molecule, know the symmetry elements and hence point group of the molecule.
2. Apply the concept of point group for determining optical activity of the molecule.
3. Understand product of symmetry operations, classes, representation of groups and construction of character tables using the Great Orthogonality Theorem.
4. Apply projection operator to find out the normalized SALCs of the molecule.
5. Correlate the application of symmetry to spectroscopy and find out the possible modes and IR active modes of vibration.

SECTION-II Main Group Elements (2 Credits, 30 L)

- **Hydrogen and its compounds (4 L)**

Hydrides: Classification of Hydrides, electron deficient, electron precise and electron rich hydrides, preparation, properties, reactions and applications, hydride stability.

- **Alkali and Alkaline Earth Metals (3 L)**

Solutions in non - aqueous media: in ammonia, ether and other macrocyclic compounds, application of crown ether in extraction of alkali and alkaline earth metals, Important organometallic compounds of alkali and alkaline earth metals:

preparation, properties, reactions and applications

- **Boron Group** **(6 L)**
  Boron Hydrides: preparation, structure and Bonding with reference to LUMO, HOMO, interconversion of lower and higher boranes, metalloboranes, carboranes, reactions of organoboranes, STYX rules and structure of higher boranes. Organometallic compounds of B, Al & Ga.

- **Carbon Group** **(6 L)**
  Allotropes of carbon: Diamond, Graphite, Graphene, fullerenes and carbon nanotubes: synthesis, properties, Structure - single walled and multi walled nanotubes and its applications. Intercalation compounds of graphite, fullerene metal complexes. Silicates: structures, properties, uses, Molecular sieves and zeolites. Organometallic compounds of Si, Sn and Pb

- **Nitrogen Group** **(4 L)**
  Nitrogen activation, Oxidation states, oxyacids and oxoanions of nitrogen and their interconversion**,** Compounds of nitrogen with Boron, Phosphorus and sulphur, with respect to structure, properties and applications, Organometallic compounds of As, Sb and Bi.

- **Oxygen Group** **(3 L)**
  Metal Selenides and Tellurides, Oxyacids and oxoanions of Sulphur. Ring,Cage and Cluster compounds of p-block elements.

- **Halogen Group** **(2 L)**
  Pseudohalogen and interhalogen compounds: Synthesis, structures, Properties and Applications

- **Noble gases** **(2 L)**
  Occurrence, Compounds of Xenon with fluorine and Oxygen

References:

1) Inorganic Chemistry by Shriver and Atkins
2) Concise Inorganic Chemistry by J. D. Lee
3) Inorganic chemistry byPrinciple of Structures and Reactivity by Huheey, Keiter, Medhi
4) Inorganic Chemistry by Catherine Housecraft
5) Inorganic Chemistry by MeisslerandTarr
6) Organometallics by Christoph Elschenbroich
7) Organometallics by A Concise Introduction by Christoph Elschenbroich and AlbrechtSalzer
8) Basic Organometallic Chemistry by B. D. Gupta and A. J. Elias

Learning outcomes:

1. Know the types, preparation, structures, properties, and applications of binary compounds of hydrogen.

2. Understand the chemistry of s-block elements with respect to their compounds in non-aqueous solvents, extraction and organometallic compounds.
3. Learn the advance chemistry of boranes, fullerene, silicates including molecular sieves and zeolites, polymers etc.
4. Know important organometallic compounds of some elements and study their preparation, structure, properties and applications.

CHE51103 Physical Chemistry Practical - 1 (11 Experiments)

(2 Credits, 60 hrs.)

Course Outcomes

CO1: The students should be able to apply and correlate the concepts in theory while performing the experiments.
CO2: The students should develop the skill for the laboratory safety and handling of chemicals.
CO3: The students should be able to work independently in the laboratory.

List of the experiments

1. Statistical treatment of experimental data (calculation of mean and standard deviation for given data and least square method for calibration curve method) (compulsory)

Part-I: Chemical Kinetics: (Any three)

2. Kinetic decomposition of diacetone alcohol by dilatometry.
3. Determination of an order of a reaction.
4. Brönsted primary salt effect.
5. Kinetics of oxidation of ethanol by $K_2Cr_2O_7$

Part-III: Colorimetry and spectrophotometry (Any five)

6. Simultaneous determination of Ni and Co by spectrophotometry
7. Simulations determination of $KMnO_4$ and $K_2Cr_2O_7$ by spectrophotometry.
8. To study the adsorption of certain dyes such as methyl violet, picric acid or malachite green on charcoal. (Ref-2)
9. To determine the indicator constant of bromocresolpuple by half height method
10. Estimation of Cu (II) by titration with Na_2 EDTA by colorimetry
11. Determination of energy of n to Π^* transition in acetone and study of effect of solvent on energy of this transition by recording absorbance spectra in n-hexane and water. b. To study the effect of the extended conjugation on the λ_{max} of p-nitro phenol by recording spectrum in acidic and alkaline medium.

Part-III Non instrumentation experiments: (Any two)

12. Determination of molecular weight by steam distillation.
13. Glycerol radius by viscosity.
14. Partial Molar Volume (Polynometry) Determination of the densities of a series of solutions and tocalculate the molar volumes of the components.

References:

1. Practical physical chemistry, A. Findlay, T.A. Kitchner (Longmans, Green and Co.)
2. Experiments in Physical Chemistry, J.M. Wilson, K.J. Newcombe, A.r. Denko. R.M.W. Richett(Pergamon Press)

CHE51104 Inorganic Chemistry Practical-1 (2 Credits, 60 hrs.)

Course Outcomes

CO1: Prepare the exact solutions for quantitative analysis.

CO2: Apply the knowledge of quantitative analysis for the determination of metals from ores/alloys.

CO3: Know different methods for the synthesis and characterization of nanoparticles

CO4: Learn various applications of nanoparticles

CO5: Understand principle and working ofIon-exchange chromatography for separation of metal ions using ion-exchange resin.

Part-I: Ore Analysis (at least two of the following)

1. Determination of Silica and Manganese from pyrolusite ore.
2. Determination of Aluminum and Silica from Bauxite ore.
3. Determination of silica and iron from hematite ore.
4. Determination of copper and iron from Chalcopyrite ore.

Part-II: Alloy Analysis (at least two of the following)

1. Determination of tin and lead from solder alloy.
2. Determination of iron and chromium from stainless steel alloy.
3. Determination of copper and nickel from cupranickel alloy.

Part-III: Synthesis of solid state materials / nano-materials (any three)

1. Synthesis of ZnO from zinc oxalate - precursor method and determine band gap by absorption spectroscopy.
2. Synthesis of TiO_2 using $TiCl_4$ or Ti-isopropoxide by Sol-gel method and determine band gap by absorption spectroscopy
3. Synthesis of Colloidal silver nanoparticles and determine band gap byabsorption spectroscopy
4. Synthesis of Fe_2O_3 nanoparticles sol-gel/coprecipitation/hydrothermal (any one method).
5. Spectral analysis (powder XRD/SEM/TEM) of one compound.

Part-IV: Applications of Solid State Materials

1. Removal and kinetics of photocatalytic dyes, degradation (methylene by ZnO or TiO_2 photocatalysis .
2. Study of adsorption of phosphate ion on α-Fe_2O_3

Part-V: Ion – Exchange Chromatography

Separation of mixture of Zn(II) and Mg(II) using Amberlite IRA 400 anion

exchanger and quantitative estimation of separated ions Zn(II) and Mg(II)

References:

1. Text book of Quantitative Analysis by A.I. Vogel 3^{ed}ed^{n} (1963).
2. Experimental Inorganic Chemistry by Mounir A. Malati, Horwood
3. Nanotechnology by S. K. Kulkarni

CHE51105 Organic Chemistry Practical -1 (11 Experiments)

(2 Credits, 60 hrs.)

Course Outcomes

1. Students are trained to different purification techniques in organic chemistry like recrystallization, distillation, steam distillation and extraction.
2. Students are made aware of safety techniques and handling of chemicals.
3. Students are made aware of carrying out different types of reactions and their workup methods.
4. This practical course is designed to make student aware of green chemistry and role of green chemistry in pollution reduction.
5. Students are made aware of carrying out different types of reactions and their workup methods.
6. This practical course is designed to make student aware of green chemistry and role of green chemistry in pollution reduction.

Time allotted: Two practical sessions of 4 hours per week for one semester (one practical sessionfor Section-I and one practical session for Section-II per week is compulsory)

Introduction to Laboratory Safety: Meaning of safety signs on container of chemicals, safety handling of chemicals, MSDS sheets: Detailed explanation at least for 4 different types of substances (e.g. nitric acid, benzene, potassium dichromate, bromine, etc.), Handling of glassware's and care to be taken, handling of organic flammable as well as toxic solvents in laboratory, use of safety goggles, shoes and gloves, fire extinguisher and its use, action to be taken in accidental cases e.g. cleaning of acid spill over, use eye wash station and bath station in emergency, etc. (compulsory)

- **Purification Techniques**
  a. Crystallization
  b. Distillation (upward and downward)
  c. Column Chromatography p-nitroaniline + o-nitroaniline

- **Single stage preparations (any 4)**
  a. Benzil benzilic acid rearrangement
  b. Synthesis of 1,4-dihydropyrimidin-[4*H*]-ones
  c. Preparation of Schiff's bases in aqueous medium.
  d. Nitration of bromobenzene or Anisole (low temp)
  e. Reduction of cyclohexanone using $NaBH_4$

Semester II

CHE52101 Coordination and Bioinorganic Chemistry (4 Credits, 60 L)

Course Outcomes

After successfully completing this course, students will be able to

CO1: find out the number of microstates, construct a microstate table and know meaningful term symbols for various configurations.

CO2: find out splitting of the free ion terms in weak and strong ligand fields and draw Orgel, correlation and Tanabe-Sugano diagrams for various configurations in Td an Oh ligand field.

CO3: Study electronic spectra, its interpretation and solve numerical based on crystal field parameters.

CO4: Understand various terms involved in magneto chemistry, know various phenomena of magnetism and their temperature dependence.

CO5: Understand Importance of bioinorganic chemistry and Role of metals in living systems.

CO6: Know the similarities in coordination theory for metal complexes and metal ions complexed with biological ligands.

CO7: Importance and transport of metal ions by ionophores and Mechanism for active transport of Na^+ and K^+ ions.

SECTION I Coordination Chemistry (2 Credits, 30 L)

1) Concept and Scope of Ligand Fields (8 L)

Quantum numbers, Free ion Configuration, Terms and States, Energy levels of transition metal ions, free ion terms, microstates, microstate table, term wave functions, spin-orbit coupling.

2) Ligand Field Theory of Coordination Complexes (8 L)

Effect of ligand field on energy levels of transition metal ions, weak cubic ligand field effect on Russell- Saunders terms, Orgel diagrams, strong field effect, correlation diagrams,Tanabe-Sugano Diagrams, Spin-Pairing energies.

3) Electronic spectra of Transition Metal Complexes (8 L)

Introduction, band intensities, band energies, band width and shapes, electronic spectra of 1^{st}, 2^{nd} and 3^{rd} row transition metal ions and complexes, electronic spectra of Lanthanides and actinides, calculations of Dq, B, β parameters, percentage of covalent character for metal complexes, spectrochemical and Nephelauxetic series, charge transfer and luminescence spectra.

4) Magnetic Properties of Coordination Complexes (6 L)

Origin of magnetism, types of magnetism, Curie law, Curie-Weiss Law Magnetic properties of complexes - Para magnetism, 1^{st} and 2^{nd} Ordered Zeeman effect, Quenching of orbitalangular momentum by Ligand fields, Magnetic propertiesof A, E and T ground terms in complexes, temperature dependence of magnetism.

References:

1. Ligand field theory and its applications by B.N. Figgis and M.A. Hitachman
2. Symmetry and spectroscopy of moleculesby K. Veera Reddy
3. Elements of Magnetochemistry by R. L. Datta and A. Syamal

Learning Outcomes

After successfully completing this Section, students will be able to

1. Understand ligand field theory, terms, states, microstates and microstate table.
2. Use Hund's rules for arranging the terms according to energy.
3. Know the inter electronic repulsion and spin orbit coupling in metal ions.
4. To draw correlations diagram for various configurations in Td an Oh ligand field.
5. know basic instrumentation and interpretation of electronic spectra, selection rules and relaxation in rules.
6. Understand the concept of spectro chemical series and Nephelauxetic series.
7. Understand types of magnetism, magnetic properties of complexes and quenching of orbital magnetic moment.

SECTION-II Bioinorganic Chemistry (2 Credits, 30 L)

1) Overview of Bioinorganic Chemistry (4 L)

Historical Background and current relevance, role of metals in Biology, metalloproteins, metalloenzymes, nucleic acids and in medicine.

2) Concepts of Inorganic Chemistry in Bioinorganic Chemistry (10 L)

Thermodynamic aspects - HSAB concept, chelate effect and Irving-William

series, pK_a values of coordinated ligands, Tuning of redox potential, Biopolymer effects. Kinetic aspects: Electron transfer reaction, Electronic substitution reaction, reactions of coordinated ligands and Template effect, concept of spontaneous self-assembly and model compounds.

Proteins, Nucleic acids and other metal binding biomolecules.

3) Functions and Transport of Alkali and Alkaline Earth Metal Ions (6 L)
Importance of alkali and alkaline earth metals, Distribution of cationic and anionic electrolytes in blood plasma and intracellular fluid, Ionophores: Natural and Synthetic, Application of ionophores, Different mechanism involved in exchange of ions across cell wall, Na^+/K^+-ATPase ion pump for active transport of Na^+ and K^+.

4) Biochemistry of following Elements (10 L)

- Ca in Blood coagulation.
- Magnesium in Photosystem I
- Manganese in Photosystem II
- Iron in Ferritin, Transferrin, Fe-S clusters

References:

1. Principle of Bioinorganic Chemistry by S.J. Lippard and J. M. Berg
2. Bioinorganic Chemistry: Inorganic Elements in Chemistry of Life by W.Kaim and B.Schwederski

Learning outcomes:

1. After successfully completing this course, students will be able to:
2. Understand Importance of bioinorganic chemistry and Role of metals in Biology and in medicine.
3. Apply the concepts in Inorganic coordination Chemistry to metal ions complexed with biological ligands.
4. Importance and transport of metal ions by ionophores
5. Mechanism for active transport of Na^+ and K^+
6. Importance and function of Ca, Fe, Mn and Mg in metalloprotein

CHE52102 Photochemistry and Organic Spectroscopy

(4 Credits, 60 L)

SECTION I Photochemistry (2 Credits, 30 L)

1. Photochemistry (14 L)
Photochemistry: Singlet, Triplet, Excited states, Fate of excited species, Jablonskii diagram, Phosphorescence, Fluorescence etc, Barton reaction. Photochemistry of Carbonyl compounds:

Paternobuchi, Norrish I and II, Dienone phenol rearrangement Photochemistry of alkenes and dienes: [2+2] cycloaddition.
Photochemistry of aromatic compounds: Formation of Dewar Benzene, Electrocyclization involving heteroatoms, Di-Pi methane rearrangement,Photodimerization.

2. Addition to C-C and C-X multiple bonds (10 L)

3. Carbon-Carbon double bond formation (6 L)

Peterson olefination, Julia-Lythgoe olefination, carbonyl coupling reaction (McMurryreaction), Tebbe reagent, Shapiro and related reactions, β-elimination and dehydration

References:

1. Advanced Organic Chemistry, Part A by F. A. Carey and R. J. Sundberg

2. Excited states in Organic Chemistry by J.A. Barltrop and J.D.Coyle

3. Organic photochemistry: A visual approach by Jan Kopecky

4. Conservation of orbital symmetry by R. B. Woodward and R. Hoffmann

5. Advanced Organic Chemistry, Part B by F. A. Carey and R. J. Sundberg

6. A guidebook to mechanism in organic chemistry – Peter Sykes 6th Ed.

Learning Outcomes

1. Students will be able to understand free radicals formation, stability and reactivity and should also be able to use the basic understanding in writing probable reaction mechanisms.

2. They will be able to understand carbon-carbon bond formation and will be able to write the mechanism for addition reactions.

3. Students will be able to learn different types of name reactions.

SECTION II Organic Spectroscopy (2 Credits, 30 L)

1. UV Spectroscopy (6 L)

UV: Recapitulation of UV spectroscopy, calculations of max of aromatic compounds IR spectra of important functional groups 1. With and without conjugation, 2. Ring size effect 3. Effect of H-bonding, 4. Resonance effect, 5. Inductive effect.

2. ^{1}H-NMR (14 L)

Understanding of basic principle, chemical and magnetic nonequivalence, Homotopic, Enantiotopic, diastereotopic protons, chemical shifts and factors influencing chemical shift: electronegativity, NMR solvent polarity, temperature, anisotropic effect, chemical shifts of acidic protons, D_2O exchange, Multiplicity patterns and Coupling Constants: Pascal's triangle, understanding of tree diagram, complex splitting patterns in aromatic, vinylic, saturated monocyclic compounds, bicyclic compounds (fused and bridged rings).

3. ^{13}C-NMR (6 L)

Basic of ^{13}C-NMR: Chemical shift and factors affecting chemical shifts in ^{13}C NMR, off resoanance and proton decoupled spectra. Simple problems on ^{13}C-NMR.

3. Combined problems on UV, IR and NMR (4 L)

References:

1. Introduction to Spectroscopy by Donald L. Pavia and Gary M. Lampman

2. UV-VIS Spectroscopy and Its Applications by Perkampus, Heinz-Helmut

3. Infrared Spectroscopy: Fundamentals and Applications by Barbara H. Stuart

4. Infrared Spectroscopy by James M. Thompson

5. Spectrometric Identification of Organic Compounds by Robert M. Silverstein, Francis X. Webster, David J. Kiemle, David L. Bryce

6. Introduction to Spectroscopy by Donald L. Pavia

7. Understanding NMR Spectroscopy by James Keeler

8. Applications of NMR Spectroscopy by Atta-ur-Rahman, M. Iqbal Choudhar

9. Solving Problems with NMR Spectroscopy by Atta-ur-Rahman Muhammad Choudhary Atia-tul- Wahab

Learning Outcomes

1. Students will be able to calculate λmax of organic compounds containing more than one and less than four conjugated systems. Students should able to correlate IR bands with functional groups using numerical data as well as spectral data.

2. Students will able to solve 1H-NMR problems and should also able to draw the 1H-NMR spectrum for simple organic compounds mentioning multiplicity pattern and coupling constant with the help of "Tree Diagram" Should able to predict and analyze the multiplicity patterns with more than one coupling constants.

3. Students will be able to use 13C-NMR data to interpret the structure NMR problems and

should also able to draw the 1H-NMR spectrum for simple organic compounds mentioning multiplicity pattern and coupling constant with the help of "Tree Diagram" Should be able to predict and analyze the multiplicity patterns with more than one coupling constants.

4. Students should able to know various key factors responsible for the spectroscopic data acquisition and should able to solve Problems based on UV, IR, MS, 1H-NMR,13C-NMR.

CHE52106 Molecular Spectroscopy, Nuclear and Radiation Chemistry

(4 Credits, 60 L)

CO1: Students will be able to understand the principle of Microwave, IR, Raman, NMR and ESR spectroscopy

CO2: Students will be able to analyze Microwave, IR, Raman and ESR spectra.

CO3: The student should be able to understand the concepts in Nuclear and Radiation Chemistry

CO4: The student should be able to understand the applications of radioactivity

SECTION – I Molecular Spectroscopy (2 Credits, 30 L)

1) Microwave Spectroscopy (5 L)

Types of molecule on the basis of moment of inertia. Microwave spectra of di- and poly-atomic molecules.

2) Infra-red Spectroscopy (5 L)

The vibrating diatomic molecule, harmonic and Anharmonic oscillator, The diatomic vibrating rotator, breakdown of the Born-Oppenheimer approximation, The vibrations of polyatomic molecule, Fourier transform spectroscopy and its advantages, The carbon dioxide laser, Applications.

3) Raman Spectroscopy (5 L)

Quantum and classical theory of Raman effect, pure rotational Raman spectra, vibrational Raman spectra, rule of mutual exclusion- structure determination from Raman and Infra-red spectroscopy, applications.

4) Electronic Spectroscopy of molecules (5 L)

Electronic spectra of diatomic molecules - The Born- Oppenheimer approximation, Frank- Condon principle, dissociation energy

5) Mossbauer Spectroscopy (5 L)

Principle, Instrumentation and Applications of Mossbauer Spectroscopy.

6) Electron Spin Resonance Spectroscopy (3 L)

Principle and spectral analysis

7) Nuclear Spin Resonance Spectroscopy (2 L)

Principle and spectral analysis

Learning Outcome:

1) Students will be able to understand the principle of Microwave, IR, Raman, NMR and ESR spectroscopy
2) Students will be able to analyze Microwave, IR, Raman, NMR and ESRspectra.

SECTION – II Nuclear and Radiation Chemistry (2 Credits, 30 L)

1) Radioactivity **(5 L)**

Types of radioactive decay, general characteristics of radioactive decay, decay kinetics, general expression for the activity of a daughter nuclide, Geiger- Nuttal's law, α-decay: A problem in classical physics, Internal conversion and the Auger effect.

2) Elements of Radiation **(10 L)**

Chemistry: Interaction of radiation with matter, interaction of γ radiation with matter, units for measuring radiation absorption, Radiation dosimetry, Radiolysis of water, free radicals in water radiolysis, Radiolysis of some aqueous solutions.

3) Nuclear Fission: **(5 L)**

The discovery of nuclear fission, the process of nuclear fission, fission fragments and their mass distribution, charge distribution, Ionic charge of fission fragments, fission energy fission cross-section and threshold, fission neutrons, theory of nuclear fission, Neutron evaporation and spallation.

4) **Applications of Radioactivity** **(10 L)**

The Szillard- Chalmers reaction,

Radiochemical principles in the use of tracers, Isotopes in elucidating reaction mechanism and structure determination,

physic-chemical research - The solubility of a sparingly soluble substances, surface area of a powder or precipitate rates of diffusion,

Analytical applications- Isotope dilution analysis, Neutron activation analysis, Radiometric titrations, Medical applications-Thyroiditis, Assessing the volume of blood in a patient,

Industrial applications thickness measurements and control, friction and wear out, gamma radiography.

References:

1) Elements of Nuclear Chemistry by H.J.Arnikar
2) Source book of Atomic energy by S. Glasstone and D. Van
3) Chemical applications of radioisotopes by H.J.M. Brown
4)Fundamentals of molecular spectroscopy by C.N.Banwell and E.M.McCash

Learning Outcomes

1) The student should be able to understand the concepts in Nuclear and Radiation Chemistry
2) The student will be able to larn the various applications if radioactivity.
3) The student should be able to know the hazards of radioactivity and management of nuclear waste.

CHE52103 Physical Chemistry Practical -2 (2 Credits, 60 hrs.)

Course Outcomes

CO1: The student should get the hands on experience of conductivity meter, potentiometer and pH meter
CO2: The student should be able to analyse the experimental data

Total 11 practical to be conducted.
Part-I: Conductometry: (Any three)
1. Hydrolysis of NH_4Cl or CH_3COONa or aniline hydrochloride.
2. Determination of λ_0 or $\lambda\alpha$ and dissociation constant of acetic acid.
3. Hydrolysis of ethyl acetate by NaOH.
4. Determination of critical micellar concentration (CMC) and ΔG of micellization of sodium Lauryl Sulphate / Detergent

Part-II: Potentiomerty: (Any three)
5. Stability Constant of a complex ion.
6. Solubility of a sparingly soluble salt.
7. Determination of equilibrium constant using potentiometry.
8. Estimation of halide in mixture.

Part-III: pH metry (any three)
9. Determination of the acid and base dissociation constant of an amino acid and hence the isoelectric point of the acid.
10. Determination of dissociation constants of tribasic acid (phospheric acid)
11. Determination of Hammet constant of given substituted benzoic acid using pH meter
12. Construct pH curve for titration of strong base – strong acid, strong base - weak acid and predict the best indicator in these titrations (methyl orange, methyl red, brocresol green, phenolphthalein)

Part-IV: Table Work (any one)
13. Detailed interpretation of IR spectra of diatomic molecules
14. Detailed interpretation of Raman spectra of diatomic molecules

References:
1. Practical physical chemistry, A. Findlay, T.A. Kitchner (Longmans, Green and Co.)
2. Experiments in Physical Chemistry, J.M. Wilson, K.J. Newcombe, A.r. Denko. R.M.W. Richett(Pergamon Press)
3. Senior Practical Physical Chemistry, B.D. Khosla and V.S. Garg (R. Chand and Co., Delhi.).
4. Experimental Physical Chemistry by D. P. Shoemaker, Mc. Growhill, 7th Edition, 2003.
5. Physical chemistry by Wien (2001)
6. Advance Physical Chemistry Experiment, Gurtu and Gurtu, Pragati Publication (Meerut) M.

CHE52104 Inorganic Chemistry Practical-2 (2 Credits, 60 hrs.)

Course Outcomes

CO1: To prepare the exact solutions for quantitative analysis.

CO2: Understand the principle and working of different instruments like colourimeter, conductometer, spectrophotometer, etc. and handle these instruments.

CO3: Synthesize Inorganic complexes and find their purity.

CO4: Study the electronic spectra of Ni (II) complexes.

Part-I: Synthesis of coordination complexes (any three)

1. Synthesis and Purity of [Mn $(acac)_3$]
2. Synthesis and Purity Chloropentaamminecobalt (III) chloride.
3. Synthesis and Purity Nitro pentaamminecobalt (III) chloride.
4. Synthesis and Purity Bis [TrisCu(I) thiourea]

Part-II: Inorganic Conductometry (any two)

5. Structural determination of metal complexes by conductometric measurement.

6. To study complex formation between Fe (III) with sulfosalicylic acid by conductometry.

7. To verify the Debye Huckel theory of ionic conductance for strong electrolytes like KCl, $BaCl_2$, K_2SO_4 and $[K_3Fe(CN)_6]$

8. Determination of Pb (II) in solution with Na_2SO_4 solution and determination of solubility product of $PbSO_4$

Part-III: Inorganic characterization techniques (any two of the following)

9. Determination of equilibrium constant of M – L systems Fe (III) - sulphosalicylic acid or Fe (III)–β–resorcilic acid by Job's continuous variation method.

10. Solution state preparation of $[Ni(en)_3]$ S_2O_3, $[Ni(H_2O)_6]$ Cl_2, $[Ni(NH_3)_6]$ Cl_2. Record absorption spectra in solution of all three complexes and calculate 10 Dq. Arrange these ligands according to their increasing strength depending on your observations.

Part-IV: Inorganic Kinetics Experiment (any two)

11. Synthesis and photochemistry of $K_3[Fe(C_2O_4)_3].3H_2O$.
12. Kinetics of substitution reaction of $[Fe(Phen)_3]^{2+}$
13. Kinetics of formation of Cr (III)-EDTA complex

Part-V: Solvent Extraction and colorimetric (any one experiment)

14. Determination of Cu(II) by solvent extraction as Dithiocarbamate complex.
15. Determination of iron by solvent extraction techniques in a mixture of Fe (III) or Fe (III) + Ni (III) using 8–hydroxyquinoline reagent.

References:

1. Vogel's Textbook of Inorganic quantitative analysis
2. Experimental Inorganic Chemistry, Mounir A. Malati, Horwood Series in Chemical Science (Horwood publishing, Chichester) 1999
3. Experiments in Chemistry, D. V. Jahagirdar, Himalaya Publishing House
4. General Chemistry Experiments, Anil. J Elias, University Press (2002)
5. Practical physical Chemistry, B. Vishwanathan and P. S. Raghwan, Viva Books

CHE52105 Organic Chemistry Practical-2 (2 Credits, 60 hrs.)

Course Outcomes

1. Students are trained to different purification techniques in organic chemistry like recrystallization, distillation, steam distillation and extraction.

2. Students are made aware of safety techniques and handling of chemicals.

3. Students are made aware of carrying out different types of reactions and their workup methods.

4. This practical course is designed to make student aware of green chemistry and role of greenchemistry in pollution reduction.

5. Students are made aware of carrying out different types of reactions and their workup methods.

6. This practical course is designed to make student aware of green chemistry and role of greenchemistry in pollution reduction.

Ternary mixture separation (Any 4)

Separation of minimum 04 mixtures containing three components. The mixtures should also involve separation of nitrophenols, amino acids, low boiling and water soluble and insoluble compounds solids and liquids with multifunctional groups. The mixture separation should be carried out on micro-scale using ether or water.

The students should be able to

A) Understand and employ concept of type determination and separation
B) Meticulously record physical constants
C) Recrystallize /distill the separated compounds and extend these skills to organic synthesis

Green Chemistry Reactions (Any 6)

1. Preparation of acetanilide from aniline and acetic acid using Zn dust

2. Base catalyzed aldol condensation using $LiOH.H_2O$ as a Catalyst.

3. Benzil Benzilic acid rearrangement under solvent free condition

4. Thiamine hydrochloride catalyzed synthesis of benzoin from benzaldehyde

5. Ecofriendly nitration of phenols and its derivatives using Calcium nitrate

6. Green approach for preparation of benzopinacolone from bezopinacol using iodine catalyst

7. Preparation of 1, 1-bis-2-naphthol under grinding at room temperature.

References:

1. Comprehensive Practical Organic Chemistry by V.K. Ahluwalia and Renu Aggarwal

2. Monograph on Green Chemistry Laboratory Experiments by Green ChemistryTask Force Committee, DST

CHE51207 Research Methodology (Theory) (2 Credits, 30 L)
CHE51208 Research Methodology (Practical) (2 Credits, 60 hrs)

Compulsory activities 10

Any 3 of 4 activities 4 lectures each (4 × 3= 12 lectures)

Course Outcomes:

By the end of the course, the students will be able to:

CO1: Identify the thirst area of research based on the need in day to day life.

CO2: Learn how to do literature survey based on the research problems

CO3: Know how to communicate the research findings with plagiarism check.

CO4: Learn to draw chemical structures and mechanism in the Chemistry related softwares -hemdraw / chemwin/ ISIS

CO5: Wtudy the research paper in the area of their interest

CO6: Write the research proposal to a funding agency

Theory of Research Methodology

Unit 1: Concept of Research (6 L)

Historical development of research, difference between research method and research methodology, introduction to the types of research (Descriptive vs analytical; applied vs fundamental/basic, quantitative vs. qualitative; conceptual vs empirical). General flow chart of the research process . Research ethics.

Unit 2: Literature Survey (10 L)

Print: Sources of information: Journals: Journal abbreviations, abstracts, current titles, reviews, text-books, current contents, Introduction to Chemical Abstracts and Beilstein, Subject Index, Substance Index, Author Index, Formula Index with examples.

Digital: Web resources, E-journals, Journal access, Citation index, Impact factor, H-index, E-books, Internet discussion groups and communities, Blogs, Search engines, Google Scholar, Google Patents, Pub Med, Wiki- Databases, Science Direct, SciFinder, Scopus, Chemistry Students must be given exposure to applications of molecular modelling softwares, like chemdraw, chemwin.origin

Unit 3: Safe storage, use and disposal of chemicals. (4 L)

Recovery, recycling and reuse of laboratory chemicals. Identification, verification and segregation of laboratory waste. Disposal of chemicals in the sanitary sewer system. Incineration and transportation of hazardous chemicals.

Unit 4: Methods of Scientific Research and Writing Scientific Papers (8 L)

Funding agencies of research, Writing Research Proposals and Research Papers, Writing literature surveys and reviews. Presentation in Seminar and Conferemces. Ethics in Science, Plagiarism awareness.

Unit 5: IPR (2 L)

Introduction, Mechanism for filing IP

Evaluation

Assignment**,** open book test, group discussion, seminars etc.

Practical in Research Methodology (2 Credits, 60 Hrs)

Project work

It is expected that the students should do 50% of the project work independently and take the teachers guidance when required. This is the first step for the students to think and work independently. The assigned lectures are just for the project related discussion with the students in the classroom.

1. Identify thirst area for research and do its literature survey and review writing.
2. Development of method for reproducibility, productivity and future scope.

Perform any three activities among the following

3. Demonstration for checking of plagiarism of any one research paper using recommended software.
4. Prepare PowerPoint presentation on any one research paper published in a reputed journal.
5. Making of poster any one research paper published in a reputed journal or your own project work.
6. Write research proposal to the funding agency

References

1. Dawson C. (2002) Practical Research Methods
2. Kothari C.R. (2004), Research Methodology, New Age International (P) Ltd.

3. S.B. Mishra, S Alok, (2017) Handbook of Research Methodology, Educreation ISBN: 978-1-5457-0340-3

4. Chemical safety matters IUPAC – IPCS, Cambridge University Press, 1992. 2. OSU safety manual 1.01.

Progressive Education Society's

Modern College Of Arts, Science and Commerce, Ganeshkhind, Pune – 411 016

(Autonomous)

Syllabus for

F. Y. M.Sc. (Zoology)

Introduction:

Zoology is a major subject of Basic Sciences which deals with all aspects of animal biology. It includes an interesting range of highly diverse topics. The advancements in biological Sciences demands a zoology student to be a master of many areas in the subject. This Postgraduate degree program has been designed by the Board of Studies in Zoology with a tangible understanding of what is needed from zoologists and what zoologists need to pursue as a skilled career. It emulates closely the Benchmark Statement for Biosciences and the guidelines laid down by the University Grants Commission, New Delhi. This Newly designed Curriculum is an appropriate blend of the classical aspects in Zoology which has been the "backbone" knowledge required for all zoologists and the recent and specialized areas. The flexibility in the Curriculum allows the students to choose their areas of interest leading to enhanced employability. Students will be provided sufficient number of hours for their skill development through the Lab Courses and the Project component. The lab courses have differing flavours and priorities to make a good zoologist. This degree offers specialization in Entomology along with a range of core courses like Biochemistry, Molecular Biology, Comparative Animal Physiology, Developmental Biology, Environmental Biology etc. The field trip/surveys and study tours are included to give the student an enticing taste of what life is specially outside the walls of the classroom. On successful completion of the programme, the students are expected to understand the key life processes of human and other animal groups, the functioning of molecules, cells, tissues, organs and systems. Also the students will gain increased confidence to use initiative and judgement to make decisions in complex and changeable situations and reflect critically and analytically on personal experience and make informed decisions about further study, training and employment opportunities. The Master of Science (M.Sc.) in Zoology is a Postgraduate program under the Faculty of Science and Technology. The curriculum designed M. Sc. Zoology encompasses subjects like Physiology, Entomology, Genetics, Cell Biology, Developmental Biology, Endocrinology, Biochemistry, Molecular Biology, Freshwater Zoology, Environmental Biology etc. Both classical and applied subjects of Zoology have been rightly blended to offer holistic understanding of the subject. The Choice Based Credit System (CBCS) will be implemented through this curriculum. This curriculum would certainly felicitate students to develop a strong base of the fundamentals and specialize in the desired area of their fondness and abilities. The students pursuing this program would get a privilege to select optional subjects of their choice. This curriculum will allow students to acquire the skill in handling scientific instruments planning and performing in the laboratory and exercising critical judgement, independent

thinking and problem solving skills.

Programme Objectives:

After successfully completing the M.Sc. Zoology program students will be able to:

PO1. Zoology knowledge: Apply the knowledge of Zoology, Life Sciences and allied subjects to the understanding of complex life processes and phenomena.

PO2. Problem analysis: Identify, review research literature, and analyse complex situations of living forms.

PO3. Design/development of solutions: Design processes/strategies that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions in real situations.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and ICT tools for understanding of the subject.

Suggested internal assessment tools for courses:

The concerned teacher shall announce the units for which internal assessment will take place. A teacher may choose one of the methods given below for the assessment.

1. Library notes
2. Students Seminar
3. Short Quizzes / MCQ Test
4. Home Assignments
5. Tutorials/ Practical
6. Oral test
7. Research Project
8. Group Discussion
9. Open Book Test
10. Written Test
11. PPT presentation
12. Industrial Visit
13. Viva

Teaching Methodology:

1. Classroom Teaching
2. Guest Lectures
3. Group Discussions

4. Surveys
5. Power Point Presentations
6. Visit to Industries
7. Research Papers & Projects
8. E-content

Eligibility:

The candidate should have a B.Sc. degree with Zoology as principal subject or B.Sc. (General) degree with Zoology as one of the subsidiary subjects. Graduates in any life science related subjects such as Biotechnology, Bioinformatics, Life science, Biochemistry, Microbiology, Agriculture, Veterinary sciences, Biology, Botany etc. Admission: Admissions will be given as per the selection procedure / policies adopted by the respective college, in accordance with conditions laid down by the University of Pune. Reservation and relaxation will be as per the government rules.

Subject List

FY M.Sc (Zoology) Sem I

Course Type	Sr. No.	Course (Subject) Title	Course (Subject) code	Credits	Weightage for Internal Marks	Weightage For External Marks	Weightage for practical	Total Marks
Mandatory major	**1**	Biochemistry and biotechniques (4C) (T)	**ZOO51101**	**4**	**40**	**60**		**100**
Mandatory major	**2**	Cell and Developmental Biology (4C)(T)	**ZOO51102**	**4**	**40**	**60**		**100**
Mandatory major	**3**	Advanced Genetics (2C) (T)	**ZOO51103**	**2**	**20**	**30**		**50**
Mandatory major	**4**	Scientific Communication (2C) (T)	**ZOO51104**	**2**	**20**	**30**		**50**
Mandatory major	**5**	Zoology Lab- I (2C) (P)	**ZOO51105**	**2**	**20**	**30**	**50**	
Major elective	**6**	Limnology (2C) (T)	**ZOO51201**	**2**	**20**	**30**		**50**
Major elective	**7**	Zoology Lab- II (2C) (P)	**ZOO51202**	**2**	**20**	**30**	**50**	
RM	**8**	Research Methodology (2C) (T)	**ZOO51301**	**2**	**20**	**30**		**50**
RM	**9**	Research Methodology (2C) (P)	**ZOO51302**	**2**	**20**	**30**	**50**	
			Total	**22**	**Total**			**550**

FY M.Sc (Zoology) Sem II

Course Type	Sr. No.	Course (Subject) Title	Course (Subject) code	Credits	Weightage for Internal Marks	Weightage For External Marks	Weightage for practical	Total Marks
Mandatory major	1	Molecular Biology And Bioinformatics (4C) (T)	ZOO52101	4	40	60		100
Mandatory major	2	Endocrinology and Comparative Animal Physiology (4C) (T)	ZOO52102	4	40	60		100
Mandatory major	3	Parasitology (2C) (T)	ZOO52103	2	20	30		50
Mandatory major	4	Environmental Biotechnology (2C) (T)	ZOO52104	2	20	30		50
Mandatory major	5	Zoology Lab- III (2C) (P)	ZOO52105	2	20	30	50	
Major elective	6	Ichthyology (2C) (T)	ZOO52201	2	20	30		50
Major elective	7	Zoology Lab- IV (2C) (P)	ZOO52202	2	20	30	50	
	8	OJT/FP- 4C	ZZOO52401	2	40	60	100	
			Total	22		Total		550

Credit Allocation: - CC-Core Course, EC-Elective Course, PR-Practical, PJ-Project, AECC-Ability Enhancement Compulsory Courses, SEC-Skill Enhancement Courses.

Total - Credits for First years Programme.

F.Y.M.Sc - Zoology, Semester I

Course Code:ZOO51101

Subject Name: **Biochemistry and Biochemical Techniques**

Total lectures: 60 **Total Credits: 4**

Prerequisites: - Basic knowledge of Biochemistry and biochemical techniques

Course Objectives:

Define basic terms in biochemistry and biochemical techniques.

Explain the applications of the various biochemical techniques. CO3: Explain the structure and functions of various biomolecules.

Course Outcome:-

Explain the importance of biomolecules with in biological systems.
Explain the importance and applications of techniques in biochemistry.
Explain the principle and applications of various techniques with examples.
Explain the principle, working, materials used and applications of electrophoresis.

Unit	Topic	No of lectures
1	**Chapter 1:-Biochemistry- Definition, scope and applications** **1.1** Basics of chemistry- Structure of atoms, molecules and chemical bonds 1.2 Normality, molarity, molality	02
2	**Chapter 2 :- Chemistry of Water** **2.1** Structure of water and physicochemical properties 2.2 Water as an universal solvent	02
3	**Chapter 3: pH and Buffers** **3.1** Definition of pH, pH scale **3.2** Henderson- Hasselbalch equation 3.3 Definition of buffer: Biological Buffer System	03
4	**Chapter 4: Carbohydrates** **4.1** Basic Structure and Classification **4.2** Properties of monosaccharides, oligosaccharides and polysachharides 4.3 Clinical and Biological Significance.	03
5	**Chapter 5: Lipids** **5.1** Basic structure and Classification **5.2** Properties of lipids 5.3 Clinical and Biological significance.	03
6	**Chapter 6: Vitamins** **6.1** Classification: water-soluble and fat-soluble 6.2 Clinical and Biological significance**.**	02

7	**Chapter 7: Amino acids** **7.1** Basic structure and classification **7.2** Physical properties- Optical Isomerization, Absorption in UV light, Ionization 7.3 Chemical properties- Reactions with carboxyl group and amino group	03
8	**Chapter 8: Proteins** **8.1** Peptide bond formation **8.2** Protein structures- Primary, Secondary, Tertiary and Quaternary with examples **8.3** Ramachandran plot. 8.4 Clinical and Biological significance.	04
9	**Chapter 9: Enzymes** **9.1** Classification, nomenclature and properties **9.2** Enzyme kinetics -one substrate reaction (Michaelis-Menten Equation) 9.3 Factors affecting enzyme activity **9.4** Enzyme inhibition **9.5** Allosteric Enzymes. **9.6** Isozymes (LDH) and coenzymes 9.7 Clinical and industrial significance	08
	BIOCHEMICAL TECHNIQUES	
1	**Chapter 1: Chromatography** Principle, working and applications of: **1.1** Adsorption chromatography **1.2** Partition chromatography **1.3** Ion-exchange chromatography **1.4** Molecular exclusion chromatography **1.5** Affinity chromatography **1.6** Gas chromatography 1.7 High Performance Liquid Chromatography.	07
2	**Chapter 2: Electrophoresis** **2.1** Support media **2.2** Electrophoresis of proteins and nucleic acids Isoelectric focussing.	04
3	**Chapter 3: Absorption spectroscopy** **3.1** Concept of light and electromagnetic spectrum **3.2** Ultraviolet and Visible spectrophotometry Atomic absorption spectrometry and its applications.	04
4	**Chapter 4: Radioactivity** **4.1** Properties of radioisotopes **4.2** Structure &working of G.M counter	04

	4.3 Isotopic dilution analysis Use of isotopes in biology and Radiation hazards.	
5	**Chapter 5: Introduction to microscopy** **5.1** Bright field and Dark field Concept of phase differences, Phase contrast microscopy, Differential Interference contrast (Nomarsky) microscopy	04
6	**Chapter 6:** **Methods for protein sequencing.** N-terminal sequencing C-terminal sequencing. **Methods for DNA sequencing** Maxam- Gilbert Sequencing Chain termination method Dye terminator sequencing	04
7	**Chapter 7: Centrifugation:** Principle, Types of centrifugation- Preparative and Analytical. Applications of centrifugation.	03

Reference Books:

1. Biochemistry, 3rd Ed. (2005), Voet Donald and Voet Judith G. John, Publisher: Wiley & sons, New York.
2. Biochemistry 6th Ed, (2007) Berg Jeremy, Tymoczko John, StryerLubert, Publisher: W. H. Freeman, New York.
3. Lehninger's Principles of Biochemistry, 4th edition, (2005) Nelson D. L. and Cox M. M. W. H. Freeman & Co. NY.
4. Biochemical Calculations, 2nd Ed., (1997) Segel Irvin H., Publisher: John Wiley and Sons, New York.
5. Enzymes: Biochemistry, Biotechnology & Clinical chemistry, (2001) Palmer Trevor, Publisher: Horwood Pub. Co., England.
6. Biochemistry, Geoffrey Zubay, William C Brown Pub; 4th edition (June 1999)
7. Principles and Techniques of Biochemistry and Molecular Biology, 6th edition (2008), Keith Wilson and John Walker, Publisher–Cambridge University Press.
8. Light Microscopy in Biology: A Practical Approach, 2nd edition (1999), Alan
9. J. Lacey, Publisher–Oxford University Press.
10. Electron Microscopy: Principles and Techniques for Biologists, (1992), Lonnie
11. D. Russell, Publisher-Jones & Bartlett

Course Code: ZOO51102
Subject Name: **Cell Biology and Developmental Biology**

Total lectures: 60 **Total Credits: 04**

Prerequisites: - Basic knowledge about Cell and the development

Course Objectives:

Describe the structure and functions of the prokaryotic and eukaryotic cell.

Highlight the ultrastructure and functions of various types of cell organelles

Define the terms in developmental biology
Explain the significance of model organism for developmental studies.

Course Outcome:-

Explain the concepts of cell signalling

Explain the concept of Protein Trafficking

Illustrate the chemistry and organization of cytoskeleton.

Diagrammatically represent the cell cycle phases and its regulation.

Explain the types of eggs, concept of fertilization.

Explain the concept of mesoderm induction and pattern formation with examples.

Describe neural competence and induction.

Unit	Topic	No of lectures
1	**Chapter 1:-** Introduction to Cell Biology 1.1 Definition and Scope of Cell biology 1.2 Cell Theory 1.3 Overview of Cell Types	02
2	**Chapter 2 :-** Plasma membrane: 2.1 Ultrastructure- Fluid Mosaic Model, Membrane proteins: channels, carriers and pumps; 2.2 Membrane transport- Active, Passive, Bulk Transport 2.3Membrane potential	05
3	**Chapter 3:**Nucleus 3.1 Ultrastructure – nuclear envelope, nuclear lamina, nuclear pore complex, nucleolus. 3.2 Functions of Nucleus	02
4	**Chapter 4:** Endomembrane system: 4.1 Endoplasmic reticulum, Golgi complex, Lysosomes- Structure and Function 4.2 Protein trafficking – secretory and endocytic pathways.	06

5	**Chapter 5:**Mitochondria **5.1** Structure, function 5.2 Protein import	03
6	**Chapter 6:**Cytoskeleton 6.1 Types and Organisation 6.2 Role of Cytoskeletal Proteins	03
7	**Chapter 7:**Cell Cycle 7.1 Phases, check points, mechanism of regulation 7.2 Regulators of cell cycle progression – MPF, cyclins and cyclin dependent kinases (CDKs).	05
8	**Chapter 8:**Cell signalling 8.1 Signalling molecules and their receptors 8.2 Cell surface receptors 8.3 Signalling through G-protein coupled receptors 8.4 Secondary messengers	04
	DEVELOPMENTAL BIOLOGY	

Unit	**Topic**	**No. Of Lectures**
1.	**Chapter1:Basic concepts of development :** 1.1 Concepts of Developmental biology –Growth, Potency, Stemness, commitment, specification, induction, competence, determination and differentiation, Cryptobiosis.	03
2.	**Chapter 2:Model Organisms:** *2.1* Invertebrate: *Drosophila melanogaster,* 2.2 Pisces: Zebra Fish- *Danio rerio*, *2.3* Amphibians: *Xenopus laevis,* 2.4 Birds: Chicken, **2.5** Mammals: Mouse**.**	03
3	**Chapter 3: Gametogenesis:** 3.1 Spermatogenesis: spermatogenesis, structure of sperm, regulation of sperm motility, 3.2 Oogenesis: previtellogenesis, Vitellogenesis and post-Vitellogenesis, Structure of ovum	04
4	**Chapter 4:Fertilization:** 4.1 Concept of fertilization, types of fertilization, 4.2 Species specific sperm attraction, recognition of egg & sperm, 4.3 Acrosome reaction, 4.4 Prevention of polyspermy: Fast block & Slow block.	04L
5	**Chapter 5:Morphogenesis:** 5.1 Blastulation: Frog and Chick, Mid Blastula Transition, 5.2 Gastrulation: Frog, Chick 5.3 Neurulation: Frog, Chick 5.4 Organogenesis: vulva formation in *Caenorhabditis elegans*, eye lens induction.	06

6	**Chapter 6:Pattern formation:** 6.1.Setting up Animal-vegetal and Dorso-Ventral axis in Amphibians, 6.2 Antero-posterior axis: *Drosophila*-role of bicoid, nanos, hunchback.	04
7	**Chapter 7:Regeneration:** 7.1 Definition and Types- Epimorphosis and Morphallaxis *7.1* Limb regeneration in *Salamander,* 7.2 Regeneration in Hydra	03
8	**Chapter 8:Growth and post embryonic development**: 8.1 Apoptosis 8.2 Aging and senescence.	03

Reference Books:

Cell Biology:

1. Karp Gerald (2010) Cell Biology. 9th Edition, John Willey & Sons (Asia) Pt. Ltd.
2. Cooper Geoffrey M. (1997) The Cell: A Molecular Approach. ASM Press, Washington D.C., U.S.A.
3. Sadava David E. (1993) Cell Biology – Organelle Structure and Function. Jones &Barlett Publishers, Boston, London.
4. Hardin Jeff, Gregory Bertoni and Lewis J. Kleinsmith (2012) World of the Cell. 8th Edition, Pearson Education, Inc., San Francisco, U.S.A.
5. Alberts B., A. Johnson, J. Lewis, M. Raff, K. Roberts and P. Walter (2008) Molecular Biology of the Cell. 6th Edition, Garland Science, New York, U.S.A.
6. Lodish H., D. Baltimore, A. Berk, L. Zipursky, M. Matsudaira and J. Darnell (1995) Molecular Cell Biology. Eds. 3, Scientific American & W. H. Freeman, New York.
7. De Robertis E. D. P. and De Robertis E. M. E. (1987) Cell and Molecular Biology. 8th Edition, Lea and Febiger, Philadelphia.
8. Nelson D. L. and Cox M. M. (2008) Lehninger Principles of Biochemistry. 5th Edition, W. H. Freeman & Co. NY.
9. Developmental Biology:
10. Developmental Biology, 9th edition (2010), S.F. Gilbert. Publisher –Sinauer, Associates Inc.
11. Principles of Development, 6th edition (2007), Lewis Wolpert, Publisher- Oxford, University Press.
12. An Introduction to Embryology, 5th edition (2004), B. I. Balinsky. Publisher – ThomasAsia Pvt. Ltd.
13. Developmental Biology, (2001), R. M. Twyman, Publisher - Bios Scientific, Publishers LTD.

14. Analysis of Biological Development , 2000, Klaus Kalthoff, McGraw-Hill Science/Engineering/Math; 2nd Ed edition.

15.

Course Code: ZOO51103

Subject Name: Advanced Genetics

Total lectures: 30 **Total Credits: 02**

Prerequisites: - Basic knowledge about genes and herdity

Course Objectives:

Describe the structure and functions of the genes and genomes

Course Outcome:-

Highlight the importance of Mendelian inheritance.
Explain the significance of Non- mendelian inheritance
To analyse and understand the importance of quantitative traits and their inheritance pattern.

Examine how genes affect the population

Unit	Topic	No. Of Lectures
1	**Chapter 1: Introduction :** **1.1** Scope of Genetics and Practical applications of genetics in brief	02
2	**Chapter 2: Recapitulation of Mendelian principles; Mendel and his work** **2.1** Mendelian principles.	02
3	**Chapter 3: Classical concept of a gene :** **3 . 1** Allele, pseudoalleles, multiple alleles (blood groups)	02
4	**Chapter 4: Extensions of Mendelian principles:** **4.1** Gene interactions and epistasis and their types.	02
5	**Chapter 5: Linkage and crossing over :** **5.1** Linkage, linkage groups, types of crossing over, sex linkage, 5 . 2 S ex limited and sex influenced Characters 5.3 Recombination, recombination maps in diploids for 2 point and 3 point test cross, (determination of gene order with suitable examples).	06
6	**Chapter 6: Quantitative genetics :** **6.1** Polygenic inheritance, heritability and its measurements and Quantitative Traits Locus mapping.	03
7	**Chapter 7: Somatic cell genetics and its applications.**	02
8	**Chapter 8: Principles of Population Genetics:** Hardy-Weinberg law and its application for autosomal genes. Calculations of gene frequencies with suitable examples.	05
9	**Chapter 9: Microbial genetics :** 9.1 Methods of genetic transfers – transformation,	03

	conjugation, transduction.	
10	**Chapter 10: Extra chromosomal inheritance:** Inheritance of Mitochondria.	01
11	**Chapter 11: Human genetics:** Dominant and recessive disorders, physical traits.	04

REFERENCE BOOKS :

1. Genetics, 3Rd Edn by Strickberger, Pearson India, 2015, Paperback,

2. Principles of Genetics,Gardner, E.J., Peter & Simmons, M.J. and Snustad, D.P. 8 thEdn.John Wiley and Sons, New York, 2006.

3. Concepts of Genetics. William S Klug and Michael R Cummings. 10thEdn. Pearson Education India, 2016.

4. Lewin, Benjamin. Genes IX. John Wiley and Sons, New York,2008.

5. Genetics By Verma,PS. And Agrawal, VK., S.Chand and Co.,New Delhi

6. Genetics By Gupta, PK., Rastogi Publication, Meerut

7. Genetics By Sarin,C., Tata McGraw Hill,New Delhi

8. Genetics: Daniel J Fairbanks, W. Ralph Andersen; Brooks / Cole Publ. co. (1999).

9. iGenetics: A Molecular Approach, 3rdEdn by Peter J Russell, Pearson India, 2016, Paperback, 9789332571624

Course Code: ZOO51104

Subject Name: Scientific Communication

Total lectures: 30 **Total Credits: 02**

Prerequisites: - Basic knowledge about the importance of Scientific English

Course Objectives:

Describe the importance of the english language in scientific communication.

Course Outcome:-

Highlight the importance of vocabulary and word building.

Explain the significance of grammar and parts of speech.

To analyse and understand the importance of errors in spoken and written communication

To know the different styles of communication.

Unit	Topic	No. Of Lectures
1	**Chapter 1: Language as a communication tool:** **1.1** Relationship of language among reading, writing, listening and speaking.	02
2	**Chapter 2: Pragmatic competence:** **2.1 C**o-operative principles and politeness principles 2 . 2 Introduction of Scientific Writing : Introduction, Meaning, Language of a Scientific Paper	01
3	**Chapter 3: Organisation of English language:** **3 . 1** Sentence structure, basic grammar, sequence and tenses, syntax, paragraphs, paraphrases and précis writing, synonyms and antonyms. C**lassical concept of a gene :** Allele, pseudoalleles, multiple alleles (blood groups)	03
4	**Chapter 4: Common errors in written and spoken English:** **4 . 1** Tautology, double negative, double positive, superfluous words	02
5	**Chapter 5: Oral presentation:** **5.1** How to prepare a presentation, power point slides, use of communication and IT, voice, speed of delivery, obstacles in effective communication	02
6	**Chapter 6: Outline of research project proposal writing**: 6.1 Drafting of a research project for financial assistance from funding agency, writing of scientific paper using word processor.	02

7	**Chapter 7: Outline of a scientific research paper:** 7.1 Hypothesis, theory and concept 7.2 Title designing, framing Abstract and Keywords 7.3 Introduction: statement of the problem and justification; aim, objectives, need, significance and rationale of the study, review of literature. 7.4 Materials and Methods: contents, importance of measurements, reproducibility etc. 7.5 Observations and Results: text and data presentation, tables, graphs, histograms, diagrams, photographic plates, legends and captions 7.6 Discussion: logical sequence and critical analysis of ideas and evidences, data conclusion 7.7 References: finding references from journals, books and databases; Citation - styles of citations 7.8 Summary, Acknowledgements	14
8	**Chapter 8: Editing and correcting:** **8.1** Proof-reading symbols, jargons and abbreviations	03
9	**Chapter 9: Plagiarism:** **9.1** Meaning, types, avoiding plagiarism.	01

REFERENCE BOOKS:

1. O'Conner M. and F. P. Woodford (1975) Writing Scientific Papers in English. Elsevier- ExcerptaMedica-North Holland Publ., Amsterdam.

2. Trelease S. F. (1958) How to Write Scientific and Technical Papers. Williams and Wilkins Co. Baltimore, U.S.A.

3. Day Robert (1996) How to Write and Publish a Scientific Paper. Cambridge University Press.

4. McMillan V. (1997) Writing Papers in the Biological Sciences. Edn. 2, W. H. Freeman, New York.

5. Winkler Anthony C. and Jo Ray McCuen-Metherell (2008) Writing the Research Paper, A Handbook. 7th Edition, Wadsworth Cengage Learning, Boston, M.A., U.S.A.

6. Vijayalakshmi G. and C. Sivapragasam (2008) Research Methods – Tip & Techniques. M.J.P. Publishers, Chennai.

Course Code: ZOO51201
Subject Name: Limnology
Total lectures: 30 **Total Credits: 02**

Prerequisites: - Basic knowledge about the importance of freshwater ecosystems and their functioning

Course Objectives:

Explain the types of aquatic habitats.

Discuss the aquatic adaptations of common freshwater forms.

Course Outcome:-

Enlist the diagnostic features of shrimps.

Illustrate the physicochemical properties of water.

Demonstrate the effect of pollutants on freshwater bodies
Justify the presence of zooplanktons and aquatics forms in freshwater bodies.

Unit	Topic	No. Of Lectures
1	**Chapter 1: Physico-chemical properties of water** 1.1 Physical conditions: Water current, watercolor, turbidity, and temperature. 1.2 Chemical conditions: pH, carbon dioxide, dissolved oxygen, hardness, alkalinity, nitrate, and phosphate.	06
2	**Chapter 2: Introduction to freshwater habitats.** 2.1 Lentic habitat: Lakes, ponds, wetlands, and ephemeral water bodies. Thermal stratification in lakes. 2.2 Lotic habitat: Major rivers in India	02
3	**Chapter 3: General characters of Zooplankton with two examples** 3.1 Rotifera, Copepoda, Cladocera and Ostracoda	04
4	**Chapter 4: Introduction to minor phyla:** 4.1 Gastrotricha, Bryozoa and Tardigrada (water bears).	02
5	**Chapter 5: Diversity and economic importance of freshwater Crustacea and Mollusca.**	03
6	**Chapter 6: Diagnostic features and Economic importance of freshwater fishes (two example)**	02
7	**Chapter 7: Locomotory and respiratory adaptation in freshwater insect orders:** 7.1 Odonata, Coleoptera, Diptera and Hemiptera.	03
8	**Chapter 8: Eutrophication: Causes and problems**	03

9	**Chapter 9: Anthropogenic impact on freshwater:** 9.1 Sewage and silage, mining waste, agricultural chemicals, industrial outflows.	04

REFERENCE BOOKS:

1. Limnology: lake and river ecosystem, Robert G. Wetzel. Academic Press,3rd edition.
2. Treatise of Limnology. Hutchinson G. E. John Willy Publication, New York (3 volumes).
3. Field Guide to freshwater invertebrates of North America. Thorp and Rogers. Academic press.
4. Environmental Physiology of Animals. Pat Wilmer, Graham Stone and Ian Johnston. Wiley-Blackwell; 2nd edition.
5. Current status of freshwater resources of India. Kailash Chandra, Gopi K.C., Rao D.V., Valarmathi K. and Alfred J.R.B. Zoological survey of India, 2017.
6. Freshwater Ecology: Concepts and Environmental Applications of Limnology. Academic press, 2nd edition.

Course Code: ZOO51105
Subject Name: Zoology Lab- I
Total Credits: 02

Chapter-I Biochemistry and Biochemical Techniques		
1	Preparation of Acid & Alkali solutions and acid-base titration **(Compulsory)**	**1P**
2	Principle and working of Colorimetry and spectrophotometry	**1P**
3	To prepare Buffers of known pH and molarity and measurement of pH of various samples, Buffering capacity	**1P**
4	Units and specific activity of enzymes.	**1P**
5	Effect of substrate concentration on enzyme activity **(Compulsory)**	**1P**
6	Determine the concentration of Vitamin C by titration method from various sources.	**1P**
7	Estimation of Sugar (Glucose) by Folin Wu method. **(Compulsory)**	**1P**

8	Isolate proteins by salting out / by adjusting isoelectric point. **(Compulsory)**	**1P**
9	Estimation of protein by Biuret method method**.(Compulsory)**	**1P**
10	Principle and uses of different microscopes	**1P**
11	To study the effect of different solvents for a given dye using thin layer chromatography **(Compulsory)**	**1P**
Chapter-II Advanced Genetics and Scientific Communication		
1	Study of sex linked inheritance in *Drosophila sp.*	**1P**
2	Study of monohybrid and Dihybrid ratio in *Drosophila sp.***(Compulsory)**	**1P**
3	Determination of gene distances and gene order for a given three-point test cross**.(Compulsory)**	**1P**
4	Polytene chromosomes of *Drosophila or Chironomous*-examination of puff and bands**.(Compulsory)**	**1P**
5	Estimation of allelic frequencies, heterozygote frequencies in human populations**.(Compulsory)**	**1P**
6	Pedigree Analysis: Sex-Linked, Autosomal dominant and recessive.	**1P**
7	Culturing *E.Coli* on solid and liquid media	**1P**
8	English vocabulary, word formation, basic grammar-verb, adverb, adjective, noun, pronoun **(Compulsory)**	**1P**
9	Syntax, paraphrasing and précis writing, synonyms, antonyms, abbreviations.	**1P**
10	Spoken English: pronunciation, diphthong, accent, clarity, speed, punctuation, simplicity and syntax	**1P**
11	Common errors in written and spoken presentation- Tautology, double negatives and double positives, sequence and tenses, ambiguity, spellings, jargons**.**	**1P**
12	Outline of a scientific paper; preparation of a research project.	**1P**
13	Writing abstracts, conclusion/ summary and acknowledgements, key words and suggest a suitable title to the given abstract/paper**(Compulsory)**	**1P**
14	Assigning legends to given graphs, figures and captions to given tables, Deciphering the given pictorals**.**	**1P**

15	Study of proof correction symbols; proof- reading the given text & correcting the proofs.	**1P**
16	How to write materials and methods , observation section of a research paper**.**	**1P**
17	Write discussion section for the given discussion-less research paper and writing Citations/ Bibliography **(Compulsory)**	**1P**
18	Oral presentation: Rhythm, style, control, mock presentation of 10 minutes.	**1P**

Course Code: ZOO51202
Subject Name: Zoology Lab- II
Total Credits: 02

Chapter-II Cell Biology and Developmental Biology		
1	Study of ultrastructure of cell organelles. **(Compulsory)**	**1P**
2	Study of different types of cells. **(Compulsory)**	**1P**
3	Temporary preparation of human cheek epithelial cells. **(Compulsory)**	**1P**
4	Study of different stages of mitosis in suitable material. **(Compulsory)**	**1P**
5	Study of meiosis in Grasshopper testes / Onion flower buds / *Aloe vera* with emphasis on all stages of prophase. **(Compulsory)**	**1P**
6	Limits of cleanliness (To check for microbial flora)	**2P**
7	Cell fractionation – Nuclei, mitochondria observation, nuclear count.	**2P**
8	Mounting of chick embryos and preparation of permanent mounts **(Compulsory)**	**1P**
9	Filter paper ring method for *in vitro* culturing of chick Embryo &observations.	**1P**
10	Gross anatomy and histology of chick embryo upto 72 hrs. Brain, heart, lens, ear development.**(Compulsory)**	**1P**
11	Study of embryonic and post-embryonic development using frog egg as a model system**.**	**1P**

12	Study of life cycle of *Drosophila melanogaster* **(Compulsory)**	**1P**
13	Study of effect of ligature in Drosophila / House fly larva	**1P**
14	Study of regeneration in *Hydra/ Planaria.*	**1P**
15	Study the early developmental stages in any freshwater snail.	**1P**

Chapter II: **Limnology**		
1	Estimation of total carbon dioxide and chloride form given water sample.	**1P**
2	Estimation of phosphates forms given water sample**.**	**1P**
3	Estimation of total nitrate from given water sample.	**1P**
4	Estimation of calcium and total hardness of given water sample.	**1P**
5	Estimation of total alkalinity of given water sample.	**1P**
6	Collection, preservation and identification of zooplankton from freshwater habitat. (Prepare permanent slides and Identify up to genus level usingtaxonomic key).	**2P**
7	A qualitative and quantitative analysis of zooplankton from a given freshwater sample using Lackey's drop count method/ Sedgwick rafter counting cell.	**2P**
8	Identification of economically important freshwater crustaceans and fishes**.**	**1P**
9	Study of locomotory and respiratory adaptations in aquatic insects and larvae (*Ranatra, Notonecta, Gerris, Bellostoma and Dytiscus*).	**1P**
1 3	A Compulsory visit to local freshwater body and preparation of report on physicochemical conditions and faunal organisms.	**1P**

Course Code: ZOO51301
Subject Name: **Research Methodology**

Total lectures: 30 **Total Credits: 02**

Prerequisites: - Basic knowledge about the research processes

Course Objectives:

Perform literature reviews using online databases

Preparation of Dissertation for the project

Course Outcome:-

Identify, explain, compare, and prepare the key elements of a research proposal/report.

Compare and contrast quantitative and qualitative research paradigms

Applications of new techniques.
Justify the rationale for research ethics

Sr. No.	Topic	No. Of Lectures
1.	**Chapter 1: Research:** Meaning, Objectives, Types of research, Literature review, Collection of literature from Books and Journals, Digital library, Search of articles - Google Scholar, Pub med, Inflibnet, Medline	03
2.	**Chapter 2: Publishing of Articles**: National and International Journals, Selection of Journals, Concepts related to journals- ISSN Number, Peer reviewed Journals, Science citation index, Impact factor.	02
3.	**Chapter 3: Dissertation**: Structure, Components – Introduction, Review of literature, Materials and Methods, Presentation of Results, Discussion, Conclusions, Summary, Arrangement and how to quote references in thesis, Appendix.	02
4.	**Chapter 4: Data Collection**: Meaning, Methods and Tools of Data Collection Hypothesis Sampling, Data Processing, Analysis and Interpretation of Data.	02
5.	**Chapter 5: Quantitative methods:** Biostatistics used for analysis of Biological data	02
6.	**Chapter 6: Computer application**: Bioinformatics, Databases and their applications	03
7.	**Chapter 7: Tools and techniques**: • Techniques used Purification and characterization of biomolecules: Recapitulation of centrifugation, chromatography and electrophoresis. • NMR, MALDI-TOF, X-ray crystallography, Circular Dichroism CD • Microscopic techniques including Fluorescence microscopy, Confocal microscopy, Atomic force microscopy and live cell imaging FACS analysis. Real time PCR, DNA microarray, New generation DNA sequencing, Protein Microarray.	10
8.	**Chapter 8: Intellectual property rights and patent law**: Trade Related aspects of Intellectual Property Rights, Reproduction of published material- Plagiarism, Citation and Acknowledgement Patent Criteria and Procedure of patenting	02
9.	**Chapter 9: Bioethics**, Good Laboratory Practice (GLP) and Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) Guidelines- Introduction to Bioethics, Bioethic regulation frame work in India, GLP introduction and CPCSEA guidelines for laboratory Animal Facility	03

REFERENCES:

1. Kothari, C.R. (1985): Research Methodology: Methods and Techniques, Wiley Eastern.
2. Dominowski, R.L. (1980): Research Methods, Prentice Hall Inc., New Jersey.
3. Mishra, R.P. (1980): Research Methodology, Handbook Concept Publishing Company,New Delhi.
4. IIPS (1996): Research Methodology, IIPS, Mumbai.
5. Research and Writtings – By-P. Ramdas , A.Wilson srunai M.J.Publisher (2009).
6. Scientific thesis writings and Paper presentations-N.Gurumani. M.J.Publisher (2010).
7. Anderson, Durston&Polle 1970: Thesis and assignment, writing Wiley Eastern Limited
8. G. Vijayalakshmi and C. Sivapragasam. (2008) Research Methods –Tip & Techniques,MJP
9. Publishers, Chennai. WWW.mjppublishers.com
10. Malter K, 1972: Statistical analysis in Biology, Chapmen Hall, London.
11. Cohen, L. Lawrence, M., & Morrison, K. (2005). Research Methods in Education (5thedition). Oxford: Oxford University Press.
12. Leedy, P. D. (1980). Practical Research: Planning and design. Washington: Mc Millan Publishing Co., Inc.
13. Singh, Y. K. (2006). Fundamental of Research Methodology and Statistics. New Delhi.New International (P) Limited, Publisher

Course Code: ZOO51302
Subject Name: **Research Methodology (Practical)**

Total Credits: 02

Sr. No.	**Name of the practical**	No. of practicals
1.	Writing a project proposal to a funding agency **(Compulsory)**	**1P**
2.	Use of MS Excel in data presentation **(Compulsory)**	**1P**
3.	Examples of some common statistical tests **(Compulsory)**	**2P**
4.	Purification of a biomolecule.	**1P**
5.	Making a ICT enabled scientific presentation **(Compulsory)**	**1P**
6.	Microscopic techniques.	**1P**
7.	Presentation of any ONE research paper. **(Compulsory)**	**1P**
8.	Writing a review on a particular topic.	**1 P**

F.Y.M.Sc (Zoology) Semester II

Course Code: ZOO52101

Subject Name: Molecular Biology and Bioinformatics

Total lectures:60 **Total Credits: 04**

Prerequisites: - Basic knowledge about the DNA and its interaction at the cellular and molecular level

Course Objectives:

Illustrate the process of DNA replication, transcription, translation and their regulations.

Illustrate the database tools with their significance.

Schematically represent the processes of central dogma.

Course Outcome:-

Explain the DNA structure & types, topology, Physical properties; chromatin structure and organization.

Discuss genome organization, DNA and Protein sequencing with their application in evolutionary studies.

Explain mechanism of DNA damage and repair.

Unit	Topic	No. Of Lectures
1	**Chapter 1: DNA structure and topology** **1.1**. Types of DNA **(A,B,Z)** **1.2** Structure of chromatin, nucleosome **1.3** Higher order organization - chromosome, centromere, telomere, Histones and its effect on structure and function of chromatin	05
2	**Chapter 2: Physical properties of DNA** **2.1** Tm, hypo and hyper chromicity **2.2 S**olubility, mutarotation and buoyancy**.**	02
3	**Chapter 3: Genome organization** **3.1** c- value paradox and genome size **3.2** Cot curves, repetitive and non-repetitive DNA sequence and their importance **3.3** Cot ½, kinetic and sequence complexity, satellite DNA, Pseudogenes , Gene families, Gene clusters, Super-families Organelle genome	04

4	**Chapter 4: DNA Replication** ***4.1*** DNA replication in *E. coli* **4.2** Types of *E. coli* DNA polymerases **4.3** Origin of replication, , replication process and its regulation **4.4** Connection of replication to cell cycle. **4.5** Different models of replication for linear and circular DNA replication **4.6** Eukaryotic DNA replication, multiple replicons, eukaryotic DNA polymerases	08
5	**Chapter 5: DNA damage and repair** **5.1** Different types of DNA damage **5.2** Different DNA repair systems **5.2.1** Nucleotide excision repair **5.2.2** Base excision repair **5.2.3** M ismatch repair **5.2.4** Recombination repair **5.2.6** Nick Translation and SOS Repair	05
6	**Chapter 6: Transcription** **6.1** Transcriptional Unit in prokaryotes and eukaryotes **6.2** Role and significance of promoter, enhancer, intron, exon, silencer, **6.3** Transcriptional factors, mechanism of prokaryotic gene transcription **6.4** Type and structure of RNA polymerases **6.5** Post transcriptional processing: Capping, polyadenylation and splicing in eukaryotes and significance, Ribonucleoproteins (SnRNPs & ScRNPs)	07
7	**Chapter 7: Translation** **7.1** Prokaryotic translation – Genetic code, deciphering genetic code **7.2** Structure of ribosome (prokaryotic and eukaryotic) **7.3** tRNA – structure of tRNA, modified bases of tRNA, **7.4** Activation of tRNA Initiation – role of initiation factors, Shine Dalgarno sequences **7.5** Elongation – Role of elongation factors **7.6** Termination – termination codons, role of release factors	07

	7.7 Fidelity of translation **7.8** Post transcriptional modifications	
8	**Chapter 8: Gene regulation and expression in prokaryotes** **8.1** Lac operon **8.2** Arabinose operon **8.3** Trp operon**.**	03
9	**Chapter 9: Mobile DNA elements** **9.1** Transposable elements in bacteria **9.2** IS elements, composite transposons, replicative, non-replicative transposons **9.3** Mu transposition Controlling elements in Tn A and Tn 10 transposition **9.4** SINES and LINES. **9.5** Retroviruses and retrotransposon.	04
	BIOINFORMATICS	
1	**Chapter 1: Introduction** **1.1** Introduction to Bioinformatics and Bioinformatics web resource (NCBI, EBI,ExPASy, PubMed, OMIA) **1.2** Applications of Bioinformatics	02
2	**Chapter 2 :Databases – Tools and their uses** **2.1** Biological databases, Primary sequence databases **2.2** Nucleic acid sequence databases (GenBank, EMBL-EBI, DDBJ) **2.3** Protein sequence data bases (UniProtKB, PIR, PDB) **2.4** Secondary sequence databases **2.5** Derived databases - PROSITE, BLOCKS, Pfam/ Prodom **2.6** Structure databases and bibliographic databases	04
3	**Chapter 3: Sequence alignment methods** **3.1** BLAST, FASTA **3.2** Significance of sequence alignment **3.3** Pairwise sequence alignment (Needleman &Wunsch, Smith & Watermanmethods)	04

	3.4 Multiple sequence alignment (PRAS, CLUSTALW)	
4	**Chapter 4: Predictive applications using DNA and protein sequences** **4.1** Evolutionary studies: Concept of phylogenetic trees **4.2** Parsimony and Bayesian approaches **4.3** Functional Proteomics: applications of Proteomics **4.5** Omics: Pharmacogenomics: Discovering a drug: Target identification Metabolomics: Concept and applications	05

Reference Books:

1.Genes IX, 9th edition (2008), Benjamin Lewin, Publisher - Jones and BarlettPublishers,Inc.

2.Molecular Biology of the Gene, 5th Edition (2004), James D. Watson, Tania Baker,

3.Stephen P. Bell, Alexander Gann, Michael Levine, Richard Lodwick. Publisher -Pearson Education, Inc. and Dorling Kindersley Publishing, Inc

4.Bioinformatics - Concepts, Skills, and Applications; S.C. Rastogi& others; CBS Publishing; 2003.

5.Introduction to Bioinformatics; 1st Edition; T K Attwood, D J parry- Smith; Pearson Education, 11th Reprint; 2005.

6.Bioinformatics; 1st Edition; C S V Murthy; Himalaya Publishing House; 2003

7.Bioinformatics sequence and genome analysis; David W. Mount; Cold spring harbor laboratory press; 2004

8.Phylogenetics: Theory and Practice of Phylogenetic Systematics; Second edition; Bruce S. Lieberman; Wiley-Blackwell; 2011

9.Molecular Evolution: A Phylogenetic Approach; Roderick D.M. Page, Dr Edward C. Holmes; Well Publishing; 1998

10.Proteomics - From Protein Sequence to Function; 12 S. R. Pennington,

M. J. Dunn; First edition; Springer publications; 2001

11.Proteomics; Timothy Palzkill; Springer; 2002

12.Metabolomics - A Powerful Tool in Systems Biology; Jens Hřiriis Nielsen, Michael C. Jewett; Springer; 2007

13.Understanding Bioinformatics; Marketa Zvelebil and Jeremy O. Baum; Garland Science (Taylor and Francis Group); 2008

14.Bioinformatics; Prakash S. Lohar; MJP Publishers, Chennai; 2009

15.A text book of Molecular Biology- J.Pal and S. Ghaskadabi, Oxford Publication- India.

Course Code: ZOO52102

Subject Name: Endocrinology and Comparative Animal Physiology

Total lectures: 60 **Total Credits: 04**

Prerequisites: - Student should have a basic information about Endocrinology and Comparative Animal Physiology

Course Objectives:

The student will be able to list the major complex biomolecules found in living cells, three of which are found on food labels and the basis for grouping of bio molecules into those four groups.

The student will be able to develop an understanding of the role of the endocrine system in maintaining homeostasis and health.

Course Outcome:-

Unit	Topic	No. Of Lectures
1	**Chapter 1: Introduction of Endocrinology** **1.1** Introduction, Hormones- structure and role as chemical messenger **1.2** Types of hormones-protein and non-protein	02
2	**Chapter 2: Hormone receptors :** **2.1** Receptors on the plasma membrane, cytoplasm & nucleus	02
3	**Chapter 3: Mechanism of hormone action:** 3.1 Mechanism of hormone action- signal transduction cascade.	02
4	**Chapter 4: Endocrine system** **4.1** Hypothalamic hypophysiotropins	02
5	**Chapter 5: Adenohypophysial hormones** **5.1** ACTH, PRL, STH and TSH	04
6	**Chapter 6: Control of chromatophores** **6.1** Pituitary, pineal	02
7	**Chapter 7: Hormonal regulation of carbohydrates, protein & lipid metabolism** 7.1 Pancreatic hormones- glucocorticoids	03
8	**Chapter 8: Osmoregulatory hormones** **8.1** ADH, mineralocorticoids, renin-angiotensin	02
9	**Chapter 9: Regulation of Gastrointestinal tract 9.1** Gastrointestinal hormones.	02
10	**Chapter 10: Endocrine control** **10.1** Control of calcium and phosphate metabolism	02
11	**Chapter 11:Endocrine mechanism in crustacean: 11.1** X & Y organs **11.2** Regulation of metabolism **11.3** Salt and water balance, reproduction **11.4** Colour change, moulting	03

12	**Chapter 12: Chronobiology** **12.1** Introduction, significance, Clocks, Rhythm and Calendar **12.2** The biological timing system: Concepts and methods, Types: Ultradian, circadian and circannual rhythms	03
	COMPARATIVE ANIMAL PHYSIOLOGY	
1	**Chapter 1: Digestion** **1.1 Digestive system:** Physiology of digestion and absorption.	03
2	**Chapter 2: Respiration** **2.1** Respiratory Surfaces: comparison of ventilation associated with gills and pulmonary respiration. **2.2** Blood pigment, role in Oxygen transport. **2.3** O2 dissociation curves physiological and ecological significance, CO2. **Respiratory system :** **2.4** Comparison of respiration in different species, anatomical considerations **2.5** Transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration.	04
3	**Chapter 3: Muscle contraction** **3.1** Structure (light & electron microscopic) of the skeletal muscle **3.2** Proteins of the myofilaments, nature of actin-myosin interaction **3.3** Sarcoplasmic recticulum and role of Ca++ in contraction	04
4	**Chapter 4: Osmotic regulation** **4.1** Concepts of osmole , osmolarity and tonicity, ionic regulation, **4.2** Hyper-and hypo-osmotic regulators, ureosmotic animals.	04
5	**Chapter 5: Excretion, Comparative physiology of excretion** **5.1** Basic processes in urine formation, renal function in animals specially the mammalian kidney **5.2** Renal pressure system, Comparative biochemistry of nitrogen excretion.	04
6	**Chapter 6: Thermoregulation** **6.1** Biokinetic Zones, tolerance and resistance. **6.2** Thermobiological terminologies. **6.3** Compensatory patterns in poikilotherms. **6.4** Critical temp, and zone of thermal neutrality. **6.5** Mechanism of thermoregulation in homeotherms.	04
7	**Chapter 7: Chemical Communication** **7.1** Neurosecretion, neuroheamal & endocrine organs.	03
8	**Chapter 8: Sense organ** **8.1** Classification & functions (details of photoreception as a model).Reflexes, Principles of neural integration.	04

Reference Books:

1.Bentley, P.J. (1998). Comparative vertebrate endocrinology, edn.3, Cambridge University Press, London.

2.Bollander, F. (1994). Molecular endocrinology, edn.2,Acad. Press, SanDiego.

3.Hadely, M.E. (1996). Endocrinology. Edn.4, Prentice Hall, Upper Saddle Park.

4.Thomdyke, M.C. and Goldsworthy, G.J. (1988). Neurohormones in Invertebrates. Cambridge University Press.

5.Hoar, W.S. and Hickman, C.P., Jr. (1983). A laboratory companion for general and comparative physiology. Edn.3, Prenticed- Hall, Englewood Cliffs, N.J., USA.

6.Kobayashi, H. Malsumolo, A. and Ishii, S. (Eds.) (1992).Atlas of endocrine organs: vertebrates and invertebrates. Springer Verlag, Berlin.

7.Zarrow, M.X., Yachim, J.M. and McCarthy, J.L. (1964). Experimental endocrinology: a sourcebook of basic techniques. Academic Press, New York

8.Comparative animal physiology, Clifford Ladd Prosser, John Wiley & Sons

9.Animal physiology, Richard W. Hill, Gordon A. Wyse. Harper and Row

10.Comparative animal physiology, Philip Carew Withers, Saunders College Pub., 1992

Course Code: ZOO52103

Subject Name: Parasitology

Total lectures: 30 **Total Credits: 02**

Prerequisites: - Students should have a basic knowedge about parasites.

Course Objectives:

To introduce general Parasitology

To impart advanced knowledge on various important protozoan parasites including some important microbial parasites.

Course Outcome:-

The students will be able to learn about basics and scope of parasitology.

The students will be able to learn the types of host and parasite with examples.

The students will be able to learn about the morphology, life cycle, pathogenicity and treatment of common parasites (Protists and Platyhelminthes).

The students will be able to learn about host -parasite relationships and their effects on host body.

The students will be able to learn about the arthropod parasites and their role as vector

Unit	Topic	No. Of Lectures
1	**Chapter 1: Host-Parasite systems** 1.1 Preadaptation to infectiousness	07

	1.2 Myasis: Classification according to tissue,vectors specific, sub specific, accidental 1.3 Symptoms, diagnostic, control method prevention, treatment.; Transmission: Types, categories: A. Conspecific: Contact,Transplacental, Transovarian B. Heterospecific: Mechanical (Indirect & Direct),Biological Paratenic, Hyper parasitic, Parasitoidal. 1.4 Manipulation of Host behaviour, Parasitism & Altruism 1.5 Parasites & social behavior of hosts 1.6 Parasitism & life history, parasitic effects benefiting thehost.	
2	**Chapter 2: Type study** 2.1 Classification, geographical distribution, morphology, life-cycle 2.2 Transmission, pathogenicity, treatment and prophylaxis of: 2.2.1 Protozoa: *Trypanosoma* Sps, LeishmaniaSps. 2.2.2 Platyhelminthes: *Schistosoma* Sps., *Echinococcus*Sps. 2.2.3 Nematoda: *Ancylostoma* Sps., *Dracunculus* Sps.	08
3	**Chapter 3: Mycology** 3.1 General Mycology : Fungus – Classification, Fungal Structure & Morphology 3.2 Reproduction in fungi 3.3 Normal fungal flora of human beings. 3.4 Immunity to Fungal Infections 3.5 Diagnostic Mycology - Epidemiology, Pathogenesis, Laboratory Diagnosis of Fungal Infections. 3.6 Specimen collection, preservation, Transportation & Identification of Mycological Agent.	07
4	**Chapter 4: Serology & immunodiagnostic methods** *4.1* Serology & antibody synthesis, preparation & demonstration of specificantigens of *Entamoeba, Plasmodium, Trypanosoma* & *Leishmania* 4.2 Immunodiagnostic assays, Immunodiffusion, haemogglutination test, Radioimmuno assay, ELISA, complement fixation test.	06
5	**Chapter 5: Prophylaxis & control** 5.1 Biological, Genetic, Chemical, Physical & Othermethods.	02

References:

1. Parasitology: K. D. Chatterjee.

2. Parasites: ecology, diseases, and management (2013).

3. Parasitic Helminths: Targets, Screens, Drugs, and Vaccines, 201.

4. Parasitism: The Diversity and Ecology of Animal Parasites (2014) Tim Goater, Timothy M. Goater, Cameron P. and Esch, Gerald W. Cambridge University Press.

5. Principles of Veterinary Parasitology (2016), 1st Edn, Dennis E. Jacobs, Mark Fox, Lynda M. Gibbons, Carols Hermosilla, John Wiley & Sons.

6. Veterinary Parasitology (2013), Hany M. Elsheikha, Jon S. Patterson, CRC Press Taylor & Francis Group

7. Textbook of medical parasitology – C. K. Jayaram Panikar.

8. Textbook of medical parasitology – Arora & Arora.

9. Textbook of medical parasitology – S. C. Parija.

10. Veterinary Parasitology, 2013 - (Taylor, M. A.).

11. Encyclopedia of parasitology, 2008

Course Code: ZOO52104

Subject Name: Environmental Biotechnology

Total lectures: 30 **Total Credits: 02**

Prerequisites: - Students should have a basic knowledge about the environment.

Course Objectives:

Describe various components of environment.

Course Outcome:-

Explain types of pollution and associated pollutants.
Describe waste water treatment process.
Discuss bioremediation technology and its global perspective.

Unit	Topic	No. Of Lectures

1	**Chapter 1: Components of Environment and Global Environmental Problems** Hydrosphere, lithosphere, atmosphere and biosphere – definitions with examples; Interaction of man and environment; Environmental Studies as a multidisciplinary subject. Green House Effect, Acid rain, El Nino Effect, Ozone depletion, Biodiversity loss; chemical and radiation hazards.	08
2	**Chapter 2: Environmental pollution and Environmental Management** Pollution of air, water and land with reference to their causes, nature of pollutions, impact and control strategies; noise pollution; Environmental damage by agriculture, Perspectives of pollution in urban, industrial and rural areas. Habitat Pollution by Chlorinated Hydrocarbons (DDT, PCBs, Dioxin etc.), Organophosphates, Heavy Metals, Die-offs, Endocrine disrupting chemicals, Nutrient pollution. Environmental Management – Concept of health and sanitation. Environmental diseases – infectious (Water and air borne) and pollution related, spread and control of these diseases, health hazards due to Pesticide and metal pollution, waste treatment, solid waste management, environmental standards and quality monitoring.	10
3	**Chapter 3: Waste water treatment and management** Domestic Waste Water Treatments: Primary, Secondary and Tertiary. Important microorganisms in waste water treatment, Microbial kinetics Waste water treatment Reactors: Introduction and types in brief Aerobic Biological Treatments: Activated sludge process, Lagoons Aerobic biofilm processes- Trickling filter and biological towers,	06
	Rotating Biological Contactors, fluidized-bed and circulating –bed biofilm reactors; Anaerobic Biological Treatments: up flow anaerobic sludge blanket (UASB) reactor, Fluidized bed reactors	
4	**Chapter 4: Biodegradation and Bioremediation** Biodegradation: Definition and Concept, Aerobic and Anaerobic degradation pathways in Microbes. Biodegradation of Hydrocarbon with Suitable Examples, Xenobiotics biodegradation-pesticide biodegradation with suitable example Bioremediation: Introduction, Definition and Concept, Methods of Bioremediation (In Situ and Ex Situ Methods) Phytoremediation: Concept and Types.	06

References:

1.Environmental Biotechnology: Theory and Applications (2003), Evan G. M. and Furlong J.C, John Wiley and Sons Ltd., England.

2.Environment: Problems and Solutions (2001), Asthana D.K. and Asthana M., S. Chand and Company Ltd, New Delhi.

3.Introduction to Environmental Biotechnology (2004) Chatterji A.K. Prentice Hall of India Pvt. Ltd, New Delhi.

4.Environmental Biotechnology (2006),3rd Edi. Jogdand S.N., Himalaya Publishing House, Mumbai.

5.Environmental Science and Biotechnology: Theory and Techniques (2005). Murugesan A.

G. and Rajkumari., C, MJP Publishers, Chennai.

6.Environmental Biotechnology Principles and Applications. (2001) Rittmann B. E. And McCarty P. L, McGraw Hill, USA

7.Waste water engineering and management (1972) Eddy and Metcalf Tata Mac Graw-Hill.

Course Code: ZOO52201

Subject Name: Ichthyology

Total lectures: 30 Total credits: 02

Prerequisites: - Students should have a basic knowledge about the environment.

Course Objectives:

Understand the common fishes of India

Course Outcome:-

Explain the general characters and evolution of fishes.

Explain the fish morphology, anatomical modifications and physiology.

Illustrate the physiology of reproductive and endocrine organs in fish.

Discuss the signs, symptoms and control measures of common diseases in fish.

Unit	Topic	No. Of Lectures
1	**Chapter 1:** 1.1 Introduction, general characteristics, evolutionary succession and fossil history of fishes. 1.2 The early evolution of fishes: Chondrichthian fishes - Sharks, Skates and Rays.	03

2	**Chapter 2:** 2.1 Eschmeyer's classification of fishes and diagnostic characters up to orders(one major order from each class).	04
3	**Chapter 3:** 3.1 External morphology, body form, appendages, pigmentation, skin and scales.	01
4	**Chapter 4:** 4.1 Food and feeding habits	02
	4.2 Digestive system and its anatomical modifications.	
5	**Chapter 5:** 5.1 Respiratory mechanism: Respiratory gills and lungs. 5.2 Accessory respiratory organs: 5.3 Origin of air breathing organs; skin, buccopharynx opercular cavity and air bladder.	02
6	**Chapter 6:** 6.1 Circulatory system: Heart and accessory pumps.	02
7	**Chapter 7:** 7.1 Excretion and Osmoregulation: Glomerular and aglomerular kidneys; 7.2 Nitrogen (ammonia, urea, TMAO) excretions. Water and salt balance in steno- and euryhayline fishes. 7.3 Role of skin and gills.	03
8	**Chapter 8:** 8.1 Reproduction: Structure of gonads, gametogenic cycles; spawning.	02
9	**Chapter 9:** 9.1 Nervous system and Sense organs: 9.2Organization of the central and peripheral nervous systems. 9.3 Olfactory, taste buds, touch receptors, photoreceptors, lateral line and internal ear	03
10	**Chapter 10:** 10.1 Endocrine system: Pituitary gland, urohypophysis, adrenal gland, gonads, and thyroid gland.	02

11	**Chapter 11:** 11.1 Fish pathology: Signs of sickness and effects on fish; 11.2 Pathological procedure for diagnosis offish diseases, 11.3 Symptoms and control measures of viral, bacterial, fungal, protozoan, worm and crustacean diseases.	02
12	**Chapter 12:** 12.1 Ornamental Fish production and management: World trade of ornamental fishes. 12.2 Different varieties of exotic andindigenous ornamental fishes. 12.3 Principles of a balanced aquarium. 12.4 Fabrication, setting up and maintenance of freshwater aquarium. 12.5 Water quality management. Water filtration system – biological, mechanical and chemical. 12.6 Types of filters. Aquarium plants and their propagation methods. Lighting and aeration. 12.7 Aquarium accessories and decoratives. Aquarium fish feeds. Dry, wet and live feeds. 12.8 Breeding and rearing of ornamental fishes. 12.9 Common diseases and their control. 12.10 Conditioning, packing, transport and quarantine methods. 12.11 Trade regulations and wild life act in relation to ornamental fishes.	04

References:

(1) An Introduction to fishes-S.S.Khanna.

(2) Fish and Fisheries of India-V.G.Jhingran.

(3) Fish and Fisheries –A.R.Shukla

(4) Fish and Fisheries-B.N.Yadav.

(5) Ichthyology-Lagler,Bardach,Passino & Miller

(6) Fundamentals of Ichthyology-Gupta,Guhalwat,Yadav,Jain

(7) Fundamentals of Ichthyology-S.P.Biswas

(8) General and Applied Ichthyology-S.K.Gupta,P.C.Gupta.

(9) An Introduction to fishes-G.S.Sandhu.

(10) Fish Biology-C.B.L.Srivastava

(11) A Textbook of Fish Biology and Fisheries- S.S.Khanna and H.R.Singh

Course Code: ZOO52105
Subject Name: Zoology Lab- III
Total Credits: 02

	Module-I Molecular Biology and Bioinformatics	
1	Lab Safety Techniques and sterilization**.**	**1P**
2	Isolation of bacterial DNA and estimation by UV spectrophotometry **(Compulsory)**	2**P**
3	Isolation of Liver DNA and quantification, Agarose gel electrophoresis of isolated DNA**.(Compulsory)**	**2 P**
4	Isolation of RNA and agarose gel electrophoresis.	**1 P**
5	Concept of biological database, gene and protein search by BLASTA and FASTA **(Compulsory)**	**1 P**
6	To analyse protein on native PAGE and SDS-polyacrylamide gel electrophoresis.**(Compulsory)**	**2P**
7	Construction of phylogenetics tree for DNA and protein **(Compulsory)**	**1P**
8	Demonstration of DNA amplification by PCR	**1P**
Module-II Parasitology and Environmental Biotechnology		
1	Study of life cycle, role as vector & control measures of:Ticks(*Argas, Boophilus*) Mosquito – any two from- *Anopheles/ Aedes/ Culex* Any two flies: *Tabanus/ Phlebotomus/ Sarcophaga*.Cyclops. **(Compulsory)** (Specimen, Slides or charts may be used.)	**1P**
2	Ectoparasites & Endoparasites of wild rat, cattle, dog, chick & human including stages in excreta.	**2P**
3	Study of life cycle of parasitic protozoa: *Trypanosoma, Leishmania.***(Compulsory)**	**1P**
4	Study of life cycle of helminth parasites: *Schistosoma. Echinococcus, Ancylostoma, Dracunculus***(Compulsory)**	**2P**
5	Study of Parasites from digestive tract of Cockroach/gut / parasites of hen. (Compulsory)	**1P**

6	A visit to aquatic ecosystem and methods for water and plankton collection**. (Compulsory)**	**1P**
7	Plankton identification and quantification from river / lake water samples.**(Compulsory)**	**1P**
8	Vegetation studies by line, quadrates and belt transect methods and their analysis.	**2P**
9	Preparation of media for microbial culture, Isolation and culturing of microbes from soil/water samples**. (Compulsory)**	**2P**
10	Water analysis for physico-chemical characteristics**.(Compulsory)**	**1P**
11	Physico-chemical analysis of soil. **(Compulsory)**	**1P**

Course Code: ZOO52202
Subject Name: Zoology Lab- IV
Total Credits: 02

	Module-I Endocrinology and Comparative Animal Physiology	
1	Histology of invertebrate and vertebrate neurosecretory and endocrine structures.(Compulsory)	**1P**
2	Blood sugar regulation in the crab- role of eye stalk. **(Compulsory)**	**1P**
3	Study of retrocerebral complex of the cockroach.	**1P**
4	Introduction of alloxan diabetes in the mouse/ rat / human. **(Compulsory)**	**1P**
5	Gonadectomy in the mouse/ rat.	**2P**
6	Pancreatectomy in the mouse/ rat.	1P
7	Effect of insulin on blood sugar, hepatic and muscle glycogen of the rat/human. **(Compulsory)**	1P
8	Thyroidectomy in the rat.	1P
9	Study of nitrogenous waste products of animals from different habitats**.(Compulsory)**	1P
10	Study of RBCs in different vertebrates and in different physiological conditions.	1P
11	Study of relation of Body size and oxygen consumption in aquatic animals(crab/fish). **(Compulsory)**	1P

12	Estimation of sugar in rat/crab/human blood. **(Compulsory)**	1P
13	Determination of bleeding time & clotting time of human blood.**(Compulsory)**	1P
14	Determination of the heart beat in the crab-effect of temperature & ions.	1P
15	Effect of eye stalk ablation on glucose in the haemolymph of the crab.	1P
Module II: Ichthyology		
1	Study of fish evolution with the help of charts/models/Pictures.	**1P**
2	General external characters, fins and scales (permanent slides & temporary preparations and submission during examination).	
3	Classification of fishes (one example from each order); use of diagnostic keys.	**2P**
4	Length-weight relationship, condition factor, gonado-somatic index of any one fish species.	**1P**
5	Adaptations of fishes (adhesive organs, accessory respiratory organs, stomachless fishes, spiral valve, electric organs and sense organs.)	**1P**
6	Study of Weberian ossicles in Heteropneustes/ Labeo.	**2P**
7	Anatomical observations, demonstration and detailed explanation of fish in general, Digestive, urino-genital system, Endocrine glands of carp/ catfish/ Tilapia.	**2P**
8	Identification of fish developmental stages: egg, spawn, fry fingerling and adult.	**1P**
9	Cranial nerves (V, VII, IX & X) and eye ball musculature and innervations in Scoliodon/ carp/ catfish.	**1P**
10	Histology of digestive, respiratory, excretory, reproductive and endocrine organs.	**1P**
11	Study of common diseases in fish their diagnosis and control strategies.	**1P**
12	Setting up of an aquarium and its management and study of breeding behaviour of gourami, Siamese fighting and swordtail.	**2P**
13	Visit to fish farm/ fish breeding centre/fish market and preparation of detail visit report.	**1P**

Course Code: ZOO52401 **Name of the Course: OJT/FP (4C)**

Chairman,

Board of Studies in Zoology

Progressive Education Society's

Modern College of Arts, Science and Commerce Ganeshkhind, Pune 16

(An Autonomous College Affiliated to Savitribai Phule Pune University)

Two Year Degree Program in

Statistics (Faculty of Science &

Technology)

M.Sc. (Statistics) Part-I

Choice Based Credit System (REVISED) Syllabus under NEP

To be implemented from Academic Year 2024-25

Title of the Course: M. Sc. (Statistics)

Preamble:

M. Sc. Statistics (Honors) program is of semester pattern. There will be 2 semesters and in each semester a syllabus of 14 credits (Disciplinary Major Mandatory) +4 Credits (DSE Electives) +4 credits(Research Methodologies) will be covered. And in the 2nd semester along with this 4 credits for on job training will be discovered. The program is structured so as to increase the employability of the candidates in industry, academics and other by providing knowledge and skills in depth. Accordingly, the program has important features such as individual/ group projects, elective courses and courses on standard software packages such as MATLAB, MINITAB, SPSS, R. Syllabus of the first two semesters covers core courses. It is possible for the students to study basic courses from other disciplines such as economics, life sciences, computer science, and mathematics in place of electives.

Introduction:

(a) The program consists of core courses which may be compulsory or electives.

(b) In addition, there are lab courses (practical) and a project course.

(c) Some courses are termed Open Courses (O). The open courses are those which can be offered to other departments.

For every course, there will be Continuous Internal Assessment (CIA) conducted by department or college and End of Semester Examination (ESE) conducted by the college at the end of semester.

Structure of the Syllabus:

Following is the structure of two year M.Sc. Statistics program.

T: Theory P: Practical O:Open C: Compulsory

E: Elective M.Sc.(Statistics)-Part I

Course Code	T/P	O/C/ E	Title	Credits	ESE Duration	Marks Assigned
Semester I						
STA51101	T	C	Basics of Real Analysis	2	2 Hours	50
STA51102	T	C	Multivariate Analysis	4	4 Hours	100
STA51103	T	C	Stochastic Processes	4	4 Hours	100
STA51105	T	E	Machine learning	2	2 Hours	50
STA51107	T	E	Numerical Methods	2	2 Hours	50
STA51104	P	C	Practical based on Real Analysis, Multivariate Analysis, Stochastic Processes	4	8 Hours	100
STA51106	P	E	Practical based on Machine learning	2	4 Hours	50
STA51108	P	E	Practical based on Numerical Methods	2	4 Hours	50
STA51209	T	C	Research Methodology	2	2 Hours	50
STA51210	P	C	Research Methodology	2	4 Hours	50
			Total	**22**		**550**
Semester II						
STA52101	T	C	Linear Algebra	2	2 Hours	50
STA52102	T	C	Bayesian Analysis	4	4 Hours	100
STA52103	T	C	Time series and Econometrics	4	4 Hours	100
STA52105	T	E	Categorical data analysis	2	2 Hours	50
STA52107	T	E	Sampling Methods	2	5 Hours	50
STA52104	P	C	Practical based on Linear Algebra, Bayesian Analysis, Time series and Econometrics	4	8 Hours	100
STA52106	P	E	Practical based on Nonparametric inference	2	4 Hours	50
STA52108	P	E	Practical based on Power BI	2	4 Hours	50

STA52109	P	C	OJT	4	8hours	100
			Total	**22**		**550**

Semester I

STA51101: Basics of Real Analysis **No. of credit : 02**

Course Outcomes:-On completion of the course, the students will be able to:

CO1) Differentiate between various distributions with respect to their probability function and probability curve

CO2) Compute moments and hence shape of the distribution

CO3) Interrelations between the distributions

CO4) Real life situations where they can use the probability distributions as models

Unit1: Set Theory **[7 Hours]**

- Review of Set theory, Set of real numbers
- Supremum and infimum of sets of real numbers,
- Archimedean principal,
- countable and uncountable sets, countability of rational numbers, uncountability of real numbers, Metric space, Properties of metric space
- Neighborhood points, Exterior and interior points , boundary points , limit points, open , closed and compact sets.
- Bolzano – Weierstrass and heine- Borel theorem.

Unit2: Sequence and series **[7 Hours]**

- **Sequence**
  - ★ limit of sequence and its properties,
  - ★ Convergence and divergence of sequence Cauchy sequence and related theorems
  - ★ (Cauchy criteria of convergence),
  - ★ subsequence and their convergence and divergence, convergence of bounded monotone sequence.
- **Series**
  - ★ Convergence and divergence of series of real numbers,
  - ★ test for convergence (root test, ratio test) (without proof)
  - ★ absolute convergence (without proof), uniform convergence,
  - ★ power series , radius of convergence of power series (Binomial , Exponential, geometric and log series),
  - ★ term by term differentiation (integration) of absolute convergent series, change of order of summation of series.,

Unit4: Integral **[7 Hours]**

- **Riemann and Riemann –Stieltjes integral:**
  - ★ Partition of interval, norm of partition, finer partion, tagged partion,

- ★ Upper and Lower Riemann and R-S sums, order relation between Upper and Lower Riemann sums.
- ★ Effect of finer partition on the difference between Upper and Lower Riemann sums.
- ★ Necessary and sufficient condition for a function to be R and R-S integrable
- ★ Properties with proof
  (i) Continuous bounded function is R and R-S integrable
  (ii) Monotonic bounded function is R and R-S integrable
  (iii) Fundamental theorem of integral calculus.

- **Improper integrals: Definition, convergence of an integral,**
  - ★ P- integral , exponential integral test for convergence (comparison test),
  - ★ convergence of beta and gamma integrals, relationship between beta and gamma functions

Sr. No.	Name of the Book	Author	Publisher
1	Introduction to probability models	Ross, S. (2000), 7th Edition	Academic Press
2	Stochastic processes	MedhiJ. (1982)	Wiley Eastern
3	Introduction to stochastic processes	Hoel ,P.G.,Port, S.C. ,Stone, C.J. (1972)	
4	Stochastic models: Analysis and applications	Bhat, B.R. (2000)	New Age International
5	An introduction to finite Markov processes	Adke, S.R., Manjunath, S.M. (1984)	Wiley Eastern
6	Stochastic processes (John Wiley)	Ross, S. (1996)	John Wiley
7	An introduction to stochastic modeling	Taylor, H N and Karlin, S. (1984)	Academic Press
8	Modeling and Analysis of Stochastic Systems	VidyadharG. Kulkarni	CRS Press Publications.
9	Stochastic modeling and its Applications	Tijms S	Wiley Publishers

STA51102: Multivariate Analysis

Course Outcomes:-On completion of the course, the students will be able to:

CO1) Differentiate between various distributions with respect to their probability function and probability curve

CO2) Compute moments and hence shape of the distribution

CO3) Interrelations between the distributions

CO4) Real life situations where they can use the probability distributions as models

Unit 1: [15 Hours]

- Exploratory multivariate Data Analysis: Sample mean vector, Dispersion Matrix, Correlation Matrix, Linear transformation and its mean and variance, graphical interpretation.
- Principal component Analysis (by using covariance and correlation method, standardized method) , Factor analysis (Their models, rotation types) , Canonical correlation with real life

Unit 2: [15 Hours]

- Cluster analysis (Hierarchical and Non hierarchical, Agglomerative, Single, complete, average , Wald's linkage , K- mean clustering method , qualitative method clustering)
- Multivariate normal distribution , Singular and nonsingular normal distribution , mean , variance of multivariate normal distribution, independence of variable ,M.G.F, Characteristic function, moments , Distribution of linear and quadratic form of normal variables, marginal and conditional distribution, multiple and partial correlation coefficient (3 random variable case)with examples on each of the topic.

Unit 3: [15 Hours]

- MLES of parametric of multivariate normal distribution and their sampling distribution, Tests and confidence region for the mean when dispersion matrix is known,
- Wishart distribution (generalized case of chi-square) and its properties
- Hotelling T^2 statistic and its distribution, applications of Hotelling T^2 statistic.
- Beharen- Fishers problem , confidence region for mean vector of multivariate normal distributions

Unit 4: [15 Hours]

- MANOVA technique , Likelihood ratio test , Test for equality of dispersion matrices, Discriminant analysis (by using prior probabilities , by using cost), Fisher Discriminant analysis, Mahalanobis D^2 Statistics

Sr. No.	Name of the Book	Author	Publisher
1	Introduction to Multivariate Analysis	Anderson, T. W. (1984)	John Wiley
2	Symmetric Multivariate and RelatedDistributions	Fang ,K., Kotz, S., Ng K. W. (1990)	Chapman and Hall
3	Applied Multivariate Statistical Analysis	Härdle, W. K. & Simar, L. (2012)	Springer, New York
4	Multivariate Statistics: Exercises andSolutions	Härdle, W. K., Hlávka, Z. (2007)	Springer, New York
5	Applied Multivariate Statistical Analysis	Johnson R.A. &Wichern, D.W. (1988)	Prentice Hall Inc.
6	Continuous Multivariate Distributions, Volume 1, Models and Applications,	Kotz, S., Balakrishnan N. and Johnson N. L. (2000)	John Wiley & Sons
7	Multivariate Analysis	Kshirsagar, A. M. (1983)	Marcel Dekker
8	Directional Statistics	Mardia,K. V. and Jupp, P. E. (2000)	John Wiley & Sons
9	Multivariate Statistical Methods,	Morrison, D.F. (1990)	McGraw Hill Co

STA51103: Stochastic Processes **No. of credit : 04**

Course outcomes: On completion of the course, the students will be able to:

CO1) Understand Markov chain process and apply it to the Birth and Death processes

CO2) Learn in detail continuous-time stochastic processes, with topics drawn from: Poisson Processes other Markov pure jump processes Brownian motion Other related Gaussian processes.

CO3) Understand to formulate simple stochastic process models in the time domain

CO4) Able to classify states of a given markov chain.

Unit1: **[15 Hours]**

- Stochastic processes, Markov property, Markov chains (MC), finite MC,
- transition probabilities, initial distribution, illustrations such as random walk, Ehrenfest chain, gambler's ruin chain, queuing chain, birth death chain, branching chain,
- Chapman Kolmogorov equation, n-step transition probabilities, transition probability matrix (t.p.m.) hitting times,

- probability of ever return, transient and recurrent states, decomposition of state space,
- closed set of states, irreducible set of states, irreducible MC, absorption probabilities, martingales,
- classification of states of birth and death chains, branching chain, queuing chain, random walk, gambler's ruin chain with absorbing ,
- reflecting and elastic barrier, etc. probability of ruin cases
- expected gain, expected duration of the game.

Unit2: **[15 Hours]**

- Elementary properties of stationary distributions, illustrations such as birth and death chains,
- Ehrenfest chain, particles in box, average number of visits to recurrent state, non null and positive recurrent states,
- probability of absorption in persistent class starting from transient state,
- period of state, existence of uniqueness of stationary distributions, reducible chains, illustrations such as queuing chain finite chains,
- convergence to the stationary distribution. Steady state distribution, ergodic Markov chain, Ergodic theorem.
- Branching Chain: BGW branching process, offspring distribution, mean and variance, generating function for probability of ultimate extinction, nth generation size and related recurrence relations

Unit3: **[15 Hours]**

- Intensity rates, it's relation with transition probabilities. Kolmogorov consistency condition, Markov property in continuous time stochastic processes. Kolmogorov forward and backward equations.
- Poisson process: Postulates and properties of Poisson process, probability distribution of N(t) the number of occurrences of the event in (0,t], Poisson process and probability distribution of interarrival time, generalizations of Poisson process: pure birth process: Yule Furry process. Non-homogeneous Poisson processes
- Renewal process: renewal process in continuous time, renewal function and renewal density, renewal equation, stopping time: wald's equation, elementary renewal theorem and its applications: (i) Age and block replacement policies, (ii) Replacement on failure and block replacement, renewal theorems (Blackwell's and Smith's)

Unit4: **[15 Hours]**

- Birth and death process: (i) Pure-Birth process , Yule Furry Process (ii)Pure death process, particular cases: Birth immigration process. (i) immigration-emigration process, (ii) linear growth process, (iii) linear growth with immigration, (iv) immigration death process.
- Continuous time Markov chains: Markov processes with continuous state space: Introduction to Brownian motion and its properties, Transition probabilitiesBrownian motion process as limiting case of random walk.Wiener process and its properties.

Sr. No.	Name of the Book	Author	Publisher
1	Introduction to probability models	Ross, S. (2000), 7th Edition	Academic Press
2	Stochastic processes	MedhiJ. (1982)	Wiley Eastern
3	Introduction to stochastic processes	Hoel ,P.G.,Port, S.C. ,Stone, C.J. (1972)	
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8	Modeling and Analysis of Stochastic Systems	VidyadharG. Kulkarni	CRS Press Publications.
9	Stochastic modeling and its Applications	Tijms S	Wiley Publishers

STA51104: Practical based on Real Analysis, Multivariate Analysis and StochasticProcesses

No. of credit : 04

Sr. No.	Name of Practical	No of Practical
1	Exploratory Multivariate Analysis	1
2	Contour Plots	1
3	Principal Component Analysis	1
4	Factor Analysis	1
5	Cluster Analysis	1
6	Canonical Correlation	1
7	Model Sampling From multivariate Normal Distribution and Computation of M.L.E's of Parameter	2
8	Discriminant Analysis	2
9	Application of Hotelling T square	2
10	Realization of Markov Chain When TPM is given and computation of transition probabilities and stationary distribution of markov chain	1
11	Classification of States (persistent ,transient ,ergodicity)	1
12	The Realization of Poisson process	1
13	Realization of Birth and Death process	1
14	Realization of Gausian and Brownian Motion	1
15	Verify for the Convergence of Sequence	1
16	Verify for the convergence of Series	1
17	Practical based on Rieman integral	1
18	Practical based on Rieman Steilje's integral	1
19	Application of Hessian matrix	1
20	Manual Practical on integration	2
21	Project equivalent to 5 practicals	5
Total Number of practical		30

STA51105: Machine Learning **No. of credit : 02**

Course Outcomes:

After completion of the course, students will be able to:

CO1) Apply appropriate learning algorithm for analyzing data.
CO2) Use appropriate R-packages for data analysis.
CO3) Design learning algorithms for new tasks.
CO4) Self-learn many other ML techniques.
CO5) Be a better data scientist

Unit1: **[15 Hours]**

- Need for and meaning of Machine Learning (ML).
- Various ML tasks.Framework of ML environment.
- Relationship with other fields such as Data Mining, Statistics, Data Science, Big Data Analytics.
- Introduction to Classification task and optimality of Bayes rule.Generative and
- discriminative approaches to classification problems.
- Nearest neighbor classifier,
- Naïve Bayes classifier,
- Linear and non-linear discriminant functions. (15 L)

Unit2: **[15 Hours]**

- SVM Learning.
- Linear separability.Hard and soft margin optimal decision boundaries.
- Kernel trick. Neural Network Learning - basic concepts, Perceptron learning and its limitations, Back-propagation algorithm, Logistic regression,
- Multi class classification with softmax- activation function.

Unit3: **[15 Hours]**

- Decision Tree Learning – Impurity measures, construction of classification tree, tree pruning.
- modifications for regression trees. Ensemble learning-Bagging and boosting, random forests, Cross validation.

Unit4: **[15 Hours]**

- Cluster learning- k-means algorithm, Agglomerative hierarchical clustering.
- Cluster quality. Regression Learning.Linear, non-linear regression.
- Association analysis and some miscellaneous topics.

Sr. No.	Name of the Book	Author	Publisher
1	Data Mining: Concepts and Techniques	Han J., Kamber M., and Pei J (2012)	Elsevier
2	Introduction to Machine Learning	Alex Smola and S.V.N. Vishwanathan (2008), 3rd Edition	Cambridge University Press

3	Data Mining: Practical Machine Learning Tools and Techniques.	Ian H. Witten and Eibe Frank (2005), 2nd Edition	Elsevier

STA51106: Practical based on Machine Learning **No. of credit : 02**

Sr.No.	Title	No of Experiment
1A	Implementation of the K-NN (K nearest neighbor) algorithm for classification problems.	1
1B	Implementation of K-NN (K nearest neighbor) algorithm for Regression problem.	1
2	Implementation of Naïve Bayes Classifier	1
3A	Implementation of Decision tree for classification	1
3B	Implementation of Decision tree for regression	1
4	Ensemble learning-Bagging and boosting	1
5A	SVM learning for classification	1
5B	SVM learning for regression	1
6	Implementation of k means clustering	1
7	Implementation of A priori algorithm	1
8	Project (equivalent to 5 Practicals)	5
Total Number of practical		**15**

STA51107: Numerical Methods **No. of credit : 02**

Course Outcomes:

After completion of the course, students will be able to:

CO1) Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.

CO2) Apply numerical methods to obtain approximate solutions to mathematical problems.

CO3) Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations**.**

Unit 1 : [10 Hours]

- Riemann and Riemann- Stieltjes Integral, applications in Statistics.

Uni2: [5 Hours]

- **I**mproper integrals of first and second kind for one variable
- Conditions for convergenceof beta and Gamma functions , relation between beta and gamma functions, properties of beta and gamma functions
- Duplication formula. Implict function Theorem / Inverse function theorem and their simple applications.

Uni3: **[**15 Hours]

- (i)Newton–Raphson method for two or more simultaneous transcendental equations, (ii) Newton's bivariate interpolation formula, (iii) Unconstrained optimization : Grid search method, Gradient search : Seepest descent method ,Newton's , method. (iv) Simpson's , Trapezoidal rule for bivariate integrals; (v) Simulation : Linear congruential generator ; Monte Carlo method to evaluate single and multiple integrals. (vi) Jack – Knife estimators. (vii) Boot-Strap method

Sr. No.	Name of the Book	Author	Publisher
1	Principles of Mathematical Analysis	Rudin W.(1985)	McGraw – Hill
2	Mathematical Analysis: A Modern Approach toAdvanced Calculus	Apostol T. M. (1975)	Addison - Wesley
3	Elements of Real Analysis	Bartle R. G. (1976)	Wiley
4	Mathematical Analysis	Bhat, B.R. (2000)	Wiley Eastern Limited2nd edition)

STA51108: Practical based on Numerical Methods **No. of credit : 02**

Sr.No.	Title	No of Experiment
1	Simultaneous Transcendental equations N- R method.	2
2	Grid search , steepest descent and Newton's Method of optimization.	3

3	Bivariate interpolation.	2
4	Computations of double integral	2
5	Numerical integration using simulations.	2
6	Computation of integral by Riemann and Riemenn – Stiltjes sums.	2
7	Boots Trap method	1
8	Jack knife method	1
Total Number of practical		**15**

ssemester II

STA52101: Linear Algebra

Course Outcomes:-On completion of the course, the students will be able to:

CO1)Learn about the concept of linear independence of vectors over a field, and the dimension of a vector space.

CO2) Basic concepts of linear transformations, dimension theorem, matrix representation of a linear transformation, and the change of coordinate matrix.

Unit 1 **[9 Hours]**

- Vector space, subspace
- Linear dependence and independence
- Basis of vector space, Dimension of a vector space, orthogonal and orthonormal vectors, orthonormal basis, Gram- Schmidt orthogonalization Matrix algebra, special types of matrices,orthogonal matrix, idempotent matrix partitioned matrices, elementary operations, rank of a matrix, inverse of a matrix

Unit 2 **[9 Hours]**

- Characteristic roots of a matrix,right and left characteristic vectors
- Properties of characteristic roots and vectors, algebraic and geometric multiplicities
- Spectral decomposition, nth power of a matrix, Cayley- Hamilton theorem.

Unit 3 **[12 Hours]**

- g-inverse, Moore-Penrose g-inverse, solution of a system of homogeneous
- and non- homogeneous linear equations. Gauss seidel and Gauss Jacobi iterative methods.
- Quadratic forms, definition, reduction and classification,simultaneous reduction of two quadratic forms, maxima and minima of ratio of quadratic forms.

Sr. No.	Name of the Book	Author	Publisher
1	Matrix Algebra Useful for Statistics	Searle S.A.(1982):	Wiley
2	An introduction to linear Statistical models Volume I,	Graybill (1961):	Mc Graw Hill
3	Linear Statistical Inference and its Applications	Rao C.R. (1973)	Wiley Eastern

STA52102: Bayesian Analysis

Unit1: [15 Hours]

- Subjective and frequentist probability ,
- Bayesian inference set up, prior and posterior distributions,
- loss functions, principles of minimum expected posterior loss, quadratic and other loss functions,
- advantages of being Bayesian ,
- improper priors ,Common problems of Bayesian Inference,
- point estimation, maximum a posteriori estmatior (MAP) ,HPD confidence intervals, credible intervals,
- predictions of future observations, Bayesian testing.

Unit2: [15 Hours]

- Bayesian analysis with subjective priors ,
- classes priors, conjugate class of priors,
- Jeffreys prior, probability matching prior,
- robustness and sensitivity.

Unit3: [15 Hours]

- Bayesian model selection BIC,
- Bayes factors, limit of posterior distributions,
- consistency and asymptotic normality of posterior distributions

Unit4: [15 Hours]

- Bayesian computing, E-M Algorithm ,
- MCMC, MH Algorithms ,
- Gibb' sampling ,
- convergence diagnostics. (Note: Minimum 10 hours of computational practice)

Sr. No.	Name of the Book	Author	Publisher
1	Introduction to Bayesian Statistics	Bolstad W M(2007), 2nd Edition	Wiley
2	Bayesian Ideas and Data Analysis: An introduction for Scientists and Statisticians	Christensen R. Johnson W. Branscum A. and Hanson T. E.(2011)	Chapman and Hall
3	Bayesian Statistical Modeling	Congdon P (2006)	Wiley
4	An Introduction to Bayesian Analysis :Theory and Methods	Ghosh J.K., Delampady M. and T.Samantha(2006)	Springer
5	Bayesian Computation with R	Jim A (2009), 2nd Edition	Springer
6	Bayesian Thinking Modelling and Computation, Handbook of Statistics	Rao C. R. and Day D. (2006), Vol 25	Elsevier

STA52103: Time Series and Econometrics

Course Outcomes:On completion of the course, the students will be able to:

CO1) To learn and develop scientific view to understand the time series data and its analysis.

CO2) To learn stationary and non-stationary, and seasonal and non-seasonal time series modeEstimate model parameters and compare different models developed for the same dataset in terms of their estimation and prediction accuracy.ls.

CO3) Learn to create POWERFUL reports and dashboards with Microsoft Power BI with a few clicks of the mouse

CO4) To learn some basic concepts of econometrics.

Unit1: **[15 Marks]**

- Inference in Econometric Models: Simultaneous equation models – endogenous and exogenous models,

- Problems with OLS estimators, Identification problem and reduced models. Indirect Least Squares Method,
- 2 stage and 3 stage OLS estimation.
- Properties of the estimators.Indirect Inference in Econometric models. (12 L)

Unit2: **[15 Marks]**

- Time - series as a discrete parameter stochastic process.
- Exploratory time Series analysis, Autocovariance and autocorrelation functions and their properties.
- Methods of estimation and elimination of trend and seasonality: Graphical method, Moving average, exponential smoothing and least square method.
- Testing the estimated noise sequence: The sample ACF, the Portmanteau tests, the turning point test, the difference sign test and the rank test.
- Holt -Winters smoothing. Forecasting based on smoothing, adaptive smoothing.

Unit3: **[15 Marks]**

- Stationary processes: General linear processes, moving average (MA), auto regressive (AR) and autoregressive moving average (ARMA) processes.
- Causal and non-causal process, Stationarity and inevitability conditions.
- Non-stationary and seasonal time series models: Auto regressive integrated moving average (ARIMA) models, Seasonal ARIMA (SARIMA) models,
- Transfer function models (Time series regression). (12L)

Unit4: **[15 Marks]**

- Forecasting in time series models, Durbin-Levinson algorithm, innovation algorithm (without proof).
- Estimation of mean, autocovariance and autocorrelation functions, Yule-Walker estimation, Estimation of ARIMA models parameters, maximum likelihood method, large sample theory (without proofs).
- Choice of AR and MA periods, FPE, AIC, AICc, BIC, residual analysis and diagnostic checking.
- Unit-root non stationarity, unit-root tests (Dickey-Fuller).

Sr. No.	Name of the Book	Author	Publisher
1	An Introduction to Time Series Analysis	Brockwell, P.J. and Davis	Springer
2	Time Series Forecasting	Chatfield, C. (2001)	Chapman & hall, London

3	Time Series Analysis using R	Chatfield, C. (2007).	Chapman & hall, London
4	Introduction to Statistical Time Series	Fuller, W. A. (1996)	John Wiley
5	Time Series Analysis.	Hamilton N. Y. (1994).	Princeton University press. Princeton
6	Time Series	Kendall, Sir Maurice and Ord, J. K. (1990), 3rd Edition	Edward Arnold
7	Applied Time Series Econometrics	Lutkepohl, H. and Kratzing, M. (Ed.) (2004).	Cambridge University Press, Cambridge
8	Time Series Analysis & Its Applications	Shumway, R. H.andStoffer D. S. (2010)	Springer, New York
9	Introduction to time series	Tsay, R. S. (2010).	Wiley.

STA52104: Practical based on Linear Algebra, Bayesian Analysis, and Time series and Econometrics

Sr. No.	Name of Practical	No of Practical
1	Matrices :Properties of matrices ,Row Space ,Column space and Null Space	2
2	Inverse of square matrix (Direct method ,g inverse ,MPg inverse,partitioning method)	1
3	Gram Schmidt orthogonalization: Forming an orthogonal matrix of specified order using Gram Schmidt orthogonalization	1
4	Eigenvalue ,Eigen vectors ,spectral decomposition and power of matrix (Spectral Decomposition)	2
5	Solution of System of linear equation using Gauss elimination ,Gauss Jordan elimination ,Gauss Seidel and gauss Jacobi methods	2
6	Classification and reduction of quadratic forms ,Verification of Cayley Hamilton theorem	1

	Estimation of mean and autocovariance of given time series.	1
7	Smoothing the series using various Filters and Estimation of trend and seasonal component	1
8	Calculating and plotting ACF and PACF	1
9	Simulation of AR and MA models and Fitting of AR, MA Models.	1
10	Fitting of ARMA, AIMA and SARIMA model	2
11	Forecasting using Holt Winters method	2
12	Fitting of suitable time series model and calculation of FPE, AIC, AICc, BIC, residual analysis and diagnostic checking.	1
	Testing the stationarity of time series.	1
13	Order selection in time series: use of ACF/PACF and ATC, BIC, fitting of AR, MA models	1
15	Plotting the Prior and posterior density functions and likelihood function on the same graphs paper	1
16	Generating random samples from different posterior distributions.	1
17	Constructing Highest posterior density credible intervals	1
18	Testing of hypothesis by computing Bayes factor	1
19	Practical based on MH algorithm.	1
20	Project (equivalent to 5 Practicals)	5
Total		30

STA52105: Categorical data analysis

Course Outcomes: On completion of the course, the students will be able to:

CO1) Appreciation of difference between linear models and logistic and log-linear models.

CO2) Knowledge of models for categorical data analysis and ability to fit them and interpret the results.

CO3) Awareness of dependence relationships amongst categorical variables.

CO4) Ability to use any related software to fit models for categorical data

Unit 1: **[6 Hours]**

Introduction to Categorical data analysis: categorical response data, Probability distributions for categorical data, statistical inference for discrete data.

Contingency tables: Probability structure for contingency tables, comparing proportions with 2x2 tables, odds ratio, tests for independence, exact inference, extension to three way and larger tables

Unit 2: **[8 Hours]**

Generalized linear models (GLM): GLM for binary data and count data, Statistical inference and model checking, fitting GLMs. Logistic Regression: interpretation, inference, logistic regression withcategorical predictors

Unit 3: **[8 Hours]**

Multiple logistic regression, building and applying logistic regression model, multicategory logit models. Log-linear models for two way and three way tables, inference for log linear models, log linear-logistic connection, independence graphs and collapsibility

Unit 4: **[8 Hours]**

Models for matched pairs: comparing dependent proportions, logistic regression for matched pairs, comparing margins of square contingency tables. Random effects modeling of clustered categorical data, extension to multinomial responses, hierarchical models.

Books Recommended:

Sr. No.	Name of the Book	Author	Publisher
1	Analysis of Categorical Data,	A. Agresti	Wiley, 1990.
2	An Introduction to Categorical Data Analysis	A. Agresti	Wiley, New York

STA62106: Practical based on Sampling Methods

Sr.No.	Title	No of Experiment
1	Practical based on SRSWOR, SRSWR methods	2
2	Practical based on Stratified random sampling, various kinds of allocation, Post stratification, using auxiliary information.	3
3	Practical based on Ratio and regression methods of estimation	2
4	Practical based on pps sampling design	2
5	Practical based on Double sampling	2
6	Practical based on two stage sampling	2
7	Practical based on Systematic sampling	1
8	Practical based on cluster sampling Randomized response technique.	1
Total Number of practical		**15**

STA52107: Sampling Method

Course Outcomes:

At the end of this course, a student will have developed ability to:

CO1) Explain the methods for simple random sampling and estimate the population mean, population total and their variances using simple random sampling methods.

CO2) Explain stratified and systematic sampling methods and estimate the population mean, population total and their variances using these method

CO3) Learn to use ratio and regression method of sampling in proper sampling situation.

Unit1: Introduction to sampling **[7 Hours]**

- Basic methods of sample selection,
- simple random sampling with replacement (SRSWR),
- simple random sampling without replacement (SRSWOR),
- probability proportional sampling with and without replacement

Unit 2: Introduction to Systematic and stratified Sampling [8 Hours]

- systematic sampling, estimation problems
- Horwitz- Thompson estimator and its properties.
- Stratification: Allocation problems and estimation problems, formation of strata and number of strata, method of collapsed strata. Use of supplementary information for estimation

Unit 3: Ratio and Regression method of sampling [15 Hours]

- ratio and regression estimators with their properties and generalizations
- Jackknife methods. Cluster sampling, multistage-sampling. Double sampling procedures,
- Ratio and regression estimators, stratification. Non-sampling errors, response and non-response errors and their treatments, randomized response.

Books Recommended:

Sr. No.	Name of the Book	Author	Publisher
1	Sample Survey Theory	Des Raj and Chandhok, P. (1998)	Narosa
2	Sampling Theory of Surveys with Applications	Sukhatme P.V, Suktatme, B.V., Sukhatme S. and Asok C. (1984)	Indian Soc. for Agricultural Statistics, New Delhi
3	Sampling Techniques	Cochran, W.G. (1984).	Wiley

STA61108: Practical based on BI

Course Outcomes:

CO1) Easily create a wide range of GRAPHS and VISUALISATIONS using drag and drop technologies

CO2) Learn to create Data Models and use the DAX Formula language to develop POWERFUL calculations

CO3) Learn to create POWERFUL reports and dashboards with Microsoft Power BI with a few clicks of the mouse

CO4) PUBLISH reports and dashboards on the Internet and view using laptops, tablets or smartphones in minutes

Unit1: Power BI Introduction **[12 Hours]**

- **I**ntroduction
- · Data analytics and Microsoft .
- Getting Started with Power BI .
- · Get Data from Various Data Sources .
- · Optimize Performance .
- Resolve Data Errors .
- Data Shaping .
- Enhance the Data Structure .
- · Data Profiling
- Programs on this
  - ★ Import given data into Power BI
  - ★ To carry cleaning of data (Trim,Upper Case,Lower Case,Spacing).

Uni2:Designing a data model in power BI **[15 Hours]**

- Introduction to Data Modeling .
- Working with Tables .
- Dimensions
- Visualization of data

- Programs on this unit
  - ★ To create tables from imported data.
  - ★ To Format table using data modeling techniques.
  - ★ Create Bar Plot, Pie Chart,Donut ,water flow chart from the given data

Uni3: . Create Measures using DAX in power BI **[18 Hours]**

- Introduction to DAX .
- DAX Content .
- Advanced DAX .
- Optimize the data model for Performance .
- Optimize DirectQuery Models .
- Create and manage Aggregations .
- Programs on this unit
  - ★ To carry out arithmetic calculations (addition, subtraction, multiplication, division).
  - ★ To carry out making duplicate columns and carry out arithmetic calculations

Unit 4 : Create Dashboards [15 Hours]

- Create a Dashboard.
- Real-time Dashboards.
- Enhance a Dashboard.

- Programs on this unit
    - ★ Get real life data (Primary or Secondary) and make appropriate dashboard.

Progressive Education Society's

Modern college of Arts, Science and Commerce

Ganeshkind, Pune

Faculty of Commerce

Board of Studies: Accountancy

Class: M.Com I Sem I

Subject: Advanced Accounting

Course Code:

Subject Type: DSC

No. of Credit: 02

No. of Lectures: 30

Depth of the program – Advanced Knowledge

Objectives of the course

1. To lay a theoretical foundation of Accounting & Accounting Standards.
2. To gain ability to solve problems relating to Advanced Accounting.
3. To be able to calculate valuation of Shares and Goodwill

Unit No.	Unit Title	Contents	Purpose Skills to bedeveloped	Total Lectures
1	**Liquidation of Company:**	- Meaning and Modes of Liquidation - Liquidators Final Statement of Account - Preparation of the Statement of Affairs - Deficiency Account - Preferential Payment - Preferential Creditors - Liquidators Final Statement	To Prepare Statement of Affairs of the Companies inLiquidation	10
2	**Valuation of Shares:**	**Valuation of Shares -** Need for valuation - Methods of valuation of shares- Net Asserts method, Dividend yield method,Earning yield method, Return on Capital method, Price/Earning method and Fair value method & DCF Method (Discounted CashFlow Method).	In the today's competitive Corporate World to understand the needs and methods of valuation of Shares	10
3.	**Valuation of Goodwill:**	- **Valuation of Goodwill -** Need for valuation - Methods ofvaluing Goodwill - Number of Years purchase of average profits method, Capitalization method - Annuity method - Superprofits method	In the today's competitive Corporate World to understand the needs and methods of valuation of Goodwill	10
		Total Lectures		**30**

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1.	Advanced Accounts	Shukla and Grewal	S. Chand & Co Ltd. New Delhi	Delhi
2.	Advanced Accounts	Jain and Narang	Kalyani Publishers, Ludhiana	Ludhiana
3.	Accountancy, Volume-I and II	Sr. K. Paul	New Central Book Agency, Kolkata	Kolkata
4.	Accounting Theory	Dr. L. S. Porwal	Tata McGraw Hill	

Modern College, Ganeshkhind

Department of Commerce

M.Com Part I, Semester I

Board: Accountancy & Taxation

Subject: - Goods & Service Tax

Course code: - COMM-11106

Credit: 2

Objectives of the course

a. To enable the students to acquire knowledge of Goods & Service Tax

b. To study application procedure of Goods & Service Tax

Unit No.	Unit Title	Contents	Skills to be Developed
1	Introduction of GST	Meaning of GST, Concept, Objectives & Scope, Types of GST, Rates of GST Types of GST returns	Understanding the concepts of GST
2	Application of GST	Input & Output Tax , Reconciliation Statement Notices for defaults in Payments , Reply procedure for Notices	Practical implementation of GST
3	Calculation of Tax Liability	GST - Input Tax Credit GST- Output Tax Liability	Understand to Calculate Tax Liability

Teaching methodology

Topic No.	Innovative methods to be used	No of Lectures	Project	Expected Outcome
1	PowerPoint presentations	10	Types, Rates and Registration	Application of IT for
2	Application through money control, PPT and MS Excel	10	Online Registration	Learn to analyze and identify the process of Online Registration
3	Use of Invoice and GTR	10	-------	Understand the calculation of GST

Books:

GST books of ICFAI

GST books issued by Governments

Vyapari Mitra

Website :
Government Websites

Modern college of Arts, Science and Commerce
Ganeshkind, Pune
Faculty of Commerce
Board of Studies: Accountancy

Class: M.Com I

Subject: Income Tax

Course Code:

Subject Type: Special Elective Subject-Group A

No. of Credit: 04

No. of Lectures: 48

Objectives:

1. To understand the provisions of Income Tax Act and Law.
2. To teach students the application of knowledge for competition of tax liability and address application oriented issues.
3. To make students proficient as professional tax practitioners and to plan Income Tax liability.
4. To complement practical aspect to teach Income Tax theory

UNIT	TITLE AND CONTENTS	NO. OF LECTURES
1	TAX SYSTEM IN INDIA **PART A** 1.1 History of Income Tax in India 1.2 Meaning of Direct & Indirect Taxes 1.3 Types of Taxes 1.4 Fundamental Concepts and Definitions under Income Tax Act, 1961 1.5 Basis of Charge 1.6 Residential Status and Scope of Total Income 1.7 Income Exempt from Tax 1.8 Capital & Revenue	16
2	HEADS OF INCOME 2.1 Income from Salary 2.2 Income from House Property 2.3 Income from Business & Profession 2.4 Income from Capital Gains 2.5 Income from other Sources	16
3	DEDUCTIONS 3.1 Permissible deduction U/S 80C to 80U of Income Tax Act 3.2 Rebate U/s 87A 3.3 Relief U/s 89 3.4 Salary TDS	16
	Total	48

LIST OF LEARNING ACTIVITIES AND ALLOCATION OF PERIODS

SR. NO.	ACTIVITIES	NO. OF LECTURES
1	Quizzes	4
2	Assignments	4
3	Classroom tests/ Presentation	4
	TOTAL	12

References:

SR. NO.	TITLE OF THE BOOK	NAME OF AUTHOR/S	PUBLICATIONS
1	Income Tax	T. N. Manoharan	
2	Students Guide To Income Tax (University Edition)	Vinod K Singhania	Taxmann,2019
3	Self-Preparation and Filing of Income Tax Returns	Kindle Edition	
4	Bare Income Tax Act, 1961 amended by Finance Act 2019		Taxmann
5	Direct Taxes, Law and Practice	Dr. Vinod Singhania	Taxman Publication

Pedagogy:

- Theory Lecture
- Case Study
- Assignments
- Offline or online Practical

Outcomes:

1. Students will understand various norms of Income Tax Laws
2. Students will be capable enough to understand concepts of type of Returns.
3. Finally, this course will provide an opportunity for students to become Income Tax Professionals to facilitate the above assesses.

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Modern College of Arts,Science & Commerce

Department of Commerce

Board of Studies: Accountancy & Taxation

M. Com Part I Semester – I

Subject: Management Accounting

Compulsory Subject

Course Code: COMM-111O2 **Total Credits: 04**

Depth of the Programme: Basic Knowledge with recent advancement and its applicability

Objectives of the Programme:

1. To enhance the abilities of learners to develop the concept of management accounting and its significance in the business.
2. To enhance the abilities of learners to analyze the financial statements.
3. To enable the learners to understand, develop and apply the techniques of management accounting in the financial decision making in the business corporate.
4. To make the students develop competence with their usage in managerial decision making and control.

Unit No.	***Unit Title***	**Contents**	**Purpose Skills to be developed**
1	***Fundamentals of Management Accounting***	1. Meaning, Definition, Importance of Management Accounting 2. Limitations of Conventional Financial Accounting 3. Distinction between Management Accounting and Financial Accounting 4. Emergence of Management Accounting and Cost Accounting 5. Advantages of Management Accounting and Cost Accounting 6. Distinction between Management Accounting and Cost Accounting 7. Management Accounting as a decision	To understand the concept of Financial Accounting and its limitations, emergence of Management Accounting and Cost Accounting, its advantages and distinction between Management Accounting and Cost Accounting.

		making tool	
2	**Working Capital Management**	1. Concept and definition of working capital, 2. Determination of Working capital, Assessment of Working 3. Capital needs - Study of components of working capital such as cash management 4. Accounts Receivable Management and Inventory management.	To understand the concept of Working Capital Management, determination of working capital, components of working capital and accounts receivable and inventory management.
3	**Budgets as a tool for Decision Making**	1. Budget Manual 2. Budget Committee and Budgetary Control 3. Preparation of Budget 4. Master Budget 5. Purchase and Sales Budgets 6. Fixed and Flexible Budget 7. Cash Budget	To understand the concept of budget and budgetary control, types of budgets and preparation of functional budgets in an organization.
4	**Application of Management Accounting Techniques**	1. Marginal Costing and Cost-Volume Profit (CVP) Analysis, Key Factors 2. Decision Making through Managerial Cost Accounting (Make or Buy Decision) Purchasing and Leasing 3. Techniques and Managerial Cost Accounting 4. Standardization of Accounting System a. Fixed and Variable Cost Analysis b. Application of Fixed and	To understand the concept of Marginal Costing, its applications, different techniques of managerial cost accounting and Fixed and Variable Cost Analysis in decision making process.

		Variable Cost Analysis technique in decision making process	

References

Sr. No.	Title of the Book	Author/s	Publication	Place
1.	Management Accounting	P.C. Tulsian	Tata McGraw Hill Publishing Company	New Delhi
2.	Management Accounting	A.Mukharji & M. Hanif	Tata McGraw Hill Publishing Company	New Delhi
3.	Management Accounting	S. N. Maheshwari & S.K. Maheshawari	Vikas Publishing House Pvt. Ltd.	New Delhi
4.	Advanced Accounting	M. C. Shukla & S.P. Gerwal	S. Chand and Co. Ltd.	New Delhi
5.	Advanced Accountancy	S.P. Jain & K.N. Narang	Kalyani Publishers	New Delhi

6.	Advanced Accountancy	R.L. Gupta & M. Radhaswamy	S. Chand and Co. Ltd.	New Delhi
7.	Advanced Accounting	Dr. Sadashiv Sirgave	Success Publications	Pune
8.	Principles of Management Accounting	S. N. Maheshwari	Vikas Publishing House Pvt. Ltd.	New Delhi
9.	Management Accounting	I.M. Pandey	Vikas Publishing House Pvt. Ltd.	New Delhi
10.	Advanced Management Accounting	Ravi Kishore	Taxman	New Delhi
11.	Management Accounting	Dr. Arun Gaikwad	Success Publications	Pune
12.	Management Accounting	Dr. Yashodhan Mithare	Success Publications	Pune

Suggested references

Web reference

Lectures	PPTs	Articles
Introduction to Cost & Management Accounting: CA Raj K. Agarwal (On youtube)	Management Accounting: An Introduction to concept and Methods: Igor Baranov	How do managers react to a Peer's situation? The influence of environmental similarity on budgetary reporting: James N. Cannon (https://www.sciencedirect.com/science/article/pii/S1044500518300659)
Working Capital Management: Shivansh Sharama (On youtube)	Study Material PPT: ICMAI	Regulation and adaptation of management accounting innovations: The case of economic value added in Thai state-owned enterprises: Pimsiri Chiwamit and others (**https://www.sciencedirect.com/science/article/pii/S1044500517300100**)

Budgetary Control: CA Naresh Agarwal (On youtube	Managerial Accounting: Maher, Stickney and Weil	Identity conflict and the paradox of embedded agency in the management accounting profession: Adding a new piece to the theoretical jigsaw: Kate E. Horton (**https://www.sciencedirect.com/science/article/pii/S1044500516300245**)
Decision Making in Cost and Management Accounting: CA Naresh Agarwal (On youtube)	Management Accounting: James T. Mocky and Others	The role of cognitive frames in combined decisions about risk and effort: Karla Oblak, Mina Licen and others (**https://www.sciencedirect.com/science/article/pii/S1044500517300239**)

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Modern college of Arts, Science and Commerce
Ganeshkind, Pune
Faculty of Commerce
Board of Studies: Accountancy

Class: M.Com I Sem II

Subject: Business Tax Assessment and Planning

Course Code:

Subject Type: Special Elective Subject-Group A

No. of Credit: 04

No. of Lectures: 48

Objectives:

1. To impart knowledge in relation to the Taxation of various forms of Business.
2. To get total knowledge of Goods and Service Tax.
3. To Interpret Income Tax Notices.
4. To impart knowledge on increasing ability to correlate the sections and reduce tax liability by tax planning.

UNIT	TITLE AND CONTENTS	NO. OF LECTURES
1	TAX PLANNING 1.1 Concept of Tax Planning and Management 1.2 Need of Tax Planning and Management 1.3 Objectives of Tax Planning and Management 1.4 Limitations of Tax Planning and Management 1.5 Types of Tax Planning and Management 1.5.1 Short Term 1.5.2 Long Term 1.5.3 Permissive 1.5.4 Purposive 1.6 Difference Between Tax Exemption, Tax Evasion and Tax Avoidance (Theory)	16
2	ASSESSMENTS OF VARIOUS ENTITIES 2.1 Assessments of Partnership Firms including LLP 2.2 Assessments of Co-Operative Societies. (Theory and Problems)	12

3	MISCELLANEOUS Part A: 3.1. Deduction and Collection of Tax at Source 3.2.Advance Payment of Tax - Interest Payable and receivable 3.3.Conceptual Study of Tax Planning and Management 3.4.Types of return, Procedure of filling return 3.5.Types of assessment, procedure for assessment 3.6.Income Tax authorities and their Powers 3.7.Provision for Appeals and Revision 3.8. Provisions for Penalties, Offenses and Prosecutions Part B: 3.9 Set and Carry forward of losses 3.10 Clubbing of Income (Theory and Problems)	20
	Total	48

LIST OF LEARNING ACTIVITIES AND ALLOCATION OF PERIODS

SR. NO.	ACTIVITIES	NO. OF LECTURES
1	Group Discussion	04
2	Classroom Tests	04
3	Presentation	04
	Total	12

Reference Books:

SR. NO.	TITLE OF THE BOOK	NAME OF AUTHOR/S	PUBLICATIONS
1	Income Tax	T. N. Manoharan	
2	Students Guide To Income Tax (University Edition)	Vinod K Singhania	Taxmann
3	Self-Preparation and Filing of Income Tax Returns		Kindle Edition
4	Bare Income Tax Act, 1961 amended by Finance Act 2019		Taxmann
5	Indirect Taxes	Vinod Singhania	Taxmann

Pedagogy:

- Lectures
- Case Studies
- Assignment at class and homework assignment
- Internet research/Library research

Outcomes:

1. Students will be able to interpret Income Tax forms and documents.
2. Students will be able to interact with Income Tax Authorities.
3. Students will be able to compute tax liability.

P.E.Society's

Modern College of Arts,Science & Commerce

Department of Commerce

M. Com Part I Semester – II

Board of Studies: Accountancy & Taxation

Compulsory Subject

Subject Name: - Financial Analysis & Control

Course Code: COMM-121O1 **Total Credits: 04**

Depth of the program – Fundamental Knowledge

Objectives of the course

a. To Enable the students to acquire knowledge of financial analysis and control tools
b. To Make appropriate application and uses of financial analysis and control

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	Fundamentals of financial analysis and control	Meaning of financial analysis and control, importance, advantages limitations& uses, Methods of Financial Statement Analysis	Understanding basics of financial analysis.
2	Comparative statement Analysis	Meaning, Importance, Advantages, Limitations, Uses, Problems on Intra & Inter Company Comparison	To gain knowledge of practically comparing financial results of different years and different companies.
3	Ratio analysis and trend analysis	Meaning, importance, advantages, limitations, uses, Problems on Ratio analysis and Trend analysis	To understand the importance of cash liquidity in an organization. To understand the computation of cash and fund flows under operating, investing and financing categories.

4	Cash flow and fund flow statements	Meaning,. importance, advantages limitations. uses. Problems on Cash flow and fund flow statements	To develop the skill of appropriate use of different ratios to evaluate the financial performance of entities.

Teaching methodology

Topic No.	Total Lectures	Innovative methods to be used	Project	Expected Outcome
1	06	PowerPoint presentations		Application of IT for financial analysis
2	14	Use of MS Excel	Financial analysis of any sector (eg: Software) using common size and comparative statements as a tool of analysis.	Generate interest among students to use and apply Excel as a tool for financial analysis.
3	14	Application through money control, PPT and MS Excel	Financial analysis of any five companies using fund flow and cash flow statement as a tool of analysis	Learn to analyze and identify financially strong and weak companies
4	14		Financial analysis of peer companies using ratio analysis as a tool of analysis	Develop needed understanding and use of various ratios for financial analysis.

Method of Evaluation

Subject	*Internal Evaluation*	External Evaluation	Suggested Add on Course
Unit – I	*Assignment use of PowerPoint, group discussion*	100% based on theory	Functioning of National Stock Exchange
Unit – II	*MCQ test*	30% theory 70% problems	Financial statement analysis
Unit – III	Problem solving	30% theory 70% problems	
Unit – IV	Case study	30% theory 70% problems	

References

Sr. No.	Author/s	Title of the Book	Publication	Place
1.	Ravi Kishore	Advanced Management Accounting	Taxman	New Delhi
2.	Ravi M. Kishore	Management Accounting & Financial Analysis	Taxman	New Delhi
3.	Dr.Jawahar Lal Dr. Sucheta Guaba	Financial Reporting and Analysis	Himalaya Publication House	New Delhi
4.	P Perm Chand and Madna Mohan	Financial Accounting and Analysis	Himalaya Publishing	Mumbai
5.	M.Y.Khan&P.K.Jain	Management Accounting & Financial Analysis	(Tata McGraw hill)	New Delhi
6.	Advanced Accounting	Dr. Sadashiv Sirgave	Success Publications	Pune
7.	Management Accounting	Dr. Arun Gaikwad	Success Publications	Pune
8.	Management Accounting	Dr. YashodhanMithare	Success Publications	Pune

Sr. no	Lectures	Films
1	Financial Statement	https://docs.google.com/spreadsheets/d/e/2PACX-1vRgBO0bXtb52Ocx-aT7yy6j5twA-3GcgWiN5RCGboG3XTD6P5hWpG_jbz8PZA1Aw5YPl2MeEPziCyKm/pubhtml?gid=0&single true
2	Cash Flow	https://www.investopedia.com/terms/c/cashflowfromfinancing.asp
3	Ratio Analysis	https://www.investopedia.com/financial-edge/0910/6-basic-financial-ratios-and-what-they-tell-you.aspx

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Progressive Education Society's
Modern college of Arts, Science and Commerce
Ganeshkind, Pune
Faculty of Commerce
Board of Studies: Accountancy

Class: M.Com I Sem II

Subject: Specialised Areas in Accounting

Course Code:

Subject Type: Special Elective Subject-Group A

No. of Credit: 02

No. of Lectures: 30

Objectives:

1. To impart knowledge of specialized areas in accounts such as Accounting for Hotels, Transport Industry and Hospitals.
2. To teach accounting for Consolidated Financial Statement of Holding company and its subsidiary company.

UNIT	TITLE AND CONTENTS	NO. OF LECTURES	PURPOSE SKILLS TO BE DEVELOPED
1	CONSOLIDATED FINANCIAL STATEMENTS 1.1 Consolidated Accounts of Holding and two Consolidated Profit & Loss Accounts subsidiary Companies 1.2 Consolidation Inter Company transactions Issue of Bonus Shares 1.3 Revaluation of Fixed Assets 1.4 Debentures and Preference Shares of subsidiary Company Dividend (Holding company with two subsidiaries Only to be studied). AS.21.	14	Understanding the Consolidation of Financial Statements of Holding Companies & two Subsidiary Companies
2.	SERVICE SECTOR ACCOUNTING 2.1 Hotel Accounting 4.1.1 Introduction 4.1.2 Visitor's Ledger 2.2 Hospital Accounting 4.2.1 Introduction 4.2.2 Capital and Revenue Expenditure 4.2.3 OPD & IPD Register 2.3 Transport Undertaking 2.3.1 Introduction 2.3.2 Preparation of Final Accounts 2.3.3 Accounting of Roadways – Preparation of Final Accounts	16	To acquaint with hotel accounting, Hospital accounting, Transport undertakings accounting fund based accounting to create an avenue for employment in the academics and also to benefit Industry
	Total	30	

Reference Books:

SR. NO.	TITLE OF THE BOOK	NAME OF AUTHOR/S	PUBLICATIONS
1	Advanced Financial Accounting	Shawar Saleem	Vikas Publication House
2	Advanced Accounts-Vol.-I.	Shukla, M.C., T.S. T.S. Grewal and S.C. Gupta	S. Chand & Co.
3	Advanced Accountancy	Jain and Narang	Kalyani Publishers
4	Advanced Practical Accounts	Anjan Bhattacharya SubrataMukerjee	S. Chand & Co.

Modern College of Arts, Science and Commerce
(Autonomous)
Ganeshkhind Pune 411016
FY BBA- CA Semester II
Subject: Organizational Behavior & Human Resource Management
Subject Code:

- **Syllabus under NEP**

Program Objectives:

i) To understand basic concept of HRM & OB
ii) To make aware students about traditional & modern methods of procurement & development in organization.
iii) To know the major trends in HRM & OB

Credits: 2

Unit No.	Unit Title	Contents	Proposed and Skills to be developed
1	**Introduction to Organizational Behavior (10 Lectures)**	Definition, concept, scope, Models of OB, Total Quality management, Cultural diversity, Impact of Globalization on Organizational Behavior Recent Trends in Organizational Behavior Organizational change, Stress Management: Sources of Stress, Effects of Stress & Stress Management, Work life Balance and Quality of Work Life	To understand the basic concept of OB & To develop knowledge about major trends & ability to handle cultural diversity Stress, change and to maintain work life balance.
2	**Introduction to HRM (10 Lectures)**	**Introduction to HRM**- Definition, Concepts, scope, importance Functions, Objectives & limitations, Role of HR Manager.	To understand the basic concept of HRM & developing knowledge & ability of the student about HRM.
3	**Procurement, Training & Development** **(10 Lectures)**	**HRP**-Concept, Definition, Merits & Demerits, process, influencing factors of HRP **Recruitment**-Concept, Definition, sources of recruitment and their utility in identifying vacancies, methods, E-recruitment, **Selection-** Concepts, definition, process, Types of interviews and frequently Talent Acquisition, E- selection **Training & Development-** Concept, definition, importance, Methods, E-Training, Recent trends in Training. RPO (Recruitment Process Outsources)	To understand process & importance of HR procurement and to develop the skills among students regarding awareness of new trends of Recruitment Selection and interview preparation To know the training & performance appraisal methods & to develop evaluation skill.

Teaching Methodology

Innovative methods to be used	Project	Expected Outcome
Lecture ,Interactive teaching & Ice breaking session	Role play on HR Manager	To develop group cohesiveness.
Lab activity of Searching links about E-recruitment and E- selection.	Project report	Up gradation of knowledge of new trends in Recruitment and Selection.
Guest lecture	Assignment	Up gradation of skill.
Case Study , Video clips on Cultural Diversity and Stress management	Case study report	To develop decision making skill.

Fourth Year B.Com

Sem VII

Subject Title: - Financial Management

Teaching 4 hrs/Week **Fourth Year B.Com**

CIA 40 + ESE 60 = 100 marks **Sem VII**

No of Lectures 30 – 2 Credits

Objectives of the course

- To acquaint the student with knowledge of various Financial Management Concepts
- To utilize the information gathered to reach an optimum conclusion by a process of reasoning
- To enable the students to use their learning to evaluate , make decisions and provide recommendations

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	**Introduction**	Meaning and objectives and Scope of Financial Management , Functions of Financial Manager Financial systems in India – RBI , SEBI., NBFC New trends in Financial Management	• Understanding Financial Management • Recognizing the Financial System of India.
2	**Financial Statements & Financial Analysis**	Concept of Financial Statements – Income and Balance Statements Financial Analysis – Types and Techniques	• Understanding Financial Statements • Analyzing the Financial Statements

3	**Recent Trends in Financial Management**	• Digital transformation. • Integration of FinTech & financial institutions. • IPO finance for corporates. • FPOs. • Corporate bond market. • Private Equity. • Merger & acquisition.	• To understand the new trends in market • To enable students to know recent development

Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Project	Expected Outcome
1	08	Lecture Methods	Individual assignment report	Developing understanding on Financial Management
2	12	Lectures Method Guest Lectures by subject Experts	Case analysis and Discussions	Develop the ability to analyze financial statements
3	10	Survey analysis , Assignments , Field Visits	Field Visit Article Review	Will Learn Recent Trends of Subject

References :

List of Books Recommended :-

2. Financial Management – By M.Y.Khan and P.K. Jain (Tata Mcgraw Hill)
3. Financial Management – By I.M.Pandey (Vikas Publishing House)
4. Financial Management – By Prasanna Chnadra (Tata Mcgraw Hill)
5. Financial Management – By P.V. Kulkarni (Himalaya Publishing House)
6. Financial Management – By Prasanna Chnadra (Tata Mcgraw Hill)
7. The Indian Financial System – By Bharati Pathak (Dorling Kindersley Pvt. Ltd.)
8. Financial Policy and Management Accountant – By Bhabatosh Banerjee(PHI Learning Pvt. Ltd.)
9. Introduction to Lease Financing – By Rajas Parchure , N. Ashok(Time Research Foundation)
10. Credit Management – By Herbert Edwards (Coles Publishing Co. Ltd.)
11. Financial Management – Dr. Parag Kalkar, Success Publications.

M.COM I - Semester: - II

Business Administration

Subject Name - Business Administration Special Paper II

Subject Title: - Elements of Knowledge Management

Course Code - 22-COM124(b)

Objectives of the course

1 To develop Analytical and Research oriented skills among the students.
2 To understand value application and relevance of Knowledge management in today's corporate world.
3 To promote research and innovation ideas based on Knowledge Management.
4 To enhance knowledge level and practice of linking theoretical background with applied Social Science.

Depth of the program – Fundamental Knowledge

Unit No.	Unit Title	Contents
1	**Introduction to Knowledge Management**	a. a Knowledge Management - Concept , Meaning , Definition , Nature and Relevance of it in today's Business world. b. Knowledge Management Process c. Approaches to Knowledge Management d. Difference between information and knowledge e. Recent Trends in Knowledge Management

2	**Tools and Techniques of Knowledge Management**	a Concept , Meaning , Types of Knowledge sharing b System of Presenting Knowledge c Role of Knowledge Management in Management of Change d. Measurement of Knowledge e. Role of a Leader in Knowledge Management
3	**Cross Functional areas and Knowledge**	a. Finance and Knowledge Management b. Marketing and Knowledge Management c. E- Commerce and Knowledge Management d. TQM and Knowledge Management e. CRM and Knowledge Management f. Human Resource and Knowledge Management
4	**Knowledge Strategies**	a Meaning , Nature , Scope and knowledge strategy creation b Using Knowledge Management to safeguard Intellectual Property c. Knowledge engineering for IT based services Future Prospects of Knowledge Intensive Business Services and its impact on the economy

Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	Case Study and PPT	PPT	Home Assignment	Conceptual Clarity
2	14	Group Discussion	Corporate Cases and Discussions on it	Written Test	Analytical ability
3	10	Multiple Choice Question and Interview	Online Multiple Choice Question Test	Report Writing	Application Oriented Skills
4	12	Report Writing	Referring to various websites	Discussion with exercises	Managerial skills

Method of Evaluation

Subject	Internal Evaluation	External Evaluation	Suggested Add on Course
Unit – I	Home Assignment	Written exam	Visit to Corporates
Unit – II	Continuous Evaluation/PPT	Written exam	Report on Field Visit
Unit – III	Continuous Evaluation/ MCQ	Written exam	Interaction with experts
Unit – IV	Continuous Evaluation/Case Study	Written exam	Guest lectures on concerned topics

References :

List of Books Recommended :-

1 Knowledge Management – By Elias and Hassan Gazai (Pearson Publication)
2 E-World Emerging Education Pvt. Ltd. – By Arpita Gopal and Chandranil Singh
3 Knowledge Management Toolkit – By AmritTiwan
4 Knowledge Management Field Work – By Bukowitz W. R. and Williams R. I.
5 Building the Knowledge Management Network – By Egaallo C.F.
6 Change Management for Competitive Success – By Pettigrwe A., Whipp R.,(Infinity Books)

Progressive Education Society's

Modern College of Arts, Science and Commerce Ganeshkhind Pune

Faculty of Commerce

Board of Studies: Business Administration

Proposed Syllabus

First Year M. Com Sem I

Subject Name: Production and Operation Management

Subject Code: -

Name of the Vertical: DSC

Credits Assigned: 4

Objectives of the course

- To understand and develop deep insight of Production & Operation Management.
- To understand & identity business problems involving operational function, planning and control, design development and quality management.
- Demonstrate awareness and importance of application, operation and supply chain management.
- To develop skills necessary to effectively analyze and synthesize the many inter relationship inherent in complex socio-economic productive systems.
- To increase the knowledge and perspective to gain from emerging trends in production and operation management.

Depth of the program – Fundamental Knowledge

Unit No.	Unit Title	Contents	Purpose Skills to be developed
1	**Fundamentals of Production and Operation Management**	a. <u>Production and Operation Management :</u> Meaning ,importance , Functions , Types of Production Systems – Mass Production /FlowLine , Continuous, Intermittent , Batch Production , Job Lots etc. b. Service Systems – Recent trends in productionand service systems c. Plant Layout – Objectives , basic principles andtypes d. Safety Considerations and environmental Aspects	• Acquaint the students knowledge about Production and Operation Management. • Recognize the inherent conflict of interest inmany business decisions relating to safety consideration and environmental aspects.
2	**Supply Chain Management and Career Opportunities in Supply Chain Management**	a. Supply chain Management : Introduction , Scope, Components, Process of Supply ChainManagement. b. Tools and Techniques of Supply Chain Management , Performance Measurement andimplementation. c. Career opportunities in Supply Chain Management	• Understanding the scope and Process ofSupply Chain Management • Knowledge on various career opportunitiesin
3	**Production Planning, Control and Product Design**	a. Production Planning : Meaning , Objectives , Importance and its components b. Production Control : Meaning , Objectives, Significance and factors affecting ProductionControl. c. Product Design and Development – Concept ,Process and factors affecting product development d. Product Design – Meaning, determining the characteristics of good design, Factor responsible for product development	• Acquaint the students with knowledge ofProduction Planning and Control. • Motivate the students to develop and innovate ideas for Product Design andDevelopment

4	**Total Quality Management and Emerging Issues**	a. Total Quality Management – Meaning , Dimensions , Objectives and importance b. Basic concept of ISO 9000 to ISO -4000 c. Emerging Issues in Production and Operations Management – i. Atomization of Operational Processes ii. Outsourcing iii. Waste Management iv. Six Sigma and Lean Management v. Industry 4.0	• Recognize the importance of Total Quality Management • Identification of emerging issues in Production and operation Management

Teaching Methodology

Topic No.	Total Lectures	Innovative methods to be used	Film shows and AV Applications	Project	Expected Outcome
1	12	Article Review , Group Discussion , Quiz	Documentary	Report on the Review of Article	Conceptual Clarity
2	12	Survey Report , Poster Presentation , Guest Lecture	Documentary	Survey Report / Poster Presentation	Awareness on Career opportunities in Supply Chain Management Introduction to AlternativeCareer opportunities
3	12	Interview , Game , PPT , Narrating	Documentary	Report Writing	Development of Innovativeabilities and Application oriented skills
4	12	Project making , street Play , Jingles making	Documentary	Project / Industrial Visit	Awareness on the recent and emerging areas Change in overall perceptiontowards quality enhancement

Progressive Education Society's

Modern College of Arts, Science and Commerce (Autonomous)

Ganeshkhind, Pune 411016

www.moderncollegegk.org

(CBCS pattern to be implemented from 2023-2024)

As Per New Education Policy

Faculty of Humanities

MA I History Syllabus

Semester - I & II

Non Grant NEP Course Structure

MA in History

Degree	Sem	Mandatory	Electives	RM	OJT/FP	RP	Cumulative credit
PG Diploma after 3 year degree	I	1. Political History of modern World (1200-1914) (4 credit) HIS51101 2. Maharashtra in the 19th Century (4 credit) HIS51102 3 History of Modern Japan (1900 A.D. to 1990 A.D.) (4 credit) HIS51103 Tourism Management (2 credit) HIS51104	1. Economic History of British India (4 credit) HIS51105	Research Methodology in History (4 credit) HIS51206	_		**22**
	II	1. World after World War I (1914-1991) (4 credit) HIS52101 2. Maharashtra in the 20th Century (4 credit) HIS52102 3. History of Modern China (1949A.D. to 1997 A.D.) (4 credit) HIS52103 South Indian Art and Architecture (2 credit) HIS52104	History, Culture and Heritage of Mumbai (C.1850A.D. to 1990) (4 credit) HIS52105		OJT (4 credit) HIS52306		**22**
Cum. Credit PG Diploma		**28**	**08**	**04**	**04**		**44**

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Proposed Syllabus of MA in History
Academic Year 2023-2024
Semester: I

Mandatory - 4 Credits
Title of the Paper- Political History of the Modern World (1200-1914)

Learning Objectives:

- This paper is designed us introduce the students to the history of the Modem World with its socio-religious, political and economic developments
- It will enable students to study interesting historical developments in the countries other than India, which had a significant impact on almost all over the Modern World.
- It will enable students to understand the significant impact of the modern concepts such as Renaissance, Nationalism, Communism, Imperialism, etc.
- 4 will get students acquainted with the major revolution, and political developments which led to the World War and its consequences

Learning Outcomes:

- I will enable students to develop the overall understanding of the Modern World
- The students will get acquainted with the Renaissance, major political, socio-religious and economic developments during the Modern World
- It will enhance their presumption of the history of the Modern World
- It will enable students to understand the significance of the intellectual, Economic and political developments of the Modern World.

Pedagogy: Lectures Visual presentation Role play Critical analysis/Assignments Tests Quit

Course Content

Unit I. The Modern Age **(15 Lectures)**

a. Renaissance-Background and Nature
b. Religious Movement-Martin Luther King

Unit II. The Age of Revolutions **(15 Lectures)**

a. The American Revolution -Causes and Consequences
b. The French Revolution-Causes and Consequences
c. The Industrial Revolution Causes and Consequences

Unit III. Nationalism **(15 Lectures)**

a. Unification of Italy
b. Unification of Germany
c. Japan-The Meiji Revolution

Unit IV. World War I and Rise of Communism **(15 Lectures)**

d. World War I-Causes and Consequences
e. Paris Peace Settlement, League of Nations
f. The Russian Revolution - Causes and Consequences

Reference Book:

English

1. Carr E.H.. International Relations between the two World Wars. 2.Corwall R.D. World History in 20th Century, Longman, London, 1976.
2. Dev Arjun and Indira Dev, History of the World, Orient Black Swan, Delhi, 2009.
3. Gooch V.P, History of Modern Europe, Grant and Temperley, Europe in the 19th and 20 centuries.
4. Hazen, Modern Europe
5. Jain H. and K. Mathur, A History of the Modern World 1500-2000 A.D., Jain Prakashan Mandir, Jaipur, 2014.
6. Rao B.V., World History (3rd edition) from early time to AD 2000, New Dawn Press INC. V.S.A. UK., India, 2006.

मराठी संदर्भ ग्रंथ

1. आचार्य धनंजय, विसाव्या शतकातील जग, श्री साईनाथ प्रकाशन नागपुर.
2. कुलकर्णी देशपांडे आधुनिक जगाचा इतिहास (भाग १ व २) स्नेहवर्धन प्रकाशन पुणे.
3. के. कुलकर्णी, फडके, आधुनिक युरोपचा इतिहास
4. शं गो. कोलारकर , आधुनिक युरोप
5. गायकवाड, कदम, थोरात, पाटील, आधुनिक जगाचा इतिहास
6. जी. पी. जोशी विसाव्या शतकातील जगाचा इतिहास विद्या प्रकाशन
7. वैद्य सुमन, आधुनिक जग, साईनाथ प्रकाशन नागपुर.
8. वैद्य सुमन कोठेकर शांता आधुनिक जग, साईनाथ प्रकाशन नागपुर.

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Proposed Syllabus of MA in History
Academic Year 2023-2024
Semester: I

Mandatory - 4 Credits
Title of the Paper- Maharashtra in the 19th Century

Course Objectives:

- To Introduce the students to the history of 19th century in Maharashtra
- To study Political, Social, Economic and conceptual History of the 19th Century Maharashtrain an analytical way with the help of primary sources.
- To evaluate contribution of 19th century in Maharashtra to the establishment of Maharashtrastate contribution of successors and later development of the 19th century Maharashtra
- To study Socio-religious System of the 19th Century in Maharashtra.

- **Course Outcomes:**
  - Student will develop the ability to analyse sources for 19th century Maharashtra History.
  - Student will learn significance of Regional History and Socio- religious reformism foundation of the region.
  - It will enhance their perception of 19th Century Maharashtra.
  - Appreciate the skills of leadership and the Socio-religious System of the Maharashtra.
- **Pedagogy**: Lectures Visual presentation Role play Critical analysis/Assignments Tests Quit

Course Content

Unit-I. Foundation of British Power in Maharashtra (15 Lectures)

a. Background
b. British Administration.
c. Impact of British Power in Maharashtra.

Unit-II. Reformism in Maharashtra (15 Lectures)

a. Contribution of Intellectuals –Balshastri Jambhekar, Jagannath Shankarsheth Gopal HariDeshmukh (Lokhitwadi) ,Mahatma Jyotiba Phule
b. Institutional Experiments-Paramahamsa Mandali, Prarthana Samaj,SatyashodhakSamaj, Sarvajanik Sabha

Unit-III. Uprising and Political Agitation (15 Lectures)

a. Local Uprisings (Uprising of Ramoshi, Bhill, Koli, Revolt of 1857 and Deccan Riots (1875)
b. Rise of Nationalism (Indian National Congress, Moderate, Nationalist)

Unit-IV. Economic Transformation in Maharashtra (15 Lectures)

a. Economic Exploitation
b. Revenue (Rayatwari system)
c. Commercialization of Agriculture.
d. Economic Thought –Brief Survey

References:

1. Ballhatchet Kenneth, Social Policy and Social Change in Western India. 1817-1830, OUP, 1961.
2. Nurullah Syed and Naik J.P. A History of Education in India (During the BritishPeriod)Macmillan and Co.Ltd. Bombay,1951.
3. Paranjpe Shrikant, Dixit Raja and Das C.R. Western India: History Society and Culture, Itihas Shikshak Mahamandal, Maharashtra, Pune-1997.
4. Ravindra Kumar, Western India in the Nineteenth Century: A Study in the Social HistoryofMaharashtra Routledge and Kegan Paul, Toronto, 1968.

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Proposed Syllabus of MA in History
Academic Year 2023-2024
Semester: I

Mandatory - 4 Credits
Title of the Paper- History of Modern Japan (1900-1990)

Objectives:

- Help the students to know more about Japanese History.
- To acknowledge Japan's modernization and its impact.
- To understand post-World War II impact and developments.
- To know Japan's role in world politics.

- **Expected outcomes:**
  - It will enable students to develop an overall understanding of Japan.
  - Students will study the impact of Japan's modernization.
  - Students will be introducing to the impact and development of world war second.
  - Student will understand Japan's role in world politics.

Course content

Unit I . Japan as Imperial Power **(15 Lectures)**

a. Economic and Political Setup
b. Regional International imbalance Japans Concern
c. Towards War

Unit II . Japan, East Asia and conflict with the West **(15 Lectures)**

a. East Asia in sphere of influence
b. Sino -Japanese Conflict
c. Conflict with the West

Unit III. World War **(15 Lectures)**

a. Joining of the World War II
b. Japan in conflict.
c. Destruction and Reconstruction

Unit IV. Economy and Society **(15 Lectures)**

a. Economic Miracles
b. Social security
c. Position of Women and other classes

References:

1. Clyde and Beers Hall , D.G.E. – History of Southeast Asia.
2. Pannikkar, K.M. – Asia and Western Dominance.
3. R. Layman- Japan's last bid for victory: The Invasion of India 1944
4. R.H.P. Mason- History of Japan
5. Reischauer, E.O. – Japan
6. Totman Conard- A History of Japan
7. https://vishwakosh.marathi.gov.in/18944/

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Semester: I

Mandatory - 2 Credits
Title of the Paper- Tourism Management

Course Objectives:

1. This paper is designed to introduce the students to Tourism Management.

2. It will get students acquainted with all the processes of Tourism Industry to work great potential.

3. It will enable students to seek self-employment by starting their own tourism business.

Course Outcome:

1. Students will get an overall understanding of the process of Tourism Management.

2. They will learn to work in the Tourism Management with great potential. 3. They will be able to seek self-employment by starting their own tourism business.

Course Content:

Unit 1 Tourism (05 Lectures)

a) Definition and Nature of Tourism

b) Important Components

c) Topology of Tourism

Unit II Tourism recent trends (04 Lectures)

a) Concept of Domestic and International Tourism

b) Tourism Recent Trends.

Unit III Tourism as Industry (06 Lectures)

a) Tourism as an Industry

ii) Visitor, Tourist, Excursionist

Unit IV Tourism in India and Impact (05 Lectures)

a) Growth and development of tourism in India

b) Economics and Social impact

c) Physical and environmental impact

Unit V Filed Trip and Report Writing (05 Lectures)

Reference Books:

1. Beaver and Allan (2002), A Dictionary of Travel and Tourism Terminology", CAB

International Wallingford, pp. 313.

2. Bhatia A.K. (1983), Tourism Development' Sterling Publishers (P) Ltd. New Delhi

3.Bhatia A.K, Tourism development Principles and Practices, Streling Publisher(P) Ltd. New Delhi

4.Anand M.M., Tourism and Hotel Industry in India, Sterling Publishers(P) Ltd, New Delhi

5. Kaul R.H, Dynamics of Tourism, A Terilogy Sterling Publishers(P) Ltd, New Delhi 6. IITTM, Growth of Modern Tourism, Manogra IITTM, New Delhi, 1989

7. IITTM, Tourism as an Industry.Manogra IITTM, New Delhi, 1989

8. Burhat and Mandlik, Tourismn- Past, Present and Future Heinemann, London

9. Wahab S.K Tourism Management, International Press, London, 1986 10. Brymer Robert A. Introduction to Hotel and Restaurant Management, Hub Publication

Company, Lawa, 1982

11. Pran Nath Seth (1997), 'Successful Tourism Management, Vikas Publishing House (P) Ltd.. New Delhi, pp. 329.

12. Riceline J.R. Brent, Travel and Tourism Hospitality Research, London, 1982
13. Aggarwal Surinder Travel Agency Management, Communication India, 1983 14 Tourism Planning: Gunn, Clare A

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Proposed Syllabus of MA in History
Academic Year 2023-2024

Semester: I
Elective - 4 Credits
Title of the Paper: Economic History of British India

Objectives

- To acquaint the student with structural and conceptual changes in Indian economy after coming of the British
- To make them aware of the exploitative nature of the British rule
- To help them understand the process of internalization by Indians of new economic ideas, principles and practices.

Course Outcomes:

- The students will understand the transition of economy after British rule.
- The students will learn about the colonial economic policy .
- The students will be interpret the process of de-industrialization And Development of the modern industry.
- The students will able to review the economic history books and articles.

Course Content

Unit I. European economic interests in India and colonial economy (12 Lectures)

a. Mercantilist phase

b. Free trade phase

c. Financial imperialism phase

Unit II. Agrarian settlements (15 Lectures)

a. Permanent settlement

b. Ryotwari system

c. Mahalwari system

d. Commercialization of agriculture and its effects

Unit III. Industry (15 Lectures)

a. De-industrialization

b. Development of modern industry: Textile, Mining, Iron and Steel, Shipping

c. Railways

d. Labour Issues and Factory Acts 1894-1942

Unit IV. Trade: internal and foreign (12 Lectures)

Unit V. Fiscal System (06 Lectures)

a. Banking

Readings

English

1. Bagchi, A.K., Private Investment in India, 1900-1939, Cambridge, 1972.
2. Charlesworth, Neil, British Rule and the Indian Economy 1880-1914, London, 1983.
3. Chandra Bipan, The Rise and Growth of Economic Nationalism in Indian : Economic
4. Dharma Kumar (ed.), The Cambridge Economic History of India. Vol. II. (1750 to 1970), Cambridge, 1982.
5. Gadgil D.R., The Industrial Evolution of India in Recent Times: 1860-1939, OUP, Dehli, Fifth edition, Fifth impression, 1982.
6. Policies of Indian National Leadership,1880-1905, Peoples Publishing House, New Delhi, 1991 (reprint).
7. Ray, Rajat K., Industrialization in India: Growth and Conflict in the Private Corporate
8. Roy, Tirthankar, The Economic History of India :1857-1947,OUP,New Delhi,2002.
9. Tomlinson, B.R., The Economy of Modern India, 1860-1970, Cambridge, 1993 10. Sector, 1914-1947, Delhi, 1979.

Marathi

1. बेडेकर डी.के. (सं.), चार जुने मराठी अर्थशास्त्र ग्रंथ (१८४३-१८५५), गोखले अर्थशास्त्र संस्था, पुणे

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Semester: I

Research Methodology (RM) - 4 Credits

Title of the Paper: RM- Research Methodology in History

Objectives

- To acquaint the student with research methodology in Historical knowledge.
- To make Students aware of the technics of research with multidisciplinary method.
- To make students enable to understand the multiple historical perspectives in Historical research

Course Outcomes:

- The students will basics of research in History.
- The students will learn about the multiple approaches to construct historical knowledge.
- The students will be able to interprets the historical facts.
- The students will able to understand the process of knowledge construction.

Course Content

Unit 1- Historical Research: Concepts and Nature (15 Lectures)

- Research: Definition, Nature and Importance
- Research in Science and Humanities: Nature, Similarities and Differences
- Types of Research: Philosophical, Applied, Descriptive and Case study
- Qualities of a Good Researcher

Unit 2- Historical Research and other Branches of Knowledge (15 Lectures)

- Auxiliary Sciences: Archaeology, Numismatics, Iconography, Epigraphy,
- Museology, Paleography, Genetics
- Allied Sciences: Political Science, Economics, Sociology, Anthropology,
- Geography, Linguistics, Computer

Unit 3 – Type of Sources and Data Collection (15 Lectures)

- Sources: Primary and Secondary
- Sources: Archaeological, Numismatic, Epigraphical, Literary, Digital
- Data Collection methods
- Archival Studies
- Field Work
- Survey and Questionnaire
- Interviews

Unit 4 – Historical Research Method (15 Lectures)

- Selection of Problem and its appropriateness (objectives, Scope, Importance andLimitations)
- Review of Literature

- Formulation of Hypotheses
- Research Proposal
- Data Collection and organization of Data
- Data Analysis- Internal and External Criticism
- Classification, Collation and Interpretation of data
- Report Writing- Technique and method of scientific communication

References :

1. Keith Jenkins, What is History? : from Carr and Elto to Rorty and White
2. Keith Jenkins, Rethink History.
3. E. H. Carr What is History
4. Ranajit Guha (Edited) Writings on South Asian History and Society Delhi: Oxford University Press, 1982
5. Ludden, David, ed., Reading Subaltern Studies. Critical History, Contested Meaning and the Globalization of South Asia, London 2001.
6. Chaturvedi, Vinayak, ed., Mapping Subaltern Studies and the Postcolonial. London and New York 2000.
7. Cronin, Stephanie, ed., "Subalterns and Social Protest: History from Below in the Middle East and North Africa". Routledge, 2008
8. Bennett, Judith (2009). History Matters: Patriarchy and the Challenge of Feminism.
9. Lerner, Gerda, The Majority Finds Its Past: Placing Women in History (Oxford University Press, 1981)
10. Laslitt, Barbara, Ruth-Ellen B. Joeres, Mary Jo Maynes, Evelyn Brooks Higginbotham, and Jeanne Barker-Nunn, ed. History and Theory: Feminist Research, Debates, Contestations (University of Chicago Press, 1997).
11. Bagade Umesh, Ambedkar's Historical Method: a non- Brahminical Critique of Positivist History, critical quest, New Delhi 2025.
12. Blackledge, Paul (2018). Vidal, Matt; Smith, Tony; Rotta, Tomás; Prew, Paul (eds.). "Historical Materialism" in Oxford Handbook on Karl Marx.
13. Giddens, Anthony (1981). A Contemporary Critique of Historical Materialism.
14. Dalits and the Democratic Revolution – Dr. Ambedkar and the Dalit Movement in Colonial India, by Gail Omvedt. 1994, Sage Publications
15. Debrahmanising History : Dominance and Resistance in Indian Society, by Braj Ranjan Mani. 2005
16. Dalit Visions: The Anti-caste Movement and the Construction of an Indian Identity, by Gail Omvedt. Orient Longman, 2006
17. From Untouchable to Dalit – Essays on the Ambedkar Movement, by Eleanor Zelliot. 2005, Manohar.
18. वाम्बूरकर जास्वदीं, इतिहासातील नवीन प्रवाह, डायमंड प्रकाशन, २०१४
19. उर्मिला पवार, आम्हीही इतिहास घडवला

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Proposed Syllabus of MA in History
Academic Year 2023-2024
Semester: II

Mandatory - 4 Credit

Title of the Paper: World after World War I (1914-1991)

Learning Objectives:

- This paper is designed to introduce the students to the political history of the Modern World
- It will enable students to study remarkable historical developments in the various countries including India, which had a significant impact on almost all over the Modern World.
- It will enable students to understand the significant impact of the modern concepts such as Dictatorship, Cold War, Nationalism, Communism, Imperialism, Polarization, etc.
- It will get students acquainted with the major nationalist movements, the World War II and its consequences, the Cold War and its Consequences.

Learning Outcomes:

- It will enable students to develop the overall understanding of the Modern World
- The students will get acquainted with the major nationalist movements, the World War II and its consequences, the Cold War and its Consequences
- It will enhance their overall perception of the history of the Modern World.
- It will enable students to understand the significance of the strategic political developments in the Modern World.

Course Content

Unit 1. Nationalist Movements in Asia and Africa (15 Lectures)

a. Dr. Sun-Yet-Sen
b. Mahatma Gandhi (Non-Cooperation Movement, Civil Disobedience Movement, Quit India Movement)
c. Dr. Nelson Mandela

Unit II. Rise of Dictatorship **(15 Lectures)**

a) Italy – Mussolini
b) Germany-Hitler
c) Turkestan - Kemal Pasha
d) Militarism in Japan

Unit III. World War II and the Rise of World Power **(15 Lectures)**

a) World War II-Causes and Consequences
b) United Nations Organization - Structure and Functions
c) The Rise of the World Powers US.A. and U.S.S.R.

Unit IV. Cold War and Third World **(15 Lectures)**

a. Cold War: Causes, Nature and Course
b. Third World: Non-Alignment Movement
c. End of the Cold War and Disintegration of U.S.S.R..

References: English

1. Carr EH, International Relations Between the Two World Wars.
2. Corwall RD: World History in the 20th Century, Longman, London, 1976,
3.Dev Arjim and Indira Dev, History of the World Orient BlackSwan, Delhi, 2009.
4. Gooch VP, History of Modern Europe.
5. Grant and Temporally, Europe in the 19th and 20th centuriesx.
6. Hazen, Modern Europe
7. Jain H. and K. Mathur, A History of the Modern World 1500-2000 AD, Jain Prakashan Mandir, Jaipur, 2014,
8. Rao BV: World History (Jrd edition) from early time to AD 2000, New Dawn Press. INC, VSA UK, India. 2006.

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१ आचार्य धनंजय, विसाव्या शतकातील जग, श्री साईनाथ प्रकाशन नागपुर.
२ कुलकर्णी देशपांडे आधुनिक जगाचा इतिहास (भाग १ व २) स्नेहवर्धन प्रकाशन पुणे.
3 कुलकर्णी, फडके, आधुनिक युरोपचा इतिहास
४ शं गो. कोलारकर , आधुनिक युरोप
५ गायकवाड, कदम, थोरात, पाटील, आधुनिक जगाचा इतिहास
६. जी. पी. जोशी विसाव्या शतकातील जगाचा इतिहास विद्या प्रकाशन
७ वैद्य सुमन, आधुनिक जग, साईनाथ प्रकाशन नागपुर.
८ वैद्य सुमन कोठेकर शांता आधुनिक जग, साईनाथ प्रकाशन नागपुर

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Proposed Syllabus of MA in History
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Semester: II

Mandatory - 4 Credit

Title of the Paper: Maharashtra in the 20th Century

Course Objectives:

- To Introduce the students to the history of 20th Century in Maharashtra
- To study Political, Social, Economic and Conceptual History of the 20thCenturyMaharashtra in an Analytical way with the help of Primary Sources.
- To evaluate contribution of 20th Century in Maharashtra to the establishment of Maharashtra state contribution of successors and later development of the 19thcenturyMaharashtra
- To study Socio-Religious System of the 20th Century in Maharashtra.

Course Outcomes:

- Student will develop the ability to analyses sources for 20th Century Maharashtra History.
- Student will learn significance of regional history and Socio- Religious Reformism foundation of the region.
- It will enhance their Perception of 20th Century Maharashtra.
- Appreciate the skills of leadership and the Socio-Religious System of the Maharashtra.

Course Content

Unit I. Thoughts and work of Intellectuals (15 Lectures)

a. Pandita Ramabai
b. Rajarshri Chhatrapati Shahu Maharaj
c. Maharshi Vitthal Ramji Shinde
d. Maharshi Dhondo Keshav Karve
e. Maharaja Sayajirao Gaikwad.
f. Dr. Babasaheb Ambedkar
g. Karmaveer Bhaurao Patil

Unit II. Industrial and Economic Development of Maharashtra (15 Lectures)

a. Industrialization and Urbanization
b. Cotton and Sugar Industry
c. Co-operative Movement -Brief survey

Unit III. Movements in 20th Century Maharashtra (15 Lectures)

a. Workers Movement
b. Peasants Movement
c. Dalit Movement
d. Non-Brahmin Movement

Unit IV. Integration and Reorganization of Maharashtra (15 Lectures)

a. Marathawada Mukti Sangram
b. Sanyukta Maharashtra Movement
c. Maharashtra-Karnataka Border Dispute

References:

1. Ballhatchet Kenneth, Social Policy and Social Change in Western India. 1817-1830, OUP, 1961.
2. Nurullah Syed and Naik J.P. A History of Education in India (During the British Period) Macmillan ana Co.Ltd. Bombay,1951.
3. Paranjpe Shrikant, Dixit Raja and Das C.R. Western India: History Society and Culture, Itihas Shikshak Mahamandal, Maharashtra, Pune-1997.
4. Ravindra Kumar, Western India in the Nineteenth Century: A Study in the Social HistoryofMaharashtra Routledge and Kegan Paul, Toronto, 1968.

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Semester: II

Mandatory - 4 Credits

Title of the Paper: History of Modern China (1949A.D. to 1997 A.D.)

Objectives

- The objectives of the course is to acquaint the students with the History of Communist China so that they may understand the events that led to the emergence of new order that made Japan to become the second economic world power.

Course Content

Unit I. Introduction **(15 Lectures)**

a. History, Geography, and Sources
b. New leadership and Ideology
c. The Reconstruction programme

Unit II. Communist China **(15 Lectures)**

a. Leadership and Ideological Ferment
b. Cultural Revolution
c. Science, Technology and Defence Development an impact on USA , USSR and India

Unit III. Mao Zedong and his ideological impact on Asia **(15 Lectures)**

a. Debate on Marxism
b. Russian rift
c. Three world Theory

Unit IV. Deng Xiaoping and New China **(15 Lectures)**

a. Four modernization Programme
b. Foreign Policy
c. Defence

References :

1. Bian M. L., Making of the State Enterprise System in Modern China: The Dynamics of Institutional Changes, Harvard University, 2005.
2. David M.D., The Making of Modern China, Himalaya Publication, Mumbai, 2006.
3. David M.D., and Ghoble, T.R., India China and South Asia, Dynamics of Development, Deep, New Delhi, 2000.
4. Dutt Gargi and Dutt V.P.,China's Commune System, Asia Pub. House, 1970.
5. Dutt Gargi and Dutt V.P., China's Cultural Revolution, Asia Pub. House, 1970.
6. Dutt, V.P. and Gargi Dutt, China After Mao, Vikas Pub., New Delhi, 1991.
7. Fairbank, John King and Merle Goldman, China: A New History, Cambridge: Harvard University Press, 1998.
8. Garver, J.W., Foreign Relations of the People's Republic of China, Prentice Hall, Jersey, 1993.
9. Garver, J.W., Protracted Contest, Sino – Indian Rivalry in the 20th Century, University of Washington Press, 2001.
10. Ghoble T.R., China's Foreign Policy Opening in the West, Deep and Deep Publication, New Delhi, 1990.
11. Ghoble T.R., China – Nepal Relations and India, Deep and Deep Publication, New Delhi, 1986, 1991 (Reprinted). HSU Immanuel C. Y., Rise of Modern China, Oxford University press, 1990.
12. Hsueh, Chun-Tu, Revolutionary Leaders o f Modern China, Oxford University press, 1971. Hutchings Graham, Modern China: A Companion to a rising power, Penguin Books, 2000.
13. Jung Chang, Jon Halliday, Mao Unknown Story, Vintage Books, London, 2005.
14. King F.H.H., Concise Economic History of Modern China, Vora Publishers, 1968.
15. Latourette, Kenneth Scott, History of Modern China, Penguin Books, 1954.
16. Moise Edwin E., Modern China : A History (Present and the Past), Longman, 1986.
17. Neville Maxwell, India's China War, Jaico Published, Bombay, 1973.
18. Pong, David ed. Encyclopaedia of Modern China: A-E Vol. 1, Gale Cengage Learning, 2009.
19. Suyin Han, Eldest Son: Zhou enlai and the making of Modern China, 1898-1976, Jonathan Cape, 1994.
20. Wou Odoric Y. K. Militarism in Modern China: The career of Wu Pei-Fu, 1916-39, Australian University Press, 1978.
21. Zelin M., Merchants of Zigong: Industrial Entrepreneurship in Early Modern China, Columbia University, 2005.

Modern College of Arts Science Commerce Ganeshkhind Pune 16 Autonomous
Under the Faculty of Humanities
As per New Education Policy

Proposed Syllabus of MA in History
Academic Year 2023-2024
Semester: II

Mandatory - 2 Credits

Title of the Paper: South Indian Art and Architecture Title of the Paper

Objectives:
1. To acquaint the students, the Arts and Architecture of South India.
2. To acquaint the students, the and development of the Arts and Architecture of South India.
3. To enable the students to understand the Process of development of the Arts and Architecture of South India.
4. To create an interest among the students for the study of Arts and Architecture of South India.

Course Outcomes:
1. Students will get an overall understanding of the development of the Art and Architecture in South India.
2. They will understand the changing patterns of the Art and Architecture in South India.
3. They will understand the impact of Persian Art on Islamic Art and Architecture in South India

Unit. I- Introduction to Panting **(10 Lectures)**

a) Ajanta Painting.

b) Lipasakhi Painting.

Unit. II - Introduction to Sculpture **(10 Lectures)**

a) Mahabalipuram.

b) Badami

Unit.III- Introduction to Architecture **(10 Lectures)**

a) Pattukel ,Velur

b) Tanjavur, Vesara

c) Field Visite

Reference Books:

English

1. Rowland B., Art and Architecture Of India, Penguin Book, London, 1967.

2. Agarwal, O. P. Ed. Conservation of Cultural Properties in India, New Delhi, 1967-68.

3. Brown, Percy, Indian Architecture, 2 Vols., Bombay, 1959.

4. Deglurkar, G. B. Temple Architecture and Sculpture of Maharashtra, Nagpur, 1974.

5. Fletcher, Bannister, A History of Architecture, 17th Ed., London, 1961.

6. Fergusson, James, History of Indian and Eastern Architecture, 2 Vols., Delhi, 1967.

7. Kramrisch, Stella, The Hindu Temple, 2 Vols., Delhi, 1980.

8. Sastri, K. A. N. The Culture and History of the Tamils, Calcutta, 1964.

9. Sastri, K. A. N. A History of South India, Madras, 1958.

Modern College of Arts Science Commerce Ganeshkhind Pune 16 Autonomous
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Proposed Syllabus of MA in History
Academic Year 2023-2024

Semester: II
Electives - 4 Credits
Title of the Paper: History, Culture and Heritage of Mumbai (C.1850A.D. to 1990 A.D.)

Objectives:

- To introduce students to the field of urban history with a focus on the history of Mumbai. To promote research and to build up ties with research institutes and museums. To acquaint students with the contemporary challenges facing this global mega city and to enable students of other disciplines in the social sciences to study this elective course.

Unit I. Emergence of Urbs Prima in Indi's (15 Lectures)

a. Communities and Localities
b. Cotton Trade and the Shetias, Transport, Communications
c. Migration, Industrialization and Workers' Politics

Unit II. The Shaping of a Metropolis (15 Lectures)

a. Urban Planning and Governance, Patterns of Land Use
b. Housing, Water Supply and Public Health Teaching Hours
c. Heritage Conservation, Development and Contemporary Challenges

Unit III. Urban Society and Politics (15 Lectures)

a. Education and Transition of Society, Civic Activism
b. Contribution to Indian Nationalism
c. Mumbai, the Growth of Cosmopolitanism and the Linguistic Reorganization of States

Unit IV. Art, Heritage and Culture (15 Lectures)

a. Art and Architecture
b. Theatre and Cinema
c. Sports and Hospitality Industry

Reference Books :

1. Albuquerque, Teresa, Urbs Prima in Indis: An Epoch in the History of Bombay, 1840-1865, Promilla and Company, New Delhi, 1985.
2. Breckenridge, Carol (ed); Consuming Modernity: Public Culture in a South Asian World, Oxford University Press, New Delhi, 1995.
3. Chandavarkar, Rajnarayan, The Origins of Industrial Capitalism in India: Business Strategies and the Working Classes in Bombay, 1900-1940, Cambridge University Press, Cambridge, 1994.
4. David, M.D; Mumbai: The City of Dreams, Himalaya Publishing House, Third Revised Edition, Mumbai, 2011.
5. David, M.D; Urban Explosion of Bombay: Restructuring Growth, Himalaya Publishing House, Bombay, 1996.
6. D'Monte, Darryl, Ripping the Fabric: The Decline of Mumbai and Its Mills, Oxford University Press, New Delhi, 2002.
7. Dobbin, Christine, Urban Leadership in Western India: Politics and Communities in Bombay City, 1840-1885, Oxford University Press, London, 1972.
8. Dossal, Mariam, Imperial Designs and Indian Realities: The Planning of Bombay City, 18451875, Oxford University Press, Bombay, 1991.
9. Dossal, Mariam, Theatre of Conflict, City of Hope: Mumbai, 1660 to Present Times, Oxford University Press, New Delhi, 2010.
10. Dwivedi, Sharada and Mehrotra, Rahul, Bombay: The Cities Within, Eminence Designs Private Limited, Bombay, 1995.
11. Edwardes, S.M; Gazetteer of Bombay City and Island, 3 Volumes, Times Press, Bombay, 1909, Reprinted Pune, 1977.
12. Kosambi, Meera, Bombay in Transition: The Growth and Social Ecology of a Colonial City, 1880-1980, Almqvist and Wiksell International, Stockholm, 1986.
13. Masselos, Jim, Towards Nationalism: Group Affiliations and the Politics of Public Associations in Nineteenth Century Western India, Popular Prakashan, Bombay, 1974.
14. Masselos, Jim, The City in Action: Bombay Struggles for Power, Oxford University Press, New Delhi, 2007.
15. Patel, Sujata and Thorner, Alice, Bombay: Mosaic of Modern Culture, Oxford University Press, Bombay, 1995.
16. Patel, Sujata and Thorner, Alice, Bombay: Metaphor for Modern India, Oxford University Press, New Delhi, 1995.
17. Patel, Sujata and Masselos, Jim, Bombay and Mumbai: The City in Transition, Oxford University Press, New Delhi, 2003.
18. Ramanna, Mridula, Western Medicine and Public Health in Colonial Bombay, 1845-1895, Orient Longman, New Delhi, 2002
19. . Ramanna, Mridula, Healthcare in the Bombay Presidency, 1895-1930, Primus Books, New Delhi, 2012.
20. Tikekar, Aroon, The Cloister's Pale: A Biography of the University of Mumbai, Popular Prakashan, Second Edition, Mumbai, 2006.

Modern College of Arts Science Commerce Ganeshkhind Pune 16 Autonomous
Under the Faculty of Humanities
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Proposed Syllabus of MA in History
Academic Year 2023-2024

Semester: II
OJT - 4 Credits
Title of the Paper: On Job Training APAV Case Study

The course will be conducted in collaboration with educational / cultural / professional Institutions in allied areas of History. The 4 credits will be designed on a case to case basis in consultation with concerned institutions.
There will be NO LECTURES for these courses. Contact hours will include the actual work done by the students on site including the commute time.

The examination of FP/ OJT/ RP shall consist of the following allotment of marks:

INTERNAL ASSESSMENT
Proposal for FP/ OJT/ RP : - 10 Marks
Practical Record/ Field Notes : - 20 Marks
Oral Examination/ OJT Trainer's Recommendation Letter: - 20 Marks

SEMESTER END EXAMINATIO
NFP/ OJT/RP Report : - 50 Marks

Progressive Education Society's

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Choice Based Credit System

Syllabus for MA PART I Psychology

Department of Psychology,
Modern College of Arts, Science and Commerce, Autonomous,
Ganeshkind, Pune

M.A. – I: PSYCHOLOGY

	Semester	Paper No.	Title of the Paper	Lectures per week	Credit for semester
First Year	1	EP-101	Cognitive Psychology: Understanding	04	04
		EP-102	Psychometrics: The Science Of Psychological Assessment	04	04
		EP-103	Research Methodology-I (Issues And Essential Techniques In Statistics And Experimental Design)	04	04
		EP-104	**Psychology Practical: Testing**	08	04
	2	EP-201	Cognitive Psychology: Advances And Application	04	04
		EP-202	Psychometrics: Applications	04	04
		EP-203	Research Methodology-II (Qualitative methods and contemplative practices)	04	04
		EP-204	**Psychology Practical: Experiments**	08	04

SEMESTER-I

EP-101: COGNITIVE PSYCHOLOGY: UNDERSTANDING

Objectives and learning outcomes:

Understand the origin of cognitive psychology

Explore the knowledge of cognitive psychology

Make students aware with the recent trends in cognitive psychology

Help students in relating subject matter of cognitive psychology to daily life

Unit-1: Introduction to Cognitive Psychology

1.1. Definition, Nature and Scope of Cognitive Psychology

1.2. History of Cognitive Psychology

1.3. Methods to study cognitive Psychology-I

Observation

Introspection

Experimental

1.4. Methods to study cognitive Psychology-II

Quasi-Experimental

Neuropsychological

Unit-2: Exploring Cognitive Psychology

2.1. Definition, Nature and Theories:

(i) **Sensation:** Empiricism, Natural Science, Structuralism, Gestalt, Psychophysical approach, Theories of Color Vision, Theories of Pitch, Extra-Sensory Perception

(ii) **Perception:** Bottom Up theories of Perception , Top down perception theories, Computational theories

2.2. Definition, Nature and Theories:

(i) **Attention:** Bottleneck theory, Automatic versus controlled processing, Feature integration theory, Stroop Effect, Signal Detection, Vigilance

(ii) **Pattern Recognition:** Template matching theory, Prototype models, Distinctive-features models and Computational approach

2.3. Definition, Nature and Theories: Thinking: Associationism, Gestalt, Information Processing

2.4. Problem Solving: Problem Space theory, Means-End Hypothesis, AnalogyApproach

Unit-3: Exploring Cognitive Psychology

3.1. Definition, Nature and Theories :

(i) Learning: Hull's Systematic Behaviour Theory, Lewin's Field Theory of Learning, Tolman's Sign Learning, Gagne's Theory of Learning, Bandura's Social Learning Theory

(ii) Memory Model : Unitary, Dual, Multimodal

3.2. Definition, Nature and Theories: (i) Artificial Intelligence, (ii) Language

3.3. Definition, Nature and Theories : (i) Decision Making and Reasoning (ii) Creativity

3.4. Memory Improvement Techniques, Cognitive Maps

Unit-4: Recent Trends in Cognitive Psychology

4.1. **Recent Trends in :** (i) Sensation, (ii) Perception, (iii) Attention

4.2. **Recent Trends in:** (iv) Creativity, (v) Thinking, (vi) Problem Solving

4.3. **Recent Trends in:** (i) Learning, (ii) Memory, (iii) Pattern Recognition

4.4. **Recent Trends in:** (i) Language, (ii) Artificial Intelligence, (iii) Decision Making

READINGS:

1. Anderson, J. R. (2015). Cognitive psychology and its implications. New York: Worth Publishers
2. Best, J. B. (1999). *Cognitive Psychology*. USA: Wadsworth Publishing Co.
3. Borude, R.R. *Bodhanikmanasashastra.* ChhayaPrakashan.
4. Galloti, K. M. (2004). *Cognitive psychology in and out of the laboratory*. USA: Thomson Wadsworth.
5. Horton, D. L. and Turnage, T. W. (1976). *Human learning*. ND: Prentice-Hall
6. Kellogg, R. T. (2007). *Fundamentals of Cognitive Psychology*. N.D. Sage Publications
7. Matlin, M. *(1994). Cognition.* Bangalore: Harcourt Brace Pub.
8. Singh, Shyam & Singh (2008) Psychoneuroimmunology, Global Vision, New Delhi
9. Sternberg, R. J. (2007). *Cognitive Psychology*. Australia: Thomson Wadsworth.
10. Solso, R. L. (2004). *Cognitive Psychology (6th ed.).* Delhi: Pearson Education.

SEMESTER-I

EP-102: PSYCHOMETRICS: THE SCIENCE OF PSYCHOLOGICAL ASSESSMENT

Objectives and learning outcomes:

- Create critical understanding of measurement issues and techniques in psychological inquiry.
- Enable students to develop skills and competencies in test construction andstandardization.
- Understand the various biases in psychological testing and assessment.

Unit-1. Perspectives on psychometrics

1.1. Scientific method, realism, truth and psychology

1.2. Scientific measurement in psychometrics and measurement in the natural sciences

1.3. Measurement models: Classical test theory, Latent variable model, Representational measurement model

1.4. The theory of true scores, the statistical true score, the platonic true score, Psychological vs. Physical true score, the true psychometric: trait or function

Unit-2. Process of test construction:

2.1. Knowledge-based and person-based questionnaire

2.1.Objective and open-ended tests, Ethical issues in psychological testing

2.1.1. Norm-referenced and criterion-referenced testing

2.1.2. The correction for guessing in objective knowledge based test

2.2. Item analysis

2.2.1. Classical item analysis statistics for knowledge-based tests

2.2.2. Classical item analysis for person-based tests

2.2.3. Item analysis in criterion-referenced testing, Factor Analysis

2.3. Item response theory (IRT), Item characteristic curve (ICC)

2.4. Relation of IRT and Classical test theory

Unit-3. Standardization of tests

3.1. Reliability: Concept and types of reliability, forms of error; Spearman-Brown correction, cautions in the use of reliability coefficient

3.2. Validity: Concepts and types of validity; Political validity; Confusion between validation and validity.

3.3. Normalization: Algebraic normalization, graphical normalization

3.4. Types of norms

Unit- 4. Bias in testing and computer applications

4.1. Forms of bias

4.1.1. Item bias: Identifying item bias

4.1.2. Differential item functioning, item offensiveness

4.2. Intrinsic test bias: Statistical models of intrinsic test bias

4.3. Extrinsic test bias: Extrinsic test bias and ideology; legal aspects of extrinsic test bias; guidelines in case of test bias

4.4. Computerization in psychological Testing, Artificial intelligence and psychological testing

READINGS:

Borsboom, D. (2005). *Measuring the mind: Conceptual issues in contemporary psychometrics*. UK: Cambridge University Press.

Chadha, N. K. (2009). Applied psychometry. New Delhi, India: Sage.

Kline, P. (1998). *The new psychometrics: Sciences, psychology and measurement*. London & New York: Routledge.

Michell, J. (1990). *An Introduction to the logic of psychological measurement*. Hillsdale, MI: Erlbaum.

Rust, J., & Golombok, S. (2009). *Modern psychometrics: The science of psychological assessment*. London and New York: Routledge.

SEMESTER-I

EP-103: RESEARCH METHODOLOGY-I (ISSUES AND ESSENTIAL TECHNIQUES IN STATISTICS AND EXPERIMENTAL DESIGN)

1. Introduction to research

1.1. Meaning, purpose and dimensions of research, Ethical problems and principles.

1.2. Paradigms of research

- 1.2.1. Qualitative
- 1.2.2. Quantitative

1.3. Types of research

1.4. The research Process

2. Introduction to statistics

2.1. Nature of data

2.2. Measures of central tendency and variability

2.3. Testing the normality

2.4. Parametric and Non Parametric Statistics

3. Research Problem, Sampling and hypothesis testing

3.1. Research problem, definition and selection

3.2. Sampling procedures of hypothesis testing

3.3. Sampling design: definition and characteristics

3.4. Types of sample designs

4. Experimental Design and Analysis of Variance

4.1. Definition of experimental design

4.2. Types of experimental design

4.3. Selection of statistical methods Appropriate selection of Statistical techniques

4.4. Randomized experimental and quasi-experimental approaches, Group vs. single-subject designs

Quantitative analysis for examination purpose: NPC, Correlation, regression, Students t- test and one way ANOVA , Sample selection

READINGS:

Aron, Arthur; Aron, Elaine N.; Coups, Elliot J. (2006).*Statistics for Psychology* (4thEdn.).Dorling Kindersley (India) Pvt. Ltd.With Pearson Education Limited.

Bridget, S., & Cathy, L. (Eds.) (2008). Research methods in the social sciences. New Delhi, India: Vistaar Publication.

Broota, K. D. (1989, reprint 2014). *Experimental design in Behavioural Research*. New Age International Pvt. Ltd., New Delhi.

Chadha, N. K. (2009). Applied psychometry. New Delhi, India: Sage.

Garrett, Henry E. (2006). *Statistics in Psychology and Education*(1st Indian reprint).Surjeet Publications, Delhi-7.

Gliner, J. A., & Morgan, G. A. (2000). Research methods in applied settings: An integrated approach to design and analysis. Mahwah, NJ: Lawrence Erlbaum.

Howell, D. C. (2002). Statistical methods for psychology (5th ed.). Duxbury, California: Thomson Learning.

Kerlinger, Fred N. (2009). *Foundation of behavioral research* (9th reprint).Holt, Rinehart and Winston, Inc. USA. (Surjeet Publications, New Delhi).

Kothari, C. R. (2011). *Research Methodology: Methods and Techniques* (2nd revised edition). New Age International Publishers, New Delhi

Mangal, S. K. (2009).*Statistics in Psychology and Education* (2nd Edition- 10th printing). PHI learning Pvt. Ltd., New Delhi.

McBurney, Donald H.; White, Theresa L. (2007).*Research Methods* (7th Edition). Thomson.

Pallant Julie (2010). *SPSS Survival Manual: A step by step guide to data analysis using SPSS* (4th Ed.). McGraw-Hill.

Ranjit Kumar (2015). *Research Methodology: A Step by step guide for beginners*. Pearson.

Singh, A. K. (2006). *Tests, Measurements and Research Methods in Behavioural Sciences* (5th Edition).BharatiBhawan: Publishers and Distributors.

Tabachnick, Barbara G.; Fidell, Linda S. (2007).*Using Multivariate Statistics*(5thEdn.). Pearson.

Tredoux Colin and Durrheim Kevin (2002).*Numbers, Hypotheses & Conclusions: A Course in Statistics for the Social Sciences*. UCT Press, Lansdowne.SA.

Zechmeister, Jeanne S.; Zechmeister, Eugene B.; Shaughnessy, John J. (2009).*Essentials of Research Methods in Psychology*. Tata McGraw-Hill.

SEMESTER-I

EP-104: PSYCHOLOGY PRACTICAL: TESTING

Objectives: To acquaint the students with:

1. The administration of the standardized psychological tests, rapport establishment, interpretation of scores and report writing.
2. The criteria's of evaluating psychological tests
3. Certain counseling skills on the basis of psychological results

UNIT-1: GENERAL AND SPECIAL ABILITY TESTS (any three)

1. Standard Progressive Matrices, Cattell's Culture Fair Test of Intelligence
2. WAIS-IV (India), GATB, GMAT
3. DAT, DBDA, EATB
4. Passi Creativity test
5. Reasoning Ability Test, Cognitive Ability Test

UNIT-2: PERSONALITY TESTS (Any two)

1. NEO-PI-R, 16 PF, MBTI (Form F)
2. Vocational Preference Inventory by J. I Holland
3. Palsane's Adjustment Inventory
4. Thematic Apperception Test (TAT)
5. Attitude and Value Scale

UNIT-III: CLINICAL TESTS (Any one)

1. MMPI
2. Neuropsychological Assessment Battery (NAB)
3. Adult Neuropsychological Questionnaire
4. State-Trait Anger Expression Inventory-2 (STAXI-2)
5. Depression Scale

UNIT-IV: OTHER TESTS (ANY Two)

1. FIRO-B/ BIRO-P
2. Assessment of Subjective Wellbeing
3. Career and Family Value Scale
4. Family Environment Scale
5. Self-Concept

READINGS:

1. Anastasi, A. & Urbina, S. (1997). Psychological testing. N.D.: Pearson Education.
2. Kaplan, R.M. & Saccuzzo, D.P. (2007). Psychological Testing: Principles, Applications, and Issues. Australia: Thomson Wadsworth.
3. Gregory, R.J. (2005). Psychological testing: History, principles and applications. New Delhi: Pearson Education.
4. Singh, A.K. (2006). Tests, Measurements and Research Methods in Behavioural Sciences. Patna: Bharati Bhavan.
5. Freeman, F.S. 3rd ed. (1965). Psychological testing. New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd.
6. Cronbach L. J. (1984). Essentials of Psychological Testing (4th Ed)
7. Anastasi A. (1988). Psychological Testing. New York: McMillan
8. Murphy, K. R., Davidshofer, R. K. (1988): Psychological testing: Principles and applications.New Jersey: Prentice Hall Inc.
9. Nunnally, J.C. and Bernstein, I.H. (1994). Psychometric theory (3rd ed). NY: McGraw-Hill.
10. Aiken L.R. (1996) Rating Scales and Checklists: Evaluating Behavior, Personality and Attitudes.
11. Buros, O. (ed). (1965, 1972). The mental measurement. Year Book, NJ: Gryphon Press.
12. Ghiselli, E. E., Campbell, J. P. & Zedek, S. (1981). Measurement theory for the behavioural sciences. W.H. Freeman.
13. Chadha, N. K. (1996). Theory and practice of psychometry. N. D.: New Age International Ltd.
14. Stanley, J.C. and Hopkins, K.D. (1978). Educational and psychological measurement and evaluation. ND: Prentice-Hall of India.
15. Guilford, J.P. (1975). Psychometric methods. ND: Tata McGraw-Hill. 16. Test manuals of respective tests.

SEMESTER-II- EP-201: COGNITIVE PSYCHOLOGY: ADVANCES AND APPLICATION

Unit-1: Advance in Cognitive Psychology- I

1.1. Definition and Nature: Consciousness

1.1. Definition and Nature: Critical Thinking, Metacognition

1.2. Definition and Nature: Neuropsychology

1.3. Conceptual Understanding:

1.4. Application : Brain Assessment Tools : CT Scan, MRI, fMRI, PET Scan

Unit-2: Advances in Cognitive Psychology-II

2.1. Neuro Lingustic Programming

2.2. Gender Differences and Cognitive Abilities

2.3. IQ, EQ and Creative Thinking, Critical Thinking

2.4. Reading, Writing, Speaking and Cognitive Phenomenon

Unit-3: Applications of Cognitive Psychology- I

3.1. Application in Clinical Psychology : Brain and Behaviour Problems; Psychotherapies

3.2. Application in Clinical Psychology: Application in Education Psychology: (i) Child development (ii) Learning styles

3.3. Application in Education Psychology: (i) Forgetting (ii) Moral development

3.4. Application: Cognitive Stages of Development and Teaching methods/techniques

Unit-4: Applications of Cognitive Psychology- II

4.1. Application in Forensic Psychology : (i) Cognitive interview (ii) Lie Detector

4.2. Application in Forensic Psychology: (iii) Eyewitness testimony (iv) Face Recognition, Identity Kit

4.3. Application in Computer Science: Neural Networking

4.4. Application in Computer Science : Information processing, Signal Detection Theory

READINGS:

1. Anderson, J. R. (2015). Cognitive psychology and its implications. New York: Worth Publishers
2. Best, J. B. (1999). *Cognitive Psychology*. USA: Wadsworth Publishing Co.
3. Borude, R.R. *Bodhanikmanasashastra.* ChhayaPrakashan.
4. Galloti, K. M. (2004). *Cognitive psychology in and out of the laboratory*. USA: Thomson Wadsworth.
5. Horton, D. L. and Turnage, T. W. (1976). *Human learning*. ND: Prentice-Hall
6. Kellogg, R. T. (2007). *Fundamentals of Cognitive Psychology*. N.D. Sage Publications
7. Matlin, M. *(1994). Cognition.* Bangalore: Harcourt Brace Pub.
8. Singh, Shyam & Singh (2008) Psychoneuroimmunology, Global Vision, New Delhi
9. Sternberg, R. J. (2007). *Cognitive Psychology*. Australia: Thomson Wadsworth.
10. Solso, R. L. (2004). *Cognitive Psychology (6th ed.).* Delhi: Pearson Education.

SEMESTER-II

EP-202: PSYCHOMETRICS: APPLICATIONS

Objectives:

Understand how psychological tests are used for the purpose of assessment, guidanceand enhancing the effectiveness of teaching-learning process.

Understand the use and interpretation of various psychological tests used in educational field.

Understand the use of psychological tests are used for better health, adjustment and related Counselling.

Understand the use of psychological tests in clinical and organizational settings

Unit-1: Applications of Psychological Testing in Educational Setting

1.1. Tests of ability: General Aptitude Test Battery (GATB), Fairview Social Skills Scale (FSSS), Torrance test of creative thinking (TTCT), Differential Ability Test (DAT)

1.2. Tests of Intelligence: Standard Progressive Matrices (SPM), Wechsler Intelligence Scale for Children (WISC), Social Intelligence Scale (SIS)

1.3. Interest Inventory: Strong-Campbell Interest Inventory (SCII), Career Interest Inventory

1.4. Creativity Tests: Passi Test of Creativity, Verbal Test of Scientific Creativity

Unit-2: Applications of Psychological Testing in Counselling and Guidance

2.1. Child-Rearing Practices: Child-rearing Practices Questionnaire,

2.2. Self-concept Scales: Tennessee Self-Concept Scale, Self-Concept Inventory

2.3. Adjustment Tests: College adjustment and study skills inventory, Family Environment Scale (FES)

2.4. Attitude Tests: Brief Criminal Attitude Scale (BCATS), Tobacco Use Questionnaire

Unit-3: Applications of Psychological Testing in Clinical Setting

3.1. Tests of Personality-I: Sixteen Personality Factor (16 PF) Questionnaire, Thorndike Dimensions of Temperament, Myers-Briggs Type Indicator (MBTI)

3.2. Tests of Personality-II: Structural Clinical Interview, Choice Dilemmas Questionnaire (CDQ), Kundu's Neurotic Personality Inventory (KNPI)

3.3. Rosenzweig Picture-Frustration study for children, State-Trait Anger Test, AnxietyScale, TAT

3.4. Minnesota Multiphasic Personality Inventory (**MMPI**), Rorschach and Rotter Incomplete Sentence **Test**

Unit-4: Applications of Psychological Testing in Organizational Setting

4.1. On the Job: Minnesota Satisfaction Questionnaire, Overall Job Satisfaction Scale, Organizational Commitment Scale, Organizational Effectiveness Scale

4.2. Motivation: Intrinsic Job Motivation Scale, Motivation Scale

4.3. Leadership Opinion Questionnaire, Workers Attitude Scale, BIRO-P / FIRO-B

4.4. Occupational Stress Index, Interpersonal Trust Scale HRD Function Questionnaire/ EQ Test

READINGS:

Aiken L.R. (1996) Rating Scales and Checklists: Evaluating Behavior, Personality and Attitudes

Anastasi, A. & Urbina, S. (1997). Psychological testing. N.D.: Pearson Education.

Chadha, N. K. (1996). Theory and practice of psychometry. N. D.: New Age International Ltd.

Cronbach, L. J. 5th ed. (1990). Essentials of psychological testing. New York: Harper Collins Publishers

Freeman, F.S. 3rd ed. (1965). Psychological testing. New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd.

Ghiselli, E. E., Campbell, J. P. & Zedek, S. (1981). Measurement theory for the behavioural sciences. W.H. Freeman.

Gregory, R.J. (2005). Psychological testing: History, principles and applications. New Delhi: Pearson Education.

Kaplan, R.M. & Saccuzzo, D.P. (2007). Psychological Testing: Principles, Applications, and Issues. Australia: Thomson Wadsworth.

Kline, P. (1983). Personality measurement and theory. Hutchinson.

Murphy, K. R., Davidshofer, R. K. (1988): Psychological testing: Principles and applications. New Jersey: Prentice Hall Inc.

Nunnally, J.C. (1981). Psychometric theory. ND: Tata McGraw-Hill.

SEMESTER-II

EP-203: RESEARCH METHODOLOGY - II (QUALITATIVE METHODS AND MULTIVARIATE ANALYSIS)

1. Introduction to qualitative research tradition and its scope

1.1. What research problems in psychology require qualitative inquiry?

1.2. Basic assumptions, principles and promises of qualitative research, Brief history of qualitative research.

1.3. The critical understanding of experience within socio-historical context.

1.4. Introduction to some important methods: Ethnography, grounded theory, narrative inquiry, and phenomenological inquiry.

2. Basic procedures in qualitative inquiry

2.1. Formulating research questions.

2.2. Developing semi-structured interview schedule.

2.3. Building research relationship. Quality and rigour in qualitative research.

2.4. Generating qualitative data: The role of researcher‘s reflexivity.

3. Analyzing qualitative data: A reflexive exercise

3.1. Researcher‘s reflexivity about his/her experiential and theoretical standpoint.

3.2. Empathy and reflexivity in qualitative data analysis.

3.3. Coding and memo writing. Theoretical saturation and theoretical sampling.

3.4. Identifying and developing narrative structure.

4. Multivariate Statistical Analysis

4.1. Multivariate analysis- Introduction., Using computer programs for statistical analysis

4.2. MANOVA, ANCOVA

4.3. Multiple Regression, Factor Analysis

4.4. Causal Modelling, SEM

READINGS:

Charmaz, K. (2004). Premises, principles, and practices in qualitative research: Revisiting the foundations. Qualitative Health Research, 14, 976-993.

Charmaz, K. (2006). Constructing grounded theory: A practical guide through qualitative analysis. Thousand Oaks, CA: Sage.

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SEMESTER-II

EP-204: PSYCHOLOGY PRACTICAL: EXPERIMENTS

Objectives:

To acquaint the students with:

1. The various areas of experimentation in psychology
2. Skills required in conducting experiments in psychology
3. Applications of experimental design and report writing style

UNIT:1 EXPERIMENTS ON LEARNING (ANY THREE)

1. Problem solving (Hanoi's Tower, Heart & Bow Puzzle, Wiggly Blocks)
2. Method of serial anticipation
3. Conditioning: Verbal or hand withdrawal
4. Retroactive or proactive interference
5. Paired Associate learning
6. Bilateral transfer in Mirror Tracing/maze learning

UNIT-2: EXPERIEMENTS ON MEMORY (ANY TWO)

1. Forgetting
2. Short term Memory
3. Effect of Mnemonic strategy on memory
4. The effect of coding on memory
5. Immediate memory
6. Memory for Associated and Un-associated pairs of words
7. Recall and Recognition

UNIT-3: EXPERIMENTS ON MOTIVATION AND EMOTION (ANY Two)

1. Determining aspiration level
2. Knowledge of Result (KoR)
3. Zeigarnik Effect
4. Goal Setting
5. Effect of anxiety on performance

UNIT-5: EXPERIMENTS ON COGNITIVE PROCESS (ANY One)

1. Perceptual Defense
2. Concept formation
3. Mental imagery
4. Rational Learning
5. Stroop effect in serial learning
6. Time perception
7. Measurement of illusion

READINGS:

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6. Jalota, S. (1962). Experiments in psychology. Asia Publishing House.
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8. Sternberg, R.J. (1996). Cognitive psychology. NY: Harcourt Brace College Publishers.
9. Guenther, R.K.(1998). Human cognition. NJ: Prentice-Hall.
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12. Debold, R.C. (1968). Manual of contemporary experiments in psychology. Prentice-Hall.
13. Fergusson, E. D. (1976). Motivation: An experimental approach. Holt Rinehart & Winston.
14. Friedenberg, J., Silverman, G. (2006). Cognitive science: An introduction to the study of mind. London: Sage Publications.
15. Collins, M. & Drever, J. (1930). Experimental Psychology. London: Methuen & Co. Ltd.
16. Snodgrass J. G., Levy-Berger, Hyden (1985). Human Experimental Psychology. New York: Oxford University Press.
17. Kuppuswamy, B. (1952). Elementary Experiments in Psychology. London: Oxford University Press.

Department of Sociology

MA Sociology Part-I (Syllabus As per NEP)

Sr. No	Name of the Course		Credits
	Semester I		
1	Sociology of India	Major	**04**
2	Contemporary Social Thinkers	Major	04
3	Social Movements: Dimensions and Change	Major	04
4	Sociology of Maharashtra : Culture and Change	Elective	04
5	Methodology of Social Research	RM	04
6	OJT	OJT	04
7	Public Participation and Change	Seminar 1	02
	Semester II		
1	Sociology of environmental sustainability	Major	**04**
2	Introduction to Human Rights and Social Justice	Major	04
3	Understanding Globalization	Major	04
4	Sociology of Social Work	Elective	04
5	Social Policy: Evaluation and analysis	Seminar 2	02
	Total Credits Sem I and Sem II		40-44

Sociology of India

Objectives:

- To acquaint the students to the continuities and contradictions in Indian society.
- To assess the impact of various socio-political processes on the making of sociology in India
- To acquaint the students to various perspectives of understanding Indian society
- To introduce recent issues in Indian society and the debates around those issues

I. Trajectories in the development of sociology in India **10**

a. Colonialism, Nationalism, and Emergence of Sociology in India

b. Development of Sociology in India

II. Perspectives of understanding Indian Society **18**

a.Indological, (Ghurye, Irawati Karve) Nationalist (Ghurye)

b. Structural-Functionalism (Srinivas)

c. Marxist (A. R Desai)

d. Feminist (Uma Chakravarti, Leela Dube, Sharmila Rege)

e. Subaltern Studies (Ranjit Guha)

f. Non-Brahmanical (Gail Omvedt)

III. Recent issues of Indian Society **16**

a. Issues of Minorities

b. Issues of Tribals

c. Caste, Class, Gender, and Ethnicity

IV. Contemporary debates in India **16**

a. Nationalism, Democracy, Cultural Nationalism

b. Family and Household

c. Global capitalism and media

d. Public sphere – mobilization and movements

Essential Readings:

1. Alam J. (2004). Who Wants Democracy? Hydrabad : Orient Longman.

2. Appadurai, A. (2004). 'Public Culture'. In V. Das.(Ed.). Oxford Handbook of Sociology. New Delhi: Oxford University Press.

3. Das, V. (2012). Structure and Cognition aspects of Hindu caste and ritual. Delhi: OUP.

4. Dhanagare, D. (1990). The relevance of Sociology: Some Determinants. The Indian Journal of Social Work.

5. Dhanagare, D. (2014). The Writings of D. N. Dhanagare: Missing Tradition. New Delhi : Orient Blackswan.

6. Desai, A. (1981). Relevance of Marxist Approach for India. Sociological Bulletin,30(1): 1-20

7. Deshpande, S. (1994). Crises in Sociology – A tired Discipline? Economic and Political Weekly, 29(10).

8. Dube, S. (1990). Indian Society. New Delhi. National Book Trust.

9. Dumont, L. (1970). Homo Hierachicus: The Caste System and its Implications. Delhi: OUP.

10. Gough, K. (1981). Rural society in Southeast India. London: Cambridge University Press.

11. Ghurye, G. (1932). Caste and Race in India. London: Kegan Paul.

12. Guha, R. & Spivak, G. (1998). Selected Subaltern Studies. Delhi: OUP.

13. Ilaiah, K. (1996). Why I am not a Hindu. Kolkata : Samya Publications.

14. Jayaram, N. (2013). The Bombay School -So-called -and Its Legacies. Sociological Bulletin. 62 (2).

15. Mencher, J. (1974). The Caste System Upside Down, or The Not-So-Mysterious. Current Anthropology. 15 (4). 469-493

16. Mohpatra, S. (Ed.) (2017). Society and Culture in India: A Reader. New Delhi. Social Science Press.

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18. Ninan, S. (2007). Headlines from the Heartland: Reinventing the Hindi Public Sphere. New Delhi: Sage Publication.

19. Oberoi, P. (1993). Family, Kinship and Marriage in India. New Delhi: OUP.

20. Oberoi, P., Sundar N. & Deshpande, S. (2008). Anthropology in the East: founders of Indian sociology and Anthropology. Chicago: Seagull Books.

21. Omvedt, G. (2006). Perspective of anti caste movement: Subaltern sociological vision.

22. Omvedt, G.(1994). Dalits and the Democratic Revolution: Dr. Ambedkar and the Dalit Movement in Colonial India. Delhi: Sage Publications.

23. Patel,S. (2011). Doing Sociology in India: Genealogies, Locations, and Practices. Delhi: OUP.

24. Rege, S. (2013).Writing Caste, Writing Gender: Reading Dalit Women's Testimonies. New Delhi: Zubaan.

25. Rege, S. (1998). Dalit Women Talk Differently: A Critique of Differences and Towards a Dalit Feminist Standpoint Position. Economic Political Weekly, 33(44).

26. Rege, S. (2003). Sociology of Gender: The Challenge of Feminist Sociological Thought. Delhi: Sage. 27. Spivak,G. (1988). Can the Subaltern Speak?. In C. Nelson & L. Grossberg (Eds.). Marxism and the interpretation of Culture (271-313). Chicago: University of Illinois Press.

28. Srinivas,M. & Panini. M. (1986). Development of Sociology and social Anthropology in India in T.K.Oommen & P. Mukherji. (Eds.). Indian Sociology reflections and introspections. Bombay: Popular Prakashan

29. Srinivas, M. (2004).Collected Essays. Delhi: Oxford University Press.

30. Upadhyay, C. (2000). The Hindu Nationalist Sociology of G.S.Ghurye, Sociological Bulletin 51(1):27-56 ·

31. Ali, A. (2001). Evolution of Public Sphere in India. Economic and Political Weekly. 36(26): 2419- 2425.

32. Dubhashi, P. (2002). People's Movement against Global Capitalism. Economic and Political Weekly. 37(6): 537-543.

33. Xaxa, V. (1999). Tribes as Indigenous People of India. Economic and Political Weekly. 34(51): 3589-3595.

34. Xaxa, V. (2005). Politics of language, religion and identity: Tribes in India. Economic and political weekly. 1363-1370.

35. E-Pathshaala resources on Sociology of India

References:

1. Achin, V. (1997). Communalism Contested: Religion, Modernity and Secularization. Delhi : Vistaar Publications.

2. Beteille, A. (2002). Sociology: Essays on Approach and Method. New Delhi: OUP.

3. Breman, J. C., Kloos, P., & Saith, A. (1997). The Village in Asia Revisited. New Delhi : OUP

4. Chaudhuri, M. (EdP.). (2010). Sociology in India, Intellectual and Institutional Practices. New Delhi: Rawat Publications.

5. Das, V. (2003). The Oxford Companion to Sociology and Social Anthropology. Vol. I & II. New Delhi: OUP.

6. Das, V. (1995). Critical Events: An Anthropological Perspective on Contemporary India. New Delhi: Oxford University Press.

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11. Guha R. (1998). A Subaltern Studies Reader. New Delhi: Oxford University Press.

12. Khilnani, S.(1999). The Idea of India. New Delhi: Penguin.

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17. Vivek, P. (2002). Sociological perspectives and Indian Sociology. Mumbai: Himalaya Publishing House.

18. Murugkar, L. (1991). Dalit Panther Movement in Maharashtra: A Sociological Appraisal. Hyderabad: Sangam Books

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1. भाई, थाराबाई. (२०१७).भारतीय समाजशास्त्र: समस्या आणि आव्हाने. नवी दिल्ली : सेज भाषा
2. तांबे, श्रुती . (२००७). समाजशास्त्रापुढील अरिष्टे . समाज प्रबोधन पत्रिका
3. तांबे, श्रुती. (२००७) समाजशास्त्रातील विचारविश्वे: जागतिक आणि भारतीय
4. धनागरे, द. (२००५) संकल्पनांचे विश्व आणि सामाजिक वास्तव.पुणे : प्रतिमा प्रकाशन
5. ऊमन, टी. (२००५). भारतीय समाजातील समस्या व वाद. पुणे : डायमंड प्रकाशन
6. नगरकर, व. (१९८९). भारतीय मुसलमान. मुंबई : महाराष्ट्र राज्य साहित्य आणि संस्कृती मंडळ
7. भागवत, वि. (२०११). समकालीन समाजशास्त्र. पुणे : क्रांतीज्योत सावित्रीबाई फुले स्त्री अभ्यास केंद्र .
8. सिंह हीरा. (२०१९). जातिव्यवस्थेची नवी समीक्षा. नवी दिल्ली : सेज भाषा ,
9. सहारे पद्माकर . (२००७) .भारतीय समाजशास्त्र . औरंगाबाद : विद्या बुक पब्लिशर्स
10. सोमण, मा. आणि सावळे, सं. (२०१६). समाजशास्त्रीय विचार. पुणे: डायमंड प्रकाशन.
11. ओम्वेट, गेल. (१९९५). वासाहितक समाजातील सांस्कृतिक बंड. पुणे : सुगावा प्रकाशन.
12. गर्गे.स. (संपा.). (२०१७). विज्ञान कोश, खंड ६. भारतीय समाजशास्त्रावरील लेख. पुणे : मेहता प्रकाशन
13. बगाडे, उमेश. (२००७). साबल्टर्न स्टडीज व भारतीय इतिहास लेखनातील स्थित्यंतर. समाज प्रबोधन पत्रिका .
14. पटेल, सुजाता. (श्रुती तांबे, भाषा.). (२००५). भारतीय समाजशास्त्रीय सिद्धान्तन: टप्पे, पद्धतीशास्त्र व संकल्पना. समाज प्रबोधन पत्रिका.
15. उपाध्या, कॅरोल. (२००७). गोविंद सदाशिव घुर्ये यांचे ऐतिहासिक समाजशास्त्र . समाज प्रबोधन पत्रिका.

Note: Any other text/Article suggested by the subject teacher

Contemporary Social Theories

Objectives:

- To introduce the students to the contemporary trends in social theory
- To compare and contrast various theoretical viewpoints

I. The Crisis of Sociology and the Critique of Positivism (12)

a. Alvin Gouldner

b. C. Wright. Mills

II. Marxism from 30s to 70s

a. Frankfurt school,

b. Althusser (Theory of Ideology)

c. Gramsci (Hegemony, Civil Society)

III. Post Structuralism: (16)

a. Foucault

b. Derrida

IV. Recent Trends in Sociological Theory: (16)

a. Post-modernism: Jameson, Baudrillard, Lyotard

b. Jurgen Habermas, Anthony Giddens and Pierre Bourdieu

Essential Readings:

1. Adams and Sydie (ed.) (2001), Sociological Theory, Vistar Publication, New Delhi.
2. Appelrouth S. and Edles L.D. (2008), Classical and Contemporary Sociological Theory, London: Print Forge Press. P. No. 631-648, 683-710, 719-743, 753-785.
3. Bryan Turner, Chris Rojek and Craig Calhoun (ed) (2005), The Sage Handbook of Sociology, London: Sage Publication.
4. Calhoun, Craig and et.al. (ed.) (2007), Contemporary Sociological Theory- Second edition, London: Blackwell Publication. P. No. 231, 243, 277, 363, 370, 388.
5. Cuff, E.C, Sharrock, W.W, and Francis, D.W., Perspectives in Sociology, New York: Tylor and Franscis. P. no.184-201, 238-247, 258-279, 282-306, 316-337.
6. Dillon, Michele (2010). Introduction to Sociological Theory- Theory, Concepts and their Applicability to the Twenty-First Century, London: Wiley-Blackwell Publication,. P. No. 181, 214, 350-60, 405-426, 427-48.

7. Elliot, Anthony (ed.) (2010), The Routledge Companion to Social Theory, London: Routledge publication. P.No. 73, 86, 117.

8. Giddens A. and Turner J. (1988), Social Theory Today, California: Stanford University Press.

9. Ritzer George. and Barry Smart (ed.) (2001), Handbook of Social Theory, London: Sage Publication. P.No. 179, 201, 308, 324, 439,

10. Ritzer George (ed.) (2005), Encyclopedia of Social Theory, London: Sage Publication.

11. Seidman Steven (1994), Contested Knowledge- Social Theory in the Post modern Era, London Blackwell Publication.

12. Wolfgang J. Mommsen (ed.) (1994), The Polity Reader in Social Theory, Polity Press.

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1. Bourdieu Pierre (1990), In other words – Essays Towards a Reflexive Sociology, Stanford: Stanford University Press.

2. Bourdieu Pierre (1990), The Logic of Practice, Cambridge: Polity Press.

3. Cassell Philip (ed) (1987), The Giddens Reader, London: Macmillan Publication

4. Giddens Anthony (1984), The Constitution of Society. Outline of a Theory of Structuration, California: University of California Press

5. Goode Luke, Jurgen Habermas (2005), Democracy and the Public Sphere, London: Pluto Press.

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7. How Alan (2003), Critical Theory, Palgrave Macmillan.

8. Lemert Charles (1995), Sociology After the Crisis, New York: Westview Press

9. Smart Barry (2002), Michel Foucault, Routledge, London.

10. Steven Loyal (2003), The Sociology of Anthony Giddens, London: Pluto Press.

Marathi References:

1.तोष्णीवाल सुभाष (२०११) समाजशास्त्रीय सिद्धांतातील नाव-प्रवाह. नागपूर, मंगेश प्रकाशन

2. कुलकर्णी पी. के. प्रगत समाजशास्त्रीय सिद्धांत, नागपूर, मंगेश प्रकाशन

3. बनसोडे प्रशांत (२०१५) पंचनामा सांस्कृतिक भांडवलशाहीचा. पुणे. मनोविकास प्रकाशन (प्रकरण पहिले पान १५-२२)

4. गर्गे स. मा. (२०१७) भारतीय समाजविज्ञान कोश, खंड ६. पुणे. मेहता पब्लिशिंग हाउस

Social Movements: Dimensions and Trends

Objectives:

- To introduce the students to the role of social movements in social transformation
- To understand several major social movements in India and across the world relatedto issues of labour, ethnicity, nationalism, gender, caste, identity, environment, etc.
- To help them understand the various approaches to the study of social movements.

I. Introduction to Social Movements(10)

a. Defining Social Movements, Nature
b. Social Movement: Change, Reform and Revolution
c. Types : Old Movement and New Movement

I. Theories of Social Movements (14)

a. Structural –Functional
b. Marxist
c. Resource Mobilization Theory
d. New Social Movement
e. Framing Perspective

II. Social Movements in India (14)

a. Issues of Liberation, Equity and Security:
b. Women's Movements, Peasant Movements, Labour Movements and Environmental Movements
c. Identity Politics and Social Movements:
d. Religious and Caste Movements, Regional and Tribal Movements

III. Globalization and Alter-Globalization (10)

a. WSF, Occupy, Arab Springs
b. Lokpal, New Labour Protests, Students Protests.

Essential Readings:

1. Della Porta, D., & Diani, M. (2009). Social Movements: An Introduction. Hoboken: John Wiley & Sons.
2. Dhanagare, D. (1988). Peasant Movements in India. New Delhi: Oxford University Press.
3. Guru, G. (1997). Dalit Cultural Movement & Dalit Politics in Maharashtra. Mumbai: Vikas Adhyayan Kendra.
4. Jogdand, P. G., & Michael, S. M. (2003). Globalization and Social Movements: Struggle for a Humane Society. Jaipur: Rawat Publications.
5. Kumar, S. (2014) Social Movements: Transformative Shifts and Turning Points. New Delhi: Routledge.
6. Martin, G. (2015). Understanding Social Movements. New York: Routledge.

7. Oommen, T. (Ed.). (2010). Social Movements in Independent India, Vol. I and II. New Delhi: Oxford University Press.

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12. Rao, M. (Ed.). (1984). Social Movements in India: Studies in Peasant, Backward Classes, Sectarian, Tribal and Women's Movements. Delhi: Manohar publishers.

13. Shah, G. (2004). Social Movements in India. New Delhi: Sage Publications.

References:

1. Buechler, S. (1993) 'Beyond Resource Mobilization: Emerging Trends in Social Movement Theory'. The Sociological Quarterly.34: 217-235.

2. Buechler, S. M. (2000). Social Movements in Advanced Capitalism: The Political Economy and Cultural Construction of Social Activism. New York: Oxford University Press.

3. Calhoun, C. (1993) "New Social Movements" of the Early Nineteenth Century. Social Science History. Vol. 17, No. 3.Pp. 385-427.

4. Desai, A.R. (Ed.).(1979). Peasant Struggles in India. Bombay: Oxford University Press.

5. Frank, A. G. and Marta, F. (1987). Nine Theses on Social Movements. Economic and Political Weekly. Vol.52.No-4.

6. Eder, K. (1993). The New Politics of Class: Social Movements and Cultural Dynamics in Advanced Societies. Newbury Park CA: Sage Publications.

7. Flam, H., and King, D. (Ed.)(2005). Emotions and Social Movements. New York: Routledge.

8. Bagguley, P. (1992). Social change, the middle class and the emergence of “new social movements”: A critical analysis. The Sociological Review 40.1: 26-48

9. Bagguley, P. (1997). Beyond political sociology? Developments in the sociology of social movements. The Sociological Review 45.1: 147-61.

10. Gore, M.S.(1993).The Social Context of an Ideology: Ambedkar’s Political and Social Thoughts. New Delhi: Sage Publication.

11. Gouldner, A.W.(Ed.) (1950). Studies in Leadership, New York: Harper and Brothers.

12. Wim,V.,D., Brian, D. L., Paul G. R.(2004). Cyber protest: New Media, Citizens, and Social Movements. London: Rutledge.

13. Zelliot, E. (1995). From Untouchable to Dalit: Essays on the Ambedkar Movement.

New Delhi: Manohar: Publication.

14. Zirakzadeh, C. E. (1997). Social Movements in Politics: A Comparative Study. New Delhi: Pearson Books.

15. Rao, M.S.A. (1979).Social Movements and Social Transformation. Delhi : Macmillan.

16. Smelser, N.J. (1963). The Theory of Collective Behavior. New York: The Free Press.

17. Tarrow, S. G.(1994). Power in movement: Social movements, collective action and politics. New York: Cambridge University Press.

18. Tarrow, S.(1998). Power in Movement: Social Movements and Contentious Politics. Cambridge: Cambridge University Press.

19. Touraine, A. (1981) The Voice and the Eye: an analysis of social movements. Cambridge: Cambridge University Press.

20. Omvedt, G. (1995). Dalit Visions: The anti-caste movement and the construction of an Indian Identity .New Delhi: Orient Longman.

21. Oommen, T.K.(1972). Charisma, Stability and Change: An Analysis of Bhoodan Grandaunt Movement. New Delhi: Sage Publication.

22. Oommen, T.K.(1990). Protest and Change: Studies in Social Movements. Delhi: Sage Publication.

23. Kohli, A. (1987). State and Poverty in India. New York: Cambridge University Press.

24. Mathew, G. (1994). Panchayati Raj from Legislation to Movement. New Delhi : Concept Publication.

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26. Joshi, B. (Ed.) (1986). Untouchable! Voices of Dalit Literature Movement. Londoan: Zed Books.

27. Petras, J. and Henry, V. (2005). Social Movements and State Power. London: Pluto Press.

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5. 26. देवगावकर एस. (२००९) सामाजिक चळवळी: परंपरागत आणि नवीन. नागपूर. साईनाथ प्रकाशन.

Note: Any other text/Article suggested by the subject teacher.

Sociology of Maharashtra: Culture and Society

Objectives:

- To enhance sociological knowledge about the local and regional context of Maharashtra.
- To acquaint students with the changing trends in Maharashtra with special reference to Globalization, Development processes and caste, gender politics

I. Concept of region, mapping history and contemporary development of Maharashtra (12)

a. Social construction of Maharashtra Caste, Religion, community and language.
b. Folk culture and popular culture of Maharashtra
c. Contemporary development of Maharashtra (HDI, GDI)

II. Cultural Revolt in Colonial Maharashtra
(16)

a. Satyashodhak Movement
b. Rajarshi Shahu-Struggle and reconstruction of new Maharashtra
c. Non Brahmin Movement
d. Ambedkarite and Anti- caste Movement
e. Debate on social reform and Women's Questions in 19th Cent. Maharashtra (Age of Consent, Widow Remarriage, Education, Nation and Mother)

III. Formation of Maharashtra: Economic, Political and Cultural Issues
(16)

a. Samyukta Maharashtra Movement
b. Girangaon and Working Class Movement
c. Regional Nationalism: Shiv Sena
d. FPP, Bahujan, Dalit and OBC politics in Maharashtra e. Cooperative movement, Right to work-EGS,

IV. Contemporary issues and contradictions in Maharashtra
(16)

a. Regional Disparity in Development
b. Issues of Displacement
c. Farmer's Suicide
d. Sex Ratio
e. Atrocities against SC, ST
f. Riots and ghettoization of Minorities

Essential Readings:

1. Lele, J. (1982). Elite pluralism and class rule: political development in Maharashtra, India. Bombay: Popular Prakashan.

2. Lele, J. (1990). Caste, class and dominance: political mobilization in Maharashtra. F.Frankel & M S A Rao (Ed.). Dominance and state power in modern India: Decline of a social order (pp. 115-211). Delhi: Oxford University Press

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5) बगाडे, उ. (२००६). महाराष्ट्रातील प्रबोधन आणि वर्गजाति प्रभुत्व . पुणे : सुगावा प्रकाशन.
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7) दीक्षित, रा. (२००९) एकोणीसाव्या शतकातील महाराष्ट्र मध्यम वर्गाचा उदय. पुणे :डायमंड प्रकाशन.
8) भोळे, भा.ल., बेडकिहाळ, कि.(२००३) बदलता महाराष्ट्र. सातारा : आंबेडकर अकादमी

Methodology of Social Research

Objectives:

- To introduce the philosophical foundation of social research and related debates to thestudents.
- With this paper students will get acquainted to the Quantitative and Qualitative research strategies and debates.
- Students will understand the diversity of method and critical thinking behind everymethod.

I. Introduction to Social Research (12)

a. Positivism and Interpretivism
b. Objectivity-subjectivity debate
c. Reflexivity in social research

II. Critiques of Positivism 14

a. Phenomenology and Ethnomethodology
b. Feminist Critiques
c. Hermeneutics and Critical theory
d. Impact of Post- modernism and Post- structuralism on Methodology

III. Quantitative Research Strategies 10

a. Differences between quantitative and qualitative research
b. Survey
c. Content Analysis

IV. Qualitative Research Strategies 12

a. Ethnography
b. Oral History
c. Case Study
d. Participatory Action Research

Essential Readings:

1. Alvesson, M. & Skoldberg K. (2009). *Reflexive Methodology –New Vistas forQualitative Research* (2nd edition). London: Sage Publication.
2. Bryman, A. (2001). *Social Research Methods.* Oxford: Oxford University Press.
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3. Douglas, J. (Ed.). (1971). *Understanding Everyday Life*. London: Routeledge & Kegan Paul.
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Semester II

Sociology of Environmental Sustainability

Course Objectives:

- To provide an overview of the central debates in linkage between environment and society,environmental sociology and sustainability.
- To explore current challenges to environment and sustainability from a sociologicalperspective with associated policies, laws, alternatives, struggles, and movements.
- To examine the practical and theoretical principles of sustainability.
- To sensitise and orient students about how to apply principles of sustainability to diversesituations and communities.

I. The Sociology of Sustainability and Sociology of Environment: An Introduction (12)

1. Sociology of Environment, Sociology of Sustainability: Nature, scope and relevance
2. Concepts: Sustainability, Environment, Social Ecology, Development,
3. Three Pillars of Sustainability: Economic, Social and Environmental
4. Approaches: Gandhian, Social Constructionism, Realism, Appropriate Technology, Eco-feminism, Deep Ecology, Political Ecology, Usurping resources for 'Development'

II. Conditions and Issues of Environment and Sustainability (16)

1. Conditions of Un-sustainable Environment: Capitalism to Neoliberal Globalization (Failure of Green Revolution)
2. Sustainability and Planetary Boundaries. (Issues of energy, water, air, land, climate change, and loss of biodiversity) Anthropocene
3. Issues of development induced social injustice (communities, gender, livelihoods, culture, indigenous knowledge, and marginalization)

III. Steps towards Sustainability: Global Level (16)

1. Policies and Action Plan: Brundtland Commission- 1987, Rio 1992, The Kyoto protocol, Millennium Development Goals, The World Summit on Sustainable Development 2002, Paris Agreement, Sustainable Development Goals;
2. Major International Environmental laws: Right to Environment as Human Right, – International Humanitarian Law and Environment, Environment and Conflict Management, Law on International Watercourses

3. Civil society Initiatives and Movements, Green's Party, Civil Society Coalition on Sustainable Development (CSCSD), Alter Globalization Movement

IV. Steps towards Sustainability: Indian National and Local Level (16)

1. Policies and Programmes: Article 48 of Directive Principles, National Environment Policy 2006, National Action Plan on Climate Change and India SDG Index.

2. Legislations and Community Participation– Wildlife Protection Act, 1972; JFM, Forest Conservation Act, 1980, , Panchayats Extension to Scheduled Areas (PESA) Act 1996, Recognition of Forest Rights Act, 2006, Coastal Regulation Zone

3. Civil society Initiatives and Movements in India: Chipko Movement, Narmada Bachaav Movement; Sustainable Energy experiments, Participatory, Community based Alternative Practices

4. Lessons of Corona Pandemic and Future of Sustainability in India.

Essential Readings

1. Barry J. (1999) Environment and Social Theory; New York: Routledge.
2. Bell M. and Mayerfeld (1998) Sociology for New Century. An Invitation to Environmental Sociology, Pine Forge press.
3. Blewitt J. (2008) Understanding Sustainable Development .UK. Earthscan
4. Chakrabarti,T. (2014) Environment and Sustainable Development- India. Springer
5. Gadgil, M. and Guha R. (1996) Ecology and Equity: The use and Abuse of Nature in Contemporary India, New Delhi: OUP.
6. Gole P. (2001) Nature Conservation and Sustainable Development in India, Jaipur and New Delhi: Rawat Publications.
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12. Munshi, Indra, "Environment in sociological Theory", in Sociological Bulletin, Vol 49, No2
13. Pal B. P, Environmental conservation and Development, Dehradun: Natraj Publishers.
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10. Civil Society Report on Climate Change.(2007) .UK. International Policy Press
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Video resources:

1. An inconvenient truth full documentary
2. Climate Change & I | Dr. Priyadarshini Karve | TEDxSCAC https://www.youtube.com/watch?v=IK_LK6Dn1NU

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2. गर्गे स. मा. (२०१७) भारतीय समाजविज्ञान कोश, खंड ६, पुणे, मेहता पब्लिशिंग हाउस

3. पाटील प्रतिभा व इतर (२०१०) महात्मा गांधी आणि ग्रामीण विकास. औरंगाबाद. पब्लिशर्स एज्युकेशनल

4. बुच एम. (२००१) पर्यावरणीय जाण व दृष्टी आणि नगर नियोजन, पुणे. परिसर

5. घोरपडे अ. (२००९) ग्लोबल वार्मिंग. पुणे. राजहंस प्रकाशन

16. देऊळगावकर अ. (२०१२) विश्वाचे आर्त. पुणे. मनोविकास प्रकाशन

7. देऊळगावकर अ. (२००६) बखर पर्यावरणाची आणि विवेकी पर्यावरणवाद्याची. मुंबई. मौज

8. कर्वे प्रियदर्शिनी (२००७) उर्जेच्या शोधात. पुणे. राजहंस प्रकाशन 9. कर्वे प्रियदर्शिनी (२०२०) शाश्वत विकासाची वाट खुणावते आहे..लोकसत्ता. १० मे २०२०

https://www.loksatta.com/lokrang-news/coronavirus-pandemic-positive-changes-in nature-dd70-2156361/

10. शाश्वत विकास ध्येये https://in.one.un.org/wp

content/uploads/2018/10/Marathi_SDG_Booklet_25Jan 17.pdf

Note: Any other text/Article suggested by the subject teacher.

Introduction to Human Rights and Social Justice

Objectives:

1. To introduce students to the conceptual and philosophical foundation of rights.
2. To acquaint students with major human rights issues in India.
3. To familiarize them with the complex processes of implementation of human rights through social movements and emerging global civil society.
4. To develop in them a deeper insight with a focus on contemporary dimensions of human rights - its relevance and critiques.

Unit I. Conceptual and Philosophical Background of Human Rights (12)

a. Meaning, characteristics and generational classification
b. Natural rights theory, Marxist and Liberal theories, Feminist perspective
c. Universal Declaration of Human Rights (UDHR) and debates (Are Human Rights Universal? & Critique of dichotomy & a case for integrated approach)

Unit II. Major Human Rights Issues in India (15)

a. Rights of Vulnerable Groups: Dalits, Tribals, Minorities, Poor (the bottom billion)
b. Rights of Women and Children
c. Rights of the Disabled

Unit III. Contemporary Developments in Human Rights (15)

a. Development and Human Rights (Right to Development)
b. Human Rights and Globalisation
c. Environment and Human Rights
d. Right to Information, Right to Health, Right to Education

Unit IV. Civil Society, Social Movement and Critique of Human Rights (18)

a) Civil Society and Social Movement
   - Social Movements and Social Construction of Human Rights (Anti-Corruption Movement,Nirbhaya Movement, Anti-globalisation Movement etc.)
   - Emerging "Global Civil Society"

b) Relevance and Critiques of Human Rights
   - Global Relevance of Human Rights
   - A Contemporary Critique of/Attack on Human Rights
   - The Future of Human Rights

Essential Readings:

1. An-Na'im, Abdullahi Ahmed. (1992). Human Rights in Cross-cultural Perspectives: A Quest for Consensus. Philadelphia: University of Pennsylvania Press
2. Baxi, Upendra. (2012). The Future of Human Rights. New Delhi: OUP
3. Binion, Gayle. (1995). Human Rights: A Feminist Perspective. Human Rights Quarterly. 17(3): 509-526
4. Brysk, Alison. (2002). Globalization and Human Rights. Berkeley: University of California Press
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8. Desai, A. R. (1990). Repression and Resistance in India: Violation of Democratic Rights of

the Working Class, Rural Poor, Adivasis and Dalits. Bombay: Bombay Popular Prakashan
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11. Donnelly, Jack. (2013). Universal Human Rights: In Theory and Practice. Ithaca: Cornell University Press
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13. Fraser, Arvonne S. (1999). Becoming Human: The Origins and Development of Women's Human Rights. Human Rights Quarterly. 21(4): 853-906
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15. Goodhart, Michael. (2008). Neither Relative nor Universal: A Response to Donnelly. Human Rights Quarterly. 30(1): 183-193
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20. Ignatieff, Michael. (2001). The Attack on Human Rights. Foreign Affairs. 80(6): 102-116
21. Kadragic, Alma. (2006). Globalization and Human Rights. Philadelphia: Chelsea House Publishers
22. Le, Nhina. (2016). Are Human Rights Universal or Culturally Relative? Peace Review. 28(2): 203-211
23. Leib, Linda Hajjar. (2011). Human Rights and the Environment: Philosophical, Theoretical and Legal Perspectives. Leiden: Martinus Nijhoff Publishers
24. Levin, Leah. (2009). Human Rights: Questions and Answers. New Delhi: NBT
25. McCorquodale, Robert & Fairbrother, Richard. (1999). Globalization and Human Rights. Human Rights Quarterly. 21(3): 735-766
26. Megret, Frederic. (2008). The Disabilities Convention: Human Rights of Persons with Disabilities or Disability Rights? Human Rights Quarterly. 30(2): 494-516
27. Mendelsohn, Oliver & Baxi, Upendra. (eds.). (1994). The Rights of Subordinated Peoples. Delhi: OUP
28. Nickel, James W. (2008). Rethinking Indivisibility: Towards a Theory of Supporting Relations between Human Rights. Human Rights Quarterly. 30(4): 984-1001
29. Pogge, Thomas (ed.). (2007). Freedom from Poverty as a Human Right: Who Owes What to the Very Poor? Oxford, UK: OUP
30. Ray, Aswini K. (2003). Human Rights Movement in India: A Historical Perspective. EPW. 38(32): 3409-3415
31. Santos, Boaventura De Sousa. (2020). Toward new universal declaration of human rights (I). (see opendemocracy.net, accessed on 08/05/2020)
32. Scott, Craig. (1999). Reaching Beyond (Without Abandoning) the Category of "Economic, Social and Cultural Rights". Human Rights Quarterly. 21(3): 633-660
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6. Jochnick, Chris. (1999). Confronting the Impunity of Non-State Actors: New Fields for the Promotion of Human Rights. Human Rights Quarterly. 21(1): 56-79
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Reports:

Amnesty International Reports
Gender Development Reports Human
Development Reports Human
Rights Watch Global ReportsIndia
Development Reports
The State of Children (UNICEF)World
Development Reports

Note: Any other text/Article suggested by the subject teacher.

Understanding Globalisation

Objectives:

- To understand Historical Trajectory of concept of Globalization.
- To examine Multiple and Contested meanings and approaches to Globalization
- To examine implications of Globalization
- Scrutinize diverse responses to the processes of globalization.

Unit I Making sense of globalization (16)

a. Meaning, understanding various intellectual positions – globalists, sceptics,internationalists
b. Political economy and historical roots, from development to globalization
c. Before and after Bretton Woods, Neo-liberalism and global financial institutions(GATT, IMF, World Bank, WTO….)
d. Dimensions of globalization – economic, political and cultural

Unit II Debates and approaches to globalization (16)

a. Anthony Giddens – globalization as intensification of modernity
b. Hirst and Thompson – globalization as a necessary myth
c. Arjun Appadurai – globalization - disjuncture and difference
d. Manuel Castells – Network society

Unit III Globalization and global inequalities (16)

a. Labour in a global economy - New International division of labour, labour in knowledgeeconomy
b. Transnational Migration – transnational communities and families, issues of race andethnicity
c. Globalization, gender and sexualities
d. Globalization, climate change and social justice

Unit IV Alternatives and responses (12)

a. Global social movements
b. Transnational Civil Society
c. Lessons learnt for COVID-19

Essential Readings:

1. Ritzer, Gorge. (2010). Globalization: A Basic text. UK: Wiley Blackwell.Chapters-1-5 and 7-15
2. Walters, M. (2010). Globalization. N.Y.: Routledge. Chapters 1-8.
3. Steger, M.B. (2003). Globalization: A very short introduction. UK: OUP.
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5. Blackwell. (2007). Companion to Globalization. Malden: Blackwell.
6. Ehrenreich, B. (2002). Global Woman. N.Y : H.Holt & Co. pp.85 -103.
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4. Featherstone, Lash and Robertson (ed.).(1995). Global Modernities. New Delhi: SagePublications.
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7. Bauman,Z. (1998). Globalization. The Human Consequences. UK: Polity Press.
8. Richard P. Applebaum and William I. Robinson (eds) Critical Globalization Studies. NewYork: Routledge.
9. Naomi Klein. (2014). This Changes Everything. Introduction. NewYork: Simon & Schuster.
10. Jan Nederveen Pieterse (2009.) Globalization and Culture: Global Mélange Rowman &Littlefield Publishers
https://www.youtube.com/watch?v=9-4V3HR696k
Youtube video: “Hidden Faces of Globalization”, parts I and II
https://www.youtube.com/watch?v=8Bhodyt4fmU&list=PLm4RGa6Hu1YmUXG4Ub5IjjIoWdZ4Dybmp
https://www.youtube.com/watch?v=a0IBM7_BvTw

Sociology of Social Work

Objectives

- To provide knowledge to understand current social work concepts, perspectives,realities, welfare policy and systems.
- To make the students acquainted with the methodology for social work
- To develop understanding about the influence of various social movements in contributingto the perspectives of social work practice in India.

I. Introduction to social work (16)

a. Concept definition and history of social work in India
b. Approaches to social work
    1. Welfare approach
    2. Development approach,
    3. empowerment approach,
    4. Social action and Rights based approach

II. Basic Concepts and overview of practice methods related to Social Work. (18)

a. Basic concepts: Social Development, social Advocacy, Participation, Social Security and safety Nets,Social Exclusion (marginalization, exploitation, oppression)

b. Overview of Practice Methods

- **i.** Social case work,
- **ii.** social group work,
- **iii.** community organization,
- **iv.** Social action
- **v.** social research and
- **vi.** social welfare administration.

(Points to be covered - a. Definition b. Settings where each method is practiced c. Key differences between the methods and application d. underlying philosophy that integrates the methods)

III. Fields of Social Work (16)

a. Social work and families : women, children, youth and senior citizens
b. Social work in health: physical, mental health and community health
c. Correctional work: Prevention and rehabilitation
d. Social work with communities (rural and urban) : environment, livelihoods and infrastructure
e. People with Special Needs: differently able, stigmatized groups
f. Corporate social responsibility

IV. Orientation visits to social organizations (10)

Report Writing & Presentation of Report

References

1. AbhaVijai Prakash, (2000) Voluntary Organization and Social Welfare, ABD Pub.,Jaipur
2. Bhattacharya: Integrated Approach to Social Work in India, Jaipur : Raj PublishingHouse
3. Batra, Nitin (2004) Dynamics of Social Work in India, Jaipur : Raj Publishing House.
4. Barker, R.L. (1999). Milestones in the development of social work and social welfare. Washington, DC: NASW Press.
5. Barker, R.L. (1999). Social work dictionary. (4th ed.). Washington, DC: NASW Press.
6. Daniel S. Sanders, Oscar Kurren, Joel Fischer(1981): Fundamentals of Social WorkPractice: A Book of Readings, Wadsworth Pub. Co. Michigan
7. DasguptaSugata (1967): Towards a Philosophy of Social Work in India, Popular BookServices for the Gandhian Institute of Studies
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9. Desai, Murali (2002) Ideologies and Social Work (Historical and ContemporaryAnalysis), Jaipur :Rawat Publication.
10. Diwakar, V. D. (1991) Social Reform Movement in India, Mumbai : Popular Prakashan

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Note: Any other text/Article suggested by the subject teacher.

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