Savitribai Phule Pune University

(Formerly University of Pune)

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Director,
Board of Examinations and Evaluation,
Savitribai Phule Pune University,
Ganeshkhind - 411 007
Email : bee@pun.unipune.ac.in

Ref: Examination/MIC/ 29

Date: 24th May, 2021

To
The Principals,
Affiliated Colleges (UG Science Programs)
Savitribai Phule Pune University,

Sub: Syllabus finalized for the second term of third year under-graduate Science Programs for the end-semester Examinations (Summer 2021 Session- Online examinations scheduled in the months of July-August 2021).

Sir/Madam,

As per the directives received from the Dean, Science and Technology, Savitribai Phule Pune University, syllabus for the third Year Science Programs for the end-semester examinations (on-line examinations) of the second term of the Academic Year 2020-21 is attached herewith for your information.

It is requested to make it convenient to send desired information to all concerned eligible students, who are appearing for the second term of the third year Science programs for the end-semester examinations (summer 2021 Session- On-line examinations scheduled during the July-August 2021).

With regards.

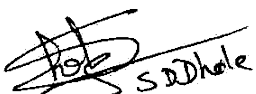
Mahesh Kakade
Director
Board of Examinations and Evaluation

Guidelines for Reduction in Syllabus for TYBSc (Sem – IV) for the Academic Year 2020-21

1. 70 % reduced syllabus for TYBSc (Sem – IV) for the following subjects under Science Faculty of Savitribai Phule Pune University

Sr. No.	Name of the Board of Studies	Name of Bos Chairperson
1	Botany	Dr. Gaikar B.M.
2	Chemistry	Dr. Avinash Kumbhar
3	Computer Science	Dr. Dhole S.D. (Coordinator)
4	Electronic Science	Dr. Gharpure D C
5	Geography (TYBA & TYBSc)	Dr. More Jyotiram C.
6	Geology	Dr. Kale Makarand(Coordinator)
7	Mathematics	Dr. Gaikwad S B
8	Microbiology	Dr. Sucheta Patil
9	Physics	Dr. Pandit Shelke
10	Zoology	Dr. Khandagle Abhay J
11	Statistics	Dr. Ramnathn T.V.
12	Biotechnology & Bioinformatics	Dr. Gacche R.N.(Coordinator)
Adhoc Boards		
1	Restructuring Pattern	Dr. R.D. Borse (Chairman)
2	Home Science	Dr. S.R. Kuchekar (Chairman)
3	B.Sc. Hospitality Studies	Dr. Surbhi Jain (Chairman)
11	Computer Application	Dr. S.S. Sane (Chairman)
17	Environmental Science	Dr. Suresh Gosavi (Chairman)
19	Nanoscience and Nanotechnology	Dr. S.K. Haram (Chairman)

2. This syllabus is only for Academic year 2020-21.



Dr. Sanjay D. Dhole
Chairman,
Committee for Syllabus Finalisation
of TYBSc (Sem-IV) SPPU Examination

Dr. Manohar Chaskar
Dean,
Faculty of Science and Technology

BOTANY

T Y B Sc Botany 70% syllabus for the year 2020-21

SEMESTER IV

Paper I: BO. 341: PLANT PHYSIOLOGY AND BIOCHEMISTRY

Plant Physiology

1) **Photosynthesis:** Structure of a chloroplast, photosynthetic pigments and their role, Photosystems, Light reaction, electron transport chain, Cyclic and Non- cyclic photophosphorylation, Path of carbon in photosynthesis - Calvin cycle, HSK pathway: Salient features of C4 plants, metabolic pathway, CAM pathway, Photo-respiration, Significance of photosynthesis. **(10)**

2) **Respiration:** Structure of a mitochondrion, Respiratory substrates, Types of respiration, Mechanism of aerobic respiration – Glycolysis, TCA cycle. Electron transport system, Chemi-osmotic hypothesis of ATP synthesis, Balance sheet of ATP generation in respiration. Significance of respiration. **(7)**

Biochemistry:

1) **Carbohydrates:** Definition and classification Properties and functions of carbohydrates. Synthesis and breakdown of starch. **(4)**
2) **Amino acids and proteins:** Definition, synthesis and properties of amino acids. Role of amino acids. Classification of proteins on the basis of structure, properties and functions of proteins. **(5)**
3) **Lipids:** Definition, classification, properties and functions of lipids. Synthesisof lipids, β-oxidation. **(4)**
4) **Enzymology:** Definition and nature of enzymes, active site, Classification (IUB) and properties of enzymes, Co-enzymes. Mechanism of enzyme action- Lock and key hypothesis, Induced fit theory. Factors

affecting enzyme activity– pH, temperature, substrate concentration, enzyme concentration. Enzyme inhibitors – Competitive, uncompitative, non-competitive. **(6)**

Paper II: BO.342: PLANT ECOLOGY AND BIODIVERSITY

PLANT ECOLOGY

1. Ecology **(8L)**

Introduction, Interrelationship between the living world and the environment, components and dynamism of Ecosystem, homeostasis. Impact of human activities on environment – Causes, Prevention and control of – Air,water and Soil Pollution Brief account of environmental toxicology – Eutrophication, bioaccumulation and biomagnifications

2. Environmental Crisis **(3L)**

Desertification, Ozone depletion and Global warming

3. Environmental Impact Assessment **(3L)**

Process, objectives of EIA, Hierarchy in EIA, Historical Review of EIA, Conceptsrelated to EIA, Basic data collection for EIA

4. Environmental Audit **(3L)**

Meaning, need, Audit Protocol, Proccessing, Certification, personnel environmental Audit.

BIODIVERSITY

1. Introduction to Biodiversity **(02 L)**

Introduction, Concept, Aims and objectives. Scope and values of Biodiversity

2. **Characterization of Biodiversity:** **(05 L)**

Introduction, need for characterization, various disciplines of Biodiversity- Genetics, Species and Ecosystem. Concept of endemism and phytogeography.

3. Conservation of Biodiversity: (11L)

Current Practices in Conservation,

In-situ Conservation: International efforts and Indian initiatives; protected areas in India, Concept of Biosphere Reserves and National Parks.

Ex-situ Conservation: Germplasm Collections, Botanical Gardens, Seed Banks, Gene Banks, Pollen Banks, DNA Banks, Wetlands, mangroves and coral reefs.Enlist national agencies playing role in conservation (BSI, NBPGR, ICAR, CSIR, DBT), ***Social Approach to Biodiversity Conservation****:* Sacred Groves, Sthalavrikshas, Chipko Movement, Role of Universities and other Educational Institutions in Biodiversity Conservation

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PAPER III BO.343: PLANT PATHOLOGY

1.Fundamentals of plant pathology 5 L

Introduction, Important terminology- Incitants, Host, Parasite, Pathogen, Inoculum, Penetration, Infection, Incubation, Disease, Disease development, Symptoms, Sign, Endophyte, Predisposition, Suscept, Resistance, Epidemic, Etiology. Economic importance of plant diseases, History of plant pathology, Introduction to Indian Agricultural Research Institute (IARI), International Crop Research Institute for Semi Arid Tropics (ICRISAT), Contribution of Anton DeBary and Prof. B.B. Mundkur.

2.Disease Development 6 L

Concept of disease cycle, Inoculation, Prepenetration, Penetration, Infection, Dissemination. Epidemics- Forms, Decline,, Exponential model. Disease forecasting, Measurement of plant disease and yield loss.

3.Defence Mechanisms **3 L**

Concept and Definition, Types- Preexisting- Structural and chemical, Induced- Structural and Biochemical

4. Methods of Studying Plant Diseases **5 L**

Macroscopic study, Microscopic study, Koch"s postulates. Culture technique, Media Types and Preparation, Pure culture methods- streak plate, Pour plate, spread plate, Serial dilution.

5.Fungal Plant Diseases **5 L**

Introduction to fungi as plant pathogens. Study of Diseases- Club root of Crucifers, Downy mildew of Grapes, Head smut of Jowar, Leaf spot of Turmeric, Tikka disease of Groundnut with reference to causal organism, symptoms and signs, disease cycle and control measures.

6. Bacterial Plant Diseases **3L**

Introduction to bacteria as plant pathogens, Study of Diseases- Citrus Canker, Black arm of Cotton with reference to causal organism, symptoms and signs, control measures.

7. Mycoplasma Plant Diseases **3L**

Introduction to Mycoplasma as plant pathogens, Study of Diseases- Grassyshoot disease of sugarcane, Little leaf of brinjal with reference to symptoms and signs, control measures.

8. Nematodal Plant Diseases **2L**

Introduction to Nematodes as plant pathogens. Study of Diseases- Root knot disease of vegetables, Ear cockle of Wheat with reference to causal organism,

symptoms and signs, control measures.

9. Viral Plant Diseases **3L**

Introduction to Viruses as plant pathogens. Study of Diseases- Tobacco Mosaic Disease, Bunchy top of Banana with reference to causal organism, symptoms and signs, control measures.

Paper IV: BO.344: MEDICINAL AND ECONOMIC BOTANY

Medicinal Botany

1. Introduction to Pharmacognosy **(3L)**

Origin, history, definition and scope of Pharmacognosy,

Methods of classification and their significance in the study of drugs ofnatural origin (alphabetical, biological, chemical, taxonomical, chemotaxonomical and pharmacological)

2. Ayurvedic Pharmacy **(8L)**

Introduction

Tridosha concept, Humoral, Indigenous Systems of medicine (Ayurveda, Siddha,Unani,Tibi, Chinese etc.) Ayurvedic principles- Ras. Guna, Vipaka, Virya, Prabhava,

Ayurvedic formulations –Asava, Arishta, Kvatha, Churna, Ksharas, Leha, Vatika, Taila, Bhasma,

3. Cultivation, collection and processing of herbal drugs from Mentha and Eucalyptus. **(3L)**

Cultivation- Methods, Factors affecting cultivation, Collection and Processing-Collection, harvesting, drying, garbling, packing,storage of crude drugs.

4. Study of medicinally important drugs **(6L)**

Study of drugs w.r.t. occurrence, distribution cultivation, microscopic characters, constituents and uses of the following.

Root Rhizome drugs :- *Glycyrrhiza*, Stem drugs: - *Ephedra,* Leaf drugs: - *Adhatod*, Flower drugs: - Clove, Fruit drugs: - Amla,Unorganized drugs :- Shilajit and *Acacia* gum,Contraceptive drugs: - *Dioscorea*.

5. Applied Medicinal Botany **(8L)**

Study of drugs with respect to Biological source, Geographical distribution, common varieties, macro and microscopic characters, chemical constituents

and therapeutic uses, adulterants of the following plants/drugs *Strychnosnux vomica*-Seeds, *Tinospora cordifolia*-Stem

Concept of active principle, and major metabolic Pathway (Carbohydrates and Proteins) leading to the Production of therapeutically active Chemical Constituents

Concept, definition and introduction to Biopharmaceutics, Pharmacodynamics and clinical Pharmacokinetics with applications

6. Ethnobotany : Definition, principles, scope and ethnic societies in India. **(2L)**

Economic Botany

1. Origin, evolution, source & uses of Rice, *Curcma longa,* Safflower, Sugarcane, *Butea monosperma/Samanea saman/ Scleichera oleosa and* Rose. **(6L)**

Paper V: BO. 345 PLANT BIOTECHNOLOGY

1. Introduction to Biotechnology **5L**

Introduction and History of plant Biotechnology

Pioneering work and significant achievements in Indian plant Biotechnology Global Impact and Current excitements of plant Biotechnology - Plant Health care and plant protection.

2. Plant Tissue Culture **15L**

Brief History, Importance of plant tissue culture

Types of culture, basic technique of plant tissue culture, Concept, technique and applications of callus culture, cell suspension culture, protoplast culture, somatic hybridization and cybrids, Haploid production, Micropropagation, embryo culture-and embryo rescue

3. Transgenic Plants as Bioreactors **6L**

Metabolic engineering of starch, cyclodextrins, fructans, Bioplastics,Genetically engineered plants as protein factories, Production of therapeutic proteins from plants.

4. Biotechnology of Biological Nitrogen Fixation **6L**

Non symbiotic Nitrogen Fixation-

Diazotrophs and their ecology, special features,

Mechanism of N_2 Fixation

Nitrogenase and Hydrogenase

Symbiotic N2 Fixation- establishment of symbiosis,

Factors affecting and mechanism of symbiotic N2

FixationGenetics of Diazotrophs- Nod genes, Nif gene

Biofertilizers- algal, fungal, phosphate solubilising and organic fertilizers

5. Biotechnology and Society
(4L)

Biotechnology- Benefits, GM foods and its safety, patenting of biotechnological inventions, Biotechnology and developing countries, Recombinant foods and religious beliefs, recombinant therapeutic product for human health care, Intellectual property rights.

Paper VI: BO346: PLANT BREEDING AND SEED TECHNOLOGY

PLANT BREEDING

1. Introduction, scope and importance (2 L)

2. Conventional techniques, methods and practices of breeding (10 L)

(a) Plant introduction and acclimatization

i. Concept, objectives
ii. Types of plant introduction
iii. Advantage, limitations/ Disadvantages and achievements.

(b) Selection methods

i. Concept,

ii. Types of selections –mass selection, pure line selection and clonal selection.
iii. Advantage and disadvantages/limitations, achievements.

(c) Hybridization
i. Definition and Concept,
ii. Difficulties in crop hybridization and precaution to be taken during hybridization
iii. General procedure of hybridization
iv. Parent selection in a breeding program
v. Criteria for selecting parents
Breeding Methodology
i. Pedigree method
ii. Bulk method
iii. Single-seed descent method
iv. Backcross method, Achievements

(d) Heterosis and hybrid vigour
i. Concept
ii. Causes of heterosis- dominance hypothesis
iii. Applications

3. Breeding for stress tolerance (4L)

Mechanisms and genetic bases of resistance/tolerance to biotic and abiotic stresses in plants,
Breeding for resistance/tolerance.
Molecular Approaches
Characteristics evaluated for drought tolerance
Characteristics evaluated for insect/pest tolerance
Achievements

SEED TECHNOLOGY

1. Introduction: (2 L)

Definition of seed,
Stages of Seed Production,
Classes of Seed (nucleus seed, breeders seed, foundation seed, certified seedand truthful seed),
Role of seed technology.

2. Seed certification: (2 L)

General procedure of seed certification,
field inspection,

observation during
inspection,field count,
Duties of seed inspector.

3. Seed sampling, storage and packaging (6 L)

Seed sampling,
Types of seed
samples,Sampling
equipments.
Factor affecting seed storage and need of seed storage,
Methods of protection and control,
Air conditioning and dehumidification,
Sanitation and fumigation of seed stores.
Seed sorting and bagging, bag weighing, bag closing, type of bag closer,Labelling and maintaining lot identify, lot numbers, seed pellets, Handling and stacking,
Maintenance of seed processing record.

4. Seed Testing

A. Moisture Testing (3L)

By air oven
method
Moisture
meters.

B. Germination testing (3L)

Definition and objectives,
General principles and requirements,
Procedure and methods (Paper, Sand and
Soil)Seedling evaluation.

5. Seed Marketing: (3L)

Marketing- Basic concepts, supply & demand, price equilibrium, seed transportation, storage, cost & returns, cost processing, packing and marketing, Organization for seed marketing, seed markets in India, structure & working.

Savitribai Phule Pune University

Board of Studies in Chemistry

T.Y.B. Sc. Chemistry [2013 Pattern]

Revised Syllabus (~70 %)

(For the academic year 2020-21 only)

Semester – IV

Physical Chemistry (CH-341)

Sr. No.	Name of Topic	Lectures
1	Electrochemical Cells	14
2	Nuclear Chemistry	12
3	Crystal Structure	12

Inorganic Chemistry (CH-342)

Sr. No.	Name of Topic	Lectures
1	Chemistry of f-block element	08
2	Metals Semiconductors and Superconductors	10
3	Ionic Solids	10
4	Homogeneous Catalysis	06

Organic Chemistry (CH-343)

Sr. No.	Name of Topic	Lectures
1	Carbanions and their reactions	06
2	Rearrangement reactions	06
3	Spectroscopic methods in structure determination of Organic compounds	24

Analytical Chemistry (CH-344)

Sr. No.	Name of Topic	Lectures
1	Solvent Extraction	08
2	Chromatography	10
3	Gas Chromatography	09
4	High Performance Liquid Chromatography	09

Industrial Chemistry (CH-345)

Sr. No.	Name of Topic	Lectures
1	Polymer chemistry	10
2	Sugar and Fermentation Industry	08
3	Soap, detergents and Cosmetics	08
4	Chemistry of pharmaceutical industries	08

Nuclear Chemistry (CH-346A)

Sr. No.	Name of Topic	Lectures
1	Nuclear Fission	10
2	Nuclear Reactors	08
3	Nuclear Accelerators	08
4	Detection and measurement of nuclear radiations	08

Polymer Chemistry (CH-346B)

Sr. No.	Name of Topic	Lectures
1	Polymer Degradation	03
2	Chemical and Geometrical structures of Polymer Molecules	04
3	Glass Transition Temperature and Heat Distortion Temperature (Softening Point)	05
4	Crystallinity in polymers	04
5	Some Important Polymers	08
6	Analysis and testing of polymers	06
7	Some Special Polymers	06

Introduction to Biochemistry and Molecular Biology (CH-346C)

Sr. No.	Name of Topic	Lectures
1	Introduction to Metabolism	02
2	Carbohydrate metabolism	06
3	Lipid metabolism	04
4	Amino acid metabolism	04
5	Electron Transport Chain and Oxidative Phosphorylation	06
6	Nucleic acids	07
7	DNA replication	06

Environmental and Green Chemistry (CH-346D)

Sr. No.	Name of Topic	Lectures
1	Water treatment and effluent management	08
2	Soil and solid waste management	04
3	Instrumental methods in environmental analysis	08
4	Green House Effect and Global Warming	04
5	Water the ultimate Green solvent	12

Dairy Chemistry (CH-346E)

Sr. No.	Name of Topic	Lectures
1	Market Milk	08
2	Common Dairy Processes	06
3	Special Milks	08
4	Milk proteins, Carbohydrates and Vitamins	08
5	Preservatives & Adulterants in Milk	06

Savitribai Phule Pune University,Pune

TYBSc(Computer Science)

70% Reduced Syllabus of Theory Courses (Semester IV)

(For Academic Year 2020-21 Only)

SAVITRIBAI PHULE PUNE UNIVERSITY
T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS
TO BE IMPLEMENTED FOR ACADEMIC YEAR 2020-21
TITLE OF PAPER : Operating Systems
Code No. : CS-341

Semester IV **Total Lectures : 35**

1:Introduction **[2]**

1.1 Operating System Structure – Simple structure, Layered approach, Micro kernels, Modules

1.2 Virtual Machines – Introduction, Benefits

1.3 System Boot

2: Process Management [4]

2.1 Process Concept – The process, Process states, Process control block.

2.2 Process Scheduling – Scheduling queues, Schedulers, context switch

2.3 Operations on Process – Process creation using fork(), Process termination

2.4 Interprocess Communication – Shared memory system, Message passing systems.

3: Multithreaded Programming [2]

3.1 Overview

3.2 Multithreading Models

4. Process Scheduling [8]

4.1 Basic Concept – CPU-I/O burst cycle, CPU scheduler, Preemptive scheduling, Dispatcher

4.2 Scheduling Criteria

4.3 Scheduling Algorithms – FCFS, SJF, Priority scheduling, Round-robin scheduling, Multiple queue scheduling, Multilevel feedback queue scheduling

4.4 Thread Scheduling

6. Deadlocks **[8]**

6.1 System model

6.2 Deadlock Characterization – Necessary conditions, Resource allocation graph

6.3 Deadlock Prevention

6.4 Deadlock Avoidance - Safe state, Resource allocation graph algorithm, Banker's Algorithm

6.5 Deadlock Detection

6.6 Recovery from Deadlock – Process termination, Resource preemption

7. Memory Management **[11]**

7.1.Background – Basic hardware, Address binding, Logical versus physical address space, Dynamic loading, Dynamic linking and shared libraries

7.2 Swapping

7.3 Contiguous Memory Allocation – Memory mapping and protection, Memory allocation, Fragmentation

7.4 Paging – Basic Method, Hardware support, Protection, Shared Pages

7.5 Segmentation – Basic concept, Hardware

7.6 Virtual Memory Management – Background, Demand paging, Performance of demand paging, Page replacement – FIFO, OPT, LRU, Second chance page replacement

***Ref Books : As mentioned in regular syllabus**

SAVITRIBAI PHULE PUNE UNIVERSITY
T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS
TO BE IMPLEMENTED FOR ACADEMIC YEAR 2020-21
TITLE OF PAPER : Compiler Construction
Code No. : CS-342

Semester IV **Total Lectures : 34**

1. Introduction **[5]**

1.1 Definition of Compiler, Aspects of compilation.
1.2 The structure of Compiler.
1.3 Phases of Compiler – Lexical Analysis,Syntax Analysis, Semantic Analysis, Intermediate Code generation, code optimization, code generation.
1.4 Error Handling
1.5 Introduction to one pass & Multipass compilers, cross compiler, Bootstrapping.

2. Lexical Analysis(Scanner) **[5]**

2.1 Review of Finite automata as a lexical analyzer,
2.2 Applications of Regular Expressions and Finite Automata (lexical analyzer, searching using RE), Input buffering, Recognition of tokens
2.3 LEX: A Lexical analyzer generator (Simple Lex Program)

3. Syntax Analysis(Parser) **[20]**

3.1 Definition , Types of Parsers
3.2 Top-Down Parser –
3.2.1Top-Down Parsing with Backtracking: Method & Problems
3.2.2 Drawbacks of Top-Down parsing with backtracking,
3.2.3Elimination of Left Recursion(direct & indirect)
3.2.4Need for Left Factoring & examples
3.3 Recursive Descent Parsing : Definition
3.3.1Implementation of Recursive Descent Parser Using Recursive Procedures
3.4 Predictive [LL(1)]Parser(Definition, Model)
3.4.1Implementation of Predictive Parser[LL(1)]
3.4.2 FIRST & FOLLOW
3.4.3 Construction of LL(1) Parsing Table
3.4.4Parsing of a String using LL(1) Table
3.5 Bottom-Up Parsers
3.6 Operator Precedence Parser -Basic Concepts
3.6.1Operator Precedence Relations form Associativity & Precedence
3.6.2 Operator Precedence Grammar
3.6.3 Algorithm for LEADING & TRAILING(with ex.)
3.6.4Algorithm for Operator Precedence Parsing (with ex.)
3.6.5Precedence Functions
3.7 Shift Reduce Parser
3.7.1Reduction, Handle, Handle Pruning
3.7.2Stack Implementation of Shift Reduce Parser (with examples)

3.8 LR Parser
3.8.1Model
3.8.2Types [SLR(1), Canonical LR, LALR] Method & examples.
3.9 YACC (from Book 3) –program sections, simple YACC program for expression evaluation

4. Syntax Directed Definition [4]

4.1Syntax Directed Definitions(SDD)
4.1.1 Inherited & Synthesized Attributes
4.1.2 Evaluating an SDD at the nodes of a Parse Tree, Example
4.2 Evaluation Orders for SDD's
4.2.1 Dependency Graph
4.2.2 Ordering the Evaluation of Attributes
4.2.3 S-Attributed Definition
4.2.4 L-Attributed Definition

***Ref Books : As mentioned in regular syllabus**

SAVITRIBAI PHULE PUNE UNIVERSITY
T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS
TO BE IMPLEMENTED FOR ACADEMIC YEAR 2020-21
TITLE OF PAPER : Computer Networks - II
Code No. : CS-343

Semester IV **Total Lectures : 34**

1. Wired LANs **[Lectures 9]**

1.1 IEEE Standards Data Link Layer, Physical Layer
1.2 Standard Ethernet MAC Sublayer – Frame Format, Frame Length, Addressing, Access Method
1.3 Physical Layer – Encoding and Decoding, 10Base5, 10Base2, 10Base-T, 10Base-F,
1.4 Changes In The Standard – Bridged Ethernet, Switched Ethernet, Full Duplex Ethernet
1.5 Fast Ethernet – Goals, MAC Sublayer,Topology, Implementation 1.6 Gigabit Ethernet – goals, MAC Sublayer, Topology, Implementation
1.7 Ten-Gigabit Ethernet – goals, MAC Sublayer, Physical Layer
1.8 Backbone Networks Bus Backbone, Star Backbone, Connecting Remote LANs
1.9 Virtual LANs Membership, Configuration, Communication between Switches, IEEE standards Advantages

2. Wireless LAN **[Lectures 2]**

2.1 IEEE 802.11 Architecture – Basic Service Set, Extended Service Set, Station Types
2.2 Bluetooth Architecture – Piconet, scatternet

3. The Network Layer **[Lectures 10]**

3.1 Design Issues Store-and-forward packet switching, Services Provided to the Transport Layer, Implementation of Connectionless Service, Implementation of Connection Oriented Service, Comparison of Virtual Circuit and Datagram subnets
3.2 Logical Addressing IPV4 Addresses – Address Space, Notations, Classful Addressing, Subnetting, Supernetting,Classless Addressing, Network Address Translation(NAT), (Enough problems should be covered on Addressing),
3.3 IPV4 Protocol Datagram Format, Fragmentation, Checksum, Options
3.4 Routing Properties of routing algorithm, Comparison of Adaptive and Non- Adaptive Routing Algorithms
3.5 Congestion Control – Definition, Factors of Congestion, Difference between congestion control and flow control, General Principles of

Congestion Control, Congestion Prevention Policies

3.6 Network Layer Devices –Routers

4. Address Mapping [Lectures 4]

4.1 Protocol(ARP)-Cache Memory, Packet Format, Encapsulation, Operation, Four Different Cases, Proxy ARP, RARP, BOOTP, DHCP – Static Address Allocation, Dynamic Address Allocation, Manual and automatic Configuration

5. The Transport Layer [Lectures 6]

5.1 Process-to-Process Delivery Client Server Paradigm, Multiplexing and De-multiplexing, Connectionless Vs Connection-Oriented Service, Reliable Vs Unreliable

5.2 User Datagram Protocol(UDP) Datagram Format, Checksum, UDP operations, Use of UDP

5.3 Transmission Control Protocol (TCP) TCP Services – Process to Process Communication, Stream Delivery Service, sending and Receiving Buffers, Segments, Full –Duplex Communication, Connection oriented service, Reliable service

5.4 TCP Features –Numbering System, Byte Number, Sequence Number, Acknowledgement Number, Flow Control, Error Control, Congestion Control

5.5 TCP Segment – Format

6. The Application Layer [Lectures 3]

6.1 Domain Name System (DNS) Name Space, Domain, Name Space, Distribution of Name Space, DNS in the Internet, Resolution

6.2 E-MAIL Architecture, User Agent, Message Transfer Agent-SMTP, Message Access Agent-POP3, IMAP4, Web Based Mail

***Ref Books : As mentioned in regular syllabus**

SAVITRIBAI PHULE PUNE UNIVERSITY
T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS
TO BE IMPLEMENTED FOR ACADEMIC YEAR 2020-21
TITLE OF PAPER : Internet Programming- II
Code No. : CS-344

Semester IV **Total Lectures : 34**

1. Web Techniques [10]
- 1.1 Variables
- 1.2 Server information
- 1.3 Processing forms
- 1.4 Setting response headers
- 1.5 Maintaining state
- 1.6 SSL

2. Handling email with php [8]
- 2.1 Email background
- 2.2 Internet mail protocol
- 2.3 Structure of an email message
- 2.4 Sending email with php
- 2.5 Email attachments.
- 2.6 Email id validation and verification
- 2.7 PHP error handling.

3. PHP framework [4]
- 3.1 Introduction to PHP framework.
- 3.2 Features, Applications.
- 3.3 One example like JOOMLA,DRUPAL.

4. XML [8]
- 4.1What is XML?
- 4.2 XML document Structure
- 4.3 PHP and XML
- 4.4 XML parser
- 4.5 The document object model
- 4.6 The simple XML extension
- 4.7 Changing a value with simple XML

5. WEB DESIGNING TECHNOLOGIES(JavaScript-DHTML) [4]
- 5.1 Overview of JavaScript, DHTML
- 5.2 Object Orientation and JavaScript
- 5.3 Basic Syntax(JS datatypes, JS variables)
- 5.4 Primitives, Operations and Expressions
- 5.5 Screen Output and keyboard input(Verification and Validation)
- 5.6 JS Control statements
- 5.7 JS Functions
- 5.8 JavaScript HTML DOM Events(onmouseup, onmousedown, onclick, onload,onmouseover,onmouseout).

***Ref Books : As mentioned in regular syllabus**

SAVITRIBAI PHULE PUNE UNIVERSITY
T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS
TO BE IMPLEMENTED FOR ACADEMIC YEAR 2020-21
TITLE OF PAPER : Programming in JAVA - II
Code No. : CS-345

Semester IV **Total Lectures : 34**

Chapter 1. Collection **[6]**
1.1 Introduction to the Collection framework
1.2 List – ArrayList, LinkedList and Vector,Stack,Queue
1.3 Set - HashSet, TreeSet, and LinkedHashSet
1.4 Map – HashMap, LinkedHashMap, Hashtable and TreeMap
1.5 Interfaces such as Comparator, Iterator, ListIterator, Enumeration

Chapter 2. Database Programming **[10]**
2.1 The design of jdbc, jdbc configuration
2.2 Types of drivers
2.3 Executing sql statements, query execution
2.4 Scrollable and updatable result sets
2.5 Metadata – DatabaseMetadata, ResultSetMetadata
2.6 Transactions – commit(), rollback(), SavePoint (Database : PostgreSQL)

Chapter 3. Servlet **[12]**
3.1 Introduction to Servlet and Hierarchy of Servlet
3.2 Life cycle of servlet
3.3 Tomcat configuration (Note: Only for Lab Demonstration)
3.4 Handing get and post request (HTTP)
3.5 Handling a data from HTML to servlet
3.6 Retriving a data from database to servlet
3.7 Session tracking – User Authorization, URL rewriting, Hidden form fields, Cookies and HttpSession

Chapter 5. Multithreading **[6]**
5.1 What are threads?
5.2 Life cycle of thread
5.3 Running and starting thread using Thread class
5.4 Thread priorities
5.5 Running multiple threads
5.6 The Runnable interface
5.7 Synchronization and inter-thread communication

References:

1) Complete reference Java by Herbert Schildt(5th edition)
2) Java 2 programming black book, Steven Horlzner
3) Programming with Java , A primer ,Forth edition , By E. Balagurusamy
4) Core Java Volume-I-Fundamentals, Eighth Edition, Cay S. Horstmann, Gary Cornell, Prentice Hall, Sun Microsystems Press
5) Core Java Volume-II-Advanced Features, Eighth Edition, Cay S. Horstmann, Gary Cornell, Prentice Hall, Sun Microsystems Press

SAVITRIBAI PHULE PUNE UNIVERSITY
T.Y. B. Sc. COMPUTER SCIENCE SYLLABUS
TO BE IMPLEMENTED FOR ACADEMIC YEAR 2020-21
TITLE OF PAPER : Computer Graphics
Code No. : CS-346

Semester IV **Total Lectures : 34**

1. Introduction to Computer graphics **[4]**

1. 1 Introduction to computer graphics & graphics systems
1.2 Components of Computer Graphics Representation, Presentation , Interaction and Transformations
1.3 Applications of Computer Graphics
1.3 Pixel/Point ,Raster v/s Vector ,RGB color model, intensity
1.4 Programming essentials – event driven programming. OpenGL library

2. Input devices and Interaction tasks [4]
2.1 Logical Interaction – Locator, valuator , pick and choice;
2.2 Physical devices used for interaction – keyboard, mouse, trackball,spaceball, tablets, light pen, joy stick, touch panel, data glove;
2.4 Keyboard , Mouse interaction in OpenGL
2.5 Graphical User Interfaces- cursors , radio buttons, scroll bars, menus, icons
2.6 Implementing GUI in open GL

3. Presentation and Output devices **[4]**
3.1 Presentation Graphics - frame buffer, display file, lookup table;
3.2 Display devices, Random and Raster scan display devices; CRT,
3.3 Hardcopy devices - Plotters and Printers

4. Raster Scan Graphics **[10]**
4.1 Line drawing algorithms; DDA algorithm, Bresenham's line drawing algorithm, Circle generation algorithm;
4.2 Scan conversions- Generation of the Display, Image compression
4.3 Displaying Lines and characters
4.3 Polygon filling -Scan converting polygons, fill algorithms, Boundary fill algorithm, flood fill algorithm

5. Transformations **[7]**
5.1 Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, Reflection, shear
5.2 Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline
5.3 Window to viewport co-ordinate transformation. Setting window and viewport in OpenGL.

6 Clipping **[5]**
6.1 clipping operations , point clipping ,
6.2 Line clipping; Cohen Sutherland algorithm, Midpoint subdivision algorithm, Cyrus beck algorithm;

***Ref Books : As mentioned in regular syllabus**

SAVITRIABAI PHULE PUNE UNIVERSITY,PUNE

BOARD OF STUDIES IN ELECTRONIC SCIENCE

T.Y.B.Sc. SEMESTER IV ELECTRONIC SCIENCE

SYLLABUS FOR THE YEAR 2020-21

As per the Guidelines by SPPU, Syllabus for Theory Courses is reduced to 70% of the Total Syllabus for the Semester IV for academic year 2020-21.

Details of the Reduced Syllabus are as follows:

Theory course/ Paper	**Course Code**	**Title of Theory Course/Paper**	**Units**	**Topics**	**Percentage**
1	EL 341	Advanced communication systems	Unit 1	**Antenna & Propagation**: Antenna**:** Basic consideration, Evolution of Dipole antenna, Parameters of Antenna, Effect of ground on Antennas. Resonant Antenna- Radiation patterns & length considerations, Non-Resonant antenna, Directional high frequency antennas, UHF & Microwave antenna, Wide-band & special purpose antennas Propagation of Waves***:*** Ground (Surface waves), sky wave propagation, space waves, Tropospheric scatter propagation.	100%
			Unit 2	**Modulation & Demodulation**: Balanced Modulator- Using diodes & FETs SSBSC- Filter Method, Phase shift method (third method) Synchronous Demodulation, Product Demodulator, Phase modulation & demodulation using PLL, Indirect method of FM generation.	100%
			Unit 3	**Transmitter & Receiver**: AM transmitters*:* Block diagram, FM Transmitters: Using Frequency multiplication & mixing, Frequency stabilized reactance FM transmitter: FM achieved through phase modulation	100%

				TV transmitter : (monochrome/colour) Mobile receiver : block diagram (800MHz), Doppler RADAR, Speed Gun, Low noise amplifier block diagram	
2	EL 342	Microcontrollers and its applications	Unit 1	**Microcontroller programming:** C Data types for 8051, C Programs for Time Delays & I/O Operation, I/O Bit Manipulation, Arithmetic and Logical Operations, ASCII and BCD Data Conversion.	100%
			Unit 2	**UART, INTERRUPT, TIMER Programming:** Timer programming - Timers and counters, delay generation using timer, waveform generation using timer. Serial Port Programming in C, Serial Data Transfer to microcontroller from PC and from PC to Microcontroller, Interrupt programming	100%
			Unit 3	**Microcontroller applications using embedded 'C':** Interfacing with 8051 and programming using C – LED/s, SSD, LCD, Stepper Motor, DC motor, DAC, ADC, Keys, Matrix keyboard, Switches, TWS, RTC (DS 12887).	100%
3	EL 343	Power Electronics	Unit 1	**Introduction to Power Electronics:** Definition of power electronics, Applications of power electronics, classification of power semiconductor devices, control characteristics of devices, characteristics of power devices as a switch, switching power losses, types of Power circuits, Concept of single phase and three phase using phasors, basics of magnetic circuits	100%
			Unit 2	**Power Devices, Protection and Driving circuits:** Power Diode (P-i-N): construction, Reverse recovery characteristics, diode in series and parallel, freewheeling diode	100%

				Power BJT, power MOSFET, IGBT: Steady state and Switching Characteristic, Driving circuits Thyristors: Types of Thyristors, SCR characteristics, Two transistor static and transient model, turn-on methods, turn-off characteristics, dv/dt and di/dt protection, gate protection circuits, gate driving circuits using BJT, UJT and PUT Thermal management of heat sinks for power devices and its design from Safe operating Area (SOA).	
			Unit 3	**Power Circuits**: Rectifiers: Performance parameters, Half wave, Full wave centre tapped and bridge rectifier with resistive and inductive loads, DC Filters: concept of C, L and LC filters Controlled rectifiers: Principle, Semi, Full and Dual Converters AC voltage controllers: on-off control, Phase angle control, Bi-directional control with Resistive load, transformer tap changer, Cycloconverter , Choppers: Step-up, Step-down, concepts of choppers operating in various quadrants Regulators: Buck and Boost regulators Inverters: Performance parameters, principle, Half Bridge and full Bridge inverter, Voltage control methods, Inverter filters, introduction to current source inverter DC Switches, Solid state relays, AC Switches and Microelectronic relays	100%
4	EL 344	Foundation of Nanoelectronics	Unit 1	**Essential Electromagnetics**: Lorentz force-Motion of charged particle in E-M fields, cyclotron frequency, Hall effect, Maxwell's equations, Relation with laws of Electrodynamics, Equation of	100%

				continuity, Poynting vector theorem, Wave equation for E and H, properties of EM waves in conducting and nonconducting media , Skin depth.	
			Unit 2	**Quantum mechanical aspects:** Particles and Waves: Classical particles, Light as wave and particle, Wave particle duality and Uncertainty principle, Wave mechanics: The Schrödinger wave equation, wave mechanics of particles, Infinite potential well, Qualitative treatment of square wave potential with special reference to tunneling phenomenon, atoms and atomic orbital.	100%
			Unit 3	**Statistical aspects**: Classical statistics, Gaussian distribution, Poisson distribution, Fermi-Dirac, Bose Einstein, Maxwell Boltzmann statistics, Time and length scales of the electrons in solids, statistics of electrons in solids and nanostructures, Density of states of electrons, electron transport, Conductivity of metals.	100%
5	EL 345	Mathematical methods and circuit analysis using MATLAB	Unit 1	**Introduction to MATLAB:** Working in command window, Built in function, Array-1D, 2D & mathematical operations with array, Script files, 2D & 3D plots. Functions: -inline, functional evaluation feval. Programming: -Conditional statement, Switch-case statement, loops, nested loops, break & continue statement, polynomial operations.	100%
			Unit 2	**Fourier Series:** Definition, Evaluation of Fourier Coefficient, Fourier series for square wave, triangular, sawtooth wave, half wave & full wave rectifiers.	100%

				MATLAB exercise: To evaluate Fourier coefficients for given waveform function.	
			Unit 3	**Laplace transform and its applications:** Definition, Laplace transform of simple functions, properties of L.T. (Linearity, shifting, change of scale), Inverse L.T., Partial fraction technique to find inverse L.T. function **Applications.** Series RC circuit, RL circuit, RLC circuit for dc input. **MATLAB Exercises:** 1.To find Laplace Transform and Inverse LT of any given function. 2.Transient analysis of RC / RL/RLC (series) circuit	100%
6	EL346(A)	Industrial Automation	Unit 1	**Generalized configuration and performance characteristics of instrumentation:** Functional Elements of an instrument, active and passive transducers, Working principle and specification of thermal sensors like thermister, thermocouple, optical sensors photodetector, and optical encoder, Mechanical sensors LVDT, magnetic sensor hall effect etc. Analog and Digital Modes of Operation, Null and Deflection Methods, Input Output configuration of Instruments and measuring systems. Working principle of electromechanical relay, heater, LED/LCD display. Generalized measurements, zero-order System, First-order System, Second–order System, Dead-Time Element, Specifications and Testing of Dynamic Response.	100%
			Unit 2	**Manipulating, computing and compensating devices:** Bridge circuits, Operational Amplifiers, Instrumentation Amplifiers, Transconductance and Transimpedance Amplifiers,	100%

				Noise Problems, Shielding and Grounding, Generalized Data Acquisition system- Elements of a data acquisition system, Single channel Data Acquisition system, Multichannel Data Acquisition system, Sample and Hold circuits, ADC, DAC, Multiplexers.	
			Unit 3	**Fundamentals of Process Automation:** Process control system: Continuous control, discrete state control, composite discrete/continuous control, Ladder Diagram: Ladder diagram elements with examples. Process Characteristics: Process equation, Process load, Process lag, self regulation Control system parameters: Error, Variable range, control parameter range, control lag, dead time, cycling,	100%
6	EL 346(B)	Consumer Electronics	Unit 1	**Audio Systems:** **Introduction to: Microphone,** Loudspeaker and Music System: Principle, construction, working and characteristics **Microphone**: Different types of microphone: Electret & carbon microphones Special Microphones: Lavalier microphone, Tie-clip microphone, Radio microphone and Noise cancelling microphone. **Loudspeakers**: Characteristics of Loudspeaker, Horn type, Multiway speaker system (Woofers & Tweeters). **P.A. System**: Block diagram of P.A. system, requirements of P A system, typical P.A. Installation planning (P.A. system for a public meeting in Public Park and P.A. System for an auditorium having large capacity)	100%
			Unit 2	**TV and Video Systems:** Television: standards, B/W/Colour, CRT/HDTV	100%

				Video Systems: VCR/VCD/DVD players, MP4 players, Set top Box, CATV and Dish TV, LCD, Plasma and LED TV, Projectors, Home theaters	
			Unit 3	**Telephone Systems:** Basic land line equipment, Telephone set, working, telephone exchange, Initiating call, calling a no., pulse dialing and tone dialing, signal to /from exchange, dial tone, dial back and engage signals, making connection, answering call, conversion, ending call, Modems, telex, PBX, PABX, transmitter and receiver. Cordless Phones: Principle of operation, Block diagram of the base unit, Block diagram of the Handset, Features and specifications. Cellular Phones - Operating principle, the cell approach, Block diagram, Functions performed by cell phones, features/ specifications. GPRS and Bluetooth, GPS Navigation system	100%
			Unit 4:	**Office Equipments and modern home appliances:** Office Equipments: Scanners-Barcode/Flatbed, Printers, Xerox machine, Multifunction Unit (Print, scan, fax, copy Home Appliances*: Microwave* Oven – Principle of operation, Block Diagram, features and specifications *Washing Machine/* Dish washers - Principle of operation, fuzzy logic, Washing machine with fuzzy logic, Block Diagram, features and specifications	50%

Note: Unit 4 is included for EL 346(B) to full fill the requirement of 70% criterion of syllabus.

Savitribai Phule Pune University, Pune

T.Y.B.A. Geography Syllabus

Gg.: 310 Regional Geography of India (G-3)

June 2015

70 Percent Syllabus for Examination 2020-2021

SECTION – I

Sr. No.	Topic	Sup Topic	Learning Points	Periods
1	Introduction	Location , Extent and Geopolitical Significance	1. Historical Background 2. Location and Extent 3. Relationship with Neighboring Countries 4. Geopolitical Importance of Indian Ocean.	10
2	Physiography	Major Physiographic Regions and their Importance	1. The Northern Mountains 2. The North Indian Plains 3. The Peninsular Plateau 4. The Costal low lands 5. The Islands	12
3	Drainage	Drainage System of India The Himalayan River System The Peninsular River System	1. The Indus , The Ganga , The Brahmaputra 2. East Flowing Rivers- Mahanadi, Godavari, Krishna, Kaveri. 3. West Flowing Rivers- Narmada, Tapi, Mahi 4. Rivers of the Sahyadri - Amba & Damanganga	12
4	Climate	Characteristics , Origin and Mechanism of Monsoon, Various Seasons	1. Characteristics of Indian Climate 2. Role of Various Controlling Factors on Climate of India 3. Monsoon: Origin and Mechanism 4. Various Seasons and Weather Associated with them	11

SECTION – II

5	Soils and Natural Vegetation	Types and Distribution	Types of Soils and its Distribution Soil Degradation and Conservation Types of Natural Vegetation and its Distribution Deforestation and Conservation	12
6	Minerals and Energy Resources	Mineral Resources Energy Resources	1. Mineral Resources & its distribution Iron ore, Manganese, Bauxite, Copper 2. Energy Resources- a)Major Conventional & its Distribution Coal, Mineral Oil, Natural Gas b)Non-conventional - Hydroelectricity, Solar energy, Wind energy, Biogas, Atomic energy	12

SPPU BOS GEOGRAPHY

Savitribai Phule Pune University, Pune

T.Y.B.A. Geography Syllabus

Gg. 310: HUMAN GEOGRAPHY(G-3)

June-2015

70 Percent Syllabus for Examination 2020-2021

Section – I

Sr. No.	Topic	Learning Points	Periods
1	Introduction to Human Geography	a) Meaning and Definition of Human Geography. b) Nature, Scope and Importance of Human Geography, approach of Human Geography & Branches of Human Geography	10
2	Development of Human Geography	a) Pre-historical Period. b) Medieval Period of Human Geography. c) Modern Period of Human Geography. d) Concepts of Determinism, Possibilism, Stop and Go Determinism	13
3	Human Evolution and Races	a) Stages of Human Evolution. b) Meaning and Definition of Human Race c) Bases of Human Race d) Griffith Taylor's Theory of Human Race e) Pure and Mixed Races	12
4	Form of Adaptation to the Environment	a) Human life in Cold Region - ESKIMO b) Human life in Tropics - PYGMY and BUSHMEN	10

Section – II

5	Study of Indian Tribes	Regional Distribution of Tribes in India a) Bhill b) Gond c) Naga d) Tribes in Maharashtra	11
6	Human Culture	a) World Languages & their distribution b) World's Major Religions & their distribution d) Distribution of Languages & Religions in India	12

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Savitribai Phule Pune University, Pune

T.Y.B.A. Geography Syllabus

Gg-320 – AGRICULTURAL GEOGRAPHY (S-3)

From June – 2015

70 Percent Syllabus for Examination 2020-2021

Section- I

Sr. No.	Topic	Units	Sub Units	Periods
1	Introduction of Agricultural Geography	**A.** Meaning, Nature & Scope **B.** Approaches **C.** Importance D. Trends	Definition, Nature & Scope of Agricultural Geography Approaches 1. Regional approach 2. Systematic approach 3. Commodity approach 4. Recent approaches Importance of Agriculture in Indian Economy Recent Trends in Agriculture Geography	12
2	Determinates of Agriculture	**A.** Physical Factors **B.** Economic Factors **C.** Social Factor **D.** Technological Factors	1.Relief 2.Climate 3.Soil 1.Capital, 2.Transportation 3. Market, 4.Storage, 5. Export Import1.Land holding, 2.Land fragmentation 3. Labour, 4.Traditional Methods 5. Farmers view towards agriculture 1. Irrigation 2.Mechanization 3.Manures, Fertilizers 4.Pesticides	15
3	Types of Agriculture	Characteristics of A. Subsistence Agriculture B. Commercial Farming	1.Shifting Cultivation 2.Dry land farming 3.Intensive Subsistent farming 1.Mixed farming 2.Horticulture / Truck farming 3. Community farming	10
4	Problems & Prospects of Agriculture	Problems and Prospects with Indian examples	1.Natural 2.Economical 3.Social 4.Political	08

SPPU BOS GEOGRAPHY

Section II				
5	Role of irrigation in Agricultural Development	**A.** Need of Irrigation **B.** Types of Irrigation **C.** Methods ofIrrigation	1. Important of irrigation 1.Canals 2. Lake 3.Well 4.Borewell & Tube well 1.Flood irrigation 2.Ring &Basin 3.Drip irrigation 4.Sprinkler irrigation	12
6	Dry Land farming And Watershed Management	**A.** Concept & Need **B.** Methods of Watershed Management	**1.** Concept & Need, Dry Land Farming Management in India **2.** Concept of Watershed Management **Methods :** 1. Continuous Contour Tranches (CCT)2. Gabian Bunds, 3.Nala Bunding 4. Biological Bunds 5. Kohlapur Type (K T) weir 6. Vanrai Bunds, 7.Perculation Tanks 8.Farm Lake / Ponds, 9. Dams, 10. Barrages	15

SPPU BOS GEOGRAPHY

Savitribai Phule Pune University, Pune

T.Y.B.A. Geography Syllabus

Gg-320: Population and Settlement Geography (S-3)June-2015

70 Percent Syllabus for Examination 2020-2021

Section-A. Population Geography

Unit No.	Topic	Sub Topic	Learning Points	Periods
1	Introduction	Nature and Scope	Definitions, Nature and Scope of Population Geography	10
		Source of Population Data	Census, National Sample Survey, Sample Registration Survey, NFHS, DLHS Data, Demographic Surveys and other Sources	
2	Population Dynamics	Spatial Pattern of Distribution	1) Determinates of Distribution and Density of Population 2) Distribution of Population – World & Indian Scenario 3) Population Growth- Global & Indian Trend	10
		Composition of Population	Population Composition: Age and Sex, Rural-Urban &Economic	
3	Demographic Attributes	Human Migration	1. Migration-Classification, Determinants and Consequences of Migration. 2.Measures – Fertility, Morbidity and Mortality, Marital Status 3.Human Development Index 4. Illegal Migrations and its Impacts Migration and its Impacts on Smarts Cities and Smart Villages	14
		Theories of Population Growth	1) Demographic Transition Model [DTM] 2) Malthus: Population Theory	
4	Population Policies	Population Policies and Programmes	1. Population Policies in the Context of Growth, Structure, Distribution &Quality Life 2. Evolution of Family Welfare Programme in India 3.National Population Policies in India [After 1991]	11

Section-B- Settlement Geography

5	Introduction of Settlement Geography	Definition, Nature and Scope	Definition, Nature and Scope of Settlement Geography	12
		Characteristics	1) Characteristics of Settlement Geography 2) Branches of Settlement Geography	
6	Man-Environment Relationship	Factors Influencing the Growth and Distribution of Settlements.	1. Physical 2. Economic 3. Social 4. Political	10

SPPU BOS GEOGRAPHY

Savitribai Phule Pune University, Pune
T.Y.B.Sc. Geography Syllabus
Gg: 331-Fundamentals of Human Geography (Part I)
June 2015
70 Percent Syllabus for Examination 2020-2021

Topic	Sub topic	Learning Points	Periods
1. Introduction to Human Geography	Definition Nature and scope Approaches to the study	a) Meaning and Definition of Human Geography b) Nature and scope of Human Geography c) Approaches to the study of Human Geography: Traditional (Systematic, Regional, Historical, Environmentalistic, Possibilistic) Contemporary (Ecological, Spatial, Behavioural, Humanistic, Welfare) Determinism, Possibilism, Neodeterminism,Probabilism	9
2. Human Race	Evolution of man Human races Classification of human races and principal human races	a) Evolution of Man b) Concept of race, physical traits of races c) Classification of Human Races d) Principal Human Races of the World e) Grifith Taylor's Migration Zone Theory of Race Evolution	9
3. Study of various aspects of Population	Factors affecting density of population, World Distribution of Population Recent trends of Population Growth Migration: Human Development	a) Factors affecting density of population, World Distribution of Population, patterns of population density according to continents b) Recent trends of Population Growth: population growth in Continents, population growth in developed, developing and underdeveloped countries. c) Migration:Meaning, definition, causes, consequences, types and theories. d) Human Development: Concept, Human development Index (HDI), Hierarchy of countries, recent trends in HDI relations between economic growth and human development.	11
4. Population Polices and Environment Issues related to population	Population Polices	a) Population Polices of The United Nations b) Changing Polices in Developed and Under Developed World	07

SPPU BOS GEOGRAPHY

Savitribai Phule Pune University, Pune
T.Y.B.Sc. Geography Syllabus - June 2015
Gg: 341-Fundamentals of Human Geography (Part II)

70 Percent Syllabus for Examination 2020-2021

Topic	Sub topic	Learning Points	Period
1. Concepts of Rural and Urban settlement and Urbanization	Rural and Urban settlement and Urbanization	a) Concepts of Rural and Urban settlements b) The rural urban fringe, Umland, Conurbation. c) Urbanisation, indicators, determinants d) Origin and growth of Urbanisation, Urban patterns of the World, features of modern urbanization.	10
2. Theories and Models of Economic Activities	Theories and Models of Economic Activities Network analysis	a) Von Thunen Theory b) Weber's Theory c) Flow theory and Network Analysis, d) Transport Nodes and Linkages e) Indices of Network analysis (Transport Network analysis), Lorenz Curve and Gini coefficient	08
3. Agricultural Geography	Agricultural types Globalization andagriculture Crisis of agriculture	a) Agricultural types: intensive, subsistence, extensive, commercial and plantation agriculture b) Globalization and agriculture, Changing pattern of Agriculture c) Crisis of agriculture. Aspects of food security and world patterns of hunger	11
4. Theories and Models of Population Geography	Theories: Composition ofpopulation	a) Theories: Malthusian, Demographic Transition Model b) Composition of population: Types of sex ratio c) Methods of age structure analysis	08

SPPU BOS GEOGRAPHY

Savitribai Phule Pune University, Pune
T.Y.B.Sc. Geography Syllabus
Gg 332: Geography of Travel & Tourism (Part I)
June 2015
70 Percent Syllabus for Examination 2020-2021

No.	Topic	Subtopic	Learning Points	Periods
1	Introduction Geographical Studies of Tourism	a. Definition b. Early Concepts c. Role of Geography in Tourism. d. Major components of Tourism.	**(i)** Tourism as a regional resource**.** (ii) Tourism as a multifaceted phenomena. (iii) Basic elements of tourism – dynamic, static, consequential elements. (i) Spatial patterns of supply. (ii) Spatial patterns of demand. (iii) The geography of resorts – seaside, resorts, winter & summer resorts. (iv) Tourist movements and flows. The impact of tourism.	**12**
2	Tourism Resources	a. Locational factors b. Attractions	(i) Geographic location – Absolute andrelative location. (ii) Major attractions – Natural features, manmade objects and man and culture. (iii) Seasonality – effect of seasonality, temperature, wind speed, precipitation, visibility. (iv) Accessibility – physical assets. (v) Accessibility - with reference to travel time, cost and distance. (vi) Market accessibility. (vii) Concept of in	**11**
3	Factors affecting Tourism	a. Physical Factors	(i) Natural features – Geography, Topography, Soils, Slope, Stability (ii) Relief features – Mountains, Lakes, Coasts, Water Falls, Hot Springs, Volcanic Islands. (iii) Climate –Temperature & rainfall, Sunny Days, Snow Free Days. (iv) Vegetation – National Parks, Sanctuaries (examples from India) (i) Growth of Historical Places. (ii) National Culture and heritage preservation.	**12**

SPPU BOS GEOGRAPHY

Savitribai Phule Pune University, Pune
T.Y.B.Sc. Geography Syllabus
Gg 342: Geography of Travel & Tourism (Part II)
June 2015
70 Percent Syllabus for Examination 2020-2021

No.	Topic	Subtopic	Learning Points	Periods
1	Types of Tourism	a. Classification	(i) Historical and Cultural Tourism, Religious Tourism. (ii) Rural Tourism – Agro-tourism, Farm-tourism (iii) Concept of Second Homes. (iv) Geo-tourism. (v) Eco-tourism.	**12**
		b. Forms	(i) Caravan Tourism, Camping. (ii) Water Transport Tourism – Boating, Cruise, Ship Travel, Rivers, Canals, Yachting (iii) Sports Tourism. (iv) Adventure Tourism.	
2	Tourism and Economic Activity	a. Role of Tourism in National Economy.	(i) Employment Generation (ii) Foreign Exchange Earnings. (iii) Balance of Payments. (iv) Range of Services in Tourism Sector. (v) Regional Development – Sustainable Tourism Development.	**12**
		b. Role of Transportation	(i) Modes of Transport used by Tourists – Air, Rail, Road and Waterways. (ii) Factors influencing Choice of Transport. (iii) Transportation Costs. (iv) Incentives offered – Tour Packages.	
		c. Role of Accommodation	(i) Need for the different types of accommodations – Hotels, Dormitories, Youth Hostels, Cottages, Homes, Tents, House Boats, Yatri Bhavans, Dharamshalas	
3	Impact of Tourism.	a. Economic Impact of Tourism	(i) Three types of expenditures – Direct, Indirect, and Induced. (ii) Types – a. Sales or Transaction Multipliers. b. Output Multipliers. c. Employment Multipliers. d. Income Multipliers. (iii) Methods of Deriving Tourism Multipliers. (iv) Increase in Land Values, Government Revenues and Trading Activity.	**07**
		b. Environmental Impact of	(i) Impacts of Recreation on Wildlife. (ii) Pollution Emissions.	

SPUBOSGEOGRAPHY

		Tourism c. Social and Cultural Impacts of Tourism.	(iii) Trampling of Vegetation and Soils. (iv) Destruction of Species. (i) Tourism and Cultural Change. (ii) Impacts on Religion, Language and Health. (iii) Impact on Local People Lifestyle. (iv) Deterioration of Traditional Arts (v) Effects of Foreign Elements on Indigenous Culture.	
4	Case Studies	a. Hill Stations b. Beach Resorts c. Temples and Caves	(i) Darjeeling, Nainital. (ii) Ooty. (i) Kerala and Goa (i) Ajanta, Ellora, Humpi.	**08**

SPPU BOS GEOGRAPHY

Savitribai Phule Pune University, PuneT.Y.B.Sc. Geography Syllabus

Gg: 333 Fundamentals of Geo-informatics – I

(Part I) June 2015

70 Percent Syllabus for Examination 2020-2021

Topic	Sub topic	Learning Points	Period
1. Introduction to Geoinformatics	Definition of Geoinformatics and its importan ce and History of GIS	Definition of Geoinformatics Scope and Importance of Geoinformatics History of GIS,Components of GIS Functions of GIS,GIS tasks-Input, Manipulation,Management,Query analysis, Visualisation	9
2. Sources and types of GIS data	Sources and Types	Toposheets, Surveying, Aerial photographs ,Satellite data and images Data types-Spatial and Non spatial	9
3. GIS data structures	Data models	Raster data and their characteristics Vector data and their characteristics	11
4 .GIS data bases and Data base management	Data analysis	Raster data analysis- grid cells or Pixels. Vector data analysis- Spatial data Generation in Vector Format	07

SPPU BOS GEOGRAPHY

Savitribai Phule Pune University, PuneT.Y.B.Sc. Geography Syllabus

Gg. 343: Fundamentals of Geo-informatics –II

(Part II) June 2015

70 Percent Syllabus for Examination 2020-2021

Topic	Sub topic	Learning Points	Period
1.Data input in GIS system	Digitization-Data transfer and key board entry	Various types of data-from scan map digital data and survey data-and attribute data	9
2.GIS data editing And attribute data linking	Relationship between entities attribute data linking	Topology building topological errors,Locational errors, edge matching Attribute data linking	9
3.Spatial and non spatial data analysis	Based on spatial and non spatial data	Query analysis-Spatial, Non spatial, Spatio-temporal, dissolve,Overlayanalysis,merge,buffer analysis, TIN Spatial analysis, Multicriteria analysis, Overlay analysis, Topographic analysis(DEM and DTM)	11
4.GPS	Global Positioning System	Types of GPS ,GPS accuracy and accuracy factors Global navigation satellites,	07

SPPU BOS GEOGRAPHY

Savitribai Phule Pune University, PuneT.Y.B.Sc. Geography Syllabus

Gg. 334: Geography of India (Part I)

June 2015

70 Percent Syllabus for Examination 2020-2021

Sr. No.	Topic	Sup Topic	Learning Points	Periods
1	Introduction	Location , Extent and Geopolitical Significance	1.Historical Background 2.Location and Extent 3.Relationship with Neighboring Countries 4.Geopolitical Importance of Indian Ocean.	10
2	Physiography	Major Physiographic Regions and their Importance	1. The Northern Mountains 2.The North Indian Plains 3.The Peninsular Plateau 4.The Costal low lands 5.The Islands	08
3	Drainage	Drainage System of India The Himalayan River System The Peninsular River System	1.The Indus , The Ganga , The Brahmaputra 2. East Flowing Rivers- Mahanadi, Godavari, Krishna, Kaveri. 3. West Flowing Rivers- Narmada, Tapi, Mahi 4. Rivers of the Sahyadri - Amba & Damanganga	10
4	Climate	Characteristics , Origin and Mechanism of Monsoon, Various Seasons	1. Role of Various Controlling Factors on Climate of India 2. Characteristics of Indian Climate- Various Seasons and Weather Associated with them	O8

SPPU BOS GEOGRAPHY

Savitribai Phule Pune University, PuneT.Y.B.Sc. Geography Syllabus

Gg. 344: Geography of India (Part II)

June 2015

70 Percent Syllabus for Examination 2020-2021

Sr. No.	Topic	Sup Topic	Learning Points	Periods
1	Minerals and Energy Resources	a) Mineral Resources b) Energy Resources	1.Mineral Resources & its distribution Iron ore, Manganese, Bauxite, Copper 2.Energy Resources- a) Major Conventional & its Distribution Coal, Mineral Oil, Natural Gas b) Non-conventional - Hydroelectricity, Solar energy, Wind energy, Biogas, Atomic energy	10
2	Agriculture	Significance and Recent Trends in Agriculture	1. Significance of Agriculture in Indian Economy 2. Green Revolution 3.Livestock Resources, White Revolution & Blue Revolution 4.Tissue Culture & Horticulture 5. Polly House Agriculture 6. Dry Farming	08
3	Population	Growth, Distribution and Composition	Population- Growth, distribution and density Population composition Problems of overpopulation and its remedies	10
4	Planning and Development	Regional Planning and development	1. Concept, Objectives, Need, Nature of Regional Planning 2. Experience of Regional Planning in India	O8

SPPU BOS GEOGRAPHY

Savitribai Phule Pune University, PuneT.Y.B.Sc. Geography Syllabus

Gg. 335: Geography of Soils (Part I)

June 2015

70 Percent Syllabus for Examination 2020-2021

No.	**Topic**	**Sub topic**	**Learning Points**	**Periods**
1	Introduction	Nature & Scope	Definition of Soil, Brief history of Soil Science/ Pedology, , Importance of soil studies in Geography.	04
2	Soil Formation And development of soil profile	Processes Mineral Composition Soil profile	a) Soil forming factors and processes, Components of soils b) Weathering and Pedogenesis Primary and secondary minerals, clay minerals, behaviour of clay minerals in tropics. Genetic structure of soil profile, Study of ideal soil profile –fundamental processes that affect profile differentiation-humification –illuviation-elluviation,calcification,podzolisation,laterisation,Gleiezation,salinization,alkalisation	10
3	Soil Physics	Basic Concepts	Soil texture - particle size analysis. and Soil structure, Effects of Soil Structure on other Physical Properties Porosity and bulk density, Soil moisture, Soil temperature, Soil color, Water holding capacity, Field capacity and wilting point.	11
4	Soil Chemistry	Chemical Processes	Soil Colloids - Types of Soil Colloids Oxidation-Reduction, Ion exchange, Hydrogen ion concentration, Redox potential, Cation- Anion exchange.	10

SPPU BOS GEOGRAPHY

Savitribai Phule Pune University, PuneT.Y.B.Sc. Geography Syllabus

Gg. 345: Geography of Soils (Part II)

June 2015

70 Percent Syllabus for Examination 2020-2021

Sr.No.	**Topic**	**Sub topic**	**Learning Points**	**Periods**
1	Integral to Soil Formation	Four Processes	1) Additions [surface or subsurface] 2) Removals surface or subsurface 3) Transformations [chemical weathering] 4) Translocations [secondary clay minerals, base cations]	08
2	Soil organic matter:	Composition	Determination of Organic carbon and matter. Humus. fractionation of organic matter, carbon cycle C:N ratio Organic Colloids – Soil Organic Matter Factors Affecting Soil Organic Matter Decomposition of Soil Organic Matter	12
3	Soil reaction	Soil pH	Acidic, Alkaline, Neutral & soil pH alkalinity : Soil Acidity , Factors Controlling Soil Reactions Influence of Soil Reaction on Availability of Nutrients	10
4	Soil survey And classification	Soil survey and USDA Soil classification	Soil survey methods and USDA Soil classification Land Capability classification,.	08

SPPU BOS GEOGRAPHY

Savitribai Phule Pune University, PuneT.Y.B.Sc. Geography Syllabus

Gg: 336 Fundamentals of Geoinformatics III (Part I)

June 2015

70 Percent Syllabus for Examination 2020-2021

Sr.No.	**Topic**	**Sub topic**	**Learning Points**	**Periods**
1.	Introduction to Remote sensing	History and Development	Historical development, Definition, A tool for resource surveys Applications	10
2.	Electromagnetic energy	Electromagnetic Radiation Electromagnetic Spectrum	Electromagnetic Radiation: Definition Properties of electromagnetic waves: velocity, wavelength, frequency. Atmospheric interactions, scattering, Reflection, emission, transmission. Division of spectrum in various spectral regions Imaging Systems: Normal color photos, IR color photos IR scanners	11
3.	Aerial Photography	Basic Concepts Geometry of Aerial Photographs	Aerial cameras, Types of photographs: vertical, oblique and terrestrial Aerial photographs as central perspective projection, Photo nadir, air base, flying height, Scales, swing and tilts	12

SPPU BOS GEOGRAPHY

Savitribai Phule Pune University, PuneT.Y.B.Sc. Geography Syllabus

Gg 346: Fundamentals of Geoinformatics– IV (Part II)

June 2015

70 Percent Syllabus for Examination 2020-2021

Sr.No.	**Topic**	**Sub topic**	**Learning Points**	**Periods**
1.	Satellite Imaging	A) Types of Satellites by their orbital characteristics B) Sensors and platforms ,scanners	Geostationary and Sun Synchronous, Passive and active sensors ERTS, LANDSAT, SPOT, INSAT, IRS & IKONOS Satellite platforms, Optical mechanical scanners, Infrared scanners,	10
2.	Satellite Images Resolution	Types Types of Resolution of satellite images	Multispectral images, Thermal infrared Images, Radar images. Spatial ,Spectral ,Radiometric and temporal	12
3.	INSAT & IRS	Types	INSAT series, IRS series, Resolution and other properties.	08
4.	Image Interpretation		elements of interpretation,	07

SPPU BOS GEOGRAPHY

Savitribai Phule Pune University

Three Year B. Sc. Degree Course in

GEOLOGY

T.Y.B.Sc. Syllabus

(Only for Semester IV of Academic Year 2020-21)

GL – 341: Metamorphic Petrology:

UNIT I) Introduction to Metamorphism: 12 Lectures

A) Introduction, Definition & Characteristics.
B) Domain of metamorphism
C) Metamorphic recrystallization as distinct from igneous crystallization
D) The concept of metamorphic facies: Diagramatic representation of pressure temperature conditions (with depth) of the different facies of contact, regional & Plutonic metamorphism
E) Introduction to mineralogical phase rule- system, component and phase
F) Introduction to phase diagrams of metamorphic rocks- ACF, A'KF and AFM diagrams

Unit II) Types of metamorphism I 12 Lectures

A) Thermal Metamorphism (6 Lectures)

a) Definition & General characteristics of the sub types of thermal metamorphism
b) Factors controlling Thermal metamorphism
c) Attainment of Chemical equilibrium
d) Chemically active fluids in heat dominant metamorphism
e) Aureoles of Thermal metamorphism
f) Effects of thermal metamorphism on :
    i) Igneous rocks (Intermediate & basic)
    ii) Aluminous & ferruginous deposits
    iii) Non – calcareous argillaceous sediments

B) Dynamic/ Cataclastic metamorphism: (6 Lectures)

a) Definition & General characteristics
b) Rock deformation involved
c) Stress & metamorphic chemical reactions
d) Stress & solubility of minerals
e) Mechanics of the formation of slaty cleavages
f) Strain & solution effects in the crystalline rocks
g) Mineralogical changes in cleaved & crystallized rocks.

Unit III) Types of metamorphism II 12 Lectures

A) Regional Metamorphism & its products (7 Lectures)

a) Definition & general characterists of the sub types of regional metamorphism
b) Depth zones & characteristic minerals
c) Diagrammatic representation of the conditions controlling metamorphism
d) Barrovian zones of regional metamorphism.
e) Development of textures & structures of regionally metamorphosed rocks
f) Crystal growth under stress
g) Effects of regional metamorphism:
    i. Argillaceous (Non – calcareous) sediments – (Barrovian zones)
    ii. Ferrugenous & aluminous sediments
    iii. Calcareous sediments
    iv. Igneous (acidic & basic)

B) Plutonic metamorphism (2 Lectures)

a) Definition & General characteristics
b) Formation of Granulites, Charnockites & Eclogites

C) Pneumatolysis / Metasomatism (3 Lectures)

a) Definition & General characteristics of the various types of metasomatism
b) Pneumatolytic processes – Tourmalinisation, Greissening, Scapolitisation & Autometasomatism

REFERENCE BOOKS -

1) Igneous & Metamorphic petrology : by Myron Best
2) Principles of Petrology : by G.W. Tyrell
3) Igneous, Metamorphic & Sedimentary petrology : by Ehler & Blatt
4) Igneous & Metamorphic petrology : by Turner & Verhoogen.
5) Metamorphism : by Alfred Harker.
6) Principles of Igneous and Metamorphic Petrology: John D. Winter
7) Principles of metamorphic petrology by Vernon and Clarke, 2008
8) Petrology of metamorphic rocks, Roger Mason

GL-342: Environmental Geology

Unit I) Concept, Objective and Scope of Environmental Geology: 12 lectures

A) Seven concepts, Objectives, and Scope of Environmental Geology; Physical, Biological, and Socio-geological Environment, Bio-geochemical cycles. **(4 lectures)**

B) Deterioration of land surface: Dimensions of Erosion, processes, causes of accelerated erosion, remedial measures. **(2 lectures)**

C) Desertification and degradation of land: meaning, extent, causes and preventive measures. **(4 lectures)**

D) Soil conservation, badland topography, alkalinity and salinity of soils **(2 lectures)**

Unit II) Natural Hazard and Mitigation: I 12 lectures

A) Natural hazards: Definition, type, Natural hazard zones and Impact assessment, Natural hazard zonation maps, Role of Geologists in disaster management plan **(2 lectures)**

B) Distinction between: hazard and disaster (with examples), local and regional context, disaster profile of India **(1 lecture)**

C) Earthquakes: Introduction, general characteristics, effects of disaster on human life and habitation, origin and severity of earthquakes, precursors (instrumental and natural), vulnerability, seismic zones of India, Impact assessment and mitigation measures **(3 lectures)**

D) Volcanoes: Introduction, types of volcanic activity and their origin, distribution, hazards, effects (lava flows, pyroclastic activity, toxic gases, mud flows, fires), Prediction and mitigation measures **(3 lectures)**

E) Mass movement: Introduction, causes and types of mass movements, Identification of landslides zones, control measures, avalanches and their causes, mitigation and concept of safety factor **(3 lectures)**

Unit III: Natural Hazard and Mitigation: II : 12 lectures

A) Floods: Introduction, definition, classification, causative factors, vulnerability, predictability (forecasting), mitigation measures, flood hazards in India **(3 lectures)**

B) Coastal hazards: Introduction, causes and impacts of coastal erosion, tsunami, storms and their predictability and mitigation measures **(3 lectures)**

C) Mining hazards: Types of mining hazards and restoration techniques **(3 lectures)**

D) Subsidence of land: Causes of subsidence of land, prediction and mitigation measures **(3 lectures)**

REFERENCE BOOKS -

1. Environmental Geology **:** By K.S. Valdiya
2. Environmental Geology **:** by E.A. Keller (Latest Edition)
3. Mining & Environment **:** by Bharat B. Dhar
4. Mineral Economics **:** by Sinha R.K.
5. Geology in Environmental planning **:** by A.D. Howard.

GL-343 : Economic Geology

Unit I) Basics of Economic Geology & Primary processes of formation of mineral deposits: 12 Lectures

A) Introduction: (2 Lectures)

a) Definition of ore minerals, gangue, tenor, overburden, country rock, syngenetic & epigenetic deposits

b) Classification of economically important metalliferous & non metalliferous mineral deposits

c) Processes of formation of mineral deposits

B) Magmatic Concentration: (3 Lectures)

a) Early magmatic deposits
b) Late magmatic deposits

C) Hydrothermal processes: (7 Lectures)

a) Principles of hydrothermal processes, characters of solutions, types of openings in rocks, factors affecting deposition from hydrothermal solution, wall rock alternations.
b) Types of hydrothermal deposits (Cavity filling & Metasomatic replacements) Cavity filling deposits:
   i) Processes & characteristic features
   ii) Types of cavity filling deposits: Fissure veins & its types (in brief), stock work, saddle reefs, ladder veins, pitches and flats, breccias filling deposits, solution cavity fillings, pore space fillings & vesicular fillings
c) Metasomatic replacement: Definition, Criteria of replacement& resulting mineral deposits

Unit II) Secondary processes of formation of mineral deposits: 12 Lectures

A) Oxidation &Supergene enrichment: (6 Lectures)

a) Oxidation& solution in the zone of oxidation
b) Gossans & Cappings, the role of iron in gossans, indigenous& transported limonite, false gossans & gossans as guides to the hidden deposits.
c) Ore deposition in the zone of oxidation & their method of precipitation
d) Supergene Sulphide Enrichment:
   i) Requirements for supergene enrichment
   ii) Factors influencing supergene enrichment
   iii) Recognition of supergene enrichment

B) Evaporation, Residual concentration & Mechanical concentration: (6 Lectures)

a) **Evaporation:**
   i) Process of mineral formation by evaporation
   ii) Evaporation deposits: Brief account of deposits of oceanic water, lake water, ground water & hot springs
b) **Residual concentration (residual deposits):**
   i) Conditions favouring of residual deposits
   ii) Brief account of residual deposits: Bauxite, clay & iron formation
c) **Mechanical concentration (placer deposits):**

i) Principles involved in the process of mechanical concentration
ii) Study of placer deposits: Eluvial, Alluvial, Beach & Aeolian

Unit III) Metallic & Radioactive deposits of India 12 Lectures

A) Study of following metallic deposits with reference to mineralogy, properties, uses & their geological & geographical distribution (8 Lectures)

i) Precious metals : Gold, Silver.
ii) Non-ferrous metals : Copper, Lead, Zinc & Aluminium
iii) Iron & Ferro alloy metals – Iron, Manganese, Nickel & Chromium
iv) Polymetallic Nodules

B) Plate tectonics & mineral deposits: (1 Lecture)

Mineral deposits associated with different plate boundaries

C) Radioactive minerals: (3 Lectures)

Study of Uranium & Thorium deposits of India with reference to mineralogy, mode of occurrence, properties, uses & their geological & geographical distribution

REFERENCE BOOKS-

1. Economic mineral deposits :by Bateman
2. Ore deposits of India :by Gokhale & Rao
3. India's Mineral Resources :by Krishnaswami
4. India's Minerals :by D.N Wadia
5. Industrial Minerals :by Deb.
6. Geology Of the industrial rocks & minerals :by Rober L.Bates
7. Economic Geology :by Umeshwar Prasad
8. Geology of Petroleum :by A.I. Levorsen
9. Economic mineral deposits of India :by Umate (IBM)
10. Elements of Petroleum geology :by R.C. Selly (2002)
11. Economic Ore Deposits :by Park & Mc-dermitt (1997)

GL: 344-Geotectonics

Unit I) Introduction to Geodynamics 12 Lectures

A) Evolution & formation of the solar system & earth & its physical properties (2 Lectures)

a) Formation and evolution of solar system
b) Meteorites- Types, Origin

B) Interior of the Earth: (10 Lectures)

a) Direct & indirect observations in exploration of Earth's interior
   i) The variable interior- evidences:
   ii) Seismic waves & Earth's interior:- Types of seismic waves & their characteristics, Seismic wave velocity & depth curve to indicate layered structure of the Earth
b) Physical-chemical characteristics of the different layers of the Interior of the earth
   i) Composition, physical properties & characteristics of three spherical zones of the Earth namely crust, mantle (including LVZ) & core
   ii) Concept of Lithosphere, Asthenosphere & Mesosphere
   iii) Concept & types of discontinuities –Conrad, Moho, Guttenberg & Lehman's Discontinuity
   iv) Introduction to Convection Currents & mantle dynamics

Unit II) Global tectonics I – Geomagnetism & Introduction to Plate Tectonics 12 Lectures

A) Introduction to Palaeomagnetism (5 Lectures)

a) Earth's Magnetic field & Geodynamo
b) Remnant magnetisation – TRM, DRM, CRM, VRM.
c) Concept of Polar wandering & its application in plate – tectonics, Apparent & True Polar wandering paths (with example)
d) Magnetic anomalies & sea floor Spreading- Mechanics & applications
e) Magnetic reversal & geomagnetic time scale.

a) Historical background of the plate tectonics theory, Plate tectonics as a unifying theory
b) Introduction to Wilson's cycle & Concept of plate tectonics
c) Characteristics of lithospheric plates
d) Concept of plate margin & plate boundary
e) Migration & motion of the plate boundaries
f) Present motion of world's large plates

Unit III) Global tectonics II- Plate Tectonics II 12 Lectures A) Three plate boundaries- (Divergent, Convergent & Transform faults-description & examples). (7 Lectures)

a) Divergent plate boundary
   i) Divergent boundary as a constructive plate boundary & source of new oceanic crust
   ii) Concept of a rift valley & mid-oceanic ridges
   iii) Structural environment at divergent plate boundary
   iv) Examples of divergent plate boundary

b) Convergent boundary as a destructive plate boundary :

Description & examples of the following types of convergent plate boundaries:
   i) Oceanic-oceanic subduction.
   ii) Oceanic-continental subduction
   iii) Continent-continent collision- case study of Alpine- Himalyan Orogeny
   iv) Concept of trench, subduction zone, Benioff zone & Ophiolite suites

c) Transform fault boundary

i) Transform fault boundary as conservative plate boundary-
ii) Distinction between Transform & Transcurrent faults
iii) Examples of Transform fault boundary

d) Assumptions & problems in plate tectonics (1 Lecture)

e) Concept of triple junctions with their examples (1 Lecture)

f) Basin tectonics – Introduction to fore arc, back arc, foreland & rift basins. **(1 Lecture)**

g) Concept of hot plumes & hot spots with examples (1 Lecture) h) Overview of Phanerozoic Tectonics- Spatial and Temporal evolution of palaeo supercontinents to present continents. **(1 Lecture)**

REFERENCE BOOKS -

1. General Geology : V. Radhakrishnan
2. Plate tectonics and Crustal evolution : Condie
3. Aspects of Tectonics : Valdiya K. S.
4. Tectonics : Moore and Twiss
5. Introducing Tectonics, Rock Structures and Mountain Belts by Graham Park
6. Geotectonics : V. V. Beloussov
7. Physical Geology : Arthur Holmes
8. Global Tectonics : Keray P and Vine F.J
9. Our evolving planet : Bergen, Alma Mater Fortag
10. Dynamic Himalaya : Valdiya K. S.
11. Geomorphology and Global Tectonics : Summerfield M. A.
12. Cratons and Fold belts of India: Ram S. Sharma
13. Global Tectonics: Kerry, Klepeis, Vine
14. Planetary Tectonics- Edited by Thomas R. Watters and Richard A. Schultz
15. Plate Tectonics: Continental Drift and Mountain Building by Frisch, Meschede and Blackey
16. Paleomagnetism: Continents and Oceans by McElhinny and McFadden
17. Essentials of Paleomagnetism by Lisa Tauxe, 2010
18. PALEOMAGNETISM: Magnetic Domains to Geologic Terranes By Robert F. Butler, (1992)

GL – 345: Phanerozoic Stratigraphy of India and Palaeontology

Unit I) Introduction to Phanerozoic Stratigraphy: 12 Lectures

A) Precambrian – Cambrian boundary

B) Study of following Geological systems with reference to their type area, broad lithology, fossils content:

Cambrian, Ordovician, Silurian, Devonian, Carboniferous, Permian, Triassic, Jurassic, Cretaceous & Tertiary

Unit II) The Paleozoic and Mesozoic Formations of Peninsular India: 12 Lectures

A) Palaeozoic Formations of Peninsular India

a) A brief history of the Paleozoic Formations,

b) Gondwana Supergroup: 1.Geographical distribution, 2. Stratigraphic classification-bipartile and tripartile, 3.Lithology, 4. Age, 5. Palaeoclimatic conditions,6. Flora,7.Fauna,
8. Igneous activity, 9. Marine intercalations, 10. Economic importance.

B) The Mesozoic Formations of Peninsular India:

a) A brief history of the Mesozoic formations.

b) Jurassic of Kachchh

c) Cretaceous of Narmada Valley/Bagh beds.

d) Cretaceous of Cauvery basin.

Unit III) Cenozoic Formations of Peninsular India and Geology of Maharashtra 12 Lectures

A)The Deccan Volcanic Province : Distribution, extent, age, structure, mode of eruption and occurrence, Petrological characters and variations, Lithostratigraphic classification, Infra trappeans and Intertrappean beds.

B)The Cenozoic Formations of Peninsular India:

a) Tertiary of Assam

b) Tertiary of the K-G basin

c) Tertiary formations along the West Coast.

C) Laterites: Definition, Origin, Types and distribution.

D) The Geology and Stratigraphy of Maharashtra

REFERENCE BOOKS -

1 Evolutionary trends in Invertebrates Swinnerton
2 Microfossils Brassier
3 Invertebrate Palaeontology Clarkson
4 Micropaleontology Daniel Jones
5 Paleaobotany Arnold
6 Geology and Evolution of the Indian Plate S.M. Naqvi
7 Invertebrate Palaeontology M.A.Koregave
8 Geology of Maharashtra: Geological Society of India
Special Publication
G.G. Deshpande
9 Geology of Western & Central India: Geological Society of
India
Special Publication
10 Stratigraphy of Lesser Himalaya by K. S. Valdiya
11 A Geological Time Scale Brian Harland et.al
12 Stratigraphy of India and Burma M. S. Krishnan
13 Fundamentals of Historical Geology & Stratigraphy of India Ravindra Kumar
14 Geology of India Vol 1 &2. Ramkrishna-Vaidhyanathan: : Geological Society of India
Special Publication

GL: 346-Applied Geology II (Engineering Geology, Geohydrology & Prospecting)

UNIT I) Engineering Properties Of Construction Material **12 Lectures**

A) Introduction:
Significance of geology in Civil engineering, knowledge of geomorphology, petrology, mineralogy, stratigraphy, photo geology and structural geology as applied to Civil engineering projects.

B) Engineering properties of rocks: Specific gravity, porosity, sorption, strength of rocks (Compressive, shear & tensile), elasticity of rocks, residual and shear stresses in rocks. Hardness test and Impact test for aggregates in brief.

C) Rocks as Construction Material: How are they obtained in nature? Use of rocks as facing stone. Factors influencing engineering usefulness of the rocks.

D) Use of rocks as an aggregate: Use of rocks as an aggregate in different types of constructions, source of different grades of aggregates, Properties of aggregates (shape, size, surface texture, roundness and coatings), cement aggregates reaction, thermal effects on aggregates. Types of aggregates (Highway, railway ballast and runway).

UNIT II) Geological And Geotechnical Investigations For Civil Engineering Projects **12 Lectures**

A) Tunnels:
Terminology, geological conditions for tunnel sites, tunnel in bedded rocks and folded rocks, influence of divisional planes, effects of faults and crushed zones. Tunnels in the vicinity of slopes. Role of groundwater in tunnelling. Tunnels in the Deccan Traps. Names and locations of at least six very important tunnels in India, Case study: Jawahar Tunnel

B) Dams and Reservoirs:
Geological conditions for the selection of dam and reservoir sites, terminology associated with dams. Types of dams (Gravity,buttress, arch and earthen), types of spillways. Location with type of all the important dams and hydroelectric projects in India.
Case study: Sardar Sarovar Dam

C) Road and Railways

Unit III: Geohydrology **12 Lectures**

A) Introduction:
a) Definition- Hydrology, Geo-hydrology, Hydrogeology.
b) Scope & groundwater development in India.
c) Vertical distribution of groundwater, Origin & rock properties affecting groundwater (porosity, permeability, their types & effects)

B) Aquifers, Darcy's law, Groundwater distribution & fluctuations:
a) Geologic formations as aquifers.
b) Types of aquifers (Confined, Unconfined, and Perched).
c) Groundwater movement (Darcy's law).
d) Groundwater fluctuations due to seasonal changes, stream-flow changes, evapo-transpiration changes.
e) Springs (cold & hot), conditions for formation of springs.
f) Factors controlling groundwater distribution (topography, climate, structural, geological, proximity of tanks, rivers etc.)

C) Groundwater recharge methods:
a) Introduction to artificial recharge methods.
b) Types of recharge methods: -
i) Water spreading methods (Flooding, Basin, Ditch & furrow, Natural channel, Irrigation).
ii) Recharge through Pits & Shafts, Recharge through wells.

iii) Rain water harvesting.
iv) Groundwater recharge methods in Maharashtra (bore-blast & jacket-well techniques).

REFERENCE BOOKS -

1) Principles of Geophysical Prospecting : M.B. Ramchandran
2) Geophysical Prospecting : Dobrin
3) Ground water Hydrology : Todd
4) Ground water : H.M. Raghunathan
5) Principles of Engineering Geology : Krynine & Judd
6) Engineering Geology : Parbin Singh
7) Fundamentals of Engineering Geology: R. S. Khurami
8) Mining Geology: Arogya Swami
9) Groundwater : Freeze and Cherry

70 % Syllabus for TYBsc/TYBA Mathematics Semester IV Examination 2020-21

Paper	Topics/Chapters for examination
MT-341 : Complex Analysis	1. Complex Numbers 2. Analytic Functions 3. Elementary Functions 4. Integrals
MT: 342: Real Analysis- II	1. Riemann Integration 2. Improper Integrals 3. Sequence and Series of Functions: Point wise and uniform convergence of sequences of functions
MT-344: Ring Theory	1. Rings and Fields 2. Ideals and Factor Rings 3. Factorization: Unique factorization Domain
MT-345: Partial Differential Equations	1. Ordinary Differential Equations in More Than Two Variables 2. First Order Partial Differential Equations: (a) Genesis of First Order Partial Differential Equations. (b) Classification of Integrals. (c) Linear Equations of the First Order. (d) Pfaffian Differential Equations. (e) Compatible Systems.
MT-347(A): Optimization Techniques	1. Network Models 2. Decision Analysis and Games 3. Replacement and Maintenance Models 4. Sequencing Problems
MT: 347(B): Differential Geometry	1. Curves in the plane and in space 2. How much does a curve? 3. Global Properties of curves 4. Surfaces in three dimensions 5. The first fundamental form
MT-347(C): C Programming II	1. Program Structures 2. Pointers 3. Structures and Unions
MT-347(D): Graph Theory	1. An Introduction to Graphs 2. Trees and Connectivity 3. Euler Tours and Hamiltonian Cycles
MT-347(E): Lebesgue Integration	1. Measurable Sets 2. Measurable Functions 3. The Lebesgue Integral:

	(i) Definition and example of the Lebesgue integrals for bounded functions. (ii) Properties of Lebesgue integrals for bounded measurable functions.
MT-347(F): Computational Geometry	1. Two Dimensional Transformations 2. Three Dimensional Transformations 3. Plane Curves

Microbiology
T.Y.B.Sc Microbiology Theory Syllabus
for
Academic Year 2020-21 only

Savitribai Phule Pune University
Microbiology Theory Syllabus for AY 2020-21 only
T. Y. B. Sc. Microbiology Semester IV Theory Course (2013 Pattern)
Semester IV
Course: MB – 341
Title: MEDICAL MICROBIOLOGY-II
Total number of lectures= 48
70% of lectures= 34

Unit No. in syllabus	Topic	No. of Lectures
I	**Chemotherapy:** **1.** Introduction to chemotherapy **2.** Desirable parameters of chemotherapeutic agent (Selective toxicity, Bioavailability of Drug, MIC, MBC, LD-50 value, routes of drug administration) **3.** Mode of action of antimicrobial agents on: **a. Bacteria:** i. Cell wall (Beta lactams [1st to 6th Generation- e.g. Meropenem, Imipenem Piperacillin], Tazobactam, Cycloserine, Bacitracin) ii. Cell membrane (Polymyxin, Monensin) iii. Protein synthesis (Streptomycin, Tetracycline) iv. Nucleic acids (Nalidixic acid, Rifamycin, Quinolones) v. Enzyme inhibitors (Trimethoprim) **b. Fungi:** (Griseofulvin, Nystatin, Voriconazole) **c. Viruses:** (Acyclovir, Zidovudine) **d. Protozoa:** (Mepacrine) **4. Resistance to antibiotics:** i. Development of antibiotic resistance (e.g. ESBL, VRE, MRSA) ii. Reasons and Mechanisms of drug resistance iii. Antibiotics misuse	**17**
II	**a. Introduction to cultivation of viruses** **b. Study of following groups of viral pathogens** (with respect to – Virion characteristics, Viability characteristics, Pathogenicity, Pathogenesis, Symptoms, Laboratory diagnosis including serological diagnosis, Epidemiology, Prophylaxis and Chemotherapy): a. HIV ii. Polio virus iii. Hemorrhagic viruses (Dengue, Ebola) iv. Hepatitis A and Hepatitis B viruses v. Influenza virus (human, swine and bird) vi. FMD virus ix. Rhabdoviruses (Rabies) xi. Oncogenic viruses (DNA, RNA)	**02** **11**
III	**Study of following groups of parasites** (with respect to – Classification, Life cycle, Morphological characteristics, Viability characteristics, Pathogenicity, Pathogenesis, Symptoms, Laboratory diagnosis (Serological diagnosis wherever applicable), Epidemiology, Prophylaxis and Chemotherapy): a. *Plasmodium*	**2**
IV	**Study of *Candida*** (with respect to – Morphological and cultural characteristics, Classification, Pathogenicity, Pathogenesis, Symptoms, Laboratory diagnosis, Epidemiology, Prophylaxis and Chemotherapy)	**2**
Total Lectures		**34**

T. Y. B. Sc. Microbiology Semester IV Theory Course (2013 Pattern)

Semester IV

Course: MB – 342

Title: GENETICS AND MOLECULAR BIOLOGY – II

Total number of lectures= 48

70% of lectures= 34

Unit No. in syllabus	Topic	No. of Lectures
I	**Gene transfer by transformation:** a. Development of competence in Gram positive and Gram-negative bacteria. b. Process of transformation in Gram positive and Gram-negative bacteria. c. Factors affecting transformation. d. Mapping of chromosome by co-transformation	**5**
II	**Gene transfer by transduction:** a. Process of generalized transduction. b. Process of specialized transduction. c. Mapping by Co-transduction.	**4**
III	**Gene transfer by conjugation:** a. Properties of F plasmid, b. F +, F-, Hfr and F′ strains c. Process of conjugation between F+ and F- and Hfr and F- d. Mapping of conjugants by interrupted mating experiment.	**5**
IV	**DNA damage and repair:** a. DNA damage by deamination, alkylation and radiation b. Base excision repair and nucleotide excision repair d. Photoreactivation	**5**
V	**Recombination and Mutants in Bacteriophages** a. Bacteriophage mutants i. Plaque morphology ii. Conditional lethal (Ts and Am) mutants iii. Deletion Mutants b. Deletion Mapping using bacteriophage deletion mutants c. Benzer's spot test	**5**
VI	**Tools of Recombinant DNA technology:** a. Vectors used: Plasmids, Viral DNA, cosmids, phagemids, PACs, BACs, YACs, Expression vectors b. Restriction Enzymes c. Insertion of foreign DNA in host	**6**
VII	**Generation of recombinant DNA molecule**: a. Cutting and joining the DNA molecules. b. Methods to transfer recombinant DNA into host cells.	**4**
Total Lectures		**34**

T. Y. B. Sc. Microbiology Semester IV Theory Course (2013 Pattern)

Semester IV

Course: MB – 343

Title: METABOLISM

Total number of lectures= 48

70% of lectures= 34

Unit No. in Syllabus	Topic	No. of Lectures
I	Membrane transport mechanisms: i. Passive transport - Diffusion, Osmosis, Facilitated transport ii. Active transport - Active transport systems in bacteria iii. Group translocation of sugars in bacteria iv. Ionophores: Mechanism and examples	6
II	Bioenergetics: i. Laws of thermodynamics ii. Concepts of free energy, entropy, high energy compounds: Pyrophosphate, enolic phosphates, acyl phosphates, thioester compounds and guanidinium compounds iii. Mitochondrial electron transport chain: components, arrangement of different components in the inner membrane, structure and function of ATP synthatase, inhibitors and uncouplers of ETC and oxidative phosphorylation, energetics of mitochondrial electron transfer chain	16
III	Biosynthesis and Degradation: a. Chemistry, concept of polymerization of macromolecules: Polysaccharides (Starch) and Lipids (Fatty acids) b. Degradation of macromolecules – Polysaccharides (starch), Lipids (fatty acids oxidation) and Proteins (urea cycle)	8
IV	Bacterial Photosynthesis: iii- Oxygenic and Anoxygenic mechanisms iv- Calvin cycle	4
Total Lectures		**34**

T. Y. B. Sc. Microbiology Semester IV Theory Course (2013 Pattern)
Semester IV
Course: MB – 344
Title: IMMUNOLOGY-II
Total number of lectures= 48
70% of lectures= 34

Unit No. in Syllabus	Topic	No. of lectures
I	**Major Histocompatibility Complex:** a. Structure of MHC in man and mouse b. Structure and functions of MHC class–I and class–II molecules c. Polymorphism of MHC molecules d. MHC antigen typing (microcytoxicity and mixed lymphocyte reaction)	6
II	**Cytokines:** Types, General characters and role in immune activation - Interferons, Interleukins and TNFs	3
III	**Antigen- Antibody Interactions** **Principles** of interactions: Antibody affinity and avidity, ratio of antigen antibody, lattice hypothesis **Visualization** of antigen antibody complexes a. Precipitation reactions: in fluid and in gel, immunoelectrophoresis b. Agglutination reactions: hemagglutination, bacterial agglutination, passive agglutination and agglutination-inhibition c. Immunofluorescence techniques: direct and indirect d. ELISA, biotin-avidin system e. RIA f. ELISpot assay	9
IV	**Immunohematology** a. Systems of blood group antigens b. ABO system - Biochemistry of blood group substances, Bombay blood group, Inheritance of ABH antigens c. Rh system d. Laboratory methods of blood group typing e. Medico-legal applications of blood groups f. Blood banking practices	8
V	**Public health immunology** a. Types of vaccines and antisera b. Immunization schedules: principles, schedules in developing and developed countries.	2
VI	**Hypersensitivity** a. Immediate and delayed type hypersensitivity b. Gell and Coomb's classification of hypersensitivity – mechanism with examples for type I, II, III and IV	2 4
Total Lectures		**34**

T. Y. B. Sc. Microbiology Semester IV Theory Course (2013 Pattern)

Semester IV

Course: MB – 345

Title: FERMENTATION TECHNOLOGY – II

Total number of lectures= 48

70% of lectures= 34

Unit No. in Syllabus	Topic	No. of Lectures
I	**Introduction to Solid State Fermentation and Submerged Fermentation**	**2**
II	**Large scale production of:**	
	a. Primary Metabolites: i. Vitamins (B12) ii. Amino acid - Glutamic acid, Lysine iii. Organic acids (Citric acid, Vinegar) **b. Secondary metabolites:** i. Ethanol and alcoholic Beverages (Beer and Wine) ii. Antibiotics (Penicillin and Streptomycin)	 **2** **4** **4** **6** **5**
	c. Enzymes (Amylase)	**2**
	d. Microbial transformation of steroids	**2**
	e. Biomass based products i. Yeast: Baker's	**1**
	f. Milk products: Cheese	**2**
	g. Vaccines (Polio, Tetanus)	**2**
	h. Immune sera	**2**
Total Lectures		**34**

T. Y. B. Sc. Microbiology Semester IV Theory Course (2013 Pattern)

Semester IV

Course: MB – 346

Title: AGRICULTURAL AND ENVIRONMENTAL MICROBIOLOGY

Total number of lectures= 48

70% of lectures= 34

Unit No. in Syllabus	Topic	No. of Lectures
1	**Agriculture Technology:** 1. Plant growth improvement with respect to: a. Disease resistance b. Environmental tolerance **2. Methods of plant disease control** a. Chemical control b. Eradication c. Biological control (employing bacterial and fungal cultures) d. Integrated pest management e. Development of insect resistant plants (BT crops) f. Application of viral proteins in controlling plant viral diseases g. Antisense RNA technology in plant disease control h. RNA interference (RNAi) in controlling plant pathogens i. Mycoviruses acting against fungal plant pathogens	14
2	**Biochemistry and production of bio-fertilizers with respect to** a. Nitrogen Fixation i. Nonsymbiotic Nitrogen fixation: Diazotrophy, role of nitrogenase and hydrogenase, mechanism of nitrogen fixation ii. Symbiotic Nitrogen fixation: Establishment of symbiosis, Nodule development, mechanism of nitrogen fixation in root nodules iii. Nod genes, Nif genes b. Phosphate solubilization c. Potassium mobilization d. Iron chelation	08
3	**Bioremediation and Wastewater Treatment:** Definition, Role of plants & Microbes in Bioremediation of Hydrocarbons **Bioaugmentation:** a. Definition b. Use of microbial cultures and enzymes for bioaugmentation	04
4	**Bioleaching:** a. Microorganisms used b. Bioleaching process c. Bioleaching of Copper	02
5	Introduction to Nanobiotechnology: Synthesis of Nanoparticles using microorganisms and its' applications	02
6	**Microbial Biosensors and Biochips in Environmental Monitoring:** Definition, components, types, advantages & limitations	02
7	**Biofuel cells and Biodegradable plastic**	02
Total Lectures		**34**

Industrial Microbiology (Voc.)

T. Y. B. Sc. Ind. Microbiology (Voc.) Theory Syllabus

for

Academic Year 2020-21 Only

Savitribai Phule Pune University
Industrial Microbiology Vocational Theory Syllabus for AY 2020-21 Only
T. Y. B. Sc. Ind. Microbiology Theory Course (2013 Pattern)
Semester IV
Course: IND-VOC-MB – 345: Theory Course V
Title: Molecular Biology & Recombinant DNA Technology
Total number of lectures= 48
70% of lectures= 34

Unit No. in Syllabus	Topic	No. of Lectures
1	**CLONING STRATEGIES**: a) Cloning vehicles-Plasmids, Bacteriophages, Cosmid, Artificial chromosomes- Shotgun cloning, PAC, BAC, YAC & other recent developedvectors. b) Genomic DNA libraries and cDNA cloning, chromosome walking c) Recombination selection and screening methods – Nucleic acid hybridization methods, Use of different probes.	10
2	**GENE MANIPULATION AND EXPRESSION** a) Expression of cloned DNA fragments in bacteria- *E. coli* , Yeast – S. cerevisiae and other eukaryotes. b) Gene transfer to plant and animal cells.	12
3	**INTERACTION WITH DNA** a) DNA sequencing- Maxam and Gibert method, Dideoxy method, automated sequencing. b) Polymerase chain reaction – primers, cloning, PCR products, RT-PCRand other modifications, Types of heat resistant enzymes used	10
4	**IMPACT OF Recombinant DNA Technology** bDNA fingerprinting – forensic applications	1
5	**HUMAN GENOME PROJECT**	1
Total Lectures		**34**

T. Y. B. Sc. Ind. Microbiology Theory Course (2013 Pattern)
Semester IV
Course: IND-VOC-MB – 346: Theory Course VI
Title: Entrepreneurship Development
Total number of lectures= 48
70% of lectures= 34

Unit No. in Syllabus	Topic	No. of Lectures
1	**INTRODUCTION:** Concept of entrepreneurship, Historical background, need and scope of entrepreneurship in modern society, Entrepreneurial behavior, attributes and skills. Key elements of entrepreneur, Entrepreneurial process, Entrepreneurial culture, Environment of Entrepreneurship, Socio economic origins of Entrepreneurship, Barriers of Entrepreneurship and means to reduce them, types of Entrepreneurs, Characteristics of Entrepreneur.	8
2	**BUSINESS ORGANIZATIONS**: Forms of business organizations such as sole proprietorship, partnership, Joint Stock Company, cooperative organization etc. Relative merits and demerits of each form, Meaning and definition, types of Small Scale Industry.	3
	Study of organizations promoting Entrepreneurship Sources of Information: Where to go for what? a. District Industry Centre (DIC) b. Maharashtra Industrial Development Corporation (MIDC) c. Maharashtra State Small Industries Development Corporation (MSSI DC) d. Small Industries Services Institute (SISI) e. National Institutes of Entrepreneurship and Small business Development (NIESBUD) f. National Entrepreneurship Development Board (NEDB) g. Entrepreneurship Development Institute of India h. Commercial and Co-operative Banks i. State Industrial Development Bank (SIDBI) j. Maharashtra State Electricity Board k. Pollution Control Board	3
	Legal Aspects of Small Business: Elementary knowledge of Income Tax, Sales Tax, VAT, Service Tax, Patent Rules, Excise Rules, Factory Act and Payment of Wages Act, Procedures for registration of SSI.	2
3	**ENTREPRENEURSHIP DEVELOPMENT:**	5

	Identification of opportunities for entrepreneurship, ideas to start new business, criteria for selection of new product or service, Market Survey as a tool.	
4	**FINANCIAL ASPECTS:** **Govt/Public sources of finance** Sources of finance, Role of various funding agencies, government and commercial Role of various funding corporations and funding institutes such as chamber of commerce, MSFC, MCED, NSSIDC, Banks, special institutes such as IDBI, MIDC, SICOMetc,	4
5	**MARKETING ASPECTS**: Meaning, scope and importance, Marketing strategy, Market segmentation, marketing channels. Marketing mix and its effect.	5
6	**HUMAN RESOURCE ASPECTS : (H.R Policies)** Concept and scope in modern industry, Different modes of employment, Placement of proper person for a job, Interpersonal relations and communication skills ,guidance for stress management, soft skills. Drafting -Appointment letter, termination tenure , experience certificates , exit policies	4
Total Lecture		**34**

Wine Technology
T.Y.B.Sc Wine Technology Theory Syllabus
for
Academic Year 2020-21 Only

Savitribai Phule Pune University
Wine Technology Theory Syllabus for AY 2020-21 Only
T. Y. B. Sc. Wine Technology Theory Course
Semester IV
Course: WT – 342
Title: Fruit and Fortified Wines
Total number of lectures= 48
70% of lectures= 34

Unit No. in Syllabus	Topic	No. of Lectures
1.	Traditional and nontraditional fruits. Harmonious blends of fruits with grape wine	9
2.	The concept of fruit beer and alcoholic wine as compared to synthetic beverages. Prospect of fruit wines: Banana and orange wine. Propensity of wine making: Guava wine and strawberry wine. Technology of sparkling wine production : Sparkling cider	12
3.	Concept of fortification, different styles of fortified wine (Late harvest style, port style wine) Methods of increasing berry sugar. Botrytis cinerea affected desert wines. Useful and harmful effect of Botrytis cinerea Addition of Brandy alcohol or liquor in wine	9
4.	Preparation of wine from grapes with high sugar levels without Botrytis influences. Wines made by addition of juice concentrate to a dry white wine. Retention of portion of grape sugar in wine.	4
Total Lectures		**34**

T. Y. B. Sc. Wine Technology Theory Course
Semester IV
Course: WT – 343
Title: Wine Defects: Identification and Rectification
Total number of lectures= 48
70% of lectures= 34

Unit No. in Syllabus	Topic	No. of Lectures
1.	Oxidation : acetaldehyde, acetic acid, ethylacetate	2
2.	Sulfur compounds: sulfur oxides, hydrogen sulfide, mercaptans, dimethyl sulfide	5
3.	Environmental : cork traint, heat damage, light strike, lady bird taint	5
4.	Microbial : Brettanomyces (Dekkera). Geosmin, Lactic acid bacteria (bitterness taint, diacetyl, geranium taint, mannitor, ropiness), Mousiness, Refermentation	8
5.	Acids in wine : volatile acidity (acetic acid), tartaric, malic, citric, lactic and succinic.	6
6.	Wine aging factors and influences: with some little or no aging potential, bottle and dumb phase aging	8
Total lecture		**34**

T. Y. B. Sc. Wine Technology Theory Course

Semester IV

Course: WT – 344

Title: Wine Laws, Management and Taxation

Total number of lectures= 48

70% of lectures= 34

Unit No. in Syllabus	Topic	No. of Lectures
1	Introduction and Historical Background	2
2	Federal Wine Laws	6
3	State wine laws: Laws that govern the distribution of wine, selling of wine, state taxationof wine, shipping of wine by producers and consumers.	6
4	State laws governing taxation.	5
5	State laws governing shipping	5
6	The Patent: Concept of patent, composition of patent, subject matter and characteristics of patent. Protection of right of inventor, infringement, cost of patent, product and process patent	10
Total Lectures		**34**

T. Y. B. Sc. Wine Technology Theory Course

Semester IV

Course: WT – 345

Title: Wine Market and Marketing

Total number of lectures= 48

70% of lectures= 34

Unit No. in Syllabus	Topic	No. of Lectures
1	Understanding Marketing	6
2	The Global wine market-Leading producers and regions , top marktes	10
3	Principles,logistics and strategies of wine marketing and sales	10
4	Understanding the market and finding a niche and developing a successful plan	8
Total Lectures		**34**

Savitribai Phule Pune University

Faculty of Science and Technology

Board of Studies in

Physics

Structure of T. Y. B. Sc. (Physics) revised syllabus
(2014-2015 Pattern)

Modified syllabus for T.Y.B.Sc. Physics Sem IV to be implemented
Only For Academic Year 2020-2021

Note: Considering pandemic situation problems and time constraint Partial reduction in syllabus is done . The syllabus for the examination will be as follows

Sr .No	**Compulsory Courses**
1	PH-341 Classical Electrodynamics
2	PH-342: Quantum Mechanics
3	PH-343: Thermodynamics and Statistical Physics
4	PH-344: Nuclear Physics
5	PH-345: Electronics/Advanced Electronics
6	**PH-346 Elective II : (Select any One)**
	G: Medical Electronics
	H: Physics of Nanomaterials
	I: Microcontrollers
	J: Electro Acoustics and Entertainment Electronics
	K: Lasers
	L: Radiation Physics

T. Y. B. Sc. Physics

PH-341: Classical Electrodynamics.

1. Electrostatics: (16 L)

1.1. Coulomb's law, Gauss law, Electric field, Electrostatic Potential

1.2. Potential energy of system of charges.

1.3. Statement of Poisson's equation, Boundary Value problems in electrostatics-solution of Laplace equation in Cartesian system,

1.4. Method of image charges: Point charge near an infinite grounded conducting plane, Point charge near grounded conducting sphere.

1.5. Polarization **P**, Electric displacement **D**, Electric susceptibility and dielectric constant, bound volume and surface charge densities.

1.6. Electric field at an exterior and interior point of dielectric.

2. Magnetostatics: (16 L)

2.1. Concepts of magnetic induction, magnetic flux and magnetic field

2.2. Magnetic induction due to straight current carrying conductor, Energy density in magnetic field, magnetization of matter. Relationship between **B,H** and **M.**

2.3. Biot-Savart's law, Ampere's law for force between two current carrying loops, Ampere's circuital law,

2.4. Equation of continuity, Magnetic vector potential **A**.

2.5. Magnetic susceptibility and permeability, Hysteresis loss, B-H curve.

3. Electrodynamics: (4L)

3.1. Concept of electromagnetic induction, Faradays law of induction, Lenz's law, Displacement current, generalization of Amperes' law

3.2. Maxwell's equations (Differential and Integral form) and their physical significance

Reference Books:

1) Introduction to Electrodynamics - By D. J. Griffith

2) Classical Electrodynamics – By J. D. Jackson.

3) Introduction to Electrodynamics - By A. Z. Capri, Panat P. V.

4) Electricity and magnetism – By Reitz and Milford

5. Electrodynamics - By Gupta, Kumar, Singh (Pragati Prakashan)

6. Electromagnetic field and waves - By Paul-Lorrain and Dale R Corson

7. Electricity and magnetism – By Murugeshan (S. Chand)

T. Y. B. Sc. Physics

PH-342: Quantum Mechanics

1. Origin of Quantum Mechanics: (10 L)

1. Historical Background
   a) Review of Black body radiation, b) Review of photoelectric effects.
2. Matter waves
   - De Broglie hypothesis. Davisson and Germer experiment.
3. Wave particle duality
4. Wave function of a particle having definite momentum.
5. Concept of wave packet, phase velocity, group velocity and relation Between them
6. Heisenberg's uncertainty principle with thought experiment.
   - Electron diffraction experiment, different forms of uncertainty.

2. The Schrodinger equation: (15 L)

1. Physical interpretation of wave function
2. Schrodinger time dependent equation.
3. Schrodinger time independent equation.(Steady state equation).
4. Requirements of wave function.
5. Probability current density, equation of continuity, and its physical significance.
6. Definition of an operator in Quantum mechanics.
   - Eigen function and Eigen values.
7. Expectation value – Ehrenfest's theorem

3. Applications of Schrodinger Steady state equation: (05 L)

1. Free particle.
2. Particle in infinitely deep potential well (one - dimension).
3. Step potential.

4. Operators in Quantum Mechanics: (05 L)

1. Hermitian operator.
2. Position, Momentum operator, angular momentum operator, and total Energy operator (Hamiltonian).
3. Commutator brackets- Simultaneous Eigen functions.
4. Commutator algebra.
5. Commutator brackets using position, momentum and angular Momentum operator.
6. Raising and lowering angular momentum operator.
7. Concept of parity, parity operator and its Eigen values.

Reference Books:

1. Quantum Mechanics of Atoms, Molecules, Solids, Nuclei and particles. –
   By R. Eisberg and R. Resnik Published by Wiley.
2. Quantum Mechanics. –
   B. H. Brandsen and C. J. Joachain: Pear son Education
3. Concepts of Modern physics. –
   By A. Beiser Published by Mc. Grawthill. Chapter 2,3,5,6.
4. Introduction to Quantum Mechanics. –
   By D. Griffiths Published by Prentice Hall.
5. Quantum Mechanics. –
   By Ghatak and Lokanathan Published by Mc. Millan.
6. Quantum Mechanics. –
   By L. I. Schiff.
7. Quantum Mechanics. –
   By Powell and Crasemann, Addison-Wesley Pub. Co.
8. Quantum Mechanics an accessible introduction
   - Robert Scherrer Pearson - Addison Wesley

T. Y. B. Sc. Physics

PH-343: Thermodynamics and Statistical Physics

1. Kinetic Theory of Gases: (8L)

Assumptions of Kinetic theory of gases, Mean free path, Transport phenomenon, Viscosity,Thermal conductivity and diffusion, Problems

2. Maxwell Relations and Application: (10 L)

Thermodynamical functions: Internal Energy, Enthalpy, Helmholtz function, Gibb's function, Derivation of Maxwell Relations, First and Second TdS Equations, Specific heat and latent heat equations, Joule Thomson effect (Throttling Process)

3. Elementary Concepts of Statistics: (10L)

Probability, distribution functions, Random Walk and Binomial distribution, Simple random walk problem, Calculation of mean values, Probability distribution for large-scale N, Gaussian
probability distributions,

4. Statistical Distribution of System of Particles: (8L)

Specification of state of system, Statistical ensembles, Basic Postulates, Probability calculations, Behaviors of density of states, Thermal, Mechanical and general interactions

References:

1. Statistical and Thermal physics - By Lokanathan, R.S. Gambhir,
2. Fundamentals of statistical and thermal physics - By F.Reif
3. Perspectives of modern physics - By A. Beiser
4. Fundamental of Statistical Mechanics - By B.B. Laud
5. A primer of Statistical Mechanics - By R.B. Singh
6. Statistical Mechanics - By Gupta, Kumar

T. Y. B. Sc. Physics

PH 344: Nuclear Physics

1. Basic Properties of Nucleus: (07 L)

Composition, charge, size, density of nucleus, Nuclear Angular momentum,Nuclear magnetic dipole moment, Electric quadrupole moment, parity andsymmetry, Mass defect and Binding energy, packing fraction, classificationof nuclei, stability of nuclei (N Vs Z Curve) and problems.

Ref 1, ch (1), Ref 2, ch (4)

Problems Ref 4 ,ch (26)

2. Radioactivity : (10 L)

Radioactivity disintegration (concept of natural and artificial radioactivity,Properties of α, β, γ rays, laws of radioactive decay, halflife, mean life,specific activity and its units, successive disintegration and equilibriumsand radioisotopes). Application of radioactivity(Agricultural, Medical, Industrial, Archiological). Problems

Ref 1 ch (8), Ref 2 – ch (15)

Problems Ref 4 ch (27, 29)

3. Nuclear forces: (08 L)

Meson theory of nuclear forces, Properties of nuclear forces, properties of deuteron system, Elementary particles, Quarks model for elementaryparticles.

Ref1ch (2, 3), Ref 2 ch (10), Ref 3 ch (3)

Problems Ref 4 ch (26)

4. Particle Accelerator and Detectors: (07 L)

Introduction to particle Accelerators, Linear (electron/proton Linac)Cyclic (Cyclotron) Classification of Nuclear Detector, Gas filled Detectors (G. M. counter), Solid state detectors (NaI (Tl) scintillation counter)

Problems Ref 1ch(7,12)

Reference Books

1 Introduction to Nuclear PhysicsH.A.Enge (Addition Wesley co.)
2 The Atomic NucleusR.D.Evans (Tata McGraw Hill co.)
3 Concepts of Nuclear Physics – B.L.Cohen (Tata McGraw Hill co.)
4 Schaum's Outline Series Modern PhysicsR.Gautrearu (McGraw Hill co.)
5 Introduction to Nuclear Physics, S. B. Patel

Additional References

1 Atomic and Nuclear PhysicsShatendra Sharma (Pearson Education,1 stEdition)
2 Nuclear PhysicsKaplan (Narosa Publishing House)
3 Introduction to Nuclear PhysicsY.R. Waghmare (Oxford IBH.)

T. Y. B. Sc. Physics
PH345: Electronics.

1. Special Purpose Diodes: (4L)

LED and Photodiode, Varactor (working and characteristics), Optocoupler. Problems

Ref. 1 Article 5.8

2. Transistor amplifier: (8L)

Classification of amplifier, class A, B (working, gain and efficiency calculation) class C and AB (working only), class B push pull amplifier, cross over distortion, differential amplifier (transistorized). Problems

Ref. 1 Article11.3, 11.4, 11.5, 11.6, 12.5, 17.1

3 Field Effect Transistor: (8L)

Introduction, classification, principle, working and IV characteristics of JFET,MOSFET (DEMOSFET and E only MOSFET),Application of JFET :-as Variable resistor, electronic switch and analogue multiplexer. Problems

Ref. 1 Article13.1 to 13.9, 14.1to 14.5

4 Operational Amplifier : (4L)

Applications of OPAMP integrator, Differentiator, Comparator, Schmitt Trigger, Instrumentation Amplifier. Problems

Ref. 1 Article20.4, 20.5, 22.1 to22.3, 22.5, 22.10

5. Timer (IC555) : (4L)

Block diagram, Astable, monostable and bistable multivibrator (working and design) Problems

Ref. 1 Article23.7, 23.8

6. Regulated Power Supply: (4L)

Block diagram of 3 pin IC regulator, study of IC 78XX, 79XX, dual power supply (using 3 pin IC) Block diagram of IC723 circuits and design of basic low voltage (2 to7 volt) and high voltage (7 to 28volt) regulator. Problems

Ref. 1 Article24.4, for IC723 refer data book.

7. Sequential Logic Circuits: (04L)

Flipflops: RS flip flop using NAND/NOR clocked RS, D, JK, and T flip flops, preset and clear inputs.

References

1 Electronic Principles (6 th edition), Malvino (Tata McGraw Hill, New Delhi)
2 Modern Digital Electronics (3rd Edition), R.P.Jain, (Tata McGraw Hill, New Delhi)
3 Basic Electronics by R. S. Sedha, S. Chand publication

T. Y. B. Sc. Physics

PH345: Advanced Electronics

(Important Note: This course is designed for the student who has offered Electronics as one of the subjects at S.Y.B.Sc. level**)**

1. Sensors: (16 L)

Metal resistance versus Temperature devices:

Metal resistance versus Temperature devices, resistance versus temperature approximation, resistance temperature detectors.

Thermistors:

Semiconductor resistance versus Temperature, Thermistor characteristics.

Thermocouples:

Thermoelectric effects, Thermocouple characteristics, Thermocouple sensors.

Other Thermal Sensors:

Bimetal strip, Gas thermometers, Vapour pressure thermometers, Liquid expansion thermometers,solid state temperature sensors.

Motion sensors:

Types of motions, Accelerometers' principles, Types of accelerometers, applications

Optical sensors:

Photo detectors:

Photo detector characteristics, photoconductive detectors, photo voltaic detectors, photo diode detectors, photo emissive detectors.

Pyrometry: Thermal radiation, broadband pyrometers, narrowband pyrometers.

Optical sources: Conventional light sources, Laser principles

Applications: Label inspection, Turbidity, Ranging.

2. Signal Conditioning using OP-AMP: (12 L)

Principles of Analog Signal Conditioning:

Signal level and bias changes, linearization, conversions, filtering and impedance matching, concept of loading.

Passive circuits: Divider circuits, bridge circuits, RC filters, Operational Amplifier, characteristics and Specification of OP-AMP Circuits in Instrumentation, Voltage Follower, Inverting and Non-Inverting

Amplifier, Instrumentation Amplifier, I to V Converter and V to I converter, Integrator (Low Pass Filter), Diffrentiator(High Pass Filter) 1st and 2nd order

3. Digital signal conditioning: **(05 L)**

Review of digital fundamentals, digital information, Fractional Binary System, Boolean algebra, Digital Electronics, Combinational Circuits, Multiplexer, De-Multiplexer, Encoder, Decoder

Reference Books:

1. Process Control Instrumentation Technology by C.D. Johnson Pearson Education 8th edition
(Economic Edition).
2. Computer Based Industrial Control by Krishna Kant (Eastern Economic Edition)
3. Instrument of Device System by Rangan, Mani, Sharma
4. Instrument measurement and analysis by B. C. Nakra, K. K. Chaudhari.

T. Y. B. Sc. Physics

PH346 Elective II(G) : Medical Electronics

1. Introduction: **(10 L)**

1. 1 Terminology of medical instrumentation,
1.2 Physiological system of body
1.3 Sources of bioelectric signals,
1. 4 Origin of bioelectric signals,
1.5 Analysis of ECG pattern
1.6 Nernst equation
1.7 Various types of bioelectric signals,
1.8 Basic medical instrumentation system,
1.9 Introduction to man instrument system,
Problems

2. Bio potential Electrodes and sensors: **(12 L)**

2.1 Electrode-electrolyte interface,
2.2 Polarizable and non-polarizable electrodes,
2.3 Electrodes for ECG,EEG, EMG,
2.4 Resistive sensor
2.5 Capacitive sensor
2.6 Inductive sensor
2.7 Piezoelectric sensor
2.8 Radiation sensor
2.9 Temperature sensor
Problems

3. Amplifiers and Signal Processing: **(09 L)**

3.1 Introduction
3.2 Basic amplifier requirements
3.3 The Differential amplifier
3.4 Common mode rejection
3.5 Instrumentation amplifier
3.6 Isolation amplifier
3.7 Pateint safety
3.8 Cardiac monitor
Problem

4. Clinical Laboratory Instrumentation: **(03 L)**

4.1 Spectrophotometry,
4.2 Spectrophotometer type instruments

Reference Books:

1. Handbook of Biomedical Instrumentation, R.S. Khandpur
2. Medical Instrumentation application design, John G Webster, Houghon

Mifflin Co.
3. Introduction to Biomedical Electronics, Joseph DfuBovy, Mc Graw Hill.
4. Clinical Biophysics, P. Narayanan
5. Introduction to Bio0medical equipment technology, fourth edition, by Joseph J. Carr and John M. Brown

T. Y. B. Sc. Physics

PH346 Elective II (H): Physics of Nanomaterials

1. Introduction to nanomaterials: **(10 L)**

Introduction to nano-sized materials and structures
Brief history of nanomaterials and challenges in nanotechnology
Significance of nano-size and properties, classification of nanostructured materials

2. Methods of synthesis of nanomaterials: **(12 L)**

Bottom-up and Top-down approaches
Physical methods: High energy ball milling, Physical vapour deposition, Ionized cluster beam deposition, sputter deposition, Ultrasonic spray pyrolysis etc.
Chemical methods: colloidal method, co-precipitation and sol-gel method
Hybrid method: Electrochemical and chemical vapour deposition.

3. Characterization techniques: **(11 L)**

UV- visible spectroscopy
X-ray diffraction
Scanning electron microscopy
Transmission electron microscopy

4. Properties of nanomaterials: **(02 L)**

Mechanical, Electrical, Thermal, Optical

Reference Books:

1. Nanotechnology: Principles and Practices by Sulbha Kulkarni, Capital Publishing Co. New Delhi.
2. Introduction to nanotechnology, by C. P. Poole Jr. and F. J. Ownes, Willey Publications.
2. Origin and development of nanotechnology by P. K. Sharma, Vista International publishing house.
3. Nanostructure and nanomaterials synthesis, Properties and applications, by G. Cao,Imperials College Press, London.

T. Y. B. Sc. Physics

PH346 Elective II (I): Microcontrollers

1. **ARCHITECTURE OF 8051: [10L]**
   Comparison of Microprocessor and Microcontroller, Overview of the 8051 family, Block diagram of Microcontroller, Functions of each block, Pin details of 8051, A and B CPU registers, Flags and Program status word (PSW), Program Counter and Data Pointer, PSW register, Memory Organization of 8051, Internal RAM, Stack and Stack Pointer, Special function registers, Internal ROM, I/O Ports, Oscillator and Clock
2. **8051 ASSEMBLY LANGUAGE PROGRAMMING: [10L]**
   Introduction to 8051 Assembly programming, Assembling and running an 8051 program, 8051 data types and directives, Intel hex file, Jump, loop, and call instructions, 8051 I/O programming, Addressing modes,
3. **ARITHMETIC & LOGIC INSTRUCTIONS AND PROGRAMS: [10L]**
   Arithmetic instructions, Signed number concepts and arithmetic operations, Logic and compare instructions, Rotate instruction, BCD, ASCII, and other application programs.
4. **TIMER AND INTERRUPTS PROGRAMMINGIN ASSEMBLY: [6L]**
   Timers. Programming 8051 timers, counter programming, Programming timers 0 and 1 in 8051, 8051 interrupts, Interrupt priority in the 8051

Reference Books:

1. 8051 Microcontroller by Kenneth J.Ayala.
2. 8051 Microcontroller and Embedded Systems using Assembly and C by Mazidi, Mazidi and D MacKinlay, 2006 Pearson Education Low Price Edition.
3. Microprocessor and Microcontroller by R.Theagarajan, Sci Tech Publication, Chennai
4. Programming customizing the 8051 Microcontroller by MykePredko, Tata McGraw Hill

T. Y. B. Sc. Physics

PH-346 Elective II –(J): Electro Acoustics and Entertainment Electronics

1. Speech and Hearing: (03 L)

Human voice and speech mechanism. Human hearing mechanism, theories of hearing

2. Electro Acoustic Transducers: (25 L)

1. Microphones: Design and operational features of carbon, moving coil and condenser microphones. Expressions for sensitivity, calibration, directivity. Problems.

2. Loudspeakers: Direct radiator dynamic type, expression for efficiency, radiated output power, effect of voice coil parameters. Horn loudspeaker cutoff frequency, output of horn. Loudspeaker cabinets – types, bass reflex cabinets. Problems.

3. Sound reinforcement system for auditoria: Power handling capacities, testing and evaluating amplifier specifications for auditoria. High-Fidelity (Hi-fi) acoustic evaluation of an auditorium/studio articulation test, sound level distribution, measurement of reverberation time. Acoustic delay units.

3. Sound recording and reproduction: (08 L)

1. Basic requirements of a system for good quality sound recording and reproduction, volume compressors, expanders, equalizers, graphic equalizers, monophonic, stereophonic sound reproducing system, surround sound. Noise reduction. Dolby A ,B system

Reference Books:

1. Fundamentals of Acoustics: Kinsler and fray etal, 4thedition, John Wiley and sons
2. Music, physics and Engineering H.F.Olson Dover publication 1960
3. Basic Acoustics D.E.Hall, Oxford University Press.
4. Acoustics Sourcebook Sybil Parker (Ed) McGraw Hill
5. Handbook for sound engineers G.M.Balov (Ed) New audio cyclopedia
6. Consumer Electronics by S.P. Bali (Pearson Publication) 7. Electroacoustics by Mendel and Kleiner (CRC Press)

T. Y. B. Sc. PHYSICS

PH346 Elective II (K): Lasers

1. Introduction to Lasers: (08 L)

Ordinary light and Lasers, Brief history of Lasers, Interaction of radiation with matter, Energy levels, Population density, Boltzmann distribution, Transition Lifetimes, Allowed and Forbidden Transitions, Stimulated Absorption, Spontaneous Emission and Stimulated Emission, Einstein's Coefficients, Einstein's relations.

2. Laser Action: (06 L)

Condition for large stimulated emission, Population inversion Condition for light amplification, Gain coefficient Active medium, Metastable states Pumping schemes: three level and four level

3. Laser Oscillator: (07 L)

Optical feedback, round trip gain, threshold gain, critical population inversion, Optical resonator, condition for steady state oscillations, cavity resonance frequencies.

4. Laser Output: (03L)

Lineshape broadening: - Lifetime broadening - Collision broadening - Doppler broadening

5. Characteristics of Laser: (04 L)

Directionality, Monochromaticity Coherence Brightness

6. Types of Lasers: (06 L)

Solid State Lasers – Ruby Laser, Diode Laser Gas Lasers – HeNe Laser,

Reference Books:

1. An introduction to Lasers – theory and applications, M.N. Avadhanulu, S.Chand and Co. New Delhi

2. Experiments with HeNe Laser by Sirohi

3. Optical fibre and Laser – Principle and applications, Anuradha De, New Age International Publishers, Second edition

T. Y. B. Sc. PHYSICS PH346

Elective II (L): Radiation Physics

1. **Low Energy Radiation: (8L)**

   Introduction to Microwave and Radio waves covering spectrum, power levels and detection methods. Laboratory sources of infrared, visible and ultra- violet radiation with details of energy spectrum. Detectors for microwaves, Infrared and Ultra violet radiation. Interactions of ultra violet and microwave radiation with matter

2. **Energetic Radiation : (8L)**

   Introduction to Cosmic radiation .Types of particles and their energies in cosmic rays. Basic laboratory sources of electrons and ions up to 50 keV. Focusing of electron and ion beams with magnetic and electrostatics lenses. Methods for measurement of electron and ion beam current and flux. Different types of neutron sources based on radioactive sources.

3. **X-Ray Radiography: (8L)**

   Principle and methods of generation of characteristics X-Rays. Interaction of X-Rays with matter, attenuation coefficient. Methods for recording X-Ray radiograph using photographic plate. Modern digital methods for recording X-ray radiograph. Medical applications of Xrays.

4. **Radiation Detectors and Dosimetry: (8L)**

   Working principle of ionization chamber and Scintillator detector, Units for radiation exposure, absorbed dose, Relative biological effective dose and dose equivalent. Fricke Dosimeter. Personal dosimeters, Film badge dosimeters, thermoluminescent dosimeter. Calibration of dosimeters. Measurement of dose delivered by an electron accelerator and high strength Cobalt -60 source.

Reference and Text Books:

(1)Nuclear and Radiation Physics in Medicine. Tony Key . World Scientific.2014

(2)Radiation Protection and Health Science. Marilyn E. Noz .World Scientific. 2007.

(3)Introduction to radiation Protection . Grupen C. Springer. 2008.

(4)Introduction to Radiological Physics and radiation dosimetry. Frank H. Attix. Wiley.1986.

(5)Radiation Physics for Medical Physicists. Podgorsak Ervin B. Springer.2005.
(6)Techniques for Nuclear and Particle Physics experiments. Leo. W.R. Springer.2005.

T.Y.B.Sc. Zoology
Syllabus for Final Semester

2020-21

Savitribai Phule Pune University
सावित्रीबाई फुले पुणे विद्यापीठ

BoS in Zoology, SPPU-Pune

SAVITRIBAI PHULE PUNE UNIVERSITY

T.Y.B.Sc. Zoology

Details of 70% syllabus for University Exam, June 2021- Final Semester Exam.

2013 Pattern **Semester- IV**

Paper- I: ZY- 341: Biological Techniques **(Total lectures : 36)**

1 Introduction to biological techniques **10**

1.1 **Solution/strengths of chemicals:** percentage, normality, molarity, molality, osmolarity, osmolality, ppm, ppb

1.2 Separation techniques: principle and applications, techniques related to isolation, purification and characterization of bio molecules

1.2.1 Chromatography (paper, ion-exchange), gel filtration

1.2.2 Electrophoresis- (agarose, polyacrylamide)

1.2.3 Ultracentrifugation

1.2.4 Colorimetry and spectroscopy

2 Haematological Techniques: **08**

2.1 Blood cell count –Total count of RBCs, WBCs and Differential count of WBCs and their significance. Examination of bone marrow. Hb%, bleeding time, clotting time and their significance

2.2 Microscopy**:** simple, compound, phase contrast, electron - their principle & working

2.3 Micrometry

2.4 Camera Lucida

3 Micro technique: **10**

3.1 Procurement of tissues and precautions to be taken to avoid tissue damage during procurement

3.2 Fixatives: Classification of fixatives and importance of fixation of tissues

3.3 Methods of fixation

3.4 Dehydration, clearing, impregnation and block making:

3.4.1. Clearing and alcoholising agents

3.4.2. Clearing and dealcoholisation

3.4.3. **Impregnation and Embedding:** Types of embedding media**,** methods of embedding and block making. Comments on hardening of paraffin

4 Microtomes and Knives: **08**

4.1 Types of microtomes

4.2 Types of microtome knives

4.3 Section cutting**:** Microtomy- steps and precautions**,** common faults in section cutting reasons & remedies**.** Mounting and spreading of ribbons.

Paper- II: ZY- 342: Mammalian Physiology & Endocrinology **(Total lectures : 33)**

1 Introduction: Definition and scope **01**

2 Nutrition: **06**

2.1 Concept of nutrition and energy requirements

2.2 Physiology of digestion**:** digestive enzymes and their actions- salivary, gastric and intestinal digestion. Role of liver and pancreas in digestion.

3 Circulation: **06**

3.1 Cardiac Cycle- systole, diastole and pacemakers

3.2 Cardiac output and blood pressure

3.3 Definitions and significance of electrocardiogram, colour doppler, angioplasty, angiography, angina pectoris, and coronary bypass.

4 Respiration: **05**
4.1 Definition and types- Pulmonary and tissue respiration
4.2 Mechanism of transport of gases
(a) Transport of Oxygen- Oxyhaemoglobin formation
(b) Transport of Carbon-dioxide
(c) Respiratory Quotient and BMR

5 Excretion: **05**
5.1 Physiology of Urine formation- ultrafiltration, reabsorption, tubular secretion
5.2 Counter-Current Multiplier theory for urine concentration
5.3 Role of ADH, and Renin angiotensin system
5.4 Definitions and clinical significance of- renal failure, renal calculi, dialysis

6 Muscles: **05**
6.1 Ultrastructure of striated muscle
6.2 Sliding filament theory of muscle contraction – physical and chemical changes
6.3 Response of muscles to stimulation- simple muscle twitch, muscle fatigue and rigor mortis

7 Nervous Excitation: **05**
7.1 Origin and conduction of nerve impulse, saltatory conduction
7.2 Synapse- ultrastructure and transmission of nerve impulse
7.3 Definitions/concepts: impulse, stimulation, conduction, response, EEG, epilepsy

Paper- III: ZY- 343: Genetics and Molecular Biology **(Total lectures : 33)**

1. Linkage, crossing over and molecular basis of recombination **05**

2. Gene Mutation **06**
2.1 Definition
2.2 Types of mutations: spontaneous, induced, somatic, gametic, forward, reverse. Types of point mutation- deletion, insertion, substitution, transversion, transition
2.3 Mutagenic agents.
a) UV radiation and ionising radiation
b) Base analogs, alkylating and intercalating agents

3. Population Genetics **05**
3.1 Basic Concepts in population genetics: Mendelian population, gene pool, gene frequency, chance mating (Panmictic mating)
3.2 Hardy Weinberg law and its equilibrium

4. Molecular Biology
4.1. DNA as genetic material- evidences (Griffith's, Avery et al and Hershey and Chase experiment), RNA as genetic material-TMV **04**
4.2. Chromatin-Heterochromatin, Euchromatin, histones, nucleosome arrangement, packaging of DNA **03**

5. Central Dogma of Molecular Biology
5.1. DNA Replication-Semiconservative (Meselson and Stahl experiment) Mechanism in prokaryotes and eukaryotes **05**
5.2. **Transcription-** Transcriptional unit, RNA polymerase, transcription in prokaryotes and eukaryotes, post transcriptional modification (splicing- mRNA, modifications at 3' and 5' end) **05**

Paper- IV: ZY- 344: Organic Evolution (Total lectures : 34)

1 Introduction. **04**
1.1 Origin of life
1.2 Origin of eukaryotic cell (Origin of mitochondria, plastids & symbionts)

2 Evidences in favour of organic evolution: **08**
Evidences from: anatomy, embryology, geographical distribution, palaeontology, physiology, biochemistry, genetics and molecular biology

3 Theories of organic evolution **08**
3.1 Lamarckism
3.2 Darwinism and Neo Darwinism
3.3 Mutation Theory
3.4 Modern Synthetic theory

4 Isolation: **06**
4.1 Isolating mechanism
4.2 Classification of isolating mechanism: Pre-zygotic and post-zygotic

5 Speciation: **04**
5.1 Types of speciation (Allopatric & Sympatric)
5.2 Mechanism of speciation
5.3 Patterns of speciation
5.4 Factors influencing speciation

6 Geological Time Scale **04**

Paper- V: ZY- 345 : General Embryology (Total lectures : 35)

1 Introduction: **04**
1.1 Definition and scope
1.2 Theories of preformation, pangenesis, epigenesis, axial gradient and germ plasm

2 Concepts in Developmental Biology: **02**
Growth, differentiation, dedifferentiation, cell determination, cell communication, morphogenesis, induction and regeneration

3 Gametogenesis: **08**
3.1 General aspects and origin of germ cells
3.2 Sperm: general structure, mention variations with reference to Insect, Amphioxus, Frog, Bird and Human
3.3 Ultra structure of typical sperm. (entire, T.S. through head, middle piece and tail)
3.4 Spermatogenesis: phases & spermiogenesis (nuclear and cytoplasmic changes)
3.5 Oogenesis phases: growth phase- pre-vitellogenesis, vitellogenesis and post-vitellogenesis
3.6 Oocyte maturation: role of MPF (maturation promotion factor)
3.7 Ovum: general structure
3.8 Egg membranes: primary, secondary and tertiary
3.9 Types of eggs

4 Fertilization: **07**
4.1 Concept and types
4.2 Attraction of gametes: sperm activation, chemotaxis (fertilizin and anti-fertilizin as enzymes and gamones as hormones)
4.3 Sperm penetration: acrosome reaction, capacitation & decapacitation
4.4 Activation of ovum: fertilization cone, polyspermy prevention: fast block (fertilization potential) & slow block (cortical reaction) & perivitelline space fertilization membrane

4.5 Amphimixis
4.6 Significance of fertilization

5 Cleavage **05**
5.1 Mechanism
5.2 Planes and symmetry
5.3 Patterns / Types
5.4 Significance

6 Blastula: Definition and types **03**

7 Gastrulation: **06**
7.1 Concept
7.2 Basic cell movements in gastrulation: epiboly, emboly, convergence, invagination, ingression &involution (with reference to frog)
7.3 Organizer: primary, secondary, tertiary
7.4 Organogenesis: cell differentiation, tissue differentiation & organ formation up to rudimentary stage

Paper- VI: ZY- 346: a) Public Health and Hygiene **(Total lectures : 37)**

1 Introduction and scope of public health **01**

2 Health: **04**
2.1 Definition, factors affecting health (inborn, environmental)
2.2 Personal and community health.
2.3 Effects of alcohol, tobacco and drugs
2.4 WHO and its programmes

3 Food: **06**
3.1 Sources: Plants and Animals
3.2 Necessity: deficiency diseases
3.3 Beverages and condiments
3.4 Food preservation methods

4 Air and ventilation: **03**
4.1 Composition of air
4.2 Purification of air
4.3 Ventilation system: natural and artificial

5 Water and water supplies: **05**
5.1 Sources and properties of water, quality of water for human consumption
5.2 Process of purification of water- small scale and large scale
5.3 Slow sand or biological filtration of water and rapid sand or mechanical filtration of water

6 Soil: **03**
Composition, properties and diseases spread by soil

7 Sanitation: **05**
7.1 Definition and concept
7.2 Disposal of human and animal waste, refuse, sewage

8 Diseases: **10**
8.1 Communicable diseases: causative organisms, signs and symptoms, modes of transmission, prevention and control measures of: influenza, chicken pox, measles, tuberculosis, leprosy, swine flu and encephalitis
8.2 Non Communicable diseases: rheumatic heart disease, coronary heart disease and diabetes

Paper- VI: ZY- 346 b) Medical Entomology (Total lectures : 36)

1 Fundamentals of Agricultural, Forest, Medical and Veterinary Entomology **02**

2 Introduction to medical entomology **06**
2.1 Morphology and anatomy of insects

3 Veterinary entomology- Insects as disease spreading agents in general **06**

4 Insects as social groups- **06**
4.1 Definition, intraspecific and interspecific relationships among insects
4.2 Social organization in wasps and termites
4.3 Significance of social organizations

6 Study of following insects as causing agents of human diseases- their classification up to family, appearance, habit, brief life history, distribution, diseases caused and control measures. **16**
6.1 Mosquito
6.2 Flea
6.3 House fly
6.4 Bed bug
6.5 Louse
6.6 Tick
6.7 Mite
6.8 Blister beetle

Syllabus for the for T.Y. B.Sc. STATISTICS, Sem IV, Theory Examinations, June 2021.

Course No./Code	Name of the Theory Paper	Units/Sections to be Included
ST 341	Actuarial Statistics	Units 1, 2, 3, 4, 5.1 **1. Insurance Business** 1.1 Insurance companies as business organizations. 1.2 Role of insurance business in Economy. 1.3 Concept of risk, types of risk, characteristics of insurable risk. 1.4 Working of insurance business, introduction of terms such as premium, policy, policyholder and benefit. 1.5 Role of Statistics in insurance. 1.6 Insurance business in India. **2. Feasibility of Insurance Business** 2.1 Measurement of adverse financial impact, expected value principle. 2.2 Concept of utility function 2.3 Feasibility of insurance business. 2.4 Illustrative examples **3.Survival Distribution and Life Tables** 3.1 Time- until death random variable, its d.f. and survival function in actuarial notation. 3.2 Force of mortality. 3.3 Interrelations among d.f., survival function, force of mortality and p.d.f. 3.4 Curtate future life random variable, its p.m.f. and survival function in actuarial notation. 3.5 Construction of life table using random survivorship approach. **4. Models for Life Insurance** 4.1 Theory of compound interest, effective rate of interest, discount factor. 4.2 Insurance payable at the end of the year of death, present value random variable, actuarial present value. 4.3 Derivation of actuarial present value for n-year term life insurance, whole life insurance and endowment insurance. **5. Annuities** 5.1 Annuities – certain, annuity due, annuity immediate.
ST 342	Testing of Hypothesis	Units 1, 2, 3 **1. Parametric Tests** 1.1 (a) Statistical hypotheses, problem of testing of hypotheses. Definition and illustrations of (1) simple hypothesis, (2) composite hypothesis, (3) test of hypothesis, (4) critical region, (5) type I and type II errors. Probabilities of type I error and type II error. Problem of controlling the probabilities of errors of two kinds. (b) Definition and illustrations of (i) level of significance, (ii) observed level of significance (p-value), (iii) size of a test, (iv) power of a test. 1.2 Definition of most powerful (M.P.) level α test of simple null hypothesis against simple alternative. Statement of Neyman-Pearson (N-P) lemma for constructing

		the most powerful level α test of simple null hypothesis against simple alternative hypothesis. Illustrations. 1.3 Power function of a test, power curve, definition of uniformly most powerful (UMP) level α test for one sided alternative. Illustrations **2. Likelihood ratio tests** Notion of likelihood ratio test (LRT), λ (x)=Sup L(θ0|x) / Sup L(θ|x) Construction of LRT for H0 : θ = θ0 against H1: θ ≠ θ0 for the mean of normal distribution for i) known σ 2 ii) unknown σ 2 (one sided and two sided alternatives). LRT for variance of normal distribution for i) known μ ii) unknown μ (one sided and two sided alternatives hypotheses). LRT for parameters of binomial and exponential distribution for two sided alternatives only. LRT as a function of sufficient statistics, statement of asymptotic distribution of -2 loge λ (x). **3. Sequential Tests** Sequential test procedure for simple null hypothesis against simple alternative hypothesis and its comparison with fixed sample size N-P test procedure. Definition of Wald's SPRT of strength (α, β). Illustration for standard distributions like Bernoulli, Poisson, Normal and Exponential. SPRT as a function of sufficient statistics. Graphical representation of SPRT
ST 343	Statistical Quality Control	Units 1, 2, 3 **1. Introduction** Meaning and purpose of Statistical Quality Control (SPC), on line process control methods (control charts) and offline process control methods (Sampling plans). Seven Process Control (PC) Tools of SPC (i) Check Sheet, (ii) Cause and effect diagram (CED),(iii) Pareto Diagram, (iv) Histogram, (v) Control chart, (vi)Scatter Diagram,(vii) Design of Experiments (DOE). (Only introduction of 7 PC tools is expected) 2. **Control charts** 2.1 Chance causes and assignable causes of variation, statistical basis of control charts, exact probability limits, k -sigma limits, justification for the use of 3- sigma limits for normal distribution and using Chebychev's inequality for non-normal distributions. Criteria for detecting lack of control situations: (i) At least one point outside the control limits (ii) A run of seven or more points above or below central line. (iii) Presence of a nonrandom pattern e.g., cycle or linear trends etc. Control chart technique as hypotheses testing problem. Construction of control charts for (i) standards given, (ii) standards not given. 2.2 Control charts for variables (I) R chart and X chart Purpose of R and X chart, normal probability plot for checking normality assumption, construction of R chart when the process standard deviation is specified: control limits, drawing of control chart, plotting of sample ranges, drawing conclusion - determination of state of control process, corrective action if the process is out of statistical control. Construction of X chart when the process average is specified: control limits, drawing of control chart, plotting of

		sample means. Drawing conclusion - determination of state of control of process, corrective action if the process is out of statistical control. (II) Construction of R chart when the process standard deviation (σ) is not given: control limits, drawing of control chart, plotting sample range values, revision of control limits if necessary, estimate of σ for future use. Construction of X chart when the process average μis not given: control limits based on μ =X , $\sigma = R\ d2$, drawing of control chart, plotting sample means, revision of control limits of X chart, if necessary. Probability of catching a shift. Note: To find revised control limits of any control chart delete the sample points above UCL and points below LCL (assuming a search for assignable causes at those points), in case of R and X charts, first of all, revisions of control limits of R is to be completed and then by using the observations for which R chart shows the process is under control, the control limits for X chart should be determined. Revision of control limits of X chart be continued without revising the value of R or σ . Estimate of μ and σ for further use. Determination of state of control of the process. Identification of real life situations where this technique can be used. Limitations of X , R charts. 2.3 Control charts for Attributes (I) p - chart (a) Construction and working of p-chart when subgroup sizes are same and value of the process fraction defective P is specified: control limits, drawing of control chart, plotting of sample fraction defectives. Determination of state of control of the process. (b) p-chart when subgroups sizes are different and value of the process fraction defective P is not specified with separate control limits, drawing of control chart, plotting sample fraction defectives, determination of state of control of the process. Interpretation of high and low spots. Identification of real life situations. Probability of catching a shift. (II) C chart (a) Construction of c-chart when standard is given; control limits justification of 3 sigma limits, drawing of control chart, plotting number of defects per unit. (b) Construction of c chart when standard is not given; control limits, explanation for the use of 3 sigma limits, drawing of control chart. Plotting number of defects per unit. Determination of state of control, interpretation of high and low spots in above cases. Identification of real life situations. **3. Capability Studies** 3.1 Specification limits, natural tolerance limits and their comparisons, decisions based on these comparisons, estimate of percent defectives. 3.2 Capability ratio and capability indices (Cp), capability performance indices Cpk with respect to machine and process, interpretation, relationship between (i) Cp and Cpk (ii)defective parts per million and Cp.
ST 344	Operations Research	Units 1, 2, 4 **1. Linear Programming** 1.1 Statement of the linear Programming Problem (LPP),(minimization and maximization) Formulation of problem as L.P. problem. Definition of (i) A slack variable, (ii) A surplus Variable. L.P. Problem in (i) Canonical

		form, (ii) standard form. Definition of (i) a solution (ii)basic and nonbasic variables (iii) a feasible solution (iv) a basic feasible solution, (v) a degenerate and non–degenerate solution (vi) an optimal solution. 26 1.2 Solution of L.P.P by Simplex Method: Obtaining Initial Basic Feasible Solution (IBFS) , criteria for deciding whether obtained solution is optimal ,criteria for unbounded solution , no solution , more than one solutions , introduction of artificial variable, Big-M method. 1.3Duality Theory: Writing dual of a primal problem, solution of a L.P.P. by using its dual problem. 1.4 Examples and problems. **2.Transportation Problem** 2.1 Transportation problem (T.P.), statement of T.P., balanced and unbalanced T.P. Minimization and maximization problem. 2.2 Obtaining basic feasible solution of T.P. by (i) Least cost method (ii) Vogel's approximation method (VAM). 2.3 u-v (MODI) method of obtaining Optimal solution of T.P., uniqueness and non- uniqueness of optimal solutions, degenerate solution 2.4 Assignment Problem : Statement of an assignment problem , Minimization and maximization problem , balanced and unbalanced problem ,relation with transportation problem , optimal solution using Hungarian method , maximization case 2.6 Examples and problems **4. Critical Path Method (CPM) and Project Evaluation and Review Techniques (PERT)** 4.1 Definition of (i) Event,(ii) Node,(iii)Activity,(iv)Critical Activity,(v)Project Duration. 4.2 CPM: Construction of network, Definitions (i) earliest start time (ii) earliest finish time (iii) latest start time (iv) latest finish time for an activity. Critical Path, Types of float, total floats, free float, independent float and their significance. Determination of critical path 4.3 PERT: Construction of network; (i) pessimistic time estimate, (ii) optimistic time estimate (iii) most likely time estimates, Determination of critical path, determination of mean and standard deviation of project duration, computations of probability of completing the project in a specified duration.
ST 345(A)	Reliability and Survival Analysis	Units 1, 2, 3.1 **1.Structural Properties of coherent system** 1.1 Binary system of independent components, order of the system, different types of systems, concept of the structure function, structure function of series system, parallel system, k- out of- n system, essentially parallel and series system, reliability block diagram, guidelines for construction of reliability block diagram. 1.2 Coherent structure function (maximum 4 components), relevant component, increasing structure function, pivotal decomposition of structure function, dual of a structure function (proof of dual of series system of order n is parallel system of order n ,dual of the parallel system of order n is a series system of order

		n, dual of k-out -of –n system is (n-k+1)-out of –n system). , path sets, cut sets, minimal path and cut set, representation of coherent system in terms of minimal path sets and cut sets, dual coherent structure function, relative importance of components, module of the coherent system, modular decomposition of coherent system. **2. Reliability of coherent system** Reliability of system of independent components, Basic properties of system reliability (such as reliability function is increasing function, system and component redundancy etc.), computation of reliability of coherent system by using minimal path and cut set representation, upper and lower bound on system reliability by using exact system reliability, relative importance of a component . **3. Ageing Properties** 3.1 Survival function , probability density function, hazard function, cumulative hazard rate, mean residual life function, equilibrium residual life function , interrelation between all these function, no ageing, proof of following properties of no ageing 1) Cauchy functional equation 2) Constant failure rate 3) Constant mean residual life 4) Exponential life distribution
ST 345(B)	Introduction to Stochastic Processes	Units 1, 2, 3 **1.Definition of a Stochastic process**, state space ,parameter space, types of stochastic processes , Markov chains (MC) { Xn, n ≥ 0}, finite MC, time homogeneous M.C. one step transition probabilities, and transition probability matrix (t.p.m.),stochastic matrix, Chapman Kolmogorov equation, n-step transition probability matrix , initial distribution, joint distribution function of {X0, X1, . . . , Xn} , partial sum of independent and identically distributed random variables as Markov chain, illustrations such as random walk, Gambler's ruin problem, Ehrenfest chain. **2. Classification of states:** Communicating states, first return probability, probability of ever return Classification of states, as persistent and transient states . Decomposition of state space, closed set of states, irreducible set of states, irreducible MC, periodicity of M.C. aperiodic M.C. ergodic M. C. (12L) **3. Stationary distribution for an irreducible ergodic finite Long run behaviour of a M.C.**
ST 346	Statistical Computing Using R Software	Units 1, 2, 3, 4, 5, 6, 7, 8 **1.Fundamentals of R** Revision of commands and functions studied in S.Y.B.Sc. Creating a vector using scan function, creating a data frame using edit command, Importing data from MS-Excel file Using *read.table* command, saving the

		R-output in a file using MS-Excel, concept of R-script file, Graphics using R: (a) High level plotting functions (b) Low level plotting functions (c) Interactive graphic functions The following statistical methods using "R" **2 Diagrams** Simple bar diagram, Subdivided bar diagram, multiple bar diagram, Piediagram, Stem and leaf diagram **3. Graphs** Boxplot for one and more than one variables, rod or spike plot, histogram for raw data with prob=T option and for both equal and unequal class intervals, frequency polygon, ogive curves, empirical distribution function Saving the diagram and graph in MS-Word file. **4. Measures of central tendency, dispersion, skewness and kurtosis**. Computations of following measures for all types of data (a)central tendency mean, mode, median, quartiles, deciles, percentiles , g.m. and h.m (b)Dispersion: variance, standard deviation, coefficient of variation, mean deviation (c)Skewness:Bowley "scoefficient and KarlPearson"s coefficient of skewness (d) Moments: Computations of raw and central moments, measure of skewness and kurtosis based on it. **5. Probability distributions:** Simulation from distributions, computations of probabilities, cumulative probabilities, quantiles and drawing random sample using d,p,q,r functions for following distributions. Binomial,Poisson,Hypergeometric,normal,exponential,gamma,Cauchy,log normal, Weibull, uniform, Laplace ,Graphs of pmf/pdf by varying parameters for above distributions. Fitting of Poisson and normal distribution, testing normality of data by Shapiro-Wilks test. **6 Testing of hypothesis** Chi-square test for independence of attributes **7. ANOVA** One way and two way classification, Bartlett's test for homoscedasticity, Kruskal Wallis test. **8. Non parametric tests** Wilcoxon's signed rank test, Mann Whitney test, Kolmogorov Smirnov test

Syllabus for the T.Y. B. A. STATISTICS (Special & General) (Annual Pattern) Theory Examinations, June 2021.

Course No./Code	Name of the Theory Paper	Units/Sections to be Included
STATISTICS (GENERAL)	Design of Experiments and Operations Research	Units 1, 2, 3, 4, 5, 6 **1. Design of Experiments** 1.1 Analysis of variance (ANOVA): concept and technique. 1.2 Basic terms of design of experiments: Experimental unit, treatment, layout of an experiment. 1.3 Basic principles of design of experiments: Replication, randomization and local control. Choice of size and shape of a plot for uniformity trials, the empirical formula for the variance per unit area of plots. 1.4 Completely Randomized Design (CRD) : Application of the principles of design of experiment in CRD, Layout, Model: Xij = μ + αi + εij i= 1,2, …….t. j = 1,2,……., ni Assumptions and interpretations. Testing normality graphically. Breakup of total sum of squares into components. Estimation of parameters, expected values of mean sums of squares, components of variance, preparation of (ANOVA) table, hypothesis to be tested H0 : α1= α2 = … = αt = 0. Comparison of treatment means using box plot techniques. Statement of Cochran's theorem. F test for testing H0 with justification (independence of chi- square is to be assumed), testing for equality of two specified treatment effects, comparison of treatment effects using critical difference. 1.5 Randomized Block Design (RBD) : Application of the principles of design of experiments in RBD, layout model: Xij = μ + αi + βj +εij i= 1,2, …….t. j = 1,2,……. B Assumptions and interpretations. Breakup of total sum of squares into components. Estimation of parameters, expected values of mean sums of squares, components of variance, preparation of analysis of variance table, hypotheses to be tested H01 : α1= α2 = α3 = …= αt= 0 H02 : β1= β2 = β3 = …= βb= 0 F test for testing H01 and H02 with justification (independence of chi- squares is to be assumed), testing for equality of two specified treatment effects, comparison of treatment effects using critical difference, 1.6 Latin Square Design (LSD): Application of the principles of design of experiments in LSD, layout, Model : Xij(k) = μ + αi + βj +γk+εij(k) i = 1,2, ⋯m, j = 1,2⋯,m, k=1,2⋯,m. Assumptions and interpretations. Breakup of total sum of squares into components. Estimation of parameters, expected values of mean sums of squares, components of variance , preparation of analysis of variance table, hypotheses to be tested. H01 : α1=

		$\alpha 2 = \cdots = \alpha m = 0$ H02 : $\beta 1 = \beta 2 = \cdots = \beta m = 0$ H03 : $\gamma 1 = \gamma 2 = \cdots = \gamma m = 0$ F test for H01, H02 and H03 with Justification (independence of chi- square is to be assumed). Preparation of ANOVA table and F test for H01, H02 and H03, testing for equality of two specified treatment effects, comparison of treatment effects using critical difference. 1.7Linear treatment contrasts, orthogonal contrasts. Scheffe's method for comparing contrasts, Tuckey's procedure for comparing pairs of treatment means(applicable to C.R.D., R.B.D. and L.S.D.) 1.8 Identification of real life situations where the above designs are used. 1.9 Analysis of non- normal data using. i) Square root transformation for counts. ii) Sin-1 (.) transformation for proportions. iii) Kruskal Wallis test **2. Efficiency of Design** 2.1 Concept and definition of efficiency of a design. 2.2 Efficiency of RBD over CRD. 2.3 Efficiency of LSD over (i) CRD (ii) RBD. **3. Analysis of Covariance (ANOCOVA) with One Concomitant Variable** 3.1 Situations where analysis of covariance is applicable. 3.2 Model for covariance in CRD, RBD. Estimation of parameters (derivations are not expected) 3.3 Preparation of analysis of variance – covariance table, test for $\beta=0$, test for equality of treatment effects (computational technique only). **4. Factorial Experiments** 4.1 General description of mn factorial experiment, 22 and 23 factorial experiments arranged in RBD. 4.2 Definitions of main effects and interaction effects in 22 and 23 factorial experiments. 4.3 Yate's procedure, preparation of ANOVA table, test for main effects and interaction effects. 4.4 General idea of confounding in factorial experiments. 4.5 Construction of layouts in total confounding and partial confounding in 22 and 23 factorial experiments. 4.6 Total confounding (confounding only one interaction) ANOVA table, testing main effects and interaction effects. 4.7 Partial confounding (confounding only one interaction per replicate); ANOVA table, testing main effects and interaction

		effects. **5. Linear Programming** 5.1 Statement of the linear Programming Problem (LPP),(minimization and maximization) Formulation of problem as L.P. problem. Definition of (i) A slack variable, (ii) A surplus Variable. L.P. Problem in (i) Canonical form ,(ii) standard form. Definition of (i) a solution (ii)basic and non basic variables (iii) a feasible solution(iv) a basic feasible solution, (v) a degenerate and non–degenerate solution (vi) an optimal solution. 5.2 Solution of L.P.P by Simplex Method: Obtaining Initial Basic Feasible Solution (IBFS) , criteria for deciding whether obtained solution is optimal ,criteria for unbounded solution , no solution , more than one solutions , introduction of artificial variable, Big-M method. 5.3 Duality Theory: Writing dual of a primal problem, solution of a L.P.P. by using its dual problem. **6. Transportation Problem and Assignment Problem** 6.1 Transportation problem (T.P.): Statement of T.P., balanced and unbalanced T.P. Minimization and maximization problem. 6.2 Obtaining basic feasible solution of T.P. by (i) Least cost method (ii) Vogel's approximation method (VAM). 6.3 u-v (MODI) method of obtaining Optimal solution of T.P., uniqueness and nonuniqueness of optimal solutions, degenerate solution 6.4 Assignment Problem : Statement of an assignment problem , Minimization and maximization problem , balanced and unbalanced problem ,relation with transportation problem , optimal solution using Hungarian method , maximization case
STATISTICS (SPECIAL- III)	Distribution Theory	Units 1, 2, 3, 4, 5, 6, 7 **1. Beta distribution** 1.1 Beta distribution of first kind p.d.f. x m-1 (1-x) n-1 , 0 ≤ x ≤ 1, m ,n >0 = 0, elsewhere Notation: X~ β 1 (m,n) Nature of probability curve, Derivation of mean, variance, rth raw moment, harmonic mean,mode. Symmetry of the distribution . 1.2 Relation with U (0, 1). Probability distributions of , X+Y, X-Y, XY, , where X and Y are iid β1 (1,1), 1.3 Beta distribution of second kind p.d.f . , x ≥ 0, m ,n >0 = 0, elsewhere Notation: X~ β 2 (m,n) Nature of probability curve ,Derivation of mean, variance, rth raw moment, harmonic mean,mode . 1.4 Derivation of interrelation between β 1 (m, n) and β 2 (m, n). 1.5 Derivation of distribution of , , when X and Y are independent gamma variates. 1.6 Statement of relation between distribution function of β 1 (m, n) and binomial distribution.

		2. Weibull Distribution 2.1 p.d.f . exp , x ≥ 0, α , β >0 = 0, elsewhere 10 Notation : X~W (α , β) . 2.2 Probability curve, location parameter, shape parameter, scale parameter. Derivation of distribution function, quartiles, mean and variance ,coefficient of variation , relationship with gamma and exponential distribution. **3. Laplace (Double Exponential) Distribution** 3.1 p.d.f. ; -∞<x< μ 0, = 0 ; elsewhere Notation: X~ L (μ , λ) 3.2 Nature of the probability curve . 3.3 Derivation of distribution function, quartiles. 3.4 MGF, CGF, Moments and cumulants, skewness and kurtosis 3.5 Derivation of Laplace distribution as the distribution of the difference of two i.i.d. exponential random variables with mean **4. Cauchy Distribution** 4.1 p.d.f. ; -∞<x< μ 0. Notation : X~ C (μ , λ) 4.2 Nature of the the probability curve, comparison with tails of normal distribution . 4.3 Derivation of distribution function, quartiles .Non – existence of moments, Statement of distribution of X + b. Derivation of distribution of i) ii) X2 where X~ C (0,1), Problems based on these results. 4.4 Statement of additive property for two Independent Cauchy variates, statement of distribution of the sample mean ,comment on limiting distribution of $\bar{X}$. 4.5 Statement of relationship with uniform, student's t and normal distributions. **5. Lognormal Distribution** 5.1 p.d.f , a< μ 0, = 0 ; elsewhere Notation: X~ LN (a ,μ , σ2) 5.2 Derivation of relation with N (μ, σ^2) distribution 5.3 Nature of the probability curve. 5.4 Derivation of moments (r-th moment of X-a), mean, variance, quartile, mode, Karl Pearson's and Bowley's coefficient of skewness and kurtosis, derivation of quartiles and mode. 5.5 Distribution of (Π Xi), when Xi's independent lognormal random variables . **6. Bivariate Normal Distribution.** 6.1 p.d.f of a bivariate normal distribution. 6.2 Nature of surface of p. d. f., marginal and conditional distributions , identification of parameters , regression of Y on X, independence and uncorrelatedness, Derivation of MGF and moments . Statement of distribution of aX+ bY+ c , X/Y. **7. Order statistics** 7.1 Order Statistics for a random sample of size n from a continuous distribution, definition, derivation of distribution function and density function of the i th order statistics X(i) ,

		particular cases for i = l and i = n. 7.2 Distribution of X(i) for a random sample from uniform and exponential distribution. 7.3 Definition of p-th sample quantile X([np]+1). Distribution of sample median for a random sample from uniform distribution.
MATHEMATICAL STATISTICS (GENERAL)	Statistical Inference	Units 1, 2, 3, 4, 5, 6 **1.Point Estimation** 1.1 Notion of a parameter, parameter space , sample space as a set of all possible values of (X1, X2, . . , Xn),general problem of estimating an unknown parameter by point and interval estimation. 1.2 Point Estimation: Definition of an estimator, distinction between estimator and estimate, illustrative examples. 1.3 Mean Square Error (MSE) of an estimator. **2. Methods of Estimation** 2.1 Method of moments : Derivation of moment estimators for standard distributions. Illustrations of situations where M.L.E. and moment estimators are distinct and their comparison using mean square error. 2.2 Definition of likelihood as a function of unknown parameter, for a random sample from i) discrete distribution ii) continuous distribution, distinction between likelihood function and p.d.f./ p.m.f. 2.3 Method of maximum likelihood: Derivation of maximum likelihood estimator (M.L.E.) for parameters of only standard distributions (case of two unknown parameters only for normal distribution). Use of iterative procedure to derive M.L.E.of location parameter μ of Cauchy distribution. Invariance property of M.L.E. 2.4 a) M.L.E. of θ in uniform distribution over i) (0, θ) ii)(- θ, θ) iii) (mθ, nθ)(m θ.c) M.L.E. of location parameter in Laplace distribution. **3. Criteria of Estimation** 3.1 Unbiasedness (4L) Definition of an unbiased estimator, biased estimator, positive and negative bias, illustrations and examples (these should include unbiased and biased estimators for the same parameters). Proofs of the following results regarding unbiased estimators. a) Two distinct unbiased estimators of ø(θ) give rise to infinitely many estimators. b) If T is an unbiased estimator of θ , then ø (T) is unbiased estimator of ø(θ)provided ø (.) is a linear function. 3.2 Variance of the estimator (4L) Notion of the Best Linear Unbiased Estimator and uniformly minimum variance unbiased estimator (UMVUE), uniqueness of UMVUE whenever it exists. 3.3 Sufficiency (7L) Concept and definition of sufficiency, statement of the Fisher-Neyman factorization theorem with proof for discrete probability distribution. Pitmann – Koopman form and sufficient statistic; Exponential family of probability distributions and sufficient statistic. Proofs of the following

		properties of sufficient statistics. i) If T is sufficient for θ, then ø (T) is also sufficient for θ provided ø is a one to one and onto function. ii) If T is sufficient for θ then T is also sufficient for ø (θ). iii) M.L.E. is a function of sufficient statistic. 3.4 Efficiency (7L) Fisher information function: Amount of information contained in statistic T = T(X1, X2, . . . , Xn). Statement regarding information in sample and in a sufficient statistic T. Cramer- Rao Inequality : Statement and proof of Cramer - Rao inequality, Cramer– Rao Lower Bound(CRLB),definition of minimum variance bound unbiased estimator (MVBUE) of ø (θ) . Proofs of following results: a) If MVBUE exists for θ then MVBUE exists for ø (θ) where ø (.) is a linear function. b) If T is MVBUE for θ then T is sufficient for θ. Comparison of variance with CRLB, relative efficiency of T1 w.r.t. T2 for (i) unbiased (ii) biased estimators. Efficiency of an unbiased estimator T w.r.t. CRLB. 3.5 Asymptotic Behavior of an Estimator (6L) Chebychev's inequality for discrete and continuous distributions. Consistency: Definition, proof of the following theorems: a) An estimator is consistent if its bias and variance both tend to zero as the sample size tends to infinity. b) If T is consistent estimator of θ and ϕ (.) is a continuous function, then Φ (T) is a consistent estimator of ϕ (θ). **4. Interval Estimation** 4.1 Notion of interval estimation, definition of confidence interval (C.I), length of C.I., Confidence bounds, confidence coefficient. 4.2 Definition of pivotal quantity and its use in obtaining confidence intervals. 4.3 Interval estimation for the following cases. i) Mean (μ) of normal distribution (σ2known and σ2 unknown). ii) Variance (σ2) of normal distribution (μ known and μ unknown). iii) Median, quartiles using order statistics. **5. Parametric Tests** 5.1 (a) Statistical hypotheses, problem of testing of hypotheses. Definition and illustrations of (1) simple hypothesis, (2) composite hypothesis, (3) test of hypothesis, (4) critical region, (5) type I and type II errors. Probabilities of type I error and type II error. Problems for calculating the probabilities of errors of two kinds. (b) Definition and illustrations of (i) level of significance, (ii) observed level of significance (p-value), (iii) size of a test, (iv) power of a test. 5.2 Definition of most powerful(M.P.) level α- test of simple null hypothesis against simple alternative. Statement of Neyman - Pearson (N-P) lemma for constructing the most powerful level α-test of simple null hypothesis against simple alternative hypothesis. Illustrations. 5.3 Power function of a test, power curve, definition of uniformly most powerful (UMP) level α -test for

		one sided alternative. Illustrations. **6. Likelihood ratio tests** 6.1 Notion of likelihood ratio test (LRT), λ (x)=Sup L(θ0|x) / Sup L(θ|x) 6.2 Construction of LRT for H0: θ ε Q against H1: θ Ï Q for the mean of normal distribution for i) known σ 2 ii) unknown σ 2 with one tailed and two tailed hypotheses. 6.3 LRT for variance of normal distribution for i) known μ ii) unknown μ with one tailed and two tailed hypotheses. 6.4 LRT for parameter of binomial, exponential etc. Two tailed alternative hypotheses, 6.5 LRT as a function of sufficient statistics, statement of asymptotic distribution of -2 loge λ (x).
APPLIED STATISTICS (GENERAL)	Applied Statistics	Units 1, 2, 3, 4, 5, 6.1, 6.2, 6.3 **1. Continuous type distributions** 1.1 Definition of continuous type of r.v. through p.d.f., Definition of distribution function of continuous type r.v. Statement of properties of distribution function of continuous type r.v.s 1.2 Normal distribution p. d. f. Standard normal distribution, statement of properties of normal distribution, the graph of p.d.f., nature of probability curve. Computation of probabilities. **2. Tests of significance** 2.1 Notion of a statistic as a function T(X1, X2 ,..., Xn) and its illustrations. 2.2 Sampling distribution of T(X1, X2 ,..., Xn). Notion of standard error of a statistic. 2.3 Notion of hypothesis, critical region, level of significance. 2.4 Tests based on normal distribution for (i) H0 : μ= μ0 against H1 : μ ≠ μ0 , μ μ0 (ii) H0 : μ1= μ2 against H1 : μ1 ≠ μ1 , μ1 < μ2 , , μ1 > μ2 (iii) H0 : P= P0 against H1 : P ≠ P0 , P < P0 , P > P0 (iii) H0 : P1 =P2 against H1 : P1 ≠ P2 ,P1< P2 , P1> P2 **3. Tests based on t, chi-square and F distributions** 3.1 t tests for (i) H0 : μ= μ0 against H1 : μ ≠ μ0 , μ μ0 (ii) H0 : μ1= μ2 against H1 : μ1 ≠ μ1 , μ1 < μ2 , , μ1 > μ2 (iii) Paired observations 3.2 Tests for H0 : σ 2 = σ0 2 against H1 : σ 2 ≠ σ0 2 , σ 2 σ0 2 3.3 Chi square test of goodness of fit. 3.4 Chi square test for independence of attributes: Chi square test for independence of 2 x 2 contingency- table (without proof).Yate's correction not expected. 3.5 Tests for H0 : σ1 2 = σ2 2 against H1 : σ1 2 ≠ σ2 2 , σ1 2 < σ2 2 , σ1 2 >σ2 2 **4. Analysis of variance techniques** 4.1 Concept of analysis of variance. 4.2 One-way and two – way classification: break up of total sum of squares, analysis of variance table, test of hypotheses of (i) equality of several means,(ii) equality of two means. 4.3 Numerical problems.

		5. Non - parametric tests 5.1 Distinction between a parametric and non-parametric problem. 5.2 Concept of distribution free statistic. 5.3 One tailed and two tailed test procedure of (a) Sign test, (b) Wilcoxon's signed rank test. 5.4 Test for randomness. **6. Statistical quality control** 6.1 Meaning and purpose of statistical quality control. 6.2 Control chart: Chance and assignable causes of quality variations, statistical basis of control chart (connection with test of hypothesis is NOT expected). Control limits (3- sigma limits only). Criteria for judging lack of control: (i) One or more points outside the control limits and (ii) Non-random variations within the control limits : such as a run of seven or more points on either side of the control line, presence of trend or cycle. 6.3 Control charts for variables: Purpose of R-chart and X chart, construction of R-chart, X-chart when standards are not given. Plotting the simple mean and ranges on X and R charts respectively. Necessity for plotting R-chart. Revision of R-chart.Drawing conclusion about state of process. Revision of X chart. Control limits for future production
STATISTICAL PRE-REQUISITES (General)	Statistical Pre-requisites	Units 1, 2, 3, 4, 5, 6.1, 6.2, 6.3 **1. Continuous type distributions** 1.1 Definition of continuous type of r.v. through p.d.f., Definition of distribution function of continuous type r.v. Statement of properties of distribution function of continuous type r.v.s 1.2 Normal distribution p.d. f . Standard normal distribution, statement of properties of normal distribution, the graph of p.d.f., nature of probability curve. Computation of probabilities. **2. Tests of significance** 2.1 Notion of a statistic as a function T(X1, X2 ,..., Xn) and its illustrations. 2.2 Sampling distribution of T(X1, X2 ,..., Xn). Notion of standard error of a statistic. 2.3 Notion of hypothesis, critical region, level of significance. 2.4 Tests based on normal distribution for (i) H0 : μ= μ0 against H1 : μ ≠ μ0 , μ μ0 (ii) H0 : μ1= μ2 against H1 : μ1 ≠ μ1 , μ1 < μ2 , , μ1 > μ2 (iii) H0 : P= P0 against H1 : P ≠ P0 , P < P0 , P > P0 (iv) H0 : P1 =P2 against H1 : P1 ≠ P2 ,P1< P2 , P1> P2 **3. Tests based on t, chi-square and F distributions** 3.1 t tests for (i) H0 : μ= μ0 against H1 : μ ≠ μ0 , μ μ0 (ii) H0 : μ1= μ2 against H1 : μ1 ≠ μ1 , μ1 < μ2 , , μ1 > μ2 (iii) Paired observations 3.2 Tests for H0 : σ 2 = σ0 2 against H1 : σ 2 ≠ σ0 2 , σ 2 σ0 2 3.3 Chi square test of goodness of fit. 3.4 Chi square

		test for independence of attributes: Chi square test for independence of 2 x 2 contingency- table (without proof).Yate's correction not expected. 3.5 Tests for H0 : σ1 2 = σ2 2 against H1 : σ1 2 ≠ σ2 2 , σ1 2 < σ2 2 , σ1 2 >σ2 2 **4. Analysis of variance techniques (12L)** 4.1 Concept of analysis of variance. 4.2 One-way and two – way classification: break up of total sum of squares, analysis of variance table, test of hypotheses of (i) equality of several means,(ii) equality of two means. 4.3 Numerical problems. **5. Non - parametric tests** 5.1 Distinction between a parametric and non-parametric problem. 5.2 Concept of distribution free statistic. 5.3 One tailed and two tailed test procedure of (a) Sign test, (b) Wilcoxon's signed rank test. 5.4 Test for randomness **6. Statistical quality control** 6.1 Meaning and purpose of statistical quality control. 6.2 Control chart: Chance and assignable causes of quality variations, statistical basis of control chart (connection with test of hypothesis is NOT expected). Control limits (3- sigma limits only). Criteria for judging lack of control: (i) One or more points outside the control limits and (ii) Non-random variations within the control limits : such as a run of seven or more points on either side of the control line, presence of trend or cycle. 6.3 Control charts for variables: Purpose of R-chart and X chart, construction of R-chart, X-chart when standards are not given. Plotting the simple mean and ranges on X and R charts respectively. Necessity for plotting R-chart. Revision of R-chart. Drawing conclusion about state of process. Revision of X chart. Control limits for future production

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Biotechnology Theory Syllabus for AY 2020-21 Only
T. Y. B. Sc. Biotechnology Theory Course (2013 Pattern)
Semester IV
70% Syllabus for
Course: Bb 341
Title: Large Scale Manufacturing Process
Total No. of Lectures: 42

Unit No. in syllabus	TOPIC	No. of Lectures
1	a. **Fermentation-** Definition, Historical perspective, Lay out of a typical fermentation unit. b. Definition and Concept of Bioprocess Engineering, Various components of Bioprocess. c. Types of fermentations: Submerged, Surface, Solid State, Dual, Batch, Continuous, Fed Batch.	4
2	a. **Screening**- Definition and Objectives: Primary and Secondary Screening b. **Strain Improvement**: Objectives, Methods for strain improvement with examples (mutant selection, mutants with altered permeability, auxotrophic mutants, analogue resistant DNA technology) c. Microbes of industrial importance, Culture collection centers of industrially important microorganisms. d. Inoculum build up for Industrial fermentations : Bacteria and Fungi	5
3	a. **Bioreactor Design**: Characteristics of an ideal Fermenter, Construction material used, surface treatment of material Design of a typical Batch Fermenter Aerator and Agitator- types, Baffles, Seals and valves used, steam traps. Additional accessories and peripherals. b. **Different designs of bioreactors**: Mechanically agitated and non-mechanically agitated • Bubble column • Bubble Cap • Air Lift (internal and external loop) • Packed Bed reactor • Fluidized bed reactor • Pressure cycle • Animal and Plant cell Bioreactors	8

4	**Media components and optimization**: Media used for large scale production: **Carbon sources:** Cane and Beet molasses, Malt, Corn, Starch, oils, hydrocarbons, alcohols. **Nitrogen sources**: Corn steep liquor, Soybean meal, peanut meal Buffers Chelators Water Precursors, Inhibitors, Inducers Antifoams- types, mode of action, advantages and disadvantages. Inoculum and Production media Media for animal cell culture. **Medium Optimization** • Classical Approach • Plackett and Burman design • Response Surface Methodology (RSM)	5
5	**Air and Media Sterilization**: Concept of Aseptic Operations and Containment. **Air sterilization**: Principles, Mechanism of capture of particles in air, Filter sterilization of air. **Media Sterilization**: Principles, Thermal Death time, Decimal reduction time, Del factor, Indicator organism.	2
6	a. **Measurement and Control of different Bioprocess parameters**: (Physical and Chemical Parameters): Fluid flow, Pressure, Weight, In let and exit gas, foam b. Oxygen Uptake rate, Oxygen transfer rate, Concept and importance of KLa, Determination of KLa values, Different rheologies of fermentation media.	4
7	**Methods and equipments used in Downstream processing:** a. Definition: Unit operations and downstream processing, General strategy of product recovery. b. Precipitation (Agents used : polyelectrolytes). e. Cell Disruption (Physico – mechanical). g. Chromatography (one example of use of Ion exchange in product recovery can be explained along with manufacturing enzymes). h. Membrane Processes (Reverse Osmosis). i. Drying (Drum and Spray Drying). j. Whole broth Processing.	4
8	**Large Scale Manufacturing Process of:** a. Biomass based Product: Single cell Protein b. Enzyme: Amylase c. Antibiotic: Penicillin d. Vitamin: B12 e. Amino acid: Glutamic acid f. Vaccine: DPT g. Biotransformation Product : Steroids	07

9	c. Tests Used for Quality Assurance of finished product: i. Sterility Testing ii. Pyrogen testing iii. Bacterial endotoxin (LAL test) iv. Ames Test.	2
10	**Bioprocess Economics**: Basic objectives in developing economically viable process.	1
Total Lectures		**42**

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Biotechnology Theory Syllabus for AY 2020-21 Only
T. Y. B. Sc. Biotechnology Theory Course (2013 Pattern)
Semester IV
70% syllabus for
Bb-342: Biochemical & Biophysical Techniques
Total No. of Lectures: 42

Sr. No.	Topic	Lecture
1	Introduction, Lab safety, Scientific notation & Units, errors & accuracy in experimentation, understanding of concentration of solutions, Strong acids and bases, weak acids and bases, polyprotic acids, pH metry.	07
2	**Microscopy:** Introduction o different types of microscopy, Confocal microscopy, Phase contrast, fluorescence microscopy.	06
3	**Spectrophotometry:** Properties of Electromagnetic radiation, electromagnetic spectra, light absorption and excitations of electrons. Beer-Lambert's Law, UV-visible spectroscopy (chromophores in proteins), instrumentation (spectrophotometer and colorimeter), Fluorescence spectroscopy.	07
4	**Centrifugation:** Introduction, basic principle of sedimatation, angular velocity & centrifugal field, g & RPM conversion - preparative & analytical centrifugation, [ultracentrifuge], density gradient centrifugation.	07
5	**Chromatography:** Introduction, principles-distributioncoefficient, RF value. Types of chromatographs a) Thin layer, HPTLC, paper chromatography b) Column chromatography – gel filtration, ion-exchange.	07
6	**Electrophoresis:** Introduction, Theory, principles. Electrophoresis of proteins- SDS, native, activity staining. Nucleic acids – Agarose, Pulse field gel electrophoresis.	08

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Biotechnology Theory Syllabus for AY 2020-21 Only
T. Y. B. Sc. Biotechnology Theory Course (2013 Pattern)
Semester IV
70% syllabus for
Bb 343: Recombinant DNA Technology

Total No. of Lectures: 42

Sr. No	Topic	Lecture
1	Milestones of genetic engineering- Historical perspective.	1
2	Molecular tools and applications -restriction enzymes, ligases, polymerases, alkaline phosphatase.	5
3	Gene cloning Vehicles- vector: plasmids, cosmids, phage vectors- λ and M13, BACs, Agrobacterial vectors	7
4	Transformation- techniques of introducing DNA in bacteria, animal and plant cells Selection of transformants	6
5	DNA sequencing techniques– Maxam-Gilbert's method, Sanger's Dideoxy method, Automated DNA sequencing, Next generation sequencing	4
6	Restriction enzyme digestion and restriction mapping Southern and northern analyses.	4
7	Genomic library-screening of recombinants	4
8	PCR Technology cDNA library, reverse transcription, comparison between genomic and cDNA library	5
9	DNA fingerprinting	2
10	Applications of Genetic Engineering, Recombinant DNA guidelines	4

Adhoc Boards

SAVITRIBAI PHULE PUNE UNIVERSITY,

Restructuring pattern

T.Y.B.Sc. Restructuring pattern 70% syllabus for the year June 2020-21.

SEMESTER IV (TERM II)

1) **Subject: Energy Studies (C Component)**

Class: T.Y.B.Sc.

Theory Syllabus (Term-II only)

1) Energy Storage:

Need of energy storage, types of energy storage- thermal, electrical, chemical and hydro storage, solar pond as storage of energy. (6 P)

2. Wind Energy:

Estimation of energy obtained from wind, velocity and power duration curves, energy pattern factor, transfer of power momentum theory and power coefficients, types of wind driven machines- horizontal and vertical axes type, performance, merits and demerits. (8 P)

3. Other renewable sources of energy:-

Hydrogen as a potential source of energy, storage of hydrogen, tidal energy, energy from sea waves, ocean thermal energy temperature gradient in sea and their use for power generation.

2) **Subject: Horticulture and it's Management (C Component)**

Class: T.Y.B.Sc.

Theory Syllabus (Term-II only)

1. Importance and scope of floriculture and ornamental gardening
2. Types of ornamental gardens: a) Formal. b) Informal. Their important features layout and planning of home or public garden
3. Garden features Importance of garden features and their proper location Establishment and maintenance of different types of lawns:
   a) Selection of site , land Preparation , selection of grasses, methods of planting
   b) Lawn mowing weeding Manuring, fertilizing, ornamental hedges, edges, shrubs, selection on ornamental garden.
4. Ornamental garden selection of site, landscape, planting and layout.
5 . Cultivation of seasonal plants:
   a) Aster

b) Marigold.

c) Gerbera.

d) Anthurium.

e) Lily plants.

6. Cultivation of perennial flower crops:

a) Rose

b) Chrysanthemum

c) Tube rose

d)Golden rod

e) Orchids

3) Subject: Applied Entomology (C Component)

Class: T.Y.B.Sc.

Theory Syllabus (Term-II only)

1. Methods of insect pest control : (13)
   - I. Cultural :
     -Crop rotation, ploughing, planting time, pruning and thinning.
   - II. Mechanical/ Physical :
     -Fly screen, mosquito nets, light traps ('zappers'), packaging and sealing (e.g. against storage pests), shifting and separation in flour mills and the use of temperature, humidity and fumigation against storage and museum pests. It also includes drainage against mosquitoes.
   - III. Biological :
     - Predators, parasites, pathogens and biocides.
     -Mention any three important biological control projects undertaken in India.
     - Mention modern methods (use of NPHV, JH).
   - IV. Genetic :
     -Male sterilization techniques, selective breeding and genetic modification.
   - V. Chemical : **Behavior modifiers** and insecticides.
     - i. **Behavior modifiers :**
       -Attractants (pheromones, food and oviposition attractants), antifeedants, antioviposition chemicals and repellents.
     - ii. Insecticides :
       Classification of insecticides on the basis of :
       a. Chemical nature : Organic and inorganic
       b. Mode of entry : Stomach, contact and respiratory
       c. Mode of action : Physical poison, protoplasmic poison, respiratory poison and nerve poison.
2. Insecticide formulations : (04)
   - I. Basic principles.
   - II. Liquid formulations : EC, S, F, A, LG.

III. LC5O and LD5O values.

3. Plant Protection appliances : (02)
-Working and applications of Compression sprayer and Soil injector.

4) Subject: Pharmaceutical Chemistry (C Component)

Class: T.Y.B.Sc.

Theory Syllabus (Term-II only)

1. General introduction to Pharmaceutical classification with some important examples of drug for typical class. Their medicinal applications with side effects should cover under different classes.

A. Analgesics and antipyretics (NSAID) (2L)
i) Aspirin ii) Paracetamol iii) Ibuprofen iv) Analgin

B. Antiseptic and Disinfectants (2L)

Phenols and its derivatives Cresol, Chloroxylenol,

cationic surface active agents – Benzalkonium chloride, Cetrimide.

C. Local Anaesthetics- **(2L)**
i) Benzocaine ii) Cocaine iii) Lignocaine

D. Antimalerials (2L)

Definition, Symptoms of Maleria, Synthesis of Chloroquine, Amodiquine,

Pyrimethamine

E. Cancer, Antineoplastic Agents and Antituberculosis (5L)

Cancer –Introduction, common cause of cancer, types of cancer,

treatment of tancer- cisplatin

Antineoplastic Agents- Classification according to their mode of action

Bucil, Mustine, Plant products Vincarosa alkaloids

Tuberculosis- Symptoms, treatment of tuberculosis.

F. Antibacterial Agents (2L)

Synthesis of Sulpha drug- Sulphonamide, Sulphadiazine

G. Antibiotics- (2L)

Penicillin- Structure, Properties, Therapeutical application.

Tetracycline- Structure, Properties, Therapeutical application

5) Subject: Dairy Science (C Component)

Class: T.Y.B.Sc.

Theory Syllabus (Term-II only)

1. History and concept of Animal breeding. 1 L.

2. Digestive system of Ruminants. 2 L.
3. Male and female reproductive system of Bovine (Cow, Buffalo, Sheep, Goat). 2 L
4. Sterility – Factors affecting sterility. 2 L
5. Milk secretion and factors affecting milk yield and milk composition. 2 L
6. Pregnancy- Stages of pregnancy and diagnosis of pregnancy. 2 L
7. Artificial insemination, Different methods advantages and disadvantages. 2 L
8. Role of Biotechnology in animal breeding. 2 L
9. Classification of feed and fodders. 2 L

Semester - VI

UNIVERSITY OF PUNE

Semester - VI

70 Percent (79%) Syllabus for Examinations in June 2021

Third Year (Textile Science & Care) Syllabus For The

Three-Year Integrated Bachelor of Science (B.Sc.) In

Home Science Degree Course

Semester – VI

Paper No. Subject		Exam scheme													
		Theory				Practical				Total				Exam	
		External		Internal		External		Internal		External		Internal			
		Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	At	By
51	Dyeing & Printing	50	20	10	04	-	-	-	-	50	20	10	04	The end of Sem	The College
52	Textiles & Costumes of India	50	20	10	04	-	-	-	-	50	20	10	04		
53	Textile Testing	50	20	10	04	-	-	-	-	50	20	10	04		
54	Pattern Making & Apparel construction	50	20	10	04	-	-	-	-	50	20	10	04		
55	Finishing Skills	50	20	10	04	-	-	-	-	50	20	10	04		
Pr 56	Based on Paper No. 1	-	-	-	-	30	12	10	04	30	12	10	04	The end of Sem	The College
Pr 57	Based on Paper No. 2	-	-	-	-	30	12	10	04	30	12	10	04		
Pr 58	Based on Paper No. 3	-	-	-	-	30	12	10	04	30	12	10	04		
Pr 59	Based on Paper No. 4	-	-	-	-	30	12	10	04	30	12	10	04		
Pr 60	Based on Paper No. 5	-	-	-	-	30	12	10	04	30	12	10	04		
Total		250		50		150		50		400		100			

T.Y. B. Sc. (Home Science) – Sem.- VI
Paper : Dyeing & Printing

Theory - 4lec./week	Theory -60 marks
Practical -	Practical -40 marks

Unit I	**Dyeing** • A brief study of different types of dyes and their applicability to different fibers • Classification of dyes & its application. • Difference between dyeing and printing. • Methods of dyeing jet- Jig, winch, warp beam etc.	12
Unit II	**Methods of printing** Fundamentals of printing – study of dyes and pigments for printing Hand printing – painting, stencil, Block, spray, hand screen • Styles of printing – Direct, resist and discharge styles	12
Unit III	**Machine printing** • Flat Bed and Rotary, screen, spray, flock • Heat transfer, photo, lacquer	12

References

1) Cockett, B. R. (1964) : Dyeing and printing, London, Sir Issac Pitman and sons Ltd.

2) Gohl and Vilensky (1987) : Textile science, Delhi, BCS Publishers and Distributors.

3) Grossicki, Watson's (1975) : Textile design and colour, Butterworth and company.

4) Pandit Savitri and Patel Saroj (1970) : Tie and dye and Batik techniques for all, Baroda, Faculty of Home Science.

5) Shenai V. A. (1973) : Chemistry of Dyes and principles of Dyeing, Ahmedabad, Textile Book Sellers and publishers.

6) Shenai V. A. (1977) : Technology of Dyeing, Technology of Textile processing. Vol. VI. Bombay Sevak Publication.
7) Story Joyce (1974) : The Thames and Hudson, Manual of Textile Printing, London, Thames and Hudson Ltd.
8) Story Joyce (1979) : Manual of dyes and fabrics, London, Thames and Hudson Ltd.
9) Rutt-Anna Hond (1969) : Home furnishing, New Delhi, Willey Eastern Pvt. Ltd.
10) Clarke, W. (1977) : Dyeing and printing, London Sir Isaac Pitman and Sons Ltd.
11) History of Indian Textiles, Ahmedabad, Calico Museum of Textiles
12) Andrea Mcnamara, Patrik Snelling (1995) : Design and practice for printed textiles, Australia, Oxford University Press.
13) S. N. Guha Ray : (1965) : 5000 Indian designs and motifs, Indian Institute of art and industry.
14) Peter Phillips, Gillian Bunce (1993) : Repeat patterns – A manual for designers, artists and architects, London, Themes and Hudson Ltd.
15) Dr. C.V.Caushik, Chemical Processing of Textiles, Ncute publishers.
16) M.L. Gulrajani, Silk dyeing printing & finishing, IIT, Delhi.

T.Y. B. Sc. (Home Science) – Sem.- VI
Paper : Textiles & Costumes of India

Theory - 4lec./week	Theory -60 marks
Practical -	Practical -40 marks

Unit I	**Textiles of North India** (With relation to material used motifs, colors, designs) • Kashmir • Himachal • Bihar • Uttarpradesh • Rajasthan **Textiles of East India** (With relation to material used motifs, colors, designs) • Assam • Manipur • Nagaland • West Bengal • Orissa	12
Unit II	**Textiles of west India** (With relation to material used motifs, colors, designs) • Gujarat • Maharashtra **Textiles of central India** (With relation to material used motifs, colors, designs) • Madhya Pradesh **Textiles of south India** (With relation to material used motifs, colors, designs) • Karnataka • Ansra Pradesh • Tamilnadu • Kerala	12
Unit III	**Costumes (Male & Female) of North India** (With respect to religion & geographical setup) • Kashmir • Himachal • Bihar • Uttarpradesh	12

	• Rajasthan **Costumes (Male & Female) of East India** (With respect to religion & geographical setup) • Assam • Manipur • Nagaland • West Bengal • Orissa	

References

1) Chattopadhyay, Kalaladevi (1975) : Handicrafts of India, New Delhi, Indian Council of Cultural Relations.
2) Brij Bhushan, Jamila (1958) : The Crafts of weavers, the costumes and Textiles of India, D.E. Tarapore Valla Sons and Co. Pvt. Ltd. Bombay.
3) Gurey, G.S. : Indian Costumes, The Popular Book Dept. Mumbai.
4) Roshan Alkaji : Costumes of India
5) Dar : Costumes of India and Pakistan
6) Koher C. (1963) : A History of costume, Dover Pub. Inc. N. York.
7) Lester Katherine (1956) : Historic costumes.
8) Gazettes of India.
9) Pupul Jeykar & John Ir win, Textiles & ornaments of India.
10) Mehta Rustum J., Master pieses of Indian Textiles, Tarapoorwala house of books.
11) Jaslin Dhameja, The Woven silks of India, Mark Publication Bombay.
12) Mehta Rustum J., Handicrafts of India, Tarapoorwala house of books.
13) Chena Desai, Ikat Textiles of India, Chronical books, Sanfransisco.

T.Y. B. Sc. (Home Science) – Sem.- VI
Paper : Textile Testing

Theory - 4lec./week	Theory -60 marks
Practical -	Practical -40 marks

Unit I	**Textile testing** **Introduction to textile testing** • Importance of textile testing • Definition related to textile testing • Sampling **Fiber Testing** • Fiber dimensions and their measurement • Measurement of length, staple length, effective length	12
Unit II	**Yarn Testing** • Yarn characteristics and their measurement • Twist, crimp, strength • Yarn numbering systems – tex, denier, count	12
Unit III	**Fabric Testing** • Fabric count • Fabric thickness and fabric weight • Bow and skewness, dimensional stability • Tensile strength and tear strength • Color fastness of fabric • Air permeability • Fabric stiffness • Per cent moisture content and moisture regain • Introduction to Drapebility and Abrasion resistance	12

References

1) Booth J.E. (1968) : Principles of textile testing, Butterworth Heinemann Ltd. U.K. or CBS publishers and distributors, New Delhi.

2) Grower and Hanby (1969) : Handbook of textile testing and quality control

3) Indian Standards Institute (1982) : Handbook of textile testing

4) Shinkle John H : Textile testing chemical publishing Co. Inc., Brooklyn, New York.

ASTM Standards

5) Wynne Andrea (1997) : Textiles, the motivate series Macmillan Texts for industrial, vocational and technical education, Macmillan Education, Ltd.,London.

T.Y. B. Sc. (Home Science) – Sem.- V
Paper : Finishing Skills

Theory - 4lec./week	Theory -60 marks
Practical -	Practical -40 marks

Unit I	**Introduction** **Garments** • Types of garments • Seasonal garments • Gender wise garments • Age wise garments **Fabric handling** • Types of fabric • Fabric defects- Identification of various kinds of defects in various kinds of fabrics • Identification of various kinds of defects in various kinds of fabrics • Quality Control	8
Unit II	**Production Measurement** • To understand relation between measurements • Measurement according to age and gender • Standard measurements • Understanding of measurement chart • Conversion of measurements • Measurements related to style according to related fabric. **Computerized Embroidery** • Punching of design/ Creation while designing for computerized embroidery. • Threads used in embroidery • Costing in embroidery • How care of canvas needs to be taken • Sharpness **Printing** • Various types of colours • Eco-friendly colours • Mixing of colours • Recipes of colour • Importance of Fastness properties Colourfastness • Steam press in industry	12

	Packaging • Price labels • Brand labels • Packing accessories • Presentations **Trims and assembles** • Variety and quality of trims • Shade cards • Quantity	

University of Pune

UNIVERSITY OF PUNE

Semester - VI

Seventy Percent (70%) Syllabus for Last semester Examination 2021

Third Year (Food Science & Nutrition) Syllabus For The Three-Year Integrated Bachelor of Science (B.Sc.) In Home Science Degree Course

Semester – VI

Paper No. Subject		Exam scheme													
		Theory				Practical				Total				Exam	
		External		Internal		External		Internal		External		Internal			
		Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	Max. Marks	Min. Marks	At	By
51	Institutional food service management	50	20	10	04	-	-	-	-	50	20	10	04	The end of Sem	The College
52	Community Nutrition	50	20	10	04	-	-	-	-	50	20	10	04		
53	Food product development and quality control	50	20	10	04	-	-	-	-	50	20	10	04		
54	Diet Therapy	50	20	10	04	-	-	-	-	50	20	10	04		
55	Finishing Skills	50	20	10	04	-	-	-	-	50	20	10	04		
Pr 56	Based on Paper No. 1	-	-	-	-	30	12	10	04	30	12	10	04	The end of Sem	The College
Pr 57	Based on Paper No. 2	-	-	-	-	30	12	10	04	30	12	10	04		
Pr 58	Based on Paper No. 3	-	-	-	-	30	12	10	04	30	12	10	04		
Pr 59	Based on Paper No. 4	-	-	-	-	30	12	10	04	30	12	10	04		
Pr 60	Based on Paper No. 5	-	-	-	-	30	12	10	04	30	12	10	04		
Total		250		50		150		50		400		100			

T.Y. B. Sc. (Home Science) – Sem.- VI

Paper 51 : Institutional Food Service Management

Theory - 4lec./week
Practical -

Theory -60 marks
Practical -40 marks

Unit I	**Food service systems and their development** • Introduction to food service industry. • Types of food service. • Styles of food service. • Menu planning.	8
Unit II	**Types of organization** • Different types and their organizational structure. • Management • Attributes and responsibility of managers. • Principles of management	8
Unit III	**Food Material Management** • Definition, importance • Food selection • Methods of purchasing, receiving and store room management.	8
Unit IV	**Financial Management** • Book Keeping, Accounting, Organization Management. • Pricing of food • Factors affecting & Cost control	8
Unit V	**Plant and equipment management** • Maintenance, sanitation, safety, • Garbage disposal, pest control. • Floor Planning & lay out & equipment planning. • Emphasis on traffic patterns and activity centers.	8

References

1) Boella M.J. (1963) : Personnel management in the hotel and catering industry, 3rd Ed., Hutchinson, London.
2) Drucker P.F. (1975) : Management, Allied Publishers, New Delhi.
3) Feam D. (1969) : Management systems for the hotel catering and allied industries.
4) Hitchcock M.J. (1980) : Food service systems administration, Macmillan, New York.
5) Koontz H., Dannel D. Weicrich H. (1983) : Essentials of management, Indian Ed.
6) Kotas R. (1972) : Accounting in the hotel and catering industry, Intertext Books, 3rd Ed. Butler and Tanner, London.
7) Moore C.L. and Jaediicke R.K. : Managerial accounting, South Western Publishing Co.
8) Sethi M., Malhan S. (1993) : Catering management : An integrated approach, Wiley Eastern, New Delhi.
9) Terry G.R. (1972) : Principles of management, 6th Ed. Irwin Dorsey Inter-national: London.
10) West B.B., Wood L. Revised by Harger V.F., Shugart G.S., Payne-Palacio J. (1989) : Food service in institutions, 6th Ed., Macmillan Pub. Co., New York.

T.Y. B. Sc. (Home Science) – Sem.- VI
Paper 52 : Community Nutrition

Theory - 4lec./week	Theory -60 marks
Practical -	Practical -40 marks

Unit I	**Assessment of Nutritional status** • Definition and methods • Anthropometry • Clinical Assessment • Biochemical Analysis • Biophysical methods • Diet surveys	**10**
Unit II	**Major** Nutritional Problems Prevalent India • PEM, • Vitamin A,Znic, Iron and Iodine Deficiencies, causes ,manifestation and prevention.	**10**
Unit III	**Food Behavior:** • Factors affecting food behavior agricultural, economic, environmental, socio-cultural, psychological, religious. • Role of industrialization, work patterns and mass media. • Food behavior and linkages with health. **Food habits** • Knowledge, attitudes, practice. • Food habits and dietary patterns in different regions and communities in India. • Factors affecting food habits – family size, composition, structure, economic status, working status of mother, education	**12**
Unit IV	**Nutrition education** • Definition • Objectives, principles and importance of nutrition education • Methods of Nutrition Education	**8**

References

1) Agrawal A. N. (1981) : Indian economy problems of development and planning. Jelliffie D. B. (1968) : Child health in the tropics.
2) Ghosh S. (1989) : You and your child.
3) Misra S.K. and Puri V.K. (1992) : Indian economy.
4) Shukla P.K. (1982) : Nutritional problems in India.
5) Thankamma J. (1976) : Food adulteration.
6) Park J.E. and Park K. (1994) : Text book of preventive and social medicine.
7) Preventive of food adulteration act (1994) : Government of India.
8) Jelliffie D. B. (1968) : Assessment of the nutritional status of the community, World Health Organization.
9) Sain D.R., Lockwood R. and Scrimashaw N.S. (1981) : Methods for the evaluation of the impact of food and nutrition programmes, United nations university.
10) Ritchie J.A. (1967) : Learning better nutrition, FAO, Rome.
11) Gopalan C. : Nutrition and health care, Nutrition Foundation of India, Special publication series.
12) Beghin I., Cap M. and Dujardan B. (1968) : A guide to nutrition status assessment, W.H.O. Geneva.
13) Gopaldas T. and Seshadri S. (1987) : Nutrition monitoring and assessment, Oxford University Press.
14) Mason J.B., Hachicht J.P., Tabatabai H. and Valverde V. (1984) : Nutritional surveillance, W.H.O.

T.Y. B. Sc. (Home Science) – Sem.- VI
Paper 53 : Food Product development and quality control

Theory - 4lec./week	Theory -60 marks
Practical -	Practical -40 marks

Unit:I	Importance and scope of product development.	8
Unit:II	Selection and storage of raw materials, methods of preparations.	8
Unit:III	Sensory evaluation, standardization of food products.	8
Unit:IV	Self life of food product and Packaging.	8
Unit:V	Hazards in supply chain (biological, chemical and physical) and food adulteration.	8

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T.Y. B. Sc. (Home Science) – Sem.- VI
Paper 54 : Diet Therapy

Unit I	**Basic concept of diet therapy** • Therapeutic adaptations of normal diet. • Principals & classification of therapeutic diets. **Routine Hospital Diet** • Regular, Light, Soft, Fluid Diet. • Parenteral & Enteral Feeding. • Per- & post-operative Diets	8
Unit II	**Diet in Obesity & Underweight** • Etiology and assessment • Prevention and treatment • Dietary management **Diet in Fever** • Causes • Types • General dietary consideration. • Typhoid, Influenza, Malaria. • TB	8
Unit III	**Diet in Gastrointestinal Diseases** **-**Etiology, Symptoms, & management of, • Peptic Ulcer. • Acidity **Diet in Liver Diseases** • Functions of liver • Liver function test • Etiology, Symptoms, & management of, -Cirrhosis of Liver -Viral Hepatitis -Hepatic Coma	8
Unit IV	**Diet in Diabetes Mellitus** • Classification, Symptoms, Diagnosis, Management of Diabetes Mellitus. • Oral Hypoglycemic agents. • Nutritional Management. • Special Diabetic Foods. • Artificial Sweeteners. • Patient Education.	8

References

1) Anderson L., Dibble M.V., Turkki P.R., Mitchell H.S. and Rynbergin H.J. (1982) : Nutrition in health and disease, 17th Ed., J.B. Lippincott and Co. Philadelphia.
2) Antia F.P. (1973) : Clinical dietetics and nutrition, 2nd Ed., Oxford University Press, Delhi.
3) Mahan L.K., Arlin M.T. (1992) : Krause's food nutrition and diet therapy, 8th Ed., W.B. Saunders Co., London.
4) Robinson C.H., Lawler M.R., Chenoweth W.L. and Garwick A.E. (1986) : Normal and therapeutic nutrition, 17th Ed., Macmillan Pub. Co.
5) Williams S.R. (1989) : Nutrition and diet therapy, 6th Ed., Times Mirror/Mosby college Pub. St Louis.
6) Raheena Begum (1989) : A textbook of foods, nutrition and dietetics, Sterling Pub., New Delhi.
7) Joshi S.A. (1992) : Nutrition and dietetics, Tata McGraw Hill Pub., New Delhi.
8) Bamji M. S. Rao, P. N. Reddy V (Eds) (1996) Textbook of Human nutrition, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

T.Y. B. Sc. (Home Science) – Sem.- VI
Paper 55 : Finishing Skills

Unit I	**Dietary counseling** • Counseling process& its significance • Assessment of need of patient • Establishing rapport • Communication process • Patient education • Pre requisites & preparation for setting up a counseling center • Calorie requirements for different activities (pre & post workout)	10
Unit II	**Traditional Indian Food Products** • History of traditional recepies of different states of the country • Value addition of traditional recepies & meals • Nutrient composition of traditional v/s value added meals	05
Unit III	**Bakery & Confectionery** • Selection, properties & functions of ingredients used in bakery & confectionary • Emulsifiers used in bakery • Tools & techniques used in bakery • Quality control of bakery products	10
Unit V	**Food Analysis** • Importance & history of food Analysis • Sample & sampling techniques • Principles & methods of estimation of different nutrients in foodstuffs.	8
Unit VI	**Application and scope of entrepreneurship development in the field of Home Science** • Entrepreneurship management like resource management (man, machine, material and human behavior) • Small enterprises – definition, characteristics, relation between small and large unit, objectives and scope, opportunities for entrepreneur carrier their role in economics development and problems	05

References

1) Jose Paul, N. Ajit Kumar, Entrepreneurship Development and Management, Himalaya Publishing.
2) Khanka S. S. Chand and Co. Ram Nagar, New Delhi, Entrepreneurship Development
3) M. Gangadhara Rao, "Entrepreneurship and Entrepreneurical development, Kanishka Publishing House, New Delhi – (1992).
4) Vasant Desai – Entrepreneurship Development, Himalaya Publishing House (1991)

5) Sami Uddin – Entrepreneurship Development in India, Mittal Publication, New Delhi.
6) Ron Mansfield, MS Office, BPB Publication, New Delhi.
7) Anderson L., Dibble M.V., Turkki P.R., Mitchell H.S. and Rynbergin H.J. (1982) : Nutrition in health and disease, 17th Ed., J.B. Lippincott and Co. Philadelphia.
8) Antia F.P. (1973) : Clinical dietetics and nutrition, 2nd Ed., Oxford University Press, Delhi.

9) Mahan L.K., Arlin M.T. (1992) : Krause's food nutrition and diet therapy, 8th Ed., W.B. Saunders Co., London.
10) Robinson C.H., Lawler M.R., Chenoweth W.L. and Garwick A.E. (1986) : Normal and therapeutic nutrition, 17th Ed., Macmillan Pub. Co.
11) Williams S.R. (1989) : Nutrition and diet therapy, 6th Ed., Times Mirror/Mosby college Pub. St Louis.
12) Raheena Begum (1989) : A textbook of foods, nutrition and dietetics, Sterling Pub., New Delhi.
13) Joshi S.A. (1992) : Nutrition and dietetics, Tata McGraw Hill Pub., New Delhi.
14) Bamji M. S. Rao, P. N. Reddy V (Eds) (1996) Textbook of Human nutrition, Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.
15) Baianu I. C. (Editor) : Physical (Chemistry) of food process, Vol –1 fundamental Aspects, AVI Books, New York.
16) Fennema, O. R. (Editor) : Food chemistry, 2nd Edn. Marcel Dekker inc. New York. (1985)
17) Hawk P. B., Oser, B.K. and Summerson, W. H. 1965, Practical Physiological Biochemistry. T ata McGraw Hill Publishing Co. Ltd., New Delhi.
18) Okoye, Z.S.C., 1992, Biochemical Aspects of Nutrition Prentice Hall of India, New Delhi.
19) A. O. A. C. 1996. Official Methods of Analysis Association of official Agricultural Chemistry, Washington.
20) Ranganna, S. 1964 Hand Book of Analysis and Quality Control for Fruit and Vegetable Products Tata McGraw Hill Publishing Co. Ltd. New Delhi.
21) Orten, J. M. and Neuhans, O. W. 1982. Human Biochemistry C. V. Mosbey Co, London.

Internship Marks = 50
(for both Specification : 1. Food Science and Nutrition 2. Textile)

Details of 70% Syllabus of TYBScHS (Sem - IV) for Upcoming MCQ Based Theory Examination June- 2021

SUBJECT: PRINCIPLES OF INTERNATIONAL CUISINE

Subject Code: HS 401

Chapter-1	**InternationalCuisine**
	1.1Introduction to influences of cultures on regions 1.2Special features with respect to equipment, ingredients, popular dishes in the following countries – •European – (France, Italy, Spain) •Oriental and South East Asian– (China, Thailand, Japan, Malaysia and Korea) •MiddleEast-(Egypt,Lebanon,Greece, Arabic, Persian, Turkey and Morocco) •Latin America, Caribbean and Mexico 1.3Nouvelle cuisine – Introduction & salient features
Chapter-2	**Desserts**
	2.1Frozen Desserts – Classification with examples, Methods of preparation 2.2Hot Puddings – Types and Methods of preparation
Chapter-3	**Charcutiere**
	3.1Larder – Functions & Duties of larder chef 3.2Cold preparations (Pate,Terrine, Galantine Mousse, Mousseline) – Definition and preparation 3.3 Forcemeat and Sausages – Definition and types 3.4Ham Bacon & Gammon – Definition & Difference
Chapter-4	**Kitchen Layout&Design**
	4.1Information required prior to designing of kitchens. 4.2Areas of the kitchen with recommended dimensions 4.3Factors that influence kitchen design. 4.4Placement of equipment. 4.5Flow of work. 4.6Kitchen layouts – Types, Examples (Multi cuisine, Specialty, Coffee shop, Bakery & Patisserie)
Chapter-5	**KitchenAdministration**
	5.1 Aims of Control 5.2Maintaining records-SOP's, List of Suppliers and SPS, Indents, Food Cost, Equipment Registers, Break down register, Standard Recipe Manual, Function Prospectus, Log book, Departmental Meeting, Appraisals, Sales Mix, Food Wastage and Spoilage. 5.3Communication with other departments – Store, Food and Beverage Service, Housekeeping, Front Office, Maintenance, Human Resource.

SUBJECT: ADVANCED FOOD & BEVERAGE SERVICE TECHNIQUES & MANAGEMENT

Subject Code: HS 402

Chapter-1	**Restaurant planning & Operations**
	1.1Types of Restaurants 1.2Location or site 1.3Sources of Finance 1.4Design Consideration 1.5Furniture 1.6Lighting and Décor 1.7Equipment required 1.8Records maintained Licences 1.9Meal Experience
Chapter - 2	**PersonnelManagementinF&BService**
	2.1Allocation of Work, Task Analysis and Duty Rosters 2.2Performance Measurement
Chapter -3	**Budgeting**
	3.1Definition & Objectives. 3.2Kinds of Budgets (Sales Budget, Labor Cost, Budget, Overhead Cost Budget) 3.3Budgeted Trading Account (P & L) 3.4Menu engineering spread sheet and matrix.
Chapter- 4	**F&BManagementinothertypesofoutlets-FastFood,IndustrialCatering,Restaurants,FacilityManagement**
	4.1 Introduction 4.2 Basic policies – Financial marketing and Catering 4.3 Organizing and Staffing

SUBJECT: SPECIALIZED ACCOMMODATION MANAGEMENT (HS)

Subject Code : 403

Chapter-1	**Colour**
	1.1 Colour Wheel 1.2 Colour Schemes 1.3 Psychological effects of colour
Chapter - 2	**Lighting**
	2.1 Classification / type 2.2 Lighting for the guest rooms & public areas
Chapter - 3	**Windows & window treatment**
	3.1 Different types of windows 3.2 Curtains & draperies , valances, swag, blinds 3.3 Window cleaning – Equipment and Agents
Chapter - 4	**Soft furnishing & Accessories**
	4.1 Types, use & care of soft furnishing 4.2 Role of accessories
Chapter - 5	**Floor, Floor finishes & Wall Coverings**
	5.1 Classification / types 5.2 Characteristics 5.1 Selection criteria 5.1.1 Cleaning Procedures – care & maintenance 5.1.2 Agents used, polishing / buffing 5.1.3 Floor seals 5.1.4 Carpets 5.1.5 Types – selection care & maintenance 5.1.6 Types of wall coverings 5.1.7 Functions of wall coverings
Chapter - 6	**Planning of a Guest Room**
	6.1 Application of Chapter 1-4 in Planning. 6.2 Size of a Guest Room as per the classification norms 6.3 Layout of the guest room to the scale 6.4 Furniture- size and arrangement 6.5 Bathroom fixtures and amenities 6.6 Planning of Service Areas – Linen Room / Laundry
Chapter - 7	**Environmental Practices in Housekeeping**
	7.1 Eco friendly cleaning supplies 7.2 Waste reductions programme 7.3 Recycling of materials
Chapter - 8	**MICE – Meeting Incentive Convention Exposition**
	8.1 Concept 8.2 Importance 8.3 Planning for MICE
Chapter - 9	**Front Office Staffing**
	9.1 calculation of staff requirement for front staff and Uniform Staff 9.2 Duty rota for Front office staff and Uniform staff 9.3 staffing guide lines for Uniform Staff and Front Desk

SUBJECT: TOTAL QUALITY MANAGEMANT

Subject Code: HS 404

Chapter-1	**Introduction to TQM**
	1.1Evolution of quality 1.2Definitions of quality 1.3 TQM Traditional and modern model 1.4Six Core concepts of TQM 1.5Benefits of TQM 1.6Barriers in TQM 1.7Cost of Quality- Prevention and Appraisal Cost
Chapter-2	**Theory by Quality Guru to TQM**
	2.1Deming's 14 Principles 2.2 Deming's Plan-Do-Check-Act cycle 2.3Juran's Trio logy 2.4 Crosby Zero defect theory
Chapter-3	**INTRODUCTION QUALITY STANDARDS**
	3.1Importance of ISO and EMS 3.2Elements of ISO 9000 3.3 Elements of ISO 14001 standards 3.4 Introduction and development of HACCP
Chapter-4	**Problem solving Tools & techniques**
	4.1 Brain storming 4.2 Pareto analysis 4.3 Fishbone Diagram
Chapter-5	**TQM TOOLS to minimize defects and improve quality**
	INTRODUCTION TO - I. Kaizen 5S II. Six Sigma III. Lean or MUDA IV. Process Mapping V. 5W&1H VI. Core values of Japanese Management - Group Orientation , Perfectionism , Innovation & Diligence

SUBJECT: HUMAN RESOURCE MANAGEMENT

Subject Code: HS 405

Chapter-1	**Introduction to Human Resource Management**
	1.1 Definition of Human Resource Management 1.2 Functions of Human Resource Department 1.3 Role of Human Resource Manager in Service Industry
Chapter - 2	**Human Resource Planning**
	2.1 Concepts and Need of Human Resource Planning 2.2.1 Job Analysis – Definition and Objectives 2.2.2 Job Description – Definition and Format of Job Description 2.2.3 Job Specification – Definition and Advantages of Job Specification 2.3 Recruitment and Selection 2.3.1 Source of Recruitment – Internal Sources – (Promotion, Transfer, Ex-employee, Present Temporary Employee, HR information system / Data Bank) External Sources – (Advertisement, Campus Recruitment, Referrals, Employment Agencies, JobPortals) 2.3.2 Selection Process 2.4 Tests and Interviews 2.4.1 Tests – Aptitude, Psychometric, Achievement, Personality, Interest & AssessmentCentre 2.4.2 Interviews – Structured, Unstructured, Stress, Exit, Appraisal, Situational,Behavioral and Psychological
Chapter - 3	**Human Resource Development**
	3.1 Definition of Human Resource Development 3.2 Orientation and Induction – Definition and Advantages 3.3 Training – Need and Objectives of Training 3.4 Methods of Training – On the job training methods – Instruction Method, Position Rotation,off the job training methods – Classroom Training, Vestibule Training, Outdoor Training and Electronic training methods 3.5 Performance Appraisal – Purpose 3.6 Promotion and Transfer 3.6.1 Promotion – Bases for promotion 3.6.2 Types of transfer – Departmental, Geographical and Product Base
Chapter - 4	**Wage and Salary Administration**
	4.1 Formulation of Compensation Structure 4.2 Objectives of a Good Compensation System 4.3 Determinants of an effective compensation policy 4.4 Fringe Benefits

SUBJECT: ENTREPRENEURSHIP DEVELOPMENT

Subject Code :HS 406

Chapter-1	**INTRODUCTION TO ENTREPRENEURSHIP**
	1.1 Entrepreneur , Entrepreneurship and Intrapreneur : Definition, meaning and functions of an entrepreneur Need and importance ofEntrepreneurship, Problem of unemployment & important of wealthcreation. 1.2 Enterprise v/s Entrepreneurship, Self – employment v/s Entrepreneurship, 1.3 Entrepreneurial career as an option. Entrepreneurial Qualities and Attributes Types of Entrepreneur: According to Type of Business Pure Entrepreneurs, Induced Entrepreneurs, Motivated Entrepreneurs Spontaneous Entrepreneurs, Growth Oriented Entrepreneurs According to stages of development 1.4 Entrepreneur Vs Entrepreneurship Entrepreneur Vs Manager External Influences on Entrepreneurship Development: Socio-Cultural, 1.5 Political, Economical, Persona, Entrepreneurial culture with specialreference to Intrapreneurship / Corporate Entrepreneurship. Entrepreneurial Success and Failure: Reasons and Remedies.
Chapter-2	**THE ENTREPRENEURIAL PROCESS**
	Idea Generation Motivation Implementation Growth
Chapter-3	**WOMEN ENTREPRENEURS**
	3.1 Definition of Women Entrepreneurs by GOI (defined by GOI) 3.2 Importance of Women Entrepreneurs 3.3 Problems faced by Women Entrepreneurs 3.4 Achievements of Woman Entrepreneurs, 3.5 Role Models of Woman Entrepreneurs.
Chapter-4	**IDENTIFYING THE OPPORTUNITY (SWOT ANALYSIS)**
	4.1 Need for SWOT analysis 4.2 Internal strengths of a company, 4.3 SWOT Analysis in Business, 4.4 SWOT Analysis and its importance
Chapter-5	**MARKET SURVEY & RESOURCE MOBILIZATION**
	5.1 Trends in the Market Segmentation

	5.2 Effectiveness of marketing 5.3 Information gathering techniques 5.4 Basic Methods of Market Research 5.5 Analysis of survey data 5.6 Method of Data Analysis 5.7 Resource Mobilization Manpower Planning, Finance, Inventory Control, Technology
Chapter-6	**FINANCE& ACCOUNTING**
	6.1 Business finance introduction, 6.2 Types of business finance 6.3 Sources of Finance: Internal , External 6.4 Importance of Business Finance 6.5 Functions of business Finance

SavitribaiPhule Pune University

Board of Studies in Computer Application

Guidelines for TYBCA 2016 Course (Sem-VI) Theory Syllabus to be covered for A.Y. 2020-21

ThirdYearB.C.A.(UnderScience)SemesterVI

CourseCode:BCA601 **CourseTitle:AndroidProgramming**

UNITNO.	DESCRIPTION	No.ofLECTURES
UNIT1	**1. IntroductiontoAndroid** 1.1. Overview 1.2. History 1.3. FeaturesofAndroid 1.4. ArchitectureofAndroid • OverviewofStack • LinuxKernel • NativeLibraries • AndroidRuntime • ApplicationFramework • Applications 1.5. SDKOverview • Platforms • Tools– (JDK,SDK,Eclipse/AndroidStudio,ADT,AVD,Android Emulator) • Versions 1.6. CreatingyourfirstAndroidApplication	**06**
UNIT2	**2. Activities,FragmentsandIntents** 2.1. IntroductiontoActivities 2.2. ActivityLifecycle 2.3. IntroductiontoIntents 2.4. LinkingActivitiesusingIntents 2.5. Callingbuilt-inapplicationsusingIntents 2.6. IntroductiontoFragments 2.7. AddingFragmentsDynamically 2.8. LifecycleofFragment 2.9. InteractionbetweenFragments	**09**
UNIT3	**3. AndroidUserInterface** 3.1. Understandingthe componentsofa screen • ViewsandViewGroups • LinearLayout • AbsoluteLayout	**10**

	• TableLayout • RelativeLayout • FrameLayout • ScrollLayout • ScrollView 3.2. Adaptingto DisplayOrientation • AnchoringViews • ResizingandRepositioning 3.3. ManagingChangestoScreenOrientation • PersistingState InformationduringChangesinConfiguration • DetectingOrientationChanges • ControllingtheOrientationoftheActivity 3.4. UtilizingActionBar • AddingActionItemstotheActionBar • CustomizingtheActionItemsand ApplicationIcon	
UNIT4	**4. DesigningYourUser InterfacewithViews** 4.1. UsingBasicViews • TextView • Button,ImageButton,EditText,CheckBox • ToggleButton,RadioButton,andRadioGroupViews • ProgressBarView • AutoCompleteTextViewView 4.2. UsingPickerViews • TimePickerView • DatePickerView 4.3. UsingListViewstoDisplayLongLists • ListViewView • Usingthe SpinnerView 4.4. UnderstandingSpecializedFragments • UsingaListFragment • UsingaDialogFragment • UsingaPreferenceFragment	**10**
UNIT5	**5. DisplayingPicturesandMenus** 5.1. UsingImageViewstoDisplayPictures • GalleryandImageViewviews • ImageSwitcher • GridView 5.2. UsingMenuswithViews • Creatingthehelpermethods • OptionsMenu • ContextMenu	**05**
UNIT6	**6. Databases–SQLite** 6.1. IntroductiontoSQLite 6.2. SQLiteOpenHelperandSQLiteDatabase 6.3. Creating, openingand closingdatabase 6.4. Workingwithcursors,Insert,Update,Delete 6.5. Buildingand executingqueries	**06**

ThirdYear B.C.A.(UnderScience)SemesterVI

CourseCode:BCA602 **CourseTitle:PythonProgramming**

UnitNo.	Contents	No. ofLectures
Unit1	**IntroductiontoPythonScripting** • WhyScriptingisUsefulin ComputationalScience • ClassificationofProgrammingLanguages • ProductivePairsofProgrammingLanguages • GluingExistingApplications • ScriptingYieldsShorter Code,Efficiency • Type-Specification(Declaration)ofVariables • FlexibleFunctionInterfaces • InteractiveComputing • CreatingCodeat RunTime • NestedHeterogeneousDataStructures • GUIProgramming • MixedLanguageProgramming • WhentoChooseaDynamicallyTyped Language • WhyPython? ScriptorProgram? • ApplicationofPython • Concept(immutable)	**04**
Unit2	**BasicPython** • Pythonidentifiersandreservedwords • Linesandindentation,multi-linestatements • Comments • Input/outputwithprintandinputfunctions, • Commandline argumentsandprocessingcommandlinearguments • Standard data types - basic, none, Boolean (true & False),numbers • Pythonstrings • Datatypeconversion • Pythonbasicoperators(Arithmetic,comparison,as signment,bitwiselogical) • Pythonmembershipoperators(in&notin) • Pythonidentityoperators(is& isnot) • Operatorprecedence • ControlStatements,Pythonloops,Iteratingby	**06**

	subsequenceindex,loopcontrolstatements(break,co ntinue,pass) • Mathematicalfunctionsandconstants(importmath),Ra ndomnumber functions	
Unit3	**Pythonstrings** • Concept,escapecharacters • Stringspecialoperations • Stringformattingoperator • Singlequotes,Doublequotes, Triplequotes • RawString,Unicodestrings, Built-inStringmethods. • PythonLists-concept,creatingandaccessingelements,updating&deletingli sts,basic listoperations,reverse • Indexing, slicingandMatrices • built-inListfunctions • Functionalprogrammingtools-filter(),map(),andreduce() • Using ListsasstacksandQueues, Listcomprehensions	**06**
Unit4	**Pythontuplesandsets** • Creating& deletingtuples • Accessingvaluesinatuple • Updatingtuples,deletetupleelements • Basictupleoperations • Indexing,slicingandMatrices,built-intuplefunctions. • Sets-Concept, operations.	**06**
Unit5	**PythonDictionary** • Concept(mutable) • Creatingandaccessingvaluesina dictionary • Updatingdictionary,delete dictionaryelements • Propertiesofdictionarykeys • built-indictionaryfunctionsand methods.	**04**
Unit6	**Functions** • Definingafunction(def) • Callingafunction • Functionarguments-Passbyvalue,Keyword Arguments,defaultarguments • Scope ofvariable-basic rules • DocumentationStrings • VariableNumberofArguments • CallbyReference • Orderofarguments(positional,extra&keyword) • Anonymousfunctions • Recursion • TreatmentofInputandOutputArguments • Unpackingargumentlists • Lambdaforms • FunctionObjects • functionducktyping&polymorphism	**08**

	• Generators(functionsandexpressions)anditerators,listcomprehensions	
Unit7	**FilesandDirectories** • Creatingfiles • Operationsonfiles(open,close,read,write) • Fileobjectattributes,filepositions,ListingFilesinaDirectory • TestingFileTypes • RemovingFilesandDirectories • CopyingandRenamingFiles • SplittingPathnames • Creatingand Movingto Directories • TraversingDirectoryTrees • Illustrative programs:wordcount,copyfile	**06**

ThirdYearB.C.A.(UnderScience) SemesterVI

CourseCode:BCA603 **CourseTitle:RecentTrendsin IT (InternetofThings)**

UnitNo.	Contents	No. ofLecctures
Unit1	**SystemonChip(SoC) andInternetofThings(IoT)Overview** - **SystemonChip:**WhatisSystemonchip?StructureofSystemon Chip. - **SoCproducts:**FieldProgrammableGateArray**(**FPGA**),** General Purpose Graphics Processing Units **(**GPU), AcceleratedProcessingUnit (APU),ComputeUnits. -**TheIoT paradigm**givingoverviewofIoTsupportedHardwareplatforms such as: Raspberry pi, SoC on ARM 8 Processors,ArduinoandIntel Galileo boards. -**Network Fundamentals**:Wired Networking(Router, Switches),WirelessNetworking(AccessPoints) - **IntroductiontoRaspberryPi:**IntroductiontoRaspberryPi,RaspberryPiHardware,Preparingyour raspberryPi. -**Raspberry Pi Boot:** Learn how this small SoC boots withoutBIOS.Configuringboot sequencesand hardware. - **IntroductiontoIoT:**WhatisIoT?IoTexamples,SimpleIoTLEDProgram. **-IoTandProtocols** **-IoT Security:**HTTP,UPnp,CoAP,MQTT,XMPP**.** - **IoTServiceasaPlatform:**Clayster,Thinger.io,SenseIoT,carriotsand NodeRED. **-IoTSecurityandInteroperability:** Risks,ModesofAttacks,Toolsfor Securityand Interoperability.	**20**

Unit2	**ProgrammingRaspberry Pi** **RaspberryPiandLinux:**AboutRaspbian,LinuxCommands,ConfiguringRaspberryPi withLinux Commands **Programminginterfaces:** IntroductiontoNode.js,Python. **RaspberryPiInterfaces:**UART, GPIO, I2C,SPI **Useful Implementations:** Cross Compilation, Pulse WidthModulation,SPIfor Camera.	**15**
Unit4	**Internet of Things Privacy, Security and Governance**Introduction,OverviewofGovernance,PrivacyandSecurityIssues,ContributionfromFP7Projects,Security,PrivacyandTrust in IoT-Data-PlatformsforSmartCities,FirstStepsTowardsaSecurePlatform,SmartieApproach.DataAggregationforthe IoTinSmart Cities,Security	**10**

ThirdYear B.C.A.(UnderScience) SemesterVor VI CourseCode:BCA-604 CourseTitle:DataAnalytics		
UnitNo.	**Contents**	**No. ofLectures**
Unit1	• IntroductiontodataScience o BasicsofData o WhatisDataScience? o Datascienceprocess o Stagesindatascienceproject • BasicsofDataAnalytics • TypesofAnalytics–Descriptive,Predictive,Prescriptive • StatisticalInference o Populationsandsamples o Statisticalmodeling, o Probability o Distribution o Correlation o Regression	10
Unit2	IntroductiontoMachineLearning • BasicsofMachineLeaning • SupervisedMachineLearning ▪ K-Nearest-Neighbors, ▪ NaïveBayes ▪ Decisiontree ▪ SupportVectorMachines • UnsupervisedMachine Learning ▪ Clusteranalysis ▪ Kmeans ▪ AssociationRuleMining • Apriorialgorithms • RegressionAnalysis ▪ LinearRegression ▪ NonlinearRegression	25
Unit3	DataAnalyticswithPythonProgrammingNumpy o Arrays o Arrayindexing o Datatypes o Arraymath o Broadcasting	15

	SciPy o Imageoperations o Distancebetweenpoints Data analysis and manipulation using Pandas package o ImportingData,CreatingADataFrame, o DataFrameMethods, o IndexingDataFrames,BooleanIndexing o IndexingUsingLabels,Multi-Indexing o MergeDataFrames o SortingDataFrames o ApplyFunction o PivotTable,Crosstab o Iteratingoverrowsofadataframe	

ThirdYearB.C.A.(UnderScience)SemesterVI

CourseCode:BCA607 **CourseTitle:IntroductiontoGreenComputing**

UnitNo.	Contents	No. ofLecctures
Unit1	**1.IntroductiontoGreenComputing** Websites&statisticsHowbadtheenergycrisisreallyis?	**04**
Unit2	**2.ReducingtheITfootprint** What really contributes to the footprint (from machinemanufacturingto disposal)? Savingenergyona singlemachine Savingenergyin networkingand othercomponentsSavingenergyin clustersand data centers Savingenergyon data center cooling	**10**
Unit3	**3. Computing technology for energy efficiency of other physicalsystems** Computing technology for greener transportationComputingtechnologyforsmarter buildings Carbon footprintcalculators:whatismyfootprint?	**10**
Unit4	**4.Major greeninitiatives** SustainableIT,GreenBusiness, SmarterPlant.	**06**

Note: For practical assignments (those that are included in the practical guidelines) that are based on Units that are not included in above mentioned syllabus, the concerned lab teachers to cover such associated theory concepts during practical sessions.

Prof. Dr. S S Sane
Chairman, BOS in Computer Applications (On behalf of all BOS Members)

70% Syllabus of T. Y. B. Sc. Semester IV for academic year 2020-21 , (Highlighted in yellow colour)

ENV-301:Aquatic Ecosystems and Management

(Paper-I, Semester-IV) 48 Lectures

Unit	Contents	Lectures
	Introduction, Limnology, The aquatic environment, the aquatic biota and water resources, water and plant functioning, structure of aquatic communities.	3
2	The parameters of the aquatic environment.	2
3	Distribution of major aquatic ecosystems, patterns, structure and classification, ecotone and edge effect, types of interactions: predation, parasitism ,antibiosis, commensalism, cooperation, and mutualism.	6
4	Fresh water ecology: The fresh water environment: types and limiting factors; Ecological classification of fresh water organisms ,the freshwater biota (flora and fauna), lentic (lakes and ponds) and lotic (rivers, streams, springs, etc) communities, plantktons.	6
5	Marine ecology: the marine environment, the marine biota (flora and fauna), zonation in the sea ,study of planktons, communities in the marine environment.	5
6	Estuarine ecology: Definition and types, biota and productivity, food Production potential, mangrove vegetation: distribution, ecological importance.	5
7	Aquatic ecosystem services and management: aesthetic and cultural benefits, tourism and recreation, pollution, etc.	4
8	Methods of aquatic ecosystem management: remote sensing, Geographical information system, Eco-development program, traditional methods, . Methods of aquatic sampling and data analysis: sampling approaches, species association.	6
9	Case studies: restoration of lake Chilika, restoration of lake Trummen, adaptive restoration of wetlands.	5
10	Exploitation and Consequences of wetlands, Sustainable managemen tof the same, Role of Local Government and people in conservation, Impact of Tourism, Eco-tourism Conservation and Sustainable use of India's aquatic resources.	6

ENV-302:Nature Conservation

(Paper-II, Semester-IV) 48 Lectures

Unit	Contents	Lectures
	Concept of Nature Conservation; Convention on Biological Diversity (CBD), Protected Area Network (PAN) in India, Details of PAN in Maharashtra state.	6
2	Approach:Species- Population dynamics and Population Genetics; Landscape/Habitat/Ecosystem approach.	6
3	Priority for Conservation:Hotspots, Conservation Status (IUCN Categories, Schedules according to Wildlife Protection Act).	4
4	Objectives of Nature Conservation Challenges (Social, Political, and Economical).	2
5	Methods: Insitu-Concept, Principles, Protected area types (global And national level, Heritage sites), Examples, challenges , merits and limitations; Exsitu-Concept, Principles, Types (captive breeding and reintroductions, seed banks, gene banks), examples, challenges, merits and limitations;Traditional/communityconservation-Concept,examples,challenges, merits and limitations.	10
6	Awareness about Conservation:Need, Importance, Methods, Examples National Initiatives for Nature Conservation Ecotourism: Objectives, Principles, Merits, Disadvantages ,Limitations, Challenges, Examples.	6
7	International efforts for Conservation: Role of IUCN, WWF and Other large organizations, Role of Governments, International Conventions and Protocols Role of NGOs, Green Peace ,International Whaling Mission ,BNHS, Reindeers, Tigers, Crocodile farms, Examples of extreme activism, and practical sustainable efforts.	9
8	Wildlife Law and Administration: Wildlife Protection Act ,it smerits And limitations State Symbols (Animals and Plants) Administrative Setup: MoEF, Central and State Pollution Control Boards, Interface between administration and NGO's. Personalities, Institutions, Groups &NGO working for environmental conservation.	5

ENV303:Air and Soil Quality

(Paper-III, Semester-IV) 48Lectures

Unit	Contents	Lectures
	Atmospher: Composition of Atmosphere, Chemical and photochemical Reactions in the atmosphere, Human Activities and meteorology ,Global Warming, Ozone Hole, ElNino, LaNina Phenomenon.	5
2	Air pollution: Meaning and definition, Sources and Types of air pollutants, Major air pollutants; types of airp ollution–indoor airp ollution, vehicular pollution, industrial pollution; Status of Airpollution in India, Effects of air pollution on plants; animals; human; and materials, Smog and Acid rains, Control of air pollution .Emission' Standards.	6
3	Analytical Methods for Monitoring Air Pollutants; Sampling, Monitoring, Carbon Monoxide, Nitrogen Oxides,SulphurDioxide,HydrogenSulphide,Hydrocarbons,ParticulateMatter Air Pollution Accidents: Bhopal Disaster, Chernobyl Disaster, London Smog.	9
4	Toxicology of gaseous pollutants: Carbon monoxide, Oxides of Nitrogen, Sulphur dioxides, Petroleum and Solvents.	4
5	Soil: Introduction to soil and its role within a natural ecosystem and an agro-ecosystem Composition of Soil, Soil types and their formation, Soil horizons, texture, soil structure, soil erosion, soil conservation.	4
6	Soil Reactions: Acid Base Reaction, Ion Exchange, Micro and Macro Nutrients, Nitrogen Path ways and NPK in soil.	4
7	Soil Analysis: pH, Lime, Silica and Phosphorous, Total Nitrogen, Total Manganese, Total Sulphur ,Soluble Salts, Pesticides, Environmental Friendly Technologies .	6
8	Factors influencing soil: Factors influencing soil structures and plant growth, Effect of soil aeration on plant growth, Effect of soil temperature on soil properties and on plant growth. Soil fertility-concept and evaluation.	4
9	Soil toxicology: Organic and inorganic chemicals in the soil environment Soil Sickness due to biological agents and toxins etc.	3
10	Soil Management: Soil as sink for waste disposal. Remediation of contaminated soil. GIS-application form amazement of soil resources.	3

ENV-304:Issues in Environmental Science-II

(Paper-IV,Semester-IV)48Lectures

Unit	Contents	Lectures
	Ecological conflicts and the environmental movements in India: Narmada Bachao Andolan, Appiko Movement, Chipko movement, Silent Valley Movement, Tehri Damconflicts ,Almatti dam, Bhopal gas tragedy, Soil Erosion, Formation and reclamation of Usar, Alkaline and Saline Soil.	9
2	CNG and pollution in various cities in India.	
3	Resources depletion and pollution (case studies),environmental problems of urbanization, environmental problems of slums, population, poverty and environment in India, international trade and economic reforms on the environment ,industrial growth, environmental and ecology in India, major issues in sustaining growth and development in less developed countries.	9
4	Use of computer in environmental health modelling, environmental health modelling, Resource management by Remote sensing &GIS	
5	Global warming and India.	
6	Land use policy for India. Urban planning for India. Rural planning and land use pattern. Concept and strategies of sustainable development. Cost-Benefit analysis. Environmental priorities in India and sustainable development	8
7	Ganga Action plan, Interlinking of rivers, Case studies related with SEZ. Handling of Solid waste management, Tribal community problems and their rehabilitation, Natural disasters and their management.	6
8	Waste lands and their reclamation. Desertification and its control. Vehicular pollution and urban air quality. Depletion of Nature resources. Biodiversity conservation and Agenda-21.	6
9	Waste disposal ,recycling and power generation. Fly ash utilization. Water Crises-Conservation of water. Environmental Hazards. Eutrophication and restoration of Indian lakes. Rainwater harvesting. Wetlands conservation. Epidemiological issues (e.g.Goitre, Fluorosis, Arsenic)	6
10	Occupational Health & Safety	

ENV-305: Environmental Governance and Equity: EMS and ISO 14000

(Paper-V, Semester-IV) 48Lectures

Unit	Contents	Lectures
	Introduction, Generic, Management system, benefits, ISO and the environment, Environmental management and sustainability, ISO/TC207,Scope of ISO/TC207'swork.	9
2	Overview of the ISO 14000 family of standards, ISO140000 Essentials ,An ISO 14001:2004-based EMS, EMS standards, The ISO 14000 family and the Plan-Do-Check-Act(PDCA)cycle.	9
3	Environmental and economic benefits Specific applications: Automotive, Energy, Education, Food safety, Healthcare, Ship recycling and risks.	8
4	Environmental standards: Ambient air quality standards, BIS Standards for drinking water, WHO water quality standards.	5
5	Environmental audits, Compliance and governance mechanism, Environment Status Report ,Various instrumental techniques, EIA in detail with case tudies, Environmental Economics ,CETP	3
6	Environmental governance and Regulation in India: Legislative efforts, Constitutional Directives ,Role of the Judiciary, Working of Environmental Regulation, Enforcement, Monitoring, Role of NGOs.	8
7	National Environmental Policy-2006.	2
8	Environment protection-issues and problems. International and National efforts for Environment Protection. Provision of Constitution of lndia regarding Environment (Article48Aand58A).	4

ENV-306:Environmental Biotechnology-II (Paper-VI,Semester-IV)48Lectures

Unit	Contents	Lectures
	Biormediation- Principles, factors responsible, microbial population For bioremediation, Environmental variation in field, Enzymatic–biodegrative pathway, Genetic Engineering Approach, Bioremediation strategies; Phytoremediation-Metal and Organic Phytoremediation, need for Research and development.	6
2	Biotechnology for Pollution abatement-Abatement of air and water Pollution ,Biological treatment, Energy reaction, Anaerobic biological process and anaerobic biological treatment.	4
3	Biodegradation process: Bioleaching- History, Advantages and Disadvantages ,microbes used; Biochemical extraction from mixture, types of bioleaching, methods of bioleaching and metal precipitation. Biosorption of Metals.	5
4	Biomethanation-Anaerobic treatment for gas generation, Microbiology and biochemistry, factors affecting, Problems in Biomethanation, Design of digester, Biomethannationin industries, Potential of Biomethanation from MSW, Merits of Biomethannation from MSW and Biomass gasification.	5
5	Role of biotechnology in environment protection, Microbial Fundamentals involved in the treatment of industrial wastes, Biochemistry of waste water treatment-impact of pollutants on organisms.	5
6	Aerobic Biological treatments-activated sludge, biofilm reactors and Biological filters, anaerobic biological treatments-UASB, Removal of specific pollutants-nitrate, phosphates, heavy metals, etc. Biosorption techniques for removal of pollutants.	6
7	Microbial metabolism of pesticides and other xenobiotic components Waste water treatment using aquatic plants; Biotechnology for air Pollution and odour control, Biotechnology of solid waste disposal; Use of immobilized enzymes and microbes for pollution abatement; Improvement of microbial strains by conventional and molecular biological techniques; Computer implementation for control and monitoring of wastewater.	13
8	Energy production from biomass-biogas, ethanol, hydrogen Biotechnology application of hazardous waste management Mining with microbes.	4

B.Sc. (Nanoscience and Nanotechnology) (Semester-IV)

Paper Code: NNT341

Paper Title: Polymer Hetro-structure and their Applications.

Unit 1- Introduction to Hetero-structures [12 Lectures]

Introduction to p-n heterojunction n-n heterojunction and p-p heterojunction. Host Polymer characterization and Inorganic semiconductor characterization.

Unit 2- Hetero-structures by Ex-situ Polymerization [12 Lectures]

Synthesis and characterization of hetero-structure by Ex-situ polymerization using metals, metal oxides and polymers.

Unit 3- Hetero-structures by In-situ Polymerization [12 Lectures]

Synthesis of hetero-structure by In-situ polymerization using metals, metal oxides and polymers.

Unit 4- Characterization and Applications of Hetero-structures [12 Lectures]

Characterization of synthesized hetero-structures using different techniques and its applications in electronics such as lasers, transistors and other optoelectronic applications.

Reference Books:

1. Nanotechnology: Technology Revolution of 21st Century by Rakesh Rathi, Published by S. Chand.
2. Introduction to Nanoscience, by Stuart Lindsay.
3. Introduction to Nanomaterials and Nanotechnology by Vladimir Pokropivny, Rynno Lohmus, Irina Hussainova, Alex Pokropivny and Sergey Vlassov.
4. Nanomaterials by A. K. Baandyopadhyay; New Age International Publishers.
5. Nanotechnology by Mark Ratner and Daniel Ratner, Pearson Education.
6. Nano Essentials- T. Pradeep/TMH.
7. Bharat Bhusan, “Springer Handbook of Nanotechnology”, springer, Newyork, 2007.
8. Hari Singh Nalwa, “Encyclopedia of Nanotecnology”, USA 2011.
9. James A. Schwarz, Cristian I. Contescu, Karol Putyera, “Dekker Encyclopedia of Nanoscience and Nanotechnology” CRC Press, 2004.
10. Introduction to Nanoscience and Nanotechnology, CRC Press, G. L. Hornyak, H. F. Tibbals, J. Dutta, J. J. Moore.
11. Nanotechnology: principles and practices, 3rd Edition, Sulabha K. Kulkarni, Capital Publishing Company.

B.Sc. (Nanoscience and Nanotechnology) (Semester-IV)
Paper Code: NNT342
Paper Title: Functional Nanomaterials

Unit Number		No. of lectures
I)	**Semiconductor quantum dots:** Growth mechanism, shape and composition control of semiconductor nanocrystals, Synthesis of semiconductor nanocrystals in organic solvents, Aqueous synthesis of semiconductor nanocrystals, Inorganic semiconductor nanocrystals, Layer-by-layer (LBL) assembly with semiconductor nanoparticles and Nanowires, Applications of quantum dots	12
II)	**Nanotubes and nanowires**: Fabrication of TiO_2 Nanotube Arrays by Electrochemical Anodization: Four Synthesis Generations, Material Properties of TiO_2 Nanotube Arrays: Structural, Elemental, Optical, and Electrical, Applications, Boron Nitride Nanotubes: Synthesis and Structure, One-Dimensional Oxide Nanostructures	12
III)	**Nanofibers and Metal Oxide Frameworks**: Introduction, The Electrospinning Process, Key Processing Parameters, Nanofiber Yarns and Fabrics Formation, Potential Applications of Electrospun Fibers, Nanocomposite Fibers and their Structural Applications Metal Oxide Frameworks, definitions, advantages, disadvantages, methods of synthesis, Structural originality of MOFs, properties, Applications	12
IV)	**Polymer nanocomposites:** Introduction and review of Polymer, Introduction to Block copolymers, Properties of polymers; solid, glass transition temperature, crystalline-melting temperature, thermal transitions, viscoelasticity and rubber elasticity. Polymer additives: plasticizers, fillers and reinforcement: Polymer blends, toughen plastics and phase separated blends. Polymer composites: mechanical properties and composite fabrication. Applications of polymer nanocomposites in: high temperature, paint formulation, Automobiles, Aerospace, Injection Moulded Products, Coatings, Adhesives, Fire-retardants, Packaging Materials, Microelectronic Packaging, Optical Integrated Circuits, Drug Delivery, Sensors, Membranes, Medical Devices, Consumer Goods	12

Reference Books:

1) TiO_2 Nanotube Arrays: Synthesis, Properties, and Applications by Craig A. Grimes and Gopal K. Mor, Springer Publisher
2) Nanotubes and Nanofibers; Advanced Materials Series, Series Editor: Yury Gogotsi, Drexel University, Philadelphia, Pennsylvania, USA, Nanotubes and Nanofibers by Yury Gogotsi
3) Hybrid porous solids: past, present, future by Gerard Ferey, Chemical Society Reviews, 37 (2008) 191-214. DOI: 10.1039/b618320b
4) Semiconductor Nanocrystal, Quantum Dots: Synthesis, Assembly, Spectroscopy and Applications by Andrey L. Rogach (Ed.), Springer Publisher
5) Nanotubes and Nanowires, CNR Rao and Govindraj, RSC Publishers
6) Quantum well, wires and dots, Paul Harison, Wiley Publisher
7) Joel R. Fried; Polymers Science and Technology, Prentice-Hall of India Pvt. Ltd. New Delhi, 2002.

B.Sc. (Nanoscience and Nanotechnology) (Semester- IV)

Paper Code: NNT343

Paper title: Applications of Nanobiotechnology

UNIT - I Functional Principles of Nanobiotechnology: (12 lectures)

Information driven nanoassembly, Energetic, Role of enzymes in chemical transformation, allosteric motion and covalent modification in protein activity regulation, Structure and functional properties of Biomaterials, Bimolecular motors: ATP Synthetase and flagellar motors, Traffic across membranes: Potassium channels,ABC Transporters and Bactreriorhodapsin, Bimolecular sensing, Self replication, Machine-Phase Bionanotechnology Protein folding; Self assembly, Self-organization, Molecular recognition and Flexibility of biomaterials.

UNIT - II Nanomolecular Diagnostics – Array and Chips: (12 lectures)

Nanodiagnostics -Rationale of Nanotechnology for Molecular Diagnostics -Nanoarrays for Molecular Diagnostics . NanoProTM System -Nanofluidic/Nanoarray Devices to Detect a Single Molecule of DNA-Self-Assembling Protein Nanoarrays -Fullerene Photodetectors for Chemiluminescence Detectionon Microfluidic Chips -Protein Microarray for Detection of Molecules with Nanoparticles Protein Nanobiochip, Nanoparticles for Molecular Diagnostics -Gold Nanoparticles -Quantum Dots for Molecular Diagnostics Magnetic Nanoparticles -Use of Nanocrystals in Immunohistochemistry -Imaging Applications of Nanoparticles Study ofChromosomes byAtomic ForceMicroscopy-Applications of Nanopore Technology for Molecular Diagnostics DNA–Protein and DNA–Nanoparticle Conjugates

UNIT - III Nanopharmaceuticals: (12 lectures)

Nanobiotechnology for Drug Discovery -Gold Nanoparticles for Drug Discovery -Use of Quantum Dots for Drug Discovery –Trojan Nanoparticles -Self-Assembling Nanoparticles for Intracellular Drug Delivery -Nanoparticle Combinations for Drug Delivery Liposomes -Liposome–Nanoparticle Hybrids-Nanospheres-Nanotubes -Nanocochleates

Nanolasers for Drug Discovery -Cells Targeting by Nanoparticles with Attached Small Molecules -Role of AFM for Study of Biomolecular Interactions for Drug Discovery

Nanoscale Devices for Drug Discovery -Nanotechnology Enables Drug Design at Cellular Level Nanobiotechnology-Based Drug Development -Dendrimers as Drugs- Fullerenes as Drug Candidates –

Nanosuspension Formulations Viruses as Nanomaterials for Drug Delivery –

Nanomotors for Drug Delivery Nanomolecular Valves for Controlled Drug Release -.

UNIT - IV Applications in Cancer Therapy and Nanomedicine: (12 lectures)

Introduction and Rationale for Nanotechnologyin Cancer Therapy -- Passive Targeting of Solid Tumors: Pathophysiological Principles and Physicochemical Aspects of Delivery Systems -Active Targeting Strategies in Cancer with a Focus on\Potential Nanotechnology Applications -Pharmacokinetics of Nanocarrier-Mediated Drug and Gene Delivery - Multifunctional Nanoparticles for Cancer Therapy- Neutron Capture Therapy of Cancer: Nanoparticlesand High Molecular Weight Boron Delivery Agents. Nano-Oncology- Nanoneurology- Nanocardiology- Nano-Orthopedics- Nano-Ophthalmology

References:

1. C. M. Niemeyer, C. A. Mirkin, ―Nanobiotechnology: Concepts, Applications and Perspectives‖, Wiley – VCH, (2004).

2 T. Pradeep, ―Nano: The Essentials‖, McGraw – Hill education, (2007).

3. Challa, S.S.R. Kumar, Josef Hormes, Carola Leuschaer, ‖Nanofabrication Towards Biomedical Applications, Techniques, Tools, Applications and Impact‖, Wiley – VCH, (2005).

4. Nicholas A. Kotov, ―Nanoparticle Assemblies and Superstructures‖, CRC, (2006).

5. David S Goodsell, "Bionanotechnology‖, John Wiley & Sons, (2004).

6. Kewal K. Jain ,‖ *The Handbook of Nanomedicine* ‖Humana Press, (2008).

7. Zhang, ‖*Nanomedicine: A Systems Engineering Approach"* 1st Ed., Pan Stanford Publishing, (2005).

8. Robert A. Freitas Jr., ―*Nanomedicine Volume IIA: Biocompatibility*‖, Landes Bioscience Publishers, (2003).

B.Sc. (Nanoscience and Nanotechnology) (Semester-IV)
Paper Code: NNT344
Paper Title: Nanoelectronics

Unit 1 - Introduction to Semiconductor technology: (12 lectures)

Survey of modern electronics and trends towards nanoelectronics, Discussion of the International Technology, Roadmap of Semiconductor (ITRS) characteristics, Need for new concept in electronics, From microelectronics towards biomolecules electronics, Moores low and CMOS scaling, Nanoscale electron transport properties: ballistic and staircase transport

Atoms-up approaches: Molecular electronics involving single molecules as electronic devices, transport in molecular structures, molecular systems as alternatives to conventional electronics, molecular interconnects.

Unit 2 &3 - Fabrication process flow for nano device (ULSI technology) (24 Lectures)

Environment for VLSI Technology : Clean room and safety requirements. Wafer cleaning processes and wet chemical etching techniques; Impurity incorporation : Solid State diffusion technology; Ion Implantation; Oxidation : Kinetics of Silicon dioxide growth for thin and ultrathin films. Oxidation technologies in VLSI and ULSI; Characterisation of oxide films; High k and low k dielectrics for ULSI. Lithography : Photolithography, E-beam lithography and newer lithography techniques for VLSI/ULSI; Mask generation. CVD techniques for deposition of polysilicon, silicon dioxide, silicon nitride and metal films; Epitaxial growth of silicon; modeling and technology. Metal film deposition : Evaporation and sputtering techniques for metal film . Multi-level metallisation schemes. Techniques for characterization of nanostructures.

Unit 4- Nano-devices and Theoretical Modeling: (12 lectures)

Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues etc.), Single electron transistors, new storage, optoelectronic, and spintronics devices.

References:

1. C.Y. Chang and S.M.Sze (Ed), ULSI Technology, McGraw Hill Companies Inc, 1996.
2. S.M. Sze (Ed), VLSI Technology, 2nd Edition, McGraw Hill, 1988.
3. Nanoelectronics and Information Technology (Advanced Electronic Materials and Novel Devices), Waser Ranier, Wiley-VCH (2003)

B.Sc. (Nanoscience and Nanotechnology) (Semester-IV)
Paper Code: NNT345
Paper Title: Energy Storage Device and Applications

Unit 1 - Introduction To Energy Storage: **(12 lectures)**

What is mean by energy storage, Need of energy storage, Worlds scenario of energy storage, Development and technology overview, Functional nanomaterials for efficient energy storage device.

Unit 2 - Battery: **(12 Lectures)**

Battery as energy storage device, Construction and working of battery, Electrode design, Charging and discharging, Types of batteries.

Unit 3- Supercapacitor : **(12 Lectures)**

Fundamental, Construction and properties, Types of supercapacitors, Cycling and performance characteristic, Recent trend of nanotechnology in supercapacitors.

Unit 4- Application of energy storage: **(12 lectures)**

Scope of energy storage device, Methods: mechanical, thermal, electrochemical, electrical, Home and industrial energy storage, Current challenges and future development, Merits and demerits.

References:

1) Energy storage device for electronic system: Rechargeable batteries and Supercapacitors by Nihal Kularatna, Academic press Elsevier
2) Advanced Batteries: Materials Science Aspects by Robert Huggins, springer Publication.
3) Supercapacitors: Materials, Systems and Applications, by Francois Beguin (Editor)
4) Energy: Sources, Utilization, Legislation, Sustainability, Illionois as model state by GA Mansoori, N Enayati, L B Agarkar, World Sci. Pub. Co. 2016

B.Sc. (Nanoscience and Nanotechnology) (Semester-IV)
Paper Code: NNT346
Paper Title: Photocatalysis for Environmental Pollution Control

Unit 1 - Introduction To Catalysis : **(12 lectures)**

Introduction to catalysis, lock and key model, classifications, heterogeneous catalysis, reactionon the solid surfaces, adsorption isotherms ; Langmuir, Freundlich and Brunauer-Emmett-Teller(BET) (no derivation).Physisorption and chemisorption.

Unit 2 - Kinetics of Catalysis: **(12 Lectures)**

Catalytic activity (bulk and nanoscale), kinetics of catalytic reactions and determination. Catalytic rate constants: apparent rate constant and normalized rate constant (for pseudo-first order kinetics).Induction time, catalytic efficiency and turnover frequency, inhibition. Application of metal nanoparticles in organic reactions (Heck and Suzuki-Maurya reactions),environmental remediation.

Unit 3- Photocatalysis : **(12 Lectures)**

Introduction of photocatalysis, basics of photochemistry, principles of light over solid, Electronics structure and photo-absorption, Jablonskii diagram and photophysical processes in electronically excited state, solar spectrum analysis. Properties of good photocatalysts.

Unit 4- Application of Photocatalysis: **(12 lectures)**

Principles of semiconductor, fundamental understanding of semiconductor interfaces, photocatalysts surface and active species, Application of photocatalysis: self cleaning, purification of water and air.

References

(1) Y. Nosaka and A Nosaka, Introduction to Photocatalysis: from basic Sciences to Application, RSC Publications, 2016.
(2) J. G. Calvert, J. N. Pitts, Photochemistry, Wiley & Sons, New York, 1966.
(3) N. Serpone, E. Pelizzetti (Eds.), Photocatalysis. Fundamentals and Applications, Wiley, New York, 1989.
(4) K. K. Rohatgi-Mukherjee, Fundamentals of Photochemistry, Wiley, New York, 3rd Edition, 2002.
(5) Photoelectrochemical solar cells, Suresh Chandra, Gordon and Breach Science Publishers, 1985.
(6) Physical Chemistry of Surfaces , W. Adamson, Wiley Intersciences,(5th edition) 1990.
(7) Physical chemistry - Peter Atkins, Julio de Paula , 7th Edition Oxford University Press.
(8) Catalytic Chemistry, B.C. Gates, John Wiley and Sons Inc. (1992)
(9) Nanoparticles and Catalysis; D. Astruc, Wiley-VCH, 2008