UNIVERSITY OF PUNE
SYLLABUS
For
Vocational biotechnology

Objectives of the syllabus
1) To give the exposure to the student as to be self employed
2) To develop skills to handle instruments and entrepreneurship development
3) To train the student in various techniques related to agricultural biotechnology and medical biotechnology.

SUMMARY CHART

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<th>Name of the paper</th>
<th>Lecture(Period/ week)</th>
<th>Total teaching/per week</th>
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**Paper – 1 Cell & molecular biology 48 L**

1) Cell structure & functional organization 6
2) Fractionation of subcellular organelles 2
3) Membrane structure and membrane transport 4
4) Cell signaling 6
5) Cell differentiation, neoplasia & cell death 6
6) Cell junctions, cell adhesion & ECM 6

**Molecular biology**

1) Structure & organization of Pro- & eukaryotic genome 2
2) Structure & function of chromatin

3) Concept of gene 2
4) DNA replication, transcription & translation 8
5) Post translational modification & transport of proteins 4
6) DNA damage & repair 2

**Reference:**

1) Cell and molecular biology by Lodish
2) Cell: a molecular - Bruce Alberts,
3) Gene VIII- Benjamin Lewin
4) Cell and molecular biology – D Robertis and D. Robertis.

**Paper – 2 – rDNA technology & bioinformatics 48L**

1) Introduction to rDNA technology 2
2) Restriction enzymes & DNA modifying enzymes 5
3) Vectors in gene cloning – plasmids, cosmids, phage vectors, shuttle vectors, BAC, YAC 8
4) Transformation & transfection methods for introduction of rDNA into host cells- 6
5) Screening & selection of transformants – southern, northern, western hybridisation radioactive & non radioactive detection procedures 8
6) Site-directed mutagenesis 2
7) Introduction to PCR 2
8) DNA sequencing methods 4
9) Introduction to Genomics & proteomics 6
10) Applications of rDNA technology 5

**Reference:**

1) Gene cloning and analysis: T.A. Brown
2) Principles of gene analysis: Old and primrose
Paper – 3 Plant & animal tissue culture 48L
1) Introduction to plant tissue culture :- History, Lab designing, Instruments, advantages of Plant tissue culture. – 4
2) Culture media, Role of growth hormones - 2
3) Stages of Micropropagation (I-VI) - 10
   i) Selection of plant
   ii) Ex-plant preparation
   iii) Surface sterilization
   iv) Inoculation and incubation
   v) Subculturing
   vi) Hardening
4) Callus, cell and protoplast culture. 4

1) Introduction to ATC 2
2) Culture medium 2
3) Types of cultures & their applications 8
4) Cell lines & characterization 6
5) Separation of cell types 3
6) Organ culture 3
7) Organ transplants 2
8) Cell banks 2

Reference:
1) Plant tissue culture M.K.Razdan
2) Plant tissue culture –H.D.Kumar
3) Animal tissue culture –Ian Freshney
4) Animal tissue culture- John Paul.

Paper – 4 Immunology 48L
1) Introduction 2
2) Organs of immune system 4
3) Innate & acquired immunity 4
4) Structure & function of antibody & antigen 8
5) Humoral & cellular immunity 6
6) Hypersensitivity 4
7) Primary & secondary immune response 6
8) Vaccines 4
9) Techniques in immunology 10

Reference:
1) Immunology by Janus Kuby
2) Essentials of Immunology Roit
3) Immunology by pathak and Palan
Biotechnology practical (30 Practicals)
Cell, molecular biology and rDNA technology
1) Introduction to microscopy and various staining techniques to stain the various cell
parts (4x3)
1) Fractionation of sub cellular organelles (4x3)
   i) Nuclei
   ii) Chloroplast
   iii) Mitochondria
   iv) lysosomes
2) Isolation and estimation of chromosomal DNA (2x3)
3) Isolation and estimation of RNA (2x3)
5) Making host cells as competent cells (2x3)
6) Transformation of cells and selection of transformants (2x3)
7) Restriction digestion of chromosomal and plasmid DNA (2x3)
8) Ligation of DNA with ligase enzyme (Demonstration) (2x3)
9) Amplification of DNA with PCR (Demonstration) (1x3)
10) Concept of Databases (2x3)
11) BLAST and FASTA (1x3)

Immunology
1) Raising of polyclonal antibodies (2x3)
2) Determination of blood group (1x3)
2) Radial immunodiffusion (1x3)
3) ELISA technique (Demonstration) (2x3)
Annexure-II

Structure/ Pattern of Syllabus must be as follows:

1) Title of the Course: Vocational Biotechnology

2) Introduction: Semester Pattern

3) Eligibility: Should have offered Vocational Biotechnology at F.Y.B.Sc. and Passed F.Y.B. Sc. As per Pune University Rules

4) Examination
   A) Pattern of examination
      i) 40:10 (University Semester examination of 40 Marks & Internal assessment of 10 Marks) Details as per the syllabus
      ii) Pattern of the question paper: As per the specimen given
   B) Standard of Passing : As per Pune University norms
   C) ATKT Rules : As per Pune University norms
   D) Award of Class : As per Pune University norms
   E) External Students : Not permitted
   F) Setting of Question paper/ Pattern of Question paper: As per Pune University norms
   G) Verification of Revaluation : As per Pune University norms

5) Structure of the Course :
   i) Optional
   ii) Medium of instruction : English

6) Equivalence subject/ papers & Transitory Provision: Vocational Biotechnology

7) University terms : As per Pune University Norms.

8) Subject wise Detail Syllabus : Attached

9) Recommended books : Mentioned in syllabus
Proposed Syllabus for S.Y B.Sc.

Computer Hardware & Network Administration (Vocational)

Paper-I: Microprocessor & Interfacing Techniques

Objective: To make students aware of the minimum level of hardware, peripherals & interfacing concepts.

Paper-II: Computer System Management

Objective: To prepare students for computer system maintenance and recovery procedures in case of system failure.

Paper-III: Practical Course

Objective: To get hands on experience of computer hardware and networking and expose them to real time applications.

Paper-I: Microprocessor & Interfacing Techniques

Term -I: Microprocessor & Interfacing Techniques – I

Unit 1: Computer, Microcomputers & Microprocessors 22 L
- An Introduction & Overview – Structure & Operation
- Specification of new processors:
  o Intel Processors: Pentium Core Solo, Dual Core, Core2 Duo, Quad Core, Xeon Processors.
  o Non-Intel Processors: Advanced Micro Devices (AMD), Cyrix Processors, Texas Instruments, Motorola Processors (iMac & Apple Macintosh)
- Advanced Systems BUS Architecture
  o EISA, PCI, VESA, MCA, PCMCIA, USB, ATA, SATA
- Interrupts & Interrupt Applications of 8086 Processor
- Software Interrupt Applications.

Unit2: Digital & Analog Interfacing 18 L
- Programmable parallel Ports & Handshake Input Output.
- Interfacing Microprocessors to Keyboard,
- Interfacing to Alphanumeric Displays.
- Sensors and Transducers
- DAC & ADC Converters: Specifications & Types, Interfacing & Types of Interfacing

Unit3: Memories and EDA Tools 8L
- The 8086 Max Mode, DMA Transfers, Interfacing & Refreshing DRAMs, Cache Memory Concepts, Computer Based design & Development Tools.
Term -II: Microprocessor & Interfacing Techniques –II

Unit 1: New Standards 8 L
- Displays: Display Adaptors, Display Systems
- Controllers: Peripheral Controllers, System Controllers, Memory Controller, Disk Drive Controller
- BIOS: Legacy, Flash BIOS, Embedded IO systems

Unit2: Computer Systems peripherals 18 L
- Micro Computer Displays
- Input Devices: Keyboards, Mouse, Scanners, Card Readers etc.
- Output Devices: Printers, Displays, Plotters etc.
- Storage Devices: Magnetic Disks, Optical Disk Data Storage, Flash Drives etc.
- Various ADD ON Cards.

Unit3: Communications 22 L
- Introduction to Asynchronous Data Communications
- Serial Data Communication Methods & Standards.
- Synchronous Serial Data Communication & Protocols
- Concepts of Personal Area Network(PAN), Local Area network(LAN) & Wide Area Network(WAN)
- Introduction to Wireless Communication Concepts & Protocols
- Introduction to Bluetooth & Zigbee Wireless Communication Standards.

Paper-II: Computer System Management

Term -I: Computer System Management - I

Unit1: Preventive Maintenance 16 L
Contributors to Failures
- Environmental: Heat, Cold, Dust, Noise Interference
- Electrical: Power Line problems, EMI, Corrosion, Magnetism,
- Storage Devices:
  - Hard Disk Drive Maintenance
  - Floppy Disk Drive Head Cleaning
  - Flash Drives (USB Pen Drives, MMC cards)
- Preventive Maintenance of PC:- (Hardware & System Software)
- Power Supply Maintenance: Stabilizers, UPS, SMPS, Cables
- Preventive Maintenance of Printers.

Unit 2: Trouble Shooting 22 L
- Introduction to Basic trouble shooting
- General Trouble Shooting Rules
- Personal Attitude for Trouble Shooting
- Need of Situation
- Software Interrupt Applications.
- Common Troubles with Modern PC
- Component Failure Recovery.
  o Disk Drive Failure
  o Display Failure
  o Motherboard & RAM Failure
  o Port Failures (Parallel, Serial & USB Ports)
  o Repair Generated Failure
  o Fault Finding & General Repairs
- Safety Precautions during trouble shooting & repairs
- H/w & S/w fault isolation Techniques
- Diagnostic Software Programs & Utilities.
- Specific Trouble Shooting & Repairs
  o Start up Problems
  o Run Problems
  o Disk Drive Problems (HDD, CDROMs, FDD, Writers etc.)
  o Keyboard & Mouse trouble Shooting.
  o Printer Problems

Unit3: Introduction to Business Continuity Process & Disaster Recovery Planning 10 L
- Preventive Maintenance Schedules.
- Causes for Incidents & Disaster
- Minimize & Recovery Alternatives
  o Access Controls: Logical & Physical
  o Backup & Restore Policies, Procedure & Implementations
- Importance of Disaster Recovery Plan

Term -II: Computer System Management – II

Unit1: Classification of Computer Systems 20 L
- Heartware:
  o Types of Users
  o Their Roles and Responsibilities
  o Information System Organizational Structure
  o Segregation of Duties and Control Matrix.
- Hardware:
  o Computer Systems: Desktop(Clients), Servers, Mainframes
  o Networks Devices: Cables, HUB, Switches, Routers, Modems,
- Software:
  o System Softwares
  o Device Drivers
  o Database Softwares
  o Application Softwares
  o Utility Softwares
  o
Unit 2: Management of Hardware Devices 18 L
- Desktop Systems:
  o List of Components
  o Assembly Procedures & Steps
  o Installation of Operating System
  o Installation of Device Drivers
  o Installing Printers
- Need of Upgradation
- Various Portable Devices
  o PDAs, Palm Tops, Notebooks, Laptops, BlackBerry & iphone Devices
  o USB Pen Drives, Flash Memories
- Various Accessories
  o Bluetooth Devices: Headphone, MIC, Printers, Interface Dongles, Keyboard, mouse, Cameras
  o USB: Keyboards, Mouse, Cameras, Printers, Modems, Wi-Fi Interfaces

Unit 3: Operations Management 10 L
- Computer Operations
  o Operation Controls
  o Scheduling Controls
  o Maintenance Controls
  o Change Process
- Network Operations
  o Local Area Network Controls
  o Wide Area Network Controls.
  o Network Resources Sharing
- Storage of Storage Media, Maintenance & Disposal of Storage Media

Paper –III: Practical Course

List of Practicals:

Section - I
Practicals should be done with TASM/ NASM
1. Arithmetic Programs
2. Code Conversion Programs
3. Program for strings and arrays
4. Programs with DOS interrupt
5. Program with BIOS interrupt
6. Writing driver programs for mouse operation
7. Program to print a line on a printer
8. Writing an Editor
9. Writing Com program
10. Interfacing with PC ports
11. PC to PC communication
Section –II

1. **Installation of Operating System** – WinXP/ Win2003 / Linux / WinVista
2. **Installation of Drivers**: INF, Graphics, Sound, Ethernet, Modem, etc.
3. **Trouble Shooting**: Trouble Shoot a PC for No Display, Hard disk Drive Failure
4. **Network Sharing**: Share a Drive on LAN, Share a Printer on LAN, Share a Folder on LAN
5. **Trouble Shoot** a Virus infected PC using a Antivirus Program (Free ware : AVAST, Fire Threat)
6. **LAN**: Site Preparation for Installation of LAN
7. **Software Installation**: MS-Office, TASM, Tally, Acrobat etc
8. **Antivirus**: Need, Installation and Updation types

**Books for References:**
1. Assembly Language for PC – John Socha, Peter Norton
2. Microprocessor and Interfacing- D.V. Hall
3. The 8086 Microprocessor Programming and Interfacing the PC – K. Ayala
4. Programming with X86 processor – Venugopal
6. PC Hardware (A+ Certificate guide) by Mike Mayer
7. PC Hardware interfaces by Michael Gook
9. Upgrading and Repairing of PCs by Scott Muller
10. IBM PC and Clones by B. Govindrajalu
Annexure-II

Structure/ Pattern of Syllabus must be as follows:

1) Title of the Course: *Computer Hardware and Network Administration*
2) Introduction: *Pattern Semester*
3) Eligibility: *Should have offered Computer Hardware and Network Administration at F.Y.B.Sc. and Passed F.Y.B. Sc. As per Pune University Rules*

4) Examination
   A) Pattern of examination: *Semester*
      i) **40:10** (University semester examination of 40 Marks & Internal assessment of 10 Marks) Details as per the syllabus
      ii) Pattern of the question paper: *As per the specimen given*
   B) Standard of Passing : *As per Pune University norms*
   C) ATKT Rules : *As per Pune University norms*
   D) Award of Class : *As per Pune University norms*
   E) External Students : *As per Pune University norms*
   F) Setting of Question paper/ Pattern of Question paper: *As per Pune University norms*
   G) Verification of Revaluation : *As per Pune University norms*

5) Structure of the Course :
   i) Optional
   ii) Medium of instruction : *English*

6) Equivalence subject/ papers & Transitory Provision: *Computer Maintenance (Vocational)*

7) University terms : *As per Pune University Norms.*

8) Subject wise Detail Syllabus : *Attached*

9) Recommended books : *Mentioned in syllabus*
Objectives:

1] To make the student aware of working principles of modern communication receivers and to impart technical knowledge of their construction as a preparation for being able to learn fault location and troubleshooting.

2] To make the student familiar with construction and working of different audio and video systems in preparation of learning their troubleshooting and maintenance.

3] To provide the students adequate knowledge of latest applications of video and TV systems.

Module I

Audio Systems

Construction, principle of working and typical applications of:

AM and FM radio receiver, receiver ICs, receiver characteristics and alignment, Use of these receiver principles in mobile phone, satellite receiver (dish TV receiver) etc. Audio tape recorder and principles of recording of electrical signal on magnetic tape. Construction of R/P head and erase head. High fidelity music systems and functions in them. Principles of recording and replay of audio CD and ACD player. MP3 compression and its use. MP3 player, process of downloading songs in it.

Public address system and its requirements

24 lectures

Module II

Video Systems

Construction, principle of working and typical applications of:


Recording of video signal on magnetic tape, need for FM of picture signal and rotating head mechanism, tape and head servo systems. Block diagram of record and playback electronics in a VCR. Video monitors-CRT and LCD. Block diagram of VCD player and basic information of VCD. DVD player and types of DVD and their construction.

Applications of TV: CCTV and CATV. Other application areas for TV such as education, underwater and in nuclear installations.

24 lectures
Paper 1 Semester 2 VOC- EEM-221 Audio, Video and Office equipment - B

Objectives:

1] To inform the student about different types of display techniques and data projectors used their setting up procedure and maintenance.
2] To impart adequate technical knowledge about latest personal computer and peripherals from the point of view of maintenance and troubleshooting.
3] To introduce troubleshooting procedures for office equipment such as FAX and XEROX machines.

Module III

**Display and Projection Systems** Construction, working principle and typical applications of:

- Concept of multimedia and softwares involved in its development. Multimedia /Data projector, LCD and DLP projectors, large screen and rolling display, slide projector and overhead projector

24 lectures

Module IV

**Office Equipments** Construction, working principle and typical applications of:

- PC, construction of CPU, connectors on the CPU, motherboard, latest processors.
- Video adapters and colour display standards.
- Printers-dot matrix, inkjet, laser. Concept of barcode-Barcode printers and different types of barcodes and readers for them.
- Different types of scanners, FAX machine, XEROX machine, EPABX system
- PC peripherals such as keyboard, different types of mouse, monitors-CRT and LCD. Light pen, touch screen and their applications.

24 lectures

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Paper 2  Semester-1 Voc-EEM-212 Maintenance Concepts and Repair 2- A

Objectives:

1] To make the student aware of basic concepts and terminology of maintenance and repairing of electronic equipment.
2] To impart technical knowledge about related tools, drawings and manuals.
3] To train the students in site preparation and installation of equipment.
Module I

**Electronic Equipment and Maintenance Concepts**

Types of electronic equipment, potential problems. Quality, reliability and failures, mean time between failures (MTBF) and mean time to fail (MTTF), maintainability, mean time to repair, availability, redundancy. Fail safe design. Maintenance policy and stages of maintenance.

15 lectures

Module II

**Maintenance aids and documentation**

Basic tools, test instruments, service manuals. Drawings and schematics. Log books and data sheets.

9 lectures

Module III

**Installation, Safety Rules and**


15 lectures

Module IV

**Preventive Maintenance**

Idea of preventive maintenance using examples of computer, tape recorders of different types, different types of batteries, cathode ray oscilloscope and CVCC power supply.

9 lectures


**Objectives:**

1] To impart knowledge about procedures for fault location and troubleshooting of communication receivers.

2] To train the student for maintenance and repairing of different types of CD players.

3] To make the student proficient in troubleshooting and repairing of TV, VCR, PC and printers.

4] To introduce methods of repairing mobile telephones.
requirements and placement of loudspeakers
15 lectures

Module II

Maintainance aids and documentation  Faultfinding of B/W and colour TV on circuit level. Various faults and their cause. Test equipment for B/W and colour TV. Faults in VCR and their location. Maintenance of a VCR, head alignment and cleaning. Troubleshooting and maintenance of VCD and DVD players. Troubleshooting of PC, troubleshooting of printers, monitors. Faultfinding in mobile telephones.

9 lectures

Paper 3  Laboratory Voc-EEM-223

Objectives:
1] To give students hands on experience in handling consumer and office electronic equipment.
2] To impart the skill required for dismantling and reassembling delicate and intricate equipment.
3] To train the student in systematic approach to fault location and troubleshooting.
4] To make the student gain expertise in the use of test equipment.
5] To train the student in circuit board tracing and identification of circuit blocks.

List of recommended experiments  Semester 1

Group A:  Identification of functional blocks / sections, assembly and testing of semi knocked down (SKD) kits, troubleshooting and fault location.

1  AM/FM radio receiver and its alignment.
2  Music system: Study of hi-fi amplifier (LM 380), stereo system, graphic equalizer, speaker system
3  Audio tape recorder: Biasing technique, record\playback modes, erasing, FF and RW modes.
4  B/W TV receiver: Observation of waveforms and voltages at various test points.
5  Colour TV receiver: Observation of waveforms and voltages at various test points.
6  Fault finding in B/W TV receiver
Group B: Setting up, preventive maintenance, minor repairs and fault identification.

7 VCR (VHS system) Identification of parts, study of servo system, replay electronics.
8 ACD player: Identification of parts, study of various controls.
9 MP3 player: Study of block diagram and various controls, downloading of songs etc.
10 VCD/DVD player: Identification of parts, study of various controls

Group C: Site preparation, installation, identification of blocks.

11 PA system
12 CCTV
13 Tracing and study of picture tube and video amplifier circuits in TV receiver.
14 Tracing and study of chroma section and colour picture tube
15 Fault finding in colour TV.

List of recommended experiments Semester 2

Group D: Identification of functional blocks/sections, preventive maintenance and minor repairs.

16 Overhead projector
17 Data/Multimedia projector: Setting up and connections to PC.
18 Mobile telephone
19 EPABX and its programming

Group E: Identification of functional blocks/sections, preventive maintenance and minor repairs.

20 Study of motherboards with latest processor including Intel
21 Study of LAN
22 CMOS setup
23 Troubleshooting of a PC
24 Scanner
25 FAX/Multifunction machine

**Group F:** Identification of functional blocks/sections, electrical interconnections, preventive maintenance and installation of drivers.

26 Dot matrix printer
27 Inkjet printer
28 Laser printer
29 Study of PLC trainer kit
30 Lighting systems using PLC
31 Indicator and bell systems using PLC
32 Power utilization system using PLC
33 Control of bottling plant using PLC

*Note:* Any other equivalent experiments may be set in lieu of the experiments in the above list. However these should be based on syllabus of two theory papers of the respective semester. Any 3 experiments each from groups A, B and C in semester 1 and 2, 3 and 4 experiments each from groups D, E and F in semester 2 may be set.

**Reference books:**

3. Prevention of failures and maintenance of electrical equipment by A. A. Hattangadi, TMH.
4. Audio and video systems, Maintenance and troubleshooting by R. G. Gupta, TMH
5. VCR: Principles, Maintenance and Repair by Sharma, TMH
7. Maintaining and Repairing Videocassette Recorders By Robert L. Goodman TAB books inc,
8. VHS Basics Technology by Philips, Central consumer service, Bombay.
9. Microprocessors, PC hardware and interfacing
11. Servicing Cassette Recorders And Two-In One By R. C. Vijay B.P.B Publications
12. Computer Installation and Troubleshooting by Rajaraman
13. Video Handbook by Van Wezel and King Newness
15. Modern Electronic Equipment: Troubleshooting, Repair and Maintenance by Khandpur, TMH
17. Electronic Instruments and Systems: Principles, Maintenance and Troubleshooting by Gupta, TMH
18. Bar Codes: Technology and Implementation by Bhasker Raj, TMH
19. VCR: Principles, Maintenance and Repair by Sharma, TMH
20. Television: Maintenance and Repair by Singh, TMH

Useful websites:

http://www.howstuffworks.com/

Annexure-II

Structure/ Pattern of Syllabus must be as follows:

1) Title of the Course: Electronic Equipment Maintenance (Vocational)
2) Introduction: Pattern Semester
3) Eligibility: Should have offered Electronic Equipment Maintenance (Vocational) at F.Y.B.Sc. and Passed F.Y.B. Sc. as per Pune University Rules
4) Examination
   A) Pattern of examination: Semester
      i) 40:10 (University semester examination of 40 Marks & Internal assessment of 10 Marks) Details as per the syllabus
      ii) Pattern of the question paper: As per the specimen given
   B) Standard of Passing : As per Pune University norms
   C) ATKT Rules : As per Pune University norms
   D) Award of Class : As per Pune University norms
   E) External Students : Not permitted
   F) Setting of Question paper/ Pattern of Question paper: As per Pune University norms
5) Structure of the Course:
   i) Optional
   ii) Medium of instruction: English

6) Equivalence subject/papers & Transitory Provision: Electronic Equipment Maintenance (Vocational)

7) University terms: As per Pune University Norms

8) Subject wise Detail Syllabus: Attached

9) Recommended books: Mentioned in syllabus

   UNIVERSITY OF PUNE
Title: Utilities, unit operations and process instrumentation

Objectives: To know unit operations and process instrumentation related to organic and inorganic chemical industry.

Topic 1: Utilities in chemical industries

- Boilers - Their types and functions
- Steam - Generation and its use
- Water - Purification and treatment

Topic 2: Unit operations in chemical industries

- Distillation
- Evaporation
- Mixing and drying
- Filtration
- Crystallization
- Extraction

Topic 3: Temperature measurements

- Units: Relation between different units
- Methods for temperature measurements (Thermometers)
- Resistance temperature detector
- Thermister
- Thermocouple
- Radiation methods

Topic 4: Pressure measurements

- Units: Relation between different units
- Apparatus used for pressure measurements
- Electrical pressure transducer
- Resistance type transducer
- Piezoelectric pressure transducer

Topic 5: Electronic pressure sensors

- Meleod vacuum gauge
- Capacitance transducer
- Inductive transducer
- Optical transducer

Topic 6: Liquid level measurements

- Float level devices
- Tilt switch
- Continuous float devices/ indicators
- Magnetically coupled indicators
- Ultrasonic level devices
Topic 7: Density measurements
   a. Double bubbler density measurement
   b. Hydrometer
   c. Chain balanced densitometer

Topic 8: Fluid flow measurements
   a. Types of flow
   b. Continuity principle

Reference books:
   1. Unit operation in chemical engineering by W.L. McCabe and J.C. Smith
   2. Handbook of chemical engineering by J.H. Perry
   3. Unit operations I & II by D.D.Kale
   5. Industrial instrumentation by D.R.Eckman
Objectives: To study different processes required for organic chemical industry.
To study separation and purification of different organic chemical products.

Topic 1: Nitration
Introduction, reagent of nitration, o/p orientation, synthesis of nitrobenzene, m-dinitro benzene, o- and p-chloronitro benzene, p-nitroacetaanilide.

Topic 2: Halogenation
Introduction, reagents, synthesis of monochloro acetic acid, choral, chorobenzene, trichloro benzene.

Topic 3: Sulphonation
Introduction, regents, synthesis of benzene sulphonic acid, di dodecyl benzene sulphonic acid.

Topic 4: Oxidation
Introduction, reagents, liquid phase oxidation, synthesis of acetaldehyde, acetic acid, benzoic acid, styrene, phthalic anhydride, malic anhydride.

Topic 5: Reduction/Hydrogenation
Introduction, reagents, catalytic hydrogenation, reduction using acid, chloride hydrogenation of olefins, aromatic compounds, carbony esters, heterocyclic compounds, hydrogenolysis of C-C, C-O, C-N, C-S and C-X linkages, selective hydrogenation, hydrogenation of oil, olefins, synthesis of methanol.

Topic 6: Amination by reduction
Introduction, reagents, methods, synthesis of various amines.

Topic 7: Alkylation
Introduction, types of alkylation, reagents, synthesis of dodecyl benzene, benzene to ethyl benzene, phenyl ethyl alcohol.

Topic 8: Esterification
Introduction, reagents using acids, catalytic esterification, alcoholysis, ester of alkanes and alkynes, synthesis of vinyl acetate, ethyl acetate, cellulose acetate.
VOCATIONAL INDUSTRIAL CHEMISTRY (VOC-212)
S. Y. B. Sc Paper IV, Semester –I
Title : Inorganic Process Industries

Objectives: To study processes in different inorganic composite industries

Topic 1: Cement  6L

Topic 2: Glass  6L
Introduction, composition of glass, manufacture of glass- melting, fabrication, annealing, finishing. Properties of glass, types and applications of glass.

Topic 3: Metal and alloys  8L
Important metals and alloys- Fe, Cu, Al, Pb, Ni, Ti, Pt and their alloys. Mechanical and chemical properties, applications.

Topic 4: Ceramics  6L
Introduction, types of ceramics, raw material, manufacture, properties and classification, specialized ceramic products.

Topic 5: Refractories  7L
Introduction, manufacture of refractories, classification.

Topic 6: Composites  3L
Introduction, classification- particle reinforced, fibre reinforced and structural reinforced.

Topic 7: Corrosion  6L
Introduction, types, mechanism, factors influencing corrosion, protection against corrosion.

Topic 8: Pigments  6L
Introduction, types and applications

Reference books:
1. K. C. College handbook
2. Unit processes of organic synthesis by P.H. Groginns
1. Industrial chemistry by B.K.Sharma
2. K.C.College Handbook

**VOCATIONAL INDUSTRIAL CHEMISTRY (VOC-222)**  
**S. Y. B. Sc Paper IV, Semester –II**  
**Title: Industrial Pollution**

Objectives: To understand chemistry and pollution and measures for preventing pollution.

**Topic 1: Environmental Chemistry**  
4L  
Air, oxygen, nitrogen cycle hydrosphere and biosphere

**Topic 2: Air pollution**  
6L  
Introduction, composition of air, organic and inorganic pollutants, pesticide pollution, radiation pollution, green house effect

**Topic 3: Analysis of air pollutants and treatment**  
6L  
Measurement of air quality, sampling, dry and wet scrubbers, electrostatic and thermal precipitators.

**Topic 4: Water pollution**  
10L  
Sources of water pollution, water pollutant analysis, sampling, measurements of water quality, dissolved oxygen. Chemical and biological demands, international standard of quality of water, toxic metals.

**Topic 5: Water treatment**  
10L  
Quality of normal water, its characteristics, municipal water treatment, physical and chemical methods of sterilization

**Topic 6: Sewage and sludge treatment**  
8L  
Introduction, objectives and criteria for sewage treatment, sewage and sludge treatment, primary and secondary processes, aerobic and anaerobic digestion, disposal of sewage and sludge.

**Topic 7: Industrial waste and treatment**  
4L  
Introduction, types of industrial waste, treatment of organic and inorganic impurities.

Reference books:

1. K. C. College handbook
2. Industrial chemistry by B. K. Sharma
3. Air pollution by M. N. Rao and H. V. N. Rao
Annexure-II

Structure/ Pattern of Syllabus must be as follows:

1) Title of the Course: Vocational Industrial Chemistry

2) Introduction: Pattern Semester

3) Eligibility: Should have offered Vocational Industrial Chemistry at F.Y.B.Sc. and Passed F.Y.B. Sc. As per Pune University Rules

4) Examination
   A) Pattern of examination
      i) 40:10 (University semester examination of 40 Marks & Internal assessment of 10 Marks) Details as per the syllabus
      ii) Pattern of the question paper: As per the Specimen given
   B) Standard of Passing: As per Pune University norms
   C) ATKT Rules: As per Pune University norms
   D) Award of Class: As per Pune University norms
   E) External Students: As per Pune University norms
   F) Setting of Question paper/ Pattern of Question paper: As per Pune University norms
   G) Verification of Revaluation: As per Pune University norms

5) Structure of the Course: Semester
   i) Optional
   ii) Medium of instruction: English

6) Equivalence subject/ papers & Transitory Provision: Vocational Industrial Chemistry

7) University terms: As per Pune University Norms.

8) Subject wise Detail Syllabus: Attached

9) Recommended books: Mentioned in syllabus
<table>
<thead>
<tr>
<th>Paper</th>
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<tbody>
<tr>
<td>1</td>
<td>I</td>
<td>Theory</td>
<td>Instrumentation and material &amp; Design</td>
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<tr>
<td>2</td>
<td>I</td>
<td>Theory</td>
<td>Introduction to Industrial Microbiology &amp; Cultural Methods and Mathematics &amp; Statistics for Biologists</td>
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<tr>
<td>3</td>
<td>I</td>
<td>Practicals</td>
<td>Based on theory papers and key competency course</td>
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<td>4</td>
<td>II</td>
<td>Theory</td>
<td>Bio-reactors –Design &amp; Operation</td>
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<td>5</td>
<td>II</td>
<td>Theory</td>
<td>Screening &amp; Process Optimization</td>
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<td>6</td>
<td>II</td>
<td>Theory</td>
<td>Microbial Fermentations &amp; Down-stream processing</td>
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<td>7</td>
<td>II</td>
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<td>Practicals</td>
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<td>9</td>
<td>III</td>
<td>Theory</td>
<td>Pollution Control Technology</td>
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<td>Theory</td>
<td>Plant &amp; Animal Tissue Culture</td>
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<td>(Voc-IND-MIC-336)</td>
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<td>11</td>
<td>III</td>
<td>Theory</td>
<td>Molecular Biology &amp; Genetic Engineering</td>
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</table>
### Types of fermenters:

1. Fermenter configuration
2. Batch fermenter
3. Continuous fermenter
4. Stirred tank fermenter
5. Tubular fermenter
6. Fluidized bed fermenter
7. Solid state fermenter
8. Hollow fibre reactors

### Parts of fermenter:

1. Body construction and temperature control
2. Aeration and agitation: Aerator (sparger), Agitation (Impellers, baffles)
3. Achievement and maintenance of aseptic conditions
   - i) Sterilization of fermenter
   - ii) Sterilization of air supply
   - iii) Sterilization of exhaust gas
   - iv) Addition of inoculum, nutrients and other supplements
   - v) Sampling, feed ports, sensor probes, foam control
   - vi) Monitoring and control of various parameters
4. Piping and Valves
5. Factors affecting design
6. Fermenter operation modes
   - (Single, dual, multiple, batch, continuous)
7. Immobilization (Concept, methods and applications)
3) Manufactures of Fermenter: (15)

   a) Design calculations
   b) Fabrication drawing
   c) Fabrication and machining techniques
   d) Assembly and testing
   e) Repairs and maintenance

4) Utilities required for fermentation: (06)

   a) Boilers
   b) Compressors
   c) Cooling towers
   d) Refrigeration and air conditioning
   e) Chilling plants
   f) Water treatment plants

5) Data acquisition and analysis: (03)

   a) On-line, off-line and derived variables.
   b) Calculations and data analysis

References:

1) Stanbury, P.F. and Whitaker, A., Principles of fermentation technology
2) Patel, A.H., Industrial Microbiology, New Delhi.
1) **Microbial Diversity and Screening:**

   a) Microbial Diversity:
      i. The expense of microbial diversity, estimates of total number of species, measures and indices of diversity
      ii. Newer approaches of exploring unculturable bacteria

   b) Screening:
      i. Primary screening
      ii. Secondary Screening
      iii. Targeted Screening

2) **Process Optimization:**

   a) Strain improvement and Maintenance of industrially important microorganisms

   b) Inoculum build-up

   c) Media formulation
      ii. Media Optimization – Plackett- Burman design
      iii. Media sterilization- Different methods, decimal reduction time, del factor.

3) **Process Control:**

   a) Process parameters and their importance – temperature, pH, O-R potential, aeration, agitation, foam, pressure, dissolved oxygen; exhaust gas analysis (N₂, CO, CO₂, O₂), etc. Measurement and control of process parameters, computer applications in process controls.

   b) Monitoring and control of media components – C, N, product, product, cell mass, precursors, bye-products, etc.

4) **Scale-up of Fermentation:**

   a) Objectives of scale-up

   b) Levels of fermentation

   c) Parameters to be scaled-up fermenter design, media, sterilization of media, etc.

**References:**

4) Patel, A.H., Industrial Microbiology.
5) Comprehensive Biotechnology Vol I, II, III
1) **Industrial production of:**

   a) Pharmaceuticals (Antibiotic / Vitamin)
   b) Organic acid (Acetic acid)
   c) Amino acid (Glutamic acid)
   d) Enzyme (Amylase)
   e) Solvents (Ethanol)
   f) Fuels (Methane)
   g) Milk product (cheese)
   h) Bioinoculants (Symbiotic & non-symbiotic fixers, Phosphate solubilizers)
   i)

2) **Downstream processing of above fermentation products by-**

   a) Pretreatment (cell disruption, flocculation)
   b) Solid liquid separation (filtration, sedimentation, centrifugation)
   c) Concentration (membranes, salt and solvent precipitation, evaporation, liquid extraction and distillation)
   d) Purification (Precipitation, chromatography, adsorption and elution)
   e) Formulation (drying, extrusion, granulation and tabletting)

**References:**

4) Peppler, H.J. (Ed), 1979, microbial Tecnology, Vols I and II, A. P.
4) Product testing with respect to:  
   a) Sterility testing  
   b) Pyrogen testing  
   c) Carcinogenicity testing  
   d) Toxicity testing  
   e) Allergen testing  
   f) Assays

5) Applications of quality control tests in following products:  
   a) Pharmaceuticals (Antibiotics and Injectables)  
   b) Health care products (Tooth pastes, creams and lotions)  
   c) Canned products (Dairy and Food products and Mineral waters)  
   d) 

References:

2) I. P. / B. P. / U. S. P.

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**Paper-8: Practical Course**  
**Based on theory papers and key competency module**

**Practicals on Paper-4: Bio-reactors – Design & Operation**

1) Design of laboratory fermenter  
2) Immobilization of enzyme  
3) Batch and continuous fermentation  
4) Changing different parameters with respect to biomass production  
5) Solid state fermentation: Mushroom production

**Practicals on Paper-5: Screening and Process Optimization**

6) Screening for  
   i) Enzyme producers  
   ii) Organic acid producers  
   iii) Antibiotic producers  
7) Optimization of parameters at flask level for production of  
   i) Enzymes  
   ii) Organic acid producers  
   iii) Antibiotic producers  
8) Scale-up of a process from flask level to laboratory fermenter level for the production of enzyme / organic acid / antibiotic producer / bio-inoculants.
Practicals on Paper-6: Microbial Fermentations and downstream Processing

9) Laboratory scale production (shake flask) and downstream processing of ETHANOL
10) Laboratory scale production (shake flask) and downstream processing of AMYLASE

Practicals on Paper-7: Quality Assurance in Industrial Product

11) Detection of adulteration in food
12) Microbiological assays of fermentation products (one antibiotic and one vitamin)
13) Sterility testing of injectibles
14) Demonstration of pyrogen testing by LAL test.

Annexure-II

Structure/ Pattern of Syllabus must be as follows:

1) Title of the Course: **Industrial Microbiology (Vocational)**

2) Introduction: **Pattern Semester**

3) Eligibility: Should have offered Industrial Microbiology (Vocational) at F.Y.B.Sc. and Passed F.Y.B. Sc. As per Pune University Rules

4) Examination
   A) Pattern of examination
      i) **40:10** (University semester examination of 40 Marks & Internal assessment of 10 Marks) Details as per the syllabus
      ii) Pattern of the question paper: **As per the specimen given**
   B) Standard of Passing : **As per Pune University norms**
   C) ATKT Rules : **As per Pune University norms**
   D) Award of Class : **As per Pune University norms**
   E) External Students : **As per Pune University norms**
   F) Setting of Question paper/ Pattern of Question paper: **As per Pune University norms**
   G) Verification of Revaluation : **As per Pune University norms**

5) Structure of the Course : 
   i) Optional
   ii) Medium of instruction : **English**

6) Equivalence subject/ papers & Transitory Provision: **Industrial Microbiology (Vocational)**

7) University terms : **As per Pune University Norms**

8) Subject wise Detail Syllabus : **Attached**

9) Recommended books : **Mentioned in syllabus**
PHOTOGRAPHY AND AUDIO VISUAL PRODUCTION (Vocational)
S.Y.B.Sc.

Paper-III:

Semester-I: Still Photography, Camera Accessories

Objectives:

1. Enhance the understanding of photographic equipment and the science behind it.

2. Understanding the role of light in photography.

3. To be able to analyze the photographic image technically.

I. Still Photography: Shutter types and their limitations. Aperture and its effects. Depth of field, depth of focus, hyper focal distance. Factors affecting the depth of field and the depth of focus. Circle of confusion and its effect on sharpness/blurr.


III. Exposure: Method of estimations. Thumb Rule. Law of reciprocity. Reciprocity failure. Exposure meter: types and comparison, differences between hands held exposure meter and TTL exposure meter, spot meter, flash meter. Reading exposure levels, interpreting the meter reading


V. Techniques of Photographing Action: Lazy shutter, Freeze-action Blurring, Superimposition, double exposure, and multiple exposures.

VI. Filters used in Photography: Need of filters, types of filters, their uses, law of transmission and absorption, filter factor, factors governing filter factors. Optical limitations of filters, Filter mount.

VII. Analysis of photographic image: Effect of exposure on the photographic image.

VIII. Sensitometry/ Densitometry: Characteristic curve and its significance. Use of the Characteristic curve for the analysis of photographic image.

References:

1. The 35 mm Hand Book- Michael Freeman
2. Focal encyclopedia of Photography, Focal Press.
6. Colour How to see it, How to paint it- Judy Martin (Chartwell Books Inc.)
8. Applied Photographic Optics- Sidney F. Ray; Focal Press
10. Light Science and Magic, An Introduction to Photographic Lighting, Fill Hunter, Steven Biver, Paul Fuqua, Focal Press

STILL PHOTOGRAPHY AND AUDIO VISUAL PRODUCTION (Vocational)
S.Y.B. Sc.

Paper-III

Semester-II: Colour Photography and Digital Photography

Objectives:

1. To understand basic colour theory.

2. To understand basics of colour photography.

3. To understand the basics of digital photography.

I. Colour Theory: Theory of colour, characteristics of colour, additive and subtractive colours. Theory of colour vision. Types of light sources and their colour characteristics. Colour temperature (Kelvin and Mired Scale), Mired shift and its use in colour photography.


IV. Colour Enlarger: Construction of colour enlarger, Colour Head, sources of light and filters used in a colour enlarger, dichroic filters, manual printing and auto printing.
V. **Colour Processing**: Development of a colour negative film, colour transparency film, colour printing papers. Printing from a colour negative and a colour transparency film. Image formation at various stages.  


VII Digital Cameras

Megapixels, Digital photography terminology, Prosumer digicams, Digital SLRs, Choosing a Digital SLR System, Check list of essential equipment, Digital camera sensors, Comparison between digital and film photography

VIII Asset Management

Digital asset management, Workflow sequence.

IX Exposure

Intensity and duration, TTL light meters, Flash meter

References:

1. The 35 mm Hand Book- Michael Freeman  
2. Focal encyclopedia of Photography, Focal Press.  
6. Colour How to see it, How to paint it- Judy Martin (Chartwell Books Inc.)  
10. The Art of Digital Photography, John Hedgecoe, DK ltd, UK  
11. Mastering Digital SLR Photography, David D. Bush, Thomson
Annexure-II

Structure/ Pattern of Syllabus must be as follows:

1) Title of the Course: Photography and Audio Visual Production

2) Introduction: Pattern Semester

3) Eligibility: Should have offered Photography and Audio Visual Production at F.Y.B.Sc. and Passed F.Y.B. Sc. As per Pune University Rules

4) Examination
   A) Pattern of examination: Semester
      i) 40:10 (University semester examination of 40 Marks & Internal assessment of 10 Marks) Details as per the syllabus
      ii) Pattern of the question paper: As per the specimen given
   B) Standard of Passing : As per Pune University norms
   C) ATKT Rules : As per Pune University norms
   D) Award of Class : As per Pune University norms
   E) External Students : As per Pune University norms
   F) Setting of Question paper/ Pattern of Question paper: As per Pune University norms
   G) Verification of Revaluation : As per Pune University norms

5) Structure of the Course :
   i) Optional
   ii) Medium of instruction : English

6) Equivalence subject/ papers & Transitory Provision: Still Photography and Audio Visual Production

7) University terms : As per Pune University Norms.

8) Subject wise Detail Syllabus : Attached

9) Recommended books : Mentioned in syllabus
Objective-

1. To create a general awareness of the basic principles of Acoustics and its application.

2. To make students familiar with the basic mechanism of Audio equipment.

3. To make students familiar with the use of various Audio Equipment (study of characteristics and Application in various procedures- Recording Playback etc.)

4. To make students familiar with the requirements of acoustics of auditoria/ studios/ classrooms.

I. **Basic Definitions**: Intensity & Intensity level, Bel and Decibel, Analogy between electrical, mechanical and acoustical quantities. 6L

II. **Basics of Architectural Acoustics**: Reverberation time, Sabine equation and Eyring Formula (Without derivation), Active enclosures with sound reinforcement systems. Synthetic reverberation, Audio delayers, Anechoic chambers. Requirement of an auditorium. Acoustic characteristics of film, radio & T.V. Studios. 10L

III. **Characteristics of Loud Speakers**: Direct radiator dynamic loudspeaker, Horn and electrodynamic type loudspeaker, loudspeaker system for halls, theaters. Directional characteristics of loud speakers, three-way speaker mechanism system including woofer, midrange and tweeter, Cross-over networks, measurement of frequency response characteristics of a loudspeaker. 10L

IV. **Microphones**: Characteristics and requirements of a microphone. Different types of microphones. Special types: lapel, wireless, shotgun. Directional response and polar diagrams of different types of microphones: moving coil (dynamic), ribbon, condenser, carbon, electret and crystal. Factors governing the selection of microphones. 10L

V. **Sound reproducing Systems**: Monophonic, Stereophonic, Surround System. Hi-Fi system. P.A. system: block diagram and use of. Home Theater Systems. 6L

VI. **Sound Recording**: Principles of Sound recording: Magnetic Recording/ Reproduction. Audio CD Recording/ Reproduction. 6L
Reference Books:

1. Fundamental of Acoustics: Kinsler & Frey
2. Elements of Acoustical Engineering: Olson.
Annexure-II

Structure/ Pattern of Syllabus must be as follows:

1) Title of the Course: Principles of Acoustics & Sound for Media

2) Introduction: Pattern Semester

3) Eligibility: Should have offered Principles of Acoustics & Sound for Media at F.Y.B.Sc. and Passed F.Y.B. Sc. As per Pune University Rules

4) Examination
   A) Pattern of examination: Semester
      i) 40:10 (University semester examination of 40 Marks & Internal assessment of 10 Marks) Details as per the syllabus
      ii) Pattern of the question paper: As per the specimen given
   B) Standard of Passing : As per Pune University norms
   C) ATKT Rules : As per Pune University norms
   D) Award of Class : As per Pune University norms
   E) External Students : As per Pune University norms
   F) Setting of Question paper/ Pattern of Question paper: As per Pune University norms
   G) Verification of Revaluation : As per Pune University norms

5) Structure of the Course :
   i) Optional
   ii) Medium of instruction : English

6) Equivalence subject/ papers & Transitory Provision: Principles of Acoustics & Sound for Media

   Paper III- Principles of Acoustics & Sound for Media

7) University terms : As per Pune University Norms

8) Subject wise Detail Syllabus : Attached

9) Recommended books : Mentioned in syllabus
OBJECTIVES

• To understand fundamentals of the communications systems.
• To understand functioning of the systems using block diagram or construction diagram.
• To understand functions and handling of frequently used communication systems and devices used in photographic fields.

1 Basics of communication systems

Introduction, Basic Communication System, Base band common & modulation, Need of modulation, Types of modulation system, Data communication, Representation of data (ASCII, EBCDIC, Baudot Code), Data transmission i.e. Parallel, Serial, signaling rate or Bit rate, Modes of Data transmission (Asynchronous, Synchronous), Simplex, Duplex, Transmission channels & its characteristics.

2 Analog Modulation

Principles of AM, FM, Angle modulation, its mathematical representations, Power relations of AM wave, Modulation of Several waves, AM transmitter, SSB, DSB, DSBFC, DSBC, VSB, Characteristics of receiver i.e. Sensitivity, Selectivity, Fidelity etc. Demodulator, Automatic gain controller(AGC)

3 Sampling & Pulse Modulation

Analog and discrete time signals and systems, Sampling process, Sampling theorem, Nyquist rate, reconstruction of original signal, aliasing, Effect of non ideal filter, Sampling techniques, Pulse modulations (PAM, PWM, PPM) generation, detection & Comparison, Multiplexing (FDM, TDM, PAM/TDM system), Signaling rate, Crosstalk, Guard times, Intersymbol interference.

4 Digital Pulse Modulation & Source Coding techniques

Introduction to digital communication, Pulse code modulation, PCM encoder/decoder, CODECS, Codec IC 2910 (Internal block diagram) quantization process, Types of quantization, Signal to quantization ratio, signal to noise ratio, Comandings, Multiplexing hierarchy, Linear delta modulation, Transmitter & Receiver, Adaptive delta modulation (ADM), Comparisons of PCM, DM, ADM.. Comparison of analog and digital communication.

5 Digital modulation techniques for MODEM
Role, types and comparison of MODEM, Data multiplexers, FSK, PSK, BPSK, QPSK, Digital continuous wave modulation techniques for modem

References books
1. Electronic communications: Roody-Coolean.
2. Electronic-communication: J.S.Chitode.
4. Modern electronic communication: Miller Beasley (PHI)
Annexure-II

Structure/ Pattern of Syllabus must be as follows:

1) Title of the Course: Principles and applications of analog and Digital Communications

2) Introduction: Pattern Semester

3) Eligibility: Should have offered Photography and AV Production at F.Y.B.Sc. and Passed F.Y.B. Sc. as per Pune University Rules

4) Examination
   A) Pattern of examination
      i) **40:10** (University semester examination of 40 Marks & Internal assessment of 10 Marks) Details as per the syllabus
      ii) Pattern of the question paper: As per the specimen given
   B) Standard of Passing: As per Pune University norms
   C) ATKT Rules: As per Pune University norms
   D) Award of Class: As per Pune University norms
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   F) Setting of Question paper/ Pattern of Question paper: As per Pune University norms
   G) Verification of Revaluation: As per Pune University norms

5) Structure of the Course:
   i) Optional
   ii) Medium of instruction: English

6) Equivalence subject/ papers & Transitory Provision: Paper IV: Studio Acoustics

7) University terms: As per Pune University Norms

8) Subject wise Detail Syllabus: Attached

9) Recommended books: Mentioned in syllabus
S. Y. B. Sc.: Paper-III: Practicals

1. Comparison of the effects of filter on B/W Film.
2. Making enlargement by using technique of dodging and burning in.
3. Techniques of shooting action by using proper shutter speed.
4. Effect of focal length on depth of field.
5. To observe the effect of focal length on the qualities of image.
6. Effect of under/over exposure on negative film.
7. Effect of under/over development on negative film.
8. Use of flash as i) Fill light source and ii) main light source.
9. Use of reflector as fill light source.
10. Making a print a portrait using 3 light set up with selected brightness ratio.
11. Effect of different paper grades on tone scale of an image.
12. Presentation skills for-i) Reading the given script, ii) Reading dialogues, News items, short script from the given scripts.
13. Visit to a sound recording/editing studio.
14. Writing a radio script on given situation.
15. Study of a Public Address (PA) system.
16. Installation of P.A. system.
17. Study of recording system.
18. Tape to take recording.
19. Recording of an interview and a talk.
22. Directional characteristics of microphones.
23. Velocity of sound in air.
Subject Title: **SEED TECHNOLOGY (Vocational)**

**Objectives:**

A. To get introduced to Morphology, Seed Physiology, Plant breeding, Seed production.
B. To get introduced to the concept of Hybrid seed, Testing, Quality control.
C. To learn seed pathology and entomology, seed farm management, processing and storage.
D. To learn the concept of Biotechnology and Intellectual property.

**SUMMARY CHART:**

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<td>Paper V: Voc. ST- 325:</td>
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Visit to a seed company in the First and Second year.
Objectives:
1. To familiarize the students with Hybrid Seed Production Technology
2. To learn various conventional and non-conventional hybrid seed production technologies.
3. To learn the principles and need for the production of hybrid seeds particularly in field crops.

Chapter-1: Heterosis and inbreeding depression. 3L
1) Definition,
2) Genetic basis,
3) Commercial utilization.

Chapter-2: Apomixis. 3L
1) Definition,
2) Types and Significance.

Chapter-3: Male sterility 5L
1) Definition and its types,
2) GMS-introduction and its use in hybrid seed production,
3) CMS- introduction and its use in hybrid seed production,
4) C-GMS-introduction, Seed production of A, B and R-Lines.

Chapter-4: Self-incompatibility 2L
1) Definition,
2) Kinds and utilization.

Chapter-5: Devices for hybrid seed production. 4L
1) Manual Emasculation and hand / insect pollination,
2) Use of genetic male sterility.
3) Use of Gametocides

Chapter-6: Basic principles of hybrid seed production 7L
1) Definition of Variety and its type,
2) Selection of site for seed production,
3) Compact area approach,
4) Sowing, row spacing, fertilizer and irrigation
5) Isolation, planting ratio and seed rate,
6) Roguing and pollen shedders.

Chapter-7: Pollination Biology 4L
1) Types of Pollination,
2) Pollen viability,
3) Pollen storage,
4) Stigma receptivity.

Chapter-8: Hybrid Seed Production of 20L
1) Maize,
2) Bajra,
3) Jowar,
4) Cotton,
5) Sunflower,
6) Groundnut, with respect to following points:
i) Source of Seed,
ii) Selection of field (Land requirement),
iii) Isolation,
iv) Sowing,
v) Cultural practices (Fertilizers, irrigation, plant protection),
vi) Roguing,
vii) Harvesting and threshing.

REFERENCES:

4. Practicals in Plant Breeding- M. M. Bhandari.
5. Cytogenetics and plant breeding- Chandrasekharan and Parthasarthy.
9. Seed production manual- NSC and Rockfeller Foundation publication.
12. Techniques in seed science and technology- P. K. Agrawal and D. Dadlani.
Objectives:
1. To learn about the important testing methods with regard to physical purity germination percentage, moisture content, vigour, ODV etc. in seeds.
2. To get familiarized with various national and international seed testing organizations such as ISTA, AOSA, CSTL and SSTL.
3. To learn about the need, plan, layout and requirements for establishing a private seed-testing laboratory.

Chapter-1: Introduction
   1) Importance and history

Chapter-2: Organizations and Seed testing
   1) International Seed Testing Association
   2) Association of Official Seed Analysts
   3) Central Seed Testing Laboratory
   4) State Seed Testing Laboratory.

Chapter-3: Seed Testing Laboratory
   1) Layout and Furnishing,
   2) Staffing,
   3) Equipments and their maintenance.

Chapter-4: Seed sampling
   1) Definition of seed sampling,
   2) General principals of sampling,
   3) Kinds and procedure of Seed sampling

Chapter-5: Receipt and registration of Samples
   1) Types of Seed Samples (service, certification and official sample),
   2) Precautions,
   3) Procedure of registration,
   4) Mixing and dividing samples,
   5) Heterogenity test

Chapter-6: Physical purity analysis
   1) Definition of purity components,
   2) Procedure,
   3) ODV test,
   4) Reporting of results.

Chapter-7: Moisture Testing
   1) By air oven method,
   2) Moisture meters.

Chapter-8: Germination Testing
   1) Definition and objective,
   2) General principles and requirements,
   3) Procedure and methods (Paper, sand, soil and TZ method)
   4) Seedling evaluation.

Chapter-9: Seed vigour testing
   1) Principle,
   2) Generalized procedure.
Chapter-10: Reporting the results and storage of guard samples

REFERENCES:

4. Practicals in Plant Breeding- M. M. Bhandari.
5. Cytogenetics and plant breeding- Chandrasekharan and Parthasarthy.
7. Seed production manual- NSC and Rockfeller Foundation publication.
**Paper II: Voc. ST- 225: Practical based on Paper III and IV**

**Paper III: Voc. ST- 213:**

b. Studies on floral morphology of some important crop plants with respect to their pollination mechanism.

c. Artificial emasculation and pollination studies in Maize and Cotton.

d. In vitro and In vivo germination of pollen.

e. Determination of percent pollen viability.

f. Study on protogynous and protandrous nature of the flower in Pearl millet and Sunflower.

g. Anthesis: Anther arrangement and time of anthesis.


i. Identification of genetic male sterile plants at bud initiation stage.

j. Method of identifying Maize sterile anthers by structure and colour.

k. Laboratory method for confirmation of sterility in Maize by aceto-carmine test under microscope.

**Paper IV: Voc. ST- 214:**

1) Filling of Entry register, Laboratory report register and seed sampling specimen.

2) Seed sampling and dividing Equipments.

3) Physical Purity Analysis.

4) Germination Testing:
   A. Paper method: a) Top paper method, b) Between paper, c) Towel method
   B. Sand method: a) Top of Sand and in sand
   C. Soil method:
   D. TZ Test.


6) ODV Test.

7) Seed vigour testing.

8) Determination of weight.
Objectives:

1. To make the students familiar with vegetable seed production technology.
2. To be aware of and learn the various hybridization techniques.
3. To learn about the cultural practices and Seed extraction and storage methods.

Chapter-1: History and objectives
Chapter-2: Reproduction
1) Definition and Types of Reproduction
2) Asexual Reproduction (Vegetative and Apomixis)
3) Sexual Reproduction
   a. Microsporogenesis
   b. Megasporegenesis
   c. Fertilization

Chapter-3: Pollination Mechanism
1) Definition
2) Modes of Pollination
3) Pollen viability
4) Stigma receptivity
5) Mechanism of Pollination control
   a. Self incompatibility (Types and control mechanism)
   b. Male sterility (GMS, CMS, CGMS)

Chapter-4: Hybridization techniques
1) Introduction
2) Objectives and Types
3) Procedure

Chapter-5: Breeding Methods
1) Introduction
2) Selection
   a. Pure line selection
   b. Pedigree selection
   c. Bulk method

Chapter-6: Population Improvement
1) Introduction
2) Objectives and Methods
3) Mass selection
4) Progeny selection
5) Applications and achievements

Chapter-7: Classification of Vegetable Crops
1) Classification based on growing season.
2) Classification based on plant part used for consumption.
Seed production procedure in the following plants with reference to land requirement, isolation, nursery management, cultural practices, roughing, plant protection, harvesting, seed extraction method, seed drying and seed storage
e.g. Brinjal, Tomato, Okra, Bitter guard, Onion.

REFERENCES:

Paper IV: Voc. ST-224

Seed Quality Control

Objectives:
1. To learn about the concepts and significance of seed quality control.
2. To know about the various aspects related to seed certification and seed legislation.
3. To have the knowledge of national and international seed quality control organizations and seed certification agencies.

Chapter-1: Introduction 2L
   1) Concept of seed quality control

Chapter-2: Seed Certification 5L
   1) Objectives
   2) Concepts
   3) Classes of seed and procedure of seed certification

Chapter-3: Seed Certification Agencies and its Organization 4L

Chapter-4: Minimum Seed Certification Standards 8L
   1) General seed certification standards
   2) Specific crop standards

Chapter-5: Field Inspection 10L
   1) Objectives and General principles
   2) Method of inspection

Chapter-6: Seed Legislation 5L
   1) Introduction
   2) Types of seed legislation
   3) Seed legislation in India (Seeds Act 1996)

Chapter-7: Seed Law Enforcement 4L
   1) Introduction
   2) Duties of seed inspector
   3) Powers of seed inspector
   4) Procedure of seed law enforcement

Chapter-8: Indian Regulatory System in Seed Quality Control 10L
   1) International organizations and seed certification
   2) Statutory bodies and agencies established in India
      a. Central seed committee
      b. Central seed certification board
      c. Central seed testing laboratory
      d. State seed certification agency
      e. State seed testing laboratory
      f. Appellate authority
      g. Committee for recognition of seed certification agencies of foreign countries
REFERENCES:

Paper II: Voc. ST- 225: Practical based on Paper III and IV

Paper III: Voc. ST- 223

a. Floral biology of some vegetable crops (Brinjal, Tomato, Okra, Bitter guard and Onion).
b. Techniques of selfing and crossing (self pollination and cross pollination) in vegetable crops.
c. Raising of Nursery and planting
   - Nursery requirements and Management for different vegetables.
   - Seedling age for transplanting.
   - Precautions and Irrigation.
d. Germination of pollen grains in water, sugar solution and other media.
e. Identification of vegetable seeds.
f. Seed extraction method in Tomato and Brinjal.
g. Visit to the vegetable breeding farm.

Paper IV: Voc. ST- 224

1) Filling of application form for seed certification.
2) Checking of seed source and isolation requirements.
3) Taking of field counts and filling of inspection reports of important field crops.
4) Study of stable morphological characters useful in identification off types in seed production crops.
5) Visit to seed quality control laboratory of reputed seed company.

Visit to seed processing plant.
LIST OF WEBSITES:
www.seedtechnologies.com
www.seedinfolet.com
www.opticstechnology.co.in
www.aosaseed.com
www.aosa.org
www.seedtest.org
www.css.cornell.edu
www.seedques.com
www.ipgri.cgiar.org
www.niab.com
www.technologyseed.com
www.pioneer.com
www.seed.slb.com
Annexure-II

Structure/Pattern of Syllabus must be as follows:

1) Title of the Course: **Seed Technology**

2) Introduction: **Pattern Semester**

3) Eligibility: **Should have offered Seed Technology at F. Y. B. Sc. and passed F. Y. B. Sc. as per the Pune University rules.**

4) Examination
   A) Pattern of examination: **Semester**
      i) **40:10** (University semester examination of 40 Marks & Internal assessment of 10 Marks) Details as per the syllabus
      ii) Pattern of the question paper: **As per the specimen given**
   B) Standard of Passing: **As per Pune University norms**
   C) ATKT Rules: **As per Pune University norms**
   D) Award of Class: **As per Pune University norms**
   E) External Students: **Not permitted**
   F) Setting of Question paper/Pattern of Question paper: **As per Pune University norms**
   G) Verification of Revaluation: **As per Pune University norms**

5) Structure of the Course:
   i) Optional
   ii) Medium of instruction: **English**

6) Equivalence subject/papers & Transitory Provision: **Seed Technology (Vocational)**

7) University terms: **As per Pune University Norms**

8) Subject wise Detail Syllabus: **Attached**

9) Recommended books: **Mentioned in syllabus**