

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

Paper	Year	Semester/Term	Name of the paper	Lecture(Period/week)		Total teaching/pe r week
1	I	Term 1st	Biochemistry	03	03	06
2	I	Term 1st	Biophysics and instrumentation	03	03	06
3	I	Term 2nd	Microbiology	03	03	06
4	I	Term 2nd	Mathematics ,statistics, and computer for biologists	03	03	06
5	II	Sem 1	Cell and molecular biology	04	04	08
6	II	Sem 1	Recombinant DNA technology and Bioinformatics	04	04	08
7	II	Sem 2	Animal and plant tissue culture	04	04	08
8	II	Sem 2	Immunology	04	04	08
9	III	Sem 3	Plant Biotechnology	04	04	08
10	III	Sem 3	Environmental biotechnology	04	04	08
11	III	Sem 4	Microbial biotechnology	04	04	08
12	III	Sem 4	Animal biotechnology	04	04	08

S. Y. B. Sc.

Paper – 1 Cell & molecular biology 48 L

- | | |
|---|---|
| 1) Cell structure & functional organization | 6 |
| 2) Fraction 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 & bio-informatics 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 radio active & 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 (2x 3)
- 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

- Green PC: Introduction, Advantages, Thick & Thin concept.
- Multimedia PC: Introduction, Minimum Requirements, MPEG Terminology, Enhanced Devices & interfaces, Sound Cards, MIDI Ports.
- 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

- Speech Synthesis and Recognition Concepts.
- 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
 - o Environmental: Heat, Cold, Dust, Noise Interference
 - o Electrical: Power Line problems, EMI, Corrosion, Magnetism,
- Storage Devices:
 - o Hard Disk Drive Maintenance
 - o Floppy Disk Drive Head Cleaning
 - o 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 Display Problems: Adaptor Cards (PCI & AGP), Device Driver Configuration, Graphics Resolution, Graphics Accelerator board.
 - 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

Unit3: 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
5. Information System Control and Audit – Ron Weber.
6. PC Hardware (A+ Certificate guide) by Mike Mayer
7. PC Hardware interfaces by Michael Gook
8. Computer Fundamentals by P. K. Sinha
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**

S. Y. B. Sc Electronic Equipment Maintenance (Vocational)
Paper 1 Semester 1 VOC- EEM-211 Audio, Video and Office equipment - A

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

24lectures

Module II

Video

Systems Construction, principle of working and typical applications of:

Principles of TV transmission, vestigial sideband transmission, standard TV channel in India. Principles of scanning and synchronization, composite video signal, B/W TV receiver. Principles of colour transmission and PAL-B colour standard. Block diagram of colour TV. Monochrome and colour picture tubes. Flat screen and LCD display latest trends.

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

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 Installation manual. Selection and preparation of site. Provision of suitable physical environment. Power supply system, artificial earth. Assembly and fixation of the machine. Testing and commissioning. Examples of installation: TV receiver, computer. Safe operating procedures.

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

Paper 2: Semester-2 Voc-EEM-222 Maintenance and repair of Audio, Video, office and communication equipment.

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.

Module I

Electronic Equipment and Maintenance Concepts Troubleshooting of AM and FM receiver, satellite receiver (dish TV). Troubleshooting of tape recorders and music systems. Maintenance and troubleshooting of ACD player and MP3 player. Troubleshooting and arrangement of a PA system. Its

requirements and placement of loudspeakers

15 lectures

Module II

Maintenance 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:

1. Electronics fault diagnosis by G. C. Loveday A H. Wheeler Publishing
2. Basic television and video systems by Bernard Grob McGraw Hill publications.
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
6. Handbook of Solid State Troubleshooting by Hershel Gardner, Taraporevala sons and co.
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
10. The Compact Disc: A handbook of theory and use By Ken C. Pohlmann Oxford University Press, 1989.
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
14. Electronic Instruments and Systems: Principles, Maintenance and Troubleshooting by R. G. Gupta Tata McGraw Hill Edition 2001
15. Modern Electronic Equipment: Troubleshooting, Repair and Maintenance by Khandpur, TMH
16. Electronics Shop Practices, Equipment and Materials By Clyde N. Herrick Prentice Hall Inc
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/>

<http://dlp.com/about-dlp/about-dlp-FAQs-technology.asp>

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

- 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: **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**

VOCATIONAL INDUSTRIAL CHEMISTRY (VOC-211)

S. Y. B. Sc. PAPER – III, Semester – I

Title: **Utilities, unit operations and process instrumentation**

Total = 48L

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

- Topic 1: Utilities in chemical industries 6L
- Boilers - Their types and functions
 - Steam - Generation and its use
 - Water - Purification and treatment
- Topic 2: Unit operations in chemical industries 18L
- a. Distillation
 - b. Evaporation
 - c. Mixing and drying
 - d. Filtration
 - e. Crystallization
 - f. Extraction
- Topic 3: Temperature measurements 4L
- a. Units : Relation between different units
 - b. Methods for temperature measurements (Thermometers)
 - c. Resistance temperature detector
 - d. Thermister
 - e. Thermocouple
 - f. Radiation methods
- Topic 4: Pressure measurements 4L
- a. Units : Relation between different units
 - b. Appratus used for pressure measurements
 - c. Electrical pressure tranducer
 - d. Resistance type transducer
 - e. Piezoelectric pressure transducer
- Topic 5: Electronic pressure sensors 4L
- a. Meleod vaccum gauge
 - b. Capacitance transducer
 - c. Inductive transducer
 - d. Optical transducer
- Topic 6: Liquid level measurements 4L
- a. Float level devices
 - b. Tilt switch
 - c. Continuous float devices/ indicators
 - d. Magnetically coupled indicators
 - e. Ultrasonic level devices

Topic 7: Density measurements 4L

- a. Double bubbler density measurement
- b. Hydrometer
- c. Chain balanced densitometer

Topic 8: Fluid flow measurements 4L

- 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
4. K.C.College Handbook
5. Industrial instrumentation by D.R.Eckman

VOCATIONAL INDUSTRIAL CHEMISTRY (VOC-211)
S.Y.BSc. Paper – III, Semester- II
Title: Unit processes in organic chemical industries

Objectives : To study different processes required for organic chemical industry.
To study separation and purification of different organic chemical products.

- Topic 1 Nitration 8L
Introduction, reagent of nitration, o/p orientation, synthesis of nitro-benzene, m-dinitro benzene, o-and p-chloronitro benzene, p-nitroacetaanilide.
- Topic 2: Halogenation 6L
Introduction, reagents, synthesis of monochloro acetic acid, chloral, chlorobenzene, trichloro benzene
- Topic 3: Sulphonation 4L
Introduction, reagents, synthesis of benzene sulphonic acid, dodecyl benzene sulphonic acid
- Topic 4: Oxidation 8L
Introduction, reagents, liquid phase oxidation, synthesis of acetaldehyde, acetic acid, benzoic acid, styrene, phthalic anhydride, malic anhydride
- Topic 5: Reduction/ Hydrogenation 8L
Introduction, reagents, catalytic hydrogenation, reduction using acid, chloride hydrogenation of olefins, aromatic compounds, carbonyl 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 2L
Introduction, reagents, methods, synthesis of various amines
- Topic 7: Alkylation 6L
Introduction, types of alkylation, reagents, synthesis of dodecyl benzene, benzene to ethyl benzene, phenyl ethyl alcohol
- Topic 8: Esterification 6L
Introduction, reagents using acids, catalytic esterification, alcoholysis, ester of alkanes and alkynes, synthesis of vinyl acetate, ethyl acetate, cellulose acetate

Reference books:

1. K. C. College handbook
2. Unit processes of organic synthesis by P.H. Groginns

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
Introduction, composition of ordinary cement, manufacture of ordinary cement- mixing, burning, grinding. Uses of cement, various types of cement, setting and hardening of cement.
- 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. 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**

SYLLABUS FOR
INDUSTRIAL MICROBIOLOGY (Vocational)

Summary Chart

Paper	Year	Paper	Name of the Paper
1	I	Theory	Instrumentation and material & Design
2	I	Theory	Introduction to Industrial Microbiology & Cultural Methods and Mathematics & Statistics for Biologists
3	I	Practicals	Based on theory papers and key competency course
4	II	Theory (Voc-IND-MIC-211)	Bio-reactors –Design & Operation
5	II	Theory (Voc-IND-MIC-212)	Screening & Process Optimization
6	II	Theory (Voc-IND-MIC-221)	Microbial Fermentations & Down-stream processing
7	II	Theory (Voc-IND-MIC-222)	Quality Assurance in Industrial Product
8	II	Practicals	Based on theory papers and key competency course
9	III	Theory (Voc-IND-MIC-335)	Pollution Control Technology
10	III	Theory (Voc-IND-MIC-336)	Plant & Animal Tissue Culture
11	III	Theory	Molecular Biology & Genetic Engineering

		(Voc-IND-MIC-345)	
12	III	Theory (Voc-IND-MIC-346)	Industrial management ,law & taxation
13	III	Practicals	Based on theory papers and key competency course

S.Y.B.Sc. Semester I, Paper-4: Bio-reactors – Design & Operation
(Voc-IND-MIC-211)

1) Types of fermenters: (05)

- a) Fermenter configuration
- b) Batch fermenter
- c) Continuous fermenter
- d) Stirred tank fermenter
- e) Tubular fermenter
- f) Fluidized bed fermenter
- g) Solid state fermenter
- h) Hollow fibre reactors

2) Parts of fermenter: (20)

- a) Body construction and temperature control
- b) Aeration and agitation: Aerator (sparger),
Agitation (Impellers,baffles)
- c) Achievement and maintenance of aspeptic 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
- d) Piping and Valves
- e) Factors affecting design
- f) Fermenter operation modes
(Single, dual, multiple, batch, continuous)
- g) 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.
- 3) McNeil, B. and Harvey, L.M. (Eds.) Fermentation, A Practical Approach. IRL Press, Oxford.
- 4) Aiba, S., Humphrey, A.L. and Millis, N.F. (1973). Biochemical Engineering (2nd edition), Academic Press, New York

S.Y.B.Sc. Semester I, Paper-5: Screening and Process Optimization
(Voc-IND-MIC-212)

1) Microbial Diversity and Screening: (10)

- 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 unculcharable bacteria
- b) Screening :
 - i. Primary screening
 - ii. Secondary Screening
 - iii. Targeted Screeing

2) Process Optimization: (16)

- a) Strain improvement and Maintenance of industrially important microorganisms
- b) Inoculum build-up
- c) Media formulation
 - i. Raw materials : Source of 'C', 'N', amino acids, vitamins, minerals, pH, water, buffering solutions, antifoam agents, precursors
 - ii. Media Optimization – Plackett- Burman design
 - iii. Media sterilization- Different methods, decimal reduction time, del factor.

3) Process Control: (14)

- 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: (08)

- a) Objectives of scale-up
- b) Levels of fermentation
- c) Parameters to be scaled-up fermenter design, media, sterilization of media, etc.

References:

- 1) Casida,L.E.,1984, Industrial Microbiology. Wiley Eastern, New Delhi
- 2) Aiba, Shuichi, 1973, Biochemical Engineering, 2nd Ed. Academic Press
- 3) Stanbury, P.F. and Whitaker, A., Principles of Fermentation Technology, Pargamon Press.
- 4) Patel, A.H. , Industrial Microbiology.
- 5) Comprehensive Biotechnology Vol I, II, III

S.Y.B.Sc. Semester II, Paper-6: Microbial Fermentations and Down Streaming Processing
(Voc-IND-MIC-221)

1) Industrial production of: (24)

- 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- (24)

- 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 tableting)

References:

- 1) Casida, L.E., 1984, Industrial Microbiology. Wiley Eastern, New Delhi
- 2) Stanbury, P.F. and Whitaker, A., Principles of Fermentation Technology, Pargamon Press.
- 3) Prescott, S.C. and Dunn, C.G., 1983, Industrial Microbiology, Reed G. (Ed.). AVI Tech books.
- 4) Peppler, H.J. (Ed), 1979, microbial Tecnology, Vols I and II, A. P.

S.Y.B.Sc. Semester II, Paper-7: Quality Assurance in Industrial Product
(Voc-IND-MIC-222)

1) Introduction to various pharmacopoeias: (06)

IP, BP, USP

2) Introduction to various standards: (06)

ISO, URO, ISI, FDA, FPO, AGMARK, etc.

3) Introduction to pharmaceutical GMP and CGMP (WHO) (04)

4) Product testing with respect to: (12)

- 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: (20)

- 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:

- 1) Casida, L.E., 1984, Industrial Microbiology. Wiley Eastern, New Delhi
- 2) I. P. / B. P. / U. S. P.

**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
 - ii) 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 down streaming 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. **6**
- II. **Camera Lens:** Optical materials, Plastics/ Glass, Lens coating, Types of lenses- Normal/ Standard, Telephoto, Teleconverter, Wide angle, fish Eye lens, Zoom, micro lens, macro lens. Supplementary lenses-Close up lens. Extension tubes faults in lenses. Aberrations, Resolution, Flare, and Ghost image etc. Lenses for digital camera, cropping factor **8**
- 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 **8**
- IV. **Lighting:** Types of light Sources, Natural and artificial light. Hard & soft light. Basic lighting set up for a portrait. Key, Fill, Back & Top light. Brightness ratio and lighting ratio. Lighting for different subjects. Flash light, Flash curves, Electronic flash. Flash synchronization for different shutter speeds. Studio Flash lights. **8**
- V. **Techniques of Photographing Action:** Lazy shutter, Freeze-action Blurring, Superimposition, double exposure, and multiple exposures. **4**
- 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. **4**
- VIII. **Sensitometry/ Densitometry:** Characteristic curve and its significance. Use of the Characteristic curve for the analysis of photographic image. **4**
- IX. **Aesthetics:** Different formats and their use. Geometric elements of composition. **6**

References:

1. The 35 mm Hand Book- Michael Freeman
2. Focal encyclopedia of Photography, Focal Press.
3. Basic Photography- M.J. Langford, Focal Press.
4. Advanced Photography (Vol.-I & Vol.-II) - M.J. Langford, Focal Press.
8. Creative Colour Photography Techniques- Marshall Cavendish.
9. Colour How to see it, How to paint it- Judy Martin (Chartwell Books Inc.)
10. Making Colour Prints- Jack H.Coote (Focal Press)
11. Applied Photographic Optics- Sidney F. Ray; Focal Press
12. The Practical Guide to Photographic Lighting, John Tarrant, Focal Press
13. 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.
8
 - II. **Filters for Colour Photography:** Need of filters in colour photography. UV filter, Polarizing Filter, Sky-light Filter, Colour conversion filters, colour compensation filter, colour/ light balancing filters.
6
 - III. **Colour Materials:** Cross-section of an integral tripack film. Characteristic curves for colour negative and colour transparency films. Cross-section of colour papers and their types.
6
 - 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.
3

- 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. **8**
- VI. **Process:** C-41, EP-2, E-6 and RA-4 Processes. **3**

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 **6**

VIII Asset Management

Digital asset management, Workflow sequence. **4**

IX Exposure

Intensity and duration, TTL light meters, Flash meter **4**

References:

1. The 35 mm Hand Book- Michael Freeman
2. Focal encyclopedia of Photography, Focal Press.
3. Basic Photography- M.J. Langford, Focal Press.
4. Advanced Photography (Vol.-I & Vol.-II) - M.J. Langford, Focal Press.
5. Creative Colour Photography Techniques- Marshall Cavendish.
6. Colour How to see it, How to paint it- Judy Martin (Chartwell Books Inc.)
7. Making Colour Prints- Jack H.Coote (Focal Press)
8. Digital Photography in Available Light- Essential Skills- mark Galer, (Focal Press)
9. Studio Photography- Essential Skills- John Child, (Focal Press)
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**

S.Y.B.Sc.: Paper-II: Principles of Acoustics & Sound for Media
Semester-I

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.
3. Acoustic Measurements: Berenek.
5. Audio and video system: R.G.Gupta.

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**

S.Y. B. Sc. (Vocational Photography)

Semester II

Principles and Applications of Analog and Digital Communications

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 10

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 & it's characteristics.

2 Analog Modulation 10

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 10

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 10

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, Compandings, 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 8

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.
3. Principles of communication engineering: Anok sinha.
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**
 - 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: **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.
20. Study of human audibility response.
21. Frequency response of a Loudspeaker.
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 introduce 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:

Class	Paper	Paper	Paper
F. Y. B. Sc. (First term)	Paper I: Voc. ST- 011: Morphology, Seed development, and Testing for Cultivar Genuineness.	Paper II: Voc. ST- 012: Seed Physiology	Paper I: Voc. ST- 013: Practical based on Paper I and II.
F. Y. B.Sc. (Second term)	Paper I: Voc. ST- 011: Plant Breeding for Crop Improvement.	Paper II: Voc. ST- 012: Seed Production	
S. Y. B. Sc. (First term)	Paper III: Voc. ST- 213: Hybrid Seed Production.	Paper IV: Voc. ST- 214: Seed Testing	Paper II: Voc. ST- 225: Practical based on Paper III and IV.
S. Y. B. Sc. (Second term)	Paper III: Voc. ST- 223: Vegetable seed production	Paper IV: Voc. ST- 224: Seed Quality Control	
T. Y. B. Sc. (First term)	Paper V: Voc. ST- 315: Seed pathology and Entomology	Paper VI: Voc. ST- 316: Seed Farm Management, Processing and Storage.	Paper III: Voc. ST- 327: Practical based on Paper V and VI
T. Y. B. Sc. (Second term)	Paper V: Voc. ST- 325:	Paper VI: Voc-ST-326: Biotechnological Approaches in Seed Technology.	

Visit to a seed company in the First and Second year.

S. Y. B. Sc. Seed Technology (Vocational)

Paper III: Voc. ST- 213 Hybrid Seed Production

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) Defination,	
2) Genetic basis,	
3) Commercial utilization.	
Chapter-2: Apomixis.	3L
1) Defination,	
2) Types and Significance.	
Chapter-3: Male sterility	5L
1) Defination 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) Defination,	
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) Defination 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:

1. Principle of plant breeding- R. W. Allard.
2. Plant Breeding- B. D. Singh.
3. Breeding Asian field crops- J. M. Poehlman and D. N. Borthakur.
4. Practicals in Plant Breeding- M. M. Bhandari.
5. Cytogenetics and plant breeding- Chandrasekharan and Parthasarthy.
6. Male sterility in higher plants- M. L. H. Kaul.
7. Handbook of seed inspectors- Central Seed Committee, Ministry of Agriculture.
8. Seed Technology- R. L. Agrawal. 1987. Oxford and IBH Publishing Co. New Delhi.
9. Seed production manual- NSC and Rockefeller Foundation publication.
10. Principles of seed certification and testing- N. P. Nema.
11. An introduction to seed technology- T. R. Johnson.
12. Techniques in seed science and technology- P. K. Agrawal and D. Dadlani.

Paper IV: Voc. ST- 214
Seed Testing

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 SSSL.
3. To learn about the need, plan, layout and requirements for establishing a private seed-testing laboratory.

Chapter-1: Introduction	2L
1) Importance and history	
Chapter-2: Organizations and Seed testing	4L
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	6L
1) Layout and Furnishing,	
2) Staffing,	
3) Equipments and their maintenance.	
Chapter-4: Seed sampling	6L
1) Defination of seed sampling,	
2) General principals of sampling,	
3) Kinds and procedure of Seed sampling	
Chapter-5: Receipt and registration of Samples	9L
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	5L
1) Defination of purity components,	
2) Procedure,	
3) ODV test,	
4) Reporting of results.	
Chapter-7: Moisture Testing	4L
1) By air oven method,	
2) Moisture meters.	
Chapter-8: Germination Testing	7L
1) Defination 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	3L
1) Principle,	
2) Generalized procedure.	

REFERENCES:

1. Principle of plant breeding- R. W. Allard.
2. Plant Breeding- B. D. Singh.
3. Breeding Asian field crops- J. M. Poehlman and D. N. Borthakur.
4. Practicals in Plant Breeding- M. M. Bhandari.
5. Cytogenetics and plant breeding- Chandrasekharan and Parthasarthy.
6. Seed Technology- R. L. Agrawal. 1987. Oxford and IBH Publishing Co. New Delhi.
7. Seed production manual- NSC and Rockefeller Foundation publication.
8. Principles of seed certification and testing- N. P. Nema.

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.
- h. Stigma extrusion: Process of stigma extrusion and hour of extrusion.
- 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.
- 5) Moisture Testing by: a) Oven method, b) Moisture meter.
- 6) ODV Test.
- 7) Seed vigour testing.
- 8) Determination of weight.

Paper III: Voc. ST- 223
Vegetable Seed Production

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	2L
Chapter-2: Reproduction	4L
1) Definition and Types of Reproduction	
2) Asexual Reproduction (Vegetative and Apomixis)	
3) Sexual Reproduction	
a. Microsporogenesis	
b. Megasporogenesis	
c. Fertilization	
Chapter-3: Pollination Mechanism	8L
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	8L
1) Introduction	
2) Objectives and Types	
3) Procedure	
Chapter-5: Breeding Methods	6L
1) Introduction	
2) Selection	
a. Pure line selection	
b. Pedigree selection	
c. Bulk method	
Chapter-6: Population Improvement	5L
1) Introduction	
2) Objectives and Methods	
3) Mass selection	
4) Progeny selection	
5) Applications and achievements	
Chapter-7: Classification of Vegetable Crops	2L
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:

1. Breeding procedure for cross-pollinated vegetable crops- V. Swarup. 1977. Indian Council of Agricultural Research, New Delhi.
2. Breeding field vegetables- N. L. Innes. 1983. Asian Vegetable Research and Development Centyre. Tainan... Taiwan.
3. Vegetable Breeding- Kallo. 1985.
4. Breeding vegetable crops- M. J. Bassett. 1986. AVI Publishing Company.

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:

1. Techniques in seed science and technology- P. K. Agrawal and D. Dadlani. 1990. South Asian Publishers, New Delhi.
2. Seed technology- R. L. Agrawal. 1987. Oxford and IBH Publishing Co. New Delhi.
3. Seed Biology Vol. III- T. T. Kozłowski. 1972 Ed. Academic Press, New York and London.
4. Indian minimum seed certification standards- N. S. Tunwar and S. V. Singh. 1988. The central seed certification Board, Dept. of Agricultural and cooperation, Ministry of Agriculture, New Delhi.

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 of types in seed production crops.
- 5) Visit to seed quality control laboratory of reputed seed company.

Visit to seed processing plant.

LIST OF WBSITES:

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**