

Course Title:	Computer Basics and Cyber Safety SEC - 518-T	Course Code SEC-518-T
Total Lecture hour 52		Hours
Unit I	Windows A - Desktop, screensaver, wallpaper, notepad, word Pad, Calculator, paint Document Management Floppy Management	10
Unit II	MS Word A-Menu (File, edit, view etc) B- Text formatting (indent margins, page breaks bullets, drop cap, borders tabs stops) C-Toolbars (word art, tables and borders, auto-text, standard, formatting, drawing) D- Mail merge	14
Unit III	MS Excel A - Features (work book & worksheets) B- Menus (File, edit, Insert, format, tools data etc.) Anetabet C- Functions (mathematical, statistical, pie, etc.) D- Chart types & features (area, line, pie, etc.) E - Toolbars (formula bar, drawing etc.)	14
Unit IV	: MS Power point A- Feature (different views) B - Elements (File, edit, insert, format, tools, slide show etc.) C- Layout D - Network neighbourhood E - Presentation Unit V: Corel Draw A - Designing tools 8 - Fills (pattern, texture etc.) C - Additional tools like trim, weld etc.) D - Measurements E - Layout Internet A.Browsers B- Getting to the net A- C - E-mail. Chat etc 1-Different Kinds of Cyber Crimes and their Remedies 2-Internet Safety Rules 3- Cyber Security Associations and Organizations 4-Available Software for Cyber Safety 5-Cyber Laws in India	14


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Skill Enhancement Courses (SEC) for PG Students

SEC-519-T

Type: Skill Enhancement Course (SEC)

Credits: 04 Total Hours: 60 (Theory + Practical)

1: PARASITOLOGY

Max. Marks: 100 Total Hours: 60

Course Objectives (COs):

- Introduce the basic principles of parasitology and life cycles of important parasites.
- Develop understanding of pathogenic mechanisms, host-parasite interactions, and epidemiology.
- Train students in identification and diagnosis of protozoan, helminthic and arthropod parasites.
- Familiarize students with classification, nomenclature and control measures of medically important parasites.
- Provide hands-on skills in microscopic examination and parasitological techniques.

Learning Outcomes (LOs):

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

- Explain life cycles, pathology, transmission and management of major human and animal parasites.
 - Identify protozoan, helminthic and arthropod parasites using permanent slides and smear preparations.
 - Perform blood smear examination and detection of parasitic infections.
 - Describe taxonomic classification and nomenclature of parasites.
 - Understand public health significance and control strategies of parasitic diseases.
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Detailed Course Content (60 Hours)

UNIT I — Introduction to Parasitology

- History and scope of parasitology
 - General life cycle patterns of parasites
 - Types of development and alternation of generation
 - Development of parasites in host tissues
 - Mechanisms of pathogenicity
 - International Zoological Nomenclature for parasites
 - Economic importance of taxonomy in parasitology
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UNIT II — Classification of parasitic protozoa.

- Structure, life history, pathogenicity, treatment and management of: Trypanosomabruceigambiense, T.b.rhodensiense, T.cruzi, T.lewisi, Leishmaniadonovani, Giardia lamblia, Trichomonastenax and Trichomonasvaginalis.
- Structure, life history, pathogenicity, treatment and management of: Entamoeba coli, E. gingivalis, E. histolytica and E. muris.
- Structure, life history, pathogenicity, treatment and management of Eimeratenella, Gregarina, Monocystislumbrici, Plasmodium vivax, P. ovale, P. malaria and P. falciparum.

UNIT III — Parasitic Helminths

- Classification of parasitic helminthes
- Trematodes: *Fasciola hepatica*, *Fasciolopsisbuski*, *Schistosomahaematobium*, *S. mansoni*, *S. japonicum*
- Cestodes: *Taeniasolium*, *Taeniasaginata*
- Nematodes: *Ascarislumbricoides*, *Trichinellaspinalis*, *Trichuristrichiura*, *Dracunculusmedinensis*, *Wuchereriabancrofti* (Structure, life cycle, pathogenicity, symptoms, diagnosis & management)

UNIT IV — Parasitic Annelids and Arthropods

- Classification of parasitic Annelids and Arthropods.
- Structure, life history, pathogenicity, treatment and management of: Glossiphonia, Pontobdella and Hirudomedicinalis.
- Structure, life history, pathogenicity, treatment and management of: Pediculushumanuscapitis, Pediculushumanuscorporis, Phthirus pubis, Cimalexularius, Mites, Ticks, Cattle louse and Xenopsyllacheopis.

Practicals:

1. Examination of blood for parasites.
2. Detection of exflagellation (microgamete formation in Plasmodium).
3. Examination of blood for inicic filarial infection (Papanicoulouhematoxylin and eosin).
4. Permanent slides: Trypanosoma, Leishmania, Giardia, Trichomonas, Entamoeba, Ehrlichia, Eimera, Gregarina, Monocystis, Plasmodium, Fasciola, Schistosoma, Taenia, Ascaris, Trichinella, Trichuris, Dracunculus, Wuchereria, Glossiphonia, Pontobdella, Hirudo, Pediculus, Phthirus, Cimex, Mites, Ticks, Cattle louse and Xenopsylla.

Suggested Books

1. Chakraborty P. — *Textbook of Medical Parasitology*, New Central Book Agency
2. Chatterjee K.D. — *Parasitology*
3. Dasgupta B. — *Parasitology*, Books and Allied Pvt. Ltd.
4. Schmidt G.D. — *Essentials of Parasitology*, Universal Book Stall

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SEC-520-T
APICULTURE
(Honey Bee Keeping)

1. Course Overview

This course imparts hands-on skills in scientific beekeeping, including honeybee biology, hive management, queen rearing, honey extraction, and disease control. It prepares students for employment and entrepreneurship in apiculture, honey processing, and pollination services.

2. Course Objectives (COs)

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

- Understand honeybee species, biology, and colony organization.
- Develop skills in hive construction, inspection, and maintenance.
- Apply scientific methods for queen rearing and colony management.
- Demonstrate skills in honey extraction, processing, and storage.
- Identify and control major bee pests and diseases.
- Acquire entrepreneurship skills for small-scale and commercial beekeeping.

3. Learning Outcomes (LOs)

Students will be able to:

- Identify different honeybee species and castes.
- Manage apiaries, maintain colonies, and ensure optimum productivity.
- Extract and process honey using standard hygienic methods.
- Prevent and manage diseases and pests of bees.
- Prepare business models for beekeeping enterprises.

Course Content (60 Hours)

Unit I: Introduction to Apiculture(15 Hours)

- History and scope of beekeeping in India
- Species of honeybees: *Apis mellifera*, *A. cerana*, *A. dorsata*, *A. florea*
- Colony structure: queen, worker, drone
- Social behaviour and communication in bees
- Basic requirements for establishing an apiary: site selection, climate, flora
- Bee products: honey, wax, royal jelly, propolis, pollen, bee venom

Unit II: Apiary Equipment & Hive Management(15 Hours)

- Types of hives: Langstroth, Indigenous hives
- Hive components: brood chamber, frames, supers, foundation sheets
- Hive construction and maintenance
- Seasonal management of colonies
- Feeding of bees and nutritional requirements
- Swarming, supersedure, absconding – causes and management
- Migration and apiary layout design

Unit III: Queen Rearing, Honey Extraction & Processing(15 Hours)

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- Queen rearing techniques: grafting, supersedure, colony splitting
- Role of queen and brood cycle
- Honey flow season and colony strengthening
- Methods of honey extraction: manual, centrifugal extractor
- Honey processing: filtration, dehydration, storage
- Quality control, FSSAI standards, adulteration testing
- Wax extraction and purification

Unit IV: Bee Pests, Diseases & Apiculture Entrepreneurship (15 Hours)

- Major pests: wax moth, mites (Varroa), ants, wasps, birds
- Diseases: American foulbrood, European foulbrood, Nosema, viral infections
- Preventive and curative measures
- Integrated Pest Management (IPM) in apiaries
- Economics of beekeeping: cost analysis, marketing strategies
- Value-added products: comb honey, flavoured honey, wax crafts
- Beekeeping as a startup: business plan, government schemes, NABARD support

5. Practical Components:

1. Identification of honeybee species and castes
2. Study of apiary tools and equipment
3. Hive inspection techniques
4. Preparation of artificial foundation sheets
5. Queen rearing demonstration
6. Honey extraction using a centrifugal honey extractor
7. Wax extraction and purification
8. Identification of diseases and pests in colonies
9. Preparation of a small apiary project report
10. Visit to bee farm / KVIC / beekeeping training centre

6. Assessment Pattern

Internal Assessment (40 Marks)

- Practical performance
- Field visit report
- Class tests / assignments
- Project / business model preparation

End Semester Exam (60 Marks)

- Theory examination covering Units I-IV

7. Suggested Readings:

- Singh, S. (2010). *Beekeeping in India*. ICAR.
- Crane, E. (1990). *Bees and Beekeeping: Science, Practice and World Resources*. Heinemann.
- Winston, M.L. (1992). *The Biology of the Honey Bee*. Harvard University Press.

SEC

COURSE CODE-SEC-521 -T

Numerical Methods

(Course Category-SEC)

Objectives of the Course

The course aims to provide a broad range of numerical methods for solving mathematical problems. The goal is to provide a basic understanding of the derivation, analysis, and use of these numerical methods along with the error in measurement and inherent limitations of numerical methods is also discussed. The concept of random variables, discrete and continuous distributions, and probability distribution function is explained.

Anju

(Dr. Anju Tanwar)

H.K.

(Dr. H.K. Mahavar)

Unit I

Error Analysis, Interpolation, and Linear Algebraic Equations: Errors in numerical analysis: sources of error, round-off error, computer arithmetic, error analysis, condition and stability, approximation, functional and error analysis, method of undetermined coefficients. Use of interpolation formulae, iterated interpolation, inverse interpolation, Hermite interpolation, and spline interpolation. Solution of linear equations: direct and iterative methods. Calculation of eigenvalues and eigenvectors for symmetric matrices.

(15 Lectures)

Unit II

Nonlinear Equations and Numerical Integration: Solution of nonlinear equations: bisection method, Newton's method, modified Newton's method, method of iteration, Newton's method and method of iteration for a system of equations, Newton's method for the case of complex roots. Integration of a function: trapezoidal and Simpson's rules, Gaussian quadrature formula, singular integrals, double integration.

(15 Lectures)

Unit III

Numerical Methods for Differential Equations and Data Analysis: Integration of ordinary differential equations: predictor-corrector methods, Runge-Kutta method. Simultaneous and higher-order equations. Numerical integration and differentiation of data. Least squares approximation. Fast Fourier Transform (FFT).

(15 Lectures)

Unit IV

Probability Theory and Random Variables: Elementary probability theory. Random variables. Binomial, Poisson, and normal distributions.

(15 Lectures)

Suggested References:

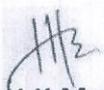
1. A First Course in Numerical Analysis, A. Ralston and P. Rabinowitz, McGraw-Hill, 1985.
2. Introductory Methods of Numerical Analysis, S. S. Sastry, Prentice Hall of India, 1979.
3. Numerical Analysis, R. L. Burden and J. D. Faires, Cengage, 2011.

Course Learning Outcomes:

After successful completion of this course, students will be able to:

1. Understand different types of numerical errors, their sources, and their effect on numerical computations.
2. Analyse the stability, convergence, and efficiency of numerical algorithms.
3. Obtain numerical solutions of nonlinear equations using iterative methods.
4. Apply numerical techniques to solve systems of linear equations and eigenvalue problems.
5. Solve ordinary differential equations and definite integrals using numerical methods.
6. Use numerical techniques for data fitting, interpolation, and Fourier analysis.


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7. Understand the basic concepts of probability theory, random variables, and probability distributions.

COURSE CODE - SEC - 522 - T

Basic Instrumentation Skills

(Course Category-SEC)

Objectives of the Course

After completion of this course, the student will be able to:

1. Understand the basic concepts of measurement including accuracy, precision, errors, resolution, and loading effects.
2. Explain the principles, operation, and specifications of analog measuring instruments such as multimeters, electronic voltmeters, and AC millivoltmeters.
3. Describe the construction and working of oscilloscopes (CRO and DSO) and use them for voltage, frequency, and time measurements.
4. Understand the working principles of signal generators, impedance bridges, Q-meters, and related testing instruments used in electronic measurements.
5. Explain the principles and advantages of digital instruments including digital voltmeters, digital multimeters, and frequency/time measurement using counters.

Unit I

Basic of Measurement: Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. Multimeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance.

Electronic Voltmeter: Advantage over conventional multimeter for voltage measurement with respect to input impedance and sensitivity. Principles of voltage measurement (block diagram only). Specifications of an electronic Voltmeter/ Multimeter and their significance. AC millivoltmeter: Type of AC millivoltmeters. Block diagram ac millivoltmeter, specifications and their significance.

(15 Lectures)

Unit II

Oscilloscope: Block diagram of basic CRO. CRT, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence. Time base operation, synchronization. Front panel controls. Specifications of CRO and their significance.

Use of CRO for the measurement of voltage (dc and ac), frequency and time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: principle of working.

(15 Lectures)

Unit III

Signal and pulse Generators: Block diagram, explanation and specifications of low frequency signal generator and pulse generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis.

Impedance Bridges: Block diagram of bridge. Working principles of basic (balancing type) RLC

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bridge. Specifications of RLC bridge. Block diagram and working principles of a Q- Meter. Digital LCR bridges.

(15 Lectures)

Unit IV

Digital Instruments: Comparison of analog & digital instruments. Characteristics of a digital meter. Working principles of digital voltmeter.

Digital Multimeter: Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/ frequency counter, time-base stability, accuracy and resolution.

(15 Lectures)

Suggested References:

1. A text book in Electrical Technology - B L Theraja - S Chand and Co.
2. Performance and design of AC machines - M G Say ELBS Edn.
3. Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
4. Logic circuit design, Shimon P. Vingron, 2012, Springer.
5. Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
6. Electronic Devices and circuits, S. Salivahanan & N. S.Kumar, 3rd Ed., 2012, Tata Mc-Graw Hill

Course Learning Outcomes:

After successful completion of this course, the student will be able to:

1. Explain fundamental measurement concepts such as accuracy, precision, errors, resolution, and loading effects in electrical and electronic measurements.
2. Describe the working principles, block diagrams, and specifications of analog measuring instruments including multimeters, electronic voltmeters, and AC millivoltmeters.
3. Use oscilloscopes (CRO and DSO) to measure voltage, frequency, and time parameters and interpret waveform characteristics.
4. Explain the operation and applications of signal generators, pulse generators, impedance bridges, and Q-meters used in testing and analysis of electronic circuits.
5. Explain the working principles of digital measuring instruments such as digital voltmeters, digital multimeters, and frequency counters, and evaluate their accuracy and resolution.

COURSE CODE - SEC-523-T

Radiation Safety

(Course Category-SEC)

Objectives of the Course

This course focusses on the applications of nuclear techniques and radiation protection. It will not only enhance the skills towards the basic understanding of the radiation but will also provide the knowledge about the protective measures against the radiation exposure. It imparts all the skills required by a radiation safety officer or any job dealing with radiation such as X-ray operators, nuclear medicine dealing jobs: chemotherapists, PET MRI CT scan, gamma camera etc. operators etc.

Unit I

Basics of Atomic and Nuclear Physics: Basic concept of atomic structure; X-rays characteristic and production; concept of bremsstrahlung and Auger electron; the composition of nucleus and

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its properties, mass number, isotopes of element, spin, binding energy, stable and unstable isotopes, law of radioactive decay, mean life and half-life, basic concept of alpha, beta and gamma decay, concept of cross section and kinematics of nuclear reactions, types of nuclear reaction, fusion, fission.

(15 Lectures)

Unit II

Interaction of Radiation with Matter: Types of radiation: Alpha, Beta, Gamma and Neutron and their sources, sealed and unsealed sources. Interaction of photons – photo-electric effect, Compton scattering, pair production, linear and mass attenuation coefficients. Interaction of charged particles: heavy charged particles – Bethe-Bloch formula, scaling laws, mass stopping power, range, straggling, channelling and Cherenkov radiation. Beta particles – collision and radiation loss (Bremsstrahlung). Interaction of neutrons – collision, slowing down and moderation.

(15 Lectures)

Unit III

Radiation quantities and units: basic idea of different units of activity, KERMA, exposure, absorbed dose, equivalent dose, effective dose, collective equivalent dose, annual limit of intake (ALI) and derived air concentration (DAC).

Radiation detection: Basic concept and working principle of gas detectors (ionization chambers, proportional counter, multi-wire proportional counters (MWPC) and Geiger Muller counter), scintillation detectors (inorganic and organic scintillators), solid state detectors and neutron detectors, thermoluminescent dosimetry.

(15 Lectures)

Unit IV

Radiation Safety Management: Biological effects of ionizing radiation, operational limits and basics of radiation hazards evaluation and control; radiation protection standards, International Commission on Radiological Protection (ICRP) principles, justification, optimization, limitations, introduction of safety and risk management of radiation. Nuclear waste and disposal management. Brief idea about accelerator driven sub-critical system (ADS) for waste management.

Application of nuclear techniques: Application in medical science (e.g., MRI, PET, projection imaging gamma camera, radiation therapy), archaeology, art, crime detection, mining and oil. Industrial uses: tracing, gauging, material modification, sterilization, food preservation.

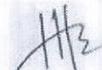
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Suggested References:

1. Basic Ideas and Concepts in Nuclear Physics: An Introductory Approach by K. Heyde, Third Edition, IOP Publication
2. Nuclear Physics by S. N. Ghoshal, First Edition, S. Chand Publication
3. Nuclear Physics: Principles and Applications by J. Lilley, Wiley Publication
4. Fundamental Physics of Radiology by W. J. Meredith and B. Massey, John Wright and Sons, UK
5. An Introduction to Radiation Protection by A. Martin and S. A. Harbison, John Wiley & Sons Inc., New York



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Course Learning Outcomes:

This course will help students in the following ways:

1. Awareness and understanding the hazards of radiation and the safety measures to guard against these hazards.
2. Learning the basic aspects of the atomic and nuclear Physics, especially the radiations that originate from the atom and the nucleus.
3. Having a comprehensive knowledge about the nature of interaction of matter with radiations like gamma, beta, alpha rays, neutrons etc. and radiation shielding by appropriate materials.
4. Knowing about the units of radiations and their safety limits, the devices to detect and measure radiation.
5. Learning radiation safety management, biological effects of ionizing radiation, operational limits and basics of radiation hazards evaluation and control, radiation protection standards, 'International Commission on Radiological Protection' (ICRP) its principles, justification, optimization, limitation, introduction of safety and risk management of radiation, nuclear waste and disposal management, brief idea about Accelerator driven Sub-Critical System 'ADS' for waste management.
6. Learning about the devices which apply radiations in medical sciences, such as MRI, PET.
7. Understanding and performing experiments like Study the background radiation levels using Radiation detectors, Determination of gamma ray linear and mass absorption coefficient of a given material for radiation shielding application.

COURSE CODE - SEC - 524 - T

Medical Instrumentation

(Course Category-SEC)

Objectives of the Course

The course is designed to give the basic concepts of Instrumentation involved in medical field and human physiology. Biomedical Instrumentation is application of technology for medical field. During the course, students will explore Electrophysiological measurements, medical imaging etc. The course will make the students understand the devices used in diagnosing the diseases.

Unit I

Physiology and transducers: Cell and its structure, Resting and Action Potential, Nervous system: Functional organization of the nervous system, Structure of nervous system, neurons, synapse, transmitters and neural communication, Cardiovascular system, respiratory system, Basic components of a biomedical system, Transducers, selection criteria, Piezo-electric, ultrasonic transducers, Temperature, measurements - Fiber optic temperature sensors

(15 Lectures)

Unit II

Electro – Physiological measurements: Electrodes: Limb electrodes, floating electrodes, pre-gelled disposable electrodes, Micro, needle and surface electrodes, Amplifiers: Preamplifiers,

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differential amplifiers, chopper amplifiers, Isolation amplifier. ECG, EEG, EMG, ERG, Lead systems and recording methods, Typical waveforms. Electrical safety in medical environment: shock hazards, leakage current-Instruments for checking safety parameters of biomedical equipment.

(15 Lectures)

Unit III

Non-electrical parameter: Measurement of blood pressure, Cardiac output, Heart rate, Heart sound Pulmonary function measurements, spirometer, Photo Plethysmography, Body Plethysmography, Blood Gas analyzers : pH of blood, measurement of blood pCO₂, pO₂, finger-tip oximeter, ESR, GSR, measurements, Standard HL7

(15 Lectures)

Unit IV

Medical Imaging: Radiographic and fluoroscopic techniques, X rays, Computer tomography, Mammography, MRI, fMRI, Ultrasonography, Endoscopy, Thermography, Different types of biotelemetry systems and patient.

(15 Lectures)

Suggested References:

1. R.S.Khandpur, 'Hand Book of Bio-Medical instrumentation', Tata McGraw Hill Publishing Co Ltd., 2003.
2. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical Instrumentation and Measurements', II edition, Pearson Education, 2002 / PHI.
3. J.Webster, 'Medical Instrumentation', John Wiley & Sons, 1995.
4. L.A. Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumentation', John Wiley & Sons, 1975.

Course Learning Outcomes:

After completing the course, the students will able to:

1. Understand the physiology of biomedical system.
2. Measure biomedical and physiological information.
3. Discuss the application of Electronics in diagnostics and therapeutic area.

COURSE CODE - SEC-525 -T

Disaster Management Techniques

(Course Category-SEC)

Objectives of the Course

A disaster management syllabus covers understanding hazards (natural/man-made), the disaster cycle (mitigation, preparedness, response, recovery), risk/vulnerability assessment, policies (like India's DM Act), technology (GIS, Early Warning Systems), institutional frameworks (NDMA, NGOs), and practical aspects like relief, rehabilitation, and community-based approaches, with a focus on linking development to disaster resilience.

Unit I

Introduction to Disasters: Definitions (hazard, risk, vulnerability, resilience), types (geological, hydrological, biological, man-made), impacts, and global trends.

Disaster Management Cycle: Mitigation, Preparedness (planning, early warning, training),



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Response (search, rescue, relief, medical), and Recovery (reconstruction, rehabilitation).

(15 Lectures)

Unit II

Risk Reduction & Vulnerability: Vulnerability assessment, hazard mapping, community-based disaster risk reduction (CBDRR), and climate change adaptation.

Policies & Governance: National Disaster Management Policy, Acts (India's DM Act, 2005), role of central/state/local bodies (NDMA, SDMA, NDRF).

(15 Lectures)

Unit III

Technology & Tools: Remote Sensing (RS), Geographic Information Systems (GIS), Information & Communication Technology (ICT) in early warning and response.

Social & Health Aspects: Psychological response, trauma care, public awareness (IEC), gender/caste impacts, and disaster medicine

(15 Lectures)

Unit IV

Emergency Response: Logistics, communication, medical response, search & rescue, managing panic.

Rehabilitation & Development: Post-disaster recovery, sustainable reconstruction, livelihood creation, linkage with development.

Case Studies: Analysis of major disasters (e.g., earthquakes, floods, pandemics) in India and globally.

(15 Lectures)

Suggested References:

1. Disaster Management Guidelines, GOI-UND Disaster Risk Program (2009-2012)
2. Damon, P. Copola, (2006) Introduction to International Disaster Management, Butterworth Heineman.
3. Gupta A.K., Niar S.S and Chatterjee S. (2013) Disaster management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, Delhi.
4. Murthy D.B.N. (2012) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.
5. Modh S. (2010) Managing Natural Disasters, Mac Millan publishers India

Course Learning Outcomes:

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

1. Explain about concepts of disaster management and types of disasters
2. Explain the Vulnerability profile of India & legal framework in India
3. Discuss about techniques about early warning systems for disaster risk reductions
4. Describe the policy and programmers for disaster risk reductions in India
5. Demonstrate rescue and relief operation in India during disaster

COURSE CODE - SEC-526-T

Basic IT Tools

(Course Category-SEC)

Objectives of the Course

1. To enable students develop IT skills that are a prerequisite in today's work environment.
2. To equip them with basic computing skills that will enhance their employability in general.
3. To enable the student to analyse and present information in a meaningful manner.

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Unit I

Introduction to Spreadsheet: Spreadsheets: Concept of worksheets and workbooks, creating, opening, closing and saving workbooks, moving, copying, inserting, deleting and renaming worksheets, working with multiple worksheets and multiple workbooks, controlling worksheet views, naming cells using name box, name create and name define; Exchanging data using clipboard, object linking and embedding; Printing and Protecting worksheets: Adjusting margins, creating headers and footers, setting page breaks, changing orientation, creating portable documents and printing data and formulae; Implementing file level security and protecting data within the worksheet; Understanding absolute, relative and mixed referencing in formulas, referencing cells in other worksheets and workbooks, correcting common formula errors, working with inbuilt function categories like mathematical, statistical, text, lookup, information, logical, database, date and time and basic financial functions.

(Lectures 15)

Unit II

Data Analysis in Spreadsheets: Consolidating worksheets and workbooks using formulae and data consolidate command, choosing a chart type, understanding data points and data series, editing and formatting chart elements, and creating sparkline graphics, Analyzing data using pivot tables: Creating, formatting and modifying a pivot table, sorting, filtering and grouping items, creating calculated field and calculated item, creating pivot table charts, producing a report with pivot tables. Introduction to recording and execution of macros.

(Lectures 15)

Unit III

Word Processing: Introduction: Creating and saving your document, displaying different views, working with styles and character formatting, working with paragraph formatting techniques using indents, tabs, alignment, spacing, bullets and numbering and creating borders; Page setup and sections: Setting page margins, orientation, headers and footers, end notes and foot notes, creating section breaks and page borders; Working with tables: Creating tables, modifying table layout and design, sorting, inserting graphics in a table, table math, converting text to table and vice versa, Create newspaper columns, indexes and table of contents, Spell check your document using inbuilt and custom dictionaries, checking grammar and style , using thesaurus and finding and replacing text; Create bookmarks, captions and cross referencing, adding hyperlinks, adding sources and compiling and bibliography; Mail merge: Creating and editing your main document and data source, sorting and filtering merged documents and using merge instructions like ask, fill-in and if-then-else; Linking and embedding to keep things together.

(Lectures 15)

Unit IV

Databases: Introduction to Database Development: Database Terminology, Objects, Creating Tables, working with fields, understanding Data types, Changing table design, Assigning Field Properties, Setting Primary Keys, using field validation and record validation rules, Indexing, working with multiple tables, Relationships & Integrity Rules, Join Properties, Record manipulation, Sorting & Filtering; Select data with queries: Creating Query by design & by wizard (Select, Make Table, Append, Delete, Cross Tab, Update, Parameterized Query, Find Duplicate and Find Unmatched), Creating multi table queries, creating & working with table joins. Using operators & expressions: Creating simple & advance criteria; Working with forms: Creating Basic



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forms, working with bound, unbound and calculated controls, understanding property sheet, Working with Data on Forms: Changing Layout, creating Sub Forms, creating list box, combo box and option groups; Working with Reports: Creating Basic Reports, Creating Header & Footer, Placing Controls on reports, sorting & grouping, Creating Sub reports.

(Lectures 15)

Course Learning Outcomes:

The Learning Outcomes of this course are as follows:

1. By studying this course, students will be able to use word-processor to generate documents with appropriate formatting, layout, review and referencing.
2. By studying this course, students will be able to manage data in worksheets and workbooks and analyze it using spreadsheet functions and built-in formulas.
3. By studying this course, students will be able to draw an analysis on data using spreadsheets to make decisions.
4. By studying this course, students will be able to make meaningful representations of data in the form of charts and pivot tables.
5. By studying this course, students will be able to manage data in database tables and use the same for generating queries, forms and reports.

Suggested References:

1. Swinford, E., Dodge, M., Couch, A., Melton, B. A. (2013). Microsoft Office Professional 2013. United States: O'Reilly Media.
2. Wang, W. (2018). Office 2019 For Dummies. United States: Wiley. Microsoft
3. Lambert, J. (2019). Microsoft Word 2019 Step by Step. United States: Pearson Education.
4. Jelen, B. (2013). Excel 2013 Charts and Graphs. United Kingdom: Que.
5. Alexander, M., Jelen, B. (2013). Excel 2013 Pivot Table Data Crunching. United Kingdom: Pearson Education.
6. Alexander, M., Kusleika, R. (2018). Access 2019 Bible. United Kingdom: Wiley.

COURSE CODE - 527-T

E-Tourism

(Course Category-SEC)

Objectives of the Course

Introduce students to the fundamentals of tourism and e-tourism.

1. Develop digital skills related to online tourism services and platforms.
2. Familiarize students with e-commerce, digital marketing, and data usage in tourism.
3. Provide exposure to emerging technologies used in smart tourism.
4. Enhance interdisciplinary employability skills relevant to the digital service sector.

Unit I

Concept, definition, and types of tourism, Components and stakeholders of tourism industry, Evolution of tourism and global tourism trends, Introduction to e-tourism: scope and significance, Role of Information and Communication Technology (ICT) in tourism, E-tourism ecosystem and digital value chain, Online Travel Agencies (OTAs) and Global Distribution Systems (GDS).


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Unit II

Fundamentals of e-commerce and business models, Online reservation and booking systems, Digital payment systems and fintech applications, Tourism websites and mobile applications, Customer Relationship Management (CRM) in tourism, Cyber security, data privacy, and consumer protection, Legal and ethical aspects of e-tourism.

Unit III

Digital marketing concepts and tools, Search Engine Optimization (SEO) and social media marketing, Online branding and content management, Role of big data and analytics in tourism, Introduction to Artificial Intelligence in tourism, GIS and location-based services in tourism, Online reviews, feedback systems, and reputation management.

Unit IV

Smart tourism and smart destinations, Internet of Things (IoT) applications in tourism, Virtual Reality (VR) and Augmented Reality (AR) in tourism, Sustainable and eco-friendly tourism through digital platforms, E-tourism entrepreneurship and start-ups, Challenges and future prospects of e-tourism, Case studies of national and international e-tourism initiatives.

Suggested References:

1. Buhalis, D., E-Tourism: Information Technology for Strategic Tourism Management, Pearson Education.
2. Sheldon, P. J., Tourism Information Technology, CABI Publishing.
3. Höpken, W., Gretzel, U., & Law, R. (Eds.), Information and Communication Technologies in Tourism, Springer.

Course learning outcomes:

After successful completion of this course, students will be able to:

1. Understand the concepts, structure, and evolution of e-tourism.
2. Use digital platforms and online tools for tourism-related services.
3. Apply e-commerce and digital marketing techniques in tourism operations.
4. Analyze the role of data analytics and emerging technologies in tourism.
5. Evaluate sustainability, ethical, and security issues in e-tourism.
6. Demonstrate skill-based competence applicable to technology-driven industries.

COURSE CODE - SEC-528 -T

Cyber Sphere & Security: Global Concern

(Course Category-SEC)

Objectives of the Course

To spread awareness and enlightening visions of the indiscriminate and diversified students to ensure their immediate and basic cyber safety and prevent loss due to sheer ignorance.

Unit I

Introducing Cyber Sphere and Security: Cyber Terminologies: Cyber Sphere, Cyber Security, Cyber Crime, Cyber Attack, Cyber Espionage, Cyber Warfare, Cybernetics Cyber Security and Paradigms, Cyber Security: Objectives and Roles.

Cyber Crime: Insight, Mitigation and Control: Cyber Crime and Cyber Activism: An Overview. Typologies of Cyber Crimes: Generic Cyber Crimes, Advanced Persistent Threats (APTs), Cyber

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Unit II

Security Threat Management, Risk Assessment: Forensic Analysis: Security threat correlation, Threat awareness, Vulnerability sources and assessment, Vulnerability assessment tools, Threat identification, Threat Analysis, Threat Modeling, Model for Information Security Planning.

Cyber Policies and Cyber Law: Cyber Policies and Cyber Law, Dimensions, Determinants, Dilemmas Existing Cyber Policies and Must Follow Up Actions Grey Areas in Cyber Laws.

(Lectures 15)

Unit III

Security Tools and Usage: Knowledge and Identification of Security Tools Cyber Security Aspects, Cyber Security Toolkits.

Security Elements: Authorization and Authentication- types, policies and techniques: Security certification, Security monitoring and Auditing, Security Requirements, Specifications- Security Policies and Procedures, Firewalls, IDS, Log Files, Honey Pots.

(Lectures 15)

Unit IV

Cyber Security: Case Studies, Government Institutions, Banks and Financial Institutions, Commercial Websites, Point of Sale issues and Online Payment, Real Time Cases.

Access control, Trusted Computing and multilevel security - Security models, Trusted Systems, Software security issues, Physical and infrastructure security, Human factors: Security awareness, training, Email and Internet use policies.

(Lectures 15)

Suggestive References:

1. Swiderski, Frank and Syndex, "Threat Modeling", Microsoft Press, 2004.
2. William Stallings and Lawrie Brown, "Computer Security: Principles and Practice", Prentice Hall, 2008.
3. Joseph M Kizza, "Computer Network Security", Springer Verlag, 2005
4. Thomas Calabres and Tom Calabrese, "Information Security Intelligence: Cryptographic Principles & Application", Thomson Delmar Learning, 2004.
5. Bertrand Venard (2019). 'Cyber Security: The New Art of War', Lecture delivered at Developing Countries Research Centre [drcr], University of Delhi, 1 April 2019.
6. Bertrand Venard (2019). 'The Determinants of Cybersecurity Behaviours: Qualitative Research Among French Students' in C. Onwubiko, X. Bellekens, A.Erola, M. Jaatun and C. Nogueira (eds.), Proceedings of the Cyber Science 2019: Cyber Situational Awareness for Predictive Insight and Deep Learning. UK: University of Oxford.
7. Bertrand Venard (2019). Cybersecurity among students. UK: Wolfson College, University of Oxford.
8. Bertrand Venard (2019). Cyber Aggressions in the XXIst Century: Equation of a Crisis. UK: University of Oxford.
9. Cristopher Hadnagy (2018). Social Engineering: The Science of Human Hacking, 2nd Edition. New York: Wiley
10. John Erickson (2008). The Art of Exploitation (2nd Edition). San Francisco: No Starch Press.
11. Kevin Mitnick and Robert Vamosi (2017). The Art of Invincibility. Boston: Little, Brown and Company.
12. Kevin Mitnick (2012). The Ghost in the Wires: My Adventures as the World's Most Wanted

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Hacker. New York: Back Bay Books.

13. Yogesh Atal and Sunil K Choudhary (2013). Combating Corruption: The Indian Case. Hyderabad and New Delhi: Orient Blackswan

Course Learning Outcomes:

1. After studying this course, students will be able to comprehend key terms of cyber domain and identify cyber threats.
2. After studying this course, students will be able to understand cyber law concepts, intellectual property and Digital Rights Management.
3. After studying this course, students will be able to diagnose and examine basic security loopholes, anomalous behavior in internet.
4. After studying this course, students will be able to understand principles of web security.
5. After studying this course, students will be able to secure and protect personal data with safe Internet usage.
6. After studying this course, students will be able to assimilate approaches for incident analysis and response, risk management and best cyber security practices.

COURSE CODE - SEC - 529 - T
Personality Development and Communication
(Course Category-SEC)

Objectives of the Course

The learning objectives of this course are as follows:

1. To develop interpersonal and effective communication skills.
2. To develop problem-solving skills and understand its influence on the behaviour and attitudes of individuals.

Unit I

Introduction, need for communication, process of communication, written and verbal communication, visual communication, signs, signals and symbols, silence as a mode of communication, inter-cultural, intra-cultural, cross-cultural and international communication, communication through questionnaires, business letter writing, electronic communication.

(15 Lectures)

Unit II

Business cases and presentations, letters within the organizations, letters from top management, circulars and memos, business presentations to customers and other stakeholders, presenting a positive image through verbal and non-verbal cues, preparing and delivering presentations, use of audio-visual aids, report writing.

(15 Lectures)

Unit III

Barriers to communication, improving communication skills, preparation of promotional material, non-verbal communication, body language, postures and gestures, value of time, organizational body language, importance of listening, emotional intelligence, working individually and in a team, leadership skills, leadership lessons, teamwork and team building, feedback, feed forward, interpersonal skills – delegation, humour, trust, expectations, values, status, compatibility and their role in building teamwork, conflict management – types of

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conflicts, how to cope with conflict.

(15 Lectures)

Unit IV

Negotiation skills, types of negotiation, negotiation strategies, selling skills – selling to customers, selling to superiors, selling to peer groups, teammates and subordinates, conceptual selling, strategic selling, selling skills – body language.

(15 Lectures)

Suggested References:

1. Mitra, B. K. – Personality Development and Soft Skills, Oxford University Press.
2. Kumar Sanjay and Pushplata – Communication Skills, Oxford University Press.
3. Mandal S. K. – Effective Communication and Public Speaking, Jaico Publishing.
4. Kushal Jin – Business Communication, VK India.
5. Krishnamacharyulu, C. S. G. & Ramakrishnan Lalitha – Personality Development, Interpersonal Skills and Career Management, Himalaya Publishing.
6. Corvette Budjac – Conflict Management: A Practical Guide to Developing Negotiation Strategies, Pearson.

Course Learning Outcomes:

The learning outcomes of this course are as follows:

1. After studying this course, students will be able to understand the importance of oral and written communication in the day-to-day working of an organization.
2. After studying this course, students will be able to develop interpersonal skills and problem-solving skills.
3. After studying this course, students will be able to understand the role of body language in effective communication.

COURSE CODE - SEC 530 - T Material Characterization Techniques

(Course Category-SEC)

Objective of the course

This course intends to provide knowledge on the advanced characterization techniques used to identify the physical and chemical properties of new materials prepared in laboratories. This includes, electrical, optical, magnetic, and dielectric properties of materials to suit specific application. The student will have the experience of different characterization techniques used in experimental condensed matter physics with the available theories, operation and instrumentation.

Unit I

Structure analysis: X-ray diffraction (XRD). Basic principle, Fourier analysis of the basis, structure factor and Atomic form factor, indexing and lattice parameter determination, features of XRD experiment, film negative and Straumannis, chamber, powder method, Laue method, information from peak position, intensity and width of XRD pattern. Crystal size and microstrain determination by Scherrer, modified Scherrer and Williamson-Hall methods.

(15 Lectures)


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Unit II

Imaging Techniques: Optical microscopies, Electron-Beam Specimen Interaction, Secondary and backscattered electrons, Interaction cross section and volume, Scanning electron microscope (SEM), Operational systems of SEM instrumentation and imaging modes, energy dispersive X-ray spectroscopy, transmission electron microscopy (TEM), selected area electron diffraction, pattern writing using optical and electron beams.

(15 Lectures)

Unit III

Spectroscopies: Characterization of fluorescence emission, Jablonski diagram, fluorescence quantum yield and life time, instrumentation for fluorescence spectroscopy, absorption and photoluminescence spectroscopy, Tauk plot, energy band gap determination, Raman spectroscopy, Fourier transform infrared spectroscopy, X-ray spectroscopy, X-ray photoemission spectroscopy, X-ray absorption spectroscopy, Nuclear magnetic resonance (NMR) spectroscopy.

Surface Morphology and Topography: Scanning probe microscopy, scanning tunnelling microscope (STM), atomic force microscope (AFM) concept and modes of operation of STM and AFM, conducting AFM.

(15 Lectures)

Unit IV

Physical Properties: Electrical measurements: Resistivity, temperature dependence of resistivity in materials, resistance in bulk and low dimensional systems, Current-voltage characteristics, elimination in resistivity using four probe Van-der Pauw methods.

Dielectric and magnetic measurements: Frequency dependence on capacitance-voltage characteristics, estimation of dielectric constants. diamagnetics, paramagnetics, ferromagnetics B-H loop, operation and analysis of vibrating-sample magnetometry, ferroelectrics, polarization electric field loop.

(15 Lectures)

Suggested References:

1. X-Ray Crystallography, M. J. Buerger, Wiley-Blackwell, 9th edition (1966)
2. Elements of X-ray Diffraction, B. D. Cullity, Addison Wesley Inc. (1978)
3. Analytical Electron Microscopy for Materials Science, Z. Shindo and T. Oikawa, Springer-Verlag, Japan; 2nd edition (2002)
4. Handbook of Spectroscopy, edited by Gunter Gauglitz, Tuan Vo-Dinh, Wiley-Vch Verlag GmbH & Co. (2003)
5. Scanning Microscopy: An Introduction to Non-Microscopy, Anne Voegtlin, Scanning Microscopy, Ben Voegtlin, Springer-Verlag, Berlin, Heidelberg (2015)

Course Learning Outcomes:

The students should be able to experience the advanced characterization techniques pursued in the experimental condensed matter physics for analyzing the physical properties of the material in the semiconductor technologies and nanotechnology.


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531-T
BOT SEC-101 (SKILL ENHANCEMENT COURSE)

Plant Diversity and Human Welfare

Unit 1: Plant diversity and its scope- Genetic diversity, Species diversity, Plant diversity at the ecosystem level, Agrobiodiversity and cultivated plant taxa, wild taxa. Values and uses of Biodiversity: Ethical and aesthetic values, Precautionary principle, Methodologies for valuation, Uses of plants, Uses of microbes.

Unit 2: Loss of Biodiversity: Loss of genetic diversity, Loss of species diversity, Loss of ecosystem diversity, Loss of agrobiodiversity, Projected scenario for biodiversity loss, **Management of Plant Biodiversity:** Organizations associated with biodiversity management- Methodology for execution-IUCN, UNEP, UNESCO, WWF, NBPGR; Biodiversity legislation and conservations, Biodiversity information management and communication.

Unit 3: Conservation of Biodiversity: Conservation of genetic diversity, species diversity and ecosystem diversity, *In situ* and *ex situ* conservation, Social approaches to conservation, Biodiversity awareness programmes, Sustainable development.

Unit 4: Role of plants in relation to Human Welfare; a) Importance of forestry their utilization and commercial aspects b) Avenue trees, c) Ornamental plants of India. d) Alcoholic beverages through ages. Fruits and nuts: Important fruit crops their commercial importance. Wood and its uses.

Suggested Readings

1. Krishnamurthy, K.V. (2004). An Advanced Text Book of Biodiversity - Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi

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532-T
BOT SEC-101 (SKILL ENHANCEMENT COURSE)

Bio fertilizers

Unit 1: General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis.

Unit 2: *Azospirillum*: isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms. *Azotobacter*: classification, characteristics – crop response to *Azotobacter* inoculum, maintenance and mass multiplication.

Unit 3: Cyanobacteria (blue green algae), *Azolla* and *Anabaena azollae* association, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation.

Unit 4: Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.

Unit 5: Organic farming – Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field Application.

Suggested Readings

1. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi.
2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
3. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay _Publication, New Delhi.
4. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.
5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New _Delhi.
6. Vayas,S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic _Farming Akta Prakashan, Nadiad

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533 -T
BOT SEC-01 (SKILL ENHANCEMENT COURSE)

Herbal Technology

Unit 1: Herbal medicines: history and scope - definition of medical terms - role of medicinal plants in Siddha systems of medicine; cultivation - harvesting - processing - storage - marketing and utilization of medicinal plants.

Unit 2: Pharmacognosy - systematic position and medicinal uses of the following herbs in curing various ailments; Tulsi, Ginger, Fenugreek, Indian Goose berry and Ashoka.

Unit 3: Phytochemistry - active principles and methods of their testing - identification and utilization of the medicinal herbs; *Catharanthus roseus* (cardiotonic), *Withania somnifera* (drugs acting on nervous system), *Clerodendron phlomoides* (anti-rheumatic) and *Centella asiatica* (memory booster).

Unit 4: Analytical pharmacognosy: Drug adulteration - types, methods of drug evaluation - Biological testing of herbal drugs - Phytochemical screening tests for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds)

Unit 5: Medicinal plant banks micro propagation of important species (*Withania somnifera*, neem and tulsi- Herbal foods-future of pharmacognosy)

Suggested Readings

1. Glossary of Indian medicinal plants, R.N.Chopra, S.L.Nayar and I.C.Chopra, 1956. C.S.I.R, New Delhi.
2. The indigenous drugs of India, Kanny, Lall, Dey and Raj Bahadur, 1984. International Book Distributors.
3. Herbal plants and Drugs Agnes Arber, 1999. Mangal Deep Publications.
4. Ayurvedic drugs and their plant source. V.V. Sivarajan and Balachandran Indra 1994. Oxford IBH publishing Co.
5. Ayurveda and Aromatherapy. Miller, Light and Miller, Bryan, 1998. Banarsidass, Delhi.
6. Principles of Ayurveda, Anne Green, 2000. Thomsons, London.
7. Pharmacognosy, Dr.C.K.Kokate et al. 1999

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534-T
SEC- (SKILL ENHANCEMENT COURSE)

Ethnobotany

Unit 1: Ethnobotany

Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context; Major and minor ethnic groups or Tribals of India, and their life styles. Plants used by the tribals: a) Food plants b) intoxicants and beverages c) Resins and oils and miscellaneous uses.

Unit 2: Methodology of Ethnobotanical studies

a) Field work b) Herbarium c) Ancient Literature d) Archaeological findings e) temples and sacred places.

Unit 3: Role of ethnobotany in modern Medicine

Medico-ethnobotanical sources in India; Significance of the following plants in ethno botanical practices (along with their habitat and morphology) a) *Azadiractha indica* b) *Ocimum sanctum* c) *Vitex negundo*. d) *Gloriosa superba* e) *Tribulus terrestris* f) *Pongamia pinnata* g) *Cassia auriculata* h) *Indigofera tinctoria*. Role of ethnobotany in modern medicine with special example *Rauvolfia serpentina*, *Trichopus zeylanicus*, *Artemisia*, *Withania*. Role of ethnic groups in conservation of plant genetic resources. Endangered taxa and forest management (participatory forest management).

Unit 4: Ethnobotany and legal aspects

Ethnobotany as a tool to protect interests of ethnic groups. Sharing of wealth concept with few examples from India. Biopiracy, Intellectual Property Rights and Traditional Knowledge.

Suggested Readings

- 1) S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
- 2) S.K. Jain (ed.) Glimpses of Indian. Ethnobotny, Oxford and I B H, New Delhi – 1981
- 3) Lone et al., Palaeoethnobotany
- 4) S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists, Lucknow, India.
- 5) S.K. Jain, 1990. Contributions of Indian ethnobotny. Scientific publishers, Jodhpur.
- 6) Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons Chichester
- 7) Rama Ro, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India. Howrah.

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535-T
BOT SEC-101 (SK Mushroom Culture Technology)

Unit 1: Introduction, history. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms. Types of edible mushrooms available in India - *Volvariella volvacea*, *Pleurotus citrinopileatus*, *Agaricus bisporus*.

Unit 2: Cultivation Technology: Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. Pure culture: Medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation - Low cost technology, Composting technology in mushroom production.

Unit 3: Storage and nutrition : Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickles, papads), drying, storage in salt solutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content - Vitamins.

Unit 4: Food Preparation : Types of foods prepared from mushroom. Research Centres - National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value.

Suggested Readings

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
4. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II.

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