SECOND SEMESTER

Math 121 3(3+0) Engineering Mathematics – II

(48 Lectures)

Unit 1	Differential Equations
	Ordinary differential equations of the first, second and arbitrary orders, Exact differential
	equations, Linear differential equations of first order, Linear differential equations of nth
	order with constant coefficients, Complementary functions and particular integrals,
	Simultaneous linear differential equations, Solutions of second order differential equations
	by changing dependent and independent variables, Method of variation of parameters,
	Applications to engineering problems
Unit 2	Laplace Transform
	Laplace transform, Existence theorem, Laplace transform of derivatives and integrals,
	Inverse Laplace transform, Unit step function. Dirac delta function, Laplace transform of
	periodic functions, Convolution theorem, Application to solve simple linear and
	simultaneous differential equations.
Unit 3	Fourier Series and Partial Differential Equations
	Periodic functions, Trignometric series, Fourier series of period 2, Eulers formulae,
	Functions having arbitrary period, Change of interval, Even and odd functions, Half range
	sine and cosine series, Introduction of partial differential equations, Linear partial
	differential equations with constant coefficients of 2 nd order and their classifications -
	parabolic, elliptic and hyperbolic with illustrative examples.
Unit 4	Applications of Partial Differential Equations
	Method of separation of variables for solving partial differential equations, Wave equation
	up to two-dimensions, Laplace equation in two-dimensions, Heat conduction equations up
	to two-dimensions, Equations of transmission Lines
Unit 5	Curve Fitting and Solution of Equations
	Correlation and Regression, Interpolation, Binomial distribution, Poisson distribution,
	Normal distribution, Method of least squares and curve fitting of straight line and
	parabola, Solution of cubic and bi-quadratic equations.
Unit 6	Infinite Series
	Convergence and divergence of series, tests of convergence, Alternating series, absolutely
	and conditionally convergent series, uniform convergence.

Text Books

- 1. Higher Engineering Mathematics, by B S Grewal, Khanna Publishers
- 2. Engineering Mathematics, by Shanti Narayan, S Chand and Co. Ltd.

Reference Books

1. Advanced Engineering Mathematics, by E. Kreyszig, Wiley Eastern

FQA 121 3 (2+1) Food Chemistry

(32 lectures + 16 Practical)

Unit 1 Introduction

Definition, approach to study of food chemistry

Unit2 Water

Definition of water in foods, Physical properties of water and ice, Structure of water and ice, Interaction of water with solutes, Sorption phenomenon, Types of water, Water activity and food spoilage

Unit 3 Carbohydrates

Classification (mono, oligo and poly saccharides), Structure of important polysaccharides (starch, glycogen, cellulose, pectin, hemicellulose, gums), Chemical reactions of carbohydrates, Modified celluloses and starches, Browning reactions in foods

Unit 4 Fats and oils

Classification of lipids. Identification of natural fats and oils using Physical propertiesmelting point, softening point, specific gravity, refractive index, smoke, flash and fire point, turbidity point. Chemical properties-Reichert Meissel value, polenske value, iodine value, peroxide value, saponification value. Auto-oxidation, rancidity, lipolysis, flavour reversion Technology of edible fats and oils (extraction, refining, hydrogenation)

Unit 5 Proteins

Protein classification and structure, properties of proteins (electrophoresis, sedimentation, amphoterism and denaturation,), functional properties of proteins, nature of food proteins (plant and animal proteins), reactions involved in processing, reactions with alkali, enzyme catalysed reactions involving hydrolysis and proteolysis, texturized proteins.

Unit 6 Enzymes

Introduction, classification, enzyme inhibitors (protease, alpha amylase, invertase, other enzyme inhibitors), immobilized enzymes, enzymes in food processing (amylases, proteases, pectinases, oxidoreductases), uses of enzymes in food industry

Unit 7 Flavour

Definition, basic tastes and taste factors, smell sensation, visual appearance and flavour, texture sensation, flavour compounds, flavour enhancers

Unit 8 Natural food pigments

Introduction, food pigments (chlorophyll, carotenoids, anthocyanins and flavonoids, beet pigments)

Unit 9 Food additives

Introduction, importance of food additives in food processing, classification of additives – antioxidants, chelating agents, coloring agents, sweetners, antimicrobial agents, emulsifiers, stabilizers, anticaking agents, thickners, firming agents, clarifying agents, preservatives (class I, II)

Unit 10 Food Toxicology

Definition, scope and general principles of food toxicology, classification of food toxicants, toxicants and allergens in foods derived from plants, animals, marine, algae and mushroom, microbial toxins, derived food toxicants – processing and packaging, toxicology and food additives, toxicological aspects of nutrient supplements, chemicals from processing – auto-xidation products, carcinogens in smoked foods

Practical Title

- 1 Estimation of moisture content in a given food sample
- 2 Estimation of reducing sugars by Lane and Eynon method
- 3 Estimation of crude fibre content in food samples
- 4 Determination of protein by Kjeldahl's method
- 5 Estimation of total ash, acid soluble and water soluble ash
- 6 Extraction of fat from given food sample by Soxhlet apparatus
- 7 Determination of smoke point and percent fat absorption for different fats and oils

- 8 Determination of percent free fatty acids in given food sample
- 9 Estimation of peroxide value in fats and oils
- 10 Estimation of iodine value in oils
- 11 Estimation of saponification value in oils
- 12 Determination of refractive index of fats and oils
- 13 Determination of specific gravity of fats and oils
- 14 Estimation of antinutritional factors (Trypsin inhibitor) in foods
- 15 Determination of carotenoids with respect to flour pigments
- 16 Estimation of water activity in a given sample of food

Text books

- 1 Food Chemistry, 3rd Ed., Marcell Dekker, New York by O R Fennema
- 2 Food Chemistry CBS Publisher, Delhi by L H Meyer

Reference books

- 1 Enzymes in Food Technology, CRC Press, Canada by R J Whitehurst and B A Law
- ² Food Enzymes, Chapman and Hall, New York *by* Dominic W S Wong
- ³ Food : The Chemistry and its Components, 4th Ed., RSC, UK by T S Coultate
- 4 Mechanism and Theory in Food Chemistry, CBS Publishers by Dominic WS Wong
- 5 Food Facts and Principles New Age International (P) Ltd. Publishers, New Delhi) by N Shakuntala Manay and M Shadaksharaswamy
- 6 Food Chemistry (Springer Publ.) by H D Belitz and W Groech
- 7 Food Chemistry by L W Aurand and A E Wood
- 8 Chemical Analysis of Foods and Food Products by M B Jacobs
- 9 Pearson's Chemical Analysis of Foods by H Egan, R S Kirk, R Sawyer

FQA 122 3 (2+1) Food Microbiology

(32 lectures + 16 Practicals)

Unit 1 Introduction

Definition, history of microorganism in food, scope of food microbiology

Unit 2 Microorganisms important in food industry

Types of microorganisms, their importance in foods, classification of food borne bacteria, their morphology and distinguishing features with examples.

Unit 3 Growth of microorganisms in foods

Intrinsic (pH, moisture content, redox potential, nutrient content, antimicrobial constituents and biological structures) and extrinsic factors (temp., RH, presence and concentration of gases) governing growth of microorganisms in food.

Unit 4 Food spoilage

Chemical changes caused by microorganisms in foods (breakdown of proteins, carbohydrates, fats and other constituents during spoilage), specific microorganisms causing spoilage of milk and milk products, meat, fish, egg, cereals, fruits, vegetables and their processed products, quality defects in canned foods, sugar and confectionary products

Unit 5 Food fermentations

General description of fermenters, parts and their functions, different types of fermentations (static, submerged, agitated, batch, continuous). Microbial culture selection by screening methods and strain improvement. Starter cultures - definition, types, Fermentation - definition, types (acid, alcohol). Fermented foods - types, methods of manufacture for vinegar, ethyl alcohol, cheese, yoghurt, baker's yeast and traditional Indian foods.

Unit 6 Microbial Foodborne Diseases

Introduction, types of microbial foodborne diseases (foodborne intoxications and foodborne infections), symptoms and prevention of some commonly occurring food borne diseases.

Unit 7 Food Preservation

Principles of preservation, methods of food preservation – high temperature, low temperature, drying, radiation, chemical preservatives, bio-preservatives, hurdle technology, active packaging, novel processing technologies.

Practical Title

- 1 Safety guidelines in food microbiology laboratory
- 2 Cleaning and sterilization of glassware
- 3 Enumeration of coliforms, yeasts and molds and total viable bacteria in fruits and vegetables. dairy products
- 4 Enumeration of coliforms, yeasts and molds and total viable bacteria in dairy products.
- 5 Enumeration of aerobic spore forming bacteria in food sample.
- 6 Estimation of alcohol content in fermented product
- 7 Isolation and identification scheme for detection of Salmonella in foods
- 8 Casein hydrolysis by microorganism on SMA
- 9 Starch hydrolysis by microorganism using starch agar
- 10 Evaluation of Starter Culture by Starter Activity Test
- 11 Assessment of surface sanitation by swab/rinse method and assessment of personnel hygiene by hand wash
- 12 To study the given sample (milk) using Methylene blue reduction test (MBRT)
- 13 To find total viable bacteria and coliforms in water by membrane filtration technique
- 14 To study microflora of air
- 15 Evaluation of canned products for anaerobic spore formers
- 16 Preparation of Yoghurt

Text books

1 Food Microbiology, TMH, New Delhi by W C Frazier & D C Westhoff

2 Modern Food Microbiology, CBS Publication, New Delhi by J M Jay

Reference books

- 1 Essentials of Food Microbiology, Arnold, London *by*John Garbutt
- ² Microbiology,5th Ed., TMH, New Delhi *by* M J Pelczar, E C S Chan and Noel R Krieg
- 3 Microbiology of Safe Food, Blackwell Science, Oxford by S J Forsythe
- 4 Developments in Food Preservation Elsevier Applied Science Publishers, London and New York *by* Stuart Thorne
- 5 Fundamentals of Food Microbiology AVI Publishing Co. Inc., Connecticut, USA by M L Fields
- 6 Microbiology of foods by J C Ayres, J O Mundt, W E Sandine, W H Freeman

FPE 1213(1+2)Basic Civil Engineering

(16 Lectures + 32 Practical)

Unit 1 Introduction

Role of Civil Engineering in the field of engineering, technology and infrastructure.

Unit 2 Structural Design

Building systems; design loads. Building drawing conventions; Elementary building byelaws; building classification. Structural steel work.

Unit 3 Design and drawings

The theory of projections – Introduction. Types of axonometric drawings. Perspective drawings (one point, two point). Oblique drawings. Orthographic projection (Parallel projection). Isometric drawing. Different rendering techniques and rendering symbols used in architectural drawings.

Unit 4 Material of construction

Materials of construction; building components and their requirements.

Unit 5 Basic Construction

Foundations – definition, purpose of foundation, causes of failure of foundation. Elements of Building Construction: Walls and types. Masonry – stone masonry, brick masonry. Stairs, lintels and arches. Plastering and pointing. Roof and roof coverings. Damp proofing and water proofing.

Unit 6 Low cost building

Specification for low cost buildings.

Unit 7 Estimating and Costing

Preliminary estimates for building / projects.

Unit 8 Safety measures

Causes and prevention of cracks in buildings.

Practical Title

- 1-2 Studies of building material, property and characterization.
- 3-4 Studies on engineering materials, construction and properties.
- 5-6 Design and drawing of steel roof truss;
- 7-8 Design and drawing of RCC building;
- 9-10 Types of foundations, Site inspection and preliminary investigation,
- 11 Materials used for damp proofing. Treatment for damp proofing and water proofing.
- 12 A visit to stone masonry and brick masonry sites.
- 13-14 Drawing of different types of stairs.
- 15-18 Preliminary estimates for a building.
- 19-32 Introduction of drawing scales; Principles of orthographic projections; References planes; Points and lines in space and traces of lines and planes; Auxiliary planes and true shapes of oblique plain surface; True length and inclination of lines; Projections of solids (Change of position method, alteration of ground lines); Section of solids and Interpenetration of solid-surfaces; Development of surfaces of geometrical solids; Isometric projection of geometrical solids.

Reference Books

- 1. Basic Civil Engineering, by P. D. Despande Nirali Prakashan, Pune
- 2. Elements of Civil Engineering, by Phadke, Phadke and Palwe, Nirali Prakashan, Pune
- 3. Building Construction by Arora and Bindra,

FPE 122 3 (2+1) Thermodynamics

(32 Lectures + 16 Practicals)

Unit 1 Fundamental Concepts

Introduction: Thermodynamics: terminology, definition and scope, microscopic and macroscopic approaches, engineering thermodynamics: definition, some practical applications of engineering thermodynamics.

System: System (closed system) and control volume (open system), characteristics of system boundary and control surface, surroundings, fixed, moving and imaginary boundaries, examples.

Thermodynamic State: Thermodynamic state, state point, identification of a state through properties, definition and units, intensive and extensive various property diagrams, path and process, quasi-static process, cyclic and non-cyclic processes, restrained and unrestrained processes.

Thermodynamic Equilibrium: Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium. Zeroth law of thermodynamics, temperature as an important property, temperature scale.

Unit 2 Work and Heat

Mechanics, definition of work and its limitations, thermodynamic definition of work and heat, sign convention, displacement works at part of a system boundary and at whole of a system boundary, expressions for displacement works in various processes through p-v diagrams, shaft work and electrical work, other types of work, examples and practical applications.

Unit 3 First Law of Thermodynamics

Statement of the First law of thermodynamics for a cycle, derivation of the first law of processes

Energy, internal energy as a property, components of energy, thermodynamic distinction between energy and work

Concept of enthalpy, definitions of specific heats at constant volume and at constant pressure.

Extension of the First law to control volume, steady state-steady flow energy equation, important applications such as flow in a nozzle, throttling, adiabatic mixing etc., analysis of unsteady processes, case studies.

Unit 4 Properties of Gas and Gas Mixtures

Ideal and Perfect Gases

Differences between perfect, ideal and real gases, equation of state, evaluation of properties of perfect and ideal gases.

Real Gases. Van der Waal's Equation of state, Van der Waal's constants in terms of critical properties, law of corresponding states, compressibility factor; compressibility chart and other equations of state (cubic and higher orders).

Unit 5 Pure Substances

Definition of a pure substance, phase of a substance, triple point and critical points, subcooled liquid, saturated liquid, vapor pressure, two-phase mixture of liquid and vapor, saturated vapor and superheated vapor states of a pure substance with water, dryness fraction, representation of pure substance properties on p-T and p-V diagrams, detailed treatment of properties of steam for industrial and scientific use (IAPWS-97, 95)

Unit 6 Basics of Energy Conservation Cycles

Heat - Work Conversion: Devices converting heat to work and vice versa in a thermodynamic cycle, thermal reservoirs.

Heat Engines and Heat Pumps, Heat engine and a heat pump, schematic representation and efficiency and coefficient of performance, Carnot cycle.

Unit 7 Second law of Thermodynamics

Identifications of directions of occurrences of natural processes, Offshoot of II law from the I, Kelvin-Planck statement of the Second law of Thermodynamics, Clasius's statement of Second law of Thermodynamics, equivalence of the two statements.

Definition of reversibility, examples of reversible and irreversible processes, factors that

make a process irreversible, reversible heat engines, evolution of thermodynamics.

Unit 8 Entropy

Clasius inequality, statement, proof, application to a reversible cycle, entropy, definition of entropy, a property, principle of increase of entropy, entropy as a quantitative test for irreversibility, calculation of entropy, role of T-S diagrams, representation of heat, TdS relations, available and unavailable energy.

Unit 9 Availability and Irreversibility

Maximum work, maximum useful work for a system and a control volume, availability of a system and a steadily flowing stream, irreversibility, second law efficiency.

Unit 10 Boilers and Engines

Boilers: Classification of steam boilers, Vertical and Cross tube Cradley boiler, Cochran, Lancashire, Locomotive and Babcock-Wilcox boilers. Boiler mountings and accessories.

Engines: Two stroke and four stroke engines, engine efficiencies and performance.

Practical Title

- 1. Calorific value and its determination
- 2. Study of various types of burners and firing of fuels
- 3. To study properties of wet, dry saturated and superheated steam
- 4. Use of steam tables and Molier charts, determination of dryness fraction of steam.
- 5. Study of steam trap and streamline layouts
- 6. Study of Boiler mountings and accessories
- 7. Study of Vertical and Cross tube Cradley boiler
- 8. Study of Babcock & Wilcox longitudinal drum water tube boiler (straight tube type)
- 9. Study of Lancashire boiler
- 10. Study of Cochran boiler
- 11. Study of Locomotive boiler
- 12. Study of Packaged boiler
- 13. Study of two and for stroke engines
- 14. Visit to food plant with steam utilization
- 15. Problems on thermodynamic applications
- 16. Problems on thermodynamic applications

Text books

- 1. Engineering Thermodynamics by P. K. Nag Publisher Tata McGraw Hill
- 2. Thermodynamics by Holman, JP, Publisher byTata McGraw Hill

Reference books

1. Thermodynamics and Heat Engines - Vol I by R. Yadav. Published by Central Publishing House, Allahabad)

FPE 123 4 (3+1) Basic Electronics & Instrumentation Engineering

(48 Lectures + 16 Practical)

Unit 1 Semiconductor Devices

Introduction to various types of resisters, capacitors, etc. Structure of atom, energy band. N-type and P-type semiconductors. Intrinsic and Extrinsic semiconductors.

Unit 2 Diodes and Rectifiers

P.N. Junction diode and its characteristics, Zener diode and its characteristics. Half wave, full wave and bridge rectifiers, L & C filters, Silicon controlled rectifier (SCR)- characteristics, principle of operation as half wave and full wave controlled rectifier

Unit 3 Transistors

Transistor structure, transistor as a switch and as an amplifier, transistor input and output characteristics. Cut-off, active and saturation regions. Transistor biasing, OPAMP as amplifier. THE Junction Transistor- Transistor current components, UNI Junction Transistor- Principle of operation, characteristics.

Unit 4 Controlled Switches

Operation of triggering circuits; GATE characteristics, circuit for GATE triggering, use of UJT as a triggering device. AC Voltage regulators-DIAC and TRIAC as AC voltage regulator. Basics of simple SMPS and DC/DC conversion circuits. Introduction to power MOSFETS;

Unit 5 Invertors

Various types of invertors and their principle of operation. Voltage and frequency controlling methods. Design of DC power supply.

Unit 6 Convertors

Line commuted circuits, input and output characteristics of bridge circuits. Effect of source ampedances, load impedance interphase, reactor control, commutation with capacitor, source impedance. Comparison of invertor and cyclo convertor. Principle of operation of chopper, voltage and current commutated choppers.

Unit 7 Digital Electronics

Digital systems, logic gates, flip flop number systems, A/D & D/A convertor circuit and its principles.

Unit 8 Electronic Instrumentations

Instruments, absolute and secondary instruments, controller and recorder. Principles of measurement, static and dynamic characteristics of instruments, error analysis and its calibration, accuracy, sensitivity, reproducibility, static errors, dead zone, drift in measuring instrument. Essentials of indicating instruments, constructional details of indicating instruments.

Induction type instruments: Principles of induction type instruments, shaded pole method and two pole method, compensation for frequency and temperature errors.

Induction type voltmeter and ammeter, advantages and disadvantages, induction type single phase watt-hour meter, errors and remedies.

Analog and digital representation of signals, data loggers, RS-232 data transfer, USB data transfer.

Mechanical input transducers. Level, pressure, flow, velocity and humidity resistive transducers. Capacitive and inductive transducers, dielectric system for humidity measurements. Temperature transducers. Resistive, inductive, capacitive and thermoelectric transducers, magnetic transducers.

Cathode ray oscilloscope. Signal generator, transducers, piezoelectric transducer,

capacitive transducer, velocity transducers. Sensors, strain gauges, thermisters and other data acquisition systems.

Practical Title

- 1 Study of VI characteristics of PN-junction diode.
- 2 Study of LC filer circuits.
- 3 Study the diode as a clipper and clamper.
- 4 Study Zener diode as voltage regulator with variable load and variable input supply.
- 5 Study of half wave, full wave and bridge rectifiers.
- 6 Study SCR as full wave controlled rectifier with resistive and inductive load.
- 7 Study of transistor characteristics in CE configurations.
- 8 Study the fixed and self bias transistors.
- 9 Study the potential divider bias transistor.
- 10 Study NAND & NOR gate IC as universal GATE.
- 11 Study of DIAC and TRIAC pair as a AC voltage controller.
- 12 Study of 741 IC as inverting and non-inverting amplifier.
- 13 Study a differential amplifier using two transistors.
- 14 To study various instrumentation symbols.
- 15 Study of CRO, function generator and power supply
- 16 Familiarize with various types of transducers, sensors, strain gauges, thermisters and other data acquisition systems.

Text book

- 1. Basic Electronics Engineering by RK Singh & A. Dixit (Laxmi Publications)
- 2. Power Electronics by P. C. Sen (Tata McGraw-Hill)

Reference Books:

- 1. Electronic Fundamentals and applications by J. D. Ryder (Prentice Hall of India)
- 2. Basic electronics and Linear Circuits by N. N. Bhargava (Tata McGraw-Hill).

FBM 121 3 (1+2)

Computer Programming and Data Structures

(16 lectures + 32 Practical)

- **Unit 1** Introduction and historical background: Review of computer technology; processor, memory, secondary storage, display devices and other peripheral devices; basic computer organisation; future trends. Brief review of present-day applications.
- **Unit 2** Programming. Introduction to systems software, applications software and programming language; algorithms and flow-charts: Input-processing-output model of a computer program. Role of the compiler and the integrated development environment.
- **Unit 3** Introduction to C: Structure of a C program. Simple data types. Declarations; operators and expressions. The assignment statement. Library functions.
- **Unit 4** Control Structures: Conditional and iterative execution of statements. Importance of documentation. Nesting of control structures and the use of indentation to indicate nesting levels. Labels and the "go to" statement.
- Unit 5 Arrays; single and multi-dimensional arrays: Character strings and string functions.
- **Unit 6** Functions: Scope rules. Argument passing by reference and by value. Storage classes. Use of function prototypes. Structures, unions and user-defined types.
- **Unit 7** Operations on files: Concept of standard input and output files. Formatting of data on input and output. Use of include files.

Practical Title

- 1-6 Familiarizing with Turbo C IDE; Building an executable version of C program; Debugging a C program;
- 7-14 Developing and executing simple programs;
- 15-17 Creating programs using decision making statements such as if, go to & switch; Developing program using loop statements while, do & for;
- 18-19 Using nested control structures;
- 20-23 Familiarizing with one and two dimensional arrays; Using string functions; Developing structures and union;
- 24-27 Creating user defined functions; Using local, global & external variables;
- 28-29 Using pointers;
- 30-32 Implementing Stacks; Implementing push/pop functions; Creating queues; Developing linked lists in C language; Insertion/Deletion in data structures

Text book

1. Fundamentals of Computers, by V Rajaraman, Prentice Hall of India

Reference Books

1 Programming with C (Schaum's Outline Series). Gottfried B S. Tata McGraw Hill

2. The Spirit of C - Introduction to Modern Programming, Mullish H & Cooper H L, Jaico