CHEMISTRY SYLLABUS ENDSEM

Endsem syllabus roadmap (Chemistry Cycle) (2021-22)

Note: This syllabus is made by manipal OSF which is a student run organisation. As far as possible, we have ensured that our syllabus is as closely matching to the official confirmed syllabus by MAHE authorities. However, we implore that you do your own due diligence when it comes to confirming the syllabus.

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Mathematics (Common to both cycles)

Brief description of the syllabus:

- Differential equations:
  - First order Differential equations:
    - Basic methods of solving first order DE's
    - Basic definitions
    - Exact differential equations and reducible to exact differentials
    - Solving exact differential equations and reducible to exact
    - Solution of Leibnitz linear differential equation
    - Analysing bernoulli's differential equation
- Higher order Differential equations
  - Solution of linear homogenous and linear non homogenous higher ODE's
  - Inverse differential operator method to calculate PI (Method of undetermined coefficients) for some common functions.
  - Calculating the PI using the method of variation of parameters.
  - Solutions of special higher order DE's like Cauchy-euler equations and legendre's equations
  - Solutions to simultaneous differential equations using cramer's rule.
- Linear algebra:

- Matrices:
  - Matrices and its properties
  - Elementary row transformations and echelon matrices
  - Finding the rank of a matrix
  - Finding consistency of a system of homogenous/non homogenous linear equations
  - Solution of systems of equations by gaussian elimination
  - Inverses using gauss Jordan elimination
- Iterative matrix solving methods
  - Gauss-seidel method
  - Gauss-Jacobi method
- Vector algebra and matrix algebra:
  - Eigen values and eigen vectors
  - Linear combination of vectors
  - Linear span
  - Theorems on linear span
  - Generalisation of the vector concept to higher dimensions
  - Dependency and independency of vectors with problems
  - Subspaces and related results
  - Definition of basis and spanning set with problems
  - Minimal spanning set, maximal linearly independent set and related
  - Orthogonal basis and orthonormal basis
  - Gram Schmidt orthogonalization
- Interpolation:
  - Finite differences and their properties
  - Newton-Gregory forward/backward interpolation
  - Lagrange interpolation and Inverse Lagrange interpolation
  - Divided difference interpolation for polynomials

- Numerical differentiation
- Numerical integration
    - Newton Cotes formula
    - Trapezoidal rule
    - Simpson’s 1/3rd rule of integration
    - Simpsons 3/8th rule
- Solution of Algebraic and transcendental equations
    - Bisection method
    - Regula-Falsi method
    - Newton Raphson’s method
    - Newton’s repeated roots
- Numerical solution of differential equations
    - Taylor series method
    - Euler’s method and modified Euler’s method
    - Runge-Kutta fourth order method

Engineering Chemistry

Brief description of the syllabus

- Electrochemistry:
    - Introduction, Single electrode potential,
    - Origin of single electrode potential theory,
    - Nernst equation to calculate the electrode potential, Numerical problems.
    - Electrochemical cells - galvanic cell and electrolytic cell
    - , representation of galvanic cell, Construction and working of galvanic cell, Liquid junction potential, Functions of salt bridge, EMF of cell,
    - Determination of EMF of cell by Poggendorff’s method using Standard cell,
    - Construction, working, application and limitations of calomel electrode, Numerical problems.

- Construction, working, applications, advantages and limitations of glass electrode, Numerical problems.
- Classification of Batteries – Introduction, primary and secondary with examples; construction, working and applications of lead acid battery.
- Construction, working and applications of Ni-Cd and Li-ion batteries, advantages and disadvantages.
- Fuel Cells – Introduction, construction and working of AFC & DMFC, advantages and disadvantages.
- Metal finishing – Electroplating – polarization, over voltage, decomposition potential including determination of decomposition potential.
- Characteristics of good deposit, Factors influencing the nature of the deposit,
- Methods of cleaning the metal surface.
- Electroplating of Cu & Cr & electroless plating of Cu.

- Corrosion
  - Introduction
  - Importance of corrosion stud Corrosion classification Electro chemical theory with special reference to rusting of iron.
  - Galvanic series: need, characteristics, advantage. Factors affecting corrosion: Primary and Secondary factors.
  - Brief account of galvanic corrosion, pitting corrosion, intergranular corrosion and stress corrosion.
  - Corrosion control by material selection and proper design. Corrosion control by use of inhibitors
  - Cathodic protection of metals, Anodic protection and metal coating
  - Corrosion control by organic (paint) and inorganic (phosphate) coatings.
- Modern methods of Chemical analysis
  - General methods of chemical analysis
    - Classical method
    - Instrumental method

        - Advantages and disadvantages
        - Types of methods
    - Introduction to spectroscopic methods of analysis
        - Electromagnetic radiation
        - Interaction of EMR with matter
        - Numerical problems
    - Concepts of rotational, vibrational and electronic energy levels.
    - Laws of spectrophotometry
    - Beer and Lambert's law and derivation
    - Qualitative and quantitative analysis (Fe estimation)
    - Numerical problems
- Chemical fuels
    - Introduction, classification
    - Gross calorific value and net calorific value
    - Solid fuel
        - Proximate and ultimate analysis
    - liquid fuel
        - Petroleum refining
        - Cracking and reforming
        - Synthetic petrol
    - Gaseous fuels (Self study)
- Materials chemistry
    - Introduction and basic principles
    - Classification of materials
    - Effect of bonding on properties of materials
    - Polymers
        - basic concepts and terminologies

        - Monomer
        - Functionality
        - Oligomer
        - Polymer
        - Degree of polymerization
    - Classification of polymers
        - On basis of origin
        - On basis of structure
        - On basis of method of formation
        - On basis of response to heat
    - Tactility in polymers
    - Correlation of polymer properties with structure
    - Glass transition temperature and factors
    - Molecular weight of polymers
        - Number average
        - weight average
    - Numerical problems
- Liquid crystals
    - Introduction
    - Classification of liquid crystals
        - Based on response to heat
        - Based on concentration
    - Classification of thermotropic liquid crystals
        - Based on structure
        - Based on phases exhibited
    - Applications of liquid crystals
        - Liquid crystal displays

- Ceramics
  - Introduction
  - Types and applications
  - Mechanical properties of ceramics
    - Brittle fracture
    - Stress-strain
    - Elastic behaviour
- Composites
  - Introduction
  - Classification
    - Particle reinforced
    - Fiber reinforced
    - Structural
  - Influence of various factors
  - Numericals
- Polymer-matrix composites
  - Polymer matrix materials
  - Glass Fiber-Reinforced Polymer(GFRP)
  - Carbon Fiber-Reinforced Polymer(CFRP)
  - Aramid Fiber-Reinforced Polymer composites
- Biomaterials
  - Definition
  - Factors which govern biomaterial choice
  - Requirement of Biomaterials
  - Types of biomaterials
    - Metals, ceramics, polymers, composites
- Thin films

- Nanomaterials
  - Classification
  - Preparation using bottom up and top-down approach
  - Advantages and disadvantages
  - examples

Problem Solving in Computers(PSUC)

- Basics of computers
  - Computer organisation
  - Early operating systems
  - Machine, assembly and high level languages
- Algorithms
  - Solving logical and numerical problems using algorithms
  - Representation of them
  - Flowcharts of algorithms
- C programs
  - General structure
    - simple C programs
    - Syntax and logical errors
    - Executable code
  - Basic concepts
    - Variable names and declarations
    - Datatypes sizes and constants
    - Arithmetic operators
    - Relational and logical operators
    - Increment and decrement operators
    - Bitwise operators

- C coding logic and expressions
  - Type conversion assignment operators and expressions
  - Conditional expression, precedence and order
  - Statements and blocks, if-else, switch
  - Looping
    - While loop
    - Do-while loop
    - For loop
    - break and continue statement
- Higher concepts
  - 1-D arrays and strings
  - Sorting
    - Selection
    - bubble
    - Sorting with strings
  - Multidimensional arrays and matrices
  - Pointer variables
    - Declaration and dereferencing pointer variables
    - Programs on pointers
  - Functions
    - Prototype declaration
    - Actual and formal parameters
    - definition
    - Passing arguments using by value
    - Passing arguments using by reference
    - Functions with and without returns Scope of variables
    - Recursive programming

        - Structures
            - Defining and simple examples
            - Array of Structures
        - Pointer arithmetic
- Computer and cyber security

Biology for engineers

- Elements of life
    - Important elements in organisms
    - Electronegativity of the elements
    - Importance of carbon
    - Different types of bonds
    - Different bonding types in biological systems
    - Water and phospholipids and their importance
    - Discussion and reasoning of alternate elements to life
    - Alternates to water, compartmentalization in life
- Structures of life
    - Carbohydrates, ATP
    - Proteins and their structures
    - Enzymes
    - Bioenergetics
- Mendelian concept of inheritance
    - Mendel monohybrid cross and segregation
    - Back cross and test cross
    - Dihybrid cross
    - Law of independent assortment
    - Concept of factor for chromosomes

    - Concept of cell division
    - Mendelian algorithm problem solving
- Morgans experiment X linked inheritance
- Pedigree analysis
- DNA
    - Discovery of DNA
        - Griffith transformation experiment
        - Hershey chase experiment
        - Chargaff’s rule
    - Structure of DNA
        - Meselson and Stahl experiment
        - Kornberg experiment
    - Interpreting complementary base pairing
    - Models of DNA replication
    - mRNA synthesis and processing
    - Idea of need of processing and why mRNA needs to go out of nucleus
    - Protein synthesis
    - genetic code
    - DNA to RNA to protein
- Evolution
    - Lamarck and darwin approaches
    - Symbiosis
    - co-evolution communal benefit parasitism etc
    - DNA as a tool of evolution
        - Mutations
        - Genotype and phenotype changes
        - Sickle cell anaemia

    - Chemical evolution
        - Chlorophyll, myoglobin, haemoglobin etc
- Vaccination
    - Logical reasoning of vaccination failure
- Lac operon
- Virus replication concept of cloning
- Ascent of sap problems
- Virus and logical importance
- Bioinspiration
    - Examples
    - Biological concept evolved into engineering outcome
    - Idea of bioinspiration
- Final summary

Environmental science (EVS)

- Chapters 1-6 Case studies 1-5

Basic electrical technology (BET) (For a detailed syllabus refer BET syllabus pdf in OSF BET materials folder)

- DC circuit analysis
- DC transients analysis
- Magnetic circuit analysis
- Single Phase AC circuit
- Three phase AC circuits
- Electrical power systems components (Coursera/NPTEL course)

Roadmap:

- Mathematics: The key is problem solving and sticking to fixed resource catalogues. The recommended book is BS Grewal for differential equations. (It is

subpar for other chapters). Use YT channel Gajendra Purohit for doubt clearing.

Manipal OSF has a large resource repository for problem solving. We have problems from IITB and assignment problems from manipal on differential equations of every type, as well as for other chapters. We also exclusively have the midsem question papers for the previous year and the library portal contains all the endsem papers.

Added to that, cygnus learn has summarisation videos for differential equations.

- Engineering chemistry. The key resource are the recordings and the docx files. OSF has a catalogue of all the docx files in one place for each chapter, which more or less covers the theory. We also have question banks (tutorial questions) on the type of questions asked in engineering chemistry for each chapter. Like always, the midsem papers and endsem papers are always there to get an understanding of how the paper is like.
- PSUC: The best resource for PSUC is coding with harry's catalogue of videos and notes. It is a yt channel from whose course, PSUC has modelled their course very similarly. Of course, OSF has a compilation of every ppt which PSUC presents in classes, to get a fair understanding of what they teach. For problem solving, refer old papers, or else solve common problems from coding platforms in C
- EVS: Watch the recordings and read the past papers. That's it 😊
- Biology for engineers: A repeat of EVS directives.