20BS03 Multivariate Calculus

Teaching Scheme:  
Lectures: 3 Hrs/Week  
Tutorial: 1 Hr/Week  
Credits: 4

Examination Scheme:  
In-Semester: 50 Marks  
End-Semester: 50 Marks

Course Objectives:  
1. To familiarize the students with techniques of differentiation and integration of multivariable function.  
2. To equip the students to deal with advanced level of Mathematics, and applications that would be essential for their disciplines.

Course Outcomes:  
After completion of this course, students will be able to  
CO1: Calculate partial derivatives and solve problems using partial derivatives.  
CO2: Analyze stationary points and calculate extrema of function of several variables.  
CO3: Solve double integral, triple integral over the region.  
CO4: Determine physical parameters using double and triple integral.

Course Content:  
Unit – I: Partial differentiation  
Function of several variables, partial derivatives, Geometrical interpretation of partial derivatives, chain rule, higher order partial derivatives, Euler’s theorem.

Unit – II: Applications of partial differentiation.  
Maxima, minima and saddle points, second derivative test, constrained extrema and Lagrange’s multipliers, applications in optimization of functions of several variables. Applications of first order partial derivatives in data fitting using the method of least squares.

Unit – III: Double integration  

Tracing of curves in Cartesian and Polar coordinate system, double integrals over a rectangle, double integrals over regions, change of order of integration, Introduction of Jacobian determinant for two variables, double integral in polar coordinates, The Gaussian integral.

**Unit – IV: Triple integration**

Triple integral over a box, triple integrals by iterated integration, change of variables, Cylindrical and Spherical coordinates, The Jacobian determinant for three variables, evaluation of triple integral.

**Unit – V: Applications of Double and Triple integration**

Applications of double integral and triple integral: Area of plane Lamina, mass of plane lamina, surface area, volume, mass of solid.

**Text Books:**


**Reference Books:**

20BS04 Physics

Teaching Scheme

Lectures: 3 Hrs /Week
Credits: 3

Examination Scheme

In-Semester: **50** Marks
End-Semester: **50** Marks

**Course Objective:**
To introduce undergraduate students of technology to the principles, notions, basic physical ideas, mathematical relations and applications of physical optics, thermodynamics, quantum physics, solid state physics and the properties of nano as well as bulk materials.

**Course Outcomes:**

By taking this course, the learner will be able to –

**CO1: Apply** the generalized Coulomb law and the law of Electromagnetic Radiation to compare the electric fields due to the stationary and the accelerated charges.

**CO2: Apply** the laws of Physical Optics to determine intensity distributions of interference and diffraction patterns, and to identify polarization-types.

**CO3: Apply** the principles of Statistical Physics to determine — the thermal distribution of atoms and molecules in different energy states and the thermal response of engineering materials in terms of their specific heats.

**CO4: Justify** the use of the Quantum Physical laws for — combining probability amplitudes, implementing single quantum-bit logic gates and determining probability distributions of polarized photons.

**CO5: Differentiate** between the physical properties of ‘nano’ materials and of their ‘bulk’ counterparts

**Course content:**

**Title of Module, Brief Description of Course Contents and No. of Lectures**

**Module – 1: Electromagnetic Radiation and Interference:** (08)

Expression for the electric field beyond Coulomb’s law; Two dipole radiators and Physics of interference; Mathematical treatment (propagating waves, rotating vectors, complex functions)

**Module – 2: Diffraction and Polarization:** (08)

The resultant amplitude due to \( n \) equal oscillators; Diffraction Grating; The electric vector of light; Types of Polarized Light; Birefringence; Polarizers
Module – 3: Statistical Mechanics and Thermodynamics: (08)

Principles of Statistical Mechanics (Distribution of particles in thermal equilibrium); Laws of Thermodynamics (Carnot Cycle, Entropy, Clausius-Clapeyron Equation); Information Entropy

Module – 4: Quantum Physics: (09)
Laws of combining probability amplitudes; The Hamiltonian matrix & Schrödinger equation; Two-state systems: Pauli spin matrices & Photon polarization states; Single Qubit Logic Gates

Module – 5: Properties of Solids: (09)
Band Theory; Electrical (conductivity, resistivity), Magnetic (dia-para-ferro), Optical (absorbance, reflectance, transmittance), Mechanical (hardness, elasticity) properties (of ‘bulk’ & ‘nano’ solids)

Text Book:


Reference Books:


20ES04 Engineering Graphics

Teaching Scheme
Theory: 2 Hrs/week
Tutorial: 1 Hr/week
Credits: 3

Examination Scheme
In-semester: 50 Marks
End- semester: 50 Marks

Course Objectives:
1. To develop the visualization and interpretation skills for the physical objects.
2. To provide the basic knowledge and develop the skills for creating 2 D drawings.
3. To provide the basic knowledge and develop the skills for creating Isometric views.
4. To familiarize about the development of solids.
5. To familiarize the construction and applications of Engineering Curves.

Course Outcomes:
After completing the course students will be able to draw

CO1: Orthographic and sectional orthographic projections of an object

CO2: Isometric views of the given object

CO3: Development of surfaces of the given object

CO4: Engineering curves by applying the given method

Course content:
Unit – 1: Introduction
Layout and sizes of drawing sheets, drawing instruments, types of lines used in drawing practice, dimensioning systems, representation of tolerances, standard codes by B.I.S (SP-46). (Not for Examination) (01)

Unit – 2: Orthographic Projection
Theory of projections, methods of obtaining orthographic views, sectional orthographic projections, Missing views. (08)

Unit – 3: Isometric Views

Isometric axes, Isometric scale, isometric projections and views, construction of isometric view from given orthographic views. (08)

Unit – 4: Development of Solids

Parallel line development, radial line development, methods to transfer points for development of prisms, pyramids, cylinder and cone. (05)

Unit – 5: Engineering Curves

Construction of ellipse, parabola, hyperbola, involute, cycloid, Archimedean spiral, helix on cone and cylinder. (06)

Text Books:


Reference Books:

20ES05 Fundamentals of Programming Language-2

Teaching Scheme:  
Lectures: 3 Hrs/week  
Credits: 3

Examination Scheme:  
In-Semester: 50 Marks  
End-Semester: 50 Marks

Course Objectives:
To facilitate the learners:
1. To understand and apply object-oriented principles for application development.
2. To develop programming applications using Java.
3. To make use of class, object, constructor.
4. Learn programming construct of Java.

Course Outcome:
By taking this course, the learner will be able to:

- **CO1**: Demonstrate and Make use of object-oriented principles for effective programming.
- **CO2**: Construct readable and maintainable code using polymorphism.
- **CO3**: Apply object oriented concepts of class, object creation and constructor for program development.
- **CO4**: Apply principles of code-refactoring and efficient code reuse for problem solving.

Course Content:

**Unit-I: Introduction to Object Oriented Programming Paradigm** (6)

Role and need of programming languages, characteristics of a good programming language, introduction to various programming paradigms. Need of object-oriented paradigm, basic concepts of object oriented programming (OOP), benefits of OOP. General characteristics for OOP, Object oriented concepts: Class, Object, abstraction, encapsulation, polymorphism, and inheritance.
Illustration through real life examples and use cases
Unit-II : Introduction to Java Programming Language (8)

History of Java, Features of Java, Java and Internet, Java virtual machine, First java Program, Command line arguments, Java Programming elements: Data types, Control Structures, Encapsulation, Abstraction and Polymorphism, Class, object, constructor
Illustration through real life examples and use cases

Unit-III : Polymorphism (6)

This keyword, static method, function overloading, argument passing, constructor overloading. String and Array’s in Java, Java Collection Framework – Arraylist, HashSet
Illustration through real life examples and use cases

Unit-IV: Inheritance (8)

Types of inheritance, base class and derived class, access specifiers, method overriding.
Illustration through real life examples and use cases

Unit-V: Abstract Class, Interfaces and Packages (8)

Abstract class, interfaces, run time polymorphism. Creating and importing packages.
Illustration through real life examples and use cases

Unit-VI: Exception Handling in Java (6)

Errors and Exceptions, Types of exceptions, try, catch, throw, throws and finally keywords, Build-in exceptions, creating and using custom exceptions.
Illustration through real life examples and use cases

Text Books:

Reference Books:
20ES06 Geo-Informatics

Teaching Scheme:

Lectures: 3Hrs./Week

Credits: 3

Examination Scheme:

In-Semester: 50 Marks

End-Semester: 50 Marks

Course Objectives:

1. To introduce the science and technologies involved in Remote sensing.
2. To understand the application of GIS in various fields
3. To explain the earth and mapping principles.
4. To learn basics about the Geodata & GIS software.

Course Outcomes:

A student should be able to:

CO1: Demonstrate fundamentals of remote sensing

CO2: Interpret data from satellite images and their characteristics.

CO3: Compare and understand an image visually and digitally with digital image processing techniques.

CO4: Explain the concepts and fundamentals of GIS.

CO5: Distinguish between types of GPS and their working principles

CO6: Apply knowledge of remote sensing and GIS in different engineering applications.

Course Content:

Unit – I: Principles of remote sensing (07)

Concept of Remote Sensing, Working Principle, Types of remote sensing, Platforms of remote sensing, Output of remote sensing – photography, satellite imaginary and visual interpretation data

Unit – II: Data interpretation method in remote sensing (06)
Types of data, Visual interpretation of images-Natural and false colour composites, Image resolution, Limitations, Applications

Unit – III: Photogrammetry & Cartography (08)

A) Fundamentals of aerial photography, satellite images, virtual images, Image processing, Digitalization of maps.
B) Cartography: - Conventional Maps, Definition, Map Basics Elements/components of map, Map Scale, Large- & Small-Scale maps, Thematic maps, Coordinate system, Polar & Cartesian (Latitude-Longitude & x,y coordinates)

Unit – IV: Geographical information system (GIS) & Database management for Geoinformatics (08)

A) GIS :- Concept & definition of GIS (based on components, based on functions), GIS vs. Conventional Mapping, Components of GIS, Working Principle of GIS, - Strengths of GIS, - Geoinformatics Vs. GIS
B) Database management for geoinformatics, GIS Data and Data Models, Concept of Query, Concept of Spatial Analysis.

Unit – V: Global positioning system (GPS) (06)

History of GPS, Types of GPS, Working principle, Applications of GPS, case study.

Unit – VI: - Application of geoinformatics (07)

Case studies to be used for demonstration-

1. Navigational services – available on phones (travel direction from A to B)
2. Vehicle tracking system / Fleet management – Cabs, City buses, Trains, Aircrafts
3. City Planning (urban sprawl, master planning)
4. Solid waste management (identifying location for waste disposal site, route optimization of waste collection, online/offline monitoring of waste collection)
5. Identifying suitable location for business outlet (Pizza hut, Teco bell, General Motors)
6. GIS for location based services (courier & other home delivery services) – Fedex, DHL
7. Telecom sector uses GIS (planning of OFC network, identifying suitable location for mobile towers, marketing, operations)

8. Disaster Management using GIS (modelling & simulation tools – through videos)

Text Books:


Reference Books:


5. Lillesand M. Thomas and Ralph W.Kiefer- Remote Sensing and Image Interpretation
20BS04L Physics Laboratory

Teaching Scheme

Lectures: 2 Hrs/ Week

Credits: 1

Examination Scheme

In-Semester: 25 Marks

Course Objectives:

The objectives of the Physics Lab course is two-fold:

1. To inculcate experimental skills,
2. To demonstrate the interplay between theoretical & experimental physics.

Course outcomes:

By taking this course, the students will be able to —

CO1: Record the observations as per the least counts of measuring instruments and Perform necessary calculations.

CO2: Compare the experimental findings with the corresponding theoretical physics models.

CO3: Determine errors in experimental findings and Analyze their sources and causes.

CO4: Reach the conclusions pertaining to the observed behavior of physical systems.

List of Experiments:

Physical Optics Experiments:
I. Michelson Interferometer, II. Diffraction Grating, III. Newton’s Rings, and IV. Polarization of light.

Electromagnetism & Heat Experiments:
I. Faraday’s Law, II. Dia-Para-Ferromagnetism, and III. Specific Heat.

Modern Physics Experiments:
I. Planck’s Constant, II. Hall Effect, and III. Zeeman Effect.
20ES04L Engineering Graphics Lab

Teaching Scheme
Practical: 2 Hrs/Week
Credits: 1

Course Objectives:
To familiarize student about
1. Advantages of using software for Engineering drawing
2. 2-D drafting using a software
3. 3-D modeling using a software
4. 3-D printing technology

Course Outcomes:
After completing the course using a software package students will be able to

CO1: Draw orthographic projections of a given component

CO2: raw Isometric projections of a given component

CO3: Draw development of solids

CO4: Draw free hand sketches of the machine elements

Part I - Introduction to 2-D Drafting using a drafting software (20)
Orthographic Projections, Isometric Projections. Development of surfaces of solids
Free hand sketching of standard machine elements

Part II - Demonstration of 3-D Modeling and 3-D Printing (08)
Creating a 3-D model of a simple component using a solid modeling software and
manufacture using a rapid prototyping technique.

Examination Scheme
In Semester: 25 marks
Text Books:

20ES05L Fundamentals of Programming Language Lab-2

Teaching Scheme:

Practical: 2 Hrs/Week

Credits: 1

Examination Scheme:

In-Semester: 25 Marks

Course Objectives:

To facilitate the learners:

1. To explore the principles of object oriented programming
2. To apply object oriented programming concept for developing applications using Java
3. To make use of class, object and constructor for coding basic object oriented program
4. To handle built-in and user defined exceptions

Course Outcome:

By taking this course, the learner will be able to:

CO1: Develop basic object oriented program using class, object and constructor
CO2: Develop readable and reusable code using inheritance and polymorphism
CO3: Make use of exceptions using inbuilt classes and user defined exceptions
CO4: Develop application using object oriented programming language Java to solve given problem

A large part of ESFL205 lab would be for understanding the basic concepts of object-oriented programming and implementation of some real-world simple applications. Assignment statements are in brief and should be implemented in JAVA programming language. Faculty members are encouraged to expand problem statements with variations. Assignments can be framed and expanded in such a way that it explores concepts, language constructs, logic of solution and simple application. Students will be encouraged to solve open problems in different domains. Faculty will appropriately adopt assignments on similar lines as the examples shown here.
Example List of assignments:-

Group A: Assignment to write program in OO language to understand concept of data abstraction and encapsulation

Write a MyDate class which has attributes as day, month and year. Create five objects of MyDate and display them.

Design a user defined abstract data type ‘Complex' in Java. Write a program to perform arithmetic operations of two complex numbers.
A complex number has a real part and an imaginary part.

a) Given the values of real part and imaginary part of a complex number, the magnitude of the complex number can be calculated as square root of the sum of squares of real part and the imaginary part.

b) The argument of the complex number can be calculated as tan inverse of ratio of imaginary part(numerator) and real part(denominator).

c) The complex number can be added to another complex number and the answer of the addition is a complex number. When one adds two complex numbers, the real parts of each of the complex numbers is added which becomes a real part of the answer and imaginary part of each complex number is added together which becomes imaginary part of the answer. Both these results are real and imaginary parts for a complex number which is the answer of the addition complex conjugate of the complex number can be calculated by negating the imaginary part of the complex number.

d) The complex number can be subtracted from another complex number and the answer of the subtraction is a complex number.

e) When one subtracts a complex number from the other, the real part one complex number is subtracted from the other and the result becomes a real part of the answer and imaginary part of one complex number is number is subtracted from the other and the result of subtraction becomes imaginary part of the answer. Both these results are real and imaginary parts for a complex number which is the answer of the subtraction.

1. Create a student result database in Java. Calculate the grades of students. Decide criteria for best student and short-list students who satisfy the criteria.

a) A student has a roll No, name, marks in five courses and a grade. A student list has many students. If a student has grade equal or beyond 8, he is considered as a top band student.

b) Create at least ten students. From these, find all such students which satisfy the criteria of top band student. Create a list of such students and display the students in the list.
2. A circle has a radius. Its area can be calculated. The area is a double number. Its perimeter can be calculated as $2\pi r$. The perimeter is a double number. Given two circles one can find out which is large and which is small. Create two circles $c1$ and $c2$ with radius as 10 and 7 respectively. Calculate the area and perimeter of each. Compare two circles with each other and display which is large and which is small.

3. Write a JAVA program to perform String operations using String/String Buffer class
   a) Write a program that reads a word and then prints the first character, the last character, and the characters in the middle. For example, if the input is Cummins, the program prints Cummins.
   b) Write a program that reads a name (such as Ranbeer Rishi Kapoor) and then prints a monogram consisting of the initial letters of the first, middle, and last name (such as RRK).

Group B: Assignment to write program in OO language to understand concept of class inheritance and polymorphism.

1. Implement Java program to calculate area and perimeter of various shapes-circle, triangle and rectangle.
2. Create an application like book shop and maintain the inventory of books that are being sold at the shop
3. Find appropriate class hierarchy, polymorphic behavior in applications like banking and implement it.
4. Model the HRD application using the concepts of inheritance, interface, polymorphism
5. A company has many employees. An employee has employee Id, basic salary, house rent allowance, dearness allowance, profession tax and total salary. An employee has an address. The address has apartment number, apartment name, road and PIN code.
   The total salary of an employee is the summation of basic salary, house rent allowance which is 20 percent of basic salary, dearness allowance which is 45 percent of basic salary. The take home salary is calculated after deducting profession tax from which is 7 percent of basic salary from the total salary. When an employee is appointed, he is assigned with an employee Id and basic salary. One can ask for total salary of the employee and take-home salary of the employee.
Identify a class/classes from the above statement, identify the attributes, the data types, the behavior. Test your program for ten employees
Display all the details of the employees as per id and as per pin code.
Display take home salary for all the employees, display the tax to be deducted across all employees.

6. Reading material has title and price. A book is a reading material. It has ISBN number. A magazine is a reading material, it has month of issue. A CD is a reading material, it has duration in minutes. Represent the above description as a generalization, specialization tree. Identify the parent class, its attributes, child class and their attributes. Write all of them clearly.

7. A vehicle has engine no and chassis number. It can be locked, unlocked. Every vehicle is movable (interface). It can be started, stopped, turned, accelerated, turned, and decelerated. A car is a vehicle. It has steering. An airplane is a vehicle. It has wings. A boat is a vehicle. It has propeller.

**Group C: Assignment to write program in OO language to understand concept of exception handling**

1) Write a program to catch various in-built exceptions(try, catch and finally block)

2) Create User defined exception to check the specific conditions for systems like recruitment etc and throw the exception if the criterion does not met in Java.

3) Consider student data consist of fields such as roll number, name, and marks of various subjects. Write a program using inbuilt and user defined exceptions to avoid invalid entry.
20ES06L Geo-Informatics Lab

Teaching Scheme:  
Practical: 2 Hr/Week  
Credits: 1

Examination Scheme:  
In-Semester: 25 Marks

Course Objectives:

1. To learn basics about the Geodata & GIS software.  
2. To introduce students basics of spatial data and its creation. 

Course Outcomes:

A student should be able to:

1. Demonstrate the process of data acquisition of satellite images and their characteristics.  
2. Apply basic data visualization concepts such as colour theory, symbolization.  
3. Explain the components of GIS.  
4. Apply knowledge of remote sensing and GIS in various engineering applications.

Course Content:

(A) Remote Sensing Lab

1. Observation of feature details seen in images of different resolutions, 3D visualization of aerial photograph using Stereoscope.  
2. Visual Interpretation of multispectral and Panchromatic image

(B) GIS Lab

3. Exploring Google Earth  
   - Locating a place  
   -Layers  
   -Display Controls  
   -Changing coordinate system  
   -Adding place marks (Ground trothing)  
   -Saving KMZ/ KML files
4. Open source software of GIS
   - Understanding QGIS interface
   - Different types of file formats

5. Working with Data
   - Adding Vector data/ Raster Data
   - Display Controls

6. Point, Line, Polygon feature,
   - Feature selection/deselection

7. Layers, Properties of layers, Feature Symbology

8. Querying data - Aspatial and Spatial Query

9. Digitization of map, creating layers

(C) **GPS Lab** - Liner data collection using GPS

**References** - Learning QGIS packt publishing by Anita Gaser