
# CHEMICAL PROCESS CALCULATIONS (17251101)

| Category | Title | Code | Credits-3 | | | Theory Paper |
|---|---|---|---|---|---|---|
| Departmental Core-DC | Chemical Process Calculations | 17251101 | L | T | P | Max.Marks-30 Duration-2hrs. |
| | | | 3 | - | - | |

**Course Objective:**

To understand and apply the basics of calculations related to material and energy flow in the processes.

**Syllabus:**

**Unit-I**: Mathematical and Engineering Calculations:- Units and dimensions, conversion units, expression and equations, Dimensional groups and constants, stochiometric and composition relationships, conversion of mass, mass and volumetric reactions, basis of compositions, Excess reactants , degree of completion.

**Unit-II**: Ideal Gases & vapor Pressure: Behavior of ideal gases, Gaseous mixtures, vapor pressure , Clausius Clapeyron equation, Cox chart, Duhring's plot, Raoult's law, Humidity and saturation, relative humidity, humid volume, dew point, humidity chart and its use.

**Unit-III**: Material Balance: Crystallization, dissolution, solving material balance problems with and without simultaneous equations, Recycle, bypass and purge calculations

**Unit-IV**: Energy Balance : Heat capacity, Heat and Latent Heats, Standard Heat of Combustion, Temperature Dependence of $\Delta H^0$, Empirical equations for heat capacities; Mean heat capacities of gases, Sensible, Enthalpy calculations, Heat of Formation, Hess's Law, calculation of the standard heat of reaction from heats of formation.

**Unit-V**: Fuels and Combustion: Fuel types, Calorific value of fuels, Calculations based on coal combustion, liquid fuels, gaseous fuels, etc., Proximate and ultimate analysis, Combustion as a case of material balance with reactions, Combustion products analysis, Excess air calculation.

**Course Outcomes:** After the completion of this course, Students will be able to

CO 1 **Recall** different unit system, basic mass volume relationship, conversion of units & equation

CO 2 **Explain** vapor pressure, vapor pressure plots , Raoult's law & Humidity

CO 3 **Solve** Material balance problems with & without reactions

CO 4 **Perform** Energy balance problems without chemical Reactions

CO 5 **Illustrate** heat of vaporization & combustion of fuels

**Text Books**

1.O.A. Hougen, K.M. Watson, R.A. Ragatz (CBS publications New Delhi 1995 edition)- Chemical Process Principles**,** part-I

**Reference Books**

1.David M. Himmelbau( prentice Hall ,sixth edition Feb. 1999)- BASIC PRINCIPLES AND CALCULATIONS IN CHEMICAL ENGINEERING.

2. B.L.Bhatt, S.M. Vora(Tata Mc-Graw –Hill, 1996) STOCHIOMETRY.
3. "Stoichiometry and Process Calculations", K.V. Narayanan, B. Lakshmikutty, Prentice-Hall of India Pvt. Ltd., 2006.

**CourseArticulationMatrix**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 1 | | 1 | | | | | | | | 1 | | 2 |
| CO2 | 3 | 3 | 2 | | 1 | 1 | | | | | | 1 | 1 | 2 |
| CO3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | | 1 | | 1 | 2 | 1 | 3 |
| CO4 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | | | 1 | 1 | 2 | 3 | 3 |
| CO5 | 2 | 3 | 3 | 3 | 1 | 1 | 1 | 1 | | | 1 | 1 | 3 | 3 |
| CO6 | 2 | 3 | 3 | 3 | 1 | 1 | 1 | | | 1 | 1 | | 1 | 1 |

1-Slightly;2-Moderately;3– Substantially


# COMPUTER PROGRAMMING (17251102)

| Category | Title | Code | Credits-2 | | | Theory Paper |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| Engineering Science Course - ESC | Computer Programming | 17251102 | 2 | - | - | Max.Marks-30 Duration-2hrs. |

**Course Objectives:**

- To develop the understanding of algorithms, programming approaches and program documentation techniques.
- To study the concepts of procedural oriented programming.
- To design and implement basic programming solutions using programming constructs.

**Syllabus:**

**Unit I**

**Introduction to Programming:** Types of Computer Programming Languages, Program Execution and Translation Process, Problem Solving using Algorithms and Flowcharts. Introduction to C++ Programming: Data Types, Constants, Keywords, Variables, Input/Output function, Operators & Expressions, Precedence of Operators.

**Unit II**

**Loops and Decisions**: Decision statements (if...else, switch…case),Loops (for, while, do…while), nested control statement, break, continue, goto and return statement.

**Unit III**

**Arrays, Strings & Pointers:** One dimensional Arrays, Passing Arrays to Functions, Multidimensional Arrays, Strings, Pointers & Addresses, Pointer to Pointer, Pointer to Array, Array of Pointers, Types of pointers, Pointer to Strings. Functions: Function & Function Prototypes, Passing Parameter by value and by reference, Passing string to function, Passing array to function, Function returning address, Recursion.

**Unit IV**

Structures & Union: Pointer to Structure, Self-Referential Structures, Dynamic memory allocation by malloc/calloc function, Storage Classes. File Handling:

Defining and Opening a file, Closing Files, Input/output Operations on Files, Predefined Streams, Error Handling during I/O Operations, Command Line Arguments.

**Unit V**

Version Control using Git& GitHub, Basics of graphics libraries (SFML, SDL, OpenGL), Event-driven programming and game loops. Using C++ for performance-critical parts of ML/DL applications. Interfacing with system APIs (Linux syscalls, Windows API)

**RECOMMENDED BOOKS**


- C++ How to Program, H M Deitel and P J Deitel, Prentice Hall.
- Programming with C++, D Ravichandran, T. M. H.
- Computing Concepts with C++ Essentials, Horstmann, John Wiley.
- The Complete Reference in C++, Herbert Schildt,TMH.
- Fundamentals of Programming C++, Richard L. Halterman.
- Object Oriented Programming in C++, Robert Lafore.


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## COURSEOUTCOMES

After completing this, the students will be able to:

**CO1**: design structured programs using basic C++ constructs.

**CO2**: analyze logic using various control structures.

**CO3**: create modular programs using arrays, strings & functions.

**CO4**: implement structured & dynamic programming solutions using pointers & structures, and perform various file operations

**CO5**: demonstrate foundational skills in version control, and apply logic-building & problem-solving techniques through competitive coding platforms

**Course Articulation Matrix**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | 3 | 1 | 2 | | | 1 | | 1 | | 3 | 3 | 2 |
| CO2 | 2 | 3 | 2 | 2 | 1 | 2 | 1 | 1 | | 1 | | 2 | 3 | 2 |
| CO3 | 3 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 1 | | 2 | 3 | 2 |
| CO4 | 1 | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 2 | 1 | | 2 | 2 | 2 |
| CO5 | 1 | 3 | 2 | 1 | 3 | 2 | 1 | 2 | 3 | 2 | 3 | 3 | 2 | 2 |

1-Slightly,2-Moderately,3-Substaintially


# FLUID MECHANICS (17251103)

| Category | Title | Code | Credits-3 | | | Theory Paper |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| Departmental Core-DC | Fluid Mechanics | 17251103 | 2 | 1 | - | Max.Marks-30 Duration-2hrs. |

**Course Objective:**

This course aims to provide a comprehensive understanding of fluid behavior, statics, and dynamics relevant to chemical engineering systems. It equips students with analytical and practical knowledge in fluid flow, machinery, dimensional analysis, and flow measurement techniques. The course also introduces microfluidics, focusing on microscale phenomena, fabrication methods, and emerging applications.

**Syllabus:**

Unit I: **Fluid Properties, Statics, and Dimensional Analysis**.

Properties of fluids: density, viscosity, surface tension, compressibility. Fluid statics: pressure variation in fluids, pressure measurement (manometers and their types), hydrostatic forces on submerged surfaces, buoyancy, and stability. Introduction to dimensional analysis: Buckingham π-Theorem, key dimensionless numbers (Reynolds, Froude, Weber, etc.), similitude and scale-up criteria.

Unit II: **Fluid Classification and Flow Dynamics Classification of fluids**:

Newtonian and Non-Newtonian fluids. Viscosity and its measurement. Equations of fluid motion: continuity equation, equation of motion, and Navier-Stokes equations. Concept of Flow past immersed bodies, flow regimes, and friction factor for laminar and turbulent flow. Head loss in pipes and fittings, friction in rough and smooth pipes.

Unit III: **Boundary Layer Theory and Fluid Machinery**

Boundary layer formation, growth, and separation. Bernoulli's equation and applications. Introduction to fluid machinery: pumps, compressors, blowers, and fans. Performance characteristics, power and head calculations and efficiency.

Unit IV: **Flow Measurement Techniques**

Measurement of fluid flow using pitot tubes, orifice meters, venturi meters, rotameters, weirs, and notches. Principles, installation, calibration, and limitations of each device. Selection of flow meters for different applications and error analysis.

UnitV: **Microfluidics**

Introduction to microfluidics: definition, scope, and applications. Governing forces at the microscale: surface tension, capillary forces, and electrokinetic effects. Microchannel fabrication techniques: soft lithography, micromilling. Micro-scale flow measurement: Micro-Pitot Tube, Micro-PIV, thermal and electrochemical sensors. Applications in drug delivery, diagnostics, inkjet printing, fuel cells, and microreactors.

**Course Outcomes (COs)**

CO1: Apply fluid statics principles to compute hydrostatic forces and analyze buoyancy and stability.

CO2:Analyze flow regimes and behavior of fluid flow past immersed bodies.

CO3:Identify different types of fluid machinery and describe their working principles.

CO4:Describe the principles and functioning of flow measurement devices such as pitot tubes and venturimeters.


CO5: Explain microscale forces such as surface tension, capillarity, and electrokinetic effects.

**Textbooks (Core Reading):**

1. Geankoplis, Christie J. Transport Processes and Separation Process Principles (Includes Unit Operations), 4th Edition, Pearson Education, 2003

2. Darby, Ron Chemical Engineering Fluid Mechanics, 2nd Edition, CRC Press, 2001

**Reference Books (Supplementary Reading):**

1. De Nevers, Noel Fluid Mechanics for Chemical Engineers, 3rd Edition, McGraw-Hill Education, 2010

2. Munson, Bruce R., Young, Donald F., Okiishi, Theodore H., and Huebsch, Wade W. Fundamentals of Fluid Mechanics, 8th Edition, Wiley, 2017

3. Vennard, John K., and Street, Robert L. Elementary Fluid Mechanics, 7th Edition, Wiley, 1982.

**Course Articulation Matrix**

1 -

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 3 | 3 | 2 | | | 1 | 1 | | 1 | 1 | | 1 | | 1 |
| CO 2 | 3 | 3 | 2 | 1 | | 1 | | | 2 | 1 | | 1 | 1 | 2 |
| CO 3 | 3 | 3 | 2 | 1 | | | | | 1 | 1 | 2 | 2 | 1 | 3 |
| CO 4 | 3 | 3 | 2 | 2 | | | 1 | | 1 | 1 | | 2 | 1 | 3 |
| CO 5 | 3 | 3 | 2 | 3 | 1 | 1 | 2 | | | 1 | | 3 | | 3 |

Slightly; 2 - Moderately; 3 – Substantially


# MECHANICAL OPERATIONS (17251104)

| Category | Title | Code | Credits-3 | | | Theory Paper |
|---|---|---|---|---|---|---|
| | | | L | T | P | |
| Departmental Core - DC | Mechanical Operations | 17251104 | 2 | 1 | - | Max.Marks-30 Duration-2hrs. |

**Course Objective:**
To understand basic principles of various mechanical operations & construction and working of the equipment.

**Syllabus:**

**Unit-I: Particulate Solids:** Properties of particulate solids, Evaluation of size and shape, surface and population of particles, standard screens and screen analysis of solids. **Size Reduction:** Principles of comminution, size reduction, crushing, grinding, pulverizing and ultra fine size reduction equipment, power requirement in comminution.

**Unit-I: Mixing:** Mixing of solids, mixing equipment's design and power requirement of mixers, Mixer Effectiveness and Mixing Index.

**Unit-III: Separation:** Principles of Separation techniques for system involving solids, liquids and gases, Classification, Sedimentation, filtration, Fluidization and related equipments.

**Unit-IV: Transportation and Handling of Solids:** Selection and conveying devices for solids: Belt, Chain, Screw-conveyors, elevators and pneumatic conveying devices, Elementary design aspects of the conveyors.

**Unit-V:UNIT-V Hybrid and Multistage Separation Systems**

Hydrocyclone design and performance for liquid-solid separation, Integration of cyclones with thickeners, filters, or membranes, Tandem and multistage arrangements for high-purity recovery, Cyclone separators in FCC units, Decanter centrifuges for wastewater biosolids, Hydrocyclones in mineral slurry classification

**Course Outcomes (COs)**

**CO1:** *Explain* the properties, characterization methods, and size reduction techniques for particulate solids.
**CO2 :** *Analyze* the performance and power requirements of mixing equipment used for solids.
**CO3:** *Classify* different solid-liquid-gas separation techniques and associated equipment.
**CO4:** *Select* appropriate conveying and handling equipment for bulk solids based on application needs.
**CO5:** *Apply* the concept of tandem and multistage separation systems to enhance separation efficiency and purity.

**Text Books**

1. Badger & Bencharo- INTRODUCTION TO CHEMICAL ENGG- Tata Mc Grawhill 1998.

2. McCabe Smith- UNIT OPERATIONS OF CHEMICAL ENGG, Mc Graw Hill 2001.


**Reference Books**

1. Coulson & Richordson Vol. 2-CHEMICAL ENGG. New Delhi Asian Book Pvt. Ltd.
2. G.G. Brown- UNIT OPERATIONS-CBS Publications New Delhi 1995.

**Course Articulation Matrix**

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | PSO 1 | PSO 2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO 1 | 1 | 2 | | | | 1 | 1 | 1 | | 1 | 1 | 1 | | 1 |
| CO 2 | 3 | 3 | 2 | 1 | | 1 | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 2 |
| CO 3 | 1 | 3 | 2 | 1 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 3 |
| CO 4 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 1 | 3 |
| CO 5 | 2 | 3 | 2 | 3 | 1 | 1 | 2 | 1 | | 1 | 1 | 2 | | 3 |

1 - Slightly; 2 - Moderately; 3 – Substantially


# BASIC ELECTRICAL & ELECTRONICS ENGINEERING (17251105)

| Category | Title | Code | Credits-2 | | | Theory Paper |
|---|---|---|---|---|---|---|
| Engineering Science Course - ESC | Basic Electrical & Electronics Engineering | 17251105 | L | T | P | Max.Marks-30 |
| | | | 2 | - | - | Duration-2hrs. |

**Course Objectives:**

- Impart foundational knowledge in Electrical and Electronics Engineering.
- Enable students to analyze electric circuits, understand electrical machines, and implement digital systems.
- Explore emerging applications in industrial automation, smart grids, and renewable systems.

**Unit I D.C. Circuits Analysis:** Voltage and Current Sources: Dependent and independent source. Source conversion. Kirchhoff's Law, Mesh and Nodal analysis. Network theorems: Superposition theorem, Thevenin's theorem & Norton's theorem and their applications.

**Unit II Single-phase AC Circuits:** Generation of sinusoidal AC voltage, definitions: Average value, R.M.S. value, Form factor and Peak factor of AC quantity, Concept of Phasor, analysis of R-L, R-C, R-L-C Series and Parallel circuit, Power and importance of Power factor, Resonance in AC circuits.

**Unit III Transformer & Electrical Machines:** Magnetic Circuits and Electromagnetism, Transformers: Construction, principle, types, losses & efficiency, OC & SC test DC Machines: Motor and Generator working Principles, Characteristics, Introduction to Induction Motors and Synchronous Machines.

**Unit IV Digital Electronics, Devices & Circuits:** Number Systems, Logic Gates and Truth Tables, Diodes, Transistors (BJT), Multiplexers, Demultiplexers.

**Unit V Emerging Trends and Applications**: Introduction to Smart Grids, Smart Meters, and Renewable Systems. Types of earthing, Sensors and Basic IoT Applications.

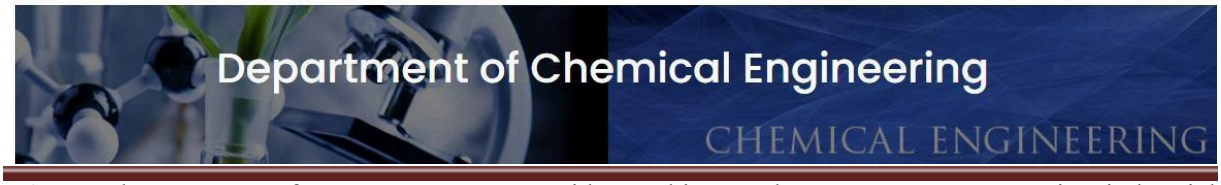
**Recommended Books:**

1. Basic Electrical and Electronics Engineering, D.P. Kothari and I.J. Nagrath, 2nd Edition, McGraw-Hill Education, 2020.
2. Basic Electrical and Electronics Engineering, S.K. Bhattacharya, 2nd Edition, Pearson Education, 2017.
3. Basic Electrical Engineering, V.N. Mittle and Arvind Mittal, 2nd Edition, McGraw-Hill Education, 2005.
4. Basic Electrical Engineering, A.E. Fitzgerald, David E. Higginbotham, and Arvin Grabel, 5th Edition, McGraw-Hill Education, 1981.
5. Principles of Electrical Engineering and Electronics, V.K. Mehta and Rohit Mehta, Revised Edition, S. Chand Publishing, 2019.

**Course Outcomes (COs):**

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

CO1. **Apply** fundamental laws and network theorems to analyze DC circuits
CO2. **Analyze** single-phase series & parallel AC circuits for calculation of power, power factor, and resonance conditions.
CO3. **Explain** the working principles, construction, and operational characteristics of transformers, DC machines, and induction motors.
CO4. **Design** basic digital logic circuits using logic gates, flip-flops, and counters




CO5. **Discuss** the concepts of smart meter, smart grids, earthing, and IoT systems to emerging industrial applications in automation and renewable energy systems.

**Course Articulation Matrix**

| COs / POs | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | *PSO1 | *PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO1** | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 1 | | |
| **CO2** | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 1 | | |
| **CO3** | 3 | 2 | 3 | 2 | 2 | 1 | - | - | - | - | - | 2 | 2 | 2 |
| **CO4** | 3 | 3 | 3 | 2 | 1 | - | - | 1 | 2 | 2 | - | 1 | | 2 |
| **CO5** | 3 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | - | 1 | 1 | 2 | 2 | 2 |

1 - Slightly; 2 - Moderately; 3 – Substantially
*PSOs will be mapped program wise.


| Bachelor of Technology Grading Scheme 2024-2025 SESSION (Flexible Curriculum) [Applicable to B. Tech.] | | | | | | |
|---|---|---|---|---|---|---|
| **S.No.** | **Subject Code** | **Subject Name** | **L** | **T** | **P** | **C** |
| **1** | **17251111** | **Universal Human Values & Professional Ethics** | **2** | **0** | **0** | **GRADE** |

**Mode of teaching:** The course is intended to be taught through lectures, discussions, case Studies, practice sessions, and assessment by self, peers, and instructor/teacher.

**Mode of Exam: MCQ**

**Course Objectives:** The objective of the course is fourfold:

1. Sensitization of student towards self, family (relationship), society and nature.
2. Understanding (or developing clarity) of nature, society and larger systems, on the basis of human relationships and resolved individuals.
3. Strengthening of self-reflection.
4. Development of commitment and courage to act.

## Course Content:

**1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education:**

- Self-Exploration–what is it?-Its content and process; 'Natural Acceptance' and Experiential Validation –as the process for self-exploration
- Continuous Happiness and Prosperity-Alookat basic Human Aspirations
- RightunderstandingRelationshipandPhysicalFacility-thebasicrequirementsforfulfilmentofaspirationsof every human being with their correct priority
- Understanding Happiness and Prosperity correctly –A critical appraisal of the current scenario

**2: Understanding Harmony in the Human Being:**

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
- Understanding the needs of Self ('I') and 'Body'- happiness and physical facility
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of 'I' with the Body

**3: Understanding Harmony in the Family and Society – Harmony in Human-Human Relationship:**

- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfillment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship


- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
- Visualizing a universal harmonious order in society

**4: Understanding Harmony in the Nature and Existence-existence as Coexistence:**

- Understanding the harmony in the Nature
- Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature
- Understanding Existence as Co-existence of mutually interacting units in all pervasive space
- Holistic perception of harmony at all levels of existence.

**5: Holistic Understanding of Harmony on Professional Ethics:**

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics:
  a. Ability to utilize the professional competence for augmenting universal human order
  b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems,
  c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- Strategy for transition from the present state to Universal Human Order:
  a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers
  b. At the level of society: as mutually enriching institutions and organizations

**Gender Sensitization:**

- Introduction to Sex, Gender & Culture
- Introduction to Women Studies and Socialization, including man-woman relationship, work distribution
- A brief review of Feminism, Patriarchy, Feminist Studies, Feminist Ideologies.
- Women and Law Constitutional Provisions and Fundamental rights related to Women.

## **Course Outcomes:** At the end of the course student will be able

- CO1. To become more aware of their surroundings, society, social problems and their sustainable solutions.
- CO2. To become sensitive to their commitment towards what they believe in (humane values. humane relationships and humane society).
- CO3. To apply what they have learnt to their own self in different day-to-day settings in real life.
- CO4. To sustain human relationships and human nature in mind.
- CO5. To have better critical ability.
- CO6. To negotiate living in harmony with self and others.

**Course Articulation Matrix**

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CO1 | 1 | - | 1 | - | 1 | 1 | 1 | 3 | 2 | 1 | - | 1 | - | - |


| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CO2** | 1 | 1 | 1 | - | 1 | 1 | 1 | 3 | 2 | 1 | - | 1 | - | - |
| **CO3** | 1 | - | 1 | - | 1 | 2 | 1 | 3 | 2 | 1 | - | 1 | 1 | 2 |
| **CO4** | 1 | 1 | 1 | - | 1 | 2 | 1 | 3 | 2 | 1 | - | 2 | - | - |
| **CO5** | 1 | - | 1 | - | 1 | 2 | 1 | 3 | 2 | 1 | 1 | 2 | 2 | 2 |
| **CO6** | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 3 | 2 | 1 | - | 2 | - | - |

**Text Book**

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

**Reference Books**

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A. N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth-by Mohandas Karamchand Gandhi
5. On Education – J Krishnamurthy
6. Siddhartha – Hermann Hesse
7. Old Path White Clouds – ThichNhatHanh
8. On Education – The Mother
9. Diaries of Anne Frank – Anne Frank
10. Life and Philosophy of Swami Vivekananda
11. Swami Vivekananda on Himself
12. Small is Beautiful - E. F Schumacher.
13. Slow is beautiful – Cecile Andrews
14. Economy of Permanence – J C Kumarappa
15. Bharat Mein Angreji Raj – Pandit Sunderlal
16. Mahatma and the Rose
17. The Poet and the Charkha
18. Rediscovering India – by Dharampal
19. Hind Swaraj or Indian Home Rule – by Mohandas K. Gandhi
20. Swaraj by Arvind Kejriwal
21. India Wins Freedom –Maulana Abdul Kalam Azad
22. Ramakrishna ki jeevani – Romain Rolland (English)
23. Vivekananda - Romain Rolland (English)
24. Gandhi-Romain Rolland (English)
25. Autobiography of a Yogi – by Paramhansa Yogananda
26. Gandhi and Question of Science–Sahatsrabudhe