II Semester:

S. No.	Course Code	Course Title	Category	Type	Credit	L	T	P
1.	22CET102	Environmental Science	PC	Theory	2	2	0	0
2.	22CST101	Programming with Python	PC	Theory	2	2	0	0
3.	22EET101	Basic Electrical and Electronics Engg	PC	Theory	3	3	0	0
4.	22MAT102	Mathematics II	PC	Theory	4	3	1	0
5.	22PHT101	Classical Physics	PC	Theory	3	3	0	0
6.	22CHT103	Chemical Process Calculations	PC	Theory	4	3	1	0
7.	22CHT104	Process Instrumentation	PC	Theory	3	3	0	0
8.	22CSP102	Programming with Python Lab	PC	Lab	1	0	0	2
9.	22ECP101	Electronics Engineering Lab	PC	Lab	1	0	0	2
10.	22EEP102	Electrical Engineering Lab	PC	Lab	1	0	0	2
11.	22PHP103	Classical Physics Lab	PC	Lab	1	0	0	2
12.	ICP101	CREATIVE ARTS / SPORTS / NSS			1			
13.	ICP102	DISCIPLINE			1			
Total					**27**			

SEMESTER – II

1. Subject Code: 22CHT103 Course Title: Chemical Process Calculations

2. Contact Hours: L:3 T:1 P:0

3. Credits: 4 Semester: II

4. Pre-requisite: Nil.

5. Objective: To introduce to the fundamental principles of chemical process analysis.

6. Course Outcomes: Upon completion of this course, the students will be able to:

i. Correlate between different Unit systems and their conversions for various process variables.

ii. Learn how to perform materials balance in any chemical processes with or without chemical reactions.

iii. Apply the gas laws to solve problems related to ideal gases and mixtures.

iv. Apply the energy balance to solve particular problems with and without chemical reactions

v. Solve de-coupled and coupled equations of mass and energy balance, numerically and computationally.

7. Details of Course:

Unit No.	Contents	Contact Hours
1.	**Introduction to Chemical Engineering Calculations:** Conversion of Units, dimensional consistency and data analysis, significant figures, precision and accuracy, concepts of molarity, molality, normality, ppm, weight fraction, mole fraction and volume fraction, density and specific gravity, process variables and principles of stoichiometry.	10
2.	**Materials balance with and without chemical reactions:** Flowchart, mole and mass balance for multi-component systems under: steady and unsteady state, single-phase and multiphase, material balances in processes including recycle, bypass and purge, Steady state material balances for reactions: species and elemental balances, combustion reactions, concept of limiting, excess reactants, fractional conversion and percentage of conversion, yield, ultimate and proximate analysis of fuels, excess air, air-fuel ratio calculations.	10
3.	**Thermodynamics of Multi-phase System**: Vapor-liquid equilibrium: Ideal and real gas, equation of state, Bubble point, dew point calculations, Phase diagram, Gibbs phase rule, Antoine equation, phase equilibria of vapour-liquid, solid-liquid and immiscible liquid-liquid systems.	10
4.	**Energy Balance with and without Chemical Reactions**: De-Coupled and coupled mass and energy balances, calculation of enthalpy changes, steady state mass and energy balance with and without reactions, heats of solution and mixing, Use of Psychometric chart, and steam table, thermochemistry, Hess's law of summation- heat of formation, Hess's Law and heats of combustion, Unsteady state material and energy balances, isothermal and adiabatic processes, Numerical and computation approach to solve problems with simultaneous mass and energy balance.	10

8. Books:

(A) Text Books

S.No.	Authors / Name of Book / Publisher	Year of Publication
1	Himmelblau, D., Riggs, J., "Basic Principles and Calculations in Chemical Engineering", 8th Ed., Pearson.	2012
2	Hougen, O.A, Watson, K.M and Ragatz R.A, "Chemical Process Principles: Part .1 (Chemical Process Principles: Material and Energy Balances)", 2nd Ed., CBS	2004

(B) Reference Books

S.No.	Authors / Name of Book / Publisher	Year of Publication
1	Bhatt B.I, and Vora S.M, "Stoichiometry", 4th Ed., McGraw-Hill.	2004
2	Felder, R.M., Rousseau, R.W., and Bullard, L.G., "Elementary Principles of Chemical Processes", 4th Ed., John Wiley and Sons.	2016
3	Narayanan, K.V., and Lakshmikutty, B., "Stoichiometry & Process Calculations", 2nd Ed., Prentice Hall Publishing.	2016
4	Chopey, N., Hicks, T., "Handbook of Chemical Engineering Calculations", 4th Ed., McGraw-Hill Education.	2012

1. Subject Code: 22CHT104 Course Title: Process Instrumentation

2. Contact Hours: L:3 T:0 P:0

3. Credits: 3 Semester: II

4. Pre-requisite: Nil.

5. Objective: To study various types of instruments in terms of fundamental concepts, functional elements, calibration, and characteristics.

6. Course Outcomes: Upon completion of this course, the students will be able to:

i. To understand scientific concepts, principles, and theories appropriate to instrumentation.

ii. Students developed an understanding of various process instruments, control valves, pressure measurement, temperature measurement, flow measurement devices.

iii. Students gained understanding of the performance criteria of instruments (range: precision, accuracy, sensitivity and range ability).

iv. To understand scientific concepts, principles, and theories appropriate to instrumentation.

v. Students developed an understanding of various process instruments, control valves, pressure measurement, temperature measurement, flow measurement devices.

7. Details of Course:

Unit No.	Contents	Contact Hours
1.	**Introduction:** Application of instrument systems, functional elements of a measurement system, classification of instruments, standards and calibration, instrument symbols & tag numbering system.	6
2.	**Temperature Measurement:** Temperature scales, temperature measuring instruments, liquid in glass thermometer, bimetallic thermometer, resistance temperature detectors (RTD), thermocouples, pyrometry.	4
3.	**Pressure Measurement:** Measurement of moderate pressure, high pressure and low pressure (vacuum), calibration and standardization.	3
4.	**Flow Measurement:** Positive displacement meters, variable head meters, variable area meters (rotameters), Weirs and notches, pitot tube, electromagnetic flow meter, hot wire anemometer, ultrasonic flow meters, laser Doppler anemometer.	5
5.	**Acoustics Measurement:** Characteristics of sound, Sound pressure, Power and intensity levels, Loudness, Typical Sound Measuring systems & Microphones.	3
6.	**Static characteristics of instruments:** Liquid level, pH, viscosity, conductivity, humidity, gas composition, and nuclear radiation, Errors and uncertainties in performance parameters, propagation of uncertainties in compound quantities, static performance parameters.	6
7.	**Dynamic characteristics of instruments:** Formulation of system	5

	equations, dynamic response, compensation, Transducers, building blocks of an instrument, Control centre, Instrumentation diagram, online instrumentation in modern plants.	
8.	**Control Valves:** Valve terminology, Valve capacity, Valve rangeability, Valve type based on body Design: Globe bodies, Angle, Needle, Ball, Eccentric rotating, Plug, Butterfly, Diaphragm, Pinch, Drag flow characteristic, Trim design, Mechanical feature, Actuator, Pneumatic types, Electric types, Electro-hydraulic types. Positioner-Pneumatic, Electro pneumatic, Positioner features & accessories, Control Valve Accessories-Testing procedure of control valve: CV and Rangeability (Valve sizing- initial level), Pressure Relieving Devices: Relief valve, Safety valves and Rupture discs.	6
9.	**Signal Converting Elements:** Pneumatic to electrical convertors, Electric to Pneumatic convertors, Voltage to Current convertor, Current to Voltage convertor, Frequency to voltage & voltage to Frequency convertor, Transmitter and Transducer signals.	4

8. Books:

(A) Text Books

S. No.	Authors / Name of Book / Publisher	Year of Publication
1	Eckman, D. P., "Industrial Instrumentation," Wiley Eastern	2004
2	Nakra, B.C. and Chaudhry, K.K., "Instrumentation, Measurement and Analysis," 2nd Ed., Tata McGraw Hill, New Delhi.	2006

(B) Reference Books

S. No.	Authors / Name of Book / Publisher	Year of Publication
1	Patranabis, D., "Principles of Industrial Instrumentation," Tata McGraw Hill, New Delhi.	2007
2	E.O. Doebelin, "Measurement Systems", McGraw Hill, 4th Ed.	1990
3	Lipták, B.G., "Instrument Engineers' Handbook: Process Measurement and Analysis," Vol 1 & 2, CRC Press.	2003