Chhattisgarh Swami Vivekanand Technical University, Bhilai

SCHEME OF TEACHING AND EXAMINATION

SEMESTER V CHEMICAL ENGINEERING

S. No	Board of Study	Subject Code	Subject	Period per week			Scheme of Exam Theory/ Practical			Total Marks	Credit L+(T+P)/ 2
				L	T	P	ESE	CT	TA		
1	Chemical Engg	319511(19)	Fluid Flow Operations	4	1	-	80	20	20	120	5
2	Chemical Engg	319512(19)	Heat Transfer Operations	4	1	-	80	20	20	120	5
3	Chemical Engg	319513(19)	Computational Methods in Chemical Engg.	3	1	-	80	20	20	120	4
4	Chemical Engg	319514(19)	Instrumentation & Measurement	3	1	-	80	20	20	120	4
5	Chemical Engg	319515(19)	Environmental Pollution and Control	4	-	-	80	20	20	120	4
6	Chemical Engg	319516(19)	Bio- Chemical Engg.	4	-	-	80	20	20	120	4
7	Chemical Engg	319521(19)	Fluid Flow Operations Lab	-	-	3	40	-	20	60	2
8	Chemical Engg	319522(19)	Heat transfer Operations Lab	-	-	3	40	-	20	60	2
9	Chemical Engg	319523(19)	Instrumentation & Measurement Lab	-	-	2	40	-	20	60	1
10	Chemical Engg	319524(19)	Bio- Chemical Engg. Lab	-	-	3	40	-	20	60	2
11	Humanities	300525(46)	Personality Development	-	-	2	-	-	20	20	1
12	Chemical Engg	319526(19)	Practical Training Evaluation* and Library	-	-	1	-	-	20	20	1
Total				**22**	**4**	**14**	**640**	**120**	**240**	**1000**	**35**

L- Lecture
T- Tutorial
P- Practical
ESE- End Semester Exam
TA- Teacher's Assessment

*** To be completed after IV semester and before the commencement of V semester**

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Semester: V
Subject: Fluid Flow Operations
Total Theory Periods: 50
Total Marks in End Semester Exam: 80
Minimum number of class tests to be conducted: 02

Branch: Chemical Engineering
Code: 319511 (19)
Total Tut Periods: 12

Unit I Introduction, Fluid Statics, Applications of Fluid Statics, Manometer, Types of Manometer, Dimensional Analysis of Flow.

Unit II Fluid Flow Phenomena, Newtonian and Non- Newtonian Fluid Flow, Boundary Layer theory, Friction Factor for Smooth and Rough Pipes.

Unit III Material and Energy Balance, Bernoulli's Equation, Flow of incompressible Fluid, Flow past Immersed Bodies, Packed Bed.

Unit IV Fluid Moving Machinery, Pump, Fans, Blowers, Fluidization Mechanism & Applications.

Unit V Measurement of Fluid Flow, Venturimeter, Orifice Meter, Rota Meter, Pitot tube, Weirs and Notches, V - Notches and Square Notches

Name of Text Books:

1. W. L. McCabe, J. C. Smith & Peter Harriott, Unit Operations of Chemical Engineering, 5th Ed., McGraw Hill Pub.
2. B. Messey, Fluid Mechanics, Chapman, London

Name of Reference Books:

1. Badger & Banchero, Introduction to Chemical Engineering, McGraw Hill
2. Brown et al., 'Unit operations', John Wiley sons.
3. Vijay Gupta, Fluid Mechanics and its application, New Age Publication
4. S C Rangwala, Fluid Mechanics, Charotar publishing house
5. Radhakrishnan, Fluid Mechanics, Prentice Hall of India.
6. Vyas R.P., Fluid Mechanics, Central Techno Publications.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Semester: B E Fifth
Subject: Heat Transfer Operations
Total Theory Periods: 50
Total Marks in End Semester Exam: 80
Minimum number of class tests to be conducted: 2

Branch: Chemical Engineering
Code: 319512 (19)
Total Tutorial Periods: 12

Unit I Modes of heat transfer, Heat transfer by conduction-concept, general heat conduction equation, thermal diffusivity and equivalent thermal conductivity, One-dimensional steady state conduction through plane, cylinders, spheres & composite walls, Introductions to unsteady state heat conduction.

Unit II Convection-Basic concept, natural and forced convection, critical insulation thickness for cylinders and spherical surfaces & optimization of insulation thickness, Hydrodynamic and thermal boundary layers, Laminar and turbulent hat transfer inside and out side of tubes, Dimensional analysis, determination of individual and overall heat transfer coefficient, fouling factors. Heat transfer in molten metals.

Unit III Condensation of mixed and pure vapours, film wise and drop wise condensation, loading in condensers, heat transfer in boiling liquids, boiling heat transfer coefficient, radiation heat transfer, Black body and gray body concept, Kirchoff's law, radiation between surfaces, combined heat transfer between surfaces.

Unit IV Heat exchangers- classification and design, menu temperature difference LMTD correction factor for multiple pass exchangers, NTU and efficiency of heat exchangers, use of efficiency chart. .

Unit V Evaporation – Elementary principle, Types of evaporators, Single and multiple effect operation, material and energy balance in evaporators, boiling point elevation, Duhrings rule, effect of liquid head, thermo compression. .

Name of Text Books:

- W. L. McCabe and J. C. Smith, "Unit Operations In Chemical Engineering", 4th Edn., McGraw Hill Publishing Co., 1985.
- D. Q. Kern, Process Heat Transfer, McGraw Hill Publishing Co., New York, 1950.

Name of Reference Books:

- M. Mikheyev, Fundamentals of Heat Transfer, Mir Publishers, Moscow, 1968
- A. S. Foust, L. A. Wenzel, C. W. Clump, Louis maus and L. B. Anderson, Principles of Unit Operations, John Wiley, New York, 1959.
- W. H. Mc Adams, Heat transmission, McGraw Hill Publishing co., New York, 1954.
- Max Jacob, Heat Transfer, Vol. I, John Wiley Inc., New York, 1949.
- N. Necati Ozisik, Basic Heat Transfer, McGraw Hill Kogakush, 1977
- Dawande S. D., Principles of Heat & Mass Transfer, Central Techno Publications.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Semester: B E Fifth — Branch: Chemical Engineering
Subject: Computational Methods in Chemical Engg. — Code: 319513(19)
Total Theory Periods: 40 — Total Tut Periods: 12
Total Marks in End Semester Exam: 80
Minimum number of class tests to be conducted: 2

Unit I **TREATMENT OF ENGINEERING DATA**
Graphical Representation of Empirical Equations, Interpolation, Extrapolation, Graphical & Numerical Integration.

Unit II. **INTERPRETATION OF ENGINEERING DATA**
Propagation of Errors, Properties of Variance, Confidence Limits for small samples.

Unit III. Application of ordinary differential equations to common chemical engineering Problems

Unit IV Applications of differential equations to unit operations.

Unit V Numerical solution of ordinary differential equations Formulation of partial differential equation. Finite difference, linear finite difference equation, Non-linear finite difference equations. Optimization, Types & Methods, its application to problems relating to Chemical processes

Name of Text Books:

1. Mickley Sherwood, Applied Mathematics in Chemical Engineering

2. B.S.Grewal, Higher Engineering Mathematics

Name of Reference Books:

1. Chapra and Canale, Numerical Methods for Engineers.

2. S.N.Saha, Fundamentals of Chemical Engineering.

3. B.S.Grewal, Numerical Methods for Engineers

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Semester: B E Fifth
Subject: Instrumentation & Measurements
Total Theory Periods: 40
Total Marks in End Semester Exam: 80
Minimum number of class tests to be conducted: 02

Branch: Chemical Engineering
Code: 319514(19)
Total Tut Periods: 12

Unit I **PRINCIPLES OF MEASUREMENT-**

Error analysis, Static & Dynamic characteristics of measurement. Dynamic response of I & II order instruments

TEMPERATURE MEASUREMENT-

Expansion Thermometers, Thermocouples, Resistance Temperature Detectors, Thermistors & Pyrometers

Unit II **PRESSURE MEASUREMENT:**

Manometers, Bourdon tubes, Bellows, Measurement of gage pressure, vacuum. Measurement of absolute Pressure. Mc Leod Gage, Pirani Gage, Ionization Gage. Vacuum sensor, Thermal vacuum sensor. Response of mechanical pressure gages, Strain Gages & LVDT.

Unit III **FLOW MEASUREMENT:**

Head flow meters, Area flow meters, Open channel meters, Positive Displacement meters, Control valves – linear & non-linear characteristics.

Unit IV **LIQUID LEVEL MEASUREMENT:**

Direct level measurement, interface measurement, Hydrostatic head level measurement in pressure vessels, Ultrasonic level devices, Point & Continuous level measurement using radioactive devices, Capacitance type devices, resistance sensors, Nuclear radiation type level gages & level switches.

Unit V **ANALYTICAL INSTRUMENTATION:**

Gas Chromatography, operating principles, type, components & applications. High performance liquid chromatography; Refractive index, pH, viscosity & conductivity measurement; Gas Analyzers.

Name of Text Books:

1. Andrew W.G. & William H.B, Applied Instrumentation in the Process Industries Vol - I
2. Eckman D.P., Industrial Instrumentation, McGraw Hill Publications (1975)

Name of Reference Books:

1. Patranabis, Principles of Industrial Instrumentation
2. Perry's Chemical Engineer's Handbook
3. A.K.Sawhney, A Course in Mechanical Measurements and Instrumentation

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Semester: B E Fifth
Subject: Environmental Pollution and Control
Total Theory Periods: 50
Total Marks in End Semester Exam: 80
Minimum number of class tests to be conducted: 2

Branch: Chemical Engineering
Code: 319515 (19)
Total Tutorial Periods: 00

UNIT-I Air Pollution and Meteorology, Air Pollution from major industrial operations And some typical chemical industries, Air Pollution control methods and Equipments.

UNIT-II Air Pollution sampling and measurement, Analytical methods, Air Pollution Legislation and regulation

UNIT- III Water Pollution- sources of water pollutants, Classification and characteristics of waste water, Water Pollution control methods and equipment, Primary, Secondary and tertiary treatment of waste water, Legislation regarding
Prevention and control of Water Pollution

UNIT-IV Nuclear waste materials and their disposal, Hazards of radioactive materials and their handling, Treatment and disposal of nuclear waste materials, source reduction and recycling of solid wastes

UNIT-V Noise Pollution- evaluation and international standards for control, Noise control Criteria, Administrative and engineering control, Effects of noise in Communication, working efficiency, industrial accidents etc, monitoring and Control of Noise Pollution, Noise measuring instruments.

Name of Text Books:

1. M.N Rao and H.V.N Rao, Air Pollution, Tata McGraw Hill
2. S. Rao, Environmental Pollution control engineering, Wiley Eastern Ltd
3. .P Singal, Noise Pollution and control, Narosa publishing House, New Delhi

Name of Reference Books:

1. G.N. Pandey and G.C. Carney Environmental engineering, Tata McGraw Hill.
2. . Parker, Air Pollution Handbook, Tata McGraw Hill.
3. .L.McGill, F.R. Haldan , Air Pollution Handbook, Edited By Tata McGraw Hill

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Semester: B E Fifth
Subject: Bio Chemical Engineering
Total Theory Periods: 50
Total Marks in End Semester Exam: 80
Minimum number of class tests to be conducted: 2

Branch: Chemical Engineering
Code: 319516(19)
Total Tut Periods: 00

UNIT – I Introduction – Principle of microbiology, structure of cells, Types of cell – Bacteria, Yeasts, Fungi, Algae, Chemical of Life – Lipids, Sugar and polysaccharides, Nucleotides to RNA and DNA, Amino acids into proteins, The hierarchy of cellular organization.

UNIT – II The kinetic of Enzyme – Catalyzed Reaction – The Enzyme substance Complex and Enzyme action, simple enzyme kinetics with one or two substrate, determination of eliminatory step rate constants, other influenses on enzyme activity applications, hydrolytic enzymes immobilized- enzyme technology-enzyme mobilization

UNIT – III Metabolic stoichiometry and energetic – Concept of metabolic reaction coupling, reaction sampling ATP and NADP, Anaerobic metabolism, fermentation, respiration, photosynthesis, Biosynthesis, bioconversion, Transport across cell membranes.

UNIT – IV Kinetics of Substrates Utilization, Product formation and Biomass production in cell. Culture – Growth cycle phases for linear Batch cultivation.

UNIT – V Introduction to Bio reaction, Fermentation technology, Reactors for Bio-mass production, down stream process recovery of particulate, Product isolation, concentration, purification and drying.

Name of Text Books

1. Balleys & Ollis, Bio-Chemical Engg. Fundaments, Mc-Graw hill Publication
2. B. D. Singh, Bio - Technology, Kalyani Publication

Name of Reference Books:

1. Michael Shuler L, Fikret Kargi , Bioprocess Engineering Basic Concept
2. Rohit S S, Biotechnology- Fundamentals and Applications

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Semester: B.E. Fifth — Branch: Chemical Engineering
Subject: Fluid Flow Operations Lab — Practical Code: 319521(19)
Total Practical Periods: 40
Total Marks in End Semester Exam: 40

Experiments to be performed (Minimum 10)

- Determination of the discharge coefficient of given venturi meter.
- Determination of discharge coefficient of given orifice meter.
- Determination of friction factor and head loss in given pipe assembly.
- Determination of the discharge coefficient of given rectangular notch.
- Determination of the discharge coefficient of given V- notch.
- To verify Bernoulli's theorem experimentally.
- To determine the pressure drop across packed column.
- To determine the friction factor/ pressure drop across contraction in a given pipe assembly.
- To determine the friction factor/ pressure drop across expansion in a given pipe assembly.
- To determine equivalent length of double pipe assembly.
- To determine the time required to empty an open hemispherical tank and
- coefficient
- To calibrate the given Rota meter.

List of Equipments/Machines required:

1. Bernoulli's apparatus
2. Packed column apparatus
3. Venturi meter
4. Orifice meter
5. Rectangular notch & V - notch apparatus
6. Rota meter
7. Hemispherical tank
8. Pipe assembly.

Recommended Books:

W. L. McCabe and J. C. Smith, "Unit Operations In Chemical Engineering", 4th Edn., McGraw Hill Publishing Co., 1985.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Semester: B.E. Fifth | Branch: Chemical Engg
Subject: Heat Transfer Operations Lab | Practical Code: 319522(19)
Total Practical Periods: 40
Total Marks in End Semester Exam: 40

Experiments to be performed (Minimum 10)

- Determination of thermal conductivity of insulating powder by Spherical Method.
- To determine the total thermal conductivity and the thermal resistance of given compound resistances in series by slab system.
- Study of temperature gradient along the composite wall structure by slab system.
- To determine the heat transfer coefficient ofdouble pipe heat exchanger for co-current flow.
- To determine the heat transfer coefficient of double pipe heat exchanger for counter-current flow.
- To determine the heat transfer coefficient of shell & tube heat exchanger.
- To study the temperature distribution along the length of pin fin in natural convection.
- To study the temperature distribution along the length of pin fin in forced **convection.**
- To verify the Stefan- Boltzmann constant.
- Study of Single Effect Evaporator
- To study the open pan evaporator.
- To study the triple effect evaporator.
- To study the horizontal tube condenser.

List of Equipments/Machines Required

(i) Open pan evaporator
(ii) Triple Effect Evaporator
(iii) Horizontal Tube condenser
(iv) Spherical set up for insulating powder
(v) Compounded resistance set up of metal slabs
(vi) Double pipe heat exchanger
(vii) Shell & tube heat exchanger
(viii) Pin fin apparatus
(ix) Stefan Boltzman Radiation setup
(x) Single Effect Evaporator

Recommended Books:

1. D. Q. Kern, " Process Heat Transfer", McGraw Hill Publishing Co., New York, 1950
2. W. L. McCabe and J. C. Smith, “Unit Operations In Chemical Engineering", 4th Edn., McGraw Hill Publishing Co., 1985.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Semester: B.E. Fifth
Branch: Chemical Engineering
Subject: Instrumentation & Measurement Lab
Practical Code: 319523(19)
Total Practical Periods: 28
Total Marks in End Semester Exam: 40

Experiments to be performed (Minimum 10)

- To determine the % composition of unknown liquid using Abbe Refractometer
- To determine the TDS value of the given sample using TDS Meter.
- To determine the specific conductance of given liquid using Digital Direct Reading Conductivity meter.
- Determination of TDS, Temperature, Conductivity, ORP, D.O. of water sample by portable water analyser kit.
- Determination of acid - base characteristics of given sample using Digital pH Meter.
- To determine the % composition of given solution by Photoelectric Colorimeter.
- To determine the % composition of given solution by UV-VIS Spectrophotometer.
- To detect the presence of alkali metals in the given solution using Flame Photometer.
- Determination of turbidity of given sample using Nephelo-Turbidity meter.
- 10 . Measurement of temperature of hot surface using thermocouple.
- 11. Determination of wavelength at which given liquid shows maximum absorbance using UV-VIS Spectrophotometer.

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List of Instruments Required

1. Abbe Refractometer
2. TDS meter
3. DDR Conductivity meter
4. Portable water analyser kit
5. Digital pH Meter
6. Photoelectric Colorimeter.
7. UV-VIS Spectrophotometer
8. Digital Flame Photometer.
9. Digital Nephelo-Turbidity meter
10. Digital Thermocouple

Recommended Books:

1. Andrew W.G. & William H.B, Applied Instrumentation in the Process Industries, Vol - I.
2. Eckman D.P., Industrial Instrumentation, McGraw Hill Publications (1975)
3. Patranabis, Principles of Industrial Instrumentation
4. Perry's Chemical Engineer's Handbook
5. Khandpur , Handbook of Analytical Instrumentation.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Semester: B.E. Fifth
Subject: Bio-Chemical Engg Lab
Total Practical Periods: 40
Total Marks in End Semester Exam: 40

Branch: Chemical Engineering
Practical Code 319524(19)

Experiments to be performed (Minimum 10)

- Estimation of Carbohydrate
- Estimation of Protein
- Determination of Iodine value of fat
- Determination of Saponification value of fat
- Identification of given sample (Carbohydrate, Protein, Fat)
- Separation of amino acid by paper chromatography.
- Isolation of Amy lose producing organism
- Citric acid production by fermentation
- Study of various technique of enzyme immobilization
- Study of various technique of enzyme engg.
- Preparation of poly/ bi functional enzymes

List of Equipments/Machines Required

(i) Centrifuge
(ii) Colorimeter
(iii) Refractometer
(iv) Spectrophotometer (UV-VIS)
(v) Hot Air Oven
(vi) Electronic Balance Dhona
(vii) pH meter

Recommended Books

1. Balleys & Ollis, Bio-Chemical Engg. Fundaments, Mc-Graw hill Publication
2. Singh B.D., Bio- Technology, Kalyani Publication
3. Schuller and Kargi, Bioprocess Engineering.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Semester : B.E. V

Branch : **Common to All Branches**

Subject : **Personality Development**
No. of Periods : 2 pds/week
Total Marks in End Semester Exam. : NIL
Minimum number of class tests to be conducted: Two

Code : **300525 (46)**
Tutorial Periods : NIL
Teacher's Assessment: 20Mks

Objective: The course is introduced to develop one's outer and inner personality tremendously and enrich the abilities to enable one to meet the challenges associated with different job levels. Personality Development is essential for overall development of an individual apart from gaining technical knowledge in the subject.

Unit – I
Personality concepts:

- **What is Personality** – its physical and psychic aspects. How to develop a positive self-image. How to aim at Excellence. How to apply the cosmic laws that govern life and personality.
- **How to improve Memory.** How to develop successful learning skills. How to develop and effectively use one's creative power.
- **How to apply the** individual MOTIVATORS **that make you a self-power personality.**

Unit – II
Interpersonal Skills**:**

- **Leadership:** Leaders who make a difference, Leadership: your idea, What do we know about leadership? If you are serious about Excellence. Concepts of leadership, Two important keys to effective leadership, Principles of leadership, Factors of leadership, Attributes.
- **Listening:** Listening skills, How to listen, Saying a lot- just by listening, The words and the music, How to talk to a disturbed person, Listening and sometimes challenging.
- **How to win friends** and influence people, How to get along with others. How to develop art of convincing others. How can one make the difference. How to deal with others particularly elders. Conflicts and cooperation.

Unit – III
Attitudinal Changes:

- **Meaning of attitude,** benefits of positive attitudes, how to develop the habit of positive thinking.
- **Negative attitude and wining:** What is FEAR and how to win it. How to win loneliness. How to win over FAILURE. How to win over PAIN. How to win over one's ANGER and others anger. How to overcome CRITICISM. What is stress and how to cope up with it? What is crisis and how to manage it.
- How to apply the **character MOTIVATORS** that elevate you and your personality to the top, the art of self motivation.
- How to acquire **mental well-being.**
- How to acquire **physical well-being.**
- How to formulate effective **success philosophy.**

Unit –IV
Decision Making:

How to make your own LUCK. How to plan goals/objectives and action plan to achieve them. How to make RIGHT DECISION and overcome problems. How to make a Decision. Decision making : A

question of style. Which style, when? People decisions: The key decisions. What do we know about group decision making? General aids towards improving group decision making. More tips for decisions of importance.

Unit – V

Communication Skills:

- **Public Speaking:** Importance of Public speaking for professionals. The art of Speaking - Forget the fear of presentation, Symptoms of stage fear, Main reason for speech failure, Stop failures by acquiring Information; Preparation & designing of speech, Skills to impress in public speaking & Conversation, Use of presentation aids & media.
- **Study & Examination:** How to tackle examination, How to develop successful study skills.
- **Group discussions:** Purpose of GD, What factors contribute to group worthiness, Roles to be played in GD.

Reference Books:

1. How to develop a pleasing personality by Atul John Rego, Better yourself books, Mumbai, 2000.
2. How to Succed by Brain Adams, Better Yourself books, Mumbai, 1969.
3. Basic Managerial skills for all by E. H McGrawth, Prentice Hall India Pvt Ltd, 2006.
4. The powerful Personality by Dr Ujjawal Patni & Dr Pratap Deshmukh, Medident Publisher, 2006.
5. Great Words win Hearts by Dr Ujjwal Patni, Fusion Books, 2006.
6. Personality : Classic Theories & Modern Research; friedman ; Pearson Education 2006.
7. How to win friends and influence people by Dale Carnigie, A.H. Wheeler 2006.