

**SYLLABUS OF 3<sup>rd</sup> SEMESTER  
CHEMICAL ENGINEERING BRANCH (DRAFT)**

**DETAILED SYLLABUS**  
**BRANCH: CHEMICAL ENGINEERING**  
**Semester: 3<sup>rd</sup>**

**A. Credit Distribution**

**Semester- III**

S.No.	Course Code	Course Title	L	T	P	Credit
1	CHPC- 301	Principles of Unit Operation- I	2	1	0	3
2	CHPC- 302	Energy Engineering	3	0	0	3
3	CHPC- 303	Stoichiometry & Thermodynamics	2	1	0	3
4	CHPC-304	Fundamentals of Chemical Reaction Engineering	2	0	0	2
5	CHPC-305	Industrial Chemical Processes-I	3	0	0	3
6	CHPC-306	Industrial Chemical Processes-I Lab	0	0	2	1
7	CHPC- 307	Principles of Unit Operation-I Lab	0	0	2	1
8	CHPC-308	Fundamentals of Chemical Reaction Engineering Lab	0	0	2	1
9	CHPC-309	Energy Engineering Lab	0	0	2	1
10	CHOE-301	Industrial Robo( Tata)/ MS Office & AutoCAD ( Infosys)	0	0	4	2
11	CHOE-302	Engineering Economics and Accountancy	2	0	0	2
12	AU-301	Essence of Indian Knowledge and Tradition	2	0	0	0
Total Credit =						20

NOTE: Choose any one Subject CHOE-301 code or CHOE-302 code

**B. Marks Distribution**

S. No.	Course Code	Course Title	Internal Assessment (Theory)		ESE		Internal Assessment (Practical)		Practical Test		Total marks (Course)	Pass marks (Course)
			Total marks	Pass marks	Total marks	Pass marks	Total marks	Pass marks	Total marks	Pass marks		
1	CHPC- 301	Principles of Unit Operation- I	40	16	60	24					100	40
2	CHPC- 302	Energy Engineering	40	16	60	24					100	40
3	CHPC- 303	Stoichiometry & Thermodynamics	40	16	60	24					100	40
4	CHPC-304	Fundamentals of Chemical Reaction Engineering	40	16	60	24					100	40
5	CHPC-305	Industrial Chemical Processes-I	40	16	60	24					100	40
6	CHPC-306	Industrial Chemical Processes Lab					60	24	40	16	100	40
7	CHPC- 307	Principles of unit operation lab					60	24	40	16	100	40
8	CHPC-308	Fundamentals of Chemical Reaction Engineering Lab					60	24	40	16	100	40
9	CHPC-309	Energy Engineering Lab					60	24	40	16	100	40
10	CHOE-301	Industrial Robo( Tata)/ MS Office & AutoCAD ( Infosys)					60	24	40	16	100	40
11	CHOE-302	Engineering Economics and Accountancy	40	16	60	24					100	40
12	AU-301	Essence of Indian Knowledge and Tradition	40	16	60	24					100	40
Total											1000	

**Course Title: Principles of Unit Operation – I (PUO – I)**  
**Course code: CHPC-301**

**Course Outcomes:**

**CO1** : Recall the various fluid properties, types of flow and their behaviour.

**CO 2** : Apply different laws and basic equations of fluid mechanics to appropriate situation.

**CO 3** : Analysing the performance of various fluid transportation and metering devices.

**CO 4** : Explain the modes of heat transfer and various laws associated with it.

**CO 5** : Apply knowledge of different heat transfer equipment like heat exchangers, condensors, evaporator etc

**Teaching scheme:**

Lecture	Tutorial	Total
2 hours/week	1 hour/week	3 hours

**Examination scheme:**

ESE	Internal	Total	Pass (ESE)	Pass (Internal)	Credit
60	40	100	24	16	3

**Detailed Course content:**

Chapter No.	Chapter Title	Contents	Duration (in hours)
1.	Fundamentals of Fluid Flow	Introduction to fluid Study about the types of fluid and fluid properties Rheology of fluids	6
2.	Fluid Statics	Types of flow Hydrostatic pressure Forces on submerged body Manometry Buoyancy	5

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3.	Fluid Dynamics	Conservation of mass Equation of Continuity Laws of fluid dynamics Bernoulli's principle & its applications	8
4.	Transportation and metering of fluids	Flow meters Pumps Compressors Blowers Valves	10
5.	Introduction to Heat Transfer	Modes of heat transfer Laws of heat transfer	6
6.	Heat Transfer Equipments	Heat Exchangers Condensor Evaporator	10

**Text books/ References:**

1. Unit Operation of Chemical Engg. by –McCabe and Smith. McGraw –Hill Publication.
2. Chemical Engg. Vol-I by –Coulson and Richardson.
3. Heat transfer -Principles and applications; B K Dutta, Prentice Hall India
4. Heat Transfer –A basic approach by M. Necati Ozisik

**Course Title: Principles of Unit Operation – I laboratory**  
**Course code: CHPC-307**

**Course Outcomes :**

**CO 1:** Apply the knowledge of fluid statics and fluid mechanics on various fluid transport and metering devices.

**CO 2 :** Apply knowledge of different heat transfer equipment like heat exchangers, condensers, evaporator etc

**Lab Experiments:**

Sl. No.	Name of the experiment
1	To verify Bernoulli's equation experimentally
2	To determine the Reynolds number for the given flow in pipes.
3	To measure the discharge through Venturi meter, Orifice meter.
4	To measure the discharge through Rota meter
5	To determine the discharge through centrifugal pump.

**Course Title: Energy Engineering**

**Course code: CHPC-302**

**Course outcome:**

**CO 1:** Recall the basic concepts of energy engineering by identifying the current energy scenarios

**CO 2:** Explain the classification, characteristics, and uses of various solid fuels, Liquid Fuels and Gaseous Fuels.

**CO 3:** Explain the working principles and significance of different renewable energy sources and their role in meeting global energy needs.

**Teaching scheme:**

Lecture	Tutorial	Total
3 hours/ week	-	3 hours

**Examination scheme:**

ESE	Internal	Total	Pass (ESE)	Pass (Internal)	Credit
60	40	100	24	16	3

**Detailed course content:**

Chapter no.	Chapter Title	Contents	Duration (in hours)	Marks
1	Introduction to Energy Engineering	1.1 Energy Scenario: Indian and global, Energy crisis. 1.2 Classification of various energy sources. 1.3 Remedial measures to some energy crisis.	3	5
2	Solid Fuel	2.1 Origin of coal 2.2 Classification of coal 2.3 Calorific value 2.4 Rank of coal 2.5 Proximate and Ultimate analysis	12	15
3	Liquid Fuel	3.1 Introduction to petroleum geology 3.2 Origin of petroleum (theories) 3.3 Characteristics of liquid fuel	10	15
4		4.1 Composition and production of	10	10

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	Gaseous Fuel	4.1.1 Natural gas 4.1.2 LPG 4.1.3 Producer gas 4.1.4 Carburetted water gas 4.2 Analysis of gas		
5	Renewable Energy	5.1 Hydroelectricity 5.2 Solar energy 5.3 Energy from biomass 5.4 Geothermal energy 5.5 Wind energy 5.6 Mitigating the effects of conventional fuels using renewable energy	10	15

**Text Books/ References**

1. Basics of Energy Engineering by S. Hussain and Smriti R. Konwar.
2. Solid, liquid & gaseous fuels by Brame & King.
3. Fuels and Combustion by Samir Sarkar

**Course Title: Energy Engineering Laboratory**

**Course Outcome:**

**Course code: CHPC-309**

1. Determining energy output from various fuels
2. Analyzing the quality of various fuels

**Teaching scheme:**

Lecture	Practical	Total
-	2 hours/ week	2 hours

**Examination scheme:**

ESE	Internal	Total	Pass (ESE)	Pass (Internal)	Credit
40	60	100	16	24	1

**Detailed course content:**

Unit	Topic	Duration (in hours)
1	1.1 Determination of flash point by Pensky Marten, Abel's and Cleveland apparatus 1.2 Determination of kinematic viscosity by Redwood I & II viscometer 1.3 Determination of pour point and smoke point	16
2	1.1 Determine the calorific value of a solid and a liquid sample using Bomb's calorimeter 1.2 Proximate analysis of a solid sample	8
3	1.1 Determine softening point of bitumen using Ring and Ball apparatus 1.2 Determine penetration index of bitumen	6

**Course Title: Stoichiometry & Thermodynamics**  
**Course Code: CHPC-303**

**Course Outcomes:**

**CO 1:** Explain the concept of physical quantities, systems of units, and dimensional analysis to explain the significance of units and verify the dimensional consistency of physical equations. (**Understand**)

**CO 2:** Apply the principles of stoichiometry to solve numerical problems involving mole concept, mass and volume relationships, limiting reagents, and percentage yield in chemical reactions. (**Apply**)

**CO 3:** Explain the fundamental concepts of thermodynamics. (**Understand**)

**CO 4:** Recall the Laws of Thermodynamics. (**Remember**)

**CO 5:** Apply the laws of thermodynamics to evaluate the performance of heat engines, refrigerators, and heat pumps. (**Apply**)

**Teaching Scheme**

Lecture	Tutorial	Total
2 hours/ week	1 hour/week	3 hours

**Examination Scheme**

ESE	Internal	Total	Pass (ESE)	Pass (Internal)	Credit
60	40	100	24	16	3

**Detailed course content:**

Chapter No.	Chapter Title	Content	Duration
1.	Units and Dimensions	1.1 Dimensions and System of Units 1.2 Fundamental and Derived Units 1.3 Dimensional Consistency 1.4 Conversion Factor	3 hr
2.	Fundamental Concepts of Stoichiometry	2.1 Laws of Chemical Combination 2.2 The mole concept 2.3 Composition of Mixtures 2.3.1 Mass Fraction (Weight Fraction) 2.3.2 Mass Percent Weight Percent) 2.3.3 Mass Ratio 2.3.4 Mole Fraction and Mole Percent 2.3.5 Volume Fraction and Volume Percent	8 hr

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		<p>2.3.6 Normality, Molarity and Molality</p> <p>2.4 Chemical Reactions and Process Calculations</p> <p>2.4.1 Excess and Limiting Reactant</p> <p>2.4.2 Conversion</p> <p>2.4.3 Yield</p>	
3.	Introduction to Thermodynamics	<p>3.1 Introduction</p> <p>3.2 Classification of Thermodynamics system</p> <p>3.2.1 Closed system</p> <p>3.2.2 Open system</p> <p>3.2.3 Isolated system</p> <p>3.3 Properties of a system</p> <p>3.4 State and Path functions</p> <p>3.5 Temperature and Zeroth Law of Thermodynamics</p> <p>3.6 Ideal gas</p> <p>3.7 Energy, Work and Heat</p>	10 hr
4	First Law of Thermodynamics	<p>4.1 First law of Thermodynamics</p> <p>4.2 Internal energy</p> <p>4.3 Joule's Law</p> <p>4.4 Thermodynamic Processes</p> <p>4.4.1 Adiabatic Process</p> <p>4.4.2 Isothermal Process</p> <p>4.4.3 Isochoric Process</p> <p>4.4.4 Isobaric Process</p> <p>4.4.5 Polytropic Process</p>	10 hr
5	Second Law of Thermodynamics	<p>5.1 Kelvin Plank Statement</p> <p>5.1.1 Thermal reservoir</p> <p>5.1.2 Heat Engine</p> <p>5.1.3 Carnot Cycle and it's Efficiency</p> <p>5.2 Clausius Statement</p> <p>5.2.1 Refrigerator</p> <p>5.2.2 Coefficient of Performance</p> <p>5.2.3 Heat Pump</p> <p>5.3 Entropy</p> <p>5.4 Compressibility Factor</p>	15 hr

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**Text/ Reference Books:**

1. Smith, J.M. and Van Ness, H.C., Introduction to Chemical Engg. Thermodynamics, McGraw-Hill
2. K V Narayanan, a Text book of Chemical Engg Thermodynamics, Prentice Hall India.
3. Dodge, Chemical Engg. Thermodynamics, McGraw-Hill
4. Wilson and Ric, Principles of Chemical Engg. Thermodynamics, McGraw-Hill.

**Course Title: Fundamentals of Chemical Reaction Engineering**  
**Course code: CHPC-304**

**Course outcome:**

1. Recall the classification of chemical reactions and ideal reactors. **(Remember)**
2. Explain the performance equations of ideal reactors. **(Understand)**
3. Analyze the kinetics and rates of different kinds of chemical reactions. **(Analyse)**

**Teaching scheme:**

Lecture	Tutorial	Total
2 hours/ week	-	2 hours

**Examination scheme:**

ESE	Internal	Total	Pass (ESE)	Pass (Internal)	Credit
60	40	100	24	16	2

**Detailed course content:**

Chapter no.	Chapter Title	Contents	Duration (in hours)
1	Basics of Chemical reactions	1.1. Introduction. 1.2. Types of Chemical Reactions 1.3. Rate of Chemical Reactions 1.4. Relative Rate of reaction. 1.5. Factors affecting the rate reaction 1.6 Reaction Mechanism 1.7. Molecularity 1.8. Order of reaction 1.9. Rate constant 1.9.1. Arrhenius Theory 1.9.2 Collision Theory 1.9.3 Transition state Theory	8
2	Kinetics of Homogeneous System	2.1. Constant volume system 2.2. Rate equation for different order of reaction 2.2.1. Zero-Order 2.2.2. First Order 2.2.3. Second Order 2.2.4. Half -Life	12

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3	Introduction to Ideal Reactors and Their Design equation	3.1. Idea Batch Reactor 3.2. Flow Parameters 3.2.1. Space time 3.2.2. Space velocity etc 3.3. Ideal CSTR 3.4. Ideal PFR	10
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**Text Books/ References**

1. Chemical Reaction Engineering by Levenspiel, WileyEastern.
2. Elements of Chemical Reaction engineering, Fogler, 3rd Ed, Prenticehall
3. Chemical Engineering Kinetics by D.M. Smith, McGraw HillPublication.
4. Reaction Kinetics for Chemical Engineers by Wales, McGraw HillPublication.

**Course Title: Fundamentals of Chemical Reaction  
Engineering Lab**  
**Course code: CHPC-308**

**Course outcome:**

**CO 1:** Explain the working of different reactors.

**CO 2:** Analyze the kinetics of reactions performed in different reactors.

**Teaching scheme:**

Lecture	Practical	Total
-	2 hours/week	2 hours

**Examination scheme:**

ESE	Internal	Total	Pass (ESE)	Pass (Internal)	Credit
40	60	100	16	24	1

**Detailed course content:**

Sl. No.	Name of the Experiment
1	Kinetics in Batch reactor (equimolar feed)
2	Experiments on PFR a. Study the effect of variation of conversion with residence time b. To determine the reaction rate constant.
3	Determine the reaction rate constant in a MFR.

**Course Title: Industrial Chemical Process- I**  
**Course Code: CHPC-305**

**Course Outcomes:**

**CO 1:** Recall the concepts of unit processes and unit operations. **(Remember)**

**CO 2:** Explain the sources, types, properties, and processing methods of fats and oils **(Understand)**

**CO 3:** Explain the manufacturing processes, properties, and industrial significance of common acids and alkali industries **(Understand)**

**CO 4:** Explain the manufacturing processes, chemical composition, and applications of soaps and detergents. **(Understand)**

**CO 5:** Apply the knowledge of water quality parameters and select appropriate wastewater treatment methods. **(Apply)**

**Teaching Scheme**

Lecture	Tutorial	Total
3 hours/ week	---	3 hours

**Examination Scheme**

ESE	Internal	Total	Pass (ESE)	Pass (Internal)	Credit
60	40	100	24	16	3

**Detailed course content**

Chapter No.	Chapter Title	Content	Duration (in Hours)
1	Introduction	1.1 Unit Processes and Unit Operations and the differences between them. 1.2 Chemical process industries with reference to Indian resources and industries.	3

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2	Water	2.1 Water Quality parameters 2.2 Industrial waste water treatment.	10
3	Acid Industry	3.1 Manufacture of Sulphuric acid (Contact Process) and its application 3.2 Manufacture of Hydrochloric acid by Direct Synthesis and its application 3.3 Manufacture of Nitric acid by Ammonia Synthesis method and its application 3.4 Handling and storage of acids	12
4	Alkali Industry	4.1 Manufacture of Soda Ash (Sodium carbonate) by Solvay process and its application 4.2 Manufacture of Caustic Soda (Sodium Hydroxide) by Chor-alkali process and its application 4.3 Lithium-ion battery and its application	12
5	Soaps and Detergents	5.1 Manufacture of Soap 5.2 Manufacture of Detergents	5
6	Fats and Oils	6.1 Overview of oil types- vegetable, animal, mineral and essential. 6.2 Chemical nature and consistency of vegetable oil 6.2 Hydrogenation of vegetable oil 6.3 Production of oil from oil seeds.	3

**Text Books/ References:**

1. Outlines of Chemical Technology by Dryden
2. Chemical Process Industries by Shreve
3. Chemical Technology by G.N. Pandey

**Subject: Industrial Chemical Process- I Laboratory**

**Subject Code: CHPC-306**

**Course Outcomes:**

CO 1: Analyze water quality parameters

CO 2: Analysis of soap properties

CO 3: Analysis of vegetable oil.

**Teaching scheme**

Lecture	Practical	Total
---	2 hours/ week	2 hours

**Detailed Course Content**

Sl. No.	Name of the Experiment
1	Determine and interpret water quality parameters (pH, turbidity, hardness, DO, BOD and COD)
2	Assess properties of soap such as pH and moisture content.
3	Analysis of vegetable oil in respect of 3.a) Acid value 3.b) Saponification value 3.c) Iodine value

**COURSE TITLE::ENGINEERING ECONOMICS AND ACCOUNTANCY**

Course Title	:	Engineering Economics and Accountancy
Course Code	:	OE 301
Semester	:	Third
Number of Credits	:	2 (L: 2, T: 0, P: 0)
Prerequisites	:	Nil
Course Category	:	Open Elective

**LEARNING OBJECTIVES:**

LO1	:	To introduce the students to some important economic and accounting terms.
LO2	:	To acquaint the students with some economic laws and banking organizations etc.
LO3	:	To make the students capable of recording business transaction under double entry system.
LO4	:	To introduce the students about financial statements.

**COURSE OUTCOME:** After the end of the course, students will be able to:

CO1	:	Define some important economic and accounting terms.
CO2	:	Explain some basic economic laws.
CO3	:	Explain double entry system of book keeping.
CO4	:	Record business transactions under double entry system of book keeping.
CO5	:	Define Financial Statements.

**TEACHING SCHEME:** (in hours/week)

Theory			Practical (credit)
Lecture	Tutorial	Total credits	
2	0	2	0

**TEACHING SCHEME:** (in hours)

Theory			Practical
Lecture	Tutorial	Total	
30	0	30	0

**EXAMINATION SCHEME:**

Theory				Practical				Total Marks
ESE		IA		ESE		IA		
Full Marks	Pass Marks	Full Marks	Pass Marks	Full Marks	Pass Marks	Full Marks	Pass Marks	100
60	24	40	16	0	0	0	0	

**DETAILED COURSE CONTENT**

Unit	Chapter Title	Contents	Hours
Part A: Engineering Economics			
1	Introduction to Economics	Introduction to Economics : 1.1 Definition of Economics, its utility and definition of engineering economics 1.2 Meaning and concepts of utility, National income, inflation and wants.	2hrs
2	Demand and Supply	2.1 Meaning of demand, The Law of demand and demand schedule 2.2 Meaning of supply and The Law of supply	2hrs
3	Production	3.1 Meaning and factors of production and meaning of production function 3.2 Factors determining efficiency of labour	2hrs

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4	Banking Organisations	4.1 Central Bank – its functions 4.2 Commercial banks – its functions	2hrs
5	Pricing	5.1 Objectives of pricing policy 5.2 price determinants 5.3 Price discrimination	2hrs
<b>B. Accountancy</b>			
6	Introduction to Book-Keeping and Accounting	6.1 Definition & objectives of Book- keeping 6.2 Need and advantages of Book- keeping 6.3 Definition of Accounting 6.4 Difference between Book- keeping and Accounting 6.5 Double Entry System – main features 6.6 Advantages and disadvantages of 6.7 Double Entry System 6.8 Concept of Computerized Accounting Software 6.9 Need for Computerized Accounting 6.10 Difference between Manual and Accounting and Computerized Accounting	4hrs
7	Transaction	7.1 Definition 7.2 Meaning of Account 7.3 Classification of Accounts: Traditional Approach, Modern Approach 7.4 Meaning of Debit and Credit 7.5 Rules of Debit and Credit	2hrs
8	Journal and Ledger	8.1 Meaning Journal 8.2 Recording of Transactions in Journal 8.3 Meaning of Ledger 8.4 Objectives and utility of Ledger 8.5 Posting and balancing of Ledger 8.6 Distinction between Journal and Ledger 8.7 Names of different Books of Accounts	4hrs
9	Cash Book	9.1 Meaning and importance of Cash Book 9.2 Characteristics and advantages of Cash Book 9.3 Discount – Trade Discount and Cash Discount 9.4 Different types of Cash Book:-Single Column Cash Book, Double Column Cash Book, Triple Column Cash Book 9.5 Bank Reconciliation Statement –Basic idea	4hrs
10	Trial Balance & Errors in Accounting	10.1 Meaning and objects of Trial Balance 10.2 Main features and advantages of Trial Balance 10.3 Preparation of Trial Balance 10.4 Types of errors in accounting.	3hrs
11	Components of Final Accounts:	11.1 Meaning and objectives of trading Account 11.2 Contents of Trading Account 11.3 Meaning and objectives of Profit and Loss Account 11.4 Contents of Profit and Loss Account 11.5 Meaning of depreciation, revenue expenditure and capital expenditure 11.6 Contents of Balance	3hrs
<b>Total Contact Hours</b>			<b>30</b>

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**Table of Specification**

Units	Allotted Hours	Objective			Short Answer Type				Long Answers Type						Total Marks
		R	U	AP	R	U	AP	AN	R	U	AP	AN	E	C	
1.	2hrs	1			2										3
2.	2hrs		1				2								3
3.	2hrs	2	1												3
4.	2hrs								4						4
5.	2hrs	2	1												3
6.	4hrs	2			2					4					8
7.	2hrs									5					5
8.	4hrs	1				2						6			9
9.	4hrs		1					2				6			9
10.	3hrs	1	1		2		2								6
11.	3hrs	1			2	2		2							7
Total	30 hrs														
<b>Total Marks</b>		<b>15</b>			<b>20</b>				<b>25</b>						<b>60</b>

**NB:**R: Remember, **U:** Understand, **AP:** Apply, **AN:** Analyze, **E:** Evaluate, **C:** Create

**REFERENCE BOOK LIST:**

Sl No.	Book Name	Author Name	Publishing House, Volume, ISBN
1	Introductory Micro Economics	Sandeep Garg	DhanpatRai Publication Pvt. Ltd. New Delhi
2	Introductory Macro Economics	Sandeep Garg	DhanpatRai Publication Pvt. Ltd. New Delhi
3	Theory and Practice of Accountancy	B. B. Dam R. A. Sarda R. Barman B. Kalita	Capital Publishing Company, Guwahati – 5
4	Book-Keeping & Accountancy	Juneja, Chawla &Saksena	Kalyani Publisher, New Delhi – 110002
5	Tally. ERP 9 For Beginners	Tally Solutions Pvt. Ltd.	Sahaj Enterprises, Bangalore

**COURSE TITLE: ESSENCE OF INDIAN KNOWLEDGE AND TRADITION**

Course Code:	Subject Title	Semester	Hours Per Week			Credit
			L	T	P	
AU-301	Essence of Indian Knowledge and Tradition	III	2	0	0	0

**Pre-requisites: Nil**

**Learning Objectives:**

1. To introduce the foundational elements of Indian Knowledge Systems (IKS).
2. To explore the scientific and technological heritage of India in ancient times.
3. To build awareness of traditional Indian philosophy, ethics, and medicine.
4. To encourage appreciation for the relevance of IKS in modern contexts.
5. To develop basic research interest in India's indigenous knowledge base and innovations.

**Course Outcome (CO):** After completion of this course, the students will be able to:

CO	Statement of Course Outcomes
CO1	Explain the concept, scope, and sources of Indian Knowledge Systems.
CO2	Identify significant contributions of ancient India to science, technology, and mathematics.
CO3	Understand traditional Indian governance, education, and core societal values.
CO4	Understand traditional wellness systems and sustainable living practices rooted in Indian Knowledge Systems.
CO5	Appreciate Traditional Indian Knowledge and its relevance in modern contexts.

**Syllabus:**

Unit No.	Description	Contact Hours
I	<b>Fundamentals of Indian Knowledge System(IKS):</b> <ul style="list-style-type: none"> <li>• Definition, Importance, and Scope of IKS</li> <li>• Overview of major IKS Texts: Vedas, Upanishads, Puranas etc.</li> <li>• Classification of knowledge in Indian traditions: Vidyas (Science) and Kalas (Arts)</li> </ul>	4
II	<b>Science and Technological Heritage:</b> <ul style="list-style-type: none"> <li>• Mathematics: Sulbasutras, Contributions of Aryabhata, Bhaskaracharya</li> <li>• Astronomy and Cosmology: SuryaSiddhanta, Planetary</li> </ul>	12

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	<ul style="list-style-type: none"> <li>• motion, Concept of Time</li> <li>• Metallurgy and Material Sciences: Iron Pillar, Woltz Steel, Ayurvedic alloys</li> <li>• Chemistry of Dyes, Pigments and Chemicals</li> <li>• Civil Engineering and Architecture: Temple architecture, Town planning and water management</li> </ul>	
III	<p><b>Governance, Society and Education Systems:</b></p> <ul style="list-style-type: none"> <li>• Ancient Indian Polity and Administration</li> <li>• Education systems: Gurukula, Nalanda, Takshashila</li> <li>• Value based education: Satya, Ahimsa, Seva</li> <li>• Role of Teacher and Student in Society</li> </ul>	6
IV	<p><b>IKS in Holistic Wellness and Sustainable Living:</b></p> <ul style="list-style-type: none"> <li>• Foundations of Ayurveda, Yoga and Siddha</li> <li>• Holistic health and wellness practices</li> <li>• Agriculture, Animal husbandry, Sacred groves, Sacred water bodies; Land, Water and Soil Conservation and Management practices.</li> </ul>	4
V	<p><b>The Modern Relevance of Indian Knowledge Systems:</b></p> <ul style="list-style-type: none"> <li>• Practices of Traditional Indian Knowledge in Modern Science and Engineering</li> <li>• IKS and Entrepreneurships: Organic Farming ,Ayurveda based Start-ups</li> <li>• Government initiatives: National Education Policy 2020, IKS Division under AICTE</li> </ul>	4
Total Contact Hours		30

**Suggested Books and Other Study Materials:**

1. "Indian Knowledge Systems"-Kapil Kapoor and Avadhesh Kumar Singh.
2. "Ancient Indian Leaps into Mathematics"- B.S.Yadav.
3. "Science and Technology in Ancient India"- O.P.Jaggi.
4. "The Positive Sciences of the Ancient Hindus"- Brajendranath Seal.
5. AICTE Model Curriculum for IKS(Available online)
  - NPTEL/SWAYAM courses on IKS
  - AICTE-IKS Portal(<https://iksindia.org/>)
  - Digital Library of India (<https://dli.gov.in>)

**Table of Specification for Essence of Indian Knowledge and Tradition (Theory)**

Sl No	Contact Hours	Units	Objective			Short answer type				Long answer type					Total Marks	
			R	U	A P	R	U	A P	A N	R	U	A P	A N	E		C
1	4	Unit I	1	1	1	1	2	0	0	0	0	2	0	0	0	8
2	12	Unit II	3	1	1	2	2	0	0	1	2	3	9	0	0	24
3	6	Unit III	1	1	0	2	1	0	0	2	1	1	3	0	0	12

**DETAILED SYLLABUS****BRANCH: CHEMICAL ENGINEERING**

Sem4ster: 3 <sup>rd</sup>	4	Unit IV	1	1	0	1	1	0	0	2	1	1	0	0	0	8
5	4	Unit V	1	1	1	2	0	0	0	0	1	2	0	0	0	8
	30	Total Marks	7	5	3	8	6	0	0	5	5	9	12	0	0	60

**NB: R:** Remember, **U:** Understand, **AP:** Apply, **AN:** Analyze, **E:** Evaluate, **C:** Create

**Annexure-1: Essence of Indian Knowledge and Tradition (Theory)**

SI No	Units	Time Allotted (Hrs)	Percentage Weightage	R	U	AP	AN	E	C	Total Marks
1	I	4	13.33%	2	3	3	0	0	0	8
2	II	12	40.00%	6	5	4	9	0	0	24
3	III	6	20.00%	5	3	1	3	0	0	12
4	IV	4	13.33%	4	3	1	0	0	0	8
5	V	4	13.33%	3	2	3	0	0	0	8
	Total	30	100%	20	16	12	12	0	0	60

**Curriculum Development cell, State Council for Technical Education, Directorate of Technical Education, Assam**

Sl. No.	Name	Designation
1	Shri Dhrubajyoti Borah, ACS	Director of Technical Education, Assam
2	Dr. Indrani Gogoi	Joint Director of Technical Education, Assam
3	Dr. Mrinalini Das	Controller of Examination, State Council for Technical Education, DTE, Assam
4	Mr. Ankush Borgohain	Training cum Placement Officer, DTE, Assam
5	Shri Ashok Das	Principal, Assam Textile Institute
6	Dr. Utpal Baruah	Principal, Kamrup Polytechnic
7	Shri Boobool Sarma	Assistant Controller of Examination, SCTE, DTE, Assam

**Academic Expert Committee for Chemical Engineering**

Sl No	Name	Institute	Designation
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2	Dr. Kabita Chakrabarty, Prof & HOD	Assam Engineering College, GHY	Member
3	Mr Nilay Das, Design consultant	Numaligarh Refinery Limited	Member
4	Mr. Souradip Choudhury, Lecturer	Assam Engineering Institute, Guwahati	Member
5	Ms. Smriti Rekha Konwar, Lecturer	Assam Engineering Institute, Guwahati	Member
6	Dr. Prerona Gogoi, Lecturer	Lakhimpur Polytechnic	Member

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Sl No	Name	Institute	Designation
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2	Mr. Aditya Sahu, Lecturer	Lakhimpur Polytechnic	Member
3	Mr. Shanku Pratim Borah, Lecturer	Lakhimpur Polytechnic	Member
4	Mr. Nitu Das, Lecturer (HOD i/c)	Baksa Polytechnic	Member
5	Ms. Pratyasha Priti Das, Lecturer	Assam Engineering Institute, GHY	Member