FOUR YEAR UNDERGRADUATE PROGRAM(2024 – 28)
DEPARTMENT OF INDUSTRIAL CHEMISTRY
COURSE CURRICULUM

PART-A: Introduction				
Program: Bachelor in Science *(Honors/ Honors with Research)*			**Semester - VIII**	Session: **2024-2025**
1	**Course Code**	**ICSE-08T**		
2	**CourseTitle**	**MANUFACTURING AND UTILIZATION OF IRON, CEMENT AND COAL**		
3	**Course Type**	**DSC**		
4	**Pre-requisite(if,any)**	***As per program***		
5	**Course Learning. Outcomes(CLO)**	➢ *To learn about the production methods of iron and its alloys* ➢ *To learn about the production of Cement.* ➢ *Apply the knowledge of recent coal utilization methods.* ➢ *Describe the different coal preparation methods*		
6	**Credit Value**	**3 Credits**	***Credit = 15 Hours -learning & Observation***	
7	**Total Marks**	**Max. Marks: 100**	**Min Passing Marks:40**	

PART -B: Content of the Course

Total No.of Teaching–learning Periods(01 Hr. per period) - 45 Periods (45 Hours)

Unit	Topics(Course contents)	No.of Period
I	**Production and casting of Iron base materials** Production of Iron in blast furnace-Raw materials, charging and sequence of operations, casting ,operation of pig casting machine. Manufacture of steel by Bessemer process. (Removal of silicon, decarbonisation, demanganisation, desulphurisation, dephosphorisation) and surface treatment (argon treatment, heat treatment, nitriding, carburizing). Production of semi-killed and killed steel in steel melting shop (LD process)- mixing of raw materials, charging sequences, operation in converter, blowing, tapping and testing process, timing in pit side, holding and stripping operations. Continuous casting of semi-finished steel products.	12
II	**Steel and Alloys (ferrous and non-ferrous): Composition, Properties and classification** Composition and properties of different types of steels (role of Ni, Cr, Mo, Si, Mn, V, W, Al). Classification of alloys - ferrous alloys (iron base alloys) - cast iron and steel, tool steel) and nonferrous alloys (copper, lead and tin alloys); composition of brass, bronze, cupro-nickel, manganin, constantan, antifriction bearing, solders, Pb-Sn, Pb-Sb. Specific properties of elements in alloys: role of Ti in Al and Mg alloys, Ni in copper and iron alloys, Sn and Cu in lead base alloys.	11
III	**Manufacturing of Cement** Cement Industry Introduction; Classification and Manufacturing processes of Cement and Lime; Setting and Hardening process. Historical developmentofPortland cement, definition, chemistry of cement, Raw materials, manufacturing process of cement: dry process, semi-dry process, wet process, sequence of operations-winning of raw materials, size reduction, storage of crushed materials, grinding of raw mix. Burning the ground mix to clinker, cooling of hot clinker,	11

	grinding the clinker mixed with gypsum, cement making Rotary kilns, reactions occurs in the different zones of rotary kiln, Refractory used in Rotary kiln. Hydration of cement, Heat of Hydration, Setting and hardening of Portland cement, Flash set and False set of cement. Pozzolana Cement, Blast Furnace slag cement, Quick setting cement, White Portland Cement, High Alumina Cement, Testing of cement.Cementindustries in India.	
IV	**Coal Processing Technology** Clean coal technology, Coal processing, Screening of coal, Size reduction of coal, Pulp/Slurry density, Wash ability of coal, Coal beneficiation processes, Principles of gravity concentration processes, Heavy medium separation, Jigging, Flowing film concentration, Cyclone separation, Froth flotation, Centrifugal separators, Dry beneficiation of coal, Dewatering, Coal washing efficiency, Coal washing practice in India, Recent development in coal processing, Coal utilization, Carbonization, Coking mechanism, Selection of coal for metallurgical coke, Combustion, Gasification, Types of gasifiers, liquefaction, production of liquid fuels, carbon capture and storage	**11**
Keywords	***Iron, Ferrous and non-ferrous alloys, Cement, Coal, Production, Classification, Industrial Applications***	

SignatureofConvener&Members (CBoS):

PART–C:Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. *Ray, H. S., Sridhar, R., & Abraham, K. P (2002). Extraction of Nonferrous Metals. . (Affiliated EastWest Press Pvt. Ltd.), New Delhi.*
2. *Roy, H. S., & Ghosh, A. (2004). Principles of Extractive Metallurgy, New Age International (P) Ltd., Publishers.*
3. *Sharma, B. K (2005). Industrial Chemistry. . (Geol Publishing House*
4. *SubbaRao, D. V., &Gouricharan, T. (2017). Coal Processing and Utilization, CRC Press.*

Reference Books Recommended –

1. *Lea, F. M. (2001). Chemistry of Cement.*
2. *46. Wilson, A. G., & Wales, C. E. (2007). Coal, Coke, and Coal Chemicals. MGH*

Online Resources–

- **https://www.sciencedirect.com/topics/materials-science/iron-casting**
- **https://www.worldsteel.org/steel-by-topic/manufacturing-processes/iron-making/blast-furnace.html**
- **https://www.britannica.com/technology/Bessemer-process**
- **https://www.sciencedirect.com/topics/materials-science**
- **https://www.theconstructor.org/building/cement-manufacturing-process/12138/**
- **https://www.sciencedirect.com/topics/engineering**

Online Resources–

- **e-Resources / e-books and e-learning portals**

PART-D:Assessment andEvaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100 Marks
Continuous Internal Assessment(CIA):30 Marks
End Semester Exam(ESE):70 Marks

Continuous Internal Assessment(CIA): (By Course Teacher)	Internal Test / Quiz-(2): **20 +20** Assignment/Seminar- **10** Total Marks -**30**	Better marks out of the two Test / Quiz+ obtained marks in Assignment shall be considered against **30** Marks

End Semester Exam (ESE):	**Two section – A & B** Section A: **Q1**. Objective – **10 x1= 10** Mark; **Q2**. Short answer type- **5x4 =20Marks** Section B: Descriptive answer type qts.,**1out of 2** from each unit- **4x10=40Marks**

Name and Signature of Convener & Members of CBoS:

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PART-A: Introduction				
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2	**CourseTitle**	**MANUFACTURING AND UTILIZATION OF IRON, CEMENT AND COAL LAB. COURSE**		
3	**CourseType**	~~DSC~~ DSE		
4	**Pre-requisite**(if,any)	*As per program*		
5	**Course Learning. Outcomes(CLO)**	➢ *To learn about the composition analysis of iron based alloys and materials.* ➢ *To acquire an idea about the Nitration, Oxidation, Partial reduction, Esterification, Polymerization & chemical analysis methods of cement.* ➢ *Analyse the composition of supplied coal samples by proximat Analysis.* ➢ *Demonstrate the working principle of Bomb calorimeter.*		
6	**CreditValue**	**1 Credits**	*Credit =30 Hours Laboratory or Field learning/Training*	
7	**TotalMarks**	**Max.Marks:50**		**Min Passing Marks:20**

PART -B: Content oftheCourse

TotalNo.of learning-Training/performancePeriods:30 Periods (30 Hours)

Module	Topics(Coursecontents)	No.ofPeriod
Lab./Field Training/ Experiment Contents of Course	1. Analysis of composition of steel, mild steel and alloys. 2. Estimation of Lime by Rapid Lime Method, Total Carbonate of Sample, Ful analysis (SiO_2, Al_2O_3, Fe_2O_3, CaO and MgO) of Cement & Clinker. Physica testing of Cement: Compressive testing, Specific surface area analysis etc. 3. To determine the composition of the supplied sample of Coal by Proximat Analysis 4. To determine the Gross calorific value of the supplied sample of coal usin Automatic Bomb Calorimeter. 5. Case study on iron rusting in the power plants and manufacture industries. 6. Case study on impact of cement particles on soil, water streams and agriculture. 7. Case study on impact of coal on soil, water streams and agriculture. 8. Detail report on industrial training.	**30**
Keywords	*Steel, Cement, Coal, Analysis, Plant and industries, Water, Composition*	

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PART–C:Learning Resources

Text Books, Reference Books and Others

Text Books Recommended –

1. Ray, H. S., Sridhar, R., & Abraham, K. P. (1995). Extraction of Nonferrous Metals. New Delhi, India: Affiliated EastWest Press Pvt. Ltd.
2. Jain, P. C., & Jain, M. (2010). Engineering Chemistry. New Delhi, India: Dhanpat Rai Publishing Co. Pvt. Ltd.
3. Sharma, B. K. (2003). Industrial Chemistry. Meerut, India: Geol Publishing House.
4. SubbaRao, D. V., &Gouricharan, T. (2014). Coal Processing and Utilization. Boca Raton, FL: CRC Press.

Reference Books Recommended –

1. Wilson, L. G., & Wales, C. E. (1998). Coal, Coke and Coal Chemicals. New York, NY: McGraw-Hill Education.
2. *Kent, J. A. (Ed.). (1998). Riegel's handbook of industrial chemistry. CBS Publishers & Distributors.*

Online Resources–

- https://www.nist.gov/materials-and-chemical-characterization/steel-alloys
- https://www.astm.org/Standards/C114.htm
- https://www.cement.ca/what-we-do/testing-certification
- https://www.usgs.gov/centers/nmic/coal-and-coalbed-gas
- https://www.iapws.org/faq1/rust.html
- https://www.epa.gov/
- https://www.osha.gov/SLTC/etools/steelmaking/index.html

Online Resources–

- **e-Resources / e-books and e-learning portals**

PART-D:Assessment andEvaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 50 Marks
Continuous Internal Assessment(CIA):15 Marks
End Semester Exam(ESE):35Marks

Continuous Internal Assessment(CIA): (By Course Teacher)	Internal Test / Quiz-(2): **10 &10** Assignment/Seminar +Attendance- **05** Total Marks **-15**	Better marks out of the two Test / Quiz +obtained marks in Assignment shall be considered against **15** Marks
End Semester Exam (ESE):	**Laboratory / Field Skill Performance: On spot Assessment** **V. Performed the Task based on lab. work - 20 Marks** **W. Spotting based on tools& technology (written) – 10 Marks** **X. Viva-voce (based on principle/technology) - 05 Marks**	**Managed by Course teacher as per lab. status**

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