DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.TECH. CHEMICAL ENGINEERING (UG)

REGULATION-2019 WITH AMENDMENT

The course code 21 indicates that the students joined in the academic year 2021

(For the students admitted during the academic year 2021-2025)

SEMESTER I

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21HE1101	Technical English	HS	2	1	0	3	40	60	100
2	21MA1102	Calculus and Linear Algebra	BS	3	1	0	4	40	60	100
THEORY WITH LAB COMPONENT										
3	21PH1151	Applied Physics	BS	2	0	2	3	50	50	100
4	21CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100
5	21CS1151	Python Programming and Practices	ES	2	0	2	3	50	50	100
6	21ME1152	Engineering Drawing	ES	1	0	4	3	50	50	100
PRACTICAL										
7	21HE1001	Language Competency Enhancement Course-I	HS	0	0	2	1	100	0	100
MANDATORY COURSES										
8	21HE1072	Career Guidance Level – I Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
			Total :	**14**	**2**	**12**	**20**	**480**	**320**	**800**

SEMESTER II

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21HE2101	Business English for Engineers	HS	2	1	0	3	40	60	100
2	21MA2101	Differential Equations and Complex Variables	BS	3	1	0	4	40	60	100
3	21EE2103	Basics of Electrical and Electronics Engineering	ES	3	0	0	3	40	60	100
4	21CH2101	Principles of Chemical Engineering	ES	3	0	0	3	40	60	100
THEORY WITH LAB COMPONENT										
5	21PH2151	Material Science	BS	2	0	2	3	50	50	100
6	21CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
PRACTICAL										
7	21ME2001	Engineering Practices	ES	0	0	4	2	60	40	100
8	21HE2001	Language Competency Enhancement Course-II	HS	0	0	2	1	100	0	100
MANDATORY COURSES										
9	21HE2072	**Career Guidance Level – II** Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10	21HE2073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100
		Total :		**18**	**2**	**10**	**22**	**620**	**380**	**1000**

SEMESTER III

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21MA3103	Fourier Analysis and Numerical Methods	BS	3	1	0	4	40	60	100
2	21CH3201	Chemical Process Calculations	PC	3	1	0	4	40	60	100
3	21CH3202	Fluid Mechanics for Chemical Engineers	PC	3	0	0	3	40	60	100
4	21CH3203	Chemical Engineering Thermodynamics – I	PC	3	0	0	3	40	60	100
THEORY WITH LAB COMPONENT										
5	21CH3251	Analytical Instruments for Analysis	PC	2	0	2	3	50	50	100
PRACTICAL										
6	21CH3001	Fluid Mechanics Lab	PC	0	0	3	1.5	60	40	100
7	21CH3002	Chemical Analysis Lab	PC	0	0	3	1.5	60	40	100
MANDATORY COURSES										
8	21AC3191	Indian Constitution	AC	2	0	0	0	100	0	100
9	21HE3072	**Career Guidance Level – III** Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10	21HE3073	Leadership Management Skills	EEC	1	0	0	0	100	0	100
		Total		**19**	**2**	**8**	**20**	**630**	**370**	**1000**

SEMESTER IV

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21CH4201	Process Heat Transfer	PC	3	1	0	4	40	60	100
2	21CH4202	Mass Transfer – I	PC	3	0	0	3	40	60	100
3	21CH4203	Chemical Engineering Thermodynamics - II	PC	3	0	0	3	40	60	100
THEORY WITH LAB COMPONENT										
4	21CH4251	Mechanical Operations	PC	3	0	2	4	50	50	100
5	21MA4153	Applied Probability Statistics	BS	3	0	2	4	50	50	100
PRACTICAL										
6	21CH4001	Heat Transfer Lab	PC	0	0	3	1.5	60	40	100
7	21CH4002	Petrochemical Analysis Lab	PC	0	0	3	1.5	60	40	100
MANDATORY COURSES										
8	21AC4191	Essence of Indian tradition knowledge/Value Education	AC	2	0	0	0	100	0	100
9	21HE4072	**Career Guidance Level – IV** Personality, Aptitude and Career Development	EEC	2	0	0	0	100	-	100
10	21HE4073	Ideation Skills	EEC	2	0	0	0	100	-	100
		Total		**21**	**1**	**10**	**21**	**640**	**360**	**1000**

SEMESTER V

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21CH5201	Chemical Reaction Engineering – I	PC	3	1	0	4	40	60	100
2	21CH5202	Mass Transfer – II	PC	3	1	0	4	40	60	100
3	21CH5203	Process Instrumentation Dynamics and Control	PC	3	1	0	4	40	60	100
4	21CH5204	Safety in Chemical Industries	PC	3	0	0	3	40	60	100
5	21CH53XX	**Professional Elective -I**	PE	3	0	0	3	40	60	100
THEORY WITH LAB COMPONENT										
6	21CH5251	Water Treatment and Solid Waste Management	PC	2	0	2	3	50	50	100
PRACTICALS										
7	21CH5001	Mass Transfer Lab	PC	0	0	3	1.5	60	40	100
8	21CH5002	Process Control Lab	PC	0	0	3	1.5	60	40	100
MANDATORY COURSES										
9	21HE5071	Soft Skills - I	EEC	1	0	0	1	100	0	100
10	21HE5072	Design Thinking	EEC	1	0	0	1	100	0	100
		Total		**19**	**3**	**8**	**26**	**570**	**430**	**1000**

SEMESTER VI

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21CH6201	Chemical Reaction Engineering– II	PC	3	1	0	4	40	60	100
2	21CH6202	Chemical Process Industries	PC	3	0	0	3	40	60	100
3	21CH6181	Professional Ethics in Engineering	HS	3	0	0	3	40	60	100
4	21CH63XX	**Professional Elective - II**	PE	3	0	0	3	40	60	100
5	21XX64XX	**Open Elective– I**	OE	3	0	0	3	40	60	100
THEORY WITH LAB COMPONENTS										
6	21CH6251	Fluidization Engineering	PC	2	0	2	3	50	50	100
PRACTICALS										
7	21CH6001	Chemical Reaction Engineering Lab	PC	0	0	4	2	60	40	100
MANDATORY COURSES										
8	21CH6701	Internship/Industrial Training/Skill Development Course (Minimum 3 weeks)	EEC	-	-	-	1	100	0	100
9	21HE6071	Soft Skills - II	EEC	1	0	0	1	100	0	100
10	21HE6072	Intellectual Property Rights (IPR)	EEC	1	0	0	1	100	0	100
			Total	**19**	**1**	**6**	**24**	**610**	**390**	**1000**

SEMESTER VII

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21CH7201	Process Economics and Engineering Management	PC	3	0	0	3	40	60	100
2	21CH7202	Process Equipment Design	PC	3	1	0	4	40	60	100
3	21CH73XX	**Professional Elective-III**	PE	3	0	0	3	40	60	100
4	21XX74XX	**Open Elective – II**	OE	3	0	0	3	40	60	100
PRACTICALS										
5	21CH7001	Design and Simulation Lab	PC	0	0	3	1.5	60	40	100
6	21CH7002	Rubber Testing Lab	PC	0	0	3	1.5	60	40	100
PROJECT WORK										
7	21CH7901	Project Work – Phase I	EEC	0	0	4	2	50	50	100
			Total	**12**	**1**	**10**	**18**	**330**	**370**	**700**

SEMESTER VIII

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	21CH83XX	**Professional Elective –IV**	PE	3	0	0	3	40	60	100
2	21CH83XX	**Professional Elective- V**	PE	3	0	0	3	40	60	100
PROJECT WORK										
3	21CH8901	Project Work – Phase II	EEC	0	0	16	8	100	100	200
			Total	**6**	**0**	**16**	**14**	**180**	**220**	**400**

TOTAL NO OF CREDITS: 165

LIST OF PROFESSIONAL ELECTIVES

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I										
1	21CH5301	Energy Technology	PE	3	0	0	3	40	60	100
2	21CH5302	Petroleum Technology	PE	3	0	0	3	40	60	100
3	21CH5303	Electrochemical Engineering	PE	3	0	0	3	40	60	100
4	21CH5304	Polymer Technology	PE	3	0	0	3	40	60	100
5	21CH5305	Food Technology	PE	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVE II										
1	21CH6301	Petroleum Exploration and Exploitation Techniques	PE	3	0	0	3	40	60	100
2	21CH6302	Enzyme Engineering	PE	3	0	0	3	40	60	100
3	21CH6303	Fundamentals of Nano science	PE	3	0	0	3	40	60	100
4	21CH6304	Corrosion Science and Engineering	PE	3	0	0	3	40	60	100
5	21CH6305	Piping and Instrumentation	PE	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVE III										
1	21CH7301	Natural Gas Engineering	PE	3	0	0	3	40	60	100
2	21CH7302	Pulp and Paper Technology	PE	3	0	0	3	40	60	100
3	21CH7303	Transport Phenomena	PE	3	0	0	3	40	60	100
4	21CH7304	Multicomponent Distillation	PE	3	0	0	3	40	60	100
5	21CH7305	Chemical Process Optimization	PE	3	0	0	3	40	60	100
6	21CH7306	Fundamentals and Testing of Rubber Compounds	PE	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVE IV										
1	21CH8301	Industrial Management	PE	3	0	0	3	40	60	100
2	21CH8302	Sugar Technology	PE	3	0	0	3	40	60	100
3	21CH8303	Total Quality Management	PE	3	0	0	3	40	60	100
4	21CH8304	Foundation Skills in Integrated Product Development	PE	3	0	0	3	40	60	100
5	21CH8305	Supply Chain Management	PE	3	0	0	3	40	60	100
PROFESSIONAL ELECTIVE V										
1	21CH8306	Process Plant Utilities	PE	3	0	0	3	40	60	100
2	21CH8307	Fermentation Technology	PE	3	0	0	3	40	60	100
3	21CH8308	Frontiers of Chemical Technology	PE	3	0	0	3	40	60	100
4	21CH8309	Industrial Nanotechnology	PE	3	0	0	3	40	60	100
5	21CH8310	Drugs and Pharmaceutical Technology	PE	3	0	0	3	40	60	100

LIST OF OPEN ELECTIVES										
CHEMICAL ENGINEERING										
S.No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CIA**	**ESE**	**TOTAL**
1	21CH6401	Waste to Energy Conversion	OE	3	0	0	3	40	60	100
2	21CH7401	Biomass Conversion and Biorefinery	OE	3	0	0	3	40	60	100
LIFE SKILL COURSES										
3	21LSZ401	General Studies for Competitive Examinations	OE	3	0	0	3	40	60	100
4	21LSZ402	Human Rights, Women's Rights and Gender Equality	OE	3	0	0	3	40	60	100
5	21LSZ403	Indian Ethos and Human Values	OE	3	0	0	3	40	60	100
6	21LSZ404	Indian Constitution and Political System	OE	3	0	0	3	40	60	100
7	21LSZ405	Yoga for Human Excellence	OE	3	0	0	3	40	60	100
NCC COURSES (Only forthe students' who have opted NCC subjects in Semester I, II, III & IV are eligible)										
8	21HEZ401	NCC course level 1	OE	3	0	0	3	40	60	100
9	21HEZ402	NCC course level 2	OE	3	0	0	3	40	60	100

(Note: Z Stands for semester, students can't choose twice the course)

ADDITIONAL CREDIT COURSE FOR NCC CADETS										
S.No.	**Course Code**	**Course Title**	**Type**	**L**	**T**	**P**	**C**	**CIA**	**ESE**	**TOTAL**
1	21HE1074	NCC General and National Integration	VA	1	0	0	1	100	-	100
2	21HE2074	Social services and community development	VA	1	0	0	1	100	-	100
3	21HE3074	Leadership Qualities and camp activities	VA	1	0	0	1	100	-	100
4	21HE4074	General awareness, communication and Aero engines	VA	1	0	0	1	100	-	100

ADDITIONAL CREDIT COURSE FOR CHEMICAL ENGINEERING						
S.No	**Course Code**	**Course Title**	**Category**	**Duration**	**Assessment**	**Credit**
1.	21VACH01	Industrial Automation	VA	30 hrs	Internal	1
2.	21VACH02	Bulk Solid Handling for Chemical Engineers	VA	30 hrs	Internal	1
3.	21VACH03	Fundamentals of AI and it's Chemometric Applications	VA	30 hrs	Internal	1
4.	21VACH04	Introduction to Chemical Engineering MATLAB	VA	30 hrs	Internal	1
5.	21VACH05	IOT- Basics and Application in Unit Operations	VA	30 hrs	Internal	1

Enrolment for B.E. / B. Tech. Honours (Specialisation in the same discipline) / B.E. / B. Tech. Honours and B.E. / B. Tech. Minor Degree in other specialisation.

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E. / B. Tech. (Honours) or Minor Degree.For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only. For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes.

(i) B.E. / B.Tech. Honours (specialisation in the same discipline):

a. The student should have earned additionally a minimum of 18 credits from a vertical of the same programme.

b. Should have passed all the courses in the first attempt.

c. Should have earned a minimum CGPA of 7.50.

(ii) B.E. / B.Tech. Honours:

a. The students should have earned additional courses (minimum of 18 credits) from more than one vertical of the same programme.

b. Should have passed all the courses in the first attempt.

c. Should have earned a minimum CGPA of 7.50.

(iii) B.E. / B.Tech. (Minor in other specialisation):

The student should have earned additionally a minimum of 18 credits in any one of the verticals of other B.E. / B.Tech. programmes or from any one of the following verticals

VERTICAL I: FINTECH AND BLOCK CHAIN

VERTICAL II: ENTREPRENEURSHIP

VERTICAL III: ENVIRONMENT AND SUSTAINABILITY

- Students can earn maximum of 6 credits in online mode (SWAYAM platform), out of these 18 credits as approved by Centre for Academic Courses.

- B.E. / B. Tech. (Honours) Specialisation in the same discipline, B.E / B.Tech. Honours and B.E. / B.Tech. Minor in other specialisation degree will be optional for students.

- For the categories (i) to (ii), the students will be permitted to register the courses from V Semester onwards provided the marks earned by the students until III semester should be of CGPA 7.50 and above and cleared all the courses in the first attempt.

- For the category (iii), the students will be permitted to register the courses from Semester V onwards provided the marks earned by the students until Semester III is CGPA 7.50 and above.

- If a student decides not to opt for Honours, after completing certain number of additional courses, the additional courses studied shall be considered instead of the Professional Elective courses which are part of the curriculum. If the student has studied more number of such courses than the number of Professional Elective courses required as per the curriculum, the courses with higher grades shall be considered for the calculation of CGPA. Remaining courses shall be printed in the mark sheet, however, they will not be considered for calculation of CGPA.

- If a student decides not to opt for Minor, after completing certain number of courses, the additional courses studied shall be considered instead of Open Elective courses which are part of the curriculum. If the student has studied more number of such courses than the number of open electives required as per the curriculum, the courses with higher grades shall be considered for calculation of CGPA. Remaining courses shall be printed in the mark sheet, however, they will not be considered for calculation of CGPA.

- The Head of Department, shall forward the proposal to the Controller of Examinations after getting the approval from Head of the Institution / Dean Academics, before the commencement of the fifth semester of the programme for the students undergo optionally B.E. / B. Tech. Honours (Specialisation in the same discipline) / B.E. / B. Tech. Honours and B.E. / B. Tech. Minor Degree in other specialisation

VERTICALS FOR MINOR DEGREE
CHEMICAL ENGINEERING OFFERING MINOR DEGREE

Minor Specialization in Chemical Process Engineering

SL. NO.	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21CH5231	Introduction to Chemical Process	MDC	3	0	0	3	3
2	21CH6231	Fluid Flow Operations in Chemical Engineering	MDC	3	1	0	4	4
3	21CH6232	Fundamentals of Chemical Thermodynamics	MDC	3	1	0	4	4
4	21CH7231	Process Heat and Mass Transfer	MDC	3	0	0	3	3
5	21CH7232	Reaction Engineering	MDC	0	0	4	4	2
6	21CH8231	Unit Operations and Process Laboratory	MDC	0	0	4	4	2

*MDC – Minor Degree Course

In addition to the above the following additional courses for Minor Degree can also be given to the student's common to all the branches.

VERTICAL I: FINTECH AND BLOCK CHAIN								
S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	2MB5231	Financial Management	MDC	3	0	0	3	3
2	21MB6231	Fundamentals of Investment	MDC	3	0	0	3	3
3	21MB6232	Banking, Financial Services and Insurance	MDC	3	0	0	3	3
4	21MB7231	Introduction to Block chain and its Applications	MDC	3	0	0	3	3
5	21MB7232	Fintech Personal Finance and Payments	MDC	3	0	0	3	3
6	21MB8231	Introduction to Fintech	MDC	3	0	0	3	3

VERTICAL II: ENTREPRENEURSHIP								
S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21MB5232	Foundations of Entrepreneurship	MDC	3	0	0	3	3
2	21MB6233	Team Building & Leadership Management for Business	MDC	3	0	0	3	3
3	21MB6234	Creativity & Innovation in Entrepreneurship	MDC	3	0	0	3	3
4	21MB7233	Principles of Marketing Management For Business	MDC	3	0	0	3	3
5	21MB7234	Human Resource Management for Entrepreneurs	MDC	3	0	0	3	3
6	21MB8232	Financing New Business Ventures	MDC	3	0	0	3	3

VERTICAL III: ENVIRONMENT AND SUSTAINABILITY

VERTICAL III: ENVIRONMENT AND SUSTAINABILITY								
S No	**Course Code**	**Course Title**	**Category**	**Periods Per week**			**Total Contact Periods**	**Credits**
				L	**T**	**P**		
1	21CE5232	Sustainable infrastructure Development	MDC	3	0	0	3	3
2	21AG6233	Sustainable Agriculture and Environmental Management	MDC	3	0	0	3	3
3	21BM6233	Sustainable Bio Materials	MDC	3	0	0	3	3
4	21ME7233	Materials for Energy Sustainability	MDC	3	0	0	3	3
5	21CE7233	Green Technology	MDC	3	0	0	3	3
6	21CE8232	Environmental Quality Monitoring and Analysis	MDC	3	0	0	3	3

VERTICALS FOR B Tech (Hons) and B Tech (Hons) in Chemical Engineering with Specialization

Vertical I **Computer Aided Process Engineering**	**Vertical II** **Polymer Technology**	**Vertical III** **Petroleum Engineering**
Process Flow Sheeting	Polymer Chemistry	Petroleum Geology
Transport Phenomena	Processing Technology	Petroleum Exploration
Advanced Process Optimization	Rubber Technology	Drilling Technology
Artificial Intelligence in Process Engineering	Polymer Product Design, Blends, and Alloys	Petroleum Production Engineering
Digital Twin and Soft Computing in Process Modelling	Polymer Structure and property relationships	Petroleum Reservoir Engineering
Advanced Process Modelling and Simulation	Polymer Compounding Technology	Offshore Engineering

B Tech (Hons) Chemical Engineering with Specialization in Computer Aided Process Engineering

S No	**Course Code**	**Course Title**	**Category**	**Periods Per week**			**Total Contact Periods**	**Credits**
				L	**T**	**P**		
1	21CH5203	Process Flow Sheeting	MDC	2	0	2	4	3
2	21CH6202	Transport Phenomena	MDC	3	1	0	3	4
3	21CH6203	Advanced Process Optimization	MDC	2	0	2	4	3
4	21CH7203	Artificial Intelligence in Process Engineering	MDC	2	0	2	4	3
5	21CH7204	Digital Twin and Soft Computing in Process Modelling	MDC	2	0	2	4	3
6	21CH8201	Advanced Process Modelling and Simulation	MDC	0	0	4	4	2

B Tech (Hons) Chemical Engineering with Specialization in Polymer Technology

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21CHXXXX	Polymer Chemistry	MDC	3	0	0	3	3
2	21CHXXXX	Processing Technology	MDC	3	0	0	3	3
3	21CHXXXX	Rubber Technology	MDC	3	0	0	3	3
4	21CHXXXX	Polymer Product Design, Blends, and Alloys	MDC	3	0	0	3	3
5	21CHXXXX	Polymer Structure and property relationships	MDC	3	0	0	3	3
6	21CHXXXX	Polymer Compounding Technology	MDC	3	0	0	3	3

B Tech (Hons) Chemical Engineering with Specialization in Petroleum Engineering

S No	Course Code	Course Title	Category	Periods Per week			Total Contact Periods	Credits
				L	T	P		
1	21CHXXXX	Petroleum Geology	MDC	3	0	0	3	3
2	21CHXXXX	Petroleum Exploration	MDC	3	0	0	3	3
3	21CHXXXX	Drilling Technology	MDC	3	0	0	3	3
4	21CHXXXX	Petroleum Production Engineering	MDC	3	0	0	3	3
5	21CHXXXX	Petroleum Reservoir Engineering	MDC	3	0	0	3	3
6	21CHXXXX	Offshore Engineering	MDC	3	0	0	3	3

CREDIT DISTRIBUTION

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	20	22	20	21	26	24	18	14	**165**

*** Student can earn extra credit 35 over and above the total credits**

HINDUSTHAN COLLEGE OF ENGG & TECH ACADEMIC COUNCIL Chairman

CHAIRMAN, BOARD OF STUDIES

Chairman - BoS
CHE - HiCET

DEAN - ACADEMICS

Dean (Academics)
HiCET

PRINCIPAL

PRINCIPAL
Hindusthan College Of Engineering & Technology
COIMBATORE - 641 032.

SEMESTER - I

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21HE1101	TECHNICAL ENGLISH (COMMON TO ALL BRANCHES)	2	1	0	3

Course Objective

- ✓ To facilitate students to communicate effectively with coherence.
- ✓ To train the learners in descriptive communication.
- ✓ To introduce professional communication.
- ✓ To enhance knowledge and to provide the information on corporate environment.
- ✓ To equip the trainers with the necessary skills on critical thinking.

Unit	Description	Instructional Hours
I	**Listening and Speaking** – Opening a conversation, maintaining coherence, turn taking, closing a conversation (excuse, general wishes, positive comments and thanks) **Reading** –Reading articles from newspaper, Reading comprehension **Writing** Chart analysis, process description, Writing instructions **Grammar and Vocabulary-** Tenses, Regular and irregular verb, technical vocabulary.	9
II	**Listening and Speaking-** listening to product description, equipment & work place (purpose, appearance, function) **Reading-** Reading technical articles **Writing-** Letter phrases, writing personal letters, **Grammar and Vocabulary**-articles, Cause & effect, Prepositions.	9
III	**Listening and Speaking- -** listening to announcements **Reading-** Reading about technical inventions, research and development **Writing-** Letter inviting a candidate for interview, Job application and resume preparation **Grammar and Vocabulary-** Homophones and Homonyms.	9
IV	**Listening and Speaking- -** Practice telephone skills and telephone etiquette (listening and responding, asking questions).**Reading-** Reading short texts and memos **Writing-** invitation letters, accepting an invitation and declining an invitation **Grammar and Vocabulary-** Modal verbs, Collocation, Conditionals, Subject verb agreement and Pronoun-Antecedent agreement.	9
V	**Listening and Speaking-** listening to technical group discussions and participating in GDs **Reading-** reading biographical writing - **Writing-** Proposal writing, Writing definitions, **Grammar and Vocabulary-** Abbreviation and Acronym, Prefixes & suffixes, phrasal verbs.	9
	Total Instructional Hours	**45**

Course Outcome

CO1- Trained to maintain coherence and communicate effectively.
CO2- Practiced to create and interpret descriptive communication.
CO3- Introduced to gain information of the professional world.
CO4- acquired various types of communication and etiquette.
CO5- Taught to improve interpersonal and intrapersonal skills.

TEXT BOOKS:

T1- Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press, 2016.
T2- Raymond Murphy, "Essential English Grammar", Cambridge University Press, 2019.

REFERENCE BOOKS:

R1- Meenakshi Raman and Sangeetha Sharma. "Technical Communication- Principles and Practice", Oxford University Press, 2009.
R2- Raymond Murphy, "English Grammar in Use"- 4th editionCambridge University Press, 2004.
R3- Kamalesh Sadanan "A Foundation Course for the Speakers of Tamil-Part-I &II", Orient Blackswan, 2010.

Chairman, Board of Studies

Chairman - BoS
CHE - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean - Academics

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21MA1102	**CALCULUS AND LINEAR ALGEBRA**	3	1	0	4

Course Objective

1. Understand the concept of differentiation.
2. Evaluate the functions of several variables which are needed in many branches of engineering.
3. Understand the concept of double integrals.
4. Understand the concept of triple integrals.
5. Develop the skill to use matrix algebra techniques that is needed by engineers for practical Applications

Unit	Description	Instructional Hours
	DIFFERENTIAL CALCULUS	
I	Rolle's Theorem – Lagrange's Mean Value Theorem- Maxima and Minima – Taylor's and Maclaurin's Theorem	12
	MULTIVARIATE CALCULUS (DIFFERENTIATION)	
II	Totalderivatives - Jacobians – Maxima, M inima and Saddle points - Lagrange's method of undeterminedmultipliers – Gradient, divergence, curl and derivatives	12
	DOUBLE INTEGRATION	
III	DoubleintegralsinCartesiancoordinates– Area enclosed by the plane curves (excluding surface area)– Green's Theorem (Simple Application) - Stoke's Theorem – Simple Application involving cubes and rectangular parellopiped.	12
	TRIPLE INTEGRATION	
IV	Tripleintegrals in Cartesian co-ordinates – Volume of solids (Sphere, Ellipsoid, Tetrahedron) using Cartesian co-ordinates. Gauss Divergence Theorem – Simple Application involving cubes and rectangular parellopiped.	12
	MATRICES	
V	Eigen valuesand Eigen vectors – PropertiesofEigen values andEigen vectors (without proof) - Cayley - Hamilton Theorem (excluding proof) - Reduction of a quadratic form to canonical form by orthogonal transformation.	12
	Total Instructional Hours	60

Course Outcome

CO1: Apply the concept of differentiation in any curve.
CO2: Identify the maximum and minimum values of surfaces.
CO3: Apply double integrals to compute area of plane curves.
CO4: Evaluation of triple integrals to compute volume of solids.
CO5: Calculate Eigen values and Eigen vectors for a matrix which are used to determine the natural frequencies (or Eigen frequencies) of vibration and the shapes of these vibrational modes.

TEXT BOOKS:

T1 - Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018.

T2 - Veerarajan T, "Engineering Mathematics", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016.

REFERENCE BOOKS :

R1- Thomas & Finney " Calculus and Analytic Geometry" , Sixth Edition,,Narosa Publishing House, New Delhi.

R2 – Weir,M.D and Joel Hass, ' Thomas Calculus" 12th Edition,Pearson India 2016.R3 - Grewal B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.

Chairman, Board of Studies

Chairman - BoS
CHE - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21PH1151	APPLIED PHYSICS (Common to all branches)	2	0	2	3

Course Objective

1. Enhance the fundamental knowledge in properties of matter
2. Analysis the oscillatory motions of particles
3. Extend the knowledge about wave optics
4. Gain knowledge about laser and their applications
5. Conversant with principles of optical fiber, types and applications of optical fiber

Unit	Description	Instructional Hours
	PROPERTIES OF MATTER	
I	Elasticity – Hooke's law – Stress-strain diagram - Poisson's ratio – Bending moment – Depression of a cantilever – Derivation of Young's modulus of the material of the beam by Uniform bending theory and experiment.	6
	Determination of Young's modulus by uniform bending method	3
	OSCILLATONS	
II	Translation motion –Vibration motion – Simple Harmonic motion – Differential Equation of SHM and its solution – Damped harmonic oscillation - Torsion stress and deformations – Torsion pendulum: theory and experiment.	6
	Determination of Rigidity modulus – Torsion pendulum	3
	WAVE OPTICS	
III	Conditions for sustained Interference – air wedge and it's applications - Diffraction of light –Fraunhofer diffraction at single slit –Diffraction grating – Rayleigh's criterion of resolution power - resolving power of grating.	6
	Determination of wavelength of mercury spectrum – spectrometer grating	3
	Determination of thickness of a thin wire – Air wedge method	3
	LASER AND APPLICATIONS	
IV	Spontaneous emission and stimulated emission – Population inversion – Pumping methods – Derivation of Einstein's coefficients (A&B) – Type of lasers – Nd:YAG laser and CO_2 laser- Laser Applications – Holography – Construction and reconstruction of images.	6
	Determination of Wavelength and particl size using Laser	3
	FIBER OPTICS AND APPLICATIONS	
V	Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index, modes and materials) – Fiber optical communication link – Fiber optic sensors – Temperature and displacement sensors.	6
	Total Instructional Hours	**45**

Course Outcome

After completion of the course the learner will be able to

CO1: Illustrate the fundamental properties of matter
CO2: Discuss the Oscillatory motions of particles
CO3: Analyze the wavelength of different colors
CO4: Understand the advanced technology of LASER in the field of Engineering
CO5: Develop the technology of fiber optical communication in engineering field

TEXT BOOKS:T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2015.

REFERENCE BOOKS:

R1 - Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2015

R2 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi 2016

R3 - Dr. G. Senthilkumar "Engineering Physics – I" VRB publishers Pvt Ltd., 2016

Chairman, Board of Studies

Chairman - BoS
CHE - HiCET

HINDUSTHAN ACADEMIC COUNCIL * Chairman * HINDUSTHAN COLLEGE OF ENGG & TECH

Dean – Academics

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21CY1151	CHEMISTRY FOR ENGINEERS (COMMON TO ALL BRANCHES)	2	0	2	3

Course Objective

1. The boiler feed water requirements, related problems and water treatment techniques.
2. The principles of polymer chemistry and engineering applications of polymers and composites.
3. The principles of electrochemistry and with the mechanism of corrosion and its control.
4. The principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
5. The important concepts of spectroscopy and its applications.

Unit	Description	Instructional Hours
I	**WATER TECHNOLOGY** Hard water and soft water- Disadvantages of hard water- Hardness: types of hardness, simple calculations, estimation of hardness of water – EDTA method – Boiler troubles - Conditioning methods of hard water – External conditioning - demineralization process - desalination: definition, reverse osmosis – Potable water treatment – breakpoint chlorination. **Estimation of total, permanent and temporary hardness of water by EDTA**	6 +3=9
II	**POLYMER & COMPOSITES** polymerization – addition and condensation polymerization – mechanism of free radical addition polymerization – copolymers – plastics: classification – thermoplastics and thermosetting plastics, preparation, properties and uses of commercial plastics – PVC, Bakelite – moulding of plastics (extrusion and compression); Composites: definition, types of composites – polymer matrix composites (PMC) – FRP	6
III	**ELECTROCHEMISTRY AND CORROSION** Electrochemical cells – reversible and irreversible cells - EMF- Single electrode potential – Nernst equation (derivation only) – Conductometric titrations. Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types –galvanic corrosion – differential aeration corrosion – corrosion control – sacrificial anode and impressed cathodic current methods - protective coatings – paints – constituents and functions. **Conductometric titration of strong acid vs strong base (HCl vs NaOH). Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4. Estimation of Ferrous iron by Potentiometry.**	6+9 =15
IV	**ENERGY SOURCES AND STORAGE DEVICES** Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery- lithium battery- fuel cell H_2 -O_2 fuel cell applications.	6
V	**ANALYTICAL TECHNIQUES** Beer-Lambert's law – UV-visible spectroscopy and IR spectroscopy – principle – instrumentation (block diagram only) – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy. **Determination of iron content of the water sample using spectrophotometer.(1,10 phenanthroline / thiocyanate method).**	6+3
	Total Instructional Hours	**45**

Course Outcome

CO1: Differentiate hard and soft water and to solve the related problems on water purification and its significance in industries and daily life
CO2: Acquire the basic knowledge of polymers, composites and FRP and their significance.
CO3: Develop knowledge on the basic principles of electrochemistry and understand the causes of corrosion, its consequences to minimize corrosion to improve industrial design.
CO4: Develop knowledge about the renewable energy resources and batteries along with the need of new materials to improve energy storage capabilities.
CO5: Identify the structure and characteristics of unknown/new compound with the help of spectroscopy.

TEXT BOOKS

T1 - P. N. Madudeswaran and B.Jeyagowri, "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd,Chennai
T2 - P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2018).

REFERENCES

R1 - B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2012).
R2 - S.S.Dara "A Text book of Engineering Chemistry" S.Chand & Co. Ltd., New Delhi (2017).

Chairman, Board of Studies

Chairman - BoS
CHE - HiCET

HINDUSTHAN COLLEGE OF ENGG & TECH ACADEMIC COUNCIL Chairman

Dean – Academics

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21CS1151	PYTHON PROGRAMMING AND PRACTICES	2	0	2	3

Course Objectives

- To know the basics of algorithmic problem solving.
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops and to define Python functions and call them.
- To use Python data structures – lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**ALGORITHMIC PROBLEM SOLVING** Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert acard in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.	9
II	**DATA, EXPRESSIONS, STATEMENTS** Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; modules and functions, function definition and use, flow of execution, parameters and arguments. **Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.**	7+2
III	**CONTROL FLOW, FUNCTIONS** Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. **Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.**	5+4
IV	**LISTS, TUPLES, DICTIONARIES** Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; **Illustrative programs: selection sort, insertion sort, merge sort, histogram.**	3+6
V	**FILES, MODULES, PACKAGES** Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages. **Illustrative programs: word count, copying file contents.**	5+4
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1: Develop algorithmic solutions to simple computational problems.
CO2: Read, write, execute by hand simple Python programs.
CO3: Structure simple Python programs for solving problems and decompose a Python program into functions.
CO4: Represent compound data using Python lists, tuples, dictionaries.
CO5: Read and write data from/to files in Python Programs.

TEXT BOOKS:

1. Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised andupdated for Python 3.6.2, Shroff Publishers, First edition (2017).
2. S. Annadurai, S.Shankar, I.Jasmine, M.Revathi, Fundamentals of Python Programming, Mc-Graw Hill Education (India) Private Ltd, 2019.

REFERENCE BOOKS:

1. Charles Dierbach, —Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013.
2. Timothy A. Budd, —Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd., 2015.
3. Robert Sedgewick, Kevin Wayne, Robert Dondero, —Introduction to Programming inPython: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.

Chairman, Board of Studies
Chairman - BoS
CHE - HiCET

HINDUSTHAN ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Dean – Academics
Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21ME1152	ENGINEERING DRAWING	1	0	4	3

Course Objectives

- To gain the knowledge of Engineer's language of expressing complete details about objects and construction of conics and special curves.
- To learn about the orthogonal projections of straight lines and planes.
- To acquire the knowledge of projections of simple solid objects in plan and elevation.
- To learn about the projection of sections of solids and development of surfaces.
- To study the isometric projections of different objects.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**UNIT I PLANE CURVES** Importance of engineering drawing; drafting instruments; drawing sheets – layout and folding; Lettering and dimensioning, BIS standards, scales. Geometrical constructions, Engineering Curves Conic sections – Construction of ellipse, parabola and hyperbola by eccentricity method. Construction of cycloids and involutes of square and circle – Drawing of tangents and normal to the above curves.	12
II	**UNIT II PROJECTIONS OF POINTS, LINES AND PLANE SURFACES** Introduction to Orthographic projections- Projection of points. Projection of straight lines inclined to both the planes, Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the planes by rotating object method (First angle projections only).	12
III	**UNIT III PROJECTIONS OF SOLIDS** Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is perpendicular and inclined to one plane by rotating object method.	12
IV	**UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES** Sectioning of simple solids with their axis in vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinder and cone. Development of lateral surfaces of truncated solids.	12
V	**UNIT V ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS** Isometric views and projections simple and truncated solids such as - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions. Free hand sketching of multiple views from a pictorial drawing. Basics of drafting using AutoCAD software.	12
	Total Instructional Hours	**60**

Course Outcomes

Upon completion of the course, students can be able to

CO1: Understand and interpret the engineering drawings in order to visualize the objects and draw the conics and special curves.
CO2: Draw the orthogonal projections of straight lines and planes.
CO3: Interpret the projections of simple solid objects in plan and elevation.
CO4: Draw the projections of section of solids and development of surfaces of solids.
CO5: Draw the isometric projections and the perspective views of different objects.

TEXT BOOKS:

1. K.Venugopal, V.Prabu Raja, "Engineering Drawing, AutoCAD, Building Drawings", 5th edition New Age International Publishers, New delhi 2016.
2. K.V.Natarajan, "A textbook of Engineering Graphics", Dhanlaksmi Publishers, Chennai 2016.

REFERENCE BOOKS:

1. BasantAgrawal and C.M.Agrawal, "Engineering Drawing", Tata McGraw Hill Publishing company Limited,New Delhi 2013.
2. N.S. Parthasarathy, Vela Murali, "Engineering Drawing", Oxford University PRESS, India 2015.

Chairman, Board of Studies

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL * HiCET * COLLEGE OF ENGG & TECH
Chairman

Dean - Academics

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21HE1071	LANGUAGE COMPETENCY ENHANCEMENT COURSE- I	0	0	2	1

Course Objective

- ✓ To enhance student language competency
- ✓ To train the students in LSRW skills
- ✓ To develop student communication skills
- ✓ To empower the trainee in business writing skills.
- ✓ To train the students to react to different professional situations

Unit	Description	Instructional Hours
I	**Listening** Listening to technical group discussions and participating in GDs. listening to TED talks. Listen to Interviews & mock interview. Listening short texts and memos.	3
II	**Reading** Reading articles from newspaper, magazine. Reading comprehension. Reading about technical inventions, research and development. Reading short texts and memos.	3
III	**Writing** E-mail writing: Create and send email writing (to enquire about some details, to convey important message to all, to place an order, to share your joy and sad moment). Reply for an email writing.	3
IV	**Speaking** To present a seminar in a specific topic (what is important while choosing or deciding something to do). To respond or answer for general questions (answer for your personal details, about your family, education, your hobbies, your aim etc.,).	3
V	**Speaking** Participate in discussion or interactions (agree or disagree express your statement with a valid reason, involve in discussion to express your perspective on a particular topics).	3
	Total Instructional Hours	**15**

Course Outcome

CO1- Trained to maintain coherence and communicate effectively.
CO2- Practiced to create and interpret descriptive communication.
CO3- Introduced to gain information of the professional world.
CO4- acquired various types of communication and etiquette.
CO5- Taught to improve interpersonal and intrapersonal skills.

TEXT BOOKS:

T1- Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press, 2016.

T2- Raymond Murphy, "Essential English Grammar", Cambridge University Press, 2019.

REFERENCE BOOKS:

R1- Meenakshi Raman and Sangeetha Sharma. "Technical Communication- Principles and Practice", Oxford University Press, 2009.

Chairman, Board of Studies

Chairman - BoS
CHE - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Course code	Course title	L	T	P	C
21HE1072	Career Guidance Level - I Personality, Aptitude and Career Development	2	0	0	0

Pre-requisite None **Syllabus version** 1

Course Objectives:

- Introduce students to building blocks of Logical reasoning and Quantitative Aptitude [SLO 1]
- Train students on essential grammar for placements [SLO 2]
- Introduce students on scientific techniques to pick up skills [SLO 3]
- Provide an orientation for recruiter expectation in terms of non-verbal skills, and for how to build one's career with placements in mind [SLO 4]

Expected Course Outcome:
Enable students to approach learning Aptitude with ease, and understand recruiter expectation.

Student Learning Outcomes (SLO): 1, 2, 3 and 4

Module:1 Lessons on excellence **1 hour** **SLO:** 3
Skill introspection, Skill acquisition, consistent practice

Module:2 Logical Reasoning **7 hours** **SLO:** 1
Thinking Skill

- Problem Solving
- Critical Thinking
- Lateral Thinking

Taught through thought-provoking word and rebus puzzles, and word-link builder questions

Coding & decoding, Series, Analogy, Odd man out and Visual reasoning

- Coding and Decoding
- Series
- Analogy
- Odd Man Out
- Visual Reasoning

Sudoku puzzles
Solving introductory to moderate level sudoku puzzles to boost logical thinking and comfort with numbers

Attention to detail
Picture and word driven Qs to develop attention to detail as a skill

Module:3 Quantitative Aptitude **8 hours** **SLO:** 1
Speed Maths

- Addition and Subtraction of bigger numbers
- Square and square roots
- Cubes and cube roots
- Vedic maths techniques
- Multiplication Shortcuts
- Multiplication of 3 and higher digit numbers
- Simplifications
- Comparing fractions
- Shortcuts to find HCF and LCM
- Divisibility tests shortcuts

Algebra and functions

Module:4 Recruitment Essentials **1 hour** **SLO:** 4
Looking at an engineering career through the prism of an effective resume

- Importance of a resume - the footprint of a person's career achievements
- How a resume looks like?
- An effective resume vs. a poor resume: what skills you must build starting today and how?

Impression Management

Getting it right for the interview:

- Grooming, dressing
- Body Language and other non-verbal signs
- Displaying the right behaviour

Module:5 Verbal Ability **3 hours** **SLO:** 2

Essential grammar for placements:

- Nouns and Pronouns
- Verbs
- Subject-Verb Agreement
- Pronoun-Antecedent Agreement
- Punctuations

Verbal Reasoning

Total Lecture hours: 20 hours

Mode of Evaluation: Assignments, 3 Assessments with End Semester (Computer Based Test)

Chairman, Board of Studies
Chairman - BoS
CHE - HiCET

Dean - Academics
Dean (Academics)
HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

SEMESTER II

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21HE2101	**BUSINESS ENGLISH FOR ENGINEERS (COMMON TO ALL BRANCHES)**	2	1	0	3

Course Objective

1. Introduce business communication.
2. Train to respond different professional situations.
3. Make the learners familiar with the managerial skills
4. Empower the trainee in business writing skills.
5. Educate to interpret and expertise different business content.

Unit	Description	Instructional Hours
I	**Listening and Speaking** – listening and discussing about programme and conference arrangement Reading – reading auto biographies of successful personalities **Writing** Formal & informal email writing, Recommendations **Grammar and Vocabulary-** Business vocabulary, Adjectives & adverbs.	9
II	**Listening and Speaking-** listening to TED talks **Reading-**Making and interpretation of posters**Writing-** Business letters: letters giving good and bad news, Thank you letter, Congratulating someone on a success"**Grammar and Vocabulary-** Active & passive voice, Spotting errors (Tenses, Preposition, Articles).	9
III	**Listening and Speaking-**travel arrangements and experience **Reading-** travel reviews **Writing-** Business letters (Placing an order, making clarification & complaint letters). **Grammar and Vocabulary-** Direct and Indirect speech.	9
IV	**Listening and Speaking-** Role play- **Reading-** Sequencing of sentence **Writing-** Business report writing (marketing, investigating) **Grammar and Vocabulary-** Connectors, Gerund & infinitive.	9
V	**Listening and Speaking-** Listen to Interviews & mock interview **Reading-** Reading short stories, reading profile of a company **- Writing-** Descriptive writing (describing one's own experience) **Grammar and Vocabulary-** Editing a passage(punctuation, spelling& number rules).	9
	Total Instructional Hours	**45**

Course Outcome

CO1- To know different modes of business communication
CO2- To understand managerial techniques.CO3- To apply the rules of grammar and vocabulary in effective business communication.
CO4-To analyse and interpret business documents.
CO5-To draft business reports

TEXT BOOKS:

T1 - Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate",Cambridge University Press, 2016.

T2- Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2015.

REFERENCE BOOKS :

R1 -Michael Mc Carthy, "Grammar for Business", Cambridge University Press, 2009.

R2- Bill Mascull, "Business Vocabulary in use: Advanced 2nd Edition", Cambridge University Press, 2009.

R3-Frederick T. Wood, "Remedial English Grammar For Foreign Students", Macmillan publishers, 2001.

Chairman, Board of Studies **Dean - Academics**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21MA2101	DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES	3	1	0	4

Course Objective

1. Describe some methods to solve different types of first order differential equations.
2. Solve ordinary differential equations of certain types using Wronskian technique
3. Use the effective mathematical tools for the solutions of partial differential equations.
4. Describe the construction of analytic functions and conformal mapping.
5. Illustrate Cauchy's integral theorem and calculus of residues

Unit	Description	Instructional Hours
I	**FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS** Solutions of Equations of the first order and of the first degree – Variable seperable method-Homogeneous equations – Exact differential equations (Excluding non Exact differential Equations) – Linear equations – Equations reducible to the linear form – Bernoulli's equation.	12
II	**ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER** Second order linear differential equations with constant and variable co-efficients – Cauchy – Euler equations – Cauchy – Legendre equation – Method of variation of paramers. Solution of ODE related to electric circuits, bending of beams.	12
III	**PARTIAL DIFFERENTIAL EQUATIONS** Formation of partial differential equations by the elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations of the form f(p,q)=0, Clairaut's type : z = px+qy +f(p,q) – Lagrange's linear equation.	12
IV	**COMPLEX DIFFERENTIATION** Functions of complex variables – Analytic functions – Cauchy's – Riemann's equations and sufficient conditions (excluding proof) – Construction of analytic functions – Milne –Thomson's method – Conformal mapping w = A+z , Az, 1/z and bilinear transformations.	12
V	**COMPLEX INTEGRATION** Cauchy's integral theorem – Cauchy's integral formula –Taylor's and Laurent's series (statement only) – Residues - Cauchy's Residue theorem.	12
	Total Instructional Hours	60

Course Outcome

CO1: Apply few methods to solve different types of first order differential equations.
CO2: Develop sound knowledge of techniques in solving ordinary differential equations
CO3 Solve Partial Differential Equations using various methods.
CO4: Infer the knowledge of construction of analytic functions and conformal mapping.
CO5: Evaluate real and complex integrals over suitable closed paths or contours.

TEXT BOOKS:

T1- Ravish R Singh, Mukul Bhatt, "Engineering Mathematics", McGraw Hill education (India) Private Ltd., Chennai,2017
T2- Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018.

REFERENCE BOOKS:

R1- Veerarajan T, "Engineering Mathematics", McGraw Hill Education (India) Pvt Ltd, New Delhi, 2016
R2- Grewal B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.
R3- Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning,2012.

Chairman, Board of Studies

Chairman - BoS
CHE - HiCET

Dean - Academics

Dean (Academics)
HiCET

HINDUSTHAN ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21CH2101	PRINCIPLES OF CHEMICAL ENGINEERING	3	0	0	3

Course Objectives

- To understand the overall view of the chemical reactions and chemical engineering.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	Chemistry, Chemical Engineering and Chemical Technology; Chemical process industries: History and their role in Society; Role of Chemical Engineer; History and Personalities of Chemical Engineering; Greatest achievements of Chemical Engineering. Role of Mathematics, Physics, Chemistry and Biology.	9
II	Scientific laws in Chemical kinetics, Thermodynamics and Fluid mechanics; Arrhenius equation, Avogadro's law, Boltzmann equation, Boyle's law, Carnot's theorem, Charles's law, Dalton's law, Darcy's law, Fick's law of diffusion, Fourier's law, Gibbs–Helmholtz equation, Graham's law, Henry's law, Hess's law, Helmholtz free energy, Stefan–Boltzmann law, Stokes's law - Definition.	9
III	Introduction - Law of conservation of matter, Chemical equations **and** chemical reactions. Reactants **to** products **-balancing the chemical reaction, coefficients,** stoichiometry. Types of Chemical Reactions; **Chemical reactions – Classifications and definations;** Combination reactions, Decomposition reactions, Combustion reactions, Oxidation reactions, Reduction reactions - examples.	9
IV	Quantities in Chemical Reactions; Introduction – Mole, atomic and molar masses, mole – mass, mole-mole, mass-mass conversion and relationships in chemical reactions-basic problems. Energy and Chemical Processes; Introduction -Energy and its Units, Heat, Phase Changes, Bond Energies and Chemical Reactions, Energy of Biochemical Reactions.	9
V	Role of Computer in Chemical Engineering; Chemical Engineering Software. Role of Chemical Engineers in the area of Food, Medical, Energy, Environmental, Biochemical, Electronics etc. Paradigm shifts in Chemical Engineering; Range of scales in Chemical Engineering; Opportunities for Chemical Engineers; Future of Chemical Engineering.	9
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1: Understand the role of chemical engineers.
CO2: Understand the scientific and governing laws in chemical engineering.
CO3: Understand about the various chemical reactionsin the processes.
CO4: Understand the measurement of quantities and energy in process.
CO5: Understand the demand of chemical engineers, opportunities and future.

TEXT BOOKS:

1. Salil K. Ghosal, Siddhartha Datta "Introduction to Chemical Engineering" Tata McGraw-Hill Education.
2. Introduction to chemical engineering, S. Pushpavanam, PHI Learning Pvt. Ltd.,-2012.
3. Dryden, C.E., "Outlines of Chemicals Technology", Edited and Revised by GopalaRao, M. and M.Sittig, 2nd Edition, Affiliated East-West press,1993.
4. The Language of Chemistry or Chemical Equations, by G.D. Tuli, P.L. Soni, EPH (Eurasia Publishing House)

REFERENCEBOOKS:

1. Finlayson, B. A., Introduction to Chemical Engineering Computing, John Wiley & Sons, New Jersey,2006.
2. McCabe, W.L., Smith, J. C. and Harriot, P. "Unit operations in Chemical Engineering", McGraw Hill, 7th Edition,2001.

Chairman, Board of Studies

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean - Academics

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21PH2151	MATERIAL SCIENCE (COMMON TO ALL BRANCHES)	2	0	2	3

Course Objective

1. Acquire fundamental knowledge of semiconducting materials which is related to the
2. engineering program
3. Extend the knowledge about the magnetic materials
4. Explore the behavior of super conducting materials
5. Gain knowledge about Crystal systems
6. 5. Understand the importance of ultrasonic waves

Unit	Description	Instructional Hours
	SEMICONDUCTING MATERIALS	
I	Introduction – Intrinsic semiconductor – Compound and elemental semiconductor - direct and indirect band gap of semiconductors. Carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination. Optical properties of semiconductor – Light through optical fiber(Qualitative).	6
	Determination of band gap of a semiconductor	3
	Determination of acceptance angle and numerical aperature in an optical fiber	3
	MAGNETIC MATERIALS	
II	Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti ferromagnetic materials – Ferrites and its applications.	6
	B – H curve by Magnetic hysteresis experiment	3
	PERCONDUCTING MATERIALS	
III	Superconductivity : properties(Messiner effect, effect of magnetic field, effect of current and isotope effects) – Type I and Type II superconductors – High Tc superconductors – Applications of superconductors –Cryotron and magnetic levitation.	6
	CRYSTAL PHYSICS	
IV	Crystal systems - Bravais lattice - Lattice planes - Miller indices - Interplanar spacing in cubic lattice - Atomic radius, Coordination number and Packing factor for SC, BCC and FCC crystal structures.	6
	ULTRASONICS	
V	Production – Magnetostrictive generator – Piezoelectric generator – Determination of velocity using acoustic grating – Cavitations – Viscous force – co-efficient of viscosity. Industrial applications – Drilling and welding – Non destructive testing – Ultrasonic pulse echo system.	6
	Determination of velocity of sound and compressibility of liquid – Ultrasonic wave	3
	Determination of Coefficient of viscosity of a liquid –Poiseuille's method	3
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand the purpose of acceptor or donor levels and the band gap of a semiconductor

CO2: Interpret the basic idea behind the process of magnetism and its applications in everyday

CO3: Discuss the behavior of super conducting materials

CO4: Illustrate the types and importance of crystal systems

CO5: Evaluate the production of ultrasonics and its applications in NDT

TEXT BOOKS:

T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.

T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2015.

REFERENCE BOOKS:

R1 - Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2015

R2 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi 2016

R3 - Dr. G. Senthilkumar "Engineering Physics – II" VRB publishers Pvt Ltd., 2016

Chairman, Board of Studies

Chairman - BoS
CHE - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean - Academics

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21CY2151	**ENVIRONMENTAL STUDIES (COMMON TO ALL BRANCHES)**	2	0	2	3

Course Objective

1. The importance of environmental education, ecosystem and biodiversity.
2. The knowledge about environmental pollution – sources, effects and control measures of environmental pollution.
3. The natural resources, exploitation and its conservation
4. Scientific, technological, economic and political solutions to environmental problems.
5. An awareness of the national and international concern for environment and its protection.

Unit	Description	Instructional Hours
I	**ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY** Main objectives and scope of environmental studies-Importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – food chain, food web and ecological pyramids - energy flow in the ecosystem – ecological succession processes - Introduction, types, characteristic features, structure and function of the forest and ponds ecosystem – Introduction to biodiversity definition: types and value of biodiversity – hot-spots of biodiversity – threats to biodiversity– endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.	6
II	**NATURAL RESOURCES** Renewable and Non renewable resources - Forest resources: Use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forests and tribal people - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture – Energy resources: Renewable and non renewable energy sources – Solar energy and wind energy - role of an individual in conservation of natural resources.	6+9=15
III	**ENVIRONMENTAL POLLUTION** Definition – causes, effects and control measures of: Air pollution- Water pollution – Water quality parameters- Soil pollution - Noise pollution- Nuclear hazards – role of an individual in prevention of pollution. **Determination of Dissolved Oxygen in sewage water by Winkler's method. Estimation of alkalinity of water sample by indicator method. Determination of chloride content of water sample by argentometric method.**	6
IV	**SOCIAL ISSUES AND THE ENVIRONMENT** From unsustainable to sustainable development – urban problems related to energy- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- Municipal solid waste management. Global issues – Climatic change, acid rain, greenhouse effect and ozone layer depletion – Disaster Management – Tsunami and cyclones. **Determination of pH in beverages.**	6+3=9
V	**HUMAN POPULATION AND THE ENVIRONMENT** Population growth, variation among nations – population explosion – family welfare programme – environment and human health – effect of heavy metals – human rights – value education – HIV / AIDS – women and child welfare – Environmental impact analysis (EIA)- GIS-remote sensing-role of information technology in environment and human health. **Estimation of heavy metal ion (copper) in effluents by EDTA.**	6+3=9
	Total Instructional Hours	**45**

Course Outcome

CO1: Realise the importance of ecosystem and biodiversity for maintaining ecological balance.
CO2: Understand the causes of environmental pollution and hazards due to manmade activities.
CO3: Develop an understanding of different natural resources including renewable resources.
CO4: Demonstrate an appreciation for need for sustainable development and understand the various social issues and solutions to solve the issues.
CO5: Gain knowledge about the importance of women and child education and know about the existing technology to protect environment

TEXT BOOKS:

T1- S.Annadurai and P.N. Magudeswaran, "Environmental studies", Cengage Learning India Pvt.Ltd, Delhi, 2020
T2 – Anubha Kaushik and C. P. Kaushik, "Perspectives in Environmental studies", Sixth edition, New Age International Publishers, New Delhi, 2019.

REFERENCES:

R1 – Erach Bharucha, "Textbook of environmental studies" University Press (I) Pvt.ltd, Hyderabad, 2015
R2 - G.Tyler Miller, Jr and Scott E. Spoolman"Environmental Science" Thirteenth Edition, Cengage Learning, 2010.
R3 - Gilbert M. Masters and Wendell P. Ela "Introduction to Environmental Engineering and Science", 3rd edition, Pearson Education, 2013.

Chairman, Board of Studies
Chairman - BoS
CHE - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean - Academics
Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21ME2001	ENGINEERING PRACTICES	0	0	4	2

Course Objectives

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical and Electrical Engineering.

S.No.	DESCRIPTION
	GROUP A (CIVIL & MECHANICAL)
1.	Preparation of Single pipe line and Double pipe line connection by using valves, taps, couplings, unions, reducers and elbows.
2.	Arrangement of bricks using English bond for 1brick thick wall and 11/2 brick thick wall for right angle corner junction.
3.	Arrangement of bricks using English bond for 1brick thick wall and 11/2 brick thick wall for T junction.
4.	Preparation of arc welding of Butt joints, Lap joints and Tee joints. structures.
5.	Practice on sheet metal Models– Trays and funnels
6.	Hands-on-exercise in wood work, joints by sawing, planning and cutting.
7.	Practice on simple step turning, taper turning and drilling.
8.	Demonstration on Smithy operation.
9.	Demonstration on Foundry operation.
10.	Demonstration on Power tools.

S.No.	DESCRIPTION
	GROUP B (ELECTRICAL)
1.	Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2.	Fluorescent lamp wiring.
3.	Stair case wiring.
4.	Measurement of Electrical quantities – voltage, current, power & power factor in single phase circuits.
5.	Measurement of energy using single phase energy meter.
6.	Soldering practice using general purpose PCB.
7.	Measurement of Time, Frequency and Peak Value of an Alternating Quantity using CRO and Function Generator.
8.	Study of Energy Efficient Equipment's and Measuring Instruments.

Total Instructional Hours 45

Course Outcomes

Upon completion of the course, students can be able to

- Fabricate wooden components and pipe connections including plumbing works.
- Fabricate simple weld joints.
- Fabricate different electrical wiring circuits and understand the AC Circuits.

Chairman, Board of Studies

Chairman - BoS
CHE - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean - Academics

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21HE2071	LANGUAGE COMPETENCY ENHANCEMENT COURSE- II (COMMON TO ALL BRANCHES)	0	0	2	1

Course Objective

- ✓ **To introduce to business communication.**
- ✓ **To train the students to react to different professional situations.**
- ✓ **To make the learner familiar with the managerial skills**
- ✓ **To empower the trainee in business writing skills.**
- ✓ **To learn to interpret and expertise different content.**

Unit	Description	Instructional Hours
I	**Listening and Speaking** – listening and discussing about programme and conference arrangement **Reading** –reading auto biographies of successful personalities **Writing** Formal & informal email writing, Recommendations **Grammar and Vocabulary-** Business vocabulary, Adjectives & adverbs.	3
II	**Listening and Speaking-** listening to TED talks **Reading-** Making and interpretation of posters **Writing-** Business letters: letters giving good and bad news, Thank you letter, Congratulating someone on a success" **Grammar and Vocabulary-** Active & passive voice, Spotting errors (Tenses, Preposition, Articles).	3
III	**Listening and Speaking-**travel arrangements and experience **Reading-** travel reviews **Writing-** Business letters (Placing an order, making clarification & complaint letters). **Grammar and Vocabulary-** Direct and Indirect speech.	3
IV	**Listening and Speaking-** Role play - **Reading-** Sequencing of sentence **Writing-** Business report writing (marketing, investigating) **Grammar and Vocabulary-** Connectors, Gerund & infinitive.	3
V	**Listening and Speaking-** Listen to Interviews & mock interview **Reading-** Reading short stories, reading profile of a company - **Writing-** Descriptive writing (describing one's own experience) **Grammar and Vocabulary-** Editing a passage(punctuation, spelling & number rules).	3
	Total Instructional Hours	**15**

Course Outcome

CO1- Introduced to different modes and types of business communication.
CO2- Practiced to face and react to various professional situations efficiently.
CO3- learnt to practice managerial skills.
CO4- Familiarized with proper guidance to business writing.
CO5- Trained to analyze and respond to different types of communication.

TEXT BOOKS:

T1 - Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate",Cambridge University Press, 2016.
T2- Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2015.

REFERENCE BOOKS :

R1 - Michael Mc Carthy. "Grammar for Business", Cambridge University Press, 2009.
R2- Bill Mascull, "Business Vocabulary in use: Advanced 2nd Edition", Cambridge University Press, 2009.
R3- Frederick T. Wood, "Remedial English Grammar For Foreign Students", Macmillan publishers, 2001.

Chairman, Board of Studies

Chairman - BoS
CHE - HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean – Academics

Dean (Academics)
HiCET

Course code	Course title	L	T	P	C
21HE2072	Career Guidance Level - II Personality, Aptitude and Career Development	2	0	0	0
Pre-requisite	None	Syllabus version 1			

Course Objectives:

- Solve Logical Reasoning questions of easy to intermediate level [SLO 6]
- Solve Quantitative Aptitude questions of easy to intermediate level [SLO 7]
- Solve Verbal Ability questions of easy to intermediate level [SLO 8]

Expected Course Outcome:

Enable students to solve questions on Verbal, Logical and Quantitative Aptitude of placement level

Student Learning Outcomes (SLO): 6, 7, 8

Module:1 Logical Reasoning **5 hours** **SLO:** 6

Word group categorization questions

Puzzle type class involving students grouping words into right group orders of logical sense

Cryptarithmetic

Data arrangements and Blood relations

- Linear Arrangement
- Circular Arrangement
- Multi-dimensional Arrangement
- Blood Relations

Module:2 Quantitative Aptitude **8 hours** **SLO:** 7

Ratio and Proportion

- Ratio
- Proportion
- Variation
- Simple equations
- Problems on Ages
- Mixtures and alligations

Percentages, Simple and Compound Interest

- Percentages as Fractions and Decimals
- Percentage Increase / Decrease
- Simple Interest
- Compound Interest
- Relation Between Simple and Compound Interest

Number System

- Number system
- Power cycle
- Remainder cycle
- Factors, Multiples
- HCF and LCM

Module:3 Verbal Ability **7 hours** **SLO:** 8

Essential grammar for placements

- Prepositions
- Adjectives and Adverbs
- Tenses
- Forms and Speech and Voice
- Idioms and Phrasal Verbs
- Collocations, Gerund and Infinitives

Reading Comprehension for placements

- Types of questions
- Comprehension strategies

- Practice exercises

Articles, Prepositions and Interrogatives

- Definite and Indefinite Articles
- Omission of Articles
- Prepositions
- Compound Prepositions and Prepositional Phrases
- Interrogatives

Vocabulary for placements

- Exposure to solving questions of
- Synonyms
- Antonyms
- Analogy
- Confusing words
- Spelling correctness

Total Lecture hours: 20 hours

Mode of Evaluation: Assignments, 3 Assessments with End Semester (Computer Based Test)

Chairman, Board of Studies

Chairman - BoS
CHE - HiCET

Dean - Academics

Dean (Academics)
HiCET

HINDUSTHAN ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.TECH.	21HE2073	ENTREPRENEURSHIP & INNOVATION	1	0	0	0

Course Objective`

1. To acquire the knowledge and skills needed to manage the development of innovation.
2. To recognize and evaluate potential opportunities to monetize these innovations.
3. To plan specific and detailed method to exploit these opportunities.
4. To acquire the resources necessary to implement these plans.
5: To make students understand organizational performance and its importance.

Module	Description
1.	Entrepreneurial Thinking
2.	Innovation Management
3.	Design Thinking
4.	Opportunity Spotting / Opportunity Evaluation
5.	Industry and Market Research
6.	Innovation Strategy and Business Models
7.	Financial Forecasting
8.	Business Plans/ Business Model Canvas
9.	Entrepreneurial Finance
10.	Pitching to Resources Providers / Pitch Deck
11.	Negotiating Deals
12.	New Venture Creation
13.	Lean Start-ups
14.	Entrepreneurial Ecosystem
15.	Velocity Venture

Course Outcome

CO1: Understand the nature of business opportunities, resources, and industries in critical and creative aspects.
CO2: Understand the processes by which innovation is fostered, managed, and commercialized.
CO3: Remember effectively and efficiently the potential of new business opportunities.
CO4: Assess the market potential for a new venture, including customer need, competitors, and industry attractiveness..
CO5: Develop a business model for a new venture, including revenue. Margins, operations, working capital, and investment.

TEXT BOOKS

T1: Arya Kumar "Entrepreneurship – Creating and leading an Entrepreneurial Organization", Pearson, Second Edition (2012).
T2: Emrah Yayici "Design Thinking Methodology", Artbiztech, First Edition(2016).

REFERENCE BOOKS

R1: Christopher Golis "Enterprise & Venture Capital", Allen & Unwin Publication, Fourth Edition (2007).
R2: Thomas Lock Wood & Edger Papke "Innovation by Design", Career Press.com, Second Edition (2017).
R3: Jonathan Wilson "Essentials of Business Research", Sage Publication, First Edition (2010).

WEB RESOURCES

W1: https://blof.forgeforward.in/tagged/startup-lessons
W2: https://blof.forgeforward.in/tagged/entrepreurship
W3: https://blof.forgeforward.in/tagged/minimum-viable-product
W4: https://blof.forgeforward.in/tagged/minimum-viable-product
W5: https://blof.forgeforward.in/tagged/innovation
W6:https://www.youtube.com/watch?v=8vEyL7uKXs&list=PLmP9QrmTNPqBEvKbMSXvwlwn7fdnXe6Lw

Chairman, Board of Studies

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG. & TECH. * Chairman

Dean - Academics

Dean (Academics)
HiCET

HINDUSTHAN EDUCATIONAL AND CHARITABLE TRUST

HICET

HINDUSTHAN

COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution)

Coimbatore – 641032

DEPARTMENT OF CHEMICAL ENGINEERING

2019 REGULATIONS

DETAILS OF CHANGES CARRIED OUT IN CURRICULUM & SYLLABUS

CBCS PATTERN

UNDERGRADUATE PROGRAMMES

B.TECH. CHEMICAL ENGINEERING (UG)

REGULATION-2019

SEMESTER I

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE1101	Technical English	HS	2	1	0	3	25	75	100
2	19MA1102	Calculus and Linear Algebra	BS	3	1	0	4	25	75	100
THEORY WITH LAB COMPONENT										
3	19PH1151	Applied Physics	BS	2	0	2	3	50	50	100
4	19CY1151	Chemistry for Engineers	BS	2	0	2	3	50	50	100
5	19CS1151	Python Programming and Practices	ES	2	0	2	3	50	50	100
6	19ME1152	Engineering Drawing	ES	1	0	4	3	50	50	100
PRACTICAL										
7	19HE1001	Language Competency Enhancement Course-I	HS	0	0	2	1	0	100	100
MANDATORY COURSES										
8	19HE1072	**Career Guidance Level** – I Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
			Total :	**14**	**2**	**12**	**20**	**350**	**450**	**800**

As Per AICTE Norms 3 Weeks Induction Programme is Added in The First Semester as an Audit Course

SEMESTER II

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19HE2101	Business English for Engineers	HS	2	1	0	3	25	75	100
2	19MA2101	Differential Equations and Complex Variables	BS	3	1	0	4	25	75	100
3	19EE2103	Basics of Electrical and Electronics Engineering	ES	3	0	0	3	25	75	100
4	19CH2101	Principles of Chemical Engineering	ES	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
5	19PH2151	Material Science	BS	2	0	2	3	50	50	100
6	19CY2151	Environmental Studies	BS	2	0	2	3	50	50	100
PRACTICAL										
7	19ME2001	Engineering Practices	ES	0	0	4	2	50	50	100
8	19HE2001	Language Competency Enhancement Course-II	HS	0	0	2	1	0	100	100
MANDATORY COURSES										
9	19HE2072	**Career Guidance Level – II** Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10	19HE2073	Entrepreneurship & Innovation	EEC	1	0	0	0	100	0	100
		Total :		**18**	**2**	**10**	**22**	**450**	**550**	**1000**

SEMESTER III

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19MA3103	Fourier Analysis and Numerical Methods	BS	3	1	0	4	25	75	100
2	19CH3201	Chemical Process Calculations	PC	3	1	0	4	25	75	100
3	19CH3202	Fluid Mechanics for Chemical Engineers	PC	3	0	0	3	25	75	100
4	19CH3203	Chemical Engineering Thermodynamics – I	PC	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
5	19CH3251	Analytical Instruments for Analysis	PC	2	0	2	3	50	50	100
PRACTICAL										
6	19CH3001	Fluid Mechanics Lab	PC	0	0	3	1.5	50	50	100
7	19CH3002	Chemical Analysis Lab	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8	19MC3191	Indian Constitution	AC	2	0	0	0	100	0	100
9	19HE3072	**Career Guidance Level – III** Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10	19HE3073	Leadership Management Skills	EEC	1	0	0	0	100	0	100
		Total		**19**	**2**	**8**	**20**	**550**	**450**	**1000**

SEMESTER IV

S.No	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19CH4201	Process Heat Transfer	PC	3	1	0	4	25	75	100
2	19CH4202	Mass Transfer – I	PC	3	0	0	3	25	75	100
3	19CH4203	Chemical Engineering Thermodynamics - II	PC	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
4	19CH4251	Mechanical Operations	PC	3	0	2	4	50	50	100
5	19MA4153	Applied Probability Statistics	BS	3	0	2	4	50	50	100
PRACTICAL										
6	19CH4001	Heat Transfer Lab	PC	0	0	3	1.5	50	50	100
7	19CH4002	Petrochemical Analysis Lab	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
8	19AC4191	Essence of Indian tradition knowledge/Value Education	AC	2	0	0	0	100	0	100
9	19HE4072	**Career Guidance Level – IV** Personality, Aptitude and Career Development	EEC	2	0	0	0	100	0	100
10	19HE4073	Ideation Skills	EEC	2	0	0	0	100	0	100
		Total		**21**	**1**	**10**	**21**	**575**	**425**	**1000**

SEMESTER V

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19CH5201	Chemical Reaction Engineering – I	PC	3	1	0	4	25	75	100
2	19CH5202	Mass Transfer – II	PC	3	1	0	4	25	75	100
3	19CH5203	Process Instrumentation Dynamics and Control	PC	3	1	0	4	25	75	100
4	19CH5204	Safety in Chemical Industries	PC	3	0	0	3	25	75	100
5	19CH53XX	**Professional Elective -I**	PE	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENT										
6	19CH5251	Water Treatment and Solid Waste Management	PC	2	0	2	3	50	50	100
PRACTICALS										
7	19CH5001	Mass Transfer Lab	PC	0	0	3	1.5	50	50	100
8	19CH5002	Process Control Lab	PC	0	0	3	1.5	50	50	100
MANDATORY COURSES										
9	19HE5071	Soft Skills - I	EEC	1	0	0	1	100	0	100
10	19HE5072	Design Thinking	EEC	1	0	0	1	100	0	100
		Total		**19**	**3**	**8**	**26**	**475**	**525**	**1000**

SEMESTER VI

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19CH6201	Chemical Reaction Engineering– II	PC	3	1	0	4	25	75	100
2	19CH6202	Chemical Process Industries	PC	3	0	0	3	25	75	100
3	19CH6181	Professional Ethics in Engineering	HS	3	0	0	3	25	75	100
4	19CH63XX	**Professional Elective - II**	PE	3	0	0	3	25	75	100
5	19XX64XX	**Open Elective– I**	OE	3	0	0	3	25	75	100
THEORY WITH LAB COMPONENTS										
6	19CH6251	Fluidization Engineering	PC	2	0	2	3	50	50	100
PRACTICALS										
7	19CH6001	Chemical Reaction Engineering Lab	PC	0	0	4	2	50	50	100
MANDATORY COURSES										
8	19CH6701	Internship/Industrial Training/Skill Development Course (Minimum 3 weeks)	EEC	-	-	-	1	100	0	100
9	19HE6071	Soft Skills - II	EEC	1	0	0	1	100	0	100
10	19HE6072	Intellectual Property Rights (IPR)	EEC	1	0	0	1	100	0	100
		Total		**19**	**1**	**6**	**24**	**525**	**475**	**1000**

SEMESTER VII

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19CH7201	Process Economics and Engineering Management	PC	3	0	0	3	25	75	100
2	19CH7202	Process Equipment Design	PC	3	1	0	4	25	75	100
3	19CH73XX	**Professional Elective-III**	PE	3	0	0	3	25	75	100
4	19XX74XX	**Open Elective – II**	OE	3	0	0	3	25	75	100
PRACTICALS										
5	19CH7001	Design and Simulation Lab	PC	0	0	3	1.5	50	50	100
6	19CH7003	Computational Fluid Dynamics Lab	PC	0	0	3	1.5	50	50	100
PROJECT WORK										
7	19CH7901	Project Work – Phase I	EEC	0	0	4	2	50	50	100
		Total		**12**	**1**	**10**	**18**	**250**	**450**	**700**

SEMESTER VIII

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
THEORY										
1	19CH83XX	**Professional Elective –IV**	PE	3	0	0	3	25	75	100
2	19CH83XX	**Professional Elective- V**	PE	3	0	0	3	25	75	100
PROJECT WORK										
3	19CH8901	Project Work – Phase II	EEC	0	0	16	8	100	100	200
			Total	**6**	**0**	**16**	**14**	**150**	**250**	**400**

TOTAL NO OF CREDITS: 165

LIST OF PROFESSIONAL ELECTIVES

S.No.	Course Code	Course Title	Category	L	T	P	C	CIA	ESE	TOTAL
PROFESSIONAL ELECTIVE I										
1	19CH5301	Energy Technology	PE	3	0	0	3	25	75	100
2	19CH5302	Petroleum Technology	PE	3	0	0	3	25	75	100
3	19CH5303	Electrochemical Engineering	PE	3	0	0	3	25	75	100
4	19CH5304	Polymer Technology	PE	3	0	0	3	25	75	100
5	19CH5305	Food Technology	PE	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE II										
1	19CH6301	Petroleum Exploration and Exploitation Techniques	PE	3	0	0	3	25	75	100
2	19CH6302	Enzyme Engineering	PE	3	0	0	3	25	75	100
3	19CH6303	Fundamentals of Nano science	PE	3	0	0	3	25	75	100
4	19CH6304	Corrosion Science and Engineering	PE	3	0	0	3	25	75	100
5	19CH6305	Piping and Instrumentation	PE	3	0	0	3	25	75	100
6	19CH6306	Sugar Technology	PE	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE III										
1	19CH7301	Natural Gas Engineering	PE	3	0	0	3	25	75	100
2	19CH7302	Pulp and Paper Technology	PE	3	0	0	3	25	75	100
3	19CH7303	Transport Phenomena	PE	3	0	0	3	25	75	100
4	19CH7304	Multicomponent Distillation	PE	3	0	0	3	25	75	100
5	19CH7305	Chemical Process Optimization	PE	3	0	0	3	25	75	100
6	19CH7306	Fundamentals of rubber testing compounds	PE	3	0	0	3	25	75	100
7	19CH7307	Chemical Manufacturing Plant Operation	PE	3	0	0	3	25	75	100
8	19CH7308	Chemical storage and Handling Operation	PE	3	0	0	3	25	75	100
9	19CH7309	Chemical Effluent treatment plant Operation	PE	3	0	0	3	25	75	100
10	19CH7310	Analytical Instruments Operation	PE	3	0	0	3	25	75	100
PROFESSIONAL ELECTIVE IV										
1	19CH8301	Industrial Management	PE	3	0	0	3	25	75	100
2	19CH8302	Sugar Technology	PE	3	0	0	3	25	75	100
3	19CH8303	Total Quality Management	PE	3	0	0	3	25	75	100
4	19CH8304	Foundation Skills in Integrated Product Development	PE	3	0	0	3	25	75	100
5	19CH8305	Supply Chain Management	PE	3	0	0	3	25	75	100

PROFESSIONAL ELECTIVE V										
1	19CH8306	Process Plant Utilities	PE	3	0	0	3	25	75	100
2	19CH8307	Fermentation Technology	PE	3	0	0	3	25	75	100
3	19CH8308	Frontiers of Chemical Technology	PE	3	0	0	3	25	75	100
4	19CH8309	Industrial Nanotechnology	PE	3	0	0	3	25	75	100
5	19CH8310	Drugs and Pharmaceutical Technology	PE	3	0	0	3	25	75	100
6	19CH8311	Membrane Separation Process	PE	3	0	0	3	25	75	100

LIST OF OPEN ELECTIVES										
CHEMICAL ENGINEERING										
S.No.	**Course Code**	**Course Title**	**Category**	**L**	**T**	**P**	**C**	**CIA**	**ESE**	**TOTAL**
1	19CH6401	Waste to Energy Conversion	OE	3	0	0	3	25	75	100
2	19CH7401	Biomass Conversion and Biorefinery	OE	3	0	0	3	25	75	100
LIFE SKILL COURSES										
3	19LSZ401	General Studies for Competitive Examinations	OE	3	0	0	3	25	75	100
4	19LSZ402	Human Rights, Women's Rights and Gender Equality	OE	3	0	0	3	25	75	100
5	19LSZ403	Indian Ethos and Human Values	OE	3	0	0	3	25	75	100
6	19LSZ404	Indian Constitution and Political System	OE	3	0	0	3	25	75	100
7	19LSZ405	Yoga for Human Excellence	OE	3	0	0	3	25	75	100

(Note: Z Stands for semester, students can't choose twice the course)

ADDITIONAL CREDIT COURSE FOR CHEMICAL ENGINEERING						
S.No	**Course Code**	**Course Title**	**Category**	**Duration**	**Assessment**	**Credit**
1.	19VACH01	Industrial Automation	VA	30 hrs	Internal	1
2.	19VACH02	Bulk Solid Handling for Chemical Engineers	VA	30 hrs	Internal	1
3.	19VACH03	Fundamentals of AI and it's Chemometric Applications	VA	30 hrs	Internal	1
4.	19VACH04	Introduction to Chemical Engineering MATLAB	VA	30 hrs	Internal	1
5.	19VACH05	IOT- Basics and Application in Unit Operations	VA	30 hrs	Internal	1

CREDIT DISTRIBUTION

Semester	I	II	III	IV	V	VI	VII	VIII	**Total**
Credits	20	22	20	21	26	24	18	14	**165**

*** Student can earn extra credit 35 over and above the total credits**

Chairman, Board of Studies
Chairman - BoS
CHE - HiCET

Dean (Academics)
Dean (Academics)
HiCET

HINDUSTHAN ACADEMIC COUNCIL * Chairman * HINDUSTHAN COLLEGE OF ENGG & TECH

Principal
PRINCIPAL
Hindusthan College Of Engineering & Technology
COIMBATORE - 641 032.

B.TECH. CHEMICAL ENGINEERING
SYLLABI (I to VIII SEMESTERS)

Programme	Course Code	Name of the Course	L	T	P	C
B.E/B.Tech	19HE1101	**TECHNICAL ENGLISH** (COMMON TO ALL BRANCHES)	2	1	0	3

Course Objective

- ✓ To facilitate students to communicate effectively with coherence.
- ✓ To train the learners in descriptive communication.
- ✓ To introduce professional communication.
- ✓ To enhance knowledge and to provide the information on corporate environment.
- ✓ To equip the trainers with the necessary skills on critical thinking.

Unit	Description	Instructional Hours
I	**Listening and Speaking** – Opening a conversation, maintaining coherence, turn taking, closing a conversation (excuse, general wishes, positive comments and thanks) **Reading** –Reading articles from newspaper, Reading comprehension **Writing** Chart analysis, process description, Writing instructions **Grammar and Vocabulary-** Tenses, Regular and irregular verb, technical vocabulary.	9
II	**Listening and Speaking-** listening to product description, equipment & work place (purpose, appearance, function) **Reading-** Reading technical articles **Writing-** Letter phrases, writing personal letters, **Grammar and Vocabulary**-articles, Cause & effect, Prepositions.	9
III	**Listening and Speaking-** - listening to announcements **Reading-** Reading about technical inventions, research and development **Writing-** Letter inviting a candidate for interview, Job application and resume preparation **Grammar and Vocabulary-** Homophones and Homonyms.	9
IV	**Listening and Speaking-** - Practice telephone skills and telephone etiquette (listening and responding, asking questions).**Reading-** Reading short texts and memos **Writing-** invitation letters, accepting an invitation and declining an invitation **Grammar and Vocabulary-** Modal verbs, Collocation, Conditionals, Subject verb agreement and Pronoun-Antecedent agreement.	9
V	**Listening and Speaking-** listening to technical group discussions and participating in GDs **Reading-** reading biographical writing - **Writing-** Proposal writing, Writing definitions, **Grammar and Vocabulary-** Abbreviation and Acronym, Prefixes & suffixes, phrasal verbs.	9
	Total Instructional Hours	**45**

Course Outcome

CO1- Trained to maintain coherence and communicate effectively.
CO2- Practiced to create and interpret descriptive communication.
CO3- Introduced to gain information of the professional world.
CO4- acquired various types of communication and etiquette.
CO5- Taught to improve interpersonal and intrapersonal skills.

TEXT BOOKS:

T1- Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate", Cambridge University Press, 2016.
T2- Raymond Murphy, "Essential English Grammar", Cambridge University Press, 2019.

REFERENCE BOOKS :

R1- Meenakshi Raman and Sangeetha Sharma. "Technical Communication- Principles and Practice", Oxford University Press, 2009.
R2- Raymond Murphy, "English Grammar in Use"- 4th editionCambridge University Press, 2004.
R3- Kamalesh Sadanan "A Foundation Course for the Speakers of Tamil-Part-I &II", Orient Blackswan, 2010.

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL • HINDUSTHAN COLLEGE OF ENGG & TECH • Chairman

Dean (Academics)
HiCET

19HE1101 - Technical English

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1.0	1.0	1.0	1.0	-	-	-	-	2.0	3.0	1.0	2.0	-	-
CO2	2.0	2.0	1.0	1.0	-	-	-	-	2.0	3.0	1.0	2.0	-	-
CO3	-	1.0	1.0	1.0	-	-	-	-	2.0	3.0	1.0	2.0	-	-
CO4	-	2.0	1.0	1.0	-	-	-	-	2.0	3.0	1.0	2.0	-	-
CO5	-	1.0	1.0	1.0	-	-	-	-	2.0	3.0	1.0	3.0	-	-
AVG	**1.5**	**1.4**	**1.0**	**1.0**	-	-	-	-	**2.0**	**3.0**	**1.0**	**2.2**	-	-

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Programme/sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	19MA1102	**CALCULUS AND LINEAR ALGEBRA**	3	1	0	4

Course Objective

1. Remember the concept of differentiation.
2. Evaluate the functions of several variables which are needed in many branches of engineering.
3. Illustrate the concept of double integrals.
4. Understand the concept of triple integrals.
5. Develop the skill to use matrix algebra techniques that is needed by engineers for practical Applications

Unit	Description	Instructional Hours
I	**DIFFERENTIAL CALCULUS** Rolle's Theorem – Lagrange's Mean Value Theorem- Maxima and Minima – Taylor's and Maclaurin's Theorem	12
II	**MULTIVARIATE CALCULUS (DIFFERENTIATION)** Totalderivatives - Jacobians – Maxima, M inima and Saddle points - Lagrange's method of undeterminedmultipliers – Gradient, divergence, curl and derivatives	12
III	**DOUBLE INTEGRATION** DoubleintegralsinCartesiancoordinates– Area enclosed by the plane curves (excluding surface area)– Green's Theorem (Simple Application) - Stoke's Theorem – Simple Application involving cubes and rectangular parellopiped.	12
IV	**TRIPLE INTEGRATION** Tripleintegrals in Cartesian co-ordinates – Volume of solids (Sphere, Ellipsoid, Tetrahedron) using Cartesian co-ordinates. Gauss Divergence Theorem – Simple Application involving cubes and rectangular parellopiped.	12
V	**MATRICES** Eigen valuesand Eigen vectors – PropertiesofEigen values andEigen vectors (without proof) - Cayley - Hamilton Theorem (excluding proof) - Reduction of a quadratic form to canonical form by orthogonal transformation.	12
	Total Instructional Hours	60

Course Outcome

CO1: Apply the concept of differentiation in any curve.
CO2: Identify the maximum and minimum values of surfaces.
CO3: Apply double integrals to compute area of plane curves.
CO4: Evaluation of triple integrals to compute volume of solids.
CO5: Calculate Eigen values and Eigen vectors for a matrix which are used to determine the natural frequencies (or Eigen frequencies) of vibration and the shapes of these vibrational modes.

TEXT BOOKS:

T1 - Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018.

T2 - Veerarajan T, "Engineering Mathematics ", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016.

REFERENCE BOOKS :

R1- Thomas & Finney " Calculus and Analytic Geometry" , Sixth Edition,,Narosa Publishing House, New Delhi.

R2 – Weir,M.D and Joel Hass, ' Thomas Calculus" 12th Edition,Pearson India 2016.R3 - Grewal B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

19MA1102 - Calculus and Linear Algebra

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	3.0	3.0	2.0	2.0	2.0	-	-	1.0	2.0	2.0	2.0	2.0
CO2	3.0	3.0	3.0	3.0	2.0	2.0	2.0	-	-	1.0	2.0	2.0	2.0	2.0
CO3	3.0	3.0	3.0	3.0	2.0	2.0	2.0	-	-	1.0	2.0	2.0	2.0	3.0
CO4	3.0	3.0	3.0	3.0	2.0	2.0	2.0	-	-	1.0	2.0	2.0	1.0	2.0
CO5	3.0	3.0	3.0	3.0	3.0	2.0	2.0	-	-	1.0	2.0	2.0	2.0	1.0
AVG	**3.0**	**3.0**	**3.0**	**3.0**	**2.2**	**2.0**	**2.0**	-	-	**1.0**	**2.0**	**2.0**	**1.8**	**2.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★
Chairman

Programme/sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ I	19**PH1151**	**APPLIED PHYSICS (Common to all branches)**	2	0	2	3

Course Objective

1. Enhance the fundamental knowledge in properties of matter
2. Analysis the oscillatory motions of particles
3. Extend the knowledge about wave optics
4. Gain knowledge about laser and their applications
5. Conversant with principles of optical fiber, types and applications of optical fiber

Unit	Description	Instructional Hours
I	**PROPERTIES OF MATTER** Elasticity – Hooke's law – Stress-strain diagram - Poisson's ratio – Bending moment – Depression of a cantilever – Derivation of Young's modulus of the material of the beam by Uniform bending theory and experiment.	6
	Determination of Young's modulus by uniform bending method	3
II	**OSCILLATONS** Translation motion –Vibration motion – Simple Harmonic motion – Differential Equation of SHM and its solution – Damped harmonic oscillation - Torsion stress and deformations – Torsion pendulum: theory and experiment.	6
	Determination of Rigidity modulus – Torsion pendulum	3
III	**WAVE OPTICS** Conditions for sustained Interference – air wedge and it's applications - Diffraction of light – Fraunhofer diffraction at single slit –Diffraction grating – Rayleigh's criterion of resolution power - resolving power of grating.	6
	Determination of wavelength of mercury spectrum – spectrometer grating	3
	Determination of thickness of a thin wire – Air wedge method	3
IV	**LASER AND APPLICATIONS** Spontaneous emission and stimulated emission – Population inversion – Pumping methods – Derivation of Einstein's coefficients (A&B) – Type of lasers – Nd:YAG laser and CO_2 laser- Laser Applications – Holography – Construction and reconstruction of images.	6
	Determination of Wavelength and particl size using Laser	3
V	**FIBER OPTICS AND APPLICATIONS** Principle and propagation of light through optical fibers – Derivation of numerical aperture and acceptance angle – Classification of optical fibers (based on refractive index, modes and materials) – Fiber optical communication link – Fiber optic sensors – Temperature and displacement sensors.	6
	Total Instructional Hours	**45**

Course Outcome

After completion of the course the learner will be able to

CO1: Illustrate the fundamental properties of matter
CO2: Discuss the Oscillatory motions of particles
CO3: Analyze the wavelength of different colors
CO4: Understand the advanced technology of LASER in the field of Engineering
CO5: Develop the technology of fiber optical communication in engineering field

TEXT BOOKS:T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.
T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2015.

REFERENCE BOOKS:

R1 - Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2015

R2 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi 2016

R3 - Dr. G. Senthilkumar "Engineering Physics – I" VRB publishers Pvt Ltd., 2016

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

19PH1151 - Applied Physics

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	2.0	1.0	1.0	1.0	2.0	-	-	-	-	-	-	-
CO2	3.0	3.0	1.0	1.0	1.0	1.0	2.0	-	-	-	-	-	-	-
CO3	3.0	2.0	1.0	2.0	2.0	1.0	2.0	-	-	-	-	-	-	-
CO4	3.0	2.0	1.0	2.0	3.0	1.0	2.0	-	-	-	-	-	-	-
CO5	3.0	3.0	1.0	3.0	2.0	1.0	2.0	-	-	-	-	-	-	-
AVG	**3.0**	**2.4**	**1.2**	**1.8**	**1.8**	**1.0**	**2.0**	-	-	-	-	-	-	-

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★
Chairman

Programme/sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech	19CY1151	**CHEMISTRY FOR ENGINEERS (COMMON TO ALL BRANCHES)**	2	0	2	3

Course Objective

1. The boiler feed water requirements, related problems and water treatment techniques.
2. The principles of polymer chemistry and engineering applications of polymers and composites.
3. The principles of electrochemistry and with the mechanism of corrosion and its control.
4. The principles and generation of energy in batteries, nuclear reactors, solar cells, wind mills and fuel cells.
5. The important concepts of spectroscopy and its applications.

Unit	Description	Instructional Hours
I	**WATER TECHNOLOGY** Hard water and soft water- Disadvantages of hard water- Hardness: types of hardness, simple calculations, estimation of hardness of water – EDTA method – Boiler troubles - Conditioning methods of hard water – External conditioning - demineralization process - desalination: definition, reverse osmosis – Potable water treatment – breakpoint chlorination. **Estimation of total, permanent and temporary hardness of water by EDTA**	6 +3=9
II	**POLYMER & COMPOSITES** polymerization – addition and condensation polymerization – mechanism of free radical addition polymerization – copolymers – plastics: classification – thermoplastics and thermosetting plastics, preparation, properties and uses of commercial plastics – PVC, Bakelite – moulding of plastics (extrusion and compression); Composites: definition, types of composites – polymer matrix composites (PMC) –FRP	6
III	**ELECTROCHEMISTRY AND CORROSION** Electrochemical cells – reversible and irreversible cells - EMF- Single electrode potential – Nernst equation (derivation only) – Conductometric titrations. Chemical corrosion – Pilling – Bedworth rule – electrochemical corrosion – different types –galvanic corrosion – differential aeration corrosion – corrosion control – sacrificial anode and impressed cathodic current methods - protective coatings – paints – constituents and functions. **Conductometric titration of strong acid vs strong base (HCl vs NaOH). Conductometric precipitation titration using $BaCl_2$ and Na_2SO_4. Estimation of Ferrous iron by Potentiometry.**	6+9 =15
IV	**ENERGY SOURCES AND STORAGE DEVICES** Introduction- nuclear energy- nuclear fission- controlled nuclear fission- nuclear fusion differences between nuclear fission and fusion- nuclear chain reactions- nuclear reactor power generator- classification of nuclear reactor- light water reactor- breeder reactor. Batteries and fuel cells: Types of batteries- alkaline battery- lead storage battery- lithium battery- fuel cell H_2 -O_2 fuel cell applications.	6
V	**ANALYTICAL TECHNIQUES** Beer-Lambert's law – UV-visible spectroscopy and IR spectroscopy – principle – instrumentation (block diagram only) – flame photometry – principle – instrumentation (block diagram only) – estimation of sodium by flame photometry – atomic absorption spectroscopy – principles – instrumentation (block diagram only) – estimation of nickel by atomic absorption spectroscopy. **Determination of iron content of the water sample using spectrophotometer.(1,10 phenanthroline / thiocyanate method).**	6+3
	Total Instructional Hours	**45**

Course Outcome

CO1: Differentiate hard and soft water and to solve the related problems on water purification and its significance in industries and daily life
CO2: Acquire the basic knowledge of polymers, composites and FRP and their significance.
CO3: Develop knowledge on the basic principles of electrochemistry and understand the causes of corrosion, its consequences to minimize corrosion to improve industrial design.
CO4: Develop knowledge about the renewable energy resources and batteries along with the need of new materials to improve energy storage capabilities.
CO5: Identify the structure and characteristics of unknown/new compound with the help of spectroscopy.

TEXT BOOKS

T1 - P. N. Madudeswaran and B.Jeyagowri, "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd,Chennai
T2 - P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2018).

REFERENCES

R1 - B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2012).
R2 - S.S.Dara "A Text book of Engineering Chemistry" S.Chand & Co. Ltd., New Delhi (2017).

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL • HINDUSTHAN COLLEGE OF ENGG & TECH • Chairman

Dean (Academics)
HiCET

19CY1151 - Chemistry for Engineers

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	2.0	2.0	2.0	1.0	1.0	-	-	-	-	1.0	-	-
CO2	3.0	2.0	2.0	2.0	2.0	1.0	1.0	-	-	-	-	1.0	-	-
CO3	3.0	2.0	2.0	2.0	2.0	1.0	1.0	-	-	-	-	1.0	-	-
CO4	3.0	2.0	2.0	2.0	2.0	1.0	1.0	-	-	-	-	1.0	-	-
CO5	3.0	2.0	2.0	2.0	2.0	1.0	1.0	-	-	-	-	1.0	-	-
AVG	**3.0**	**2.0**	**2.0**	**2.0**	**2.0**	**1.0**	**1.0**	-	-	-	-	**1.0**	-	-

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CS1151	**PYTHON PROGRAMMING AND PRACTICES**	**2**	**0**	**2**	**3**

Course Objectives

- To know the basics of algorithmic problem solving.
- To read and write simple Python programs.
- To develop Python programs with conditionals and loops and to define Python functions and call them.
- To use Python data structures – lists, tuples, dictionaries.
- To do input/output with files in Python.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**ALGORITHMIC PROBLEM SOLVING** Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation(pseudo code, flow chart, programming language), algorithmic problem solving, simple strategiesfor developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert acard in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.	9
II	**DATA, EXPRESSIONS, STATEMENTS** Python interpreter and interactive mode; values and types: int, float, boolean, string, and list;variables, expressions, statements, tuple assignment, precedence of operators, comments;modules and functions, function definition and use, flow of execution, parameters and arguments. **Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.**	7+2
III	**CONTROL FLOW, FUNCTIONS** Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: returnvalues, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. **Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.**	5+4
IV	**LISTS, TUPLES, DICTIONARIES** Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, listparameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations andmethods; advanced list processing - list comprehension; **Illustrative programs: selection sort, insertion sort, merge sort, histogram.**	3+6
V	**FILES, MODULES, PACKAGES** Files and exception: text files, reading and writing files, format operator; command line arguments,errors and exceptions, handling exceptions, modules, packages. **Illustrative programs: word count, copying file contents.**	5+4
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1: Develop algorithmic solutions to simple computational problems.

CO2: Read, write, execute by hand simple Python programs.

CO3: Structure simple Python programs for solving problems and decompose a Python program into functions.

CO4: Represent compound data using Python lists, tuples, dictionaries.

CO5: Read and write data from/to files in Python Programs.

TEXT BOOKS:

1. Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised andupdated for Python 3.6.2, Shroff Publishers, First edition (2017).
2. S. Annadurai, S.Shankar, I.Jasmine, M.Revathi, Fundamentals of Python Programming, Mc-Graw Hill Education (India) Private Ltd, 2019.

REFERENCE BOOKS:

1. Charles Dierbach, —Introduction to Computer Science using Python: A ComputationalProblem-Solving Focus, Wiley India Edition, 2013.
2. Timothy A. Budd, —Exploring Python‖, Mc-Graw Hill Education (India) Private Ltd., 2015.

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL * MAHENDHRA COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

19CS1151 - Python Programming and Practices

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1.0	2.0	3.0	-	1.0	1.0	-	1.0	1.0	1.0	1.0	1.0	2.0	1.0
CO2	1.0	2.0	3.0	-	1.0	1.0	-	1.0	1.0	1.0	1.0	1.0	2.0	1.0
CO3	1.0	2.0	3.0	-	1.0	1.0	-	1.0	1.0	1.0	1.0	1.0	2.0	1.0
CO4	1.0	2.0	3.0	-	1.0	1.0	-	1.0	1.0	1.0	1.0	1.0	2.0	1.0
CO5	1.0	2.0	3.0	-	1.0	1.0	-	1.0	1.0	1.0	1.0	1.0	2.0	1.0
AVG	**1.0**	**2.0**	**3.0**	-	**1.0**	**1.0**	-	**1.0**	**1.0**	**1.0**	**1.0**	**1.0**	**2.0**	**1.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL
Chairman
HINDUSTHAN COLLEGE OF ENGG & TECH

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19ME1152	**ENGINEERING DRAWING**	**1**	**0**	**4**	**3**

Course Objectives

- To gain the knowledge of Engineer's language of expressing complete details about objects and construction of conics and special curves.
- To learn about the orthogonal projections of straight lines and planes.
- To acquire the knowledge of projections of simple solid objects in plan and elevation.
- To learn about the projection of sections of solids and development of surfaces.
- To study the isometric projections of different objects.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**UNIT I PLANE CURVES** Importance of engineering drawing; drafting instruments; drawing sheets – layout and folding; Lettering and dimensioning, BIS standards, scales. Geometrical constructions, Engineering Curves Conic sections – Construction of ellipse, parabola and hyperbola by eccentricity method. Construction of cycloids and involutes of square and circle – Drawing of tangents and normal to the above curves.	12
II	**UNIT II PROJECTIONS OF POINTS, LINES AND PLANE SURFACES** Introduction to Orthographic projections- Projection of points. Projection of straight lines inclined to both the planes, Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the planes by rotating object method (First angle projections only).	12
III	**UNIT III PROJECTIONS OF SOLIDS** Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is perpendicular and inclined to one plane by rotating object method.	12
IV	**UNIT IV SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES** Sectioning of simple solids with their axis in vertical position when the cutting plane is inclined to one of the principal planes and perpendicular to the other – Obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinder and cone. Development of lateral surfaces of truncated solids.	12
V	**UNIT V ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS** Isometric views and projections simple and truncated solids such as - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions. Free hand sketching of multiple views from a pictorial drawing. Basics of drafting using AutoCAD software.	12
	Total Instructional Hours	**60**

Course Outcomes

Upon completion of the course, students can be able to

CO1: Understand and interpret the engineering drawings in order to visualize the objects and draw the conics and special curves.

CO2: Draw the orthogonal projections of straight lines and planes.

CO3: Interpret the projections of simple solid objects in plan and elevation.

CO4: Draw the projections of section of solids and development of surfaces of solids.

CO5: Draw the isometric projections and the perspective views of different objects.

1. K.Venugopal, V.Prabu Raja, "Engineering Drawing, AutoCAD, Building Drawings", 5th edition New Age International Publishers, New delhi 2016.

REFERENCE BOOKS:

1. BasantAgrawal and C.M.Agrawal, "Engineering Drawing", Tata McGraw Hill Publishing company Limited,New Delhi 2013.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E/B.Tech	19HE1001	**LANGUAGE COMPETENCY ENHANCEMENT COURSE- I**	0	0	2	1

Course Objective

- ✓ To enhance student language competency
- ✓ To train the students in LSRW skills
- ✓ To develop student communication skills
- ✓ To empower the trainee in business writing skills.
- ✓ To train the students to react to different professional situations

Unit	Description	Instructional Hours
I	**Listening** Listening to technical group discussions and participating in GDs. listening to TED talks. Listen to Interviews & mock interview. Listening short texts and memos.	3
II	**Reading** Reading articles from newspaper, magazine. Reading comprehension. Reading about technical inventions, research and development. Reading short texts and memos.	3
III	**Writing** E-mail writing: Create and send email writing (to enquire about some details, to convey important message to all, to place an order, to share your joy and sad moment). Reply for an email writing.	3
IV	**Speaking** To present a seminar in a specific topic (what is important while choosing or deciding something to do). To respond or answer for general questions (answer for your personal details, about your family, education, your hobbies, your aim etc.,).	3
V	**Speaking** Participate in discussion or interactions (agree or disagree express your statement with a valid reason, involve in discussion to express your perspective on a particular topics).	3
	Total Instructional Hours	**15**

Course Outcome

CO1- Trained to maintain coherence and communicate effectively.
CO2- Practiced to create and interpret descriptive communication.
CO3- Introduced to gain information of the professional world.
CO4- acquired various types of communication and etiquette.
CO5- Taught to improve interpersonal and intrapersonal skills.

TEXT BOOKS:

T1- Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate",Cambridge University Press, 2016.

T2-Raymond Murphy, "Essential English Grammar", Cambridge University Press, 2019.

REFERENCE BOOKS :

R1- Meenakshi Raman and Sangeetha Sharma. "Technical Communication-Principles and Practice", Oxford University Press, 2009.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

Programme/sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ II	19HE1901	**BUSINESS ENGLISH FOR ENGINEERS** (COMMON TO ALL BRANCHES)	2	1	0	3

Course Objective

1. Introduce business communication.
2. Train to respond different professional situations.
3. Make the learners familiar with the managerial skills
4. Empower the trainee in business writing skills.
5. Educate to interpret and expertisedifferent business content.

Unit	Description	Instructional Hours
I	**Listening and Speaking** – listening and discussing about programme and conference arrangement **Reading** –reading auto biographies of successful personalities **Writing** Formal & informal email writing, Recommendations **Grammar and Vocabulary-** Business vocabulary, Adjectives & adverbs.	9
II	**Listening and Speaking-** listening to TED talks **Reading-**Making and interpretation of posters**Writing-** Business letters: letters giving good and bad news, Thank you letter, Congratulating someone on a success"**Grammar and Vocabulary-** Active & passive voice, Spotting errors (Tenses, Preposition, Articles).	9
III	**Listening and Speaking-**travel arrangements and experience **Reading-** travel reviews **Writing-** Business letters (Placing an order, making clarification & complaint letters). **Grammar and Vocabulary-** Direct and Indirect speech.	9
IV	**Listening and Speaking-** Role play- **Reading-** Sequencing of sentence **Writing-** Business report writing (marketing, investigating) **Grammar and Vocabulary-** Connectors, Gerund & infinitive.	9
V	**Listening and Speaking-** Listen to Interviews & mock interview **Reading-** Reading short stories, reading profile of a company - **Writing-** Descriptive writing (describing one's own experience) **Grammar and Vocabulary-** Editing a passage(punctuation, spelling& number rules).	9
	Total Instructional Hours	**45**

Course Outcome

CO1- To know different modes of business communication
CO2- To understand managerial techniques.CO3- To apply the rules of grammar and vocabulary in effective business communication.
CO4-To analyse and interpret business documents.
CO5-To draft business reports

TEXT BOOKS:

T1 - Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate",Cambridge University Press, 2016.

T2- Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2015.

REFERENCE BOOKS :

R1 -Michael Mc Carthy, "Grammar for Business", Cambridge University Press, 2009.

R2- Bill Mascull, "Business Vocabulary in use: Advanced 2nd Edition", Cambridge University Press, 2009.

R3-Frederick T. Wood, "Remedial English Grammar For Foreign Students", Macmillan publishers, 2001.

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL • HINDUSTHAN COLLEGE OF ENGG & TECH • Chairman

Dean (Academics)
HiCET

19HE2101 - Business English for Engineers

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1.0	1.0	1.0	1.0	-	-	-	-	2.0	3.0	1.0	2.0	-	-
CO2	2.0	2.0	1.0	1.0	-	-	-	-	2.0	3.0	1.0	2.0	-	-
CO3	-	1.0	1.0	1.0	-	-	-	-	2.0	3.0	1.0	2.0	-	-
CO4	-	2.0	1.0	1.0	-	-	-	-	2.0	3.0	1.0	2.0	-	-
CO5	-	1.0	1.0	1.0	-	-	-	-	2.0	3.0	1.0	3.0	-	-
AVG	**1.5**	**1.4**	**1.0**	**1.0**	-	-	-	-	**2.0**	**3.0**	**1.0**	**2.2**	-	-

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Dean (Academics)
HiCET

Programme/sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ II	19MA2101	**DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLES**	3	1	0	4

Course Objective

1. Describe some methods to solve different types of first order differential equations.
2. Solve ordinary differential equations of certain types using Wronskian technique
3. Use the effective mathematical tools for the solutions of partial differential equations.
4. Describe the construction of analytic functions and conformal mapping.
5. Illustrate Cauchy's integral theorem and calculus of residues

Unit	Description	Instructional Hours
I	**FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS** Solutions of Equations of the first order and of the first degree – Variable seperable method-Homogeneous equations – Exact differential equations (Excluding non Exact differential Equations) – Linear equations – Equations reducible to the linear form – Bernoulli's equation .	12
II	**ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDER** Second order linear differential equations with constant and variable co-efficients – Cauchy – Euler equations – Cauchy – Legendre equation – Method of variation of paramers. Solution of ODE related to electric circuits, bending of beams.	12
III	**PARTIAL DIFFERENTIAL EQUATIONS** Formation of partial differential equations by the elimination of arbitrary constants and arbitrary functions – Solution of standard types of first order partial differential equations of the form f(p,q)=0, Clairaut's type : z = px+qy +f(p,q) – Lagrange's linear equation.	12
IV	**COMPLEX DIFFERENTIATION** Functions of complex variables – Analytic functions – Cauchy's – Riemann's equations and sufficient conditions (excluding proof) – Construction of analytic functions – Milne –Thomson's method – Conformal mapping w = A+z , Az, 1/z and bilinear transformations.	12
V	**COMPLEX INTEGRATION** Cauchy's integral theorem – Cauchy's integral formula –Taylor's and Laurent's series (statement only) – Residues - Cauchy's Residue theorem.	12
	Total Instructional Hours	60

Course Outcome

CO1: Apply few methods to solve different types of first order differential equations.
CO2: Develop sound knowledge of techniques in solving ordinary differential equations
CO3 Solve Partial Differential Equations using various methods.
CO4: Infer the knowledge of construction of analytic functions and conformal mapping.
CO5: Evaluate real and complex integrals over suitable closed paths or contours.

TEXT BOOKS:

T1- Ravish R Singh, Mukul Bhatt, "Engineering Mathematics", McGraw Hill education (India) Private Ltd.,Chennai,2017
T2- Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018.

REFERENCE BOOKS :

R1- Veerarajan T, "Engineering Mathematics", McGraw Hill Education(India) Pvt Ltd, New Delhi, 2016
R2- Grewal B.S, "Higher Engineering Mathematics", 42nd Edition, Khanna Publications, Delhi, 2012.
R3- Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Edition, Cengage learning,2012.

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL • HINDUSTHAN COLLEGE OF ENGG & TECH • Chairman

Dean (Academics)
HiCET

19MA2101 - Differential Equations and Complex Variables

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	3.0	2.0	2.0	1.0	1.0	-	-	1.0	1.0	2.0	2.0	2.0
CO2	3.0	3.0	3.0	2.0	2.0	1.0	1.0	-	-	1.0	1.0	2.0	2.0	2.0
CO3	3.0	3.0	3.0	3.0	3.0	1.0	1.0	-	-	1.0	1.0	2.0	2.0	2.0
CO4	3.0	3.0	3.0	2.0	2.0	1.0	1.0	-	-	1.0	-	2.0	2.0	2.0
CO5	3.0	3.0	3.0	3.0	3.0	1.0	1.0	-	-	1.0	-	2.0	2.0	2.0
AVG	**3.0**	**3.0**	**3.0**	**2.4**	**2.4**	**1.0**	**1.0**	-	-	**1.0**	**1.0**	**2.0**	**2.0**	**2.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★
Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19EE2103	**BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING**	**3**	**0**	**0**	**3**

Course Objectives

- To understand the basic laws and apply them in Electrical circuits and understand different measuring instruments.
- To impart knowledge on construction and working of DC and AC machines
- To create awareness on the methods for electrical safety, load protection basics.
- To provide knowledge on the fundamentals of semiconductor devices and their applications.
- To impart knowledge on digital electronics and its principles.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**UNIT I: ELECTRICAL CIRCUITS AND MEASUREMENTS** Ohm's Law – Kirchoff's Laws – Steady State Solution of DC Circuits – Introduction to AC Circuits – Waveforms and RMS Value – Power and Power factor – Single Phase circuits - Three Phase Balanced Circuits. Operating Principles of Moving Coil and Moving Iron Instruments - Ammeters and Voltmeters, Dynamometer type Watt meters and Energy meters.	9
II	**UNIT II : ELECTRICAL MACHINES** Construction, Principle of Operation of DC Generators - EMF Equation - Construction, Principle of Operation of DC shunt and series Motors, Single Phase Transformer - EMF Equation, Single phase capacitor start - capacitor run – Construction, Principle of Operation of Three Phase Induction Motor – Applications - (Qualitative Approach only).	9
III	**UNIT III : ELECTRICAL WIRING AND SAFETY** Wiring types and applications: Service mains, meter board and distribution board - Brief discussion on concealed conduit wiring. One way and two way control. Elementary discussion on Circuit protective devices: fuse and Miniature Circuit Breaker (MCB's). Electric shock, precautions against shock, Objectives for Neutral and Earthing, types of earthing; pipe and plate earthing, Residual current circuit breaker.	9
	UNIT IV : SEMICONDUCTOR DEVICES AND APPLICATIONS Characteristics of PN Junction Diode – Zener Diode and its Characteristics – Zener Effect – Half wave and Full wave Rectifiers – Voltage Regulation. Bipolar Junction Transistor (BJT) – CB, CE, CC Configurations and Characteristics – FET – Characteristics.	9
	UNIT V : DIGITAL ELECTRONICS Binary Number System – Logic Gates – Boolean Algebra – Half and Full Adders – Flip-Flops (RS, JK, T & D), A/D and D/A Conversion (Dual Slope, SAR, Binary-weighted and R-2R).	9
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1: Apply the KVL and KCL in Electrical circuits.
CO2: Explain the constructional features of AC and DC machines.
CO3: Develop awareness on the methods for electrical safety, load protection basics.
CO4: Identify electronics components and use of them to design circuits.
CO5: Develop Combinational and Sequential logic circuits.

TEXT BOOKS:

1. Muthusubramanian R, Salivahanan S and Muraleedharan K A, "Basic Electrical, Electronics and Computer Engineering", Tata McGraw Hill, Eighteenth Reprint, 2014.
2. Mittle N., "Basic Electrical Engineering", Tata McGraw Hill Edition, New Delhi, 1990.

REFERENCES BOOKS:

1. Premkumar N, "Basic Electrical and Electronics Engineering", Anuradha Publishers, 2018.
2. Mehta V K, "Principles of Electronics", S.Chand& Company Ltd, 1994.
3. Nagsarkar T K and Sukhija M S, "Basics of Electrical Engineering", Oxford press 2005.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

19EE2103 - Basics of Electrical and Electronics Engineering

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	2.0	2.0	2.0	1.0	1.0	-	-	-	1.0	2.0	3.0	2.0
CO2	3.0	3.0	3.0	2.0	2.0	1.0	1.0	-	-	-	1.0	2.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	1.0	1.0	-	-	-	1.0	2.0	3.0	2.0
CO4	3.0	3.0	3.0	2.0	2.0	1.0	1.0	-	-	-	1.0	2.0	3.0	2.0
CO5	3.0	3.0	3.0	2.0	2.0	1.0	1.0	-	-	-	1.0	2.0	2.0	3.0
AVG	**3.0**	**2.8**	**2.8**	**2.0**	**2.0**	**1.0**	**1.0**	-	-	-	**1.0**	**2.0**	**2.8**	**2.2**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH2101	**PRINCIPLES OF CHEMICAL ENGINEERING**	**3**	**0**	**0**	**3**

Course Objectives **Students should be able to**

1. Understand the overall view of the chemical reactions and chemical engineering.
2. Examine the scientific laws in chemical kinetics
3. Illustrate the role of computers in chemical industry.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**HISTORY**: Chemistry, Chemical Engineering and Chemical Technology; Chemical process industries: History and their role in Society; Role of Chemical Engineer; History and Personalities of Chemical Engineering; Greatest achievements of Chemical Engineering. Role of Mathematics, Physics, Chemistry and Biology.	9
II	**SCIENTIFIC LAWS IN CHEMICAL KINETICS:** Thermodynamics and Fluid mechanics; Arrhenius equation, Avogadro's law, Boltzmann equation, Boyle's law, Carnot's theorem, Charles's law, Dalton's law, Darcy's law, Fick's law of diffusion, Fourier's law, Gibbs–Helmholtz equation, Graham's law, Henry's law, Hess's law, Helmholtz free energy, Stefan–Boltzmann law, Stokes's law- Definition.	9
III	**INTRODUCTION** - Law of conservation of matter, Chemical equations **and** chemical reactions. Reactants **to** products -balancing the chemical reaction, coefficients, stoichiometry. Types of Chemical Reactions; Chemical reactions – Classifications and definations; Combination reactions, Decomposition **reac**tions, Combustion reactions, Oxidation reactions, Reduction reactions - examples.	9
IV	**QUANTITIES IN CHEMICAL REACTIONS**: Introduction – Mole, atomic and molar masses, mole – mass, mole-mole, mass-mass conversion and relationships in chemical reactions-basic problems. Energy and Chemical Processes; Introduction -Energy and its Units, Heat, Phase Changes, Bond Energies and Chemical Reactions, Energy of Biochemical Reactions.	9
V	**ROLE OF COMPUTER IN CHEMICAL ENGINEERING:** Chemical Engineering Software. Role of Chemical Engineers in the area of Food, Medical, Energy, Environmental, Biochemical, Electronics etc. Paradigm shifts in Chemical Engineering; Range of scales in Chemical Engineering; Opportunities for Chemical Engineers; Future of Chemical Engineering.	9
	Total Instructional Hours	**45**

Upon completion of the course, students can be able to

Course Outcomes

CO1: Understand the role of chemical engineers.
CO2: Understand the scientific and governing laws in chemical engineering.
CO3: Understand about the various chemical reactions in the processes.
CO4: Understand the measurement of quantities and energy in process.
CO5: Understand the demand of chemical engineers, opportunities and future.

TEXT BOOKS:

1. Salil K. Ghosal, Siddhartha Datta "Introduction to Chemical Engineering" Tata McGraw-Hill Education.
2. Introduction to chemical engineering, S. Pushpavanam, PHI Learning Pvt. Ltd.,-2012.
3. Dryden, C.E., "Outlines of Chemicals Technology", Edited and Revised by GopalaRao, M. and M.Sittig, 2nd Edition, Affiliated East-West press,1993.
4. The Language of Chemistry or Chemical Equations, by G.D. Tuli, P.L. Soni, EPH (Eurasia Publishing House)

REFERENCEBOOKS:

1. Finlayson, B. A., Introduction to Chemical Engineering Computing, John Wiley & Sons, New Jersey,2006.
2. McCabe, W.L., Smith, J. C. and Harriot, P. "Unit operations in Chemical Engineering", McGraw Hill, 7th Edition,2001.

Chairman - BoS
OHE - HiCET

ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

19CH2101 - Principles of Chemical Engineering

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2.0	-	2.0	-	-	2.0	2.0	-	-	-	-	-	2.0	2.0
CO2	3.0	-	-	2.0	-	-	-	-	-	-	-	-	3.0	2.0
CO3	3.0	-	-	2.0	-	-	-	-	-	-	-	-	3.0	2.0
CO4	3.0	-	-	2.0	-	-	-	-	-	-	-	-	3.0	3.0
CO5	2.0	1.0	2.0	1.0	3.0	-	2.0	-	-	-	-	3.0	-	2.0
AVG	**2.6**	**1.0**	**2.0**	**1.75**	**3.0**	**2.0**	**2.0**	-	-	-	-	**3.0**	**2.75**	**2.2**

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★
Chairman

Dean (Academics)
HiCET

Programme/sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ II	**19PH2151**	**Material Science (Common to all Branches)**	2	0	2	3

Course Objective

1. Acquire fundamental knowledge of semiconducting materials which is related to the
2. engineering program
3. Extend the knowledge about the magnetic materials
4. Explore the behavior of super conducting materials
5. Gain knowledge about Crystal systems
6. Understand the importance of ultrasonic waves

Unit	Description	Instructional Hours
I	**SEMICONDUCTING MATERIALS** Introduction – Intrinsic semiconductor – Compound and elemental semiconductor - direct and indirect band gap of semiconductors. Carrier concentration derivation – Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination. Optical properties of semiconductor – Light through optical fiber(Qualitative). Determination of band gap of a semiconductor Determination of acceptance angle and numerical aperature in an optical fiber	6 3 3
II	**MAGNETIC MATERIALS** Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – anti ferromagnetic materials – Ferrites and its applications. B – H curve by Magnetic hysteresis experiment	6 3
III	**PERCONDUCTING MATERIALS** Superconductivity : properties(Messiner effect, effect of magnetic field, effect of current and isotope effects) – Type I and Type II superconductors – High Tc superconductors – Applications of superconductors –Cryotron and magnetic levitation.	6
IV	**CRYSTAL PHYSICS** Crystal systems - Bravais lattice - Lattice planes - Miller indices - Interplanar spacing in cubic lattice - Atomic radius, Coordination number and Packing factor for SC, BCC and FCC crystal structures.	6
V	**ULTRASONICS** Production – Magnetostrictive generator – Piezoelectric generator – Determination of velocity using acoustic grating – Cavitations – Viscous force – co-efficient of viscosity. Industrial applications – Drilling and welding – Non destructive testing – Ultrasonic pulse echo system. Determination of velocity of sound and compressibility of liquid – Ultrasonic wave Determination of Coefficient of viscosity of a liquid –Poiseuille's method	6 3 3
	Total Instructional Hours	**45**

Course Outcome

CO1: Understand the purpose of acceptor or donor levels and the band gap of a semiconductor

CO2: Interpret the basic idea behind the process of magnetism and its applications in everyday

CO3: Discuss the behavior of super conducting materials

CO4: Illustrate the types and importance of crystal systems

CO5: Evaluate the production of ultrasonics and its applications in NDT

TEXT BOOKS:

T1 - Rajendran V, Applied Physics, Tata McGraw Hill Publishing Company Limited, New Delhi, 2017.

T2- Gaur R.K. and Gupta S.L., Engineering Physics, 8th edition, Dhanpat Rai Publications (P) Ltd., New Delhi, 2015.

REFERENCE BOOKS:

R1 - Arthur Beiser "Concepts of Modern Physics" Tata McGraw Hill, New Delhi – 2015

R2 - M.N Avadhanulu and PG Kshirsagar "A Text Book of Engineering physics" S. Chand and Company ltd., New Delhi 2016

R3 - Dr. G. Senthilkumar "Engineering Physics – II" VRB publishers Pvt Ltd., 2016

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

19PH2151 - Material Science

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	1.0	1.0	1.0	1.0	-	-	-	-	-	-	-	-
CO2	3.0	3.0	1.0	1.0	2.0	-	-	-	-	-	-	-	-	-
CO3	3.0	2.0	1.0	2.0	2.0	-	-	-	-	-	-	-	-	-
CO4	3.0	3.0	1.0	2.0	2.0	1.0	-	-	-	-	-	-	-	-
CO5	3.0	2.0	2.0	3.0	2.0	1.0	2.0	-	-	-	-	-	-	-
AVG	**3.0**	**2.4**	**1.2**	**1.8**	**1.8**	**1.0**	**2.0**	-	-	-	-	-	-	-

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Dean (Academics)
HiCET

Programme/sem	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech/ II	19CY2151	**ENVIRONMENTAL STUDIES (COMMON TO ALL BRANCHES)**	2	0	2	3

Course Objective

1. The importance of environmental education, ecosystem and biodiversity.
2. The knowledge about environmental pollution – sources, effects and control measures of environmental pollution.
3. The natural resources, exploitation and its conservation
4. Scientific, technological, economic and political solutions to environmental problems.
5. An awareness of the national and international concern for environment and its protection.

Unit	Description	Instructional Hours
I	**ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY** Main objectives and scope of environmental studies-Importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – food chain, food web and ecological pyramids - energy flow in the ecosystem – ecological succession processes - Introduction, types, characteristic features, structure and function of the forest and ponds ecosystem – Introduction to biodiversity definition: types and value of biodiversity – hot-spots of biodiversity – threats to biodiversity– endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.	6
II	**NATURAL RESOURCES** Renewable and Non renewable resources - Forest resources: Use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forests and tribal people - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture – Energy resources: Renewable and non renewable energy sources – Solar energy and wind energy - role of an individual in conservation of natural resources.	6+9=15
III	**ENVIRONMENTAL POLLUTION** Definition – causes, effects and control measures of: Air pollution- Water pollution – Water quality parameters- Soil pollution - Noise pollution- Nuclear hazards – role of an individual in prevention of pollution. **Determination of Dissolved Oxygen in sewage water by Winkler's method. Estimation of alkalinity of water sample by indicator method. Determination of chloride content of water sample by argentometric method.**	6
IV	**SOCIAL ISSUES AND THE ENVIRONMENT** From unsustainable to sustainable development – urban problems related to energy- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- Municipal solid waste management. Global issues – Climatic change, acid rain, greenhouse effect and ozone layer depletion – Disaster Management – Tsunami and cyclones. **Determination of pH in beverages.**	6+3=9
V	**HUMAN POPULATION AND THE ENVIRONMENT** Population growth, variation among nations – population explosion – family welfare programme – environment and human health – effect of heavy metals – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- GIS-remote sensing-role of information technology in environment and human health. **Estimation of heavy metal ion (copper) in effluents by EDTA.**	6+3=9
	Total Instructional Hours	**45**

Course Outcome

CO1: Realise the importance of ecosystem and biodiversity for maintaining ecological balance.
CO2: Understand the causes of environmental pollution and hazards due to manmade activities.
CO3: Develop an understanding of different natural resources including renewable resources.
CO4: Demonstrate an appreciation for need for sustainable development and understand the various social issues and solutions to solve the issues.
CO5: Gain knowledge about the importance of women and child education and know about the existing technology to protect environment

TEXT BOOKS:

T1- S.Annadurai and P.N. Magudeswaran, "Environmental studies", Cengage Learning India Pvt.Ltd, Delhi, 2020
T2 – Anubha Kaushik and C. P. Kaushik, "Perspectives in Environmental studies", Sixth edition, New Age International Publishers, New Delhi, 2019.

REFERENCES:

R1 – Erach Bharucha, "Textbook of environmental studies" University Press (I) Pvt.ltd, Hyderabad, 2015
R2 - G.Tyler Miller, Jr and Scott E. Spoolman"Environmental Science" Thirteenth Edition, Cengage Learning, 2010.
R3 - Gilbert M. Masters and Wendell P. Ela "Introduction to Environmental Engineering and Science", 3rd edition, Pearson Education, 2013.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19ME2001	**ENGINEERING PRACTICES LAB**	**0**	**0**	**4**	**2**

Course Objectives

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical and Electrical Engineering.

S.No.	DESCRIPTION
	GROUP A (CIVIL & MECHANICAL)
1.	Preparation of Single pipe line and Double pipe line connection by using valves, taps, couplings, unions, reducers and elbows.
2.	Arrangement of bricks using English bond for 1brick thick wall and 11/2 brick thick wall for right angle corner junction.
3.	Arrangement of bricks using English bond for 1brick thick wall and 11/2 brick thick wall for T junction.
4.	Preparation of arc welding of Butt joints, Lap joints and Tee joints. structures.
5.	Practice on sheet metal Models– Trays and funnels
6.	Hands-on-exercise in wood work, joints by sawing, planning and cutting.
7.	Practice on simple step turning, taper turning and drilling.
8.	Demonstration on Smithy operation.
9.	Demonstration on Foundry operation.
10.	Demonstration on Power tools.

S.No.	DESCRIPTION
	GROUP B (ELECTRICAL)
1.	Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2.	Fluorescent lamp wiring.
3.	Stair case wiring.
4.	Measurement of Electrical quantities – voltage, current, power & power factor in single phase circuits.
5.	Measurement of energy using single phase energy meter.
6.	Soldering practice using general purpose PCB.
7.	Measurement of Time, Frequency and Peak Value of an Alternating Quantity using CRO and Function Generator.
8.	Study of Energy Efficient Equipment's and Measuring Instruments.

Total Instructional Hours 45

Course Outcomes

Upon completion of the course, students can be able to

- Fabricate wooden components and pipe connections including plumbing works.
- Fabricate simple weld joints.
- Fabricate different electrical wiring circuits and understand the AC Circuits.

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL • HINDUSTHAN COLLEGE OF ENGG & TECH • Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E/B.Tech	19HE2001	**LANGUAGE COMPETENCY ENHANCEMENT COURSE- II** (COMMON TO ALL BRANCHES)	0	0	2	1

Course Objective

- ✓ **To introduce to business communication.**
- ✓ **To train the students to react to different professional situations.**
- ✓ **To make the learnerfamiliar with the managerial skills**
- ✓ **To empower the trainee in business writing skills.**
- ✓ **To learn to interpret and expertise different content.**

Unit	Description	Instructional Hours
I	**Listening and Speaking** – listening and discussing about programme and conference arrangement **Reading** –reading auto biographies of successful personalities **Writing** Formal & informal email writing, Recommendations **Grammar and Vocabulary**- Business vocabulary, Adjectives & adverbs.	3
II	**Listening and Speaking-** listening to TED talks **Reading**-Making and interpretation of posters**Writing**- Business letters: letters giving good and bad news, Thank you letter, Congratulating someone on a success" **Grammar and Vocabulary-** Active & passive voice, Spotting errors (Tenses, Preposition, Articles).	3
III	**Listening and Speaking**-travel arrangements and experience **Reading**- travel reviews **Writing**- Business letters (Placing an order, making clarification & complaint letters). **Grammar and Vocabulary-** Direct and Indirect speech.	3
IV	**Listening and Speaking**- Role play**- Reading**- Sequencing of sentence **Writing**- Business report writing (marketing, investigating) **Grammar and Vocabulary**- Connectors, Gerund & infinitive.	3
V	**Listening and Speaking**- Listen to Interviews & mock interview **Reading**- Reading short stories, reading profile of a company - **Writing**- Descriptive writing (describing one's own experience) **Grammar and Vocabulary-** Editing a passage(punctuation, spelling& number rules).	3
	Total Instructional Hours	**15**

Course Outcome

CO1- Introduced to different modes and types of business communication.
CO2- Practiced to face and react to various professional situations efficiently.
CO3- learnt to practice managerial skills.
CO4- Familiarized with proper guidance to business writing.
CO5- Trained to analyze and respond to different types of communication.

TEXT BOOKS:

T1 - Norman Whitby, "Business Benchmark-Pre-intermediate to Intermediate",Cambridge University Press, 2016.

T2- Ian Wood and Anne Willams. "Pass Cambridge BEC Preliminary", Cengage Learning press 2015.

REFERENCE BOOKS :

R1 -Michael Mc Carthy, "Grammar for Business", Cambridge University Press, 2009.

R2- Bill Mascull, "Business Vocabulary in use: Advanced 2nd Edition", Cambridge University Press, 2009.

R3-Frederick T. Wood, "Remedial English Grammar For Foreign Students", Macmillan publishers, 2001.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19MA3103	**FOURIER ANALYSIS AND NUMERICAL METHODS**	**3**	**1**	**0**	**4**

Course Objectives

- Introduce Fourier series analysis which is central to many applications in Engineering.
- Solve boundary value problems by applying Fourier series.
- Apply Fourier transform techniques used in wide variety of situations.
- Apply various methods to solve numerical differentiation and numerical integration.
- Explain the numerical solution of ordinary differential equations as most of the engineering problems are expressed in the form of differential equations.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**FOURIER SERIES** Introduction:Dirichlet's conditions- General Fourier Series – Odd and Even Functions – Half range sine and cosine series –Change of Interval - Parseval's Identity - Harmonic analysis.	12
II	**BOUNDARY VALUE PROBLEMS** Classification – solution of one dimensional wave equation – one dimensional heat equation –Fourier series solution in Cartesian coordinates.	12
III	**FOURIER TRANSFORMS** Fourier Transform Pair - Fourier sine and cosine transforms – Properties - Transforms of Simple functions – Convolution Theorem – Parseval's identity.	12
IV	**INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION** Interpolation: Newton's forward and backward difference formulae – Newton's divided difference formula and Lagrangian interpolation for unequal intervals. Differentiation: Newton's forward and backward interpolation formulae for equal intervals – Newton's divided difference formula for unequal intervals. Numerical integration: Trapezoidal and Simpson's 1/3 and 3/8 rules.	12
V	**INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS** Single step methods: Taylor's series method – Modified Euler's method for first order equation – Fourth order Runge- kutta method for solving first order equations – Multi step method: Milne's predictor and corrector method.	12
	Total Instructional Hours	**60**

Course Outcomes

Upon completion of the course, students can be able to

CO1: Understand the function in terms of sine and cosine terms in Fourier series and also to get knowledge in Fourier transforms.

CO2: Demonstrate the application of Fourier series in solving the heat and wave equations.

CO3: Illustrate the mathematical principles on Fourier transforms and able to solve some of the Physical problems of engineering.

CO4: Apply the concepts of interpolation, numerical differentiation andintegration.

CO5: Examine the concept of solving ordinary differential equations using single and multi step methods.

TEXT BOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Private Ltd., New Delhi, 2018.
2. Grewal.B.S. " Higher Engineering Mathematics", 44th Edition, Khanna Publications, New Delhi, 2012.

REFERENCE BOOKS:

1. Kreyszig.E. "Advanced Engineering Mathematics", Eight Edition, John Wiley & sons (Asia) ltd 2010.
2. Veerarajan. T.,"Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., Second reprint, New Delhi, 2012.
3. S.K.Gupta, Numerical Methods for Engineers", New Age International Pvt.Ltd Publishers,2015.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

19MA3103 - Fourier Analysis and Numerical Methods

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	3.0	2.0	2.0	1.0	1.0	-	-	1.0	2.0	2.0	2.0	2.0
CO2	3.0	3.0	3.0	2.0	2.0	1.0	1.0	-	-	1.0	2.0	2.0	2.0	2.0
CO3	3.0	3.0	3.0	3.0	2.0	1.0	1.0	-	-	1.0	2.0	2.0	3.0	2.0
CO4	3.0	3.0	3.0	3.0	3.0	1.0	2.0	-	-	1.0	2.0	2.0	3.0	2.0
CO5	3.0	3.0	3.0	3.0	3.0	1.0	2.0	-	-	1.0	3.0	2.0	3.0	2.0
AVG	**3.0**	**3.0**	**3.0**	**2.6**	**2.4**	**1.0**	**1.4**	-	-	**1.0**	**2.2**	**2.0**	**2.6**	**2.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★
Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH3201	**CHEMICAL PROCESS CALCULATIONS**	**3**	**1**	**0**	**4**

Course Objectives

The student should be able to

Formulate material balances to solve for compositions and flow rates of process streams

Incorporate single and multiple reactions into unit operations within chemical processes

Perform material and energy balance calculations in various systems

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**Units & Dimensions** – Unit Conversion; Process variables and Properties; Stoichiometric Equations, Degrees of freedom.	12
II	**Introduction to material balances -** Material balance problems for single units, multiple units – Distillation, Humidification, Adsorption & Stripping, Extraction & Leaching, Crystallization, Psychrometry, Drying, Evaporation; Stoichiometry and Chemical reaction equations; Material balance for processes involving reaction; Bypass, Purging, Recycle operations.	12
III	**Ideal gases, Real gases,** Single component two phase systems, Multiple component phase systems, Phase rule, Phase equilibria, Combustion processes – Flue gas analysis, Ultimate and Proximate analyses of coal.	12
IV	**Energy balances**, Conservation of Energy processes without reaction, Heat capacity, Energy balances with chemical reaction, Efficiency applications.	12
V	**Application of energy balances;** Unsteady state material and energy balances; Solving material and energy balances using process simulators.	12
	Total Instructional Hours	**45 + 15 = 60**

Course Outcomes

Upon completion of the course, students can be able to

CO1: Remember the units, unit's conversion and degrees of freedom.

CO2: Calculate the reactor systems and perform material and energy balances for process flow sheets by applying degree of freedom.

CO3: Apply the calculations associated with gases in two phase systems, in combustion processes.

CO4: Inspect the energy balance and heat capacity calculations.

CO5: Identify the simulation of steady-state and unsteady state processes using process simulators.

TEXT BOOKS:

1. David M. Himmelblau, "Basic Principles and Calculations in Chemical Engineering", 8thEdition, Prentice Hall of India, New Delhi, 2012.
2. Bhatt B.I. and Vora S.M., "Stoichiometry", 2nd Edition, Tata McGraw Hill, New Delhi,2004.

REFERENCE BOOKS:

1. Hougen O A, Watson K M and Ragatz R A, "Chemical process principles" Part I, 2nd Edition, CBS publishers, 2004.
2. Venkatramani. V, Anatharaman. N and MeeraShariffaBegam" Process Calculations" Printice Hall of India, New Delhi, 2nd Edn, 2011.
3. Felder, R. M. and Rousseau, R. W., "Elementary Principles of Chemical Processes",3rd Edition, John Wiley & Sons, New York, 2005.

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL * HINDUSTHAN COLLEGE OF ENGG & TECH * Chairman

Dean (Academics)
HiCET

19CH3201 - Chemical Process Calculations

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	3.0	-	-	-	-	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	3.0	-	-	-	-	-	2.0	-	3.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	-	-	-	1.0	-	2.0	-	3.0	3.0	3.0	2.0
CO4	3.0	3.0	3.0	2.0	-	2.0	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	3.0	3.0	-	2.0	2.0	-	2.0	-	3.0	3.0	3.0	2.0
AVG	**3.0**	**3.0**	**3.0**	**2.5**	-	**2.0**	**1.67**	-	**2.0**	-	**2.8**	**3.0**	**3.0**	**2.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★
Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH3202	**FLUID MECHANICS FOR CHEMICAL ENGINEERS**	**3**	**0**	**0**	**3**

Course Objectives **The student should be able to**

Develop an understanding of the fundamental properties of fluids and their behavior in static conditions.

Familiarize students with the principles of fluid flow, including laminar and turbulent flow, flow equations, and flow measurement techniques.

Enable students to understand various flow metering techniques and their applications in fluid transportation.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**Fluid Properties and Statics:** Nature of fluids - properties of fluids; Types of fluids- Newtonianand Non-Newtonian fluids, Compressible and incompressible fluids; Introduction-Hydrostatic equilibrium; Pressure measurement – Manometers.	9
II	**Principles of Fluid Flow:** Types of flow – laminar and turbulent flow in pipes and closed channels;Equation of Continuity; shear stress distribution; friction factors; Bernoulli'sequation and applications; Introduction - Boundary layer concept.	9
III	**Flow Past Immersed Bodies:** Drag- types, drag coefficient, friction factor for flow through beds of solids, applications to packed and fluidized beds; packing materials; determination of pressure drop using Ergun equation, Fluidization-types, determination of minimum fluidization velocity and pressure drop; Motion of particles through fluids – calculation of terminal settling velocity.	9
IV	**Metering of Fluids:** Classification and selection of flow meters; variable head and variable area meters: venturi, orifice and rotameters; determination of discharge and discharge coefficient; Pitot tube; Anemometer; Introduction to notches, weirs, turbine, Vortex and Magnetic flow meters.	9
V	**Transportation of Fluids:** Classification of fluid moving machinery; Centrifugal pump-characteristics and applications; elementary principles of Reciprocating, gear, air lift, diaphragm and submersible pumps; Introduction to valves and pipe fittings. **Dimensional analysis:** Basics of dimensional analysis: Rayleigh's method and Buckingham's-π method.	9
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1: Elucidate the principles of fluid properties and fluid statics

CO2: Apply the principles of fluid flow problems like pressure drop power and loss coefficient and apply the same in chemical process industries.

CO3: Illustrate the flow behavior of solid and liquid and to demonstrate the understanding of packed and fluidized bed.

CO4: Categorize and select the fluid measuring devices for different application in process industries.

CO5: Examine and select the characteristics of pumps, flow meters and valves for different applications in process industries.

TEXT BOOKS:

1. McCabe W.L., Smith J.C. and Harriot P., — "Unit Operations in Chemical Engineering", 7 th Edition, McGraw Hill International Edition, New York, 2006.
2. Bansal R.K., "Fluid Mechanics & Hydraulic Machines", Laxmi Publications, 2015.

REFERENCE BOOKS:

1. Cengel, Yunus and Cimbala John M, — "Fluid Mechanics Fundamentals and Applications", 2nd Edition, Tata McGraw Hill Publishing Company, New Delhi, 2006.
2. Munson B.R., Young D.F., Okiishi T.H. and Huebsch W.W., — "Fundamentals of Fluid Mechanics", 6th Edition, Wiley India, New Delhi, 2010.
3. Noel de Nevers, "Fluid Mechanics for Chemical Engineers", 3rd Edition, McGrawHill, New York, 2004.

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

19CH3202 - Fluid Mechanics for Chemical Engineers

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	3.0	-	-	-	-	2.0	-	2.0	3.0	3.0	-
CO2	3.0	3.0	2.0	3.0	-	-	-	-	2.0	-	2.0	3.0	3.0	-
CO3	3.0	3.0	3.0	3.0	-	-	-	-	2.0	-	2.0	3.0	3.0	-
CO4	3.0	3.0	2.0	3.0	-	-	-	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	3.0	-	-	-	-	2.0	-	3.0	3.0	3.0	2.0
AVG	**3.0**	**3.0**	**2.2**	**3.0**	-	-	-	-	**2.0**	-	**2.4**	**3.0**	**3.0**	**2.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH3203	**CHEMICAL ENGINEERING THERMODYNAMICS - I**	**3**	**0**	**0**	**3**

Course Objectives

The student should be able to

Calculate and analyse the P-V-T behaviour of the gases using various equation of states and compressibility charts.

Know the first and second law of thermodynamics and will learn to apply these to the solution of chemical engineering problems.

Assess thermodynamic potential and the concept of Internal energy and enthalpy

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**Scope of thermodynamics**; Definition of system, control volume, state and path function, equilibrium, reversibility, energy, work and heat. Zeroth law; temperature scales. Joule's experiment, internal energy, first law, energy balance for closed systems, mass and energy balance for open systems.	9
II	**PVT behaviour of fluids**; Mathematical representation of PVT behaviour; generalized compressibility factor correlation; generalized equations ofstate.	9
III	**Statements of the second law of thermodynamics**, heat engine and refrigerator, Carnot cycle and Carnot theorems, thermodynamic temperature scale, entropy and its calculation, second law of thermodynamics for a control volume. Third law of thermodynamics, entropy from a microscopic point of view.	9
IV	**Thermodynamic potentials** – Internal energy, Enthalpy, Helmholtz free energy, Gibbs free energy; thermodynamic property relations – Maxwell relations - partial derivatives and Jacobian method; residual properties; thermodynamic property tables and diagrams.	9
V	**Duct flow of compressible fluids**, Compression and expansion processes, steam power plant, internal combustion engines, jet and rocket engines.	9
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1: Remember the concepts of heat, work and energy.
CO2: Determine the properties and relationships of thermodynamic fluids.
CO3: Illustrate the laws thermodynamics and correctly use thermodynamics terminology.
CO4: Remember the fundamental thermodynamic properties.
CO5: Examine the basic thermodynamic cycles.

TEXT BOOKS:

1. Smith, J.M., Van Ness, H.C and Abbot M.M "Introduction to Chemical Engineering Thermodynamics ", McGraw Hill Publishers, VI edition, 2003.
2. Narayanan, K.V. A Textbook of Chemical Engineering Thermodynamics Prentice Hall India, 2004.

REFERENCE BOOKS:

1. Kyle, B.G., "Chemical and Process Thermodynamics III Edition", Prentice Hall of India Pvt. Ltd., 3rd edition, 2004.
2. Elliott J.R., Lira, C.T., "Introductory Chemical Engineering Thermodynamics", Prentice Hall,Second Edition, 2011.
3. Rao, Y.V.C., "Chemical Engineering Thermodynamics" Universities Press, 2005.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

19CH3203 - Chemical Engineering Thermodynamics – I

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	-	-	-	-	2.0	-	-	3.0	3.0	-
CO2	3.0	3.0	2.0	2.0	-	-	-	-	2.0	-	-	3.0	3.0	-
CO3	3.0	3.0	3.0	3.0	-	-	-	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	3.0	-	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	-	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
AVG	**3.0**	**3.0**	**2.2**	**2.4**	-	-	**2.0**	-	**2.0**	-	**2.67**	**3.0**	**3.0**	**2.0**

Chairman - BoS
CHE - HiCET

Chairman
ACADEMIC COUNCIL
HINDUSTHAN COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH3251	**ANALYTICAL INSTRUMENTS FOR ANALYSIS**	**2**	**0**	**2**	**3**

Course Objectives

The student should be able to

- Develop the ability to select the instruments based on appropriate criteria,
- Analyze and interpret the experimental data.
- Examine the working of instruments.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**Introduction:** Introduction to classical qualitative and quantitative analysis, classification of instrumental methods, Errors, precision and accuracy of instruments, statistical methods of data handling.	6
II	**Spectroscopy:** Beer‟s Law, deviation of Beer‟s Law, instrumentation of UV and IR spectroscopy: Monochromatic Source, grating systems and types of detectors, different sampling techniques and application of UV &IRSpectroscopy: **Determination of Pka value of a component usingUV-spectroscopy, Study of Chemical Reaction Kinetics usingUV-System, Determination of wavelength using UV- spectroscopy.**	6+9
III	**Gravimetric analysis:** Principle of Thermogravimetric analyzer (TGA), construction of TGA, principle of bomb Calorimeter (BC), principle of Differential scanning calorimeter (DSC), Instrumentation of TGA and BC, Application of TGA andBCinstruments: **Effect of temperature on viscosity of oils using red woodviscometer.**	6+6
IV	**Gas chromatography:** Introduction, Principle, carrier gas, stationary phase, instrumentation, column detectors (TCD, FID, ECD), qualitative andquantitativeanalysis.	6
V	**High performance liquid chromatography:** Principle, instrumentation, types of columns, sample injection, detectors used like (absorbance, refractive index, and electrochemical measurements), criteria for mobile phase selection and applicationofHPLC.	6
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1: Understand qualitative and quantitative analysis
CO2: Determine the operation and analyze the samples using UV-spectroscopy
CO3: Examine the principles of gravimetric analysis of samples
CO4: Choose the particular sample for analyses using gas chromatography
CO5: Illustrate the sample analyses using HPLC

TEXT BOOKS:

1. Instrumental Methods of Chemical Analysis; Gurudeep R. Chatwal and Sham K. Anand, Himalaya PublishingHouse.
2. Douglas A. Skoog, F. James Holler, Stanley R. Crouch., “Principles of Instrumental Analysis”, 6th Edition, published by Thomson Brooks/Cole,2007.

REFERENCE BOOKS:

1. Lloyd R. Snyder, Joseph J. Kirkland, John W. Dolan., “Introduction to Modern Liquid Chromatography”., 3rd Edition, Wiley-Blackwell, scholarlypublishing.
2. H.H. Willard, L.L. Merritt, J.N. Dean and F.A. Settle, “Instrumental methods ofanalysis”., I.B.H. Publishing House, New Delhi.

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

19CH3251 - Analytical Instruments for Analysis

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	3.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	3.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	3.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	3.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	3.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
AVG	**3.0**	**3.0**	**2.2**	**3.0**	**2.0**	-	**2.0**	-	**2.0**	-	**2.4**	**3.0**	**3.0**	**2.0**

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL ★ KINGSTON ENGG & TECH ★ KINGSTHAN COLLEGE OF ENGG & TECH
Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH3001	**FLUID MECHANICS LAB**	**0**	**0**	**3**	**1.5**

Course Objectives

- To learn experimentally to calibrate flow meters, find pressure loss for fluid flows and determine pump characteristics.

S.No.	DESCRIPTION
1.	Viscosity measurement of non Newtonian fluids
2.	Calibration of constant and variable head meters
3.	Calibration of weirs and notches
4.	Open drum orifice and draining time
5.	Flow through straight pipe
6.	Flow through annular pipe
7.	Flow through helical coil and spiral coil
8.	Losses in pipe fittings and valves
9.	Characteristic curves of pumps
10.	Pressure drop studies in packed column
11.	Hydrodynamics of fluidized bed
12.	Drag coefficient of solid particle

Total Practical Hours 45

Course Outcomes

Upon completion of the course, students can be able to

- Measure viscosity of non: Newtonian fluids under varying shear rates and flow conditions.
- Calibrate flow measurement devices, including head meters, weirs, and notches, for accurate fluid flow analysis.
- Analyze fluid flow through straight, annular, helical, and spiral pipes, including associated pressure losses.
- Evaluate pressure drops in packed columns and hydrodynamics of fluidized beds for process optimization.
- Determine drag coefficients for solid particles and construct characteristic curves for pump performance.

REFERENCE BOOKS:

- McCabe W.L, Smith, J C and Harriot. P "Unit Operations in Chemical Engineering", McGraw Hill, VII Edition, 2005
- White, F.M., "Fluid Mechanics ", McGraw-Hill Inc., VII Edition, 2011.

Chairman - BoS
CHE - HiCET

HINDUSTHAN ACADEMIC COUNCIL • HINDUSTHAN COLLEGE OF ENGG & TECH • Chairman

Dean (Academics)
HiCET

19CH3001 - Fluid Mechanics Lab

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	3.0	2.0	-	-	-	-	2.0	-	-	2.0	3.0	2.0
CO2	3.0	3.0	-	2.0	-	-	-	-	2.0	-	-	2.0	3.0	2.0
CO3	3.0	3.0	3.0	-	-	-	2.0	-	2.0	-	-	2.0	3.0	3.0
CO4	2.0	2.0	-	2.0	-	-	2.0	-	2.0	-	2.0	2.0	3.0	3.0
CO5	2.0	2.0	2.0		-	-	2.0	-	2.0	-	2.0	2.0	3.0	3.0
AVG	**2.6**	**2.4**	**2.67**	**2**	-	-	**2**	-	**2**	-	**2**	**2**	**3**	**2.6**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★
Chairman

rogramme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH3002	**CHEMICAL ANALYSIS LAB**	**0**	**0**	**3**	**1.5**

Course Objectives

- To make the student acquire practical skills in the wet chemical and instrumental methods for quantitative estimation of nitrite in water, cement, oil, coal and Phenol.

S.No.	DESCRIPTION
1.	Determination of Redwood / Saybolt numbers, kinematic viscosity and viscosity index of Lubricating oils.
2.	Determination of flash point, fire point, cloud and pour point of oils.
3.	Determination of acid value and iodine value of oils.
4.	Determination of COD of water samples.
5.	Cement Analysis a. Estimation of silica content b. Estimation of mixed oxide content c. Estimation of calcium oxide content d. Estimation of calcium oxide by rapid method.
6.	Coal Analysis a. Ultimate analysis of coal b. Proximate analysis of coal.
7.	Soap Analysis a. Estimation of total fatty acid b. Estimation of percentage alkali content.
8.	Estimation of phenol.
9.	Determination of calorific value using bomb calorimeter.
10.	Determination of nitrite in water.
	Total Instructional Hours 45

Course Outcomes

Upon completion of the course, students can be able to

- Develop the ability to handle and work with the equipment like viscometers, flash and fire point apparatus etc.,
- Measure acid value, iodine value, and phenol content in oils and chemical samples.
- Determine COD and nitrite levels in water for environmental and quality assessment
- Analyze cement (silica, oxides, calcium) and coal (ultimate and proximate) composition.
- Evaluate calorific value of fuels using bomb calorimeter for energy content analysis.

REFERENCE BOOKS:

1. Environmental pollution analysis, S.M.Khopkar, New age international.2011.
2. Manual of environmental analysis, N.C Aery, Ane books.2010.
3. Text book of quantitative chemical analysis, J.Mendham, Pearson education 2008.

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL • HINDUSTHAN COLLEGE OF ENGG & TECH • Chairman

Dean (Academics)
HiCET

19CH3002 - Chemical Analysis Lab

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	-	-	-	-	-	-	2.0	-	-	2.0	3.0	2.0
CO2	3.0	3.0	-	-	-	-	2.0		2.0	-	-	2.0	3.0	2.0
CO3	3.0	3.0	-	-	-	-	2.0	-	2.0	-	-	2.0	3.0	2.0
CO4	3.0	3.0	-	-	-	-	2.0	-	2.0	-	-	2.0	3.0	2.0
CO5	3.0	3.0	-	-	-	-	2.0	-	2.0	-	-	2.0	3.0	2.0
AVG	**3.0**	**3.0**	-	-	-	-	**2.0**	-	**2.0**	-	-	**2.0**	**3.0**	**2.0**

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★
Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the course	L	T	P	C
B.E. / B.Tech	**19AC3191**	**INDIAN CONSTITUTION**	2	0	0	0

COURSE OBJECTIVES

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.

UNIT **DESCRIPTIVE** **INSTRUCTIONAL HOURS**

UNIT I : BASIC FEATURES AND FUNDAMENTALE PRINCIPLES **4**

Meaning of the constitution law and constitutionalism – Historical perspective of the constitution of India – salient features and characteristics of the constitution of India.

UNIT II : FUNDAMENTAL RIGHTS **4**

Scheme of the fundamental rights – fundamental duties and its legislative status – The directive principles of state policy – its importance and implementation - Federal structure and distribution of legislative and financial powers between the union and states.

UNIT III : PARLIAMENTARY FORM OF GOVERNMENT **4**

The constitution powers and the status of the president in India. – Amendement of the constitutional powers and procedures – The historical perspective of the constitutional amendment of India – Emergency provisions : National emergency, President rule, Financial emergency.

UNIT IV: LOCAL GOVERNANCE **4**

Local self government -constitutional scheme of India – Scheme of fundamental right to equality – scheme of fundamental right to certain freedom under article19 – scope of the right to life and personal liberty under article 19.

UNIT V : INDIAN SOCIETY **4**

Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

TOTAL INSTRUCTIONAL HOURS: 20

OUTCOMES:

Upon completion of the course, students will be able to:

1.Rememberthe functions of the Indian government
2.Understand and abide the rules of the Indian constitution.

TEXT BOOKS:

T1. Durga Das Basu, "Introduction to the Constitution of India ", Prentice Hall of India, New Delhi.
T2. R.C.Agarwal, (1997) "Indian Political System", S.Chand and Company, New Delhi.
T3. Maciver and Page, " Society: An Introduction Analysis ", Mac Milan India Ltd., New Delhi.
T4. K.L.Sharma, (1997) "Social Stratification in India: Issues and Themes", Jawaharlal Nehru University, New Delhi.

REFERENCE BOOKS:

R1. Sharma, Brij Kishore, " Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.
R2. U.R.Gahai, "Indian Political System ", New Academic Publishing House, Jalaendhar.
R3. R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

rogramme	Course Code	Name of the Course	L	T	P	C
BE/BTECH	19HE3073	**Leadership Management Skills**	1	0	0	0

Course Objective`	1. To know about the leadership skills that is to be acquired for success. 2. To become a teamwork expert, real world problem solver, your views will be challenged 3. To gain global perspective and becoming an effective communicator 4. To understand about learning, negotiation and decision making 5: To get first hand information about the skills we possess and to work on improvement.

Module	Description	Instructional Hours
1.	Strategic thinking skills	
2.	Planning and Delivery skills	
3.	People management skills (Delegation)	
4.	Change management and Innovation skills	
5.	Communication skills	
6.	Persuasion and influencing skills	
7.	Learning Agility	
8.	Motivation	
9.	Personality	
10.	Emotions	
11.	Perception	
12.	Negotiation	
13.	Decision making	
14.	Problem solving	
15.	Building trust	
	Total Instructional Hours	**15**

Course Outcome	CO1: To practice essential leadership skills in day to day operations CO2: To work on leadership skills in the study environment CO3: To understand and develop the skills consciously. CO4: To know about the real worth of all the skills for success CO5: To Analyze the real worth of the person and suggestion for improvement

TEXT BOOKS

T1: A REVIEW OF LEADERSHIP THEORY AND COMPETENCY FRAMEWORKS, Bolden, R., Gosling, J., Marturano, A. and Dennison, P.June 2003

T2: LEADING FROM WITHIN: Building Organizational Leadership Capacity-David R. Kolzow, PhD, 2014

REFERENCE BOOKS

R1: Seven habits of highly effective people – Stephen R.Covey

R2: The Art of Business Leadership: Indian Experiences – G.Balasubramaniam

R3: DEVELOPING the LEADER WITHIN YOU-JOHN C. MAXWELL

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL • HINDUSTHAN COLLEGE OF ENGG & TECH • Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH4201	**PROCESS HEAT TRANSFER**	**3**	**1**	**0**	**4**

Course Objectives

The student should be able to

- Understand the heat transfer by conduction, convection and radiation.
- Apply the laws of heat conduction, convection and radiation.
- Examine the types of evaporators and heat exchangers.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**Importance of heat transfer in Chemical Engineering operations -** Modes of heat transfer **-** Fourier's law of heat conduction **-** one dimensional steady state heat conduction equation for flat plate, hollow cylinder, **-** Heat conduction through a series of resistances **-** Thermal conductivity measurement; effect of temperature on thermal conductivity; Heat transfer in extended surfaces.	12
II	**Concepts of heat transfer by convection -** Natural and forced convection, analogies between transfer of momentum and heat **-** Reynold's analogy, Prandtl and Coulburn analogy. Dimensional analysis in heat transfer, heat transfer coefficient for flow through a pipe, flow past flat plate, flow through packed beds.	12
III	**Heat transfer to fluids with phase change -** heat transfer from condensing vapours, drop wise and film wise condensation, Nusselt equation for vertical and horizontal tubes, condensation of superheated vapours, Heat transfer to boiling liquids **-** mechanism of boiling, nucleate boiling and film boiling.	12
IV	**Theory of evaporation -** single effect and multiple effect evaporation **-** Design calculation for single and multiple effect evaporation. Radiation heat transfer **-** Black body radiation, Emissivity, Stefan **-** Boltzmann law, Plank's law, radiation between surfaces.	12
V	**Log mean temperature difference -** Single pass and multipass heat exchangers; plate heat exchangers; use of correction factor charts; heat exchangers effectiveness; number of transfer unit **-** Chart for different configurations **-** Fouling factors.	12
	Total Instructional Hours	**45 + 15 = 60**

Course Outcomes

Upon completion of the course, students can be able to

CO1: Recognize the modes of heat transfer and ability to solve conduction based problems.
CO2: Comprehend the concept of convective heat transfer model using dimensional analysis.
CO3: Understand the heat transfer process with phase change.
CO4: Understand the difference between radiation and evaporation and ability to design evaporator.
CO5: Apprehend the design concepts of heat exchangers.

TEXT BOOKS:

1. McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", 7th Edn., McGraw-Hill, 2005.
2. G.K. Roy, Fundamentals of Heat and Mass Transfer, Khanna Publishers, Sixth Edition, 2017.

REFERENCES BOOKS:

1. Coulson, J.M. and Richardson, J.F., "Chemical Engineering " Vol. I, 4th Edn., Asian Books Pvt. Ltd., India, 1998.
2. Kern, D.Q., "Process Heat Transfer ", McGraw-Hill, 1999.
3. Holman, J. P., 'Heat Transfer ', 8th Edn., Tata McGraw Hill, 1997.
4. Coulson, J.M. and Richardson, J.F., "Chemical Engineering" Vol. I and II,4th Edition, Asian Books Pvt. Ltd., India,1998.

Chairman - BoS
CHE - HiCET

Chairman
HINDUSTHAN ACADEMIC COUNCIL
HINDUSTHAN COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C

19CH4201 - Process Heat Transfer

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	3.0	3.0	-	-	-	-	2.0	-	-	3.0	3.0	2.0
CO2	3.0	3.0	3.0	3.0	-	-	-	-	2.0	-	-	3.0	3.0	2.0
CO3	3.0	3.0	3.0	3.0	-	-	-	-	2.0	-	-	3.0	3.0	2.0
CO4	3.0	3.0	2.0	3.0	-	-	-	-	2.0	-	-	3.0	3.0	2.0
CO5	3.0	3.0	2.0	3.0	-	-	-	-	2.0	-	-	3.0	3.0	2.0
AVG	**3.0**	**3.0**	**2.6**	**3.0**	-	-	-	-	**2.0**	-	-	**3.0**	**3.0**	**2.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★
Chairman

B.Tech	19CH4202	**MASS TRANSFER - I**	**3**	**0**	**0**	**3**

Course Objectives

The student should be able to

- Understand the principles of mass transfer and their application to various unit operations.
- Determine mass transfer rates under laminar and turbulent conditions.
- Apply the concept of drying, crystallization in Industries.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**DIFFUSION** Introduction to mass transfer operations; Molecular diffusion in gases, liquids and solids; diffusivity measurement and prediction; multi-component diffusion.	9
II	**MASS TRANSFER COEFFICIENTS** Eddy diffusion, concept of mass transfer coefficients, theories of mass transfer, different transport analogies, application of correlations for mass transfer coefficients, inter phase mass transfer, relationship between individual and overall mass transfer coefficients. NTU and NTP concepts, Stage-wise and differential contractors.	9
III	**HUMIDIFICATION** Humidification – Equilibrium, humidity chart, adiabatic and wet bulb temperatures; humidification operations; theory and types of cooling tower, dehumidifiers and humidifiers using enthalpy transfer unit concept.	9
IV	**DRYING** Drying– Equilibrium; classification of dryers; batch drying – Mechanism and time of cross through circulation drying, continuous dryers – material and energy balance; determination of length of rotary dryer using rate concept.	9
V	**CRYSTALLISATION** Crystallization - Equilibrium, classification of crystallizers, mass and energy balance; kinetics of crystallization – nucleation and growth; design of batch crystallizers; population balance model and design of continuous crystallizers.	9
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1: Explain the diffusion process in all three phases.
CO2: Examine the concept of mass transfer coefficients and theories.
CO3: Illustrate the principle of Humidification operation.
CO4: Classify and demonstration of different dryers..
CO5: Sketch the design concepts of the crystallizer.

TEXT BOOKS:

1. Treybal, R.E., "Mass Transfer Operations", 3rd Edition, McGraw-Hill,1981.
2. G.K. Roy, Fundamentals of Heat and Mass Transfer, Khanna Publishers, Sixth Edition, 2017.
3. McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", 7thEdition., McGraw-Hill,2005.

REFERENCE BOOKS:

1. Coulson, J.M. and Richardson, J.F., "Chemical Engineering" Vol. I and II,4th Edition, Asian Books Pvt. Ltd., India,1998.
2. Foust A.S, "Principles of Unit Operations", 2nd Edition, John Wiley,2008.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

19CH4202 - Mass Transfer – I

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	-	1.0	-	-	-	-	-	-	-	-	3.0	3.0
CO2	3.0	3.0	-	2.0	-	-	-	-	-	-	-	-	3.0	3.0
CO3	3.0	3.0	-	3.0	-	2.0	2.0	2.0	-	-	-	2.0	3.0	3.0
CO4	3.0	3.0	-	3.0	-	2.0	2.0	2.0	-	-	-	2.0	3.0	3.0
CO5	3.0	3.0	2.0	3.0	-	2.0	2.0	2.0	-	-	-	2.0	3.0	3.0
AVG	**3.0**	**3.0**	**2.0**	**2.4**	-	**2.0**	**2.0**	**2.0**	-	-	-	**2.0**	**3.0**	**3.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH4203	**CHEMICAL ENGINEERING THERMODYNAMICS - II**	**3**	**0**	**0**	**3**

Course Objectives

The student should be able to

- Understand the behavior of fluids under PVT conditions and also apply them for practical purpose.
- Apply the correlation in phase equilibrium.
- Determine the COP in refrigeration cycles.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**PROPERTIES OFSOLUTIONS** Partial molar properties - ideal and non-ideal solutions - standard states definition and choice - Gibbs-Duhem equation - excess properties of mixtures.	9
II	**PHASEEQUILIBRIA** Criteria for equilibrium between phases in multi component non-reacting systems in terms of chemical potential and fugacity - application of phase rule - vapour-liquid equilibrium, phase diagrams for homogeneous systems and for systems with a miscibility gap - effect of temperature and pressure on azeotrope composition - liquid-liquid equilibrium - ternary liquid-liquid equilibrium.	9
III	**CORRELATION AND PREDICTION OFPHASEEQUILIBRIA** Activity coefficient-composition models - thermodynamic consistency of phase equilibrium - application of the correlation and prediction of phase equilibrium in systems of engineering interest particularly to distillation and liquid extraction processes.	9
IV	**CHEMICAL REACTIONEQUILIBRIA** Standard free energy change and reaction equilibrium constant - evaluation of reaction equilibrium constant - prediction of free energy data - equilibria in chemical reactors - calculation of equilibrium compositions for homogeneous chemical reactors - thermodynamic analysis of simultaneous reactions.	9
V	**REFRIGERATION** Principles of refrigeration- methods of producing refrigeration- liquefaction process- co-efficient of performance - evaluation of the performance of vapour compression and gas refrigeration cycles.	9
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1: Examine the terminologies such as chemical potential, fugacity, fugacity coefficient, activity and activity coefficient.

CO2: Apply the equations of state and activity coefficient models to describe VLE

CO3: Illustrate and develop the relations to phase equilibrium and to solve chemical engineering problems.

CO4: Calculate the equilibrium constants and predict the effects of temperature, pressure, and composition on equilibrium conversion.

CO5:Understand and solve mass, energy and entropy balances to flow processes

TEXT BOOKS:

1. Smith, J.M., VanNess, H.C., & Abbot M.C, "Introduction to Chemical Engineering Thermodynamics", McGraw Hill VII Edition2004.
2. Narayanan K.V "A Text Book of Chemical Engineering Thermodynamics" Prentice Hall of India Pvt. Ltd.2001.

REFERENCE BOOKS:

1. Hougen, O.A., Watson, K.M., and Ragatz, R.A., "Chemical Process Principles Part II", Thermodynamics, John Wiley, 1970.
2. Dodge, B.F., "Chemical Engineering Thermodynamics", McGraw-Hill, 1960.
3. Sandler, S.I., "Chemical and Engineering Thermodynamics", 2nd Edition, Wiley, 1989.
4. Stanley M.Walas" Phase equilibrium in Chemical Engineering",Elsiever Science and Technologybooks.1984.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

19CH4203 - Chemical Engineering Thermodynamics - II

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	-	-	-	-	-	-	-	-	-	2.0	3.0	2.0
CO2	3.0	3.0	3.0	2.0	-	-	-	-	-	-	-	2.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	-	2.0	-	-	-	-	2.0	2.0	3.0	3.0
CO4	3.0	3.0	3.0	2.0	-	2.0	2.0	-	-	-	2.0	3.0	3.0	3.0
CO5	3.0	3.0	3.0	2.0	-	3.0	2.0	1.0	-	-	3.0	3.0	3.0	3.0
AVG	**3.0**	**3.0**	**3.0**	**2.0**	-	**2.33**	**2.0**	**1.0**	-	-	**2.33**	**2.4**	**3.0**	**2.6**

Chairman - BoS
CHE - HiCET

HINDUSTHAN ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★
Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH4251	**MECHANICAL OPERATIONS**	3	0	2	4

Course Objectives

- **The student should be able to.**
  - Understand the basic information and the systematic diagrams of Unit operations involved in Chemical industries.
  - Apply the concepts of design, operation details and schematic of industrial equipment
  - Choose the right separation technology for easy separation of chemical components

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**PARTICLE CHARACTERIZATION AND MEASUREMENT** General characteristics of solids, different techniques of size analysis- Static - Image analysis and Dynamic analysis - Light scattering techniques, shape factor, surface area determination, estimation of particle size. Advanced particle size analysis techniques. Screening methods and equipment, screen efficiency, ideal and actual screens: **Sieve analysis.**	9+3
II	**PARTICLE SIZE REDUCTION AND SIZE ENLARGEMENT:** Laws of size reduction, energy relationships in size reduction, methods of size reduction, classification of equipments, crushers, grinders, disintegrators for coarse, intermediate and fine grinding, power requirement, work index; Advanced size reduction techniques- Nano particle fabrication-Topdown approach - Bottom-up approach. Size enlargement - Importance of size enlargement, principle of granulation, briquetting, pelletisation, and flocculation. Fundamentals of particle generation: **Reduction ratio in Jaw Crusher, Ballmill.**	9+4
III	**PARTICLE SEPARATION** Gravity settling, sedimentation, thickening, elutriation, double cone classifier, rake classifier, bowl classifier. Centrifugal separation - continuous centrifuges, super centrifuges, design of basket centrifuges; industrial dust removing equipment, cyclones and hydro cyclones, electrostatic and magnetic separators, heavy media separations, floatation, jigging: **Characteristics of batch Sedimentation, Separation characteristics of Cyclone separator, Froth floatation.**	9+4
IV	**FILTRATION AND FILTRATION EQUIPMENT** Theory of filtration, Batch and continuous filters, Flow through filter cake and filter media, compressible and incompressible filter cakes, filtration equipments - selection, operation and design of filters and optimum cycle of operation, filteraids. **Batch filtration studies using Leaf Filter and Plate and Frame Filter press.**	9+4
V	**MIXING AND PARTICLE HANDLING** Mixing and agitation - Mixing of liquids (with or without solids), mixing of powders, selection of suitable mixers, power requirement for mixing. Storage and Conveying of solids - Bunkers, silos, bins and hoppers, transportation of solids in bulk, different types of conveyors.	9
	Total Instructional Hours	**45+15 = 60**

Course Outcomes

Upon completion of the course, students can be able to

CO1: Understand the general characteristics of solids, screening and sieve analysis.
CO2: Examine the particle size reduction processes and to operate the size reduction equipment
CO3: Illustrate the methods of particles separation
CO4: Understand the theory of filtration and filtration equipment
CO5: Understand the particle handling and the power required for mixing.

TEXT BOOKS:

1. McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", 7th Edn., McGraw-Hill, 2005.
2. Coulson, J.M. and Richardson, J.F., "Chemical Engineering" Vol. I, 5th Edn., Asian Books Pvt. Ltd., India, 2006.

REFERENCE BOOKS:

1. Brown G.G., et.al., "Unit Operations", 1st edition., CBS Publisher, New Delhi, 2005.
2. Badger W.L. and Banchero J.T., "Introduction to Chemical Engineering", Tata McGraw Hill, 1st Edition, 2002.
3. Foust, A. S., Wenzel, L.A., Clump, C.W., Naus, L., and Anderson, L.B., "Principles of Unit Operations", 2nd Edn., John Wiley & Sons, 2008.

Chairman - BoS
CHE - HiCET

HINDUSTHAN ACADEMIC COUNCIL • HINDUSTHAN COLLEGE OF ENGG & TECH • Chairman

Dean (Academics)
HiCET

19CH4251 - Mechanical Operations

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	1.0	2.0	-	-	3.0	-	-	-	-	-	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	1.0	-	-	-	-	-	-	3.0	2.0
CO3	2.0	2.0	2.0	-	-	-	-	-	-	-	-	-	3.0	2.0
CO4	3.0	3.0	2.0	-	3.0	-	3.0	-	-	-	-	-	3.0	2.0
CO5	3.0	2.0	2.0	2.0	2.0	1.0	1.0	-	1.0	-	2.0	-	-	2.0
AVG	**2.8**	**2.4**	**1.8**	**2.0**	**2.33**	**1.0**	**2.33**	-	**1.0**	-	**2.0**	-	**3.0**	**2.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL
Chairman
KUMARAGURU COLLEGE OF ENGG & TECH

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19MA4153	**APPLIED PROBABILITY STATISTICS**	3	0	2	4

Course Objectives

- Construct a well defined knowledge of random variables.
- Explain the concept of two dimensional random variables and determine covariance.
- Introduce Correlation concepts to understand the relation between two random variables.
- Describe some basic concepts of statistical methods for testing the hypothesis.
- Analyze the design of experiment techniques to solve various engineering problems.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**PROBABILITY AND RANDOM VARIABLE** Random variable –Discrete and continuous random variables – Probability mass function - Probability density function – Cumulative distribution functions - Moment generating functions. **Introduction to R programming and Application of descriptive statistics – Mean, Median, Mode, variance and Box plot .**	9+3
II	**TWO DIMENSIONAL RANDOM VARIABLES** Joint probability mass function - Joint probability density function – Marginal Probability mass function – Marginal probability density function - Conditional Probability mass function - Conditional Probability density function – Independent random variables. **Application of Normal distribution.**	9+3
III	**CORRELATION AND REGRESSION** Correlation – Karl Pearson's correlation coefficient – Spearman's Rank Correlation – Regression lines (problems based on Raw data only). **Applications of Correlation and Regression.**	9+3
IV	**HYPOTHESIS TESTING** Large sample test based on Normal distribution - test of significance for single mean and difference of means -Small sample test – t test for single mean and difference of mean - F distribution for variance, Chi – Square test for independence of attributes – Goodness of fit. **Application of Student t- test for Single mean and difference of means, Application of Chi – square test**	9+3
V	**ANALYSIS OF VARIANCE** Introduction, assumptions of analysis of variance, completely randomized design, randomized block design, Latin square design. **Applications of Latin square design.**	9+3
	Total Instructional Hours	**60**

Course Outcomes

Upon completion of the course, students can be able to

CO1: Understand the concepts of random variables.
CO2: Express the phenomenon of two dimensional random variables..
CO3: Compute correlation and predict unknown values using regression.
CO4: Understand the concepts of statistical methods for testing the hypothesis.
CO5: Apply Design of Experiment techniques to solve various engineering problems.

TEXT BOOKS:

1. SaeedGhahramani, "Fundamentals of probability with stochastic processes", Prentice Hall New Jersy, 2016.
2. Medhi J," stochastic Processes", New Age International Publishers,New Delhi,2014.

REFERENCE BOOKS:

1. O.C. Ibe, "Fundamentals of Applied Probability and Random Processes", Elsevier, First Indian Reprint, 2010.
2. Applied statistics and Probability for Engineers by C.MontGomery ,6th Edition,Wiley Publications.
3. Walpole. R.E., Myers. R.H., Myers. S.L., and Ye. K., "Probability and Statistics for Engineers and Scientists", 8th Edition, Pearson Education, Asia, 2007.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH4001	**HEAT TRANSFER LAB**	**0**	**0**	**3**	**1.5**

Course Objectives

- To enable the students to develop a sound working knowledge on different types of heat transfer equipment.

S.No.	DESCRIPTION
1.	Transient heat conduction with constant heat flux
2.	Heat transfer through natural convection
3.	Heat transfer through forced convection
4.	Heat transfer in a shell and tube heat exchanger
5.	Heat transfer in a double pipe heat exchanger
6.	Heat transfer in a bare and finned tube heat exchanger
7.	Heat transfer in helical coils
8.	Heat transfer through packed bed
9.	Heat transfer in agitated vessels
10.	Heat transfer in a condenser
11.	Heat transfer in single effect evaporator
12.	Heat transfer in multi effect evaporator
13.	Stefan boltzmann experiment
14.	Emissivity measurement
	Total Instructional Hours **45**

Course Outcomes

Upon completion of the course, students can be able to

- Study transient heat conduction with constant heat flux for time: dependent temperature profiles
- Examine natural and forced convection heat transfer under different fluid flow conditions.
- Analyze heat transfer in shell and tube, double pipe, finned tube, and helical coil heat exchangers
- Perform heat transfer analysis in condensers and single/multi: effect evaporators.
- Conduct Stefan: Boltzmann and emissivity experiments for radiative heat transfer analysis.

REFERENCE BOOKS:

1. McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", 7th Edn., McGraw-Hill, 2005.
2. Holman, J. P., 'Heat Transfer ', 8th Edn., Tata McGraw Hill, 1997.

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL • HINDUSTHAN COLLEGE OF ENGG & TECH • Chairman

Dean (Academics)
HiCET

19CH4001 - Heat Transfer Lab

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	1.0	-	-	-	-	-	-	-	-	3.0	2.0
CO2	3.0	3.0	3.0	2.0	1.0	-	-	-	-	-	-	-	3.0	2.0
CO3	3.0	3.0	2.0	2.0	-	-	-	-	-	-	-	-	3.0	2.0
CO4	3.0	3.0	2.0	2.0	-	-	-	-	-	-	-	-	3.0	2.0
CO5	3.0	2.0	2.0	1.0	-	-	-	-	-	-	-	-	3.0	3.0
AVG	**3.0**	**2.8**	**2.2**	**1.6**	**1.0**	-	-	-	-	-	-	-	**3.0**	**2.2**

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★
Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH4002	**PETROCHEMICAL ANALYSIS LAB**	**0**	**0**	**3**	**1.5**

Course Objectives

- To learn basic principles involved in analysis of petrochemicalproducts.

S.No.	DESCRIPTION
1.	Sulphur content determination.
2.	Flue gas Analysis – Orsat Apparatus.
3.	Aromatic Content determination.
4.	Determination of Lead, Acid and Salt content.
5.	Analysis of petrochemicals using UV spectrophotometer.
6.	Biodegradation of petrochemicals.
7.	Bioremediation of petrochemicals.
8.	Refractive index of petrochemicals.
9.	Determination of moisture content – KF Titrator.
10.	Total acidity determination.
11.	Dynamic viscosity measurement.
12.	Calorific value of fuels.
	Total Instructional Hours **45**

Course Outcomes

Upon completion of the course, students can be able to

- Determine sulfur, lead, acid, salt, and aromatic content in petrochemicals and fuels
- Conduct flue gas analysis using Orsat apparatus for combustion efficiency evaluation
- Analyze petrochemicals using UV spectrophotometry and measure refractive index and moisture content.
- Determine dynamic viscosity, calorific value, and total acidity of fuels and petrochemicals
- Investigate biodegradation and bioremediation potential of petrochemicals for environmental sustainability.

REFERENCE BOOKS:

1. Text book of quantitative chemical analysis, J.Mendham, Pearson education 2008.
2. BhaskaraRao, B.K., "A Text on Petrochemicals", Khanna Publishers, 2000.
3. SukumarMaiti, "Introduction to Petrochemicals", 2nd Edition, Oxford and IBH Publishers, 2002.

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

19CH4002 - Petrochemical Analysis Lab

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	-	-	-	-	-	-	2.0	-	-	2.0	3.0	2.0
CO2	3.0	3.0	-	-	-	-	2.0	-	2.0	-	-	2.0	3.0	2.0
CO3	3.0	3.0	2.0	-	-	-	2.0	-	2.0	-	-	2.0	3.0	2.0
CO4	3.0	3.0	2.0	-	-	-	2.0	-	2.0	-	-	2.0	3.0	2.0
CO5	3.0	3.0	2.0	-	-	-	2.0	-	2.0	-	-	2.0	3.0	2.0
AVG	**3.0**	**3.0**	**2.0**	-	-	-	**2.0**	-	**2.0**	-	-	**2.0**	**3.0**	**2.0**

Chairman - BoS
CHE - HiCET

HINDUSTHAN ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★
Chairman

Dean (Academics)
HiCET

Programme	Course code	Name of the course	L	T	P	C
B.TECH/B.E	19AC4191	**Essence of Indian Traditional Knowledge**	2	0	0	0

Course Objectives:

1) The course aims at imparting basic principles of thought process, reasoning and inferencing.
2) Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
3) Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
4) The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view, basic principles of Yoga and holistic health care system, Indian philosophical traditions,Indian linguistic tradition and Indian artistic tradition.

UNIT	DESCRIPTIVE	INSTRUCTIONAL HOURS
UNIT I :	Basic Structure of Indian Knowledge System	**4**
UNIT II :	Modern Science and Indian Knowledge System	**4**
UNIT III :	Yoga and Holistic Health care	**4**
UNIT IV :	Philosophical tradition	**4**
UNIT V:	Indian linguistic tradition (Phonology, Morphology, Syntax and semantics), Indian artistic tradition and Case Studies.	**4**

TOTAL INSTRUCTIONAL HOURS : 20

Course Outcomes:

1) Ability to understand the structure of Indian system of life.
2) Connect up and explain basics of Indian Traditional knowledge in modern scientific perspective.

REFERENCE BOOKS:

R1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
R2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
R3. Fritzof Capra, Tao of Physics
R4. Fritzof Capra, The wave of Life.
R5. V N Jha (Eng. Trans,), Tarkasangraha of Annam Bhatta, Inernational Chinmay Foundation, Velliarnad, Amaku,am
R6. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta.
R7. GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakasham, Delhi, 2016.
R8. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016.
R9. P R Sharma (English translation), Shodashang Hridayam.

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH5201	**CHEMICAL REACTION ENGINEERING - I**	**3**	**1**	**0**	**4**

Course Objectives

The student should be able

1. Enable the students to gain knowledge on different types of chemical reactors.
2. Apply the students to design the chemical reactors under isothermal conditions.
3. Design the chemical reactors under and non-isothermal conditions

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**Rate equation, elementary**, non-elementary reactions, theories of reaction rate and Prediction; Design equation for constant and variable volume batch reactors, analysis of experimental kinetics data, integral and differential analysis.	12
II	**Design of continuous reactors -** stirred tank and tubular flow reactor, recycle reactors, Equal sized CSTRs in series and parallel, Equal sized PFRs in series and parallel,size comparison of reactors.	12
III	**Design of reactors for multiple reactions -** consecutive, parallel and mixed reactions - factors affecting choice, optimum yield and conversion, selectivity, reactivity and yield.	12
IV	**Non-isothermal homogeneous reactor systems**, adiabatic reactors, rates of heat exchanges for different reactors, design for constant rate input and constant heat transfer coefficient, operation of batch and continuous reactors, optimum temperature progression.	12
V	**The residence time distribution** as a factor of performance; residence time functions and relationship between them in reactor; basic models for non-ideal flow; conversion in non-ideal reactors	12
	Total Instructional Hours	**60**

Course Outcomes

Upon completion of the course, students can be able to

CO1- Understand the concept of rate equation and batch reactors.
CO2- Illustrate the working of CSTR and PFR.
CO3- Explain the design and working of multiple reactors.
CO4- Determine the non-isothermal effect on reactors.
CO5- Demonstrate the concept of RTD in analyzing reactor performances.

TEXT BOOKS:

1. Levenspiel O, "Chemical Reaction Engineering", Wiley Eastern Ltd., II Edition,2000.
2. Smith, J.M, "Chemical Engineering Kinetics", McGraw Hill, III Edition,1981.

REFERENCES BOOKS:

1. Froment. G.F. & K.B.Bischoff, "Chemical Reactor Analysis and Design", John Wiley and Sons, 1979.
2. Fogler.H.S., "Elements of Chemical Reaction Engineering", Prentice Hall of India Ltd., 3rd Edition,2000.
3. Lanny D. Schmidth The Engineering of Chemical Reactions, Second Edition, Oxford University Press, 2005

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

19CH5201 - Chemical Reaction Engineering – I

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2.0	3.0	-	-	-	-	-	-	1.0	1.0	-	-	3.0	3.0
CO2	3.0	3.0	2.0	-	-	-	-	-	1.0	1.0	-	-	2.0	3.0
CO3	2.0	3.0	-	-	-	-	-	-	1.0	1.0	-	-	1.0	2.0
CO4	2.0	2.0	3.0	-	-	-	-	-	2.0	1.0	-	-	2.0	2.0
CO5	-	2.0	2.0	-	-	-	-	-	2.0	1.0	-	-	3.0	3.0
AVG	**2.25**	**2.6**	**2.33**	-	-	-	-	-	**1.4**	**1.0**	-	-	**2.2**	**2.6**

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH5202	**MASS TRANSFER - II**	**3**	**1**	**0**	**4**

Course Objectives

The student should be able to

Examine the physical and thermodynamic principles of mass transfer with an emphasis on how these principles affect the design of equipment and result in specific requirements for quality and capacity.

Illustrate the process aspects and equipment used in the operations like ion exchange, extraction and leaching.

Analyze the separation of chemical components in distillation columns and adsorbers.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**ABSORPTION:** Gas Absorption and Stripping – Equilibrium; material balance; limiting gas-liquid ratio; tray tower absorber - calculation of number of theoretical stages, tray efficiency, tower diameter; packed tower absorber – rate based approach; determination of height of packing using HTU and NTU calculations.	12
II	**DISTILLATION:** Vapour liquid equilibria - Raoult's law, vapor-liquid equilibrium diagrams for ideal and non-ideal systems, enthalpy concentration diagrams. Principle of distillation - flash distillation, differential distillation, steam distillation, multistage continuous rectification, Number of ideal stages by Mc.Cabe - Thiele method and Ponchan - Savarit method, Total reflux, minimum reflux ratio, optimum reflux ratio. Introduction to multi-component distillation, azeotropic and extractive distillation.	12
III	**LIQUID-LIQUID EXTRACTION:** Liquid - liquid extraction - solvent characteristics- equilibrium stage wise contact calculations for batch and continuous extractors- differential contact equipment-spray, packed and mechanically agitated contactors and their design calculations-packed bed extraction with reflux. Pulsed extractors, centrifugal extractors- Supercritical extraction.	12
IV	**LEACHING:** Solid-liquid equilibria- leaching equipment for batch and continuous operations- calculation of number of stages - Leaching - Leaching by percolation through stationary solid beds, moving bed leaching, counter current multiple contact (shank's system), equipments for leaching operation, multi stage continuous cross current and counter current leaching, stage calculations, stage efficiency.	12
V	**ADSORPTION AND ION EXCHANGE & MEMBRANE SEPARATION PROCESS:** Adsorption - Types of adsorption, nature of adsorbents, adsorption equilibria, effect of pressure and temperature on adsorption isotherms, Adsorption operations - stage wise operations, steady state moving bed and unsteady state fixed bed adsorbers, break through curves. Principle of Ion exchange, techniques and applications. Solid and liquid membranes; concept of osmosis; reverse osmosis; electro dialysis; ultrafiltration.	12
	Total Instructional Hours	**60**

Course Outcomes

Upon completion of the course, students can be able to

CO1- Evaluate the theoretical stages, number of transfer units and height requirements for a gas absorption process
CO2- Apply the number of trays for stage wise contact and determine the height of the packed tower.
CO3- Evaluate the equilibrium stages and understand the working of extractor.
CO4- Evaluate the number of stages and the working of leaching equipment.
CO5- Understand the concept of adsorption, ion exchange & membrane separation processes.

TEXT BOOKS:

1. Treybal, R.E., "Mass Transfer Operations ", 3rd Edn., McGraw-Hill, 1981..
2. Geankoplis, C.J., "Transport Processes and Unit Operations", 4th Edition, Prentice Hall Inc., New Jersey, 2003.

REFERENCES BOOKS:

1. McCabe, W.L., Smith, J.C., and Harriot, P., "Unit Operations in Chemical Engineering", 7th Edn., McGraw-Hill, 2005.
2. Seader, J.D. and E.J. Henley, "Separation Process Principles", 2nd Ed., John Wiley,2006.
3. King,C.J.,"SeparationProcesses",2ndEdn.,TataMcGraw-Hill1980
4. Wankat, P., "Equilibrium Stage Separations", Prentice Hall, 1993.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

19CH5202 - Mass Transfer – II

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	3.0	-	-	2.0	2.0	2.0	2.0	2.0	-	3.0	3.0	3.0
CO2	3.0	3.0	3.0	-	-	2.0	2.0	2.0	2.0	2.0	-	3.0	3.0	3.0
CO3	3.0	3.0	3.0	-	-	2.0	2.0	2.0	2.0	2.0	-	3.0	3.0	3.0
CO4	3.0	3.0	3.0	-	-	2.0	2.0	2.0	2.0	2.0	-	3.0	3.0	3.0
CO5	3.0	3.0	3.0	-	-	2.0	2.0	2.0	2.0	2.0	-	3.0	3.0	3.0
AVG	**3.0**	**3.0**	**3.0**	-	-	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**	-	**3.0**	**3.0**	**3.0**

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH5203	**PROCESS INSTRUMENTATION DYNAMICS AND CONTROL**	**3**	**1**	**0**	**4**

Course Objectives

The student should be able to

Understand the measurement of different instrumentation measurement techniques

Identify the open and closed loop systems and its responses, control loop components and stability of control systems along with instrumentation.

Enable the students to compute the response of various control system strategies for different process dynamics and advanced control methods used in industries and research.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**INSTRUMENTATION:** Principles of measurements and classification of process instruments, measurement of temperature, pressure, fluid flow, liquid weight and weight flow rate, viscosity, pH, concentration, electrical and thermal conductivity, humidity of gases.	12
II	**OPEN LOOP SYSTEMS:** Laplace transformation and its application in process control. First order systems and their transient response for standard input functions, first order systems in series, linearization and its application in process control, second order systems and their dynamics; transportation lag.	12
III	**CLOSED LOOP SYSTEMS:** Closed loop control systems, development of block diagram for feed-back control systems, servo and regulatory problems, transfer function for controllers and final control element, principles of pneumatic and electronic controllers, transient response of closed-loop control systems and their stability.	12
IV	**FREQUENCY RESPONSE:** Introduction to frequency response of closed-loop systems, control system design by frequency response techniques, Bode diagram, stability criterion, tuning of controllers Z-N tuning rules, C-C tuning rules.	12
V	**ADVANCED CONTROL SCHEMES:** Feedback control of systems with dead time and inverse response. Control systems with multiple loops. Advanced Control Schemes a) Feed forward b) ratio control. Control of distillation towers and heat exchangers.	12
	Total Instructional Hours	**60**

Course Outcomes

Upon completion of the course, students can be able to

CO1- Relate the classification of various process instruments.
CO2- Examine the open loop systems in process control.
CO3- Illustrate the closed loop systems in process control.
CO4- Determine the frequency response of control systems and tune the PID controllers
CO5-Execute the advanced control schemes and to control the equipment in chemical industries.

TEXT BOOKS:

1. Coughnowr, D., " Process Systems Analysis and Control ", 3rd Edn., McGraw Hill, New York, 2008.
2. Stephanopoulos, G., "Chemical Process Control", Prentice Hall of India, 2003.

REFERENCES BOOKS:

1. Dale E. Seborg, Thomas F. Edgar, Duncan A. Mellichamp , Process dynamics and control I - 2nd ed. John Wiley & Sons, Inc.
2. Marlin, T. E., " Process Control ", 2nd Edn, McGraw Hill, New York, 2000.
3. Ogunnaike, B. A., & Ray, W. H. (1994). Process dynamics, modeling, and control (Vol. 1). New York: Oxford University Press.
4. Seborg, D. E., Mellichamp, D. A., Edgar, T. F., & Doyle III, F. J. (2010). Process dynamics and control. John Wiley & Sons.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

19CH5203 - Process Instrumentation Dynamics and Control

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	1.0	-	-	-	-	-	-	-	-	-	3.0	1.0
CO2	3.0	3.0	1.0	1.0	-	-	-	-	-	-	-	-	3.0	1.0
CO3	3.0	3.0	2.0	2.0	-	-	-	-	-	-	-	-	3.0	1.0
CO4	3.0	3.0	2.0	2.0	-	-	-	-	-	-	-	-	3.0	1.0
CO5	3.0	3.0	2.0	-	2.0	-	-	-	-	-	-	-	3.0	1.0
AVG	**3.0**	**3.0**	**1.6**	**1.67**	**2.0**	-	-	-	-	-	-	-	**3.0**	**1.0**

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Dean (Academics)
HiCET

	Course Code	Name of the Course	L	T	P	C
Programme B.Tech	19CH5204	**SAFETY IN CHEMICAL INDUSTRIES**	**3**	**0**	**0**	**3**

Course Objectives

The student should be able to

Understand the fundamental knowledge on need for safety in chemical industries and safe handling of chemicals.

Analyze, act and train for emergency in a process industry

Apply the various hazards and prevention in commissioning stage of industry

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**Need for safety in chemical industries**; Safety Programmes – components and realization; Potential hazards – extreme operating conditions, toxic chemicals; safe handling.	9
II	**Implementation of safety procedures** – periodic inspection and replacement; Accidents – identification and prevention; promotion of industrial safety.	9
III	**Overall risk analysis**--emergency planning-on site &off site emergency planning, risk management ISO 14000, EMS models case studies. Quantitative risk assessment - rapid and comprehensive risk analysis; Risk due to Radiation, explosion due to over pressure, jet fire-fire ball.	9
IV	**Hazard identification safety audits**, checklist, what if analysis, vulnerability models event tree analysis fault tree analysis, Hazan past accident analysis Fixborough-Mexico-Madras-VizagBopal analysis	9
V	**Hazop-guide words**, parameters, derivation-causes-consequences-recommendation-coarse Hazop study-case studies-pumping system-reactor-mass transfer system.	9
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1- Understand the need for safety in chemical industries and operating conditions
CO2- Examine the Plant inspection, safe handling of chemicals
CO3- Implement the risk management, ISO14000, ems
CO4- Determine the hazard identification safety audits, checklist, what if analysis
CO5- Illustrate the vulnerability models event tree analysis fault tree analysis, hazan, hazop

TEXT BOOKS:

1. Chemical Process Safety: Fundamentals with Applications, Daniel A. Crowl, J.F. Louvar, Prantice Hall, NJ, 1990.
2. Fawatt, H.H. and Wood, W.S., "Safety and Accident Prevention in Chemical Operation", Wiley Interscience, 1965.

REFERENCES BOOKS:

1. Handley, W., "Industrial Safety Hand Book ", 2nd Edn., McGraw-Hill Book Company, 1969.
2. Heinrich, H.W. Dan Peterson, P.E. and Rood, N., " Industrial Accident Prevention", McGraw- Hill Book Co., 1980.
3. Taylor, J.R., Risk analysis for process plant, pipelines and transport, Chapman and Hall, London, 1994
4. Hyatt, N., Guidelines for process hazards analysis, hazards identification & risk analysis, Dyadem Press, 2004

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

19CH5204 - Safety in Chemical Industries

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	-	2.0	2.0	-	2.0	-	-	2.0	3.0	3.0
CO2	3.0	3.0	2.0	2.0	-	2.0	2.0	-	2.0	-	-	2.0	3.0	3.0
CO3	3.0	3.0	2.0	1.0	-	2.0	2.0	-	-	-	-	3.0	3.0	3.0
CO4	3.0	3.0	2.0	2.0	-	2.0	2.0	-	-	-	-	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	-	2.0	2.0	-	-	-	-	3.0	3.0	2.0
AVG	**3.0**	**3.0**	**2.0**	**1.8**	-	**2.0**	**2.0**	-	**2.0**	-	-	**2.6**	**3.0**	**2.6**

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★
Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH5251	**WATER TRAETMENT AND SOLID WASTE MANAGEMENT**	**2**	**0**	**2**	**3**

Course Objectives

The student should be able to

- Evaluate the quality of drinking water and assess its compliance with established standards and guidelines.
- Understand the design concepts and operational considerations for preliminary and biological treatment processes.
- Assess the challenges and opportunities associated with the application of advanced water treatment technologies associated with industrial sectors

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**WATER POLLUTION:** Water as Resource, Drinking water quality, water consumption standards, Types of Water Pollutants and sources, State and central wastewater quality and its various discharge standards. Wastewater Sampling and **Characteristics - Physical, Chemical and Biological characteristics** of wastewater:	6+6
II	**WASTEWATER TREATMENT: Preliminary/Primary/physical unit operations,** Chemical unit processes, Secondary/Biological treatment process, aerobic/anaerobic attached and suspended growth process, Sludge treatment & Disposal.	6+3
III	**TERTIARY/ADVANCED WASTEWATER TREATMENT:** Ultrafiltration, **Filtration, Adsorption on Activated Carbon**, Ion Exchange, Reverse Osmosis, Electro dialysis cell. Wastewater treatment in Industries: Paper and Pulp, distillery, Leather, Food processing such dairy and fruit processing and Textile processing.	6+6
IV	**RECENT TECHNOLOGIES IN WATER TREATMENT INDUSTRIES:** Electro coagulation process in water and waste water treatment process. The Purpose of the Electro-Coagulation system is for the removal of Colour, Suspended solids, reduction of BOD, COD, and Hardness. Electro ionization process for silica removal in water and waste water treatment process.Zero discharge process for waste water treatment plant.	6
V	**SOLID WASTE MANAGEMENT:** Definitions, Characteristics and perspectives, Types of solid wastes, Sources of Solid waste, Properties of solid waste, Solid waste Management – An Overview:- Material flow in society, Reduction in raw material usage, Solid waste generation, and reuse with materials, energy recovery.	6
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1- Remember the types of water pollutants and sources.
CO2- Examine the Primary/ Secondary/Biological treatment process of waste water.
CO3- Determine the tertiary/advanced treatment process of waste water.
CO4- Examine the sources of air and noise pollution and control techniques.
CO5- Distinguish the types of solid waste, sources and solid waste management techniques.

TEXT BOOKS:

1. Environmental Engineering by Howard S. Peavey, Donald R. Rowe, George Techobanolous, McGraw-Hill International Editions.
2. Wastewater Engineering – Treatment, Disposal and Reuse, METCALF AND EDDY, INC. 3rd Edition Tata McGraw-Hill Publishing Company Limited.

REFERENCES BOOKS:

1. C S Rao, Environmental Pollution Control Engineering, New Age International Publisher, 2011.
2. M N. Rao, Air Pollution, Tata McGraw-Hill Publishing Company Limited.
3. Waste water Engineering Treatment and Reuse: Mc Graw Hill, G. Tchobanoglous, FI Biston, 2002.
4. Industrial Waste Water Management Treatment and Disposal by Waste Water Mc Graw Hill III Edition 2008.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

19CH5251 - Water Treatment and Solid Waste Management

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	-	2.0	3.0	3.0	-	-	2.0	3.0	3.0	3.0
CO2	3.0	3.0	3.0	3.0	-	2.0	2.0	-		-	3.0	3.0	3.0	3.0
CO3	3.0	2.0	3.0	3.0	-	2.0	2.0	-	2.0	-	3.0	3.0	3.0	3.0
CO4	3.0	2.0	3.0	3.0	-	2.0	2.0	-	2.0	-	3.0	3.0	3.0	3.0
CO5	3.0	3.0	3.0	3.0	-	2.0	3.0	-		-	2.0	3.0	3.0	3.0
AVG	**3.0**	**2.6**	**2.8**	**2.8**	-	**2.0**	**2.4**	**3.0**	**2.0**	-	**2.6**	**3.0**	**3.0**	**3.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH5001	**MASS TRANSFER LAB**	**0**	**0**	**3**	**1.5**

Course Objectives

- To train the students to develop sound working knowledge on different types of mass transfer equipments.

S.No.	DESCRIPTION
1.	Separation of binary mixture using Steam distillation
2.	Separation of binary mixture using Packed column distillation
3.	Measurement of diffusivity
4.	Drying characteristics of Tray dryer
5.	Drying characteristics of Rotary dryer
6.	Water purification using ion exchange columns
7.	Mass transfer characteristics of Rotating disc contactor
8.	Estimation of mass/heat transfer coefficient for cooling tower
9.	Evaporation studies (Single effect)
10.	Evaporation studies (Multiple effect)
11.	Adsorption studies
12.	Liquid-liquid extraction studies
13.	Leaching studies
14.	Demonstration of Gas – Liquid absorption
15.	Vapor liquid equilibrium
	Total Practical Hours **45**

Course Outcomes

Upon completion of the course, students can be able to

- Perform steam and packed column distillation for binary mixture separation
- Measure diffusivity and investigate mass transfer in rotating disc contactors
- Study drying characteristics of tray and rotary dryers for efficient moisture removal
- Conduct liquid: liquid extraction, leaching, and adsorption studies for component separation
- Analyze vapour - liquid equilibrium and perform evaporation and gas-liquid absorption studies..

REFERENCE BOOKS:

- McCabe W.L, Smith, J C and Harriot. P "Unit Operations in Chemical Engineering", McGraw Hill, VII Edition, 2005
- White, F.M., "Fluid Mechanics ", McGraw-Hill Inc., VII Edition, 2011.

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL • HINDUSTHAN COLLEGE OF ENGG & TECH • Chairman

Dean (Academics)
HiCET

19CH5001 - Mass Transfer Lab

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	3.0	2.0	-	-	-	-	-	-	-	3.0	3.0	3.0
CO2	3.0	3.0	3.0	2.0	-	-	1.0	-	-	-	-	3.0	3.0	3.0
CO3	3.0	3.0	3.0	2.0	-	1.0	1.0	-	-	-	-	3.0	3.0	3.0
CO4	3.0	3.0	3.0	2.0	-	1.0	1.0	-	-	1.0	-	3.0	3.0	3.0
CO5	3.0	3.0	3.0	2.0	-	1.0	1.0	-	-	1.0	-	3.0	3.0	3.0
AVG	**3.0**	**3.0**	**3.0**	**2.0**	-	**1.0**	**1.0**	-	-	**1.0**	-	**3.0**	**3.0**	**3.0**

Chairman - BoS
CHE - HiCET

HINDUSTHAN ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★
Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH5002	**PROCESS CONTROL LAB**	**0**	**0**	**3**	**1.5**

Course Objectives

- To determine experimentally the methods of controlling the processes including measurements using process simulation techniques.

S.No.	DESCRIPTION
1.	Response of first order system
2.	Response of second order system
3.	Response of Non-Interacting level system
4.	Response of Interacting level system
5.	Open loop study on a thermal system
6.	Closed loop study on a level system
7.	Closed loop study on a flow system
8.	Closed loop study on a thermal system
9.	Tuning of a level system
10.	Tuning of a pressure system
11.	Tuning of a thermal system
12.	Flow co-efficient of control valves
13.	Characteristics of different types of control valves
14.	Closed loop study on a pressure system
15.	Closed loop response of cascade control system

Total Practical Hours 45

Course Outcomes

Upon completion of the course, students can be able to

- Evaluate responses of first: order, second: order, interacting, and non- interacting systems
- Perform open and closed: loop studies on level, flow, thermal, and pressure systems.
- Tune control systems for level, pressure, and thermal processes for optimal performance.
- Determine flow coefficients and analyze characteristics of various control valve types
- Analyze closed: loop response of cascade control systems for improved process stability.

REFERENCE BOOKS:

- Coughnowr, D., " Process Systems Analysis and Control ", 3rd Edn., McGraw Hill, New York, 2008.

Chairman - BoS
OHE - HiCET

Chairman

Dean (Academics)
HiCET

19CH5002 - Process Control Lab

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	3.0	3.0	-	1.0	1.0	1.0	1.0	-	1.0	2.0	3.0
CO2	3.0	3.0	2.0	3.0	3.0	-	1.0	1.0	1.0	1.0	-	1.0	2.0	3.0
CO3	3.0	3.0	2.0	3.0	3.0	-	1.0	1.0	1.0	1.0	-	1.0	2.0	3.0
CO4	3.0	3.0	2.0	3.0	3.0	-	1.0	1.0	1.0	1.0	-	1.0	2.0	3.0
CO5	3.0	3.0	2.0	3.0	3.0	-	1.0	1.0	1.0	1.0	-	1.0	2.0	3.0
AVG	**3.0**	**3.0**	**2.0**	**3.0**	**3.0**	-	**1.0**	**1.0**	**1.0**	**1.0**	-	**1.0**	**2.0**	**3.0**

Chairman - BoS
CHE - HiCET

HINDUSTHAN ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★
Chairman

Dean (Academics)
HiCET

Programme	Course Code	Course Title	L	T	P	C
BE/BTECH	19HE5071	**Soft Skills - I**	**1**	**0**	**0**	**1**

Course Objectives:

1. To employ soft skills to enhance employability and ensure workplace and career success.
2. To enrich students' numerical ability of an individual and is available in technical flavor.
3. To interpret things objectively, to be able to perceive and interpret trends to make generalizations and be able to analyze assumptions behind an argument/statement.

Unit	Description	Instructional Hours
I	**Introduction to Soft Skills:** Introduction- Objective -Hard vs Soft Skills - Measuring Soft Skills- Structure of the Soft Skills -Self Management-Critical Thinking-Reflective thinking and writing- p2p Interaction	3
II	**Art of Communication:** Verbal Communication - Effective Communication - Active listening –Paraphrasing - Feedback - Non-Verbal Communication – Roles-Types- How nonverbal communication can go wrong- How to Improve nonverbal Communication - Importance of feelings in communication - dealing with feelings in communication.	4
III	**World of Teams:** Self Enhancement - importance of developing assertive skills- developing self-confidence – developing emotional intelligence - Importance of Team work – Team vs. Group - Attributes of a successful team – Barriers involved - Working with Groups – Dealing with People- Group Decision Making.	3
IV	**Quantitative Aptitude:** Averages - Profit and loss - Partnerships - Time and work - Time, Speed and Distance - Problems based on trains - Problems based on boats and streams	3
V	**Logical Reasoning:** Clocks - Calendars - Direction Sense - Data Interpretation: Tables, Pie Chart, Bar Graph - Data Sufficiency	2

Course Outcome:

- CO1: Students will have clarity on their career exploration process and to match their skills and interests with a chosen career path.
- CO2: Students will develop knowledge, skills, and judgment around human communication that facilitate their ability to work collaboratively with others
- CO3: Students will understand how teamwork can support leadership skills
- CO4: Students will be able to make sense of problems, develop strategies to find solutions, and persevere in solving them.
- CO5: Students will demonstrate an enhanced ability to draw logical conclusions and implications to solve logical problems.

REFERENCE BOOKS:

R1: Soft Skills Training: A Workbook to Develop Skills for Employment - Frederick H. Wentz
R2: How to prepare for data interpretation for CAT by Arun Sharma.
R3: How to Crack TEST OF REASONING in all competitive examinations by Jaikishan and Premkishan.
R4: A New Approach To Reasoning Verbal & Non-Verbal By B.S. Sijwali
R5: Quantitative Aptitude for Competitive Examinations - Dr. R.S. Aggarwal, S. Chand

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.E./B.Tech.	19HE5072	**DESIGN THINKING**	1	0	0	1

Course Objective

OBJECTIVES:

- To expose students to the design process
- To develop and test innovative ideas through a rapid iteration cycle.
- To provide an authentic opportunity for students to develop teamwork and leadership skills

Unit	Description	Instructional Hours
I	**DESIGN ABILITY** Asking Designers about what they Do – Deconstructing what Designers Do – Watching what Designers Do – Thinking about what Designers Do – The Natural Intelligence of Design Sources	**4**
II	**DESIGNING TO WIN** Formula One Designing – Radical Innovations – City Car Design – Learning From Failures – Design Process and Working Methods	**4**
III	**DESIGN TO PLEASE AND DESIGNING TOGETHER** Background – Product Innovations – Teamwork versus Individual work – Roles and Responsibilities – Avoiding and Resolving Conflicts.	**4**
IV	**DESIGN EXPERTISE** Design Process – Creative Design - Design Intelligence – Development of Expertise – Novice to Expert. Critical Thinking – Case studies: Brief history of Albert Einstein, Isaac Newton and Nikola Tesla	**3**
	Total Instructional Hours	**15**

Course Outcome

Upon completion of the course, students will be able to
CO1: Develop a strong understanding of the Design Process
CO2: Learn to develop and test innovative ideas through a rapid iteration cycle.
CO3: Develop teamwork and leadership skills

TEXT BOOKS:

T1 - 1. Nigel Cross, "Design Thinking", Kindle Edition.

REFERENCE BOOKS:

R1 - Tom Kelley, "Creative Confidence", 2013.
R2 - 3. Tim Brown, "Change by Design", 2009.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH5301	**ENERGY TECHNOLOGY**	**3**	**0**	**0**	**3**

Course Objectives

The student should be able to

Create awareness about sources of energy and able to estimate how long the available conventional fuel reserves will last.

Understand the fundamental concepts about solar energy systems and devices and to design wind turbine blades, hydro systems and geothermal energy system

Illustrate the Biomass energy and energy conservation

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**ENERGY:** Introduction to energy – Global energy scene – Indian energy scene - Units of energy, conversion factors, general classification of energy, energy crisis, energy alternatives.	9
II	**CONVENTIONAL ENERGY:** Conventional energy resources, Thermal, hydel and nuclear reactors, thermal, hydel and nuclear power plants, efficiency, merits and demerits of the above power plants, combustion processes, fluidized bed combustion.	9
III	**NON-CONVENTIONAL ENERGY:** Solar energy, solar thermal systems, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, solar energy application in India, energy plantations. Wind energy, types of windmills, types of wind rotors, Darrieus rotor and Gravian rotor, wind electric power generation, wind power in India, economics of wind farm, ocean wave energy conversion, ocean thermal energy conversion, tidal energy conversion, geothermal energy.	9
IV	**BIOMASS ENERGY:** Biomass origin - Resources – Biomass estimation. Thermochemical conversion – Biological conversion, Chemical conversion – Hydrolysis & hydrogenation, solvolysis, biocrude, biodiesel power generation gasifier, biogas, integrated gasification.	9
V	**ENERGY CONSERVATION:** Energy conservation - Act; Energy management importance, duties and responsibilities; Energy audit - Types methodology, reports, instruments. Benchmalcing and energy performance, material and energy balance, thermal energy management.	9
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1- Understand about the energy and its classification

CO2- Illustrate about the conventional energy resources and its production

CO3- Examine about non-conventional energy resources and its production

CO4- Estimate the production of biomass energy

CO5- Predict about the energy conservation and management

TEXT BOOKS:

1. Rao, S. and Parulekar, B.B., Energy Technology, Khanna Publishers, 2005.
2. Rai, G.D., Non-conventional Energy Sources, Khanna Publishers, New Delhi, 1984.
3. Energy Management, Paul W.O'Callaghan McGraw – Hill, 1993

REFERENCE BOOKS:

1. Nejat Vezirog, Alternate Energy Sources, IT, McGraw Hill, New York.
2. El. Wakil, Power Plant Technology, Tata McGraw Hill, New York, 2002.
3. Sukhatme. S.P., Solar Enery - Thermal Collection and Storage, Tata McGraw hill, New Delhi, 1981.

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL • HICET • MUNDIYAMPAKKAM COLLEGE OF ENGG & TECH • Chairman

Dean (Academics)
HiCET

19CH5301 - Energy Technology

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO3	3.0	3.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	3.0	3.0	2.0
CO4	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
CO5	3.0	3.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	3.0	3.0	2.0
AVG	**3.0**	**3.0**	**2.2**	**2.0**	**2.0**	-	**2.0**	-	**2.0**	-	**2.4**	**3.0**	**3.0**	**2.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★
Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH5302	**PETROLEUM TECHNOLOGY**	**3**	**0**	**0**	**3**

Course Objectives

The student should be able to

- Understand petroleum engineering principles, their application to petroleum and natural gas manufacturing problems
- Classify the types of catalytically cracking process.
- Analyze the cost and economic evaluation of the petroleum industry.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**INTRODUCTION:** Refinery products – Refinery Feeds – Crude distillation – Coking and thermal process.	9
II	**CATALYTIC CRACKING:** Catalytic Cracking - Catalytical hydro cracking – Hydro processing and Reused processing hydro treating.	9
III	**CATALYTICAL:** Reforming and isomerization alkylation and polymerization – Product blending – Supporting processes.	9
IV	**LUBRICIATING:** Lubricating oil blending stocks petrochemical feedstocks.	9
V	**COST EVALUATION:** Cost Evaluation – Economic evaluation of petroleum reused and refineries.	9
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1- Understand the basic refinery products by unit operation and process

CO2-Illustrate about the process of catalytic cracking and hydro treating for the production of petroleum products

CO3- Examine about the catalytically process of petroleum products production

CO4- Determine the lubrication of petroleum feed stock

CO5-Estimate the cost evaluation process in petroleum refineries

TEXT BOOKS:

1. Petroleum Refining: Technology and economics CRC Press V Edition 2007 J.CH Garry, Hardward G.E and M.J.Kaiser.
2. Nelson, W. L., "Petroleum Refinery Engineering", 4th Edition., McGraw Hill, New York,1985.

REFERENCE BOOKS:

1. Modern Petroleum Technology Upstream Vol I A.G. Lucas Hurley Edition 2002.
2. Wiseman. P., "Petrochemicals", UMIST Series in Science and Technology, John Wiley & Sons,1986.
3. Bhaskara Rao, B. K. "A Text on Petrochemicals", 1st Edition, Khanna Publishers, New Delhi, 1987.
4. Bhaskara Rao, B. K., "Modern Petroleum Refining Processes", 2nd Edition, Oxford and IBH Publishing Company, New Delhi, 1990.

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL Chairman HINDUSTHAN COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO2	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO3	3.0	2.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO4	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
CO5	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
AVG	**3.0**	**2.0**	**2.2**	**2.0**	**2.0**	-	**2.0**	-	**2.0**	-	**2.4**	**2.0**	**3.0**	**2.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL
Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH5303	**ELECTROCHEMICAL ENGINEERING**	**3**	**0**	**0**	**3**

Course Objectives

The student should be able to

- Gain knowledge about electrochemical process and its application.
- Illustrate the mass transfer application in electrochemical systems.
- Examine the deposition of electrodes in electrochemical industries.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**REVIEW BASICS OF ELECTROCHEMISTRY:** Faraday's law - Nernst potential –Galvanic cells – Polarography, The electrical double layer: 94It's role in electrochemical processes –Electrocapillary curve – Helmoltz layer – Guoy – Steven's layer – fields at the interface.	9
II	**MASS TRANSFER IN ELECTROCHEMICAL SYSTEMS:** Diffusion controlled electrochemical reaction – the importance of convention and the concept of limiting current. over potential, primary-secondary current distribution – rotating disc electrode.	9
III	**INTRODUCTION TO CORROSION:** series, corrosion theories derivation of potential-current relations of activities controlled and diffusion controlled corrosion process. Potential-pH diagram, Forms of corrosion- definition, factors and control methods of various forms of corrosion-corrosion control measures-industrial boiler water corrosion control – protective coatings –Vapor phase inhibitors – cathodic protection, sacrificial anodes – Paint removers.	9
IV	**ELECTRO DEPOSITION**: electro refining – electroforming – electro polishing – anodizing – Selective solar coatings, Primary and secondary batteries – types of batteries, Fuel cells.	9
V	**ELECTRODES USED IN DIFFERENT ELECTROCHEMICAL INDUSTRIES:** Metals-Graphite – Lead dioxide – Titanium substrate insoluble electrodes – Iron oxide – semi conducting type etc. Metal finishing-cell design. types of electrochemical reactors, batch cell, fluidized bed electrochemical reactor, filter press cell, Swiss roll cell, plug flow cell, design equation, figures of merits of different type of electrochemical reactors.	9
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1- Understand the basic electrochemistry

CO2- Examine the diffusion transfer in electrochemical systems

CO3- Illustrate the corrosion formation and control measures

CO4- Estimate the process of electro plating and fuel cells

CO5- Analyze the various types of electrodes in electrochemical industries

TEXT BOOKS:

1. Picket, " Electrochemical Engineering", Prentice Hall. 1977.
2. Newman, J. S., " Electrochemical systems", Prentice Hall, 1973.

REFERENCE BOOKS:

1. Barak, M. and Stevenge, U. K., " Electrochemical Power Sources - Primary and Secondary Batteries" 1980.
2. Mantell, C., "Electrochemical Engineering", McGraw Hill, 1972.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO2	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO3	3.0	2.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO4	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
CO5	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
AVG	**3.0**	**2.0**	**2.2**	**2.0**	**2.0**	-	**2.0**	-	**2.0**	-	**2.4**	**2.0**	**3.0**	**2.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL
Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH5304	**POLYMER TECHNOLOGY**	**3**	**0**	**0**	**3**

Course Objectives

The student should be able to

- Compute molecular weight averages from the molecular weight distribution, and transition in polymers
- Examine the types of polymerization.
- Illustrate the transition in polymers and effect of crystallization.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**INTRODUCTION:** History of Macromolecules – structure of natural products like cellulose, rubber,proteins – concepts of macro molecules – Staudinger's theory of macromolecules – difference between simple organic molecules and macromolecules.	9
II	**ADDITION POLYMERIZATION:** Chemistry of Olefins and Dienes – double bonds – Chemistry of free radicals – monomers – functionality – Polymerization: Initiation – types of initiation – free radical polymerization – cationic polymerization – anionic polymerization – coordination polymerization – industrial polymerization – bulk, emulsion, suspension and solution polymerization techniques – Kinetics – Copolymerization concepts.	9
III	**CONDENSATION POLYMERIZATION:** Simple condensation reactions – Extension of condensation reactions to polymer synthesis – functional group reactivity – polycondensation – kinetics of polycondensation- Carother's equation – Linear polymers by polycondensation – Interfacial polymerization – crosslinked polymers by condensation – gel point.	9
IV	**MOLECULAR WEIGHTS OF POLYMERS:** Difference in molecular weights between simple molecules and polymers – number average and weight average molecular weights – Degree of polymerization and molecular weight – molecular weight distribution – Polydispersity – molecular weight determination. Different methods – Gel Permeation Chromatography – Osmometry, Light Scattering.	9
V	**TRANSITIONS IN POLYMERS:** First and second order transitions – Glass transition, Tg – multiple transitions in polymers – experimental study – significance of transition temperatures – crystallinity in polymers – effect of crystallization – in polymers – factors affecting crystallization crystal nucleation and growth – relationship between Tg and Tm – Relationship between properties and crystalline structure.	9
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1- Understand about the various macromolecules and its difference with organic molecules
CO2- Examine the initiation of addition polymerization and its types
CO3- Estimate the condensation polymerization reaction for polymer synthesis
CO4- Determine the molecular distribution and the methods of determination
CO5- Remember the transition in polymers and crystallization process

TEXT BOOKS:

1. Billmeyer.F.W.,Jr, Text Book of Polymer Science, Ed. Wiley-Interscience, 1984.
2. Gowariker.V.T., Viswanathan.N.V., and Sreedar.J., Polymer Science, Wiley Eastern Ltd., 1988.

REFERENCE BOOKS:

1. Joel,R.F; Polymer Science and Technology, Eastern Economy Edition, 1999.
2. Rodriguez, F., Cohen.C., Oberic.K and Arches, L.A., Principles of Polymer Systems, 5th edition, Taylor and Francis.
3. Vishu Shah, Hand book of Plastics Testing and Failure Analysis, 3rd Edition, John-Willey &Sons, New York, 2007.

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL • HINDUSTHAN COLLEGE OF ENGG & TECH • Chairman

Dean (Academics)
HiCET

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO2	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO3	3.0	2.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO4	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
CO5	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
AVG	**3.0**	**2.0**	**2.2**	**2.0**	**2.0**	-	**2.0**	-	**2.0**	-	**2.4**	**2.0**	**3.0**	**2.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL
Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH5305	**FOOD TECHNOLOGY**	**3**	**0**	**0**	**3**

Course Objectives

The student should be able to

- Understand the general aspect of Food Industries and its needs.
- Examine the food constituents and its quality.
- Illustrate the production and utilization of food products.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**AN OVERVIEW:** General aspects of food industry; world food needs and Indian situation.	9
II	**FOOD CONSTITUENTS, QUALITY AND DERIVATIVE:** Constituents of food; quality and nutritive aspects; food additives; standards; deteriorative factors and their control.	9
III	**GENERAL ENGINEERING ASPECTS AND PROCESSING:** Preliminary processing methods; conversion and preservation operations.	9
IV	**FOOD PRESERVATION METHODS:** Preservation by heat and cold; dehydration; concentration; drying irradiation; microwave heating; sterilization and pasteurization; fermentation and pickling; packing methods.	9
V	**PRODUCTION AND UTILISATION OF FOOD PRODUCTS:** Cereal grains; pulses; vegetables; fruits; spices; fats and oils; bakery; confectionery and chocolate products; soft and alcoholic beverages; dairy products; meat; poultry and fish products.	9
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1- Illustrate the basic and general aspects of food industry

CO2- Determine the quality standards and control of food constituents

CO3- Examine the preliminary and general methods of food processing

CO4- Sketch the different food preservation methods

CO5- Prepare the production of different food products and utilization

TEXT BOOKS:

1. Heid J.L. Joslyn M.A., Fundamentals of Food Processing Operation, The AVI publishing Co., West port 1967.
2. Potter N.N., Food Science, The AVI publishing Co., Westport, 1963.

REFERENCE BOOKS:

1. Heldman D.R., Food Process Engineering, The AVI publishing co., 1975.
2. Charm S.E., The Fundamentals of Foods Engineering, The AVI Publishing Co., Westport, 1963.
3. Chakraverty, Amalendu, and Dhiren Sankar De. "Post harvest technology of cereals and pulses.1981.
4. Fellows, Peter John. Food processing technology: principles and practice. Elsevier, 2009.

Chairman - BoS
OHE - HiCET

Chairman

Dean (Academics)
HiCET

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO2	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO3	3.0	2.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO4	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
CO5	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
AVG	**3.0**	**2.0**	**2.2**	**2.0**	**2.0**	-	**2.0**	-	**2.0**	-	**2.4**	**2.0**	**3.0**	**2.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL
Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH6201	**CHEMICAL REACTION ENGINEERING– II**	**3**	**1**	**0**	**4**

Course Objectives

The student should be able to

- Understand the gas-solid catalytic and non-catalytic reactors and gas-liquid reactors
- Classify the homogeneous and Heterogeneous catalyst.
- Illustrate the gas-solid catalytic and non catalytic reactors.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**CATALYSTS:** Nature of catalysts, surface area and pore-volume distribution, catalyst preparation.	12
II	**HETEROGENEOUS REACTORS:** Rate equations for heterogeneous reactions, adsorption isotherms, rates of adsorption and desorption, surface reaction analysis of rate equation and rate controlling steps.	12
III	**GAS-SOLID CATALYTIC REACTORS:** Diffusion within catalyst particle, effective thermal conductivity, mass and heat transfer within catalyst pellets, effectiveness factor, Thiele Modulus, fixed bed reactors.	12
IV	**GAS-SOLID NON-CATALYTIC REACTORS:** Models for explaining kinetics; volume and surface models; controlling resistances and rate controlling steps; time for complete conversion for single and mixed sizes, fluidized and static reactors.	12
V	**GAS-LIQUID REACTORS:** Absorption combined with chemical reactions; mass transfer coefficients and kinetic constants; application of film, penetration and surface renewal theories; Hatta number and enhancement factor for first order reaction, tower reactor design.	12
	Total Instructional Hours	**60**

Course Outcomes

Upon completion of the course, students can be able to

CO1- Understand the nature, preparation and required properties of catalyst.
CO2- Apply the rate and isotherms studies of heterogeneous reactors.
CO3- Analyze the heat and mass transfer in gas-solid catalytic reactors.
CO4- Evaluate the rate kinetics and controlling steps in gas-solid non-catalytic reactors.
CO5- Understand the mass transfer effects on gas-liquid reactors.

TEXT BOOKS:

1. Levenspiel O, "Chemical Reaction Engineering", Wiley Eastern Ltd., II Edition,2000.
2. Smith, J.M, "Chemical Engineering Kinetics", McGraw Hill, III Edition,1981.

REFERENCES BOOKS:

1. Froment. G.F. & K.B.Bischoff, "Chemical Reactor Analysis and Design", John Wiley and Sons, 1979.
2. Fogler.H.S., "Elements of Chemical Reaction Engineering", Prentice Hall of India Ltd., 3rd Edition,2000.
3. Lanny D. Schmidth The Engineering of Chemical Reactions, Second Edition, Oxford University Press, 2005
4. L.K Doraiswamy, DenizUner, Chemical Reaction Engineering Beyond the fundamentals, CRC Press , 2014.

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL • HINDUSTHAN COLLEGE OF ENGG & TECH • Chairman

Dean (Academics)
HiCET

19CH6201 - Chemical Reaction Engineering– II

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	3.0	2.0	-	2.0	2.0	2.0	1.0	1.0	-	2.0	3.0	2.0
CO2	3.0	3.0	2.0	2.0	-	2.0	3.0	2.0	1.0	1.0	-	2.0	3.0	2.0
CO3	3.0	3.0	3.0	3.0	-	2.0	2.0	2.0	1.0	1.0	-	2.0	3.0	2.0
CO4	3.0	3.0	3.0	3.0	-	2.0	2.0	2.0	2.0	1.0	-	2.0	3.0	2.0
CO5	3.0	3.0	3.0	3.0	-	2.0	2.0	2.0	2.0	1.0	-	2.0	3.0	3.0
AVG	**3.0**	**3.0**	**2.8**	**2.6**	-	**2.0**	**2.2**	**2.0**	**1.4**	**1.0**	-	**2.0**	**3.0**	**2.2**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★
Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH6202	**CHEMICAL PROCESS INDUSTRIES**	3	0	0	3

Course Objectives

The student should be able to

- Impart knowledge on various aspects of production engineering
- Examine the practical methods of production in a chemical factory.
- Analyze the methods of producing various types of acids.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**SULFUR, SULFURIC ACID AND CEMENT:** Sulfur, Raw materials Sources, Mining and production of Sulfur – Sulfuric acid, Methods of production of Sulfuric acid – Contact process – Chamber process. Cement – properties of Cement – Methods of production – Overall factors for Cement industry.	9
II	**FERTILIZER INDUSTRY:** Major Components of Fertilizer industries – Nitrogen industries, ammonia, nitric acid, urea – Phosphorus industries - Phosphorus, Phosphoric acid, Super Phosphate – Potassium chloride, Potassium Sulphate.	9
III	**PULP, PAPER, SUGAR AND STARCH INDUSTRIES:** Pulp – Methods of production – Comparison of pulping processes. Paper – types of paper products, Raw materials, Methods of production. Sugar – Methods of production – by products of the Sugar industry – Starch – Methods of production, Starch derivations.	9
IV	**PETRO CHEMICAL INDUSTRIES:** Petroleum – Chemical Composition, Classification of crude petroleum, Petroleum Refinery products – Petroleum Conversion processes – Pyrolysis and Cracking, Reforming Polymerization, isomerization and Alkylation – petrochemicals – methanol, chloro methanol, Acetylene and ethylene, Isopropanol, Acrylonitrile, Butadiane – Chemicals from Aromatics - Benzene, Toluene and Xylene.	9
V	**FUEL AND INDUSTRIAL GASES:** Fuel Gases – Producer gas, Water gas, Coke oven gas, Natural gas, Liquefied natural gas – Industrial gases – Carbon dioxide, hydrogen, nitrogen and oxygen.	9
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1- Interpret the various unit operations, chemical reactions involved in the production process of sulfur, sulfuric acid and cement

CO2- Illustrate the various unit operations, chemical reactions involved in the production process of fertilizers and its major components.

CO3- Determine the various unit operations, chemical reactions involved in the production process of pulp, paper, sugar and starch

CO4- Examine the various unit operations, chemical reactions involved in the production process of petroleum and petro chemical products

CO5- Sketch the various unit operations, chemical reactions involved in the production process of fuel and industrial gases.

TEXT BOOKS:

1. Dryden, C.E, Outlines of Chemical technology, II Ed., Affiliate East West press, 2003.
2. Moulin, J.A., M. Makkee, and Diepen, A.V., Chemical Process Technology, Wiley, 2001.

REFERENCES BOOKS:

1. Austin, G.T., Shreve's "Chemical Process Industries", 5th ed., McGraw-Hill, 1998.
2. Srikumar Koyikkal, "Chemical Process Technology and Simulation", PHI Learning Ltd..

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

19CH6202 - Chemical Process Industries

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO2	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO3	3.0	2.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO4	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
CO5	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
AVG	**3.0**	**2.0**	**2.2**	**2.0**	**2.0**	-	**2.0**	-	**2.0**	-	**2.4**	**2.0**	**3.0**	**2.0**

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★
Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH6181	**PROFESSIONAL ETHICS IN ENGINEERING**	**3**	**0**	**0**	**3**

Course Objectives

The student should be able to

- Understand the awareness on Engineering Ethics and Human Values.
- Illustrate the Moral and Social Values and Loyalty and to appreciate the rights of others.
- Examine the Global issues in Environmental ethics.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**HUMAN VALUES:** Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.	9
II	**ENGINEERING ETHICS:** Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.	9
III	**ENGINEERING AS SOCIAL EXPERIMENTATION:** Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.	9
IV	**SAFETY, RESPONSIBILITIES AND RIGHTS:** Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.	9
V	**GLOBAL ISSUES:** Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Code of Conduct – Corporate Social Responsibility.	9
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1- Illustrate the importance of human values in the society.

CO2- Understand the ethics in engineering and its theories.

CO3- Examine how the engineers are experimenters in the society.

CO4- Implement the safety, risk assessment and intellectual property rights.

CO5- Highlight the various global issues and social responsibilities.

TEXT BOOKS:

1. Mike W. Martin and Roland Schinzinger, "Ethics in Engineering", Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, "Engineering Ethics", Prentice Hall of India, New Delhi, 2004.

REFERENCES BOOKS:

1. Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, "Engineering Ethics – Concepts and Cases", Cengage Learning, 2009.
3. John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

19CH6181 - Professional Ethics in Engineering

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	2.0	2.0	3.0	2.0	2.0	-	3.0	-	-
CO2	-	-	2.0	-	-	2.0	2.0	3.0	2.0	2.0	-	3.0	-	2.0
CO3	-	3.0	3.0	3.0	-	3.0	3.0	3.0	3.0	2.0	-	3.0	-	3.0
CO4	3.0	3.0	2.0	3.0	-	3.0	3.0	3.0	2.0	-	-	3.0	-	3.0
CO5	-	2.0	2.0	-	-	3.0	3.0	3.0	3.0	-	-	3.0	-	3.0
AVG	**3.0**	**2.67**	**2.25**	**3.0**	-	**2.6**	**2.6**	**3.0**	**2.4**	**2.0**	-	**3.0**	-	**2.75**

Chairman - BoS
CHE - HiCET

HINDUSTHAN COLLEGE OF ENGG & TECH ★ ACADEMIC COUNCIL ★ Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH6251	**FLUIDIZATION ENGINEERING**	**2**	**0**	**2**	**3**

Course Objectives

The student should be able to

- Understand the design aspects of fluidized beds.
- Apply the heat and mass transfer in fluidized bed reactors.
- Classify the fluidized bed types.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**BASICS OF FLUIDIZATION: Packed bed – Velocity – Pressure drop relations** – Correlations of Ergun, Kozneykarman – On set of fluidization – Properties of fluidized beds – **Development of fluidization from fixed bed.**	6+6
II	**FLUIDIZED BED TYPES: Minimum fluidization conditions – Expanded bed** – Elutriation – Moving solids and dilute phase – spouted bed.	6+6
III	**DESIGN ASPECTS:** Channeling – Bed expansion in liquid – Solid and gas – Solid fluidizations. Design aspects of fluidized bed systems.	6+3
IV	**HEAT AND MASS TRANSFER IN FLUIDIZED BEDS:** Heat and mass transfer in fluidized bed systems – Industrial applications and case studies of fluidized bed systems.	6
V	**OTHER TYPES OF FLUIDIZATION:** Single stage and multistage fluidization – Collection of fines – Use of cyclones.	6
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1- Understand the properties and basics of fluidization.
CO2- Categorize the different types of fluidized beds based on different fluidization conditions.
CO3- Illustrate the various design aspects of fluidized bed systems.
CO4- Examine the effects of heat and mass transfer in fluidized beds.
CO5- Compare the other types of fluidization for collection of fines.

TEXT BOOKS:

1. Levenspiel, "Fluidization Engineering", 2nd Edition, Butterworth – Heinmann, 1991.
2. Leva, M., "Fluidization", McGraw Hill Book Co, 1959.

REFERENCES BOOKS:

1. Rowe and Davidson, "Fluidization", Academic Press ,1971.
2. Robert H. Perry and Don W. Green, "Perry's Chemical Engineer's Hand Book", 7th Edition, Mc Graw Hill – International, 1997.
3. Wen-Ching Yang., "Handbook of Fluidization and Fluid-Particle Systems", Marcel Dekker Inc, 2003.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

19CH6251 - Fluidization Engineering

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	1.0	-	3.0	2.0	-	-	-	-	-	-	1.0	-	1.0
CO2	2.0	1.0	-	3.0	2.0	-	-	-	-	-	-	1.0	-	1.0
CO3	2.0	1.0	-	3.0	2.0	-	-	-	-	-	-	1.0	-	1.0
CO4	2.0	1.0	-	3.0	2.0	-	-	-	-	-	-	1.0	-	1.0
CO5	1.0	1.0	-	3.0	2.0	-	-	-	-	-	-	1.0	-	1.0
AVG	**2.0**	**1.0**	-	**3.0**	**2.0**	-	-	-	-	-	-	**1.0**	-	**1.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★ Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH6001	**CHEMICAL REACTION ENGINEERING LAB**	**0**	**0**	**4**	**2**

Course Objectives

- To impart knowledge on design of reactors.

S.No.	DESCRIPTION
1.	Kinetic studies in a Batch reactor.
2.	Kinetic studies in a Semi Batch reactor.
3.	Kinetic studies in a Plug flow reactor.
4.	Kinetic studies in a CSTR.
5.	Kinetic studies in a Packed bed reactor.
6.	Combined reactor studies in a PFR and CSTR.
7.	RTD studies in a PFR.
8.	RTD studies in a Packed bed reactor.
9.	RTD studies in a CSTR / CSTR in series.
10.	Studies on micellar catalysis.
11.	Study of temperature dependence of rate constant.
12.	Kinetic studies in Sono chemical reactor.
13.	Kinetics of photochemical reaction.
14.	Demonstration of heterogeneous catalytic reaction.
15.	Demonstration of gas-liquid reaction.

Total Practical Hours 45

Course Outcomes

Upon completion of the course, students can be able to

- Conduct kinetic studies in batch, semi: batch, CSTR, PFR, and packed bed reactors.
- Perform combined reactor studies in PFR and CSTR for enhanced process efficiency.
- Analyze residence time distribution in PFR, CSTR, and packed bed reactors for mixing characterization.
- Study micellar catalysis, heterogeneous catalysis, and gas: liquid reactions for improved reaction rates.
- Investigate temperature dependence, sono: chemical, and photochemical reaction kinetics for innovative applications.

REFERENCE BOOKS:

- McCabe W.L, Smith, J C and Harriot. P "Unit Operations in Chemical Engineering", McGraw Hill, VII Edition, 2005
- White, F.M., "Fluid Mechanics ", McGraw-Hill Inc., VII Edition, 2011.

Chairman - BoS
OHE - HiCET

Chairman

Dean (Academics)
HiCET

19CH6001 - Chemical Reaction Engineering Lab

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	3.0	3.0	2.0	-	-	-	-	-	-	-	3.0	3.0	3.0
CO2	3.0	3.0	3.0	2.0	-	-	1.0	-	-	-	-	3.0	3.0	3.0
CO3	3.0	3.0	3.0	2.0	-	1.0	1.0	-	-	-	-	3.0	3.0	3.0
CO4	3.0	3.0	3.0	2.0	-	1.0	1.0	-	-	1.0	-	3.0	3.0	3.0
CO5	3.0	3.0	3.0	2.0	-	1.0	1.0	-	-	1.0	-	3.0	3.0	3.0
AVG	**3.0**	**3.0**	**3.0**	**2.0**	-	**1.0**	**1.0**	-	-	**1.0**	-	**3.0**	**3.0**	**3.0**

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL ★ HINDUSTHAN COLLEGE OF ENGG & TECH ★
Chairman

Dean (Academics)
HiCET

Programme	Course Code	Course Title	L	T	P	C
BE/BTECH	19HE6071	Soft Skill-II	**1**	**0**	**0**	**1**

Course Objectives:	1. To make the students aware of the importance, the role and the content of softskills through instruction, knowledge acquisition, demonstration and practice. 2. To learn everything from equations to probability with a completely different approach. 3. To make the students learn on an increased ability to explain the problem comprehensively.

Unit	Description	Instructional Hours
I	**Group Discussion & Presentation Skills:** GD skills – Understanding the objective and skills tested in a GD – General types of GDs – Roles in a GD – Do's & Don'ts – Mock GD & Feedback. - Presentation Skills – Stages involved in an effective presentation – selection of topic, content, aids – Engaging the audience – Time management – Mock Presentations & Feedback	4
II	**Interview Skills and Personality Skills:** Interview handling Skills – Self preparation checklist – Grooming tips: do's & don'ts – mock interview & feedback - Interpersonal skills-creative thinking-problem solving-analytical skills	3
III	**Business Etiquette & Ethics:** Etiquette – Telephone & E-mail etiquette – Dining etiquette – do's & Don'ts in a formal setting – how to impress. Ethics – Importance of Ethics and Values – Choices and Dilemmas faced – Discussions from news headlines.	3
IV	**Quantitative Aptitude:** Permutation, Combination - Probability - Logarithm - Quadratic Equations - Algebra - Progression - Geometry - Mensuration.	3
V	**Logical Reasoning:** Logical Connectives - Syllogisms - Venn Diagrams – Cubes - Coded inequalities - Conditions and Grouping	2

Course Outcome:	CO1:	Students will have learnt to keep going according to plan, coping with the unfamiliar, managing disappointment and dealing with conflict.
	CO2:	Students will Actively participate meetings, Group Discussions / interviews and prepare & deliver presentations
	CO3:	Students will define professional behavior and suggest standards for appearance, actions and attitude in a Business environment
	CO4:	Students will be able to apply quantitative reasoning and mathematical analysis methodologies to understand and solve problems.
	CO5:	Students will excel in complex reasoning.

REFERENCE BOOKS:

R1: Bridging the Soft Skills Gap: How to Teach the Missing Basics to Todays Young Talent- Bruce Tulgan

R2: Quantitative Aptitude for Competitive Examinations (5th Edition) - Abhjit Guha

R3: How to crack test of Reasoning - Jaikishan and Premkishan

R4: The hand on guide to Analytical Reasoning and Logical Reasoning - Peeyush Bhardwaj

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL HINDUSTHAN COLLEGE OF ENGG & TECH Chairman

Dean (Academics)
HiCET

Programme	Course Code	Course Title	L	T	P	C
BE/BTECH	19HE6072	**Intellectual Property Rights (IPR)**	**1**	**0**	**0**	**1**

Course Objectives:

1. To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.
2. To disseminate knowledge on patents, patent regime in India and abroad and registration aspects.
3. To disseminate knowledge on copyrights and its related rights and registration aspects.
4. To disseminate knowledge on trademarks and registration aspects.
5. To disseminate knowledge on Design, Geographical Indication (GI) and their registration aspects.

Unit	Description	Instructional Hours
I	**INTRODUCTION TO INTELLECTUAL PROPERTY** Introduction, Types of Intellectual Property, International Organizations, Agencies and Treaties, Importance of Intellectual Property Rights.	3
II	**PATENTS** Patents -Elements of Patentability: Novelty, Non-Obviousness (Inventive Steps), Industrial Application -Non -Patentable Subject Matter -Registration Procedure, Rights and Duties of Patentee, Assignment and license.	3
III	**COPYRIGHTS** Purpose And Function Of Trade Marks, Acquisition Of Trade Mark Rights, Protectable Matter, Selecting And Evaluating Trade Mark, Trade Mark Registration Processes.	3
IV	**TRADEMARKS** Concept of Trademarks -Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) -Non-Registrable Trademarks - Registration of Trademarks.	3
V	**DESIGN AND GEOGRAPHICAL INDICATION** Design: meaning and concept of novel and original -Procedure for registration. Geographical indication: meaning, and difference between GI and trademarks -Procedure for registration.	3

Course Outcome:

CO1: Identify different types of Intellectual Properties (IPs), the right of ownership, scope of protection as well as the ways to create and to extract value from IP.
CO2: Recognize the crucial role of IP in organizations of different industrial sectors for the purposes of product and technology development.
CO3: Identify, apply and assess ownership rights and marketing protection under intellectual property law as applicable to information, ideas, new products and product marketing.
CO4: Identify different types of trademarks and procedure for registration
CO5: Recognize the concept of design, geographical indication and procedure for registration

TEXT BOOKS:

T1- Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.
T2- V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt. Ltd, 2012.

REFERENCE BOOKS:

R1- Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.
R2-Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH6304	Corrosion Science and Engineering	3	0	0	3

Course Objectives

The student should be able to

- Analyze the corrosion principles and engineering methods used to minimize and prevent the corrosion.
- Illustrate the Basic concepts, Definition and importance, electrochemical nature.
- Determine the forms of corrosion, Corrosion rate and its determination.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**CORROSION:** Corrosion - Definition, classification, forms of corrosion, expressions for corrosion rate, emf and galvanic series , merits and demerits, Pourbaix diagram for iron, magnesium and aluminium - Forms of corrosion, Uniform, pitting, intergranular, stress corrosion - Corrosion fatigue - Dezincification - Erosion corrosion - Crevice corrosion - Cause and remedial measures, Pilling Bedworth ratio, High temperature oxidation.	9
II	**BOILERS:** Boiler water corrosion by carbon dioxide and unstable salts - Corrosion prevention methods by treatment cooling water, specification, types of scales and causes, use of antiscalant - Water treatments - Maintenance of boilers - Protection of boilers during off loading, high temperature, corrosion, turbine corrosion - Corrosion inhibitors, principles and practice, inhibitors for acidic neutral and other media - Corrosion failure - Inspection and analysis of corrosion damage.	9
III	**CORROSION TESTING:** Purpose of corrosion testing, classification, susceptibility tests for intergranular corrosion, stress corrosion test, salt spray test, humidity and porosity tests, accelerated weathering tests - ASTM standards for corrosion testing.	9
IV	**POLARIZATION:** Polarization - Exchange current density, Activation polarization, Tafel Equation, Passivating metals and nonpassivating metals, Effect of oxidizing agents.	9
V	**ELECTROLESS PLATING ANDANODISING:** Electroless plating and Anodizing - Cathodic protection, metallic, organic and inorganic coatings, corrosion inhibitors - Special surfacing processes - CVD and PVD processes, sputter coating - Laser and ion implantation, arc spray, plasma spray, flame spray, HVOF.	9
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1- Understand about corrosion and its forms

CO2- Predict about to Protect boiler against corrosion

CO3-Examine various corrosion test and its ASTM standards

CO4- Sketch the Polarization and Effect of oxidizing agents on corrosion

CO5- Illustrate the Corrosion prevention methods and its applications.

TEXT BOOKS:

1. Fontana and Greene., Corrosion Engineering, McGraw Hill Book Co, New York, 1983
2. Raj Narayan ., An Introduction to Metallic Corrosion and its prevention, Oxford and IBH, New Delhi, 1983.

REFERENCE BOOKS:

1. Budinski, K.G., Surface Engineering for Wear Resistance, Prentice Hall Inc., Engelwood Cliff, New Jersey, USA, 1988
2. Uhlig, H.H ., Corrosion and Corrosion Control , John Wiley and Sons, New York, USA, 1985.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO2	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO3	3.0	2.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO4	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
CO5	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
AVG	**3.0**	**2.0**	**2.2**	**2.0**	**2.0**	-	**2.0**	-	**2.0**	-	**2.4**	**2.0**	**3.0**	**2.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL
Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH6302	**ENZYME ENGINEERING**	**3**	**0**	**0**	**3**

Course Objectives

The student should be able to

- Understand the area of Enzyme Engineering with emphasis on reactor operation and design.
- Classify the types of microorganism and isolation methods.
- Analyze the types of Industrial bioreactors.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**TYPES OF MICROORGANISM:** Structure and function of microbial cells. Fundamentals of microbial growth, batch and continuous culture. Isolation and purification of enzymes from cells. Cell and Enzyme Immobilization.	9
II	**FERMENTATION**: Types of mechanisms, Continuous fermentation – aeration and agitation, kinetics of fermentation – Processes	9
III	**INTRODUCTION OF BIOREACTOR DESIGN:** Continuously stirred aerated tank bioreactors. Mixing power correlation. Determination of volumetric mass transfer rate of oxygen from air bubbles and effect of mechanical mixing and aeration on oxygen transfer rate, heat transfer and power.	9
IV	**INTRODUCTION TO BIOCHEMISTRY:** Function and applications. Nature and function of enzyme. Coenzyme / Cofactor. Classification of enzymes. Assay methods and units. Examples of applications of enzymes in industry, analytical technique medicine and Pharmaceuticals.	9
V	**INDUSTRIAL BIOREACTORS** :Utilizing Isolated enzymes and biosensors development and applications. Designs of reactor, Batch and continue type; analysis for immobilized enzyme reactors. Sterile and non sterile operations; reactors in series with and without recycle.	9
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1- Understand the types and structure of different microbial cells, its isolation, purification of enzymes and immobilizing both

CO2- Determine the fermentation operation and its kinetics

CO3- Illustrate the mixing, oxygen transfer methodology into the cells and power requirement for the design of bioreactor

CO4- Estimate the basic biochemistry related to enzymes, its assay techniques and enzyme applications

CO5- Apply the design of bioreactors under batch, continuous mode by the use of isolated enzymes

TEXT BOOKS:

1. Technological Applications of Bio-catalysts, BIOTOL series, Butter worth, 1995.
2. Cornish. A -Bowden, Analysis of Enzyme Kinetic Data, Oxford University Press, 1996.

REFERENCE BOOKS:

1. Wiseman. A and Blakeborough N and Dunnill P, Enzymic and nonenzymic catalysis, Ex. Vol.5 Ellis and Harwood, U.K. (1981).
2. Wiseman A (Ed.), Topics in enzyme and fermentation Bio-technology, Ellis and Harwood, U.K. Vol-5.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO2	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO3	3.0	2.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO4	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
CO5	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
AVG	**3.0**	**2.0**	**2.2**	**2.0**	**2.0**	-	**2.0**	-	**2.0**	-	**2.4**	**2.0**	**3.0**	**2.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL
Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH6303	**FUNDAMENTALS OF NANO SCIENCE**	**3**	**0**	**0**	**3**

Course Objectives

The student should be able to

- Understand the basics of nonmaterial science, preparation method, types and application
- Illustrate the characterization techniques and its application.
- Classify the types of nano materials and its application.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**INTRODUCTION:** Nanoscale Science and Technology- Implications for Physics, Chemistry, Biology and Engineering- Classifications of nanostructured materials-nano particles- quantum dots, nanowires-ultra-thinfilms- multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study (qualitative only).	9
II	**GENERAL METHODS OF PREPARATION:** Bottom-up Synthesis-Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.	9
III	**NANOMATERIALS:** Nanoforms of Carbon - Buckminster fullerene- graphene and carbon nanotube, Single wall carbon Nanotubes (SWCNT) and Multi wall carbon nanotubes (MWCNT)- methods of synthesis(arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications-Nanometal oxides-ZnO, TiO2,MgO, ZrO2, NiO, nanoalumina, CaO, AgTiO2, Ferrites, Nanoclays- functionalization and applications-Quantum wires, Quantum dots-preparation, properties and applications.	9
IV	**CHARACTERIZATION TECHNIQUES:** X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS-Nanoindentation.	9
V	**APPLICATIONS:** NanoInfoTech: Information storage- nanocomputer, molecular switch, super chip, nanocrystal, Nanobiotechlogy: nanoprobes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bioimaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS).	9
	Total Instructional Hours	**45**

Upon completion of the course, students can be able to

Course Outcomes

CO1- Understand the concept of nanoscience, implications of science and mathematics and the fundamental properties

CO2- Determine the process of nanoparticle preparation methods in general

CO3- Examine about the various nonmaterial's preparation, its properties and applications

CO4- Understand about the various characterization techniques for the identification of nano size and structure

CO5- Locate the application of nanotechnology in various fields

TEXT BOOKS:

1. A.S. Edelstein and R.C. Cammearata, eds., "Nanomaterials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nanoscale Charecterisation of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCE BOOKS:

1. G Timp, "Nanotechnology", AIP press/Springer, 1999.
2. Akhlesh Lakhtakia,"The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO2	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO3	3.0	2.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO4	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
CO5	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
AVG	**3.0**	**2.0**	**2.2**	**2.0**	**2.0**	-	**2.0**	-	**2.0**	-	**2.4**	**2.0**	**3.0**	**2.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL
Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH6301	**PETROLEUM EXPLORATION AND EXPLOITATION TECHNIQUES**	**3**	**0**	**0**	**3**

Course Objectives

The student should be able to

- Understand the stages of oil and gas formation, exploration and production.
- Illustrate the methods of exploration and its economic.
- Analyze the geological structure and geologging.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**ORIGIN AND OCCURRENCE OF PETROLEUM AND SEDIMENTRARY ENVIRONMENT:** Origin of oil – Rock cycle - Important factors that control petroleum occurrence – Source, cap and reservoir rocks - Oil bearing rocks - Migration and accumulation - Continental environment – Transitional environment – Marine environment.	9
II	**EXPLORATION METHODS, WELL PROGNOSIS AND ECONOMIC:** Geological exploration methods – Geophysical exploration methods – Geochemical methods - Prognostication – Classification of drilling locations – Economic analysis – Well programme – Geotechnical order.	9
III	**GEOLOGICAL STRUCTURE AND GEOLOGGING:** Various traps and faults – Core Collection Techniques – Sample logging, Drilling time logging, Mud/Gas/Oil logging – Formation Evaluation Techniques using wire line well logging include – Spontaneous pontential logging, Natural Gamma Ray Logging, Caliber Logging, Formation Density Logging, Neutron Porosity logging, Sonic velocity Logging, Electrical Resistance Logging, etc.	9
IV	**DRILLING FLUIDS AND WORK COMPLETION:** Drilling Technology - Drilling Fluids: Function, composition, and classification – Packer fluid – Casing packs – Cementing – Various well completion methods – Various stimulation methods.	9
V	**OFF – SHORE TECHNOLOGY:** Seismic technology – Sniffer survey – Drilling technology – Off-shore rigs – Primary, secondary and enhanced oil recovery techniques and methods – Major well complication and Remedies.	9
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1- Determine the origin and occurrence of petroleum

CO2- Examine the various exploration methods and economic analysis of exploration

CO3- Illustrate the process of various logging based on various geological structure

CO4- Understand the process of drilling for well completion and different stimulation methods

CO5- Sketch the process various off-shore technology oil recovery techniques

TEXT BOOKS:

1. Bhagwan Sahay "Petroleum Exploration and Exploitation Practices" Allied Publishers Ltd., Chennai, 1994.
2. Richard Dawe, "Modern Petroleum Technology", Vol.I, Upstream, 6th Edition, John and Wiley Sons Ltd, 2000.

REFERENCE BOOKS:

1. Howard B. Bradley, "Petroleum Engineering Handbook", Society of Petroleum Engineers, 1987.
2. Norman J. Hyne., "Nontechnical Guide to Petroleum Geology, Exploration, Drilling and Production", 2nd Edition, Pennwell Books, 2001.
3. Shay B., "Wellsite Geological Techniques for Petroleum Exploration" Allied Publishers Ltd., 1991.

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL • HINDUSTHAN COLLEGE OF ENGG & TECH • Chairman

Dean (Academics)
HiCET

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO2	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO3	3.0	2.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO4	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
CO5	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
AVG	**3.0**	**2.0**	**2.2**	**2.0**	**2.0**	-	**2.0**	-	**2.0**	-	**2.4**	**2.0**	**3.0**	**2.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL
Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH6305	**PIPING AND INSTRUMENTATION**	**3**	**0**	**0**	**3**

Course Objectives

The student should be able to

- Impart knowledge on piping technology and instrumentation on pipelines
- Classify the different types of support based on requirement.
- Sketch the plan for different types of fluid storage

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**FUNDAMENTALS OF PIPING ENGINEERING:** Definitions, Piping Components their introduction, applications. Piping MOC, Budget Codes and Standards, Fabrication and Installations of piping.	9
II	**PIPE HYDRAULICS AND SIZING:** Pipe sizing based on velocity and pressure drop consideration cost, least annual cost approach, pipe drawing basics, development of piping general arrangement drawing, dimensions and drawing of piping.	9
III	**PLOT PLAN:** Development of plot plan for different types of fluid storage, equipment layout, process piping layout, utility piping layout. Stress analysis - Different types of stresses and its impact on piping, methods of calculation, dynamic analysis, flexibility analysis.	9
IV	**PIPING SUPPORT:** Different types of support based on requirement and its calculation.	9
V	**INSTRUMENTATION:** Final Control Elements; measuring devices, instrumentation symbols introduction to process flow diagram (PFD) and piping & instrumentation diagram (P&ID).	9
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1- Understand about the basic piping engineering, its standards and installations

CO2- Illustrate the drawing, sizing and hydraulics study of pipe

CO3- Examine about the development of pipe layout, plot plan and equipment layout and its dynamic analysis

CO4- Determine the different types of piping support for various requirements

CO5- Understand about the process and instrumentation diagram and cost elements

TEXT BOOKS:

1. Piping Handbook, 6 th edition, M.L. Nayyar, P.E., Mc Graw-Hill, Inc.
2. Piping Design Handbook edited by Johan J McKetta, CRC Press, 1992.

REFERENCE BOOKS:

1. Luyben, W. L.," Process Modeling Simulation and Control for Chemical Engineers, McGraw Hill, 1990.

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL • HINDUSTHAN COLLEGE OF ENGG & TECH • Chairman

Dean (Academics)
HiCET

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO2	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO3	3.0	2.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO4	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
CO5	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
AVG	**3.0**	**2.0**	**2.2**	**2.0**	**2.0**	-	**2.0**	-	**2.0**	-	**2.4**	**2.0**	**3.0**	**2.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL
Chairman

Programme	Course code	Name of the course	L	T	P	C
B.TECH.	19CH6306	SUGAR TECHNOLOGY	3	0	0	3

The student should be able to

Course Objective

Examine the various technology in sugar production and have knowledge on unit operation in sugar industries

Identify the various unit operation in sugar industries

Analyze the various Analytical methods used in Sugar Industry.

Unit	DESCRIPTION	Instructional Hours
I	**INTRODUCTION** Sugar industry in India. Chemical and Physical properties of Sucrose and reducing sugars. Source for Sucrose. Formation of sucrose plants. Non sugar compounds of sugar cane. Inorganic constituents of sugar cane juices and sugars. Analytical methods used in Sugar Industry.	9
II	**PURIFICATION** Chemical technology of the purification processes. Fundamental reactions and physical chemistry aspects of clarification. Liming, sulphitation and carbonation processes. Filtration of sugar juice.	9
III	**EVAPORATION** Evaporation of sugar juice. Heat transfer in evaporators. Evaporation equipment and auxiliaries. Methods of obtaining steam and quality of steam. Steam economy. Chemistry of the evaporation process. Scale formation and cleaning of evaporators.	9
IV	**CRYSTALLIZATION** Solubility of sucrose. Solubility of sucrose - nucleation in super saturated solutions - kinetics and growth of crystallization. Chemistry of crystallization. Control methods and equipment in sugar crystallization; Technology of sugar crystallization. Evaporation and circulation in vacuum pans.	9
V	**CENTRIFUGATION** Theory of the centrifugal processes. Centrifugal operation. Engineering principles of sugar centrifugals and the centrifugal process. Centrifugal equipment and auxiliaries. Production of final molasses and its utilizations. Grading of sugar.	9
	Total Instructional Hours	45

Course Outcome

CO1 Understand about the sugar industries and analytical methods

CO2 Examine the purification methods

CO3 Determine the evaporation technique in sugar juice processing

CO4 Illustrate the crystallization technique in sugar juice processing

CO5 Remember the centrifugation technique in sugar juice processing

TEXT BOOK:

T1 Honig P., Principles of Sugar Technology, Vol.1,2 and 3, Elsevier Publishing Company, 1953.

T2 Van der Poel P.W., Schwartz T.K., Schiweck H.M., Sugar Technology [Beet and Cane Sugar Manufacture], Beet Sugar

REFERENCES:

R1 Payne J.H., Sugarcane factory Analytical control, Fifth Edition, Elsevier Publisher, London, 1968.

R2 Jenkins G.H., Introduction to Sugarcane technology, Elsevier Publisher, London, 1966

R3 Hoing P., Principle of Sugar Cane Technology, Elsevier Publisher, London.

Chairman - BoS
CHE - HiCET

Chairman

Dean (Academics)
HiCET

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO2	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO3	3.0	2.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO4	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
CO5	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
AVG	**3.0**	**2.0**	**2.2**	**2.0**	**2.0**	-	**2.0**	-	**2.0**	-	**2.4**	**2.0**	**3.0**	**2.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL
Chairman

Programme	Course Code	Name of the Course	L	T	P	C
B.Tech	19CH6401	**WASTE TO ENERGY CONVERSION**	**3**	**0**	**0**	**3**

Course Objectives

The student should be able to

- Produce energy by experimenting with different types of wastes through thermal, biological and chemical routes.
- Apply the current thoughts and newer technology options along with their advances in the field of the utilization of different types of wastes for energy production.
- Develop the process of biofuel production using microalgae.

UNIT	DESCRIPTION	INSTRUCTIONAL HOURS
I	**Introduction:** Introduction to waste to energy conversion, characterization of wastes, Energy production form wastes through incineration, energy production through gasification of wastes	9
II	**Pyrolysis:** Energy production through pyrolysis and gasification of wastes, syngas utilization.	9
III	**Densification of biomass and waste plastic blends**: Densification of solids, efficiency improvement of power plant and energy production from waste plastics, Energy production form wastes Plastic, gas cleanup.	9
IV	**Energy production from waste:** Energy production from organic wastes through anaerobic digestion and fermentation, introduction to microbial fuel cells	9
V	**Cultivation of microalgae for biofuel production:** Energy production from wastes through fermentation and trans esterification, Cultivation of algal biomass from wastewater and energy production from algae.	9
	Total Instructional Hours	**45**

Course Outcomes

Upon completion of the course, students can be able to

CO1- Understand to characterize the waste.

CO2- Illustrate the pyrolysis and gasification process for energy production.

CO3- Examine the process of energy production from plastics.

CO4- Understand about the energy production from organic waste.

CO5- Calculate the Energy production from wastes through fermentation and trans esterification.

TEXT BOOKS:

1. Ashok K. Rathoure, Zero Waste: Management Practices for Environmental Sustainability, CRC Press, 2019, 1st Edition.
2. M. Habibur Rahman, Abdullah Al-Muyeed, Solid and Hazardous Waste Management, ITN-BUET, 2010

REFERENCES BOOKS:

1. George Tchobanoglous , Frank Kreith Handbook of Solid Waste Management, McGRAW-HILL, 2002.
2. N Klinghoffer, M Castaldi, Waste to Energy Conversion Technology, Woodhead Publishing, 2013.

Chairman - BoS
CHE - HiCET

ACADEMIC COUNCIL Chairman KARPAGAM COLLEGE OF ENGG & TECH

Dean (Academics)
HiCET

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO2	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO3	3.0	2.0	3.0	2.0	2.0	-	2.0	-	2.0	-	2.0	2.0	3.0	2.0
CO4	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
CO5	3.0	2.0	2.0	2.0	2.0	-	2.0	-	2.0	-	3.0	2.0	3.0	2.0
AVG	**3.0**	**2.0**	**2.2**	**2.0**	**2.0**	-	**2.0**	-	**2.0**	-	**2.4**	**2.0**	**3.0**	**2.0**

Chairman - BoS
CHE - HiCET

Dean (Academics)
HiCET

ACADEMIC COUNCIL
Chairman