HINDUSTHAN EDUCATIONAL AND CHARITABLE TRUST

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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**

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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.

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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**	-	-

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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.

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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**

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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

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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**	-	-	-	-	-	-	-

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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).

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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**	-	-

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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.

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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**

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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.

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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.

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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.

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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**	-	-

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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.

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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**

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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.

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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**

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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.

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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**

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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

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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**	-	-	-	-	-	-	-

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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.

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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.

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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.

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