SDM College of Engineering and Technology, Dharwad
Department of Chemical Engineering

New courses introduced in 2018 scheme year wise

	2018 Scheme for 2019-20	2018 Scheme for 2020-21	2018 Scheme for 2021-22
New Courses	Introductory Project	Drug and Pharmaceuticals Technology	Advance Bioprocess Engineering
	-	Advance waste water treatment	Green Technology
		Biology for Engineers	Environmental Impact Assessment
		Air Pollution and Control Engineering	Nanotechnology
		Soft Skill and Aptitude	Internship
Total Course	**1/60**	**5/63**	**5/64**
Percentage	**1.66**	**7.93**	**7.81**

H.O.D.
Department of Chemical Engineering
SDM College of Engg & Technology,
Dharwad-580 002

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18UCHE804	Advance Bioprocess Engineering	(3-0-0)3

Contact Hours: 39

Course Learning Objectives (CLOs):

1. To provide the students with the basics of bioreactor engineering.
2. To develop bioengineering skills for the production of biochemical product using integrated biochemical processes.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1,12)/ PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Select appropriate bioreactor configurations and operation modes based upon the nature of bioproducts and cell lines and other process criteria.	-	3, 7	2
CO-2	Design and analyse the scale up criteria for the different bioreactors.	5	2, 3, 7	-
CO-3	Understand the enzyme kinetics and design the immobilized enzyme bioreactors.	13	3, 7	-
CO-4	Apply modeling and simulation of bioprocesses so as to reduce costs and to enhance the quality of products and systems.	5	3, 7	-
CO-5	Identify the different cell cultivation system to apply in the different bioreactors.	13	3, 7	-

POs/PSOs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-13	PSO-14	PSO-15
Mapping Level	-	1.5	2.0	-	3.0	-	2.0	-	-	-	-	-	3.0	-	

Course content:

Unit-I

Operational Modes of Bioreactors: Fed batch cultivation, Cell recycle cultivation, Cell recycle cultivation in waste water treatment, two stage cultivation. Packed bed reactor, airlift reactor, fluidized bed reactor and bubble column reactor. **08 Hrs**.

Unit-II

Bioreactor Scale-Up: Regime analysis of bioreactor processes, oxygen mass transfer in bioreactors microbial oxygen demands; methods for the determination of mass transfer coefficients; mass transfer correlations. Scale up criteria for bioreactors based on oxygen transfer, power consumption and impeller tip speed. **08 Hrs.**

Unit-III

Bioreactor Consideration in Enzyme Systems: Analysis of film and pore diffusion effects on kinetics of immobilized enzyme reactions; formulation of dimensionless groups and calculation of effectiveness factors. Design of immobilized enzyme reactors – packed bed, fluidized bed and membrane reactors. **08 Hrs.**

Unit-IV

Modeling and Simulation of Bioprocesses: Study of structured models for analysis of various bioprocess – compartmental models, models of cellular energetic and metabolism, single cell models, plasmid replication and plasmid stability model. Dynamic simulation of batch, fed batch, steady and transient culture metabolism.

08 Hrs.

Unit-V

Recombinant Cell Cultivation: Different host vector system for recombinant cell cultivation strategies and advantages. E.coli, yeast Pichia pastoris/ Saccharomyces cereviseae, Animal cell cultivation, plant cell cultivation, Insect cell cultivation. High cell density cultivation, process strategies, reactor considerations in the above system.

07 Hrs.

Reference Books:

1) Jens Nielson, John Villadsen and Gunnar Liden, "Bioreaction engineering principles", 2/e, Kulwer Academic, 2002
2) Harvey W. Blanch, Douglas S. Clark, Biochemical Engineering, 2/e, CRC press, London. 1995.
3) James E. Bailey and David F. Ollis, "Biochemical Engineering Fundamentals", 2/e, McGraw Hill. Singapore. 1986
4) Atkinson, B, Mavituna, F, "Biochemical Engineering and Biotechnology Handbook" 2/e, Macmillan Publishers Ltd, New York, 1992.

18UCHO807 Green Technology (3-0-0) 3

Contact Hours: 39

Course Learning Objective (CLO):

1. To understand the principles and concepts of green technology with laws and standards.
2. To illustarte and demonstarte the tool and design of environmnetal freidnly technology.

Course Outcomes (COs) :

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1,12)/ PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Illustrate environment laws, carbon credits, ISO 14000 series	14	2	1
CO-2	Comprehend the principles of green chemistry.	-	2	1
CO-3	Summarize the importance of green technology in sustainable development	7, 14	-	-
CO-4	Apply and compare the tools of green technology and life cycle assessment.	7	-	1
CO-5	Conduct pollution prevention planning and develop the environment friendly design.	7	-	1

POs/PSOs	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO -13	PSO -14	PSO -15
Mapping Level	1	2	-	-	-	-	3	-	-	-	-	-	-	3	-

Course content:

Unit I

Introduction: Green chemistry and technology for sustainable development, Environmental laws, carbon credits, environmental management system standards- ISO 14000 series. **08 Hrs.**

Unit II

Green Chemistry: Principles of Green Chemistry, Atom efficiency, Energy conservation, Waste minimization, Substitution. **08 Hrs.**

Unit III

Life-Cycle Assessment: History, Process, Methodology, Streamlining and Application. **08 Hrs.**

Unit IV

Pollution prevention planning: Structure of the pollution prevention process, Environmental Audits, toxic release inventory. **08 Hrs.**

Unit V

Design for the environment and improvement in manufacturing operations, design for disassembly/DE manufacturing, Packaging, case studies. **07 Hrs.**

Reference Books:

1) Paul L. Bishop, Pollution Prevention: Fundamentals and Practice, McGraw Hill, 2000.
2) Anastas P.T., Warner J.C., Green Chemistry: Theory and Practice. Oxford Science Publications, Oxford, 1998.
3) Mike Lancaster, Green Chemistry- An Introductory Text, Royal Society of Chemistry Publishing, 2010 55
4) Boyle, Godfrey, Bob Everett, Janet Ramage, Energy Systems and Sustainability: Power for a Sustainable Future, Oxford University Press, 2004.

18UCHO808 Environmental Impact Assessment (3-0-0) 3

Contact Hours: 39

Course Learning Objective (CLO):

1. To understand the various aspects of Environment Impact Assessment methodologies and impact of development activities.
2. To study the Impact assessment on surface water, air and biological Environment.

Course Outcomes (COs) :

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1,12)/ PSOs (13-15)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Identify the environmental attributes to be considered for the EIA study	6	2	1
CO-2	Prepare the audit report of the EIA	6, 14	-	1
CO-3	Identify the suitable methodology and prepare Rapid EIA.	7, 14	2	1

CO-4	Indentify and incorporate mitigation measures of impact studies	6, 7, 14	-	1
CO-5	Formulate assessment report of impact studies on water and air	7, 14	2	1

POs/PSOs	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO -13	PSO -14	PSO -15
Mapping Level	1	2	-	-	-	3	3	-	-	-	-	-	-	3	-

Course content:

Unit - I

Basic concept of EIA : Objectives of EIA, Initial environmental Examination, Elements of EIA, - factors affecting EIA Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters. Types of EIA, Various types of Environmental Impacts: Direct Impacts, Indirect Impacts, Cumulative Impacts, Induced Impacts, EIA Methodologies: introduction, Criteria for the selection of EIA Methodology, EIA methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods, cost/benefit Analysis. **08 Hrs**.

Unit- II

Environmental Audit and Environmental legislation: Objectives of Environmental Audit, Types of environmental Audit, Audit protocel, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report, Post Audit activities. Related environmental legislation **08 Hrs**.

Unit- III

Creation of EIA Data Base, Compilation, Environmental Inventory: Baseline Data Generation, Environmental Monitoring Networking Design (EMND), Monitoring Stations, Data Products and Sources, Impact Identification (II) Methodologies, Interaction-Matrix Methods, Use of the Leopold Matrix, Checklist Methodologies: Simple Checklists, Descriptive Checklists, Uses of Checklists, Network Methodologies. **08 Hrs**.

Unit – IV

Impact Assessment: Assessment of impact of development activities on Vegetation and wildlife, environmental Impact of Deforestation, Soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures. **08 Hrs**.

Unit - V

Case studies: Impact Assessment, Significance and Assessment of the Impacts, Impact Mitigation Measures, Impacts on Water Environment, air environment. Case studies and preparation of Environmental Impact assessment statement for various Industries. **07 Hrs**

Reference Books:

1) R.R. Barthwal., "Environmental Impact Assessment" New Age International Publications. 2012.
2) Canter, L,W., "Environmental Impact Assessment", McGraw Hills New York, 1977.
3) M. Anji Reddy, "Environmental Impact Assessment: Theory and Practice", BS Publications.
4) N.S.Raman , A.R. Gajbhiye, S.R. Khandeshwar Environmental Impact Assessment" 1/e, IK International publishing Ltd., 2014
5) Bhatia, H. S. - Environmental Pollution and Control, Galgotia Publication (P) Ltd, Delhi.

18UCHO710	Nanotechnology	(3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

1. To provide students with the knowledge of techniques used for synthesis and surfacemodification of nanomaterials.
2. To understand the structural, morphological, and surface composition of nanomaterials and their applications.

Course Outcomes (COs) :

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1,12)/ PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Describe the fundamentals of nanoscience and nanotechnology	-	2	1
CO-2	Analyze physical and chemical methods used for synthesis and processing of nanomaterials	13	2	1
CO-3	Compare and select suitable techniques for characterization of a given nanomaterial	1	2	-
CO-4	Use different techniques to process different types of nanocomposites and know the limitations of each process	1, 13	2	5
CO-5	Learn the importance and applications of Nanotechnology in chemical industries	-	7	6

POs/PSOs	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO -13	PSO -14	PSO -15
Mapping Level	2	2	-	-	1	1	1	-	-	-	-	-	3	-	-

Course Content:

Unit-I

Introduction to Nanotechnology: Nanomaterials and its classification, Zero dimensional, one-dimensional and two dimensional nanostructure materials - classification of solids: conductor, semiconductors, insulator, types of semiconductor, doping, diodes, current flow in semiconductors, ceramics and nanocomposites, Properties of individual nanoparticles, Methods of synthesis, Reactivity of nanoparticles. **7 Hrs.**

Unit-II

Methods of Synthesis of Nanomaterials: Ball Milling, physical and chemical vapour deposition methods and Electro deposition, Solution based Synthesis of Nanoparticles, Inert gas condensation, Arc discharge, RF plasma, Plasma arc technique, Ion sputtering, Laser ablation, Laser pyrolysis and Molecular beam epitaxy, co-precipitation, sol-gel method, chemical reduction,photochemical synthesis, electrochemical synthesis,Spray pyrolysis method, flame spray pyrolysis, gas phasesynthesis. **8 Hrs.**

Unit-III

Characterization Techniques: Optical Microscopy, Electron Microscopy, Secondary electron scattering, back scattering, Scanning Probe Microscopes, Focussed Ion Beam Technique, X-ray imaging, Transmission Electron Microscope (TEM), Scanning Probe Microscope (SPM)- Atomic Force Microscope (AFM), Scanning Tunneling Microscope

(STM), UV-VIS Spectrophotometers, IR/FTIR Spectrophotometers, and Raman spectroscopy. **8 Hrs.**

Unit-IV

Nanocomposites and their Applications: Need for composite materials. Classification of composites; Matrix: Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC); Reinforcement: particle reinforced composites, Fibre reinforced composites. Applications of composites. Fibre production techniques for glass, carbon and ceramic fibres. **8 Hrs.**

Unit-V

Nanomaterials For Chemical Industry: Nanocatalysts, Smart materials, Heterogenous nanostructures andcomposites, Nanoparticles for water purification-Photocatalytic mechanism, general pathways and kinetics-Treatment of Arsenic, Removal of Heavy metal ions by Iron andpolymeric based nanoparticles, Magnetic Nanoparticles, Nanoscalecarbon for contaminant separation -Nanostructures for Molecularrecognition (Quantum dots, Nanorods, Nanotubes), MolecularEncapsulation and its applications – Nanoporous zeolites, Self assembled Nanoreactors. **8 Hrs.**

Reference Books:

1) M. H. Fulekar, "Nanotechnology importance and applications", I. K. International Publishing House Pvt. Ltd., New Delhi, 2013.
2) Manasi Karkare, "Nanotechnology, Fundamentals and Applications", I.K. International Publishing, New Delhi, 2008.
3) Jr. Poole, P. Charles and J. W. Frank, "Introduction to nanotechnology", John Wiley & Sons, 2003.
4) G. Cao, "Naostructures and Nanomaterials: Synthesis, properties and applications",Imperical College Press, 2004.
5) C. C. Koch, "Nanostructured Materials: Processing, Properties and Applications", 2/e 2007.

18UCHL704 Internship (4 Weeks) 2

Contact Hours: 30

Course Learning Objective (CLO):

1. The purpose of internship is student should be able to learn how to apply the knowledge acquired during internships in his future workplace.
2. The student should demonstrate to work in the interdisplinary approach and in a team with good communication skills.

Course Outcomes (COs):

Description of the course outcome: At the end of the course student will be able to		**Mapping to POs (1-12)/PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Analyze and gain knowledge on the recent developments in the area of chemical and allied engineering and integrate his theoretical knowledge with practical processes.	13, 15	11, 12	4, 6, 7
CO-2	Enhance his communication skills to work in interdisciplinary teams in industry.	9, 10	-	-
CO-3	Realize professional and ethical	6, 7, 8	11, 12	-

	responsibility to work in a team and project management.			

POs/PSOs	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO -13	PSO -14	PSO -15
Mapping Level	-	-	-	1	-	2	2	3	3	3	2	2	3	-	3

Internship: The students are to undergo internship in Private industries/R&D organizations/Centres of Excellence/Laboratories of Reputed Institutions/Govt. & Semi Govt. organizations, PSUs, construction companies, entrepreneurial organizations, inter departments within the college etc. to get en exposure to the external world for a period of 4 weeks in the summer vacation after VI sem and before start of VII semester. The students are to prepare a report on the internship work carried out. The internal faculty shall monitor the student and award CIE marks. There is a SEE in which the student shall present his work before a panel of examiners consisting of HoD, Guide and one faculty member during VII semester. The performance shall be communicated to the CoE office and the same shall reflect in the VII semester grade card.

18UCHE609 Drug and Pharmaceutical Technology (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

1. To provide students with the basics of drug and pharma technology and develop the skills for understanding the constituents of drug and its production.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1,12)/ PSO (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Develop nomenclature for upcoming drugs and gain knowledge of therapeutic agents to be used for treatment.	1	-	14
CO-2	Estimate the pharmacokinetic parameters and analyze the transformation of drugs in the body.	14	2, 7	-
CO-3	Employ standards of hygiene in the manufacturing processes of drugs and pharmaceuticals.	14	2, 7	-
CO-4	Examine the constituents present in pharmaceutical and microbiological products.	14	2, 7	-
CO-5	Formulate drug delivery systems to transport pharmaceutical agents in the body to achieve therapeutic effect.	14	2, 7	-

POs/PSOs	**PO -1**	**PO -2**	**PO -3**	**PO -4**	**PO -5**	**PO -6**	**PO -7**	**PO -8**	**PO -9**	**PO -10**	**PO -11**	**PO -12**	**PSO -13**	**PSO -14**	**PSO -15**
Mapping Level	3.0	2.0	-	-	-	-	2.0	-	-	-	-	-	-	2.6	-

Course content:

Unit-I

Introduction: Development, sources, and characteristics of drugs; Important terms used in chemistry of drugs- Medicinal Chemistry, Pharmacology, Pharmacophore, Gram positive and negative bacteria, virus, fungi; Classification and nomenclature of drugs. **07 Hrs**

Unit-II

Pharmacokinetics and Pharmacodynamics: Physico - chemical principles; Pharmacokinetics - Absorption Distribution, Metabolism and Excretion of Drugs; Bioavailability measurement - Plasma level-time and Urinary excretion studies; Basic Pharmacodynamics. **08 Hrs**

Unit-III

Manufacturing Principles: Compressed tablets and coating, Wet granulation, Dry granulation or Slugging, Capsules, Parenteral solutions, Oral liquids, Ointments, Good Manufacturing Practice as per Drugs and Cosmetics Act. **08 Hrs**

Unit-IV

Pharmaceuticals, Microbiological Products: Laxatives, Radiopharmaceuticals, Cardiovascular agents, Central Nervous System stimulants, External Antiseptics, Analgesics, Antacids, Antibiotics, Antineoplastic drugs, Antidiabetic drugs, Hormones, Vitamins.**08 Hrs**

Unit-V

Drug Delivery: Transdermal drug delivery, Polymers in drug delivery, Liposomal drug delivery, Nano drug delivery, Opthalmic drug delivery, Design of Controlled Drug Delivery Systems. **08 Hrs**

Reference Books:

1) G. R. Chatwal. "Synthetic Drugs". 2/e. Himalaya Publishing House, Delhi, 2009. ISBN: 978-93-5097-253-3.
2) D. M. Brahmankar and S. B. Jaiswal. "Biopharmaceutics and Pharmacokinetics - A Treatise", Vallabh Prakashan, New Delhi. 2015.
3) Felton, Linda A., Remington: "Essentials of Pharmaceutics", College of Pharmacy, Philadelphia, 1/e. Pharmaceutical Press. 2013.
4) Juergen Siepmann, Ronald A. Siegel, Michael J. Rathbone, "Fundamentals and Applications of Controlled Release Drug Delivery", Springer New York, 2011.
5) L. Lachman, Lieberman H.A. and Kanig J.L., ""he Theory and Practice of Industrial Pharmacy", 3/e. Indian Edition, Varghese Publishing House, Mumbai, 2013.

18UCHO612 Advanced Waste Water Treatment (3-0-0) 3

Contact Hours: 39

Course Learning Objectives (CLOs):

1. To create awareness on the water pollution aspects and understand the kinetics and the designing system of the plant.
2. To understand the different parameters, treatment methods and control techniques of water pollution.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		Mapping to POs (1,12)/ PSO (13-15)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Cognize the different characteristics of waste water and regulatory standards with basic design criteria for waste water treatment	-	14	3, 6, 7
CO-2	Comprehend the reaction kinetics, reactor selection and its process analysis.	13, 14	3, 6, 7	5
CO-3	Design and operational concepts of secondary treatment systems	13, 14	3, 6, 7	-
CO-4	Design and operational concepts of tertiary treatment systems	13, 14	3, 6, 7	-
CO-5	Learn the wastewater treatment criteria based on the regional requirement to understand the sewage management of the city.	3, 6, 7	14, 15	-

POs/PSOs	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-13	PSO-14	PSO-15
Mapping Level	-	-	2.0	-	-	2.0	2.0	-	-	-	-	-	3.0	2.6	2.0

Course content:

Unit-I

Introduction of Wastewater Treatment: Flow measurements and Composition. Characterization -properties and analysis of wastewater. Rural wastewater systems: waste treatability studies-a bench scale and pilot scale. Effluent standards for discharge to water bodies and land applications- state and central. Theoretical principles and design considerations - screens, equalization basin, grit chamber, primary and secondary settling tanks. **07 Hrs.**

Unit-II

Microbiology of Waste Treatment: Growth and inhibition of bacteria. Kinetics of Biological growth Batch culture substrate limited growth, Cell growth and substrate utilization. Effects of endogenous metabolism and kinetics Monod's and Michaclismenton kinetics and their applications. Determination of biokinetic constants in batch and continuous system. **08 Hrs.**

Unit-III

Secondary Waste Water Treatment: Aerobic, anaerobic, suspended and attached growth systems. Activated sludge process standard type and modifications. Aerators. Trickling filter, Aerated lagoon, Stabilization ponds, bio-towers, RBC. Treatment disposal of sludge- Sludge characteristics, Concentration. Anaerobic sludge digestion. Aerobic Sludge digestion, Sludge conditioning, Dewatering and drying. Incineration and wet oxidation. Reactor configurations. Case studies. **08 Hrs.**

Unit-IV

Tertiary Waste Water Treatment: Introduction, Need of Tertiary Waste Water Treatment, Purpose of Advanced Waste Water Treatment. Nitrogen and Phosphorus Nitrogen Removal: Nitrification, Denitrification Simultaneous nitrification and denitrification Phosphorus Removal. Membrane Bioreactor with Membrane Module Submerged in the Bioreactor.

Electro-coagulation, Electro dialysis, Reverse osmosis, Ion exchange, Adsorption, absorption, Evaporators. Case studies. **08 Hrs.**

Unit-V

Sewage Treatment and Disposal: Introduction, importance of sewage, Characteristics of sewage, Sampling and analysis of sewage, Sewage treatment and disposal: Skimming, Grit chamber, Sedimentation tanks, Septic tank, Secondary treatment-types of filters, rate of filter loading, Activated sludge process, sludge digestition, Sludge disposal. **08 Hrs.**

Reference Books:

1) Metcalf and Eddy. "Waste water Engineering: Treatment and Reuse". McGrew Hill Publication. ISBN-10: 9780070495395. 4/e. 2017
2) A. F. Gaudy and E. T. Gaudy. "Microbiological for environmental Scientist and engineers" McGraw Hill 1/e. 1980.
3) T. McGhee. "Water Supply and Sewerage", McGraw Hill. 6/e. 1991. ISBN-10: 0070609381
4) G. S. Bridie and J.S. Brides. "Water Supply and Sanitary Engineering".Dhanpat Rai & Sons 2010. ISBN-10: 8187433795.

18UCHO613 Biology for Engineers (3-0-0)3

Contact Hours: 39

Course Learning Objective (CLO):

1. Gain vivid knowledge in the fundamentals and uses of biology, human system and plant system

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1,12)/ PSO (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Describe the fundamentals of living things.	1	-	12
CO-2	Apply the concept of plant, animal and microbial systems and growth in real life systems.	13	2,3	1
CO-3	Comprehend genetic and the immune system	-	4	5
CO-4	Analyze the cause of symptoms, diagnosis and treatment of common diseases.	2	12	6
CO-5	Illustrate the application of biology system in relative industries.	1,2	3	13

POs/PSOs	**PO -1**	**PO -2**	**PO -3**	**PO -4**	**PO -5**	**PO -6**	**PO -7**	**PO -8**	**PO -9**	**PO -10**	**PO -11**	**PO -12**	**PSO -13**	**PSO -14**	**PSO -15**
Mapping Level	2.33	2.66	2.0	2.0	1.0	1.0	-	-	-	-	-	1.5	2.0	-	-

Course Content:

Unit-I

Introduction to Life: Characteristics of living organisms-Basic classification-cell theory-structure of prokaryotic and eukaryotic cell-Introduction to biomolecules: definition-general

classification and important functions of carbohydrates-lipids-proteins-nucleic acids vitamins and enzymes-genes and chromosome. **07Hrs.**

Unit-II

Biodiversity: Plant System: basic concepts of plant growth-nutrition-photosynthesis and nitrogen fixation-Animal System: elementary study of digestive-respiratory-circulatory-excretory systems and their functions-Microbial System: history-types of microbes-economic importance and control of microbes. **07 Hrs.**

Unit-III

Genetics and Immune System: Evolution: theories of evolution-Mendel'scell division–mitosis and meiosis-evidence of laws of inheritance-variation and speciation- nucleic acids as a genetic material-central dogma immunity-antigens-antibody-immune response. **08 Hrs.**

Unit-IV

Human Diseases: Definition- causes, symptoms, diagnosis, treatment and prevention of diabetes, cancer, hypertension, influenza, AIDS, Hepatitis and COVID-19 **08 Hrs.**

Unit-V

Biology and Its Industrial Applications: Transgenic plants and animals-stem cell and tissue engineering-bioreactors-biopharming-recombinant vaccines-cloning-drug discovery-biological neural networks-bioremediation-biofertilizer-biocontrol- biofilters-biosensors-biopolymers- bioenergy- biomaterials-biochips-basic biomedical instrumentation **09 Hrs.**

Reference Books:

1) Biology for Engineers: As per Latest AICTE Curriculum Wiley Editorial, ISBN: 9788126576340.
2) A Text book of Biotechnology, R.C.Dubey, S. Chand Higher Academic Publications, 2013
3) Diseases of the Human Body, Carol D. Tamparo and Marcia A. Lewis, F.A. Davis Company, 2011.
4) Biomedical instrumentation, Technology and applications, R. Khandpur, McGraw Hill Professional, 2004

18UCHE510 Air Pollution and Control Engineering (3-0-0)3

Contact Hours: 39

Course Learning Objectives (CLOs):

1. To understand the knowledge on the concepts of air pollution and its emerging trends.
2. To understand and deal with sampling and analysis, design of control of air pollution and modeling approaches.

Course Outcomes (COs):

Description of the Course Outcome: At the end of the course the student will be able to:		**Mapping to POs (1-12)/ PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Understand the basics of air pollution, legislation and its impact	6	7	3
CO-2	Comprehend the monitoring, meteorology and modelling of air pollution.	3, 5	-	14
CO-3	Design the control systems for particulate	3	-	14

	emissions.			
CO-4	Design the control systems for gaseous emissions.	3	-	14
CO-5	Explain the vehicular emission and its control system, indoor air pollution and typical control system of any industry.	3	7	6

POs/PSOs	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO -13	PSO -14	PSO -15
Mapping Level	-	-	2.6	-	3.0	2.0	2.0	-	-	-	-	-	-	1.0	-

Course content:

Unit-I

Introduction: Structure and composition of Atmosphere. History of Air pollution and episodes. Causes of air pollution and types. Sources and classification of air pollutants. Effects of air pollutants on human health, vegetation and animals, Materials and Structures. Effects of air Pollutants on the atmosphere, Soil and Water bodies. Long- term effects on the planet, Global Climate Change, Ozone Holes. Ambient Air Quality and Emission Standards and air quality legislations. Air Pollution Indices – Emission Inventions. **07 Hrs.**

Unit-II

Air Pollution Monitoring, Meteorology and Modeling: Air Sampling and monitoring methods. Physico chemical processes governing the spread of pollutants from point, non-point, line, and area sources. Generation, transport and decay of air pollutants. Introduction to meteorology toxicology and transport of air pollution. Ambient and Stack Sampling and Analysis of Particulate and Gaseous Pollutants. Effects of meteorology on Air Pollution - Fundamentals, Atmospheric stability, Inversion, Wind profiles and stack plume patterns- Transport and Dispersion of Air Pollutants - Modeling Techniques – Mathematical Modeling of dynamics of pollutants. Different dispersion models. **08 Hrs.**

Unit-III

Control of Particulate Contaminants: Factors affecting Selection of Control Equipment - Gas Particle Interaction, Working principle, Design and performance equations of Gravity Separators, cyclones, Fabric filters, Particulate Scrubbers, Electrostatic Precipitators - Operational Considerations - Process Control and Monitoring - Costing of APC equipment - Case studies for stationary and mobile sources. **08 Hrs.**

Unit-IV

Control of Gaseous Contaminants: Control Equipment, Factors affecting Selection of Control Equipment - Working principle, Design operation and performance of absorption, Adsorption, condensation, Incineration, Bio scrubbers, Bio filters - Process control and Monitoring - Operational Considerations - Costing of APC Equipment - Case studies for stationary and mobile sources. **08 Hrs.**

Unit-V

Automobile, Noise and Indoor Pollution: Vehicular Pollution: Types of emissions- Exhaust emissions, evaporative emissions, crank-case emissions. Prevention and control of vehicular pollution. Noise Pollution due to automobiles and in general. Sources types and control of indoor air pollutants and health effects. Air pollution legislation and regulations. **Case studies:** Few industrial pollution control systems like coal, cement, petroleum etc. **08 Hrs.**

Reference Books:

1) Lawrence K. Wang, Norman C. Parelra, Yung Tse Hung, Air Pollution Control Engineering, Handbook of Environmental Engineering Lawrence K. Wang, Norman C. Parelra, Yung Tse Hung, Edition, Tokyo, 2004.

2) Noel de Nevers, Air Pollution Control Engg, Mc. Graw Hill, New York, 3/e. 1995.
3) David H.F. Liu, Bela G. Liptak, Air Pollution, CRC Press. 1/e. 2000. ISBN-10: 1566705134.
4) Anjaneyulu. Y, Air Pollution & Control Technologies, BS Publication, 2/e. 2000. ISBN: 9789387593053.
5) M.N. Rao and H. V. Rao, Air Pollution, McGrew Hill Publications, 2007. ISBN-13-9780074518717.

18UHUL507	Soft skill and Aptitude	(0-0-2) 1

Contact Hours: 24

Course Learning Objectives (CLOs):

1. This is included with the objectives of improving the communication skills, proficiency in English language and aptitude ability of the student to enhance the employability.

Course Outcomes (COs):

Description of the course outcome: At the end of the course student will be able to		**Mapping to POs (1-12)/ PSOs (13-15)**		
		Substantial Level (3)	**Moderate Level (2)**	**Slight Level (1)**
CO-1	Explain the significance of communication in the profession		10	
CO-2	Use the English language with proficiency		10	12
CO-3	Solve Aptitude related problems		9	12
CO-4	Demonstrate the competency in the placement activities		9	

POs/PSOs	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-13**	**PSO-14**	**PSO-15**
Mapping Level	-	-	-	-	-	-	-	-	2.0	2.0	-	1.0	-	-	-

Contents: Training on communication skills, proficiency in English language and aptitude ability involving the internal and external resource.

Evaluation: Both the internal and external resource persons shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 25 marks in Aptitude testing and there shall be one presentation by the student for 25 marks or any other suitable testing components. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents

18UHUL605	Soft skill and Aptitude	(0-0-2) 1

Contact Hours: 24

Course Learning Objectives (CLOs):

1. This is included with the objectives of improving the communication skills, proficiency in English language and aptitude ability of the student to enhance the employability.

Course Outcomes (COs):

Description of the course outcome: At the end of the course student will be able to		Mapping to POs (1-12)/ PSOs (13-15)		
		Substantial Level (3)	Moderate Level (2)	Slight Level (1)
CO-1	Explain the significance of communication in the profession		10	
CO-2	Use the English language with proficiency		10	12
CO-3	Solve Aptitude related problems		9	12
CO-4	Demonstrate the competency in the placement activities		9	

POs/PSOs	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO -13	PSO -14	PSO -15
Mapping Level	-	-	-	-	-	-	-	-	2.0	2.0	-	1.0	-	-	-

Contents: Training on communication skills, proficiency in English language and aptitude ability involving the internal and external resource.

Evaluation: Both the internal and external resource persons shall be engaged in imparting the related knowledge and shall have only CIE as the evaluation component. There shall be one test conducted at the end for 25 marks in Aptitude testing and there shall be one presentation by the student for 25 marks or any other suitable testing components. The arrangement for CIE evaluation is to be done by the department and maintain the relevant documents.

18UCHL407	Introductory Project	(0-0-2) 1

Contact Hours: 24

Course Learning Objective:

1. To identify and understand the community expectation in terms of possible engineering solutions by applying the fundamental knowledge of basic sciences and basic engineering courses.

Course Outcomes (COs):

COs	Description: At the end of the course student will be able to	Mapping to POs (1-12) PSOs(13-15)		
		Introductory 1	Moderate 2	Substantial 3
CO1	Identify the problem.	7, 14	12	2,10
CO2	Compare the literature review and select suitable existing solutions.	7, 10,14	8,11,12	3,4,5,15
CO3	Prepare work plan with economic analysis.	9	8,10,12	11,15
CO4	Prepare a precise report with proper guidelines and references.	9	8,15	10

POs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PO1 3	PO1 4	PO1 5

Mapping Level		3.0	3.0	3.0	3.0		1.0	2.0	1.0	2.25	2.5	2.0		1.0	2.7

Introductory project is introduced with an objective of understanding and identifying the community expectation in terms of possible Engineering solutions by applying the fundamental knowledge of basic sciences and basic engineering courses. The project shall be engineering oriented in terms of problem definition, related literature survey and existing solutions. The team consisting of 10-12 students shall be asked to identify problems related to community and try to propose a solution. The faculty members handling the courses for that semester shall guide the students. A committee consisting of minimum 3 faculty members shall evaluate at the end for CIE. There is no SEE for introductory project.

Reference Books/Material:

1. Offline/online chemical engineering and its related field Journals.
2. Books in the area of chemical engineering and its related field

H.O.D.
Department of Chemical Engineering
SDM College of Engg & Technology,
Dharwad-580 002

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