

ANNA UNIVERSITY, CHENNAI
AFFILIATED INSTITUTIONS
REGULATIONS 2017
B. TECH. PHARMACEUTICAL TECHNOLOGY
CHOICE BASED CREDIT SYSTEM
III SEMESTER CURRICULUM AND SYLLABI

SEMESTER III

S. No.	COURSE CODE	COURSE TITLE	CATE GORY	CONTACT PERIODS	L	T	P	C
THEORY								
1	MA8353	Transforms and Partial Differential Equations	BS	4	4	0	0	4
2	PE8491	Chemical Engineering Thermodynamics	PC	3	3	0	0	3
3	BT8291	Microbiology	PC	3	3	0	0	3
4	PY8301	Pharmaceutical Chemistry	PC	3	3	0	0	3
5	PY8302	Physical Pharmaceutics	PC	3	3	0	0	3
6	GE8291	Environmental Science and Engineering	HS	3	3	0	0	3
PRACTICALS								
7	PY8311	Physical Pharmaceutics Laboratory	PC	4	0	0	4	2
8	BT8361	Microbiology Laboratory	PC	4	0	0	4	2
9	HS8381	Interpersonal Skills/Listening and Speaking	EEC	2	0	0	2	1
TOTAL				29	19	0	10	24

OBJECTIVE:

- To introduce the basic concepts of PDE for solving standard partial differential equations.
- To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
- To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

UNIT I PARTIAL DIFFERENTIAL EQUATIONS**12**

Formation of partial differential equations – Singular integrals - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT II FOURIER SERIES**12**

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS**12**

Classification of PDE – Method of separation of variables - Fourier Series Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two dimensional equation of heat conduction.

UNIT IV FOURIER TRANSFORMS**12**

Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS**12**

Z-transforms - Elementary properties – Inverse Z-transform (using partial fraction and residues) – Initial and final value theorems - Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transform.

TOTAL: 60 PERIODS**OUTCOMES:**

Upon successful completion of the course, students should be able to:

- Understand how to solve the given standard partial differential equations.
- Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
- Appreciate the physical significance of Fourier series techniques in solving one and two dimensional heat flow problems and one dimensional wave equations.
- Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
- Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

TEXT BOOKS:

1. Grewal B.S., "Higher Engineering Mathematics", 43rd Edition, Khanna Publishers, New Delhi, 2014.

- Narayanan S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

REFERENCES:

- Andrews, L.C and Shivamoggi, B, "Integral Transforms for Engineers" SPIE Press, 1999.
- Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 9th Edition, Laxmi Publications Pvt. Ltd, 2014.
- Erwin Kreyszig, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, India, 2016.
- James, G., "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
- Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
- Wylie, R.C. and Barrett, L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

PE8491

CHEMICAL ENGINEERING THERMODYNAMICS

**L T P C
3 0 0 3**

OBJECTIVE:

- Students will learn PVT behaviour of fluids, laws of thermodynamics, thermodynamic property relations and their application to fluid flow, power generation and refrigeration processes.

UNIT I

9

Scope of thermodynamics, basic concepts and definitions, Equilibrium state and phase rule, Energy, Work, Temperature and Zeroth Law of Thermodynamics, reversible and irreversible process, Ideal gas- Equation of State involving ideal and real gas, Law of corresponding states, Compressibility chart, First Law of Thermodynamics and its consequences.

UNIT II

9

Joule's experiment, internal energy, enthalpy, Application of first Law of Thermodynamics for Flow and non flow processes. Limitations of the first Law , statements of second Law of Thermodynamics and its Applications ,Heat Engine, Heat Pump/Refrigerator, Carnot cycle and Carnot theorem, Thermodynamic Temperature scale, Entropy , Clausius inequality, Third law of thermodynamics.

UNIT III

9

Refrigeration and liquefaction process, Thermodynamic Potentials, thermodynamic correlation, Maxwell relations, criteria for Equilibria and stability. Clapeyron equation

UNIT IV

9

Partial molar properties, ideal and non-ideal solutions, standard states definition and choice, Gibbs-Duhem equation, activity and property change of mixing, excess properties of mixtures.

UNIT V

9

Activity coefficient-composition models, thermodynamic consistency of phase equilibria, Chemical Reaction equilibria, Extent of reaction, equilibrium constant and standard free energy change

TOTAL: 45 PERIODS

OUTCOME:

- The course will help the students to know about engineering thermodynamics and understand the practical implications of thermodynamic law in engineering design.

TEXT BOOKS:

- Sonntag, Borgnakke, Van Wylen, Fundamentals of Thermodynamics, 7th Edition, Wiley India, New Delhi, 2009.

- Narayanan, K.V. A Textbook of Chemical Engineering Thermodynamics Prentice Hall India, 2004
- Smith, van Ness and Abbott, "Chemical Engineering Thermodynamics", 7th Edition, McGraw Hill, New York, 2005

REFERENCES:

- S. I. Sandler, Chemical, Biochemical and Engineering Thermodynamics, Wiley New York, 2006
- Y V C Rao, "Chemical Engineering Thermodynamics", Universities Press, Hyderabad 2005.
- Pradeep ahuja," Chemical Engineering Thermodynamics", PHI Learning Ltd (2009).
- GopinathHalder," Introduction to Chemical Engineering Thermodynamics", PHI Learning Ltd (2009).

BT8291

MICROBIOLOGY

**L T P C
3 0 0 3**

OBJECTIVES

- To introduce students to the principles of Microbiology to emphasize structure and biochemical aspects of various microbes.
- To solve the problems in microbial infection and their control.

UNIT I INTRODUCTION

6

Basics of microbial existence; history of microbiology, classification and nomenclature of microorganisms, microscopic examination of microorganisms, light and electron microscopy; principles of different staining techniques like gram staining, acid fast, capsular staining, flagellar staining.

UNIT II MICROBES- STRUCTURE AND MULTIPLICATION

12

Structural organization and multiplication of bacteria, viruses, algae and fungi, with special mention of life history of actinomycetes, yeast, mycoplasma and bacteriophages.

UNIT III MICROBIAL NUTRITION, GROWTH AND METABOLISM

12

Nutritional requirements of bacteria; different media used for bacterial culture; growth curve and different methods to quantify bacterial growth; aerobic and anaerobic bioenergetics and utilization of energy for biosynthesis of important molecules.

UNIT IV CONTROL OF MICROORGANISMS

6

Physical and chemical control of microorganisms; host-microbe interactions; anti-bacterial, anti-fungal and anti-viral agents; mode of action and resistance to antibiotics; clinically important microorganisms.

UNIT V INDUSTRIAL AND ENVIRONMENTAL MICROBIOLOGY

9

Primary metabolites; secondary metabolites and their applications; preservation of food; production of penicillin, alcohol, vitamin B-12; biogas; bioremediation; leaching of ores by microorganisms; biofertilizers and biopesticides; microorganisms and pollution control; biosensors

TOTAL: 45 PERIODS

TEXT BOOKS

- Talaron K, Talaron A, Casita, Pelczar and Reid. Foundations in Microbiology, W.C. Brown Publishers, 1993.

- Pelczar MJ, Chan ECS and Krein NR, Microbiology, Tata McGraw Hill Edition, New Delhi, India.
- Prescott L.M., Harley J.P., Klein DA, Microbiology, 3rd Edition, Wm. C. Brown Publishers, 1996..

PY8301

PHARMACEUTICAL CHEMISTRY

**L T P C
3 0 0 3**

OBJECTIVES:

- To inculcate understanding of the properties and principles of medicinal agents that originates from organic and inorganic sources and their application in pharmaceutical industry.
- To provide the basic functional group identification, molecular rearrangement, chemical bonding with their reaction mechanism.
- To provide the fundamental principles involved in the identification, preparation of pharmaceutical aids and to apply the principle of coordination compounds in pharmaceutical substances.

UNIT I STRUCTURE AND PROPERTIES

9

Molecular orbital theory, hybrid orbitals, polarity of bonds and molecules, dipole moment, resonance, inductive, mesomeric and electromeric effects, intramolecular and intermolecular hydrogen bonding.

UNIT II CHEMISTRY OF ALIPHATIC, AROMATIC AND HETEROAROMATIC COMPOUNDS

9

Characteristics of organic compounds, structure, nomenclature, preparation and reaction mechanism of alkyl and aryl halides (Mechanism of SN1, SN2, E1 and E2), Huckel's rule, structures, synthesis, properties and chemical reactions of benzenoid and nonbenzenoid compounds, mechanism of aromatic electrophilic and nucleophilic substitution. General principles of heterocyclic synthesis – Methods of preparation and reactions of Pyridines – Pyrroles – Thiophenes – Furans – Quinolines – Isoquinolines.

UNIT III PRINCIPLES OF TEST FOR PURITY IN PHARMACEUTICAL SUBSTANCES

9

Identification and characterization of impurities in Pharmaceutical substances, Limit tests: Definition, importance, general procedure for limit test for chlorides, sulphates, iron, arsenic, heavy metals and lead with suitable examples.

UNIT IV STUDY OF ORGANIC REACTIONS AND MOLECULAR REARRANGEMENTS

9

Hoesch reaction, Formylation reactions, Gattermann Reaction, Gattermann-Koch reaction, Vilsmeier reaction, Reimer-Tiemann reaction, Wolff rearrangement, Schmidt reaction. Curtius rearrangement, Catalytic dehydrogenation, Meerwein-Ponndorf-Verley, NaBH₄, Clemmenson, Sandmeyer, Ullmann, Azo coupling, Deamination, Benzidine rearrangement.

UNIT V PHARMACEUTICAL AIDS AND CO-ORDINATION COMPOUNDS

9

Preparation and properties of various agents such as – Sodium bisulphate, Sodium metabisulphate, Sulphur dioxide, Bentonite, Magnesium stearate, Zinc stearate, Aluminium sulphate, Sodium carboxy methyl cellulose, Sodium methylparaben- Theory of co-ordination compounds with special reference to application in Pharmacy such as – EDTA, Dimercaprol, Penicillamine, 1, 10-Phenanthroline.

TOTAL: 45 PERIODS

OUTCOMES:

The student will be able to

- Identify the functional groups in pharmaceutical substances and make predictions of chemical bonding along with their reaction mechanism.

molecular complexes, inclusion compounds, methods of analysis of complexes, crystalline structures of complexes and thermodynamic basis of stability constants. Protein binding and drug action, protein binding studies.

UNIT V KINETICS AND DRUG STABILITY

9

General considerations and concepts of drug reaction kinetics; zero order, first order and pseudo first order, half-life determination, Influence of temperature, light, catalytic species, solvent and other factors, Stabilization of drugs, Accelerated stability study, expiration dating.

TOTAL: 45 PERIODS

OUTCOMES:

- To know the fundamental properties of pharmaceutical solids
- To understand the surface, interfacial phenomena and the rheology of liquids
- Ability to understand the principles, characters and applications of pharmaceutical dispersions.
- To acquire the knowledge about drug diffusion, dissolution, complexation and protein binding.
- To be familiar with the degradation pathways, stabilization of drugs and their expiry date calculation.

TEXT BOOKS:

1. Manavalan, R. and Ramasamy. C. "Physical Pharmaceutics" 2nd Ed., Vignesh Publishers, 2015.
2. C.V.S. Subrahmanyam, Text book of physical pharmaceutics, 3rdEdn., Vallabhprakashan, 2015.
3. Hadkar. U. B., Physical Pharmacy, NiraliPrakashan; 12th edition, 2017.

REFERENCES:

1. Alfred N. Martin, Patrick J. Sinko, Martin's Physical Pharmacy and Pharmaceutical Sciences: Physical Chemical and Biopharmaceutical Principles in the Pharmaceutical Sciences, sixth edition, Lippincott Williams & Wilkins, 2011.
2. David B. Troy, Paul Beringer, Remington: The science and practice of pharmacy, 21st Edition, Lippincott Williams and Wilkins, 2006
3. Humphrey Moynihan and Abinacrea "Physicochemical Basis of Pharmaceuticals" Oxford University Press, 2009.

GE8291

ENVIRONMENTAL SCIENCE AND ENGINEERING

**L T P C
3 0 0 3**

OBJECTIVES:

- To study the nature and facts about environment.
- To finding and implementing scientific, technological, economic and political solutions to environmental problems.
- To study the interrelationship between living organism and environment.
- To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
- To study the dynamic processes and understand the features of the earth's interior and surface.
- To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams,

lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION

8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES

10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over- utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

7

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

6

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

- Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
- Public awareness of environmental is at infant stage.
- Ignorance and incomplete knowledge has lead to misconceptions
- Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS:

1. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.

2. Gilbert M. Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

REFERENCES:

1. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2007.
2. Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hyderabad, 2015.
3. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.
4. G. Tyler Miller and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.

PY8311

PHYSICAL PHARMACEUTICS LABORATORY

L T P C
0 0 4 2

OBJECTIVES:

- To practice the determination of fundamental properties of dosage forms of powders and dispersions.
- To study the kinetics and stability aspects of pharmaceuticals.

LIST OF EXPERIMENTS:

1. Studies on polymorphs, their identification and properties.
2. Determination of particle size, particle size distribution and surface area using various methods of particle size analysis.
3. Determination of derived properties of powders like density, porosity, compressibility, angle of repose, etc.
4. Determination of surface/interfacial tension, HLB value and critical micellar concentration (CMC) of surfactants.
5. Study of rheological properties of various types of systems using different viscometers.
6. Study of different types of colloids and their properties.
7. Preparation of various types of suspensions and determination of their sedimentation parameters.
8. Preparation and stability studies of emulsions.
9. Studies on different types of complexes and determination of their stability constants.
10. Studies on protein binding of drugs
11. Determination of half-life, rate constant and order of reaction.
12. Preparation of pharmaceutical buffers and determination of buffer capacity.
13. Determination of shelf life of a product based on Arrhenius principle

TOTAL: 60 PERIODS

LIST OF EQUIPMENTS FOR BATCH OF 30 STUDENTS

- Optical Microscope
- Sieve shaker
- Anderson pipette
- Ostwald's viscometer
- Brookfield viscometer
- Stability chamber
- Bulk density apparatus

OUTCOMES:

On completion of the course the students will be able to

- Characterize and evaluate the properties of powders by using suitable methods.
- Plan and carry out the stability studies and determine the stability of various dosage forms.
- Calculate the rate constants and determine the various order of reactions involved in pharmaceutical systems and process.

TEXT BOOKS:

1. CVS Subrahmanyam, SG Vasantharaju, Laboratory Manual of Physical Pharmacy, 2nd Ed., Vallabh Prakashan, 2009.
2. Manavalan, R. and Ramasamy. C. "Physical Pharmaceutics" 2nd Ed., Vignesh Publishers, 2015.

REFERENCES:

1. Eugene L. Parrott, Witold Sasaki, Experimental Pharmaceutics, 4th edn., Burgess Pub. Co., 1977.
2. Howard C. Ansel, Pharmaceutical Calculations, 13th edn., LWW, 2009,
3. Dr. U. B. Hadkar, Practical Physical Pharmacy & Physical Pharmaceutics, Nirali Prakashan, Pune, 2008.

BT8361**MICROBIOLOGY LABORATORY****L T P C****0 0 4 2****OBJECTIVE:**

- To demonstrate various techniques to learn the morphology, identification and propagation of microbes

Experiments

1. Introduction, Laboratory Safety, Use of Equipment; Sterilization Techniques
2. Culture Media-Types and Use; Preparation of Nutrient broth and agar
3. Culture Techniques, Isolation and Preservation of Cultures- Broth: flask, test tubes; Solid: Pour plates, streak plates, slants, stabs
4. Microscopy – Working and care of Microscope
5. Microscopic Methods in the Study of Microorganisms., Microscopic identification of yeast/mould
6. Staining Techniques Simple, Differential- Gram's Staining, spore /capsule staining
7. Quantification of Microbes: Sampling and Serial Dilution; Bacterial count in Soil – TVC
8. Effect of Disinfectants- Phenol Coefficient
9. Antibiotic Sensitivity Assay
10. Growth Curve in Bacteria and Yeast
11. Effect of pH, Temperature, UV radiation on Growth Bacteria

TOTAL: 60 PERIODS**OUTCOMES:**

Students will be able to

- Understand the advanced technical information pertaining to laboratory bio-safety and preventive measures from pathogenic microorganism.
- Know the various aseptic techniques and sterilization methods.
- Develop the minimum skills to work on several important techniques for the study of microorganisms in the laboratory.

Equipment Needed for 30 Students

Autoclave	1
Hot Air Oven	1
Incubators	2
Light Microscopes	4
Incubator Shaker	1
Colorimeter	2
Lamina Flow Chamber	2
Glassware, Chemicals, Media as required	

TEXT BOOKS

1. Cappuccino, J.G. and N. Sherman "Microbiology: A Laboratory Manual", 4th Edition, Addison-Wesley, 1999.

2. Collee, J.G. et al., "Mackie & McCartney Practical Medical Microbiology" 4th Edition, ChurchillLivingstone, 1996.

HS8381	INTERPERSONAL SKILLS/LISTENING&SPEAKING	L	T	P	C
		0	0	2	1

OBJECTIVES: The Course will enable learners to:

- Equip students with the English language skills required for the successful undertaking of academic studies with primary emphasis on academic speaking and listening skills.
- Provide guidance and practice in basic general and classroom conversation and to engage in specific academic speaking activities.
- improve general and academic listening skills
- Make effective presentations.

UNIT I

Listening as a key skill- its importance- speaking - give personal information - ask for personal information - express ability - enquire about ability - ask for clarification Improving pronunciation - pronunciation basics taking lecture notes - preparing to listen to a lecture - articulate a complete idea as opposed to producing fragmented utterances.

UNIT II

Listen to a process information- give information, as part of a simple explanation - conversation starters: small talk - stressing syllables and speaking clearly - intonation patterns - compare and contrast information and ideas from multiple sources- converse with reasonable accuracy over a wide range of everyday topics.

UNIT III

Lexical chunking for accuracy and fluency- factors influence fluency, deliver a five-minute informal talk - greet - respond to greetings - describe health and symptoms - invite and offer - accept - decline - take leave - listen for and follow the gist- listen for detail

UNIT IV

Being an active listener: giving verbal and non-verbal feedback - participating in a group discussion - summarizing academic readings and lectures conversational speech listening to and participating in conversations - persuade.

UNIT V

Formal and informal talk - listen to follow and respond to explanations, directions and instructions in academic and business contexts - strategies for presentations and interactive communication - group/pair presentations - negotiate disagreement in group work.

TOTAL: 30 PERIODS

OUTCOMES: At the end of the course Learners will be able to:

- Listen and respond appropriately.
- Participate in group discussions
- Make effective presentations
- Participate confidently and appropriately in conversations both formal and informal

TEXT BOOKS:

1. Brooks, Margret. **Skills for Success. Listening and Speaking. Level 4** Oxford University Press, Oxford: 2011.
2. Richards, C. Jack. & David Bholke. **Speak Now Level 3.** Oxford University Press, Oxford: 2010

REFERENCES:

1. Bhatnagar, Nitin and MamtaBhatnagar. **Communicative English for Engineers and Professionals**. Pearson: New Delhi, 2010.
2. Hughes, Glyn and Josephine Moate. **Practical English Classroom**. Oxford University Press: Oxford, 2014.
3. Vargo, Mari. **Speak Now Level 4**. Oxford University Press: Oxford, 2013.
4. Richards C. Jack. **Person to Person (Starter)**. Oxford University Press: Oxford, 2006.
5. Ladousse, Gillian Porter. **Role Play**. Oxford University Press: Oxford, 2014

Strong regulatory systems are needed to ensure that people around the world have timely access to quality medicines and vaccines that are both effective and safe. To-day, only 20% of the World Health Organization's Member States have well developed pharmaceutical regulatory systems, due to considerable human and financial resources that such systems entail. In a globalized world, however, the regulatory landscape needs to evolve continuously to address old and new challenges. Third, there needs to be cooperation between the stakeholders within the life sciences ecosystem. This ensures a sustainable value chain drawing on the expertise and funding from public, private and academic sectors. The pharmaceutical sector and regulation in the countries of Central and Eastern Europe. Chapter Twenty. Access to pharmaceuticals and regulation in the Commonwealth of Independent States. The Observatory supports and promotes evidence-based health policy-making through comprehensive and rigorous analysis of the dynamics of health care systems in Europe. European Observatory on Health Systems and Policies Series. Series Editors: Josep Figueras, Martin McKee, Elias Mossialos and Richard B. Saltman. Choice based credit system. Curriculum and detailed syllabi. For. B.E DEGREE (Computer Science and Engineering) PROGRAMME. For the students admitted from the academic year 2015 onwards. THIAGARAJAR COLLEGE OF ENGINEERING (A Government Aided ISO 9001-2008 certified Autonomous Institution affiliated to Anna University). MADURAI 625 015, TAMILNADU Phone: 0452 2482240, 41 Fax: 0452 2483427 Web: www.tce.edu. Approved in Board of Studies Meeting on 25.04.15. Graph Theory Fuzzy Sets And Clustering Number Theory Smart Materials For Engineers Thinfilm Technology Nanotechnology Biology For Engineers Chemistry of Engineering Materials Battery Technologies. Number of Hours / Week. L TP. To ensure uniformity in education system, Choice Based Credit System has been made mandatory by UGC. It provides mobility of student from one institute to other within country and abroad. It also provides opportunity to students to offer interdisciplinary courses for enhancing employability. The present paper aims to specify characteristics of credit system along with case study. Discover the world's research. 20+ million members. 135+ million publications. Scale-up & Technology Transfer as a Part of Pharmaceutical Quality Systems. Outline. Manufacturing Science Definition: Robustness. Goals of Technology Transfer. Pharmaceutical Quality System: Executable control strategy under site PQS. Utilize PQSs to help drive/control any changes, document learning during and post transfer. Traditional: - Based largely univariate and empirical approach to development - Three validation lots - Not a lot of emphasis on material variability. The 21st Century (Process Validation Lifecycle Approach): - A Holistic QBD life cycle approach to development supports (i.e. Fundamental first principals understanding, increased mechanistic understanding etc.) a robust validation.