



**ANNA UNIVERSITY**  
**Chennai-25.**  
**Syllabus for**

**B.Tech. Industrial Bio-Technology**

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**GE034 Creativity, Innovation and New Product Development**                      2        0        2        100

**1 . INTRODUCTION** **8**

The process of technological innovation - factors contributing to successful technological innovation - the need for creativity and innovation - creativity and problem solving - brain storming - different techniques.

**2 . PROJECT SELECTION AND EVALUATION** **8**

Collection of ideas and purpose of project - Selection criteria - screening ideas for new products (evaluation techniques).

**3 . NEW PRODUCT DEVELOPMENT** **7**

Research and new product development - Patents - Patent search - Patent laws - International code for patents - Intellectual property rights (IPR).

**4 . NEW PRODUCT PLANNING** **7**

Design of proto type - testing - quality standards - marketing research - introducing new products.

**Total No of periods: 30**

**LABORATORY:**

*Creative design - Model Preparation - Testing - Cost evaluation - Patent application.*

**References:**

1. *HARRY NYSTROM, " Creativity and innovation", John Wiley & Sons, 1979.*
2. *BRAIN TWISS, " Managing technological innovation", Pitman Publishing Ltd., 1992.*
3. *HARRY B.WATTON, " New Product Planning ", Prentice Hall Inc., 1992.*
4. *P.N.KHANDWALLA - " Fourth Eye (Excellence through Creativity) - Wheeler Publishing ", Allahabad, 1992.*
5. *I.P.R. Bulletins, TIFAC, New Delhi, 1997.*

**GE037 Intellectual Property Rights (IPR)**

**3 0 0 100**

**1 . UNIT I 5**

Introduction - Invention and Creativity - Intellectual Property (IP) - Importance - Protection of IPR - Basic types of property (i. Movable Property ii. Immovable Property and iii. Intellectual Property).

**2 . UNIT II 10**

IP - Patents - Copyrights and related rights - Trade Marks and rights arising from Trademark registration - Definitions - Industrial Designs and Integrated circuits - Protection of Geographical Indications at national and International levels - Application Procedures.

**3 . UNIT III 10**

International convention relating to Intellectual Property - Establishment of WIPO - Mission and Activities - History - General Agreement on Trade and Tariff (GATT).

**4 . UNIT IV 10**

Indian Position Vs WTO and Strategies - Indian IPR legislations - commitments to WTO-Patent Ordinance and the Bill - Draft of a national Intellectual Property Policy - Present against unfair competition.

**5 . UNIT V 10**

Case Studies on - Patents (Basumati rice, turmeric, Neem, etc.) - Copyright and related rights - Trade Marks - Industrial design and Integrated circuits - Geographic indications - Protection against unfair competition.

**Total No of periods: 45**

*TEXT BOOK*

*1. Subbaram N.R. " Handbook of Indian Patent Law and Practice ", S. Viswanathan (Printers and Publishers) Pvt. Ltd., 1998.*

*REFERENCES*

- 1. Eli Whitney, United States Patent Number : 72X, Cotton Gin, March 14, 1794.*
- 2. Intellectual Property Today : Volume 8, No. 5, May 2001, [www.iptoday.com].*
- 3. Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000. [www.ipmatters.net/features/000707\_gibbs.html.*

**1 . UNIT I 9**

Historical Background - Constituent Assembly of India - Philosophical foundations of the Indian Constitution - Preamble - Fundamental Rights - Directive Principles of State Policy - Fundamental Duties - Citizenship - Constitutional Remedies for citizens.

**2 . UNIT II 9**

Union Government - Structures of the Union Government and Functions - President - Vice President - Prime Minister - Cabinet - Parliament - Supreme Court of India - Judicial Review.

**3 . UNIT III 9**

State Government - Structure and Functions - Governor - Chief Minister - Cabinet - State Legislature - Judicial System in States - High Courts and other Subordinate Courts

**4 . UNIT IV 9**

Indian Federal System - Center - State Relations - President's Rule - Constitutional Amendments - Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

**5 . UNIT V 9**

Society : Nature, Meaning and definition; Indian Social Structure; Caste, Religion, Language in India; Constitutional Remedies for citizens - Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

**Total No of periods: 45**

**TEXT BOOKS**

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

**REFERENCES**

1. *Sharma, Brij Kishore, " Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.*
2. *U.R.Gahai, " (1998) Indian Political System ", New Academic Publishing House, Jalaendhar.*
3. *R.N. Sharma, " Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.*
4. *Yogendra Singh, " (1997) Social Stratification and Charge in India ", Manohar, New Delhi.*

**1 . INTRODUCTION 5**

Special and comparative features of German with English, Hindi and Tamil - German Alphabets, pronunciation.

**2 . THEMA 10**

Name, Land Wohnort - Studium, Beruf - Familie, Geschwister, Alter - Tagesablauf , termine - Einladung - Stellensuche, Berufswahl - Einkauf.

**3 . GRAMMATIK 10**

Personalpronomen, Verb, Wortstellung, Ort - Possessivpronomen, Verb - 'Sein' - Verb - 'Haben', Unbestimmter Artikel, Negation - 'Nicht' - 'Kein' - Zeit, Bestimmter Artikel, Starke Verben - Trennbare Verben, Imperativ - Modal Verben - Akkusativ.

**4 . UEBUNGEN 10**

Partner uebungen - Schriftliche Uebungen - Aussprache Uebungen - Kontrollue bungen - Text generation.

**5 . DIALOGUE 5**

Oral - Written.

**6 . GLOSSARY 5**

Technical Words.

**7 . TUTORIAL 15**

**Total No of periods: 60**

*Text Book:*

*1. LERNZIEL DEUTSCH (Deutsch als Fremdsprache) - Grundstufe 1 from Max Hueber varlag.*



*Text Book:*

*1. LERNZIEL DEUTSCH (Deutsch als Fremdsprache) - Grundstufe 1 from MAX Hueber Verlag.*

**1 . 9**

Introduction to Japanese Alphabets - Hiragana, Katakana and Kanji - group 1,2,3 & 4 Syllabus - Writing Practice - Pronunciation - word Order - Greetings - Receiving a visitor and exchange of pleasantries - Kanji Practice.

**2 . 9**

Basic structure of sentences - classification of verbs - Polite form of verbs - irregular verbs - Particle-E - Time expressions - question sentences - Japanese numerals - Kanji practice.

**3 . 9**

Classification of particles - Ga, Ka, Wa, O, E, Ni etc - aural comprehension - reading comprehension - noun -1 Wa, noun -2 desu - Demonstrative pronouns - kore, sore , are and dore - kono, sono, ano and dono - kochira - sochira - achira and dochira - particle - No, kara, ni and de - question - itsu - conversational grammar - soo desu ka - Na, I adjectives perfect and imperfect - question words - Doo and ikaga - particle - To, ne and yo - Kanji practice.

**4 . 9**

Desu as a substitute for a verb - demonstrative pronouns sono and sore - Group 1 particles - de, O, Made and Ka - conjunction - soshite - Question words - dare, nani, doko, itsu, dore, dochira, doyatte, ikutsu, ikura - Words for degrees - gurai or kurai - Phrase - Saa - anoo - numerals - counters and numbers - humble form of desu and arimasu - Kanji practice.

**5 . 9**

Verbs ending in-te or de - classification of Te forms and Masu forms - verb modifiers - koo, soo, aa and doo - Set phrase - Onegaishimasu - Sumimasen - Adverbs - Mazu, sore kara and saigo ni - formation of the Te form of I adjective and desu - kanji practice.

**Total No of periods: 45**

*Text Books:*

1. *OOTSUBO et al - " A Course in Modern Japanese ", Vol.1, 1983, The University of Nagoya Press, Japan.*
2. *SHIYO SUZUKI and IKUO KAWASE - Nihongo Shoho text book with audio tapes, 1981.*
3. *YAN - SAN Serial - Video tapes, Japan.*

<b>1 .</b>	<b>9</b>
Demonstrative Pronouns: Are - Interjection: Ee - Quoted Sentences - omoimsu - Non polite form of verbs - Group 1 ending in -ert or iru, group 2 verbs ending in - u - Non polite forms of - I - adjectives -non polite form of desu,deshoo,daroo - Suffic - Sugiru - expression of reason - tame (ni) - Counters: - Hon and - Do - Kanji practice.	
<b>2 .</b>	<b>9</b>
Negative - Te - form of verbs -I adjectives - Permission and prohibition - te mo desuka and - te wa ikemasen ka - Na - adjectives - suki and kirai - Verbs:Itadaku - Conjunction - Nagara - Phrase - No koto na n desu ga - usage of chotto - kanji practice.	
<b>3 .</b>	<b>9</b>
Noun modifiers - Quoting modifier - Suffix - Kata - sa and me - Particles - Made ni and dake - te form of verb and iru/imasu - noun - Uchi - Eba form of verbs - Kanji practice.	
<b>4 .</b>	<b>9</b>
Potential sentences - group 1 verbs - group 2 verbs irregular verbs - Nouns - Tsumori and Hazu - Adverbs: Moo and Made - Form of address: moshomoshi - Expression - Ee - verbs: Naru and suru - Particles - De and ka - kanji practice.	
<b>5 .</b>	<b>9</b>
Comparative sentences - no hoo ga and yori - Negative comparative sentences - Negative request - Adverbs of extent - Konna ni, sonna ni and anna ni - Te form of transitive verb and - arul - Passive sentence - neutral passive sentence - technical vocabulary related to Engineering and Technology - Preparation of technical reports.	
<b>6 . TUTORIALS</b>	<b>15</b>

**Total No of periods: 60**

*Text Books:*

1. *OOTSUBO ET AL - " A Course in Modern Japanese ", Vol.II, The University of Nagoya Press, Japan, 1983.*
2. *SHIYO SUZUKI and IKUO KAWASE - Nihongo Shoho text book with audio tapes, The Japan Foundation, Tokyo, Japan, 1981.*
3. *YAN - SAN Serial - Video tapes, Japan.*

<b>1 .</b>	<b>9</b>
Alphabets - Pronunciation - Masculine and Feminine Genders only - Numbers - Indefinite and definite articles - plurals - Verbs to be and to have.	
<b>2 .</b>	<b>9</b>
Present tense - Affirmative, interrogative and negative sentences - Adjectives - Adverbs - Prepositions - Possessive Pronoun - Personnel Pronoun - Indirect Object.	
<b>3 .</b>	<b>9</b>
Group I verbs - Conjugations - Present, Past compound, Simple past and future tenses - Singular & Plural - Masculine and Feminine - adjectives and adverbs.	
<b>4 .</b>	<b>9</b>
Group II Verbs - Conjugations- Present, Past compound, simple past and future tenses - Singular and Plural - Masculine and Feminine - adjectives and adverbs.	
<b>5 .</b>	<b>9</b>
Pronominal verbs - Present, Past compound, Simple past and future tenses - Singular and Plural - Masculine and Feminine - adjectives - adverbs - Dialogue - Glossary.	
<b>6 . TUTORIAL</b>	<b>15</b>

**Total No of periods: 60**

*Text Books:*

1. MAUGER. G - *Course de Langue et de - Civilization Francaises*, HACHETTE -PARIS, 1986.
2. DOMINIQUE BERGER and REGINE MIRIEUX, *Cadences, Method de Francais Didier*, Paris, 1994.

*References:*

1. DENIS GIRARD, *French to English, English to French Dictionary*, Cassell - Mac Millan, 1981.

**HS040 Technical French II****3 1 0 100****1 . 9**

Group III Verbs - Conjugations - Adjectives - Adverbs - sentences - present - past compound - Simple past - future.

**2 . 9**

Comparative, superlative sentences - recent past - immediate future - grammatical analysis.

**3 . 9**

Translation from English to French - Translation from French to English - Texts from Physics and Chemistry.

**4 . 9**

Translation from English to French - Translation from French to English - Texts from Basic Engineering.

**5 . 9**

Report writing and translation from English to French - Translation from French to English - Letter Writing - Dialogue - Glossary.

**6 . TUTORIALS 15****Total No of periods: 60**

*Text Books:*

1. MAUGER, G - *Cours de Langue et de - Civilization Francaises*, HACHETTE - PARIS, 1986.
2. DOMINIQUE BERGER and REGINE MIRIEUX, *Cadences Methods de Francais*, Didier, Paris, 1994.

*References:*

1. CENTRE D'ETUDES FRANCAISES, " *Functional French for Scientists and Technologists* ", Jawaharlal Nehru University, New Delhi, 1986.
2. J.O.KETTRIDGE " *Dictionary of Technical terms and phrases Vol 1 & 2* ", The Gresham Press, Surrey, Great Britain, 1980.

**1 . LISTENING 7**

Listening comprehension-listening for specific information-note-taking-use of charts and diagrams.

**2 . SPEAKING 7**

Defining-describing objects-describing uses/functions-comparing-offering suggestions-analysing problems and providing solutions-expressing opinions (agreement/disagreement) predicting-expressing possibility/certainty-framing questions-providing answers-pronunciation practice (word stress).

**3 . READING 12**

Skimming-scanning-detailed reading-predicting content-interpreting charts and tables-identifying stylistic features in texts - evaluating texts-understanding discourse coherence-guessing meaning from the context- note - making / transferring information.

**4 . WRITING 12**

Sentence definition-static description-comparison and contrast-classification of information-recommendations-highlighting problems and providing solutions-formal and informal letter writing-using flow-charts/diagrams-paragraph writing-editing.

**5 . FOCUS ON LANGUAGE 7**

Word formation with prefixes and suffixes-discourse markers and their functions-degrees of comparison-expressions relating to recommendations and comparisons-active and passive voice-antonyms-tense forms-gerunds-conditional sentences-modal verbs of probability and improbability-acronyms and abbreviations - compound nouns and adjectives-spelling-punctuation.

**6 . PRACTICE IN LANGUAGE LAB 15**

Pronunciation practice - word stress - sentence stress - Listening comprehension - discussion - interpretation of visuals.

**Total No of periods: 60**

*Text Books:*

1. "*English for Engineers and Technologists* ", Volume I. Authors : *Humanities and Social Science Department, Anna University, Published by Orient Longman Ltd., 1990.*

*References:*

1. *Narayanaswami, V.R.Strengthen Your Writing, Orient Longman Ltd., Chennai 1996 (Revised Edition)*
2. *Pickett and Laster, Technical English, Writing, Reading and Speaking, New York Harper and Row Publications.*
3. *Swan, Michael, Basic English Usage, Oxford University Press, 1984.*

**1 . LISTENING 7**

Listening comprehension - listening for specific information - note-taking and using non-verbal devices.

**2 . SPEAKING 7**

Describing processes-stating purpose-offering opinions, suggestions and recommendations-summarizing-reporting-free discussion of chosen topics-pronunciation practice (word stress, consonant clusters-homonyms)

**3 . READING 12**

Skimming-scanning-note -making-understanding the organisation of texts discourse cohesion-predicting and evaluating content-evaluating style-inferring meaning-study reading-interpreting tables, flow-charts.

**4 . WRITING 12**

Extended definition-process description-cause and effect analysis-stating choice and justifying it -safety instructions-check list-letter of application-data sheet/resume.

**5 . FOCUS ON LANGUAGE 7**

Word formation-synonyms-prepositions-adverbs-passive voice-sequence words/discourse markers-connective adverbs-numerical expressions-expansion of abbreviations-rules for writing SI units-language of instructions, check-lists, causes and effects, purpose and means-indefinite adjectives of number and quantity-spelling and punctuation.

**6 . PRACTICE IN LANGUAGE LABORATORY**

Pronunciation practice - listening comprehension - discussion - interpreting and reporting from visual inputs.

**7 . TUTORIAL 15****Total No of periods: 60**

*Text Books:*

1. *" English for Engineers and Technologists ", Volume II, AUTHORS :Humanities and Social Science Department, Anna University, Published by Orient Longman Ltd.,1990.*

*References:*

1. *Swales, John.M. and Christine B Feak, "Academic Writing for graduates students", The University of Michigan Press, USA, 1994.*
2. *Goddard, Ken - " Informative Writing - Your Practical Guide to Effective Communication ", Cassell Publication U.K. 1998.*
3. *Cutts, Martin " The Plain English guide-How to write clearly and Communicate Better ", Oxford University Press, New Delhi, 1995.*

**1 . UNIT I 22**

ORAL COMMUNICATION - Practical use of language in simulated real - life situations through role playing - social skills - interaction with employers, peers and subordinates - Group dynamics - Listening techniques - Phonological aspects of language use - pronunciation, stress and intonation.

Introducing oneself and others, narrating events - Making telephonic conversation - Making requests, Asking questions, Making recommendations using modal verbs, Expressing causal relations with suitable discourse markers, Giving instructions using imperatives, Expressing purposes and functions, obligation and preferences, Accepting offers and Counselling, Interpreting advertisements, Describing processes using sequential expressions. (Lecture:8, Practicals 14)

**2 . UNIT II 12**

Presenting one's ideas at meetings and conferences, Making extempore talks, Public speaking, Body language, Strategic competence, Use of audio - visual aids and multimedia presentations. (Lecture : 6, Practical 6)

**3 . UNIT III 8**

Technical Writing - the structure of organised writing - paragraph writing, coherence, cohesion (use of Discourse Markers) and punctuation, Use of titles, nonverbal devices - Layout - Revision strategies - Reading techniques.

Letter Writing: - Personal/Informal letters: Letters to family members and friends Business / Formal letters: Letters thanking the recipients, announcing functions, extending invitations, congratulating associates on important occasions, letters of application (Resumes), apology and complaint, letters to the editor. (Lecture:8, Practical : 0)

**4 . UNIT IV 8**

Report Writing: - persuasive, explanatory, argumentative and informative, Writing agenda, minutes, memos, project proposals and checklists.

(Lecture : 8, Practical 0)

**5 . UNIT V 10**

Grammar - study of grammatical items in contexts. Nouns, pronouns, adjectives, comparative adjectives, adverbs, gerund, prepositions, voice, tenses, 'if clauses, direct and indirect speech (reporting verbs), concord Vocabulary - Synonyms, antonyms, homonyms, homophones, hyponyms, affixes, reference words, phrasal verbs and prepositional phrases. (Lecture:10, Practical : 0)

**Total No of periods: 60**

*Text Books:*

1. *Doff, Adrian and Jones, Christopher, Language in Use: Classroom Book (Intermediate level). Cambridge: CUP. 1994 (2 audio cassettes).*
2. *Dr.V.Chellammal, Learning to Communicate - a resource book for Engineers and Technologists. Coimbatore: Kamakhya Publications 2002 (1 audio cassette)*

*References:*

1. *Sung, Abraham. 330 more Model Letters for all occasions Malaysia-Minerva Publications. 2002.*
2. *Bentley, T.J. Report Writing in Business: The Effective Communication of Information. New Delhi: Viva Books Pvt.Ltd., 2001*
3. *Vivanilam, J.V. More Effective Communication: A Manual for Professionals. New Delhi: Response Books. 2000*
4. *Michael, V.P.Communication and Research for Management. Mumbai: Himalaya Publishing House 2001.*
5. *Nauheim, Ferd. How to Write Business Letters. New Delhi; Crest Publishing House 2000.*
6. *Mohan, Krishna, Meera Banerji. Developing Communication Skills. New Delhi: Macmillan 1991.*
7. *Denny, Richard. Communicate to Win. New Delhi: Kogan Page 2002.*

<b>1 . RESEARCH &amp; WRITING</b>	<b>9</b>
The project/term paper, selecting a topic, using a library, compiling a working bibliography, taking notes, plagiarism, outlining, writing drafts, guides to writing.	
<b>2 . MECHANICS OF WRITING</b>	<b>9</b>
Spelling, punctuation, numbers, titles and quotations.	
<b>3 . FORMAT OF A TERM/PROJECT REPORT</b>	<b>9</b>
Typing, paper, margins, spacing, heading and title of paper, page numbers, tables and illustrations, corrections and insertions, binding.	
<b>4 . PREPARATION OF CITATIONS</b>	<b>9</b>
General guidelines, placement, arrangement, citing books, citing articles in periodicals, documenting sources, what is a document, parenthetical documentation, information required in parenthetical documentation, readability, sample references.	
<b>5 . ABBREVIATIONS AND REFERENCES</b>	<b>9</b>
Introduction, time, common scholarly abbreviations and references words, publishers names, symbols and abbreviations used in proof-reading and correction, literary and scientific indexing.	

**Total No of periods: 45**

*Text Book:*

1. Gibaldi W.S. " *Achtert Handbook for Writers of Research Papers* ", Wiley Eastern Reprint, 1987.

*Reference:*

1. " *Chicago Manual of Style 13 Edition* ", Chicaco, University of Chicaco Press.

- 1 . AN OUTLINE OF MOLECULAR BIOLOGY 6**  
DNA Replication, translation, transcription, fundamentals of recombinant DNA technology, Gene regulation.
- 2 . AGROBACTERIUM AND PLANT GENETIC ENGINEERING 6**  
Agrobacterium mediated gene transfer and cloning. Types of plant vectors and their use in gene manipulation
- 3 . PLANT VIRUSES 6**  
Classification diagnosis-remedy-viruses as a tool to deliver foreign DNA
- 4 . DEVELOPMENTAL ASPECTS OF RHIZOBIUM 6**  
Legume Symbiosis, Symbiotic Nitrogen fixation, Regulation of nif and nod gene.
- 5 . MOLECULAR ASPECTS OF DISEASE SUSCEPTIBILITY AND RESISTANCE 12**  
Transposable elements, factors influencing disease resistance and susceptibility RFLP.
- 6 . TRANSGENICS 9**  
Herbicide tolerance-insect resistance-virus resistance-stress tolerance-development of disease resistance plants by introducing *Bacillus thuringiensis* genes.

**Total No of periods: 45**

*References:*

1. Mantal S.H., Mahews J.A., Mickee R.A., " *Principles of Plant Biotechnology. An Introduction to Genetic Engineering in Plants* ", Blackwell Scientific Publications, 1985.
2. Marx J.L., " *Revolution in Biotechnology* ", Cambridge University Press, 1989.
3. Dodds J.H., " *Plant Genetic Engineering* ", Cambridge University Press, 1985.

**1 . INTRODUCTION 5**

What is Animal Biotechnology and its scope, animals in Biotechnology-State of the Art.

**2 . ANIMAL CELL CULTURE 20**

Principles of sterile techniques and cell propagation, Chemically defined and serum Free media for membrane cell culture, scaling up of animal cell cultures, preservation and characterisation of animal cell, organ culture, cytotoxicity and viability assays, Cell cultures as sources of valuable products

**3 . GENETIC RECOMBINATION TECHNIQUES 20**

Mammalian genome, genetic recombination in mammalian cells and embryos, Protein production by genetically engineered mammalian cell lines, optimisation of animal cells growth in bio reactors Emission.

**Total No of periods: 45**

**1 . SPECTROSCOPY 9**

Interaction of radiation with matter, Definition frequency, Wave number, types of electromagnetic radiation, interparticle forces and energies, energy levels. Population of energy levels, Scattering, Absorption and Emission.

**2 . INFRARED SPECTROSCOPY 9**

Measurement of Infraed spectrum-Physical basis of infrared spectra, Infrared of Polyatomic molecules, biological examples, infraed of oriented samples.

**3 . ULTRAVIOLET & VISIBLE SPECTROSCOPY 9**

Electronic energy levels- Electronic transitions, Selection regale, Absorbtion range of biological chromophores, transition metal d-d transition-charge trasfer spectra, application of UV spectra to proteins, properties associated with the transition dipole moment and interaction between them, meausrement of molecular dynamics by floresence spectroscopy.

**4 . NUCLEAR MAGNETIC RESONANCE 9**

The phenomenon-magnetisation-measurement, spectral parameters in NMR, Intensity, Chemical Shift-spin, spin coupling, T1 and T2 relaxation times, line widths, nuclear overhauser of NMR in biology , assignment in NMR, studies of Macromolecules, ligand binding, ionisation studies and pH kinetics, molecular motion.

**5 . ELECTRON PARAMAGNETIC RESONANCE 9**

Introduction-Resonance condition-measurement-spectral parameters, intensity g values-spectral anisotropy , time scale of EPR-spin labels transition metal ions, spins trapping.

**Total No of periods: 45**

*References:*

1. *Campbell I.D and Dwek R.A., " Biological Spectroscopy ", Benjamin Cummins and Company, 1986.*
2. *Atkins P.W., " Physical Chemistry ", Oxford IV Edition, 1990.*

**1 . INTRODUCTION 15**

Induction-Jacob Monod model, catabolite regulation, glucose effect, cAMP deficiency, feed back regulation, regulation in branched pathways, differential regulation by isoenzymes, concerted feed back regulation, cumulative feed back regulation, amino acid regulation of RNA synthesis, energy charge, regulation, amino acid regulation of RNA synthesis, energy charge, regulation, permeability control passive diffusion, active transport group transportation.

**2 . SYNTHESIS OF PRIMARY METABOLITES 6**

Alteration of feed back regulation, limiting accumulation of end products, feedback ,resistant mutants, alteration of permeability, metabolites.

**3 . BIOSYNTHESIS OF SECONDARY METABOLITES 6**

Precursor effects, prophase, idiophase relationship, enzyme induction, feedback regulation, catabolite regulation by passing control of secondary metabolism, producers of secondary metabolites.

**4 . BIOCONVERSIONS 3**

Advantages of Bioconversions, specificity, yields, factors important to bioconversion, regulation of enzyme synthesis, mutation, permeability, co-metabolism, avoidance of product inhibition, mixed or sequential bioconversions, conversion of insoluble substances.

**5 . REGULATION OF ENZYME PRODUCTION 9**

Strain selection, improving fermentation, recognising growth cycle peak, induction, feed back repression, catabolite repression, mutants resistant to repression, gene dosage.

**Total No of periods: 39**

*References:*

1. Wang D.I.C., Cooney C.L., Demain A.L., Dunnill P., Humphery A.E., Lilly M.D.,  
" *Fermentation and Enzyme Technology* ", John Wiley and Sons., 1980.
2. Stanbury P.F., and Whitaker A., " *Principles of Fermentation Technology* ", Pergamon  
Press., 1984.
3. Zubay G., " *Biochemistry* ", Macmillan Publishers, 1989.

**1 . INTRODUCTION 12**

Classification of techniques, distribution coefficients, retention chromatography, sorption mechanisms, retention parameters, factors affecting retention, qualitative and quantitative aspects of chromatography, peak shape sorption isotherms, column efficiency, band broadening processes, selectivity and resolution.

**2 . CLASSICAL CHROMATOGRAPHY 7**

Stationary phases, applications of ion exchange size exclusion, TLC-HPTLC.

**3 . HIGH PERFORMANCE LIQUID CHROMATORGRAPHY 10**

Introduction-design of a typical HPLC machine-types of columns-applications.

**4 . GAS CHROMATOGRAPHY 10**

Introduction-Instrumentation-columns-qualitative and quantitative aspects of gas chromatography -quantitative analysis of GC.

**5 . CHIRAL CHROMATOGRAPHY 6**

Principles-types of chromatography-scopes and limitations-applications-capillary electrophoresis.

**Total No of periods: 45**

*References :*

1. *Sewell P.A., Clarke B., " Chromatographic Separations ", John Wiley & Sons, 1991.*
2. *Lindsay B., " High Performance Liquid Chromatography ", John Wiley & Sons, 1991.*
3. *" Lecture Notes on short course on Enantiomeric separations ", April 28-29, 1995.*

**1 . FUNDAMENTALS OF MICRO-ORGANISMS 9**

Microbial flora of soil, growth, ecological adaptations, interactions among soil microorganisms, biogeochemical role of soil microorganisms.

**2 . DEGRADATION OF XENOBIOTIC COMPOUNDS 9**

Simple aromatics, chlorinated polyaromatic petroleum products, pesticides and surfactants.

**3 . INDUSTRIAL WASTE WATER MANAGEMENT 9**

Waste water characteristics, biological wastewater treatment, unit operation, design and modelling of activated-sludge process, mathematical modelling of anaerobically-digested dynamics.

**4 . TREATMENT OF INDUSTRIAL WASTES 9**

Dairy, pulp, dye, leather and pharmaceuticals, solid waste management.

**5 . MOLECULAR BIOLOGY 9**

Latest elements, developments pertaining to environmental biotechnology.

**Total No of periods: 45**

*References:*

1. Stanir R.Y., Ingraham J.L., Wheelis M.L., Painter R.R., " *General Microbiology* ", McMillan Publications, 1989.
2. Foster C.F., John Ware D.A., " *Environmental Biotechnology* ", Ellis Horwood Ltd., 1987.
3. Karnely D.Chakrabarty., Omen G.S., " *Biotechnology and Biodegradation, Advances in Applied Biotechnology Series* ", Vol.1, Gulf Publications Co., London, 1989.

**1 . INTRODUCTION TO FOOD PROCESSING 9**

Biotechnology in relation to the food industry, nutritive value of food, types of microorganisms associated with food, its sources, types and behavior in foods.

**2 . FOOD PRESERVATION 9**

Bioprocessing of meat, fisheries, vegetables, dairy products, enzymes and chemicals used in food processing, biochemical engineering for flavour and food production.

**3 . FERMENTED FOOD PRODUCTS 9**

Dairy products, meat, Fishery, non beverage plant products, beverages and related products of baking.

**4 . FOOD SPOILAGE 9**

Food borne illness, quality control, case studies on Biotechnology in the evolution of food quality, HFCS(High Fructose Corn Syrup) and mycoproteins.

**5 . FOOD SPOILAGE 9**

Utilisation of microorganisms in food industry , genetic manipualtions, food borne illness.

**Total No of periods: 45**

*References:*

1. *Lindsay, Willis Biotechnology, " Challenges for the flavour and food industries ", Elsevier Applied Science,1988.*
2. *Roger A., Gordan B., and John T., " Food Biotechnology ", 1989.*
3. *George J.B., and John T., " Food Microbiology ", CBS Publishers & Distributors, 1987.*
4. *James M.J., " Modern Food Microbiology ", CBS Publishers & Distributors, 1987.*

**1 . INTRODUCTION 5**

Development of Drug and Pharmaceutical Industry-Therapeutic agents, their uses and economics; Regulatory aspects.

**2 . DRUG METABOLISM AND PHARMACOKINETICS 10**

Drug metabolism-physico chemical principles, radioactivity-pharma kinetics-action of drugs on human bodies.

**3 . IMPORTANT UNIT PROCESSES AND THEIR APPLICATIONS 5**

Bulk drug Manufactures, Types of Reactions in Bulk drug Manufacture and Processes. Specil Requirements for Bulk Drug Manufacture.

**4 . MANUFACTURING PRINCIPLES 18**

Compressed tables, wet granulation-dry granulation or slugging-direct compression-tablet presses, coating of tablets, capsules sustained action dosage forms-parental solutions-oral liquids-injections-ointments-Topical Application, Preservation, analytical methods and test for various drugs and pharmaceuticals, Packing-Packing Techniques, Quality Management, GMP.

**5 . PHARMACEUTICAL PRODUCTS AND THEIR CONTROL 7**

Therapeutic categories such as vitamins, laxatives, analgesics, non-steroidal contraceptives, Antibiotics, biological, hormones.

**Total No of periods: 45**

*References:*

- 1. Leon Lachman et al Theory and Practice of Industrial Pharmacy, 3 Edition, Lea and Febiger, 1986.*
- 2. Remington's Pharmaceutical Sciences, Mark Publishing and Co.*

**45**

1. Basic concepts of developmental Biology, mosaic and regulative development, pattern formation, positional information.
2. Development of fish, amphibian, avian and mammalian embryos, development of *C.elegans*, *Drosophila*; and *Arabidopsis*.
3. Setting up the body axes-Dorsventral and anteroposterior axes. Modes of axes determination.
4. Origins of Germ Layers, germ layer formation, role of Organizer region, Hox genes and Homeotic genes.
5. *Drosophila* development-positional information gradient, gap genes, segment polarity genes, pair-rule of maintenance genes, Maternal and zygotic genes.
6. Patterning in *C.elegans* and slime molds, Morphogenesis Cell differentiation, Organogenesis, Tissue growth, aging and senescence.

**Total No of periods: 45***Reference:*

1. *L.Wolpert " Principles of Development ", Oxford University Press, 1998.*

**45**

1. Basic concepts of developmental Biology, mosaic and regulative development, pattern formation, positional information.
2. Development of fish, amphibian, avian and mammalian embryos, development of *C.elegans*, *Drosophila*; and *Arabidopsis*.
3. Setting up the body axes-Dorsventral and anteroposterior axes. Modes of axes determination.
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5. *Drosophila* development-positional information gradient, gap genes, segment polarity genes, pair-rule of maintenance genes, Maternal and zygotic genes.
6. Patterning in *C.elegans* and slime molds, Morphogenesis Cell differentiation, Organogenesis, Tissue growth, aging and senescence.

**Total No of periods: 45**

**1 . INTRODUCTION 9**

Levels of structures in Biological macromolecules. Central questions in biophysics, basic strategies in biophysics.

**2 . CONFORMATIONAL ANALYSIS 9**

Forces that determine protein and nucleic acid structure, basic problems, polypeptide chain geometrics, potential energy calculations, observed values for rotation angles, hydrogen bonding, hydrophobic interactions and water structures ionic interactions, disulphide bonds.

**3 . STRUCTURAL ANALYSIS OF MACROMOLECULES 9**

Prediction of proteins structure nucleic acids, general characteristics of nucleic acid structure, geometrics, glycosidic bond rotational isomers and those puckering backbone rotational isomers and ribose puckering backbone rotational isomers and ribose puckering forces stabilising ordered forms, base pairing, base stacking tertiary structure of nucleic acids.

**4 . KINETICS OF LIGAND INTERACTIONS 9**

Biochemical Kinetics studies, Unimolecular reactions, simple biomolecular multiple intermediates, steady state kinetics, catalytic efficiency, relaxation spectrometry, ribonuclease as an example.

**5 . TECHNIQUES FOR THE STUDY OF BIOLOGICAL STRUCTURE & FUNCTION 9**

Size and shape of macromolecules-methods of direct visualisation -macromolecules as hydrodynamic particles-macromolecular diffusion-ultracentrifugation-viscometry x-ray crystallography determination of molecular structures, X-ray fibre diffraction electron microscopy neutron scattering-light scattering.

**Total No of periods: 45**

*Reference:*

*1. Cantor R., Samuel P.R., " Biophysical Chemistry ", W.H., Freeman & Co., 1985.*

**1 . ANTIGENTS 3**

Types of antigens, their structure, preparation of antigens for raising antibodies, handling of animals, adjuvants and their mode of action.

**2 . ANTIBODIES & IMMUNODIAGNOSIS 9**

Monoclonal and polyclonal antibodies-their production and characterisation, westren blot analysis, immuno electrophoresis, SDS-PAGE, purification and synthesis of antigens, ELISA-principle and applications, radio immuno assay(RIA)-principles and applications, non isotopic methods of detection of antigens-enhanced chemiluminescence assay.

**3 . ASSESMENT TO CELL MEDIATED IMMUNITY 12**

Identification of Lymphocytes and their subsets in blood. T cell activation parameters, estimation of cytokines, macrophages activation, macrophage microbicidal assays, in-vitro experimentation-application of the above technology to understand the pathogenesis of infection diseases.

**4 . IMMUNOPATHOLOGY 6**

Preparation of storage of tissues, identification of various cell types and antigens in tissues, isolation and characterisation of cell types from inflammatory sites and infected tissues, functional studies on isolated cells, immunocytochemistry-immunoflurescence, immunoenzymatic and immunoferrtin techniques, immuno electron microscopy.

**5 . MOLECULAR IMMUNOLOGY 9**

Preparation of vaccines, application of recombinant DNA technology for the study of the immune system, production of antidiotypic antibodies, catalytic antibodies, application of PCR technology to produce antibodies and other immuological reagents, immunotherapy with genetically engineered antibodies.

**6 . CURRENT TOPICS IN IMMUNOLOGY 6**

Trends in Immunology of infectious diseases and tumours, topics as identified from time to time.

**Total No of periods: 45**

*Text Books:*

1. *Talwar G.P., and Gupta S.K., " A hand book of practical and clinical immunology ", Vol.1 &2 CBS Publications, 1992.*
2. *Weir D.M., " Practical Immunology ", Blackwell Scientific Publications, Oxford, 1990.*

*References:*

1. *Austin J.M and Wood K.J., " Principles of cellular and molecular immunology ", Oxford University Press, Oxford, 1993.*

**1 . FUNDAMENTALS OF CANCER BIOLOGY 9**

Regulation of Cell cycle, mutations that cause changes in signal molecules, effects on receptor, signal switches, tumour suppressor genes, modulation of cell cycle in cancer, Different forms of cancers, Diet and cancer.

**2 . PRINCIPLES OF CARCINOGENESIS 12**

Chemical Carcinogenesis, Metabolism of Carcinogenesis, Principles of Physical Carcinogenesis, X-Ray radiation-mechanisms of radiation Carcinogenesis.

**3 . PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER 9**

Oncogenes, Identification of Oncogenes, Retroviruses and Oncogenes, detection of Oncogenes. Oncogenes/Proto Oncogene activity. Growth factors related to transformation.

**4 . PRINCIPLES OF CANCER METASTASIS 9**

Clinical significances of invasion, heterogeneity of metastatic phenotype, Metastatic cascade, Basement Membrane disruption, Three step theory of Invasion, Proteinases and tumour cell invasion.

**5 . NEW MOLECULES FOR CANCER THERAPY 6**

Different forms of therapy, Chemotherapy, radiation Therapy, Detection of Cancers, Prediction of aggressiveness of Cancer, Advances in Cancer detection.

**Total No of periods: 45**

*References:*

1. *Maly B.W.J, " Virology a practical approach ", IRL Press, Oxford, 1987.*
2. *Dunmock N.J and Primrose S.B., " Introduction to Modern Virology ", Blackwell Scientific Publications, Oxford, 1988.*
3. *" An Introdution top Cellular and Molecular Biology of Cancer ", Oxford Medical Publications, 1991.*

**45**

1. Principles of gene Expression-Genome Mapping-Human Genome Project-Genomes of other organisms-Role of genomics in Drug discovery and development-peptide nucleic acid technology.
2. Genomics in Biopharmaceutical Industry Functional Genomes-Pharmacogenetics-Genomics in relation to molecular Diagnosis-Molecular Therapeutic technologies.
3. Gene Therapy-Gene Therapy-New Targets for drug discovery.
4. Proteomics Proteomic Techniques-Pharmaceutical Application-Proteomics in drug Discovery-in human.
5. Role of animal models in identification of genes for disorders knockout mice.

**Total No of periods: 45***Reference:*

1. S.Sahai, *Genomics and Proteomics, " Functional an Computational Aspects "*,  
*Pienum Publications, 1999.*

<b>1 .</b>	<b>2</b>
Introduction to pathogenesis, attributes of microbial pathogenesis, components of microbial pathogenicity	
<b>2 .</b>	<b>3</b>
Population genetics of Microbial pathogenesis, methods to detect genetic diversity and structure in nature population, epidemiology, cryptic diseases.	
<b>3 .</b>	<b>5</b>
Host defences against pathogens, clinical importance of understanding of host defences, components of the host surface defences systems like, mucosa and the defences systems of the eye, mouth, respiratory tract etc., components of the systemic defence like the tissues and blood.	
<b>4 .</b>	<b>5</b>
Virulence and virulence factors, colonising virulence factors, virulence factors damaging the host tissues, virulence genes and regulation of the virulence genes.	
<b>5 .</b>	<b>5</b>
Experimental methods to study host pathogen interaction, selecting the pathogen model, measurement of virulence, identification of potential virulence factors, modulation of immune response by vaccines, properties of vaccines, other immuno modulators.	
<b>6 . PARADIGMS OF PATHOGENESIS</b>	<b>14</b>
a) Diphtheria disease by colonisation.	
b) Disease without colonisation, C.Botulinum and Staph aureus.	
c) Cholera	
d) Intestinal infections, Shigella and E.coli infections.	
e) Salmonella infections	
f) Fungal infections	
<b>7 . FUTURE CHALLENGES</b>	<b>11</b>
a) Gastric and duodenal ulcers are they due to infections.	
b) Lyme disease and Syphilis-unsolved mystery	
c) Legionnaires disease-aftermath of comforts.	
d) Tuberculosis and other mycobacterial infection-re-emerging with vengeance.	
e) Rheumatic fever and glomerulo nephritis still a question to be solved.	
<b>Total No of periods:</b>	<b>45</b>

*References:*

1. Iglewski B.H and Clark V.L " *Molecular basis of Bacterial Pathogenesis* ", Academic Press, 1990.
2. Talaro K. and Talaro A. " *Foundations in Microbiology* ", W.C Brown Publishers, 1993.
3. Roitt I, " *Essentials of Immunology, 8 th edition* ", Blackwell Scientific Publishers, 1994.
4. Janeway C.A Jr.and Travers P.T. " *Immunobiology* ", Blackwell Scientific Publishers, 1994.
5. Austyn J.M and Wood K.J " *Principles of Cellular and Molecular Immunology* ", Oxford University Press, 1993.

**1 . PROCESS DESIGN DEVELOPMENT 6**

Technical feasibility survey, process development, flow diagrams, equipment design and specifications.

**2 . GENERAL DESIGN CONSIDERATION 9**

Marketability of the product, availability of technology, raw materials, equipments, human resources, land and utilities, site characteristics, waste disposal, govt, regulations and other legal restrictions, community factors and other factors affecting investment and production cost.

**3 . COST ESTIMATION 30**

Capital investment-fixed capital investments including land, building, equipments and utilities, installation cost(including equipments, instrumentation, piping, electrical installation and other utilities), working capital investment. Manufacturing costs-Direct Production cost(including raw materials, human resources,maintenance and repair, operating supplies, power and other utilities, royalties etc..) fixed charges (including depreciation, taxes insurance, rental cost etc)., Plant overheads-Administration, safety and auxiliary services, payroll overheads, ware house and storage facilities etc. Profitability Analysis-return on original investment, interest rate of return, accounting for uncertainty and variations and future developments. Optimization techniques-Linear and Dynamic programming, Optimization strategies.

**Total No of periods: 45**

*References:*

- 1. Peters and Timmerhaus, " Plant design and Economics for Chemical Engineers ", McGraw Hill 4th Edition, 1989.*
- 2. Rudd and Watson, " Strategy of Process Engineering ", Wiley, 1987.*

**1 . EMPIRICAL FORCE FIELDS MOLECULAR MECHANISMS 5**

Bond Stretching-Angel Bending -Torsional terms -Out of Plane bonding motions-Electrostatic interactions- Van Der Waals interactions-Effective pair Potentials-Hydrogen Bonding-Simulation of liquid water.

**2 . COMPUTER SIMULATION METHODS 10**

Calculation of thermodynamic properties-Phase space-Practical aspects of computer simulation-Boundaries monitoring Equilibrium-Long range process-Analysing results of simulation and estimating errors.

**3 . MOLECULAR DYNAMICS SIMULAITON METHODS 10**

Molecular Dynamics using simple modules-Molecular Dynamics with continous potentials-Running Molecular Dynamics simulation-Constant dynamics-Time dependent properties-Molecular Dynamics at constant temperature and pressure.

**4 . MONTE CARLO SIMUALTION METHODS 10**

Metropolis methods-Monte Carlo simualtion of molecules-Monte Carlo simulation of polymers -Calculating chemical potentials-Monte Carlo or Molecular Dynamics.

**5 . MOLECULAR MODELLING TO DISCOVER AND DESIGN NEW MOLECULES 10**

Molecular modelling in drug discovery-Deriving and using 3D Pharma cores-Molecular docking -Structure Based methods to identiy lead components-Denovo ligand design.

**Total No of periods: 45**

*Text Books:*

1. *A.R. Leach, "Molecular Modelling Principles and Applications", Longman, 1996.*
2. *J.M. Haile, "Molecular Dynamics Simulation Elementary Methods", John Wiley and Sons, 1997.*

*References:*

1. *GROMOS 95 Manual, BIOMOS Switzerland, 1995.*
2. *HYPERCHEM Manual hypercube Canada, 1995.*

**IB051 Neurobiology and Cognitive Sciences**

**3 0 0 100**

**1 . INTRODUCTION TO NERVOUS SYSTEMS 9**

Central and Peripheral nervous systems.

**2 . NEURO ANATOMY 9**

Structure and functions of neurons, synapse, their function, signals produced by neurons, sensors function, Glial cells, molecular and cellular organisation of neuronal differentiation, characterisation of neuronal cells.

**3 . NEUROPHYSIOLOGY AND NEUROPHARMACOLOGY 9**

Pharmaceutical mediator released by neurons, Hormones and their effect on neuronal function, Conduction of impulses by neurons Correalation of sensory functions.

**4 . NEUROLOGICAL DISORDERS 9**

Its Pathogenesis, Genetic basis of neurological disorders.

**5 . BEHAVIOUR SCIENCE 9**

Neuronal mechanism of behaviour, Animal behaviour, Behaviour in various environments.

**Total No of periods: 45**

*Reference:*

*I. A.B. Schiebel Neurobiology of higher cognitive function Guilford Press, 1990.*

1. Introduction-Characterisation of Biodiversity-Magnitude and Distribution of Biodiversity-Generation, Maintenance and loss of Biodiversity.
2. Biodiversity and ecosystem functioning - Basic principles , ecosystem analysis-Inventorying and Monitoring of Biodiversity-The Resource base for Biodiversity assessments.
3. Data and information management and communication-Biotechnology.
4. Human influences on Biodiversity-Economic values of Biodiversity.
5. Measures for conservation of Biodiversity and sustainable use of its components.

**Total No of periods:    45**

*Text Book:*

1. *V.H Heywood.R.T Watson Global Biodiversity Assessment, Cambridge University Press, 1996.*