B.TECH BIOTECHNOLOGY

SEMESTER - VII

19B701 IPR, BIOSAFETY AND BIOETHICS

3 0 0 3

BIOETHICS : Professional conducts and responsibility, Professional Ethics , Disease prevention Vs right to privacy, genetic tests in diagnostics and therapy, patentability of DNA, Case Study (7)

PATENTS AND DESIGNS : Patents and Utility models, Industrial designs, Patent search, Patent drafting, Patent Application, PCT , Indian IPR legislations, Case study (10)

IPR FOR INDIGENOUS RESOURCES : Protection of Plant varieties and Farmer's rights, Geographical Indicators,Traditional Knowledge and Folklore (8)

TRADE RELATED IP SAFEGUARDS : Copy rights: Trade secrets, WTO, TRIPS, Trade Barriers (8)

BIOPROSPECTING AND BIOSAFETY : Biodiversity, Bio-piracy, CBD, Cartagena protocol, Release of GMO into environment, safety assessment of biotechnology products, Case Study (12)

Total L: 45

TEXT BOOKS:

1. Krishna V , "" Bioethics And Biosafety In Biotechnology", 1st Edition, New Age International P Ltd, New Delhi, 2017.

2. Goel D and Parashar S , "IPR, Biosafety and Bioethics", 1st Edition, Pearson, New Dehi, 2013.

REFERENCES:

1. Ma M ,"Fundamentals Of Patenting And Licensing For Scientists And Engineers", 1s Edition, Wrld Scientific, New Jersey, 2015.
2.Gordon T T et al , "Patent Fundamentals for Scientists and Engineers 3rd Edition Canada", CRC Press,CANADA, 2012.

19B720 PROJECT WORK I

0 0 4 2

1. Identification of real life problem in thrust areas
2. Developing a mathematical model for solving the above problem Finalisation of system requirements and specification
3. Proposing different solutions for the problem based on literature survey Future trends in providing alternate solutions
4. Consolidated report preparations on the above

Total P:60

SEMESTER - VIII

19B820 PROJECT WORK II

0 0 8 4

The Project involves the following:

1. Preparing a project - Brief proposal including the following
   a. Problem Identification
   b .A statement of system/process specifications proposed to be developed (Block Diagram/Concept tree)
2. List of possible solutions including alternatives and constraints
3. Cost benefit Analysis
4. Time line of activities
5. A Report highlighting the design finalization (Based on functional requirements and standards (if any)) A Presentation including the following:
6. Plan implementation and progress made
7. Testing and validation of the developed system/hypothesis
8. Learning from the project
9. Consolidated Report Preparation

Total P:120

PROFESSIONAL ELECTIVES

19B001 PLANT BIOTECHNOLOGY

3 0 0 3

INTRODUCTION : Plant evolution and breeding - Marker Assisted selection - Organization and Expression of Plant Genes - Mitochondrial and chloroplast genomes - plant molecular genetics of photosynthesis and development. (8)

PLANT TISSUE CULTURE : methods - types - application - secondary metabolite production – Agrobacterium rhizogenes and hairyroot induction. (6)

GENETIC ENGINEERING TECHNIQUES : Agrobacterium mediated transformation - protoplast fusion - direct gene delivery methods - Plant viruses as vectors and chloroplasttranformation. (6)

STRATEGIES FOR PLANT MODIFICATIONS: introducing biotic and abiotic stress resistance/tolerance - phytoremediation - herbicide resistance. (13)

APPLICATIONS : Molecular farming/pharming - symbiotic microorganism and their role in enhancing plant growth - yanobacterial and algal modifications. Growing of GM crops - their regulations - Case studies pertinent to Indian scenario\t. (12)

Total L: 45

TEXT BOOKS:

1. Slater A, Scott N , Fowler M , "Plant biotechnology- the genetic manipulation of plants", Oxford press, 2008.
2. Kirakosyan A, Kaufman P , Cseke L , "Recent advances in plant biotechnology", Springer, 2009.

REFERENCES:

1. Trigiano, R N , Gray J D , "Plant Tissue Culture, Development and Biotechnology", CRC Press, 2010.
2. Sane, Mahajan, Khairnar, Saler & Thakur , "Fundamentals of Plant Biotechnology", Vision Publications, 2010.
3. Razdan M K , "Introduction to plant tissue culture", Science publishers, 2003.
4. Oksman , Caldente , "Plant biotechnology and transgenic plants", Marcel Dekker, 2002.

19B002 ENVIRONMENTAL BIOTECHNOLOGY

3 0 0 3

STATUS OF THE ENVIRONMENT : Global environmental issues - challenges to sustainability; anthropogenic activities and their environmental impacts; climate change; feeding a growing population. (5)

BIOENERGY : Current energy scenario and its impacts; biogas from waste; - biofuel from biomass,algae; hydrogen from bacteria; - biotechnological approaches to improve feedstock for biofuel production (12)

BIOREMEDIATION : Ecological principles; capability of microbial process for pollutant management. Bioremediation processes; Factors affecting the bioremediation processes; In situ and ex-situ bioremediation; Microbial degradation of contaminants in gas phase; biofiltration - biotrickling filtration - bioscrubbers; Phytoremediation of organic - metals and inorganic contaminants; transgenics in bioremediation. (15)

BIODIVERSITY AND ITS CONSERVATION : Biodiversity analysis: molecular methods to analyse biodiversity - gene sequencing - phylogenetic trees - ISSR - RAPDs - isozymes. DNA Barcoding - Metagenomics - Conservation of endangered species: micropropagation - cryopreservation - ART - DNA and tissue banking. (5)

BIOFERTILIZERS AND BIOPESTICIDES : Nitrogen fixers - phosphorous solubilising bacteria - phosphorous mobilizing bacteria - plant growth promoting microorganisms - Baculoviruses - entomopathogenic fungi – Bacillus thurinigiensis. (8)

Total L: 45

TEXT BOOKS:

1. Thakur I S , "Environmental Biotechnology: Basic Concepts and Applications", 1st Edition, I K International Pvt Ltd, New Delhi, 2006.
2. Bruce E Rittmann, Perry L Mc Cathy , "Environmental Biotechnology: Principles and Applications", McGraw-Hill, Inc New Delhi, 2001.

REFERENCES:

1. NIIR Board , "The Complete Technology Book on Biofertilizer and Organic Farming National Institute of Industrial Research", New Delhi, 2004.
2. Vincent Savolainen , "DNA and tissue banking for biodiversity and conservation: theory, practice and uses", 2006., 2006.
3. David M. Mousdale , "Introduction to Biofuels", CRC Press, London, 2011.

19B003 PHARMACEUTICAL TECHNOLOGY

3 0 0 3

INTRODUCTION TO BIOPHARMACEUTICS : Histroy of biologics, Basic definitions: Biogenerics, Biosimilars, Reference drugs, Small molecules, Complexity of biologics, Drug discovery and development phases of biologics and small molecules., Different therapeutic classes of biologics (Recombinant proteins, Monoclonal Antibodies , Vaccines, Immunomodulators, cytokines, Interferons , Erythropoesis stimulating factors), Approval process of generic drug and biosimiliar. - (8)

PHARMACOLOGY OF THERAPEUTIC PROTEINS : Pharmacokinetics - ADME , factors affecting ADME , Pharmacodynamics - mode of transport, drug receptors , Clinical Pharmacology of therapeutic proteins, PKPD analyses (Special population trials for biologics, drug- drug interaction studies , Bioequivalenece studies, Bioavailability) (10)

BIOLOGIC MANUFACTURING PROCESS : Expression hosts for producing biologics , Selection and characterization of high yielding strains and cell lines (WCB and MCB generation)., Media selection and optimization., Stages of process development for biologics , Different types of bioreactors for mAb production.Stages of biologic product purification (10)

CHARACTERIZATION OF BIOGENERICS AND BIOSIMILARS : Structural characteristics of biologics, Characterization of biosimiliars (LC- MS/MS and affinity capture techniques), Problems in characterization of biologics (peptides, Non – glycosylated proteins, Glycosylated proteins, Monoclonal antibodies) Post translational modifications, protein aggregates, Equivalence issues (9)

DRUG REGULATIONS AND CASE STUDIES OF BIOPHARMACEUTICAL PRODUCTS : Biologic drug regulatory process (CDSCO regulation , FDA regulation)., cGMP practices in the manufacture of biologics . - Case studies o n different biologic products : Insulin and its analogues, Trantuzumab, cetuximab, Infliximab, L-Asparginase, Streptokinase. (8)

Total L: 45

TEXT BOOKS:

1. Lachman L Lieberman, HA, Kanig, J , "Theory and Practice of Industrial pharmacy", Varghese Publishing & Co, 2009.
2.Sarfaraz K. Niazi , "Handbook of Biogeneric Therapeutic Proteins: Regulatory, Manufacturing, Testing, and Patent Issues", 2nd Edition, CRC Press, 2006.
3. Rodney J Y Ho, Milo gibaldi , "Biotechnology and Biopharmaceuticals transforming proteins and genes into drugs", 1st Edition, Wiley Liss, 2003.

REFERENCES:

1. Wei Wang, Manmohan singh , "Biological Drug Products: Development and Stratergies", 1st Edition, Wiley, 2013.
2. Goodman & Gilman's , "The Pharmacological Basis of Therapeutics", 11th Edition, Mc GrawHill Medical Publishing Division, 2006.

19B004 FOOD SCIENCE AND TECHNOLOGY

3 0 0 3

INTRODUCTION TO FOOD SCIENCE AND TECHNOLOGY : Dimension of food science - food processing industry- current status. Major classes of food components. Food categorization & composition. Probiotics and prebiotics,Nutraceutical compounds-scope and future prospects, Human nutrition and food. (9)

FOOD CHEMISTRY : Functional groups and properties - Water and acids - Carbohydrates - lipids - Proteins - color -flavor & texture - food additives. (8)

FOOD PROCESSING AND PRESERVATION : Food preservation - Manufacturing or processing in Dairy products -egg - meat - sugar - fat & oils - Beverages - cereal grains - fruits and vegetables.,SCP (8)

MICROBIOLOGY AND FERMENTED FOODS : Factors affecting microbial growth - food borne microorganism,food borne illness - food spoilage quality control; preservation techniques. Fermented Foods - Food safety – Food toxicology. (8)

FOOD ENGINEERING AND FOOD BIOTECHNOLOGY : Food material science - food micro structure - Psychometrics - Rheology - Extrusion technology,Improving plant products, Animal products, Food processing aids through biotechnology. Safety in Biotechnology derived foods. Major concerns. (12)

Total L:45

TEXT BOOKS:

1.Murano PS , "Understanding Food Science and Technology", Thomson wads worth, 2009.
2.James MJ , "Modern Food Microbiology", CBS Publishers, New Delhi, 2012.

REFERENCES:

1. Campbell -patt Edited , "Food Science and Technology", Blackwell publishing Ltd, 2009.

19B005 ANIMAL BIOTECHNOLOGY

3 0 0 3

ANIMAL CELL CULTURE : Cell culture - Cell lines - Characterization and preservation of animal cells - chemically defined and serum free media for cell culture - scaling up of animal cell cultures - organ culture - insect cell lines - Products from animal cell culture. (12)

ARTIFICIAL REPRODUCTIVE TECHNOLOGIES : Hormones in animal development - superovulation – Artificial insemination - invitro fertilization, embryo manipulation - embryo splitting and sexing. (9)

TRANSGENIC ANIMALS : Transgenic mice - generation and applications of oncomice - knock out mice - cattle & other farm animals - transgenic fish- methodology & application. Production of spider silk - improvement of wool quality. (8)

GENE THERAPY : - ex vivo gene therapy - in vivo gene therapy - viral gene delivery systems - nonviral gene delivery systems - Pros and cons of the various methods (8)

PRODUCTS FROM ANIMAL CELL CULTURE : Commercially viable products from mammalian cell culture: Selected examples in monoclonal antibodies, (Humira, Mylotarg) vaccines (Hepatitis vaccine) and therapeutics (blood clotting factors, cytokines, hormones). Quality control practices and safety for cell culture based products (8)

Total L: 45

TEXT BOOKS:

1.Glick and Pasternak , "Molecular Biotechnology", ASM Press, Washington DC, 2010.
2.Freshney IR , "Culture of Animal Cells: A Manual of Basic Technique", Wiley-Liss Inc., New York, 2000.

REFERENCES:

1.Primrose S B and Twyman R , "Principles of Gene Manipulation and Genomics", John Wiley & Sons, USA, 2013.
2.Alcamo , "DNA Technology the awesome skill", Wm, C, Brown Publishers, , Dubuque, Iowa, 2000.

19B006 BIOPROCESS PLANT DESIGN, ECONOMICS AND BIOSAFETY

3 0 0 3

TISSUE CULTURE SYSTEM DESIGN: : Engineering aspects for design of plant tissue culture system, components of plant tissue culture system –HEPA filter, Incubator, Illumination; Air flow and operational area; Movement materials; Field area, hardening facilities; (9)

DESIGN OF EQUIPMENT FOR BIOWASTE DEACTIVATION: : Aerobic and anaerobic biological waste treatment systems, hold-up and discharge area; design of biological waste water treatment system –Dairy industry as a case study. (9)

PROCESS DIAGRAMS: : Flow sheeting: Process flow diagram computer aided flow sheeting for production of enzymes, antibiotics, solvents; P&I Diagrams: Symbols and layout, mechanical design of piping systems –pipe size selection—control and instrumentation. (9)

CONSTRUCTION MATERIALS: : materials properties, common materials used for bioprocess equipment construction. (9)

PROCESS EQUIPMENT: : Pressure vessel: Pressure vessel codes and standards, mechanical design of pressure vessels, pressure vessel supports, Design of storage vessels. Bioreactor vessel: Laboratory and industrial bioreactors, components of bioreactor, selection of materials, General design consideration of bioreactor, bioreactor design using CAD, bioreactor safety, Process utilities: Design of bioprocess plant utilities. (9)

Total L: 45

TEXT BOOKS:

1.Brownell L E and Young E H , "Process Equipment Design", John-Wiley &Sons, New York,2004.
2.Mahajani VV and Umarji SB , "Process Equipment Design", McMillan Co, New Delhi,2011.

19B007 MEDICAL GENETICS

3 0 0 3

INHERITANCE PATTERN : Mendels law, Chromosome theory of inheritance,Autosomal/sex linked - mitochondrial - genetic expressivity - penetrance - pleiotropy - anticipation - genomic imprinting. (10)

POPULATION GENETICS : Hardy-Weinberg principle - mutation - migration - gene flow - genetic drift, Linkage –gene mapping in eukaroytes - QTL mapping. (9)

CYTOGENETICS AND CHROMOSOMAL DISORDERS : Karotyping - ideogram for G-banding - FISH - C C G - Aneuploidy and Deletions - Translocation - Mosaicism and Chimerism. (9)

MOLECULAR ASPECTS OF DISEASES : Triplet-Repeat Diseases - Tay Sachs disease - cystic fibrosis -

Thalasemia - DMD - - (8)

DIAGNOSIS AND THERAPY OF GENETIC DISORDERS : Genetic diseases in prenatal - the neonatal period - childhood and adulthood - screening of diseases - gene therapy. (9)

Total L: 45

TEXT BOOKS:

1. Lynn B, C Carey , "Medical Genetics", 5th Edition, Mosby publications, 2016.
2. Klug WS, Cummings MR , "Concepts of Genetics", 10th Edition, Prentice Hall International Inc,, New Jersey, 2011.

REFERENCES:

1. Micheal J Simmons, Eldon John Gardener , "Principles of Genetics", 8th Edition, John-Wiley & Sons, Newyork, 2005.

19B008 NANOMATERIALS FOR BIOAPPLICATONS

3 0 0 3

NANOTECHNOLOGY : Introduction-scientific evolution-history of nanotechnology-nanoparticles –surface –to- volume ratio- Nanoparticles for live cell dynamics (9)

NANOMATERIALS FOR CELL ENGINEERING : Nanoscale Biological Recognition and the cellular environments-Materials with controlled nanogeometry, nanochemistry& nanomechanics. Nanostructured Extracellular matrix (9)

STEALTH AND BIOMIMETIC CORE-CORONA NANOPARTICLES : Biodistribution of intravenously administered particles-Protein-rejecting abilities Polyethylene glycol coatings-stealth PEG coated Drug carriers-detection and characterization of the PEG corona (9)

NANOBIOMOTORS : General classification of bionanomotors - kinesin motor and nanoactuators, F0-F1 ATPase motor -viral DNA packaging motor-helicase (9)

SELF ASSEMBLED NANOBIOMATERIALS : Peptide systems-peptide for biomineralization-short amphiphilic peptides-cyclic peptides with alternating D &L-amino acids-boloamphiphilic peptides-peptides that form 3D scaffold hydrogels (9)

Total L: 45

TEXT BOOKS:

1. Niemeyer C M, Mirkin C A ,"Nanobiotechnology, Concepts, Applications and Perspectives", Wiley-Vch,, Germany, 2006.
2. Yubing Xie , "The nanobiotechnology Handbook", CRC press,, London, 2013.

REFERENCES:

1. H.S.Nalwa , "Encyclopaedia of Nanoscience & nanotechnology", Vol 6 & 7, American scientific publisher, 2004.
2. Stergios Logothetidis , "Nanomedicine and Nanobiotechnology", Springer, New York, 2012.
3. Boisseau P, Houdy P, Lahmani M , "Nanoscience:Nanobiotechnology and Nanobiology", Springer, New York, 2010.

19B009 SMART NANO PARTICLES IN CANCER THERAPY

3 0 0 3

INTRODUCTION TO CANCER BIOLOGY & NANOCARRIERS : Causes of cancer,p53 pathway, tumors-benign-malignancies-Enhanced Permeation and Retention effect, definition of nanomaterials& nanomedicine, need for nanomedicine & nanocarrier, factors affecting nanocarrier properties, Homing device challenge, active & passive targeting with nanoparticles(9)

MAGNETIC MICRO AND NANOPARTICLES : Introduction-histroy of magnetic drug targeting-embolotherapy- hyperthermic herapy-magnetic particles for delivery of chemotherapeutic drugs-brachy therapy-magnetic particles for gene therapy (9)

THERMORESPONSIVE LIPOSOMES FOR HYPERTHERMIC CHEMOTHERAPY : Introduction-liposomal formulation for drug delivery-membrane transition and permeability-modeling of interfacial gel-liquid regions-phospholipid selection-liposome preparation &characterization. (9)

ULTRASOUND IN DRUG DELIVERY : Ultrasound energy deposition in body-modes of ultrasound applications in drug delivery-ultrasound cavitation-effect of doxorubicin on transient cavitation- interaction with cells-ultrasound induced drug delivery from micelles (9)

VIRUS LIKE NANOPARTICLES: : Introduction-polycations, surfactants & Gemini lipids for gene delivery in Vitro, morphology of DNA-surfactant complexes-stability , surface modification strategies and targeting effects. (9)

Total L: 45

TEXT BOOKS:

1. Reza Arshady and Kenji Kono , "Smart Nanoparticles in Nanomedicine", 8th Edition, Knetus Books, London, 2006.
2. Thomas Vorup-Jensen, Dan peer, Kenneth A. Howard , "Nanomedicine", CRC press, Newyork, 2016.

REFERENCES:

1. Mingjun Zhang and Ning Xi , "Nanomedicine: A Systems Engineering Approach", Pan Stanford Publishing, Singapore, 2019.
2. Alf Lamprecht , "Nanotherapeutics Drug Delivery Concepts in Nanosience", Pan Stanford Publishing,, Singapore, 2016.

19B021 RESEARCH TOPICS IN CANCER BIOLOGY

3 0 0 3

INTRODUCTION : Molecular Biology - Cancer overview. (4)

CELL CYCLE : Mitotic spindle; MPF and cell cycle control; yeast model; complex genetic diseases; cyclins and kinases. (7)

SIGNALS AND REGULATION : TGF-; CiP1; G2 cyclins; differentiation and reversal; disease mechanisms in acute promyelocytic leukemia. (8)

APOPTOSIS : c-rel and cell death; Bcl2 interactions in cell survival; DNA replication control; growth factor dependence and apoptosis suppression. (7)

ONCOGENE : ATC - Tcf-4 - -catenins and c-myc; Waf1 and p53; phosphatase 2A. (7)

TUMORIGENESIS : Anticancer agents and p53; dosage effects of tumor suppressor; colon cancer; breast cancer metastasis. (7)

THERAPY : Control of vasculogenesis; stem cell and CML dynamics; temporal targeting. (5)

Total L: 45

TEXT BOOKS:

1. Rudden RW , "Cancer Biology", Oxford University Press, 2007.

19B022 MOLECULAR PATHOGENESIS

3 0 0 3

PATHOGENESIS : Bacterial flora of humans; Endogenous and Exogenous infection - Noninvasive and invasive pathogens.(8)

VIRULENCE : Virulence factors - toxins; Genetic basis of virulence; virulence genes and their regulation. Virulence protein secretion pathways. Microbial evasion strategies of host defense; Regulation of virulence associated genes - Methods to identify bacterial pathogenecity factors. (16)

PARADIGMS OF PATHOGENESIS : E.coli - Mycobacterium tuberculosis - Candida - Hepatitis B virus - Plasmodium. (15)

THERAPEUTIC CHALLENGES : Antibiotic resistance-molecular mechanisms - transposon mediation. Vaccine development in Malaria. (6)

Total L: 45

TEXT BOOKS:

1.Eduardo A Groismann , "Principles of bacterial pathogenesis",FL, 2001.
2.Hacker J , " Molecular Infection Biology: interaction between microorganisms and cells", Berlin 2002, 2002.

REFERENCES:

1. Wilson M, McNab R , Henderson B , "Bacterial disease mechanisms- An introduction to cellular microbiology", 2002.

19B023 DEVELOPMENTAL BIOLOGY

3 0 0 3

INTRODUCTION TO DEVELOPMENTAL BIOLOGY : Development among unicellular eukaryotes. Development pattern among the metazoans. Differential cell affinity. (5)

PATTERNS OF DEVELOPMENT : Gametogenesis - Fertilization - Cleavage - Gastrulation - Neurulation and the ectoderm - Axonal specificity - Mesoderm and endoderm. (10)

MECHANISM OF CELLULAR DIFFERENTIATION : Transcription factors - activation of specific promotes - chromatin. Control of development by differential RNA processing and translation. (6)

SPECIFICATION OF CELL FATE AND THE EMBRYONIC AXES : Autonomous - conditional and syncytial specification; Genetics

of axis specification in Drosophila - Specificity of cell fate by progressive cell- cell interactions - Establishment of\xa0 body axes in mammals and birds. (10)

CELLULAR INTERACTION DURING ORGAN FORMATION : Proximate tissue interaction - Development of the tetrapod limb. Cell interaction at a distance: Hormones as mediators of development. Sex determination. Environmental regulation of animal development. Metamorphosis - Developmental mechanisms of evolutionary (14)

Total L: 45

TEXT BOOKS:

1.Scott F Gilbert , "Developmental Biology", Sinauer Associates Inc.,2003.

2.Slack j m w , "Essential Developmental Biology", 3rd Edition, Wiley-Blackwell, OXFORD, 2012.

REFERENCES:

1. Wolpert L, Jessell T , Lawrence P , "Principles of Development", Oxford University Press, 2010.

19B024 PROTEIN ENGINEERING

3 0 0 3

PROTEIN STRUCTURE : Primary structure and peptide bond; secondary structures and supersecondary structures; folding pathways; tertiary structure; quaternary structure; post translational mofifications - - - - - (12)

PROTEIN STRUCTURE ANALYSIS : Protein sequencing, Circular dichroism and X ray crystallography for protein structure determination, Techniques for studying post translational modifications (9)

STRUCTURE FUNCTION RELATIONSHIP : DNA binding proteins- lac repressor; membrane proteins- bacteriorhodopsin, hormones receptors – estrogen receptors; serine proteases, Protease inhibitors – HIV protease (9)

PROTEIN ENGINEERING METHODS : Site directed and random mutagenesis, approaches for Protein Engineering, rational design and directed evolution, de novo protein design (8)

ENGINEERED PROTEINS : Engineering thermal stability and other properties; Antibody engineering; Therapeutic insulin; Engineering Subtilisin (7)

Total L: 45

TEXT BOOKS:

1. Creighton TE , "Protein Structure- A practical approach,", IRL Press, 1998.

2. Carl Branden and John Tooze , "Introduction to protein structure", 2nd Edition, Garland Publishing, 1998.

REFERENCES:

1. Alberghina L , "Protein engineering in Industrial Biotechnology", Chur, 2003.
2. Schulz G E, , Schirmer R H , "Principles of Protein structure", Springer-Verlag, 2003.
3. Glick B, , Pasternak J J , "Molecular Biotechnology principles and applications of Recombinant DNA", ASM Press, 2001.

19B025 IMMUNOTECHNOLOGY

3 0 0 3

ANTIGENS AND EXPERIMENTAL ANIMAL MODELS : Antigens: Epitopes - B cell & T cell epitopes - Types of antigen - factors affecting immunogenecity - Haptens - preparation of antigens for raising antibodies - adjuvants and their mode of action. Handling experimental animals - Inbred strains - SCID mice - Nude mice - knock out mice. (8)

ANTIBODIES & IMMUNODIAGNOSIS : Monoclonal and polyclonal antibodies - their production and characterization - western blot analysis - SDS - PAGE - precipitation and agglutination reactions - immunoelectrophoresis - ELISA- principle and applications - radio immuno assay (RIA) - principle and applications - nonisotopic assay methods for the detection of antigens- enhanced chemiluminescence assay. (8)

ASSESMENT OF CELL MEDIATED IMMUNITY : Identification of lymphocytes and their subsets in blood - T cell activation rameters - estimation of cytokines - macrophages activation - macrophage microbicidal assays - in- vitro experimentation- application of the above technology to understand the pathogenesis of infectious disease. (9)

IMMUNOPATHOLOGY : Preparation and storage of tissues - identification of various cell types and antigens in tissues - isolation and chracterisation of cell types from inflammatory sites and infected tissues - functional studies on isolated cells - mmunocytochemistry- immunofluoresecence - immunoenzymatic and immunoferritin techniques - immunoelectron microscopy. (9)

MOLECULAR IMMUNOLOGY : Preparation of vaccines - recombinant vector vaccines - application of recombinant DNA echnology for the study of immune systems - Antibody engineering - antiidiotypic antibodies – catalytic antibodies. (11)

Total L: 45

TEXT BOOKS:
1. Richard A, Goldsby R A, Kindt T J, Kuby J, , Osborne B A , "Immunology", W.H. Freeman and Company, 2006.
2. Chakravarty A K , "Immunology and Immunotechnology", Oxford University Press, 2006

REFERENCES:
1. Talwar G P, , Gupta S K , "A handbook of practical and clinical immunology", Vol 1 & 2, 2005.
2. Burakoff J S, , Frank Austen K , "Therapeutic Immunology", Blackwell Publications, 2001.

19B026 BIOFUEL TECHNOLOGY

3 0 0 3

INTRODUCTION : Current energy scenario and the need for alternative fuels - overview of biofuel - bioenergy and biorefinery oncepts - Biomass sources and classification - Physical and chemical characteristics and potential of different biomass materials - First - second and third generation biofuels. (7)

BIODIESEL : Transesterification reaction mechanism - Basics and chemistry of fats and oil - Oil resources and feedstock - Methods for biodiesel production - Types of catalysts employed; heterogeneous catalysis, enzyme based biodiesel - Microalgae based biodiesel - Microalgae cultivation and harvesting methods; Photo bioreactor and raceway pond (10)

BIOETHANOL : Different feedstock for Bioethanol production - Fermentation process - Sugarcane molasses and other sources for fermentation process. - Lignocellulosic pretreatment methods - Hydrolysis - Hydration – Lignin upgradation - Economics of bioethanol production (10)

BIO-OIL AND BIOHYDROGEN : Thermo-chemical conversion of lignocellulose biomass - Biomass processing for liquid fuel roduction - Biohydrogen production process: Chemical & Biological method; Factors affecting biohydrogen production; Microbial fuel cell & Electrolysis cell - Thermo chemical gasification principles and its application for different biomass treatment. (9)

BIOGAS TECHNOLOGY : Feedstock for biogas production - Aqueous wastes containing biodegradable organic m atter - nimal residues; Microbial and biochemical aspects; Operating parameters for biogas production - Kinetics and mechanism - Dry and wet fermentation (9)

Total L: 45

TEXT BOOKS:
1. Caye M Drapcho, Nhuan Phu Nghiem , Terry Walker , "Biofuels Engineering Process Technology", McGraw Hill Professional, 2008.
2. David M Mousdale , "Introduction to Biofuels", CRC Press, 2010.

REFERENCES:
1. Rezaiyan. J , N. P. Cheremisinoff , "Gasification Technologies, A Primer for Engineers and Scientists",Taylor & Francis, 2005.
2. Venkata Ramana P , Srinivas S.N , "Biomass Energy Systems", Tata Energy Research Institute, 1996.
3. Chakraverthy A , "Biotechnology and Alternative Technologies for Utilization of Biomass or Agricultural Wastes",Oxford & IBH publishing Co, 1989.

19B027 STUDIES IN PARADIGMATIC DEVELOPMENTS IN BIOLOGY

3 0 0 3

BIRTH OF MOLECULAR GENETICS : Reviving the contributions of Mendel; identifying the chromosomal location of the hereditary material; developing facile models to study and experiment: microbial systems, the phage group; Contributions of Morgan, Beadle, Luria and Delbruck. (13)

BEHAVIORAL GENETICS : Study of individual and social behavior has always puzzled and promoted learning: vitalists and reflexologists models; inspiring experimental design case studies; insect, bird and fish behavior; Contributions of Lorenz, von Frisch. (8)

DECODING THE CODE : Protein synthesis and nucleic acid synthesis; manipulation of genetic material, and extracting the information; deliberations at Asilomar; Contributions of Holley, Nirenberg, Khorana. (12)

EVOLUTION OF THE GENOME : Public health and parasite diversity; Unique viral enzymes and pathogenesis discovery. Central role of RNA in biological processes. Contributions of Baltimore, Temin, Altman, Cech. (12)

Total L: 45

TEXT BOOKS:
1. Lodish, Beck, Kaiser , "Molecular Cell Biology", WH Freeman and Co, New York, 2008.
2. Bruce Alberts , "Molecular Biologyof the Cell", Garland Science, Chicago, 2008.

REFERENCES:

1. Nobel Lectures , "Articles, Talks, Multimedia", Nobelprize.org, .

19B028 ADVANCES IN GENOMICS

3 0 0 3

RECENT TRENDS IN GENOME SEQUENCING TECHNIQUES : Next Generation Sequencing, R e and deep sequencing, analysis of deep sequencing data for SNP and miRNA identification and differential expression (7)

METAGENOMICS : Techniques and Strategies for metagenomics analysis, use of metagenomic analysis for agriculture, environment and clinical applications -case studies (8)

EPIGENETICS AND EPIGENOMICS : Epigenetic and Epigenomic regulation - Techniques used in Epigenomic analysis, ChIP, ChIP on chip,ChIP sequence, ChIP- PCR, bisulfate sequencing, enzyme based methods, NGS based sequencing of the pigenome. Epigenome systems - Human epigenome, epigenomics in plants, fungi, Applications of Epigenomics (12)

PHARMACOGENOMICS : Polymorphisms in metabolizers, transporters and receptors and their consequences in drug efficacy and drug discovery - case studies (9)

CLINICAL GENOMICS : Databases of diseases namely cancer and Alzheimer's diseases and workflow approaches for data analysis (9)

Total L: 45

TEXT BOOKS:

1. Diana Marco , "Metagenomics: Theory, methods, and applications", 1st Edition, Caister Academic Press, Norfolk, UK, 2010.
2. Nessa Carey , "The epigenetic regulation", 1st Edition, Columbia University Press, UK, 2011.

REFERENCES:

1. Robert A Myers , "Epigenetic regulation and epigenomics", Wiley- Blackwell, 2012. Allen , "Pharmacognomics: Applications to Patient Care", American College of Clinical Pharmacy, USA, 2004.

19B029 SYSTEMS BIOLOGY

3 0 0 3

INTRODUCTION TO SYSTEMS BIOLOGY : Biological Systems, Processes and Techniques - Models and Modelling What is Systems Biology? - Basic concepts – Applications - Scope and Future. (3)

MODELLING THEORY : Model building - Parameter Estimation - Model testing and Selection - Local & Global Sensitivity Analysis - Model Reduction - Model Combination - Optimisation of Model Output and Structure (10)

MODELLING AND ANALYSIS OF BIOLOGICAL SYSTEMS AND PROCESSES - I : Network Modelling: Basics of network and graph theory - Properties and types of Network Structural/Stoichiometric analysis of biochemicalsystems: Construction of stoichiometric matrices, Flux Balance Analysis, Constraint based models (14)

MODELLING AND ANALYSIS OF BIOLOGICAL SYSTEMS AND PROCESSES - II : Kinetic modeling of biochemical reactions – Construction, simulation and Analysis of ODE Models using rate equations – Case Studies. Other modeling techniques: Stochastic models - Rule based models – Statistical models. (14)

DATABASES, DATA FORMATS, STANDARDS AND SIMULATION TOOLS : Internet Databases for Modelling - Systems Biology Markup Language - BioPAX – Systems Biology Graphical Notation – Other standards – Simulation Tools and Software. (4)

Total L: 45

TEXT BOOKS:

1. Wolfram Liebermeister, Christoph Wierling, Axel Kowald, Edda Klipp , "Systems Biology: A Text Book", Wiley- Blackwell Publishing,, 2016.
2. Eberhard Voit , "A First Course in Systems Biology", Garland Science,2012.

REFERENCES:

1. Brian P Ingalls , "Mathematical Modelling in Systems Biology", MIT press, 2013.
2. UrionAlon , "IntroductiontoSystemsBiology–DesignPrinciplesofBiological Systems", CRC press, 2003.

19B030 INTRODUCTION TO BIOPOLYMERS

3 0 0 3

INTRODUCTION: Classification of biopolymers (natural and mineral origin), Structure and dimensions, Biopolymers of commercial value (Polysaccharides, Poly-esters, Poly-nucleotides), Bottlenecks of synthetic polymers, Biorefinery perspective of Biopolymer Production (4)

PROPERTIES AND POLYMERIZATION TECHNIQUES : Physicochemical Properties (Solubility and Viscosity, Emulsifying Properties, Molecular Association, Pharmacological Action, Antioxidant Properties, Antimicrobial action, Surface Functional Properties, Hydrodynamic Properties; Types of Polymerization – Step-Growth, Free Radical, Chain Co-polymerization, Ionic Chain, Coordination Addition (10)

PRODUCTION AND MECHANISM OF DEGRADATION : Methods of Production (Coacervation, Interfacial Crosslinking Polymerization, Spray Drying), Types of Sources (Bacteria, Fungi, Algae, Agricultural Waste), Types of Fermentation, Factors affecting ermentation, Pathway of Synthesis, Commercially Viable Types: Starch, Gum Arabica, Gluten, Natural Rubber; Mechanism of Degradation for naturally occurring polymers (12)

CHARACTERIZATION TECHNIQUES : Physical and Structural — X-Ray diffraction, Scanning Electron Microscopy, ransmission Electron Microscopy, Thermogravimetry, Viscometry, Turbidometry; Electrical Properties — Zeta Potential Analyzer; Elemental - Energy Dispersive X-ray Analysis (EDX), Functional - Fourier Transform Infrared Spectroscopy, Purification and Molecular Weight Analysis - Chromatography (7)

APPLICATION AND REGULATORY ASSAYS : Areas of Applications: Drug Delivery, Fuel Cell Applications, Biocontrol of Plant diseases, Tissue Engineering, Biomedical Applications, Wastewater Treatment, Textile Finishing, Green Synthesis of anoparticles; Regulatory assays: Biodegradation Assays (Die-Away Test, CO2 Evolution Test, Modified M1T1 Test, Closed Bottle Test, Modified OECD Screening Test, Manometric Respirometry Test) (12)

Total L: 45

TEXT BOOKS:

1. Steinbuchel A Matsummura S , "Biopolymers: Miscellaneous Biopolymers and Biodegradation of Polymers", Wiley-VCHVerlog GMBH, 2003 Newyork, 2003.
2. Michael Niaounakis , "Biopolymers: Processing and Products (Plastics Design Library)", 1st Edition, William Andrew,Norwich, 2014.

REFERENCES:

1. Schmidtchen F P , "Implementation And Redesign Of Catalytic Function In Biopolymers", Springer-Verlag, New York, 1999.
2. Steven T Case , "Structure, Cellular Synthesis And Assembly Of Biopolymers", Springer-Verlag, Newyork, 1992.

19B031 MICROBIAL ECOGENOMICS

3 0 0 3

INTRODUCTION TO ECOSYSTEMS : Ecosystems – components, organization and interactions; Factors affecting ecosystems — environmental, physical and chemical; energy flow in ecosystem; Microbial ecology — role of microbes in ecosystems; Interactions of microbes with other organisms and within (6)

APPLICATION OF GENOMIC TOOLS IN ECOGENOMICS : Culturable and non-culturable approaches in studying microbial diversity; molecular fingerprinting techniques — ARISA, T-RFLP, DGGE; DNA microarrays — Phylochip, Geochip; next generation sequencing techniques (8)

ECOGENOMICS OF MARINE ECOSYSTEMS : Drivers and patterns of marine microbial diversity; Marine food web; Life strategies and adaptation mechanisms of marine microbes — environmental conditions, spatial heterogeneity and nutrient oncentrations; Microbial networks in sea; Screening, production and enhancement of bioactive compounds of microbial origin from marine ecosystems (10)

ECOGENOMICS OF HUMAN GUT MICROBIOME : Hologenome concept — Microbiota of vertebrates, invertebrates and plants; Transmission of holobionts; Community structure of microbiota in GI; Influence of gut microbiome on human health; Manipulation of human gut microbiota — Prebiotics, Probiotics and Symbionts (9)

ECOGENOMICS OF EXTREME ENVIRONMENTS : Extreme environments and their characteristics; Physiology, metabolism and adaptations of extremophilic microorganisms; Case studies on the nucleic acids and thermolabile metabolites in hermophiles, membrane adaptations in psychrophiles, genome and proteome level adaptations in halophiles and ioenergetic adaptations in alkaliphiles and acidophiles; Commercial production of extremolytes – Compatible solutes, xopolysaccharides and enzymes (12)

Total L: 45

TEXT BOOKS:

1. Diana Marco , "Metagenomics: Current Innovations and Future Trends", 1st Edition, Caister Academic Press, London, 2011.
2. Lucas J Stal, Mariana S Cretoiu , "The Marine Microbiome; An Untapped Source of Biodiversity and Biotechnological

Potential", 1st Edition, Springer International Publishing, Switzerland,2016.

REFERENCES:

1. David N Fredricks , "The Human Microbiota", 1st Edition, Wiley Blackwell, New Jersey, 2013.
2. Charles Gerday, Nicolas Glansdorff , "Physiology and Biochemistry of Extremophiles", 1st Edition, ASM Press, Washington, 2007.
3. Larry L Barton, Diana E Northup , "Microbial Ecology", 1st Edition, Wiley and Sons, New Jersey,2011.

19B032 BIOTRANSFORMATION IN DRUG SYNTHESIS

3 0 0 3

SCOPE OF ENZYMES IN BIOTRANSFORMATION : Biocatalysts versus chemical catalysis; Understanding when to use a biocatalyst for a chemical problem; Advantages/disadvantages of biocatalysts compared to traditional chemical reactions and heterogeneous/ homogeneous catalysis; Mild reaction conditions, excellent stereo- chemo- and regio- selectivity versus ubstrate specificity, product inhibition, cofactor recycling; Isolated enzyme systems and whole cell systems; Cell free extract system. (7)

TYPES OF BIOTRANSFORMATION REACTIONS : Types of microbial and enzymatic biotransformation reactions: Oxidation, Reduction, Hydrolysis, Condensation, Isomerization, Formation of New C-C Bonds, Synthesis of Chiral Compounds and Reversal of Hydrolytic Reactions. (8)

BIOTRANSFORMATION OF VITAMINS : Microbial and Enzymatic biotransformation of vitamins A, B, C, D, E, H and K by various reaction mechanisms. (9)

BIOTRANSFORMATION OF STERIODS : Microbial and Enzymatic biotransformation of steroids by various reaction mechanisms. (8)

BIOTRANSFORMATION OF ANTIBIOTICS AND XENOBIOTICS : Xenobiotic biotransformation by phase I enzymes - Biotransformation of drugs. Activation of xenobiotics by cytochrome P450. P450 knockout mice. Inhibition of cytochrome P450. Induction of cytochrome P450. Phase II enzyme reactions. (13)

Total L: 45

TEXT BOOKS:

1. Klaus Buchholz, Volker Kasche, Uwe Theo Bornscheuer , "Biocatalysts and Enzyme technology", 2nd Edition,Wiley-Blackwell, 2012.
2. Kurt Faber , "Biotransformations in Organic Chemistry", 6th Edition, Springer-Verlag Berlin Heidelberg, 2011.

REFERENCES:

1. Faber and Kurt , "Biotransformations in organic chemistry: A Textbook", Springer, 2008.
2. Drauz K, Groger H and May O , "Enzyme catalysis in organic synthesis", 3rd Edition, Willey-VCH,2012.
3. Wolf dieter Fessner and Thorleif Anthonsen , "Modern Biocatalysis: Stereoselective and environmental friendly reactions", Wiley-VCH, 2009.

19B033 SYNTHETIC BIOLOGY

3 0 0 3

INTRODUCTION TO SYNTHETIC BIOLOGY: Structure, expression and regulation of prokaryotic and eukaryotic systems. Recombinant DNA Technology. Genomics, proteomics, transcriptomics (6)

COMPONENTS OF SYNTHETIC BIOLOGY: Design - build – test. Design - Engineering biological components, metabolic engineering - pathway design, phenotype engineering, Xeno biologyBuild – DNA, Oligonucleotides, genes, genetic systems, gene/genome editing. Test – High throughput screening. Designing and encoding models for synthetic biology (12)

BIOLOGICAL COMPONENTS AND CIRCUITS: bacterial chemotaxis, noise in development, Circadian oscillation, RNA and Protein circuits, autoregulatory feedback, cascades, Gene circuit design and engineering: Biobricks/BioFAB and designing software , Synthetic circuits beyond bacteria: Phage, virus, and eukaryotes. In vitro/cell-free systems. (12)

APPLICATIONS OF SYNTHETIC BIOLOGY: Bio-remediation and microbial biotechnology, Plant and marine biotechnology, Animal biotechnology, Biomedicine and Biomaterials, Biofuels, Medical biotechnology and gene therapy (8)

REGULATIONS, ETHICS AND IP: Governance, risk culture, transparency, biosafety, machine metaphors, manipulation Vs creation, Biocontainment , IP -economic viability, legal frame work, iGEM (7)

Total 45

TEXT BOOKS

1. Primrose and Twymann, Principles of Gene manipulation and Genomics, 7th Edition, Wiley-Blackwel, 2006
2. Freemont, P.S and Kitney, R.I.Synthetic Biology – a Primer. World Scientific Publishing Co pte Ltd., 2012
3. Board on Chemical Sciences and Technology; Board on Life Sciences; Division on Earth and Life Studies; National Academies of Sciences, Engineering, and Medicine, Biodefense in the Age of Synthetic Biology,The National Academies Press, 2018

REFERENCE

1. Church, G and Regis, E, Regenesis: How Synthetic Biology will Reinvent Nature and Ourselves. Basic Books, 2012.

LANGUAGE ELECTIVES

19G001 COMMUNICATION SKILLS FOR ENGINEERS

0 0 4 2

COMMUNICATION CONCEPTS :
Process of Communication
Inter and Intrapersonal Communication
Inter and Intrapersonal CommunicationActivities (9)

FOCUS ON SOFT SKILLS :
Etiquette — Work Place etiquette — Telephone etiquette
Body Language
Persuasive Communication
Public Speaking
Critical Reasoning and Conflict Management based on Case Studies
Group Communication
Meetings
Interview Techniques (14)

TECHNICAL WRITING :
Technical Writing Principles
Style and Mechanics
Technical Definitions – Physical, Functional and Process Descriptions
Technical Report Writing
Preparing Instructions and Manuals
Interpretation of Technical Data (15)

BUSINESS CORRESPONDENCE :
Writing Emails
Preparing Resumes
Memos
Technical and Business Proposals (7)

TECHNICAL COMMUNICATION :
Seminars
Process Description and Group Discussions
Use of Visual Aids (15)

Total P: 60

TEXT BOOKS:

1. Faculty Incharge "Course Material on "Communication Skills for Engineers"", PSG College of Technology., Coimbatore, 2019

REFERENCES:

1. Jeff Butterfield "Soft Skills for Everyone", Cengage Learning., New Delhi, 2013
2. Jean Naterop B and Rod Revell "Telephoning in English", Cambridge University Press., Cambridge, 2011
3. David A Mc Murrey and Joanne Buckley "Handbook for Technical Writing", Cengage Learning., New Delhi, 2011
4. Simon Sweeney "English for Business Communication", Cambridge University Press., New Delhi, 2012

19G002 GERMAN- LEVEL A1.1

0 0 4 2

GUTEN TAG! :

1. To greet, learn numbers till 20, practice telephone numbers & e mail address, learn alphabet, speak about countries & languages
2. Vocabulary: related to the topic
3. Grammar: W — Questions, Verbs & Personal pronouns I. (10)

FREUNDE, KOLLEGEN UND ICH :

1. To speak about hobbies, jobs, learn numbers from 20; build dialogues and frame simple questions & answers
2. Vocabulary: related to the topic
3. Grammar: Articles, Verbs & Personal pronouns II, sein & haben verbs, ja/nein Frage, singular/plural (10)

IN DER STADT :

1. To know places, buildings, question, know transport systems, understand international words; build dialogues and write short sentences
2. Vocabulary: related to the topic
3. Grammar: Definite & indefinite articles, Negotiation, Imperative with Sien verbs (12)

GUTEN APPETIT! :

1. To speak about food, shop, converse; Vocabulary: related to the topic; build dialogues and write short sentences
2. Grammar: Sentence position, Accusative, Accusative with verbs, personal pronouns & prepositions, Past tense of haben & sein verbs (13)

TAG FŸR TAG/ZEIT MIT FREUNDEN :

1. To learn time related expressions, speak about family, about birthdays, understand & write invitations, converse in the restaurant; ask excuse, fix appointments on phone
2. Vocabulary: related to the topic
3. Grammar: Time related prepositions, Possessive articles, Modalverbs (15)

Total P: 60

TEXT BOOKS:

1. Dengler Stefanie "Netzwerk A1.1", Klett-Langenscheidt Gmbh., München, 2013
2. Sandra Evans, Angela Pude "Menschen A1", Hueber Verlag., Germany, 2012

REFERENCES:

1. Stefanie Dengler "Netzwerk A1", Klett-Langenscheidt Gmbh., München, 2013
2. Hermann Funk, Christina Kuhn "Studio d A1", Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2009
3. Rosa-Maria Dallapiazza "Tangram Aktuell 1 (Deutsch als Fremdsprache)", Max Hueber Verlag., Munchen, 2004
4. Christiane Lemcke und Lutz Rohrmann "'Grammatik Intensivtrainer A 1", Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2012

19G003 FRENCH LANGUAGE LEVEL 1

0 0 4 2

PARTS OF SPEECH :

1. inviter et répondre à une invitation, Pronoms sujets
2. L'article définis, l'article indéfinis
3. Conjugation : présent, adjectifs possessifs
4. interrogation, décrire les personnes
5. La vie de quatre parisiens de professions différentes (12)

ELEMENTS OF GRAMMAR :

1. Exprimer l'ordre et l'obligation demander et commander
2. l'adjectif possessifs, l'article partitif, l'article démonstratif, négation ne
3. pas, l'article contracté
4. verbe pronominaux
5. prepositions (12)

SENTENCE STRUCTURE :

1. Raconter et reporter-donner son avis
2. Futur simple, pronom complètement d'objet direct, passé composé
3. plusieurs région de France, imparfait, pronom y/en, imparfait (12)

TENSES AND NUMBERS :

1. Demander l'autorisation-passé récent, futur proche
2. La vie administrative et régionale, Pluriel des noms, moyens de transport (12)

DISCOURSE :

1. le discours rapporté, décrire un lieu, exprimer ses préférences
2. décrire la carrière, discuter d'système éducation de France
3. parler de la technologie de l'information (12)

Total P: 60

TEXT BOOKS:

1. Christine Andant étal "À propos (livre de l'élève", LANGER., NEW DELHI, 2012
2. Myrna Bell Rochester "Easy French Step By Step", MCGrawhill Companies., USA, 2008

REFERENCES:

1. Michael D. Oates "Entre Amis: An Interactive Approach", Houghton Mifflin., 2005 , 5th
2. Bette Hirsch, Chantal Thompson "Moments Literaries : An Anthology for intermediate French", .,
3. Simone Renaud, Dominique van Hooff "En bonne forme", .,

19G004 BASIC JAPANESE

0 0 4 2

JAPANESE PEOPLE AND CULTURE :
1. Basic greetings and responses
2. Basic script — Method of writing hiragana and katakana — Combination sounds and simple words
3. Selfintroductions: "Hajimemashite" -Demonstratives "Kore", "Sore", "Are" — Demonstrative "Kono", "Sono", "Ano"
4. Possessive noun particle "no" — Japanese apartments: Greeting your neighbor (12)

PATICLE "NI (AT)" FOR TIME :
1. kara (from) ~ made(until) — Particle "to (and)"
2. Time periods: Days of the week, months, time of day –Verbs (Present / future and pasttense)
3. Telephone enquiry: Asking for a phone no. And business hours- Destination particle "e". (12)

LIKES AND DISLIKES :
1. Potential verbs (wakarimasu and dekimasu) — "Kara (~ because)"
2. Adverbs — Asking some one out over the phone-Verbs denoting presence
3. Introduction to Adjectives (na and ii type) -Verb groups — I, II and III — Exercises to group verbs- Please do (te kudasai)
4. Present continuous tenses (te imasu) — Shall I? (~ mashou ka) — Describing a natural phenomenon (It is raining) (12)

DIFFERENT USAGES OF ADJECTIVES :
1. Comparison — Likes and dislikes — Going to a trip- Need and desire (ga hoshii) — Wanting to . . . (Tabeti desu)- Going for a certain purpose (mi –ni ikimasu)
2. Choosing from a menu-Adjectives ("i" and "na" type) — Adjectives (Positive and negative useage) (12)

ROLE PLAYS IN JAPANESE :
1. Framing simple questions & answers
2. Writing Short paragraphs & Dialogues
3. A demonstration on usage of chopsticks and Japanese tea party (12)

Total P: 60

TEXT BOOKS:

1. Minna no Nihongo, Honsatsu Roma "ji ban (Main Textbook Romanized Version)", . International publisher — 3A Corporation., Tokyo, 2012

REFERENCES:

1. Eri Banno et.al "Genki I: An Integrated Course in Elementary Japanese I -Workbook", ., 1999
2. Tae Kim "A Guide to Japanese Grammar: A Japanese Approach to Learning Japanese Grammar", ., 2014
3. Minna No Nihongo "Translation & Grammatical Notes In English Ele

ONE CREDIT COURSES

ENGLISH

19GF01 INTERPERSONAL AND ORGANIZATIONAL COMMUNICATION

1 0 0 1

INTRA ORGANIZATIONAL COMMUNICATION : Communication Networks in an Organization; Intra- organizational communication (2)

INTER ORGANIZATIONAL COMMUNICATION : Flow Nomenclature; Workplace diversity and intercultural aspects of communication (2)

COMMUNICATION FUNCTIONS IN ORGANIZATIONS : Teamwork and team dynamics; Conflict resolution strategies and styles; Leading and influencing others-facilitation skills (3)

WRITTEN COMMUNICATION : Email Writing, Professional Reports, and Memos (4)

INTERPERSONAL SKILLS : Nature and Dimensions of Interpersonal Communication; Personality and Communication styles; Active listening and intentional responding; Working with emotional intelligence (4)

Total L: 15

REFERENCES:
1. Bagchi Subroto , "The Professional", Penguin Publications, UK, 2011.
2. PMBOK guide , "A Guide to the Project Management Body of Knowledge", Project Management Institute Inc, USA, 2013.

19GF02 HUMAN VALUES THROUGH LITERATURE

1 0 0 1

PROSE : Kalam's vision of college education in Wings of fire - Emerson's advocation of independence of Human will in Self-reliance - Harmony in Education-views of Betrand Russel (4)

POETRY : Maintaining Human relations in Robert Frost's Mending Wall - Quest for identity and freedom in Kamala Das's An Introduction (2)

DRAMA : Statesmanship and friendship in Girish Karnad's Tughlaq (3)

ONE-ACT PLAY : The theme of love in Chekhov's The Bear (3)

SHORT STORY : Empathy in Somerset maugham's Mr. Know-all - Family bond in Anita Desai's Devoted son (3)

Total L: 15

TEXT BOOKS:
1. Faculty - Department of English , "Course materials", PSG College of Technology, Coimbatore, 2019.

REFERENCES:
1. Abrams M .H, Harpham , "A Glossary of Literary Terms", Cengage, Boston, 2015.
2. Scholes R, et.al. , "Elements of Literature", IV, Indian Rpt. OUP, New Delhi, 2013.

HUMANITIES

19OFA1 EXPORT – IMPORT PRACTICES

1 0 0 1

INTRODUCTION : Export – Import Business – Preliminaries for starting Export – Import Business Registration. (3)

EXPORT PROCEDURES: : Obtaining an Export License – Export Credit Insurance – Procedures and Documentation (4)

FOREIGN EXCHANGE : Finance for Exports – Pricing - Understanding Foreign Exchange Rates. (3)

IMPORT PROCEDURES : Import Policy – License - Procedure and Documentation. (3)

EXPORT INCENTIVES : Incentives - Institutional support (2)

Total L: 15

REFERENCES:
1. Ramagopal C , "Export Import Procedures - Documentation and Logistics", New Age International, 2014.
2. Cherian and Parab , "Export Marketing", Himalaya Publishing House, New Delhi, 2008.
3. Parul Gupta , "Export Import Management", MC-Graw Hill, 2017.
4. Justin Paul, Rajiv Aserkar , "Export Import Management", Oxford, 2013.

19OFA2 INSURANCE - CONCEPTS AND PRACTICES

1 0 0 1

INTRODUCTION TO INSURANCE AND RISK MANAGEMENT : Origin, History, Nature and Scope of insurance – Meaning, types and significance of risk. (3)

INSURANCE LAWS AND REGULATIONS : Insurance Act, IRDA Act, Consumer Protection Act, Ombudsman Scheme. (2)

INSURANCE UNDERWRITING AND RISK MANAGEMENT : Meaning of underwriting and underwriter, guidelines and steps in the process of underwriting – characteristics, significance and principles of risk management. (4)

FINANCIAL ASPECTS OF INSURANCE MANAGEMENT : Role and functions of financial institutions, determination of premium for various insurance products. (3)

SETTLEMENT OF INSURANCE CLAIMS : Documents needed during various claims, Factors affecting insurance claims (3)

Total L: 15

REFERENCES:

1. Scott Harrington, Gregory Niehaus , "Risk Management and Insurance", McGraw Hill Education, 2017.
2. George E Rejda , "Principles of Risk Management & Insurance", Pearson Education, 2017.
3. John Hull , "Risk Management & Financial Institution", John Wiley and Sons, 2018.
4. Arjun Mittal, D D Chaturvedi , "Insurance and Risk Management", Scholar Tech Press, 2017.

19OFA3 PUBLIC FINANCE

1 0 0 1

INTRODUCTION: Nature and Scope of public finance – Principles of taxation. (2)

PUBLIC REVENUE AND TAXATION: Sources of Revenue – Tax and non-tax revenue – Classification of Taxes, GST. (4)

PUBLIC EXPENDITURE: Importance – Types – Causes of increase in public expenditure – Effects of public expenditure in India. (3)

DEFICIT FINANCING AND BUDGET: Sources of public debt – Debt redemption – Budget – Types – Preparation of Budget in India. (3)

FEDERAL FINANCE: Centre-State financial relations – Finance commissions. (3)

TOTAL: 15

REFERENCE BOOKS:

1. Richard A Musgrave and Peggy B Musgrave, “Public Finance in Theory and Practice” – Tata McGraw Hill Education, New Delhi, 2004.
2. Bhatia H.L, “Public Finance” – Vikas Publishing House, 29th Edition, New Delhi, 2012.
3. David N Hyman, “Public Finance: A contemporary application of theory and policy”, Cengage Publication, 11th Edition, Noida, 2014.
4. Santhosh Dalvi and Krishnan Venkatasubramanian, “An introduction to Goods and Service Tax: The biggest tax reform in India”, CCH Publisher, New Delhi, 2015.

F19OFA4 SECURITY ANALYSIS AND PORTFOLIO MANAGEMENT

1 0 0 1

INVESTMENT ENVIRONMENT : Financial Markets - Classification - Financial Instruments – Security Trading. (2)

TYPES OF SECURITIES : Trading – Orders, Margin Trading – Clearing and Settlement Procedures. (5)

SECURITY ANALYSIS I : Industry Analysis –Estimation of Rates of Return. (2)

SECURITY ANALYSIS II : Company Analysis — Estimation of Rates of Return. (2)

PORTFOLIO MANAGEMENT : Measuring Risk and Returns and Treatment in Portfolio Management. (4)

Total L: 15

REFERENCES:

1. William F Sharpe, Gordon J. Alexander, Jeffery V Bailey , "Investments", Prentice Hall, 2012.
2. Prasanna Chandra , "Investment Analysis and Portfolio Management", TATA McGraw Hill Publishing, 2011.
3. Ranganathan , "Investment Analysis and Portfolio Management", Pearson, 2004.
4. Bhalla V K , "Investment Management", TATA McGraw Hill Publishing, 2011