



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

Accredited "A" Grade by NAAC | 12B Status by UGC | Approved by AICTE

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SCHOOL OF BIO AND CHEMICAL ENGINEERING

DEPARTMENT OF BIOTECHNOLOGY

Board of Studies 2017-2018 (ODD SEM)

Minutes of Meeting

Date : 06-06-2017 (Tuesday)

10.00am-11.45am

Chair-person : Dr. Valli Nachiyar C, Prof and HOD

Attendees : Dr. Parthiban.M., External Member
Professor and Head, Department of Animal Biotechnology,
Madras Veterinary college, Chennai 600007

Dr. Ramesh kumar V, Internal member
Dr. Jayshree Nellore, Internal member
Dr. Karthick Raja Namasivayam, Internal member

The Chair-person welcomed the members.

Agenda of the meeting; Syllabus revisions and implementation in 2017- 2018 even semester;

Following which discussions were held as follows,

B Tech Biotechnology

Dr Elizabeth Rani elaborated the need of implementation of food processing and packaging in Food biotechnology syllabus (SBT1602).

Dr Parthiban recommended the addition of topics include the significant role of microorganisms, food supplements in nutraceuticals in food industry in semester VII.

Major revisions in elective courses.



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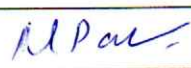
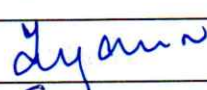
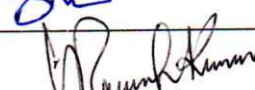
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M Tech Biotechnology

Dr Ramesh Kumar suggested the additions of topics in Marine Biotechnology syllabus in Semester III to keep up with current advances in the field.

Minor revisions in elective courses.

External Member	Signature
Dr.Prathiban M	
Internal Member	Signature
Dr. Jayshree Nellore	
Dr. Karthick Raja Namasivayam	
Dr. Ramesh kumar V	


Head of the Department/Chairperson
(Dr.Valli Nachiyar)

HEAD OF THE DEPARTMENT
DEPARTMENT OF BIOTECHNOLOGY
SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Jeppiaar Nagar, Rajiv Gandhi Salai
Chennai-600 119



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

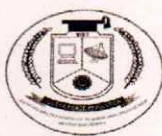
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B.Tech Biotechnology

S.No	Course code	Course name	Deleted topics	Added topics
1	SBT1602	Food Biotechnology		Unit 1: History of Microorganisms in food, Historical Developments. The Role and significance of Microorganisms, Primary sources of Microorganisms found in foods. Microbial Intrinsic and Extrinsic parameters of foods. Unit 2: Microbiological role in food process operation and production: new protein foods: SCP; mushroom; food yeasts, algal proteins. Unit 3: Destruction of Microorganisms and Applications, Radappertization, Radicidation and Radurization of food, legal status of food irradiation
			UNIT5 APPLICATION OF ENZYMES IN FOOD PROCESSING De-oxygenating and de-sugaring by glucose oxidase, beer mashing, chill proofing- cheese making by proteases – operations, unit clarification of juices.	Unit 5: Introduction to Food Packaging, interaction of food material with packaging materials, preservation of food products. Genetically modified and transgenic food development, processing- nutritional and economic aspects.



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M.Tech Biotechnology

S.No	Course code	Course name	Deleted topics	Added topics
1	SBT5609	Marine Biotechnology	NIL	Unit 1: Diversity & adaptation. Marine microbial diversity: Marinemicrobial habitats - Unit 2: Culture practices of marinefishes (seabass and cobia), Unit 3: Marine enzymes - HUFA, PUFA, Unit 5: Control of oil spills and bioremediation.

SBT1602	FOOD BIOTECHNOLOGY (OLD SYLLABUS)	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- The course describes the interaction of the food and microorganisms, their negative impact and the methods of food preservation by modern biotechnological process.

UNIT1 INTRODUCTION

9Hrs

Microbiological quality testing of foods – enumeration and detection of food borne organisms - Culture, Microscopic and Sampling Methods, Conventional, SPC, Membrane Filters, Microscopic Colony Counts, Agar droplets, Dry films, MPN, DMC, Dye reduction, Roll Tubes, Microbiological Examination of surfaces and sampling, Metabolically Injured Organism, Enumeration and Detection of food borne organisms.

UNIT2 FOOD MICROBIOLOGY

11 Hrs

Food Fermentation method of preparing and preserving foods -pickling, alcoholic beverages and other products. Food additives: Need for food additives, types of food additives. Development of novel food and food ingredients; SCP, polysaccharides, low calorie sweeteners, naturally produced flavor modifier, food coloring agent, food supplements and Nutraceuticals. Genetically modified foods and consumer preference – prebiotic and probiotic foods.

UNIT3 STORAGE& PRESERVATION

9 Hrs

General principle of spoilage, factors affecting spoilage; Spoilage of fruits and Vegetables, Spoilage of Miscellaneous Foods. Food preservation- Characteristics of Radiations of Interest in Food Preservation. Storage and Stability of irradiated foods, Preservation: High and Low Temperature, Drying

UNIT4 FOOD PROCESSING

9Hrs

Mechanism of enzyme functions and reactions in process techniques: starch and sugar conversion process or baking by amylases; de-oxygenation and desugaring by glucose oxidase; beer mashing and chill- proofing and cheese making by proteases and various other enzymes, catalytic actions in food processing. Process wastes: whey; molasses; starch substances and other food wastes for bioconversion to useful products.

UNIT5 APPLICATION OF ENZYMES IN FOOD PROCESSING

7hrs

De-oxygenating and de-sugaring by glucose oxidase, beer mashing, chill proofing- cheese making by proteases – operations, unit clarification of juices.

Max.45 hrs

TEXT / REFERENCE BOOKS

- James. M. Jay, Martin J. Loessner and David A. Golden, Food Microbiology, Springer Publication, 7th Edition, 2005.
- Frazier, Food Microbiology, McGraw Hill Publication, 4th Edition, 2001
- Shetty K., G. Paliyath et al. – Food Biotechnology – 2nd Edition- Taylor and francis, 2006.
- Keshav Trehan, Biotechnology, New Age International (P) Ltd. Publishers, 2002.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 80 Exam

Duration : 3 Hrs.

PART A : 10 questions of 2 marks each - No choice

20 Marks

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

60 Marks

SBT1602	FOOD BIOTECHNOLOGY (REVISED SYLLABUS)	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- The course describes the interaction of the food and microorganisms, their negative impact and the methods of food preservation by modern biotechnological process.

UNIT1 INTRODUCTION

9Hrs

History of Microorganisms in food, Historical Developments. The Role and significance of Microorganisms, Primary sources of Microorganisms found in foods. Microbial Intrinsic and Extrinsic parameters of foods. Microbiological quality testing of foods – enumeration and detection of food borne organisms - Culture, Microscopic and Sampling Methods, Conventional, SPC, Membrane Filters, Microscopic Colony Counts, Agar droplets, Dry films, MPN, DMC, Dye reduction, Roll Tubes, Microbiological Examination of surfaces and sampling, Metabolically Injured Organism, Enumeration and Detection of food borne organisms.

UNIT2 FOOD MICROBIOLOGY

11 Hrs

Microbiological role in food process operation and production: new protein foods: SCP; mushroom; food yeasts, algal proteins. Food Fermentation method of preparing and preserving foods -pickling, alcoholic beverages and other products. Food additives: Need for food additives, types of food additives. Development of novel food and food ingredients; SCP, polysaccharides, low calorie sweeteners, naturally produced flavor modifier, food coloring agent, food supplements and Nutraceuticals. Genetically modified foods and consumer preference – prebiotic and probiotic foods.

UNIT3 STORAGE& PRESERVATION

9 Hrs

General principle of spoilage, factors affecting spoilage; Spoilage of fruits and Vegetables, Spoilage of Miscellaneous Foods. Food preservation- Characteristics of Radiations of Interest in Food Preservation, Destruction of Microorganisms and Applications, Radappertization, Radicidation and Radurization of food, legal status of food irradiation. Storage and Stability of irradiated foods, Preservation: High and Low Temperature, Drying

UNIT4 FOOD PROCESSING

9Hrs

Mechanism of enzyme functions and reactions in process techniques: starch and sugar conversion process or baking by amylases; de-oxygenation and desugaring by glucose oxidase; beer mashing and chill- proofing and cheese making by proteases and various other enzymes, catalytic actions in food processing. Process wastes: whey; molasses; starch substances and other food wastes for bioconversion to useful products.

UNIT5 PACKAGING

7 hrs

Introduction to Food Packaging, interaction of food material with packaging materials, preservation of food products. Genetically modified and transgenic food development, processing- nutritional and economic aspects.

Max.45 hrs

TEXT / REFERENCE BOOKS

- James. M. Jay, Martin J. Loessner and David A. Golden, Food Microbiology, Springer Publication, 7th Edition, 2005.
- Frazier, Food Microbiology, McGraw Hill Publication, 4th Edition, 2001
- Shetty K., G. Paliyath et al. – Food Biotechnology – 2nd Edition- Taylor and Francis, 2006.
- Keshav Trehan, Biotechnology, New Age International (P) Ltd. Publishers, 2002.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 80 Exam

Duration : 3 Hrs.

PART A : 10 questions of 2 marks each - No choice

20 Marks

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

60 Marks

SBT5609	MARINE BIOTECHNOLOGY (OLD SYLLABUS)	L	T	P	Credits	TotalMarks
		3	1	0	4	100

COURSE OBJECTIVE

- The course gives an introduction on the micro, macroflora and fauna of the marine environment. The following section emphasis the aquaculturing and the production of marine products

UNIT1 INTRODUCTION TO MARINE ENVIRONMENT AND BIODIVERSITY

12Hrs.

Physical and chemical properties of sea water. Zonation of sea: Euphotic – mesopelagic – bathopelagic-benthos - deep sea. Marine ecosystems and biodiversity: Microbial distribution in the oceans - Factors that impact marine microbial diversity – Interactions between marine microbes and macroorganisms-Symbiotic relationship with marine invertebrates-Marine viruses.

UNIT2 AQUACULTURE

12Hrs.

Aquaculture: Definition - Importance of aquaculture-Criteria of selection of species for aquaculture. Types of culture: Monoculture, polyculture, composite fish culture and integrated fish farming., Pacific white shrimp (*Litopenaeus vannamei*), Freshwater prawn (*Macrobrachium rosenbergi*), crab, lobsters, edible oyster, pearl oyster, mussel, and Seaweeds.

UNIT3 FISH GENETICS AND BIOMEDICAL IMPORTANCE OF MARINE ORGANISMS

12Hrs.

Fish genetics: Gynogenesis, androgenesis, polyploidy, control of sex, artificial insemination, eye stalk ablation. Transgenesis and DNA Vaccine development for aquacultured fish, cryopreservation. Live feed culture: Microalgae and Artemia - Biofuel production by marine plankton- Omega-3 Fatty acid from marine organisms. New antibiotics and medicines from marine organisms. Secondary metabolites from marine cyanobacteria, actinomycetes and endophytic fungi-Probiotics.

UNIT4 MARINE VALUE-ADDED PRODUCTS

12Hrs.

Fishmeal, Fish sausages, Isinglass, Fish glue, Fish silage, Fin rays, Chitosan, Chitin, Pearl Essence, agar, Alginates, Carrageenan and Heparin. Useful products from Trash fish.

UNIT5 ENVIRONMENTAL IMPACTS OF AQUATIC BIOTECHNOLOGY

12Hrs.

Human impacts on marine microbial diversity-microbial mediated equilibria that impact environmental and human health-Using Marine Microbes to ameliorate environmental deterioration. Environmental issues: Effects of bio-fouling and bio-deterioration on marine structures. Protection methods against corrosion and fouling. Red tides: Causative factors and effects on the organisms of marine environment.

Max.60Hours

TEXT/REFERENCEBOOKS

- Pillay, T.V.R. Aquaculture Principles & Practices. Fishing News(Books)Limited, London,1990.
- Santhanam R.N. Ramanathan and G. Jegatheesan. Coastal Aquaculture in India, CBS publishers,1990.
- Le Gal, Y., Ulber, R Marine Biotechnology: Advances in Biochemical Engineering/Biotechnology (Series editor: T. Scheper) Springer-VerlagBerlinHeidelberg.Vol.96. pp. 287,2005
- Le Gal, Y., Ulber, R, Marine Biotechnology: Advances in Biochemical Engineering/Biotechnology (Series editor: T. Scheper)Springer-VerlagBerlinHeidelberg.Vol.97.pp.261,2005.
- Jennie Hunter-Cevera, David Karl and Merry Buckley, Marine microbial diversity: The key to earth's habitability: A Report from the American academy of microbiology, Published by American Academy of Microbiology, held (April8-10, 2005) in San Francisco, California.pp.28, 2005.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:80

ExamDuration:3Hrs.

PARTA: 6 Questions of 5 Marks each-No Choice

30Marks

PARTB: 2 Questions from each unit of internal choice, carrying 10Marks each

50Marks

SBT5609	MARINE BIOTECHNOLOGY (REVISED SYLLABUS)	L	T	P	Credits	TotalMarks
		3	1	0	4	100

COURSE OBJECTIVE

- The course gives an introduction on the micro, macroflora and fauna of the marine environment. The following section emphasis the aquaculturing and the production of marine products

UNIT1 INTRODUCTION TO MARINE ENVIRONMENT AND BIODIVERSITY

12Hrs.

Physical and chemical properties of sea water. Zonation of sea: Euphotic – mesopelagic – bathopelagic-benthos - deep sea. Marine ecosystems and biodiversity: Diversity & adaptation. Marine microbial diversity: Marine microbial habitats - Microbial distribution in the oceans - Factors that impact marine microbial diversity – Interactions between marine microbes and macroorganisms-Symbiotic relationship with marine invertebrates-Marineviruses.

UNIT2 AQUACULTURE

12Hrs.

Aquaculture: Definition - Importance of aquaculture-Criteria of selection of species for aquaculture. Types of culture: Monoculture, polyculture, composite fish culture and integrated fish farming. Culture practices of marine fishes (seabass and cobia), Pacific white shrimp (*Litopenaeusvannamei*), Freshwater prawn (*Macrobrachiumrosenbergi*), crab, lobsters, edible oyster, pearl oyster, mussel, and Seaweeds.

UNIT3 FISH GENETICS AND BIOMEDICAL IMPORTANCE OF MARINE ORGANISMS

12Hrs.

Fish genetics: Gynogenesis, androgensis, polyploidy, control of sex, artificial insemination, eye stalk ablation. Transgenesis and DNA Vaccine development for aquacultured fish, cryopreservation. Live feed culture: Microalgae and Artemia - Biofuel production by marine plankton- Marine enzymes - HUFA, PUFA, and Omega-3 Fatty acid from marine organisms. New antibiotics and medicines from marine organisms. Secondary metabolites from marine cyanobacteria, actinomycetes and endophytic fungi-Probiotics.

UNIT4 MARINE VALUE ADDED PRODUCTS

12Hrs.

Fishmeal, Fishsausages, Isinglass, Fishglue, Fishsilage, Finrays, Chitosan, Chitin, Pearl Essence, agar, Alginates, Carrageenan and Heparin. Useful products from Trashfish.

UNIT5 ENVIRONMENTAL IMPACTS OF AQUATIC BIOTECHNOLOGY

12Hrs.

Human impacts on marine microbial diversity-microbial mediated equilibria that impact environmental and human health-Using Marine Microbes to ameliorate environmental deterioration. Control of oil spills and bioremediation. Environmental issues: Effects of bio-fouling and bio-deterioration on marine structures. Protectionmethods against corrosion and fouling. Red tides: Causative factors and effects on the organisms of marineenvironment.

Max.60Hours

TEXT/REFERENCEBOOKS

- Pillay, T.V.R. Aquaculture Principles & Practices. Fishing News(Books)Limited, London, 1990.
- Santhanam R.N. Ramanathan and G. Jegatheesan. Coastal Aquaculture in India, CBS publishers, 1990.
- Le Gal, Y., Ulber, R Marine Biotechnology: Advances in Biochemical Engineering/Biotechnology (Series editor: T. Scheper) Springer-VerlagBerlinHeidelberg.Vol.96. pp. 287,2005
- Le Gal, Y., Ulber, R, Marine Biotechnology: Advances in Biochemical Engineering/Biotechnology (Series editor: T. Scheper)Springer-VerlagBerlinHeidelberg.Vol.97.pp.261,2005.
- Jennie Hunter-Cevera, David Karl and Merry Buckley, Marine microbial diversity: The key to earth's habitability: A Report from the American academy of microbiology, Published by American Academy of Microbiology, held (April8-10, 2005) in San Francisco, California.pp.28, 2005.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:80

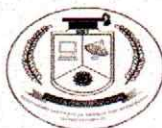
ExamDuration:3Hrs.

PARTA: 6 Questions of 5 Marks each-No Choice

30Marks

PARTB: 2 Questions from each unit of internal choice, carrying 10Marks each

50Marks



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Board of Studies 2017-2018 (EVEN SEM)

Minutes of Meeting

Date : 9-01-2018 (Tuesday)

11.00am-12.15pm

Chair-person : Dr. Valli Nachiyar C, Prof and HOD

Attendees : Dr. Parthiban M., External Member
Professor and Head, Department of Animal Biotechnology,
Madras Veterinary college, Chennai 600007

Dr. Ramesh kumar V, Internal member

Dr. Jayshree Nellore, Internal member

Dr. Karthick Raja Namasivayam, Internal member

The Chair-person welcomed the members to table the agenda.

Agenda of the meeting; Syllabus revisions and implementation in 2017- 2018 even semester;

Following which discussions were held as follows,

B Tech Biotechnology

The Chairperson abridged the members that, as per AICTE norms the implementation of Neuroscience as an elective course for even semester.

Dr. Parthiban suggested the introduction of Aqua culture as an elective in Semester VI to explore the basic concepts in marine technology.



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Dr.Valli Nachiyar recommended the addition of topics include tissue culture techniques and plant transformation in Agricultural biotechnology elective course for Semester VI.

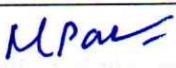
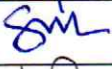
The Board considered and approved the syllabi for SBT1608 Aquaculture, SBT1603 Agriculture Biotechnology for B.Tech Biotechnology .

M.Tech Biotechnology

Dr.Ramesh Kumar recommended the addition of topics include Biofilters and Bioscrubbers, Anaerobic & Aerobic - Drinking-water treatment, e-waste, Role of GEM in bioremediation of oil spills, Bioelectricity through microbial fuel cells, energy management and safety in Environmental biotechnology

The Board considered and approved the same

The meeting ended with a vote of thanks to the Chair.

External Member	Signature
Dr.Prathiban M	
Internal Member	Signature
Dr. Jayshree Nellore	
Dr. Karthick Raja Namasivayam	
Dr. Ramesh kumar V	



Head of the Department/Chairperson

(Dr.Valli Nachiyar)

HEAD OF THE DEPARTMENT
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B.Tech Biotechnology

S.No	Course code	Course name	Deleted topics	Added topics
1	SBT1603	Agriculture Biotechnology	NIL	Unit 2: Micropropagation with shoot apex and nodal cultures, Production of haploid plant through Androgenesis and Gynogenesis Unit 4: production of transplastomics Unit 5 :therapeutic protein (Plantibodies, Plantigens, Edible Vaccines),

M.Tech Biotechnology

S.No	Course code	Course name	Deleted topics	Added topics
1	SBT5608	Environmental Biotechnology	NIL	Unit 1: Biofilters and Bioscrubbers Unit 2:Anaerobic & Aerobic - Drinking-water treatment Unit 3:E-waste Unit 4: Role of GEM in bioremediation of oil spills. Unit 5 :Bioelectricity through microbial fuel cell, energy management and safety.

SBT1608	AQUACULTURE (NEW ELECTIVE)	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To provide knowledge on the basics of aquaculture and hatcheries
- To understand the chromosomal manipulations and their effects

UNIT1 INTRODUCTION TO AQUACULTURE: 9 Hrs.

Aquaculture: Definition-Site selection, design and construction of aquaculture pond - Criteria for selecting the candidate species for aquaculture - Types and methods: Extensive, semi-intensive and intensive culture - Composite fish culture and integrated fish farming - Types of culture systems: pen culture, Cage culture, raft culture and Pond culture.

UNIT2 HATCHERY AND GROW-OUT PRODUCTION OF AQUATIC ORGANISMS 9Hrs.

Design and construction of a fish hatchery - Types of hatcheries and management practices - Live feed culture: culture of microalgae, rotifers and crustaceans (Artemia) - Selection of brooder, nutrition, gonadal changes, hormonal regulation - Culture of economically important marine species: Litopenaeus vannamei (shrimp), Lates calcarifer (seabass), Lobster, seaweeds - Culture practices of freshwater species: Prawns, carps, catfish, murels and ornamental fishes.

UNIT3 POND MANAGEMENT AND POST HARVEST TECHNOLOGY 9 Hrs.

Pond management: Nursery and grow-out pond maintenance, pond fertilization. Water quality management: Dissolved Oxygen, CO₂, Ammonia, pH, salinity, temperature and turbidity. Harvest and post-harvest technology: Types of harvest, sorting, cleaning, packing, transportation of live organisms and preservation. Fish processing: Types of processing and canning, Quality assurance: Standards of sanitation and hygiene. Implementation of HACCP (Hazard Analysis and Critical Control Point) concept and food safety in fish industry.

UNIT4 CHROMOSOME MANIPULATION AND FISH BIOTECHNOLOGY 9 Hrs.

Genetic improvement: Inbreeding and cross breeding; Hybridization, Genetic manipulation: Sex-reversal and sex control; role of steroids in sex reversal, chromosomal manipulation, polyploidy, androgenesis and gynogenesis; cryopreservation of gametes. Fish Biotechnology: Production of transgenic fishes, micro injection technique, Cloning and expression of GnRH.

UNIT5 FISH DISEASES AND CONTROL MEASURES 9 Hrs.

Disease diagnosis: Principles of disease diagnosis in finfish and shell fish. Microbial diseases: Diseases caused by bacteria (Vibriosis) - Fungi and viruses (WSSV). Parasitic diseases: Diseases caused by protozoa and metazoa (crustaceans, helminthes). Non-infectious diseases: Nutritional and environmental diseases. Aquafarm pollutants. Prevention and control of diseases: Symptoms, prevention, control and treatments (prophylactic and therapeutic).

Max.45Hours

TEXT / REFERENCE BOOKS

1. Pillay, T.V.R., Aquaculture Principles & Practices, Fishing News (Books) Limited, London, 1990
2. Santhanam R. N. Ramanathan and G. Jegatheesan, Coastal Aquaculture in India, CBS publishers, 1990
3. V. Sundararaj, M.J. Prince Jeyaseelan and S. Felix, Shrimp health Management, Mala Publishers, Chennai. 1993
4. T.V.R. Pillay, Coastal Aquaculture in the Indo-Pacific region, FAO, Rome, Italy. 1962
5. Donald R. Swift, Aquaculture training manual, Fishing News Books Ltd. 1993
6. Hand Book on aqua farming by MPEDA, Cochin. 2005

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each - No choice

20 Marks

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

60 Marks

SBT1603	AGRICULTURE BIOTECHNOLOGY (OLD SYLLABUS)	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the organization of plant genome
- To provide an insight into the applications of tissue culture and transformation

UNIT1 INTRODUCTION

9 Hrs.

History, Definition, Structure and organization of plant genome, Chloroplast and Mitochondrial genome, Totipotency, Plasticity and cytodifferentiation, Culture environment, Plant Tissue culture media and their components, Methods of sterilization, Different types of culture, Factors affecting in vitro culture.

UNIT2 TISSUE CULTURE TECHNIQUES

9 Hrs.

Regeneration of plants, Organogenesis, Somatic embryogenesis and synthetic seeds, Embryo culture and embryo rescue method, In vitro pollination and fertilization.

UNIT3 TISSUE CULTURE APPLICATION

9 Hrs.

Isolation and culture of protoplasts, protoplast fusion and somatic hybridization, Selection systems for somatic hybrids / cybrids and their characterization, Somoclonal variations, Production of secondary metabolites by plant cell cultures, Germplasm conservation and cryopreservation.

UNIT4 PLANT TRANSFORMATION

9 Hrs.

Genetic Transformation methods for production of transgenic plants (Direct, Indirect), Direct Gene Transfer (DGT) methods, Agrobacterium mediated genetic transformation (Indirect), Chloroplast transformation

UNIT5 APPLICATION AND SAFETY REGULATIONS

9 Hrs.

Production of genetically modified plants for herbicide and pest resistant, transgenic plants for quality traits, Industrial enzymes, Safety regulation for transgenic plants, Current issues related to transgenic plants.

Max.45Hours

TEXT/REFERENCEBOOKS

1. Adrian Slater, Nigel Scott, and Mark Fowler, Plant Biotechnology, Oxford University Press, NewYork, 2008.
2. Old R.W. and Primrose S.B., An Introduction to Genetic Engineering, University of California press, 1980.
3. Satyanarayana, U. Biotechnology, Allied Pvt. Ltd. Kolkata, 2007.
4. Purohit S.S., Agricultural Biotechnology, Agrobios Indi., Jodhpur, 2002.
5. Chawla H.S., Introduction to Plant Biotechnology, 2nd Edition, Oxford and IBH Press, 2003.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max.Marks:80

ExamDuration:3 Hrs.

PARTA:10 questions of 2 marks each- No choice

20 Marks

PARTB: 2 questions from each unit of internal choice; each carrying 12marks.

60 Marks

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- To understand the organization of plant genome
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History, Definition, Structure and organization of plant genome, Chloroplast and Mitochondrial genome, Totipotency, Plasticity and cytodifferentiation, Culture environment, Plant Tissue culture media and their components, Methods of sterilization, Different types of culture, Factors affecting in vitro culture.

UNIT2 TISSUE CULTURE TECHNIQUES

9 Hrs.

Regeneration of plants, Organogenesis, Micropropagation with shoot apex and nodal cultures (Clonal Propagation), Somatic embryogenesis and synthetic seeds, Embryo culture and embryo rescue method, in vitro pollination and fertilization, Production of haploid plant through Androgenesis and Gynogenesis.

UNIT3 TISSUE CULTURE APPLICATION

9 Hrs.

Isolation and culture of protoplasts, protoplast fusion and somatic hybridization, Selection systems for somatic hybrids / cybrids and their characterization, Somoclonal variations, Production of secondary metabolites by plant cell cultures, Germplasm conservation and cryopreservation.

UNIT4 PLANT TRANSFORMATION

9 Hrs.

Genetic Transformation methods for production of transgenic plants (Direct, Indirect), Direct Gene Transfer (DGT) methods, Agrobacterium mediated genetic transformation (Indirect), Chloroplast transformation and production of transplastomics.

UNIT5 APPLICATION AND SAFETY REGULATIONS

9 Hrs.

Production of genetically modified plants for herbicide and pest resistant, transgenic plants for quality traits, Industrial enzymes, Molecular farming for therapeutic protein (Plantibodies, Plantigens, Edible Vaccines), Safety regulation for transgenic plants, Current issues related to transgenic plants.

Max.45Hours

TEXT/REFERENCEBOOKS

6. Adrian Slater, Nigel Scott, and Mark Fowler, Plant Biotechnology, Oxford University Press, NewYork, 2008.
7. Old R.W. and Primrose S.B., An Introduction to Genetic Engineering, University of California press, 1980.
8. Satyanarayana, U. Biotechnology, Allied Pvt. Ltd. Kolkata, 2007.
9. Purohit S.S., Agricultural Biotechnology, Agrobios Indi., Jodhpur, 2002.
10. Chawla H.S., Introduction to Plant Biotechnology, 2nd Edition, Oxford and IBH Press, 2003.

ENDSEMESTEREXAMINATIONQUESTIONPAPERPATTERN

Max.Marks:80

ExamDuration:3 Hrs.

PARTA:10 questions of 2 marks each- No choice

20 Marks

PARTB: 2 questions from each unit of internal choice; each carrying 12marks

60 Marks

SBT5608	ENVIRONMENTAL BIOTECHNOLOGY (OLD SYLLABUS)	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVE

- Discusses on the various types of pollution and their treatment methods. Also briefs on the remediation technologies and bioenergy production

UNIT1 INTRODUCTION TO ENVIRONMENTAL POLLUTION 12Hrs.

Air, Water and Soil pollution- common effects and control measures. Air Pollution Treatment: Treatment technologies, Microbial flora of soil, Ecological adaptations, Interactions among soil microorganisms, biogeochemical role of soil microorganisms.

UNIT2 BIOLOGICAL TREATMENT METHODS FOR WASTEWATER 12 Hrs.

Aerobic digestion, Anaerobic digestion, Denitrification, Anoxic digestion, the activated sludge process, Design and modeling of activated sludge processes, Aerobic digestion, Design of a trickling biological filter, Design of an anaerobic digester.

UNIT3 INDUSTRIAL WASTE MANAGEMENT 12 Hrs.

Dairy, Paper & Pulp, Textile, leather, hospital and pharmaceutical industrial waste management, radioactive and nuclear power waste management- Solid waste management

UNIT4 BIOREMEDIATION 12Hrs.

Types of Bioremediation, Microbiology of degradation and its mechanism, Bioaugmentation, Biosorption, Bioleaching, Metabolic pathways for Biodegradation for specific organic pollutants. Heavy metals- phytoremediation.

UNIT5 BIOENERGY 12Hrs.

Alternate Source of Energy-Biocomposting, Vermiculture, Biofertilizers, Organic farming, Biofuels, Biomineralization, Bioethanol and Biohydrogen,

Max. 60 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Introduces pollution and its effects.
- CO2 - Provides information about the role of microorganisms in the environment.
- CO3 - Exposes the students to various pollution control technologies available.
- CO4 - Explains Bioremediation and biodegradation in detail.
- CO5 - Elucidates biodegradation process and mechanism.
- CO6 - Discusses different alternate source of energy.

TEXT / REFERENCE BOOKS

- Alan and Scragg, Environmental Biotechnology. Pearson Education Ltd. England 1999.
- Jogdand, Environmental Biotechnology, Himalaya Publishing House Bombay 1995.
- John. T. Cookson, Jr. Bioremediation engineering; design and application Mc Graw Hill, Inc. 1995
- Chakrabarty K.D., Omen G.S., Biotechnology And Biodegradation, Advances In Applied Biotechnology Series, Vol.1, Gulf Publications Co., London, 1989
- Metcalf and Eddy, Waste Water Engineering – Treatment, Disposal and reuse. Inc., Tata McGraw Hill, New Delhi 2000.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks:80

Exam Duration : 3Hrs.

PART A : 6 Questions of 5 Marks each –NoChoice

30Marks

PART B : 2 Questions from each unit of internal choice, carrying 10Markseach

50Marks

SBT5608	ENVIRONMENTAL BIOTECHNOLOGY (REVISED SYLLABUS)	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVE

- Discusses on the various types of pollution and their treatment methods. Also briefs on the remediation technologies and bioenergy production

UNIT1 INTRODUCTION TO ENVIRONMENTAL POLLUTION 12Hrs.

Air, Water and Soil pollution- common effects and control measures. Air Pollution Treatment: Treatment technologies, Biofilters and Bioscrubbers for treatment of industrial waste. Microbial flora of soil, Ecological adaptations, Interactions among soil microorganisms, biogeochemical role of soil microorganisms.

UNIT2 BIOLOGICAL TREATMENT METHODS FOR WASTEWATER 12 Hrs.

Aerobic digestion, Anaerobic digestion, Denitrification, Anoxic digestion, the activated sludge process, Design and modeling of activated sludge processes, Aerobic digestion, Design of a trickling biological filter, Design of an anaerobic digester. Anaerobic & Aerobic - Drinking-water treatment

UNIT3 INDUSTRIAL WASTE MANAGEMENT 12 Hrs.

Dairy, Paper & Pulp, Textile, leather, hospital and pharmaceutical industrial waste management, e-waste- radioactive and nuclear power waste management- Solid waste management

UNIT4 BIOREMEDIATION 12Hrs.

Types of Bioremediation, Microbiology of degradation and its mechanism, Bioaugmentation, Biosorption, Bioleaching, Metabolic pathways for Biodegradation for specific organic pollutants. Heavy metals- phytoremediation. Role of GEM in bioremediation of oil spills.

UNIT5 BIOENERGY 12Hrs.

Alternate Source of Energy-Bio composting, Vermiculture, Biofertilizers, Organic farming, Biofuels, Biomining, Bioethanol and Biohydrogen, Bioelectricity through microbial fuel cell, energy management and safety.

Max. 60 Hours

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Introduces pollution and its effects.
- CO2 - Provides information about the role of microorganisms in the environment.
- CO3 - Exposes the students to various pollution control technologies available.
- CO4 - Explains Bioremediation and biodegradation in detail.
- CO5 - Elucidates biodegradation process and mechanism.
- CO6 - Discusses different alternate source of energy.

TEXT / REFERENCE BOOKS

- Alan and Scragg, Environmental Biotechnology . Pearson Education Ltd. England 1999.
- Jogdand, Environmental Biotechnology, Himalaya Publishing House Bombay 1995.
- John. T. Cookson, Jr. Bioremediation engineering; design and application Mc Graw Hill, Inc. 1995
- Chakrabarty K.D., Omen G.S., Biotechnology And Biodegradation, Advances In Applied Biotechnology Series , Vol.1, Gulf Publications Co., London, 1989
- Metcalf and Eddy, Waste Water Engineering – Treatment, Disposal and reuse. Inc., Tata McGraw Hill, New Delhi 2000.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks:80

Exam Duration : 3Hrs.

PART A : 6 Questions of 5 Marks each –NoChoice

30Marks

PART B : 2 Questions from each unit of internal choice, carrying 10Markseach

50Marks



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

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SCHOOL OF BIO AND CHEMICAL ENGINEERING

DEPARTMENT OF BIOTECHNOLOGY

Board of Studies 2018-2019 (ODD SEM)

Minutes of Meeting

Date : 1 June 2018 (Friday)

10.00am-12.00pm

Chair-person : **Dr. Ramesh kumar V, Prof and HOD**

Attendees

Dr. Parthiban.M., External Member

Professor and Head, Department of Animal Biotechnology, Madras
Veterinary college, Chennai 600007

Dr.P.Venkatachalam, External Member

Professor and Head, SRMC

Dr. Ramesh kumar V, Internal member

Dr. Valli Nachiyar C, Internal member

Dr. Jayshree Nellore, Internal member

The HOD chaired the meeting and welcomed all the members and thereafter the agenda items were taken up for discussion

Item 1: To consider and approve the starting of three new programmes for B.Sc (Microbiology, Biotechnology and Biochemistry) from the academic year 2018-2019

The Head of the department explained the salient features contained in the syllabus and requested the members to consider and approve the regulations and syllabus. The regulations and syllabus for courses are available in the annexure-1.

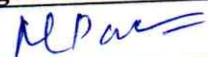
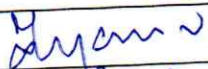
Item 2: To consider and approve the revision in the curriculum and syllabi of B.Tech. Biotechnology under Regulations 2015

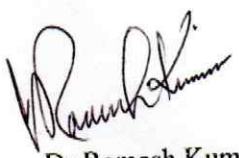
The following new electives were introduced considering the latest technologies in the industry. The BOS members reviewed and has recommended the same for approval. The approved syllabus is in the annexure II

1. SBT 1610 GMP and Quality Concepts
2. SPR 1307 Resource Management Technique

UNIVERSITY ELECTIVES

1. SHS 1601 Life and Employability Skills
 2. SHS 1602 Technical Writing for Scientists
 3. SHS 1603 Professional Communication & Advanced Rhetoric
 4. SCI 1619 Disaster Management
 5. SBI 1101 Introduction to Bioinformatics
 6. SBI 1207 PERL Programming
 7. SBI 1605 Python
 8. SBM 1304 Biomaterials
 9. SBM 1404 Hospital Management
 10. SBM 1606 BioMEMS and Nanotechnology
 11. SBT1610 GMP and Quality Concepts
 12. SBT 1611 Biology for Engineers
 13. SCH 1616 Environmental Impact Assessment
- Meeting ended with vote of thanks to the Chair.

External Member	Signature
Dr. Parthiban.M	
Dr.P.Venkatachalam	
Internal Member	Signature
Dr. Jayshree Nellore	
Dr.Valli Nachiyar	
Dr. Karthick Raja Namasivayam	


Dr.Ramesh Kumar
(Head of the Department)

**PROGRAMME: B.Sc. MICROBIOLOGY
CURRICULUM**

SEMESTER I									
Sl. No	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1.	STA1101 SFR1101 SHN1101	Tamil - I French - I Hindi - I	3	0	0	3	50	50	1 3 5
2.	SHS1109	General English - I	3	0	0	3	50	50	5
3.	SMB1101	General Microbiology	3	1	0	4	50	50	7
4.	SMB1102	Basic Biochemistry	3	1	0	4	50	50	8
5.	SBT1001	Environmental Science	3	0	0	3	50	50	9
6.	SMB4101	General Microbiology Lab	0	0	3	2	50	50	11
7.	SMB4102	Basic Biochemistry Lab	0	0	3	2	50	50	11
Total Credits for Semester 1 – 21									
Total Marks for Semester 1 – 700									

SEMESTER II									
Sl. No	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1.	STA 1102 SFR 1102 SHN1102	Tamil – II French – II Hindi – II	3	0	0	3	50	50	12 14 15
2	SHS 110	General English – II	3	0	0	3	50	50	16
3.	SBB1101	Cell Biology	3	1	0	4	50	50	17
4.	SBB1201	Immunology	3	1	0	4	50	50	18
5.	SBB1202	Intermediary Metabolism	3	0	0	3	50	50	19
6.	SBB4201	Cell Biology Lab	0	0	3	2	50	50	20
7.	SBB4202	Immunology Lab	0	0	3	2	50	50	20
Total Credits for Semester 2 – 21									
Total Marks for Semester 2 – 700									

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS

CAE – CONTINUOUS ASSESSMENT EXAMINATION,

ESE – END SEMESTER EXAMINATION

SEMESTER III									
S. No.	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1.	SBB2101	Introduction to Molecular Biology & Genetics	4	0	0	4	50	50	22
2.	SMB2101	Microbial Ecology	3	0	0	3	50	50	23
3.	SBB2103	Concepts in Biotechnology	3	1	0	4	50	50	24
4.	SMB2103	Bioinstrumentation	3	1	0	4	50	50	25
5.		Elective	3	0	0	3	50	50	
6.	SMB4301	Molecular biology Lab	0	0	3	2	50	50	26
7.	SMB4302	Bioinstrumentation Lab	0	0	3	2	50	50	26
Total Credits for Semester 3 – 21									
Total Marks for Semester 3 – 700									

SEMESTER IV									
Sl. No.	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1.	SMB2201	Soil & Agricultural Microbiology	3	0	0	3	50	50	27
2.	SMB2202	Food & Dairy Microbiology	3	0	0	3	50	50	28
3.	SMB2203	Air and Water Microbiology	3	0	0	3	50	50	29
4.	SMB2204	Industrial microbiology	4	0	0	4	50	50	30
5.		Elective	3	0	0	3	50	50	
6.	SMB4401	Soil & Agricultural Microbiology Lab	0	0	3	2	50	50	31
7.	SMB4402	Food microbiology Lab	0	0	3	2	50	50	31
Total Credits for Semester 4 – 21									
Total Marks for Semester 4 – 700									

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS

CAE – CONTINUOUS ASSESSMENT EXAMINATION,

ESE – END SEMESTER EXAMINATION

SEMESTER V									
Sl. No.	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1.	SMB3101	Medical Bacteriology	3	1	0	4	50	50	32
2.	SMB3102	Medical Virology	3	0	0	3	50	50	33
3.	SMB3103	Medical Mycology	3	0	0	3	50	50	34
4.	SMB3104	Phycology and Medical Parasitology	3	1	0	4	50	50	35
5.		Elective	3	0	0	3	50	50	
6.	SMB4501	Bacteriology and Virology Lab	0	0	3	2	50	50	36
7.	SMB4502	Mycology and Parasitology Lab	0	0	3	2	50	50	36
Total Credits for Semester 5 – 21									
Total Marks for Semester 5 – 700									

SEMESTER VI									
Sl. No.	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1.	SBT1002	Research Methodology	3	0	0	3	50	50	37
2.	SMB3201	Clinical Microbiology	3	0	0	3	50	50	38
3.	S30PROJ	Project	0	0	30	15	50	50	
Total Credits for Semester 6 – 21									
Total Marks for Semester 6 – 300									

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS

CAE – CONTINUOUS ASSESSMENT EXAMINATION,

ESE – END SEMESTER EXAMINATION,

Semester	Theory courses (including elective courses)			Practical Courses (including Project)		
	Total No.	Total Credits	Total Marks	Total No.	Total Credits	Total Marks
1	5	17	500	2	4	200
2	5	17	500	2	4	200
3	5	17	500	2	4	200
4	5	17	500	2	4	200
5	5	17	500	2	4	200
6	2	6	500	1	15	100
Overall Total	27	91	3000	11	35	1100

Overall total credits for B.Sc.(Microbiology) Programme	126
Overall total marks for B.Sc.(Microbiology) Programme	4100

LIST OF ELECTIVES

ELECTIVE COURSES									
Sl. No.	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1	SMB1601	Advances in Microbiology	3	0	0	3	50	50	39
2	SMB1602	Biofertilizers and Biopesticides	3	0	0	3	50	50	40
3	SMB1603	Food Fermentation Techniques	3	0	0	3	50	50	41
4	SMB1604	Management of Human Microbial Diseases	3	0	0	3	50	50	42
5	SBB1601	Advanced instrumentation Techniques	3	0	0	3	50	50	43
6	SBB1605	Computer Application in Biology	3	0	0	3	50	50	44
7	SMB1605	Entrepreneurial Microbiology	3	0	0	3	50	50	45
8	SMB1606	Microbial diversity	3	0	0	3	50	50	46
9	SBB1609	Introduction to Bioinformatics	3	0	0	3	50	50	47
10	SMB1507	Medical Laboratory techniques	3	0	0	3	50	50	48
11	SMB1608	Human Physiology	3	0	0	3	50	50	49
12	SMB1609	Marine microbiology	3	0	0	3	50	50	50
13	SBB3103	Plant biotechnology	3	0	0	3	50	50	51
14	SBB1611	Biostatistics	3	0	0	3	50	50	52
15	SBB1615	Bioethics, Biosafety and IPR	3	0	0	3	50	50	53
16	SBB1616	Nanobiotechnology	3	0	0	3	50	50	54

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS

CAE – CONTINUOUS ASSESSMENT EXAMINATION,

ESE – END SEMESTER EXAMINATION

STA 1101	தமிழ்-முதல் தாள்	L	T	P	Credits	Total Marks
		3	0	0	3	100

நோக்கம்:

- மாணவர்களுக்குத் தமிழ் இலக்கியப்பரப்பை எடுத்துரைத்து சிற்றிலக்கியம், உரைநடை, புதினம், சிறுகதை, புதுக்கவிதை ஆகிய இலக்கியவகைமைகளை அறிமுகப்படுத்துதல்.

பயன்

- நெடிய தமிழ் இலக்கிய வரலாற்றில் சிற்றிலக்கியம், உரைநடை, புதினம், சிறுகதை, புதுக்கவிதை ஆகிய இலக்கியவகைமைகளை அறிதல்.
- பல்வேறு இலக்கிய ஆளுமைகளையும் அவர்தம் படைப்பு, மொழி நடை, மொழிப்பற்று ஆகியவற்றை உணர்ந்து கொள்ளுதல்.
- நவீன சிந்தனைகளோடு மாணவர்தம் கருத்தாக்கங்கள் உருப்பெறல்.
- படைப்பாக்க உத்திகளையும் திறன்களையும் அறிதல்.
- மாணவர்கள் இலக்கியப்படைப்புகளை உருவாக்க அறிந்து கொள்ளுதல்.

அலகு - ஒன்று: தமிழ்இலக்கியவரலாறு

1. சிற்றிலக்கியம்-தோற்றமும் வளர்ச்சியும்
2. உரைநடை-தோற்றமும் வளர்ச்சியும்
3. புதினம்-தோற்றமும் வளர்ச்சியும்
4. சிறுகதை-தோற்றமும் வளர்ச்சியும்
5. புதுக்கவிதை-தோற்றமும் வளர்ச்சியும்

அலகு - இரண்டு: சிற்றிலக்கியம்

1. கலிங்கத்துப்பரணி-போர்பாடியது : 404 --- 408 பாடல்கள்
2. குற்றாலக்குறவஞ்சி - மலைவளம்
 - i.வானரங்கள்கனிகொடுத்து...எனத்தொடங்கும்பாடல்
 - ii.முழங்குதிரைப்புனலருவிகழங்கெனமுத்தாடும்...எனத்தொடங்கும்பாடல்

அலகு - மூன்று: புதுக்கவிதைகள்

1. பாரதியார் - நெஞ்சுபொறுக்குதிலையே...என்றுதொடங்கும் கவிதை.
2. பாரதிதாசன் - உலகஒற்றுமை -தன்பெண்டுதன்பிள்ளை...என்று தொடங்கும் கவிதை.
3. நா.காமராசன் - கருப்புமலர்கள் -காகிதப்பூக்கள் -காலமழைத்தாறலிலே...என்று தொடங்கும் கவிதை
4. இன்குலாப்-மரங்களின்சுற்றம்
5. பாரதிபுத்திரன்-மாரிக்கால இரவுகள் - சிவகாசிச்சிசுக்கள்-மகனே அன்றொருநாள்.... என்று தொடங்கும் கவிதை

அலகு - நான்கு : சிறுகதை மற்றும் புதினம்

1. புதுமைப்பித்தன் சிறுகதைகள்
 - சாபவிமோசனம்
 - கடவுளும் கந்தசாமிப்பிள்ளையும்
 - அன்று இரவு
 - வாடாமல்லி
 - ஒரு நாள் கழிந்தது
2. புதினம்
 - வாடிவாசல்-சி.சு. செல்லப்பா

அலகு - ஐந்து : உரைநடைப்பகுதி

பண்டைத்தமிழர் வாழ்வும் வழிபாடும்-கலாநிதிக . கைலாசபதி

பார்வைநூல்கள்

1. புதுக்கவிதை தோற்றமும் வளர்ச்சியும் – வல்லிக்கண்ணன்
2. தமிழில் சிறுகதை வரலாறும் வளர்ச்சியும் – சிட்டி, சிவபாதசுந்தரம்
3. தமிழ்நாவல் (புதினம்) தோற்றமும் வளர்ச்சியும் – சிட்டி, சிவபாதசுந்தரம்,
4. தமிழ்உரைநடைவரலாறு - வி.செல்வநாயகம்
5. நூற்றாண்டுதமிழ்உரைநடை – சு.சக்திவேல்
6. கலிங்கத்துப்பரணி – புலியூர்க்கேசிகன்உரை
7. குற்றாலக்குறவஞ்சி – புலியூர்க்கேசிகன்உரை
8. பாரதியார்கவிதைகள்
9. பாரதிதாசன்கவிதைகள்
10. மரங்களின்சுற்றம் - இன்குலாப்
11. கருப்புமலர்கள் – நா.காமராசன்
12. மாறிக்காலஇரவுகள் - பாரதிபுத்திரன்
13. புதுமைப்பித்தன் சிறுகதைகள்
14. வாடிவாசல்-சி.சு. செல்லப்பா
15. பண்டைத்தமிழர்வாழ்வும்வழிபாடும்-கலாநிதிக. கைலாசபதி

பருவத் தேர்வு வினாத்தாள் அமைப்பு

மொத்தமதிப்பெண்கள்: 100

பகுதி அ: 10 வினாக்களுக்குத்தலா 2 மதிப்பெண்கள்

பகுதி ஆ: 7 வினாக்களில் 5 வினாக்களுக்குத்தலா 7 மதிப்பெண்கள்

பகுதி இ: 3 வினாக்களுக்குத்தலா 15 மதிப்பெண்கள்

காலம் : 3 மணி நேரம்.

- 20 மதிப்பெண்கள்

- 35 மதிப்பெண்கள்

- 45மதிப்பெண்கள்

SFR1101	FRENCH- I	L	T	P	Credits	Total Marks
		3	0	0	3	100

Course objectives:

- To teach basic skills in written and spoken French.
- To encourage students' oral and written mastery of the language.

UNIT- I**9Hrs**

Se présenter à des publics différents et saluer - Saluer et Prendre congé - La presentation. Pronoms, objets et sujets. Articles définis /indéfinis. Des cartes d'identité. Présenter quelqu'un. Les chiffres 1 à 50. Épreuves.

UNIT- II**12Hrs**

Exprimer ses goûts, ses preferences. La negation. Les mois et les jours / le calendrier - Les verbes - L'interrogation avec intonation - Décrire un lieu, les noms des différentes salles - Les adjectifs - Les articles. Épreuves.

UNIT- III**12Hrs**

Donner des directions / localiser un lieu/ trouver un lieu-Les verbes aller et mettre.-L'article contracté et les prépositions de lieu - L'impératif- Les mots de caractérisation d'un lieu et les lieux urbains - Les transports. Épreuves.

UNIT- IV**12Hrs**

Discuter et acheter des produits - Les expressions de quantité-Les fruits, les légumes, les produits alimentaires-les produits propres aux pays différents.-La negation-le COD-Le conditionnel et les verbes-irréguliers - Épreuves.

UNIT- V**15Hrs**

Fixer un rendez-vous avec le médecin-L'heure et Les nombres de 51 à 100-L'interrogation avec est-ce que- Les parties du corps, avoir + les expressions et les-maladies communes-Les adjectifs possessifs – Le COI - L'entraînement DELF et épreuves.

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Panorama De La Langue Francaise: Level 1 by Jacky Girardet, Jean-Marie Cridlig, CLE International, 2004.
2. Krishnan, C & Albert Adeline, Le Tramway Volant - I, Saraswathi House Pvt Ltd, India, 2011.
3. CAPELLE Guy; MENAND, Robert Taxi-1, Hachette, Paris, 2008.
4. MERIEUX , Régine; LOISEAU, Yves, Connexions-1, Didier, Paris , 2004.
5. MIQUEL, Claire,Vite et Bien-1, CLE International, Paris, 2009.
6. POISSON QUINTON, Sylvie, SIREJOLS, Evelyne, Amical -1, CLE International, Paris, 20011

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A** :6 Questions to be answered out of 8 questions and each question carries 5 Marks**30 Marks****PART B**: 4 questions to be answered out of 8 questions and each question carries 10 Marks**40 Marks****PART C**: 2 questions/Problems to be answered out of 4 questions each carries 15 marks**30 Marks**

SHN1101	HINIDI - I	L	T	P	Credits	Total Marks
		3	0	0	3	100

UNIT I ALPHABETS, VOWELS**10 hrs.**

स्वर अ से अः तक - व्यंजन क से झ तक,
बारह खड़ी अनुस्वार - अनुनासिक व विसर्ग ,संयुक्ताक्षर

UNIT II WHO, WHERE, HERE, THERE**10 hrs.**

क्या ,कौन ,कहाँ ,वहाँ ,यहाँ । मैं हूँ । तुम हो । पढ़ते हो ।

UNIT III ITS, HER, HIS, MINE**10 hrs.**

का, के, की, बड़ा, बड़े, बड़ी ,मेरा, तुम्हारा, हमारा ,आउँगा ,आएगा, आओगे आँगे ,किससे , किसपर ,किसको ,
था ,थे ,थी ,थीं ,आया ,आये, आयी, आयीं , खाया , खायी , खयीं आया है ,आया था ,रहा ,रहे ,रही

UNIT IV**10 hrs.**

प्रार्थना 2 पर्यटन 3 पालतु पशु 4 महाकवी तिरुवल्लुवर

UNIT V**10 hrs.**

Grammar प्रयोग काल Tense कारक विभक्तियों Case Endings का के की -
Possessive Case गिनती - Numbers(1-50)

TEXT BOOK:

1. Hindi Parichaya Publisher: Dakshin Bharat Hindi Prachar Sabha
2. Central Hindi directorate – Certificate course material, MHRD.

EVALUATION PATTERN**1. Exercises for written test**

Fill In The Blanks With Suitable Word
Write The Number Names
Write The Hindi Meanings
Write The English Meanings
Write The Opposites
Write The Correct Word

SHS1109	GENERAL ENGLISH- I	L	T	P	Credits	Total Marks
		3	0	0	3	100

OBJECTIVES OF THE COURSE:

- The paper provides opportunities for students to read and respond to representations of current issues through texts that present themes and topics that are familiar, insightful and informative. The thrust is on preparing students to effectively communicate by applying reflective thinking practices.
- Students will have an opportunity to improve their vocabulary related to immediate environment, practice speaking skills by discussing about issues based on reading texts, read texts that include everyday problems that provide opportunities to develop problem solving skills in cooperative learning situations, develop writing skills through writing paragraphs and letters based on prompts, of a poem, email and letters and composition of dialogues/paragraphs.

UNIT 1 DRESS IN COMMUNICATION**12 Hrs.**

Speaking - Rhetorical analysis and Group Discussion. Reading for details and Global Comprehension - Dress in communication, I have a Dream Speech by Martin Luther King and The Justice Peace by Hilaire Belloc. Critical Thinking: Asking Questions, Analyzing Assumptions and Biases. Vocabulary: Expressions and markers. Collocations – Identifying collocations by reading prose passages mentioned in the UNIT one. Language Focus: Determiners, Parts of Speech Writing: Paragraph writing based on hints given on topics like 'My dream for my family/ country', 'importance of clothing for communication, 'social inequality in society', 'Judge the Book by its Cover- Can we judge people by their appearance?

UNIT II: AN INCONVENIENT TRUTH**12 Hrs.**

Speaking: Debate on the topics related to Environmental issues and Discrimination in Society, Reading for details and Global Comprehension on An Inconvenient Truth, A Different History by Kamala Das and Sujata Bhatt. Critical Thinking: Identifying Facts and Opinions, Distinguish a main idea in text from a subordinate idea. Examine views on a controversial issue and consider one's own biases and personal interest. 'Vocabulary: Collocations, Useful words to express point of view. Language focus- Tenses, Conjunctions and discourse markers Writing- Responding to Slogans, Campaign Leaflet and Writing Film Review , Letter writing

UNIT 3 A SPEECH BY N R NARAYANA MURTHY**12 Hrs.**

Speaking: Giving Impromptu speeches- Welcome address and Vote of Thanks. Reading for details and Global Comprehension- A Speech by NR Narayana Murthy and Digging by Seamus Heaney Critical Thinking: Asking ' wh ' questions Questions, Making informed decisions based on evidence, Examining Evidence by citing evidence from the textbook or lecture to support a position. Vocabulary - Word association, onomatopoeic words. Language focus: Sentence Function and Sentence Kinds Writing: Writing email , Writing Diary Entry

UNIT 4 AFTER TWENTY YEARS**12 Hrs.**

Listening: For details and Overall Idea , Speaking: Informal Speech, Reading for details and Global Comprehension- After Twenty Years by Jamila and After Twenty Years by O Henry Writing: Problem solving paragraph writing. Letter to the editor with solutions to current problems related to areas covered in the course Critical Thinking: Problem Solving selecting effective solutions for overcoming obstacles or constraints by explaining why it is the most effective of the possible solutions. Vocabulary : Phrasal Verbs Language Focus Types of sentences -simple, compound and complex. Language Focus: Subject verb Agreement

UNIT 5 I LOVE YOU MOM**12 Hrs.**

Listening for details Speaking- Greeting , thanking , apologising, offering condolences by doing Role plays Reading for details and Global Comprehension- I Love you Mom by Joanna Fuchs and Prose passage on ' I Love You Mom'. Writing: Writing restaurant review, argumentative writing. Vocabulary: Phrasal Verbs , Synonyms and Antonyms Critical Thinking : Argumentation provides a well-articulated and detailed argument

Max Hours.60

TEXT / REFERENCE BOOKS

1. P Bhaskaran Nair, C Radha Krishna Pillai, Geetha Rajeevan, CLN Prakash, Nadhini Nayar Reflections - An Anthology of Prose, Poetry and Fiction (2015) Foundation Books, Chennai . Foundation Books. ISBN 978-93-85386-008
2. Sen S , Mahendra etal. (2015) Communication and Language Skills . Foundation books. Chennai

Reference Links for teachers on Critical Thinking

<https://designteachengage.wisc.edu/course-activities-learner-interaction/sdc-activity-types-active-learning/>

<https://www.uen.org/rubric/previewRubric.html?id=1219>

<https://www.diigo.com/profile/Teachonlineuw?query=%22Critical+Thinking%22+rubric>

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 100

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each - No choice

20 Marks

PART B : 2 questions from each UNIT of internal choice; each carrying 16 marks

80 Marks

SMB1101	GENERAL MICROBIOLOGY	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- This course is aimed give an understanding about the basics of microbiology dealing types of microbes, classification & characterization

UNIT 1 HISTORY AND CLASSIFICATION**12 Hrs.**

History and scope of Microbiology, Spontaneous generation - Biogenesis theory - Contribution of Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Paul Ehrlich and Sir Alexander Flemming. Germ theory of disease. Binomial Nomenclature, Whittaker's five kingdom and Carl Woese's three kingdom classification systems and their utility. Difference between prokaryotic and eukaryotic microorganisms

UNIT- 2 MICROSCOPY AND STAINING**12 Hrs.**

Microscope- Principles, working mechanism and application - Simple and compound microscope -Dark field -Phase contrast, Fluorescence, SEM and TEM. Structure and organization of bacterial cell, Gram positive and Gram negative bacterial cell wall. Types of Staining - Simple, Differential (Gram's, AFB), Special - Capsular staining (negative), Spore. LPCB, KOH mount

UNIT- 3 SUBCELLULAR STRUCTURES**9 Hrs**

Microbial cell : Ultrastructure of bacteria, subcellular structures and cell envelope – slime, capsule, cell wall, pili, flagella, cell inclusions, biosynthesis of bacterial cell wall, cell membrane – Bio-membrane, liposomes – membrane transport – diffusion, active and passive transport and osmoregulation.

UNIT- 4 STERILIZATION**12 Hrs.**

Sterilization and Disinfection- principles -methods of sterilization- physical methods - Dry heat- Moistheat- Radiation. Filtration (Membrane and HEPA). Chemical sterilization- Chemical agents- mode of action- phenol coefficient test- sterility testing.

UNIT- 5 MEDIA AND TECHNIQUES**12 Hrs.**

Culture and media preparation - solid and liquid. Types of media- Semi synthetic, Synthetic, Enriched, Enrichment, Selective and Differential media. Pure culture techniques – Tube dilution, Pour, Spread, Streak plate. Anaerobic culture technique Wright's Tube, Roll tube method, Anaerobic Jar.

TEXT / REFERENCE BOOKS

1. Prescott, Harley, Klein. 2003. Microbiology. 5th Edition. McGraw Hill Publ.
2. Bernard R. Glick & Jack J. Pasternak. 2002. Molecular Biotechnology. Indian edition. Panima Publishing Corporation.
3. Pelzer, Chan and Kreig. 1986. Microbiology. 5th Edition. McGraw-Hill.
4. Tortora, G.J., Funke, B.R. and Case, C.L. 2012. Microbiology - An Introduction. 11th Edition. Pearson Education.
5. Stainer, Ingharam, Wheelis and Painter. 1987. General Microbiology. 5th Edition. Macmillan Education, London.
6. A.J. Salle. 1974. Fundamental Principles of Bacteriology. Tata McGraw – Hill Edition.

Max Hours.60**END SEMESTER EXAMINATION QUESTION PAPER PATTERN****Max. Marks : 100****Exam Duration : 3 Hrs.****PART A** : 10 questions of 2 marks each - No choice**20 Marks****PART B** : 2 questions from each UNIT of internal choice; each carrying 16 marks**80 Marks**

SMB1102	BASIC BIOCHEMISTRY	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- This course is aimed give an understanding about the basics of biochemistry dealing carbohydrates, Amino acids, Lipids, nucleic acid and vitamins

UNIT 1 CARBOHYDRATES**12 Hrs.**

Carbohydrate – Definition, Classification, biological significance, structure of glucose, digestion and absorption of carbohydrates.

UNIT 2 PROTEIN**12 Hrs.**

Amino acids – structure, classification (Essential and non-essential, protein and non-protein amino acids). Proteins – definition, classification and structure (primary, secondary, tertiary and quaternary).

UNIT 3 LIPIDS**12 Hrs.**

Lipids – definition, classification and biological significance. Structure, properties and functions of fatty acids.

UNIT 4 NUCLEIC ACIDS**12 Hrs.**

Nucleic acids – Structure of DNA and its functions. Different forms of DNA. Different types of RNA and its functions.

UNIT 5 VITAMINS**12 Hrs.**

Vitamins – Source, biological function, daily requirement and deficiency symptoms of fat soluble vitamins (A, D, E and K) and water soluble vitamins (Ascorbic acid, thiamine, riboflavin, pyridoxine, niacin, pantothenic acid, lipoic acid, biotin, folic acid and vitamin B12).

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Lehninger Principles of Biochemistry-David L. Nelson, Michael M. Cox, Macmillan Worth Publishers.
2. Harper—s Biochemistry-Rober K. Murray, Daryl K. Grammer, McGraw Hill, Lange Medical Books. 25th edition.
3. Fundamentals of Biochemistry-J.L. Jain, Sunjay Jain, Nitin Jain, S. Chand & Company.
4. Biochemistry-Dr. Amit Krishna De, S. Chand & Co., Ltd.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A** : 10 questions of 2 marks each - No choice**20 Marks****PART B** : 2 questions from each UNIT of internal choice; each carrying 16 marks**80 Marks**

SBT1001	ENVIRONMENTAL SCIENCE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To impart knowledge on the issues related to environment and to emphasize the importance of a clean environment

UNIT 1 MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 10 Hrs

Definition, scope and importance- Need for public awareness. Natural Resources : Renewable and non-renewable resources : Natural resources and associated problems. Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.

UNIT 2 ECOSYSTEMS, BIODIVERSITY AND ITS CONSERVATION**10 Hrs**

Concept of an ecosystem. Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: - Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Biodiversity: Definition-genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega- diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT 3 ENVIRONMENTAL POLLUTION**12 Hrs.**

Definition -Cause, effects and control measures of: - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

UNIT 4 SOCIAL ISSUES AND THE ENVIRONMENT**8 Hrs.**

Idea of Sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case Studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness.

UNIT 5 HUMAN POPULATION AND THE ENVIRONMENT**8 Hrs.**

Population growth, variation among nations. Population explosion – Family Welfare Programme. Environment and human health. Human Rights. Value Education. HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health. Case Studies.

Visit to a local area to document environmental assets-river/forest/grassland/hill/mountain

- Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
- Study of common plants, insects, birds.
- Study of simple ecosystems-pond, river, hill slopes, etc.

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Erach Bharucha, Text Book of Environmental Studies, 2nd Edition, University Press, Chennai, 2006
2. Meenakshi. P, Elements of Environmental Science and Engineering, 1st Edition, Prentice Hall of India, New Delhi, 2009.
3. Ravikrishnan. A, Environmental Science & Engineering, 3rd Edition, Sri Krishna Publications, Chennai, 2008.
4. Wrigh. R. T & Nebel B.J, Environmental science-towards a sustainable future by Richard 8th edition, Prentice Hall of India, New Delhi, 2006

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 questions of 2 marks each - No choice****20 Marks****PART B : 2 questions from each UNIT of internal choice; each carrying 16 marks****80 Marks**

SMB4101	GENERAL MICROBIOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	3	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Handling of Instruments and Laboratory safety measures.
2. Handling and Maintenance of compound microscope.
3. Cleaning of Glassware and preparation of cleaning solutions.
4. Preparation of media: Simple media, Complex media-Nutrient agar, McConkey agar, EMB agar.
5. Simple staining
6. Gram's staining
7. Motility by hanging drop method
8. Negative staining
9. Acid fast staining-permanent slide only.
10. Capsule staining
11. Endospore staining.
12. Isolation of pure cultures of bacteria by streaking method.
13. Preservation of bacterial cultures by various techniques.
14. Estimation of CFU count by spread plate method/pour plate method.

SMB4102	BASIC BIOCHEMISTRY LAB	L	T	P	Credits	Total Marks
		0	0	3	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Properties of water, Concept of pH and buffers, preparation of buffers and Numerical problems to explain the concepts
2. Estimation of Ascorbic acid.
3. Carbohydrates: Glucose, fructose, maltose and lactose.
4. Amino acids: Arginine, cysteine, tryptophan and tyrosine.
5. Colorimetric analysis (only for demonstration)
6. Estimation of protein by Lowry's method.
7. Estimation of DNA using diphenyl amine.
8. Estimation of glucose by O-Toluidine.

STA 1102	தமிழ்-இரண்டாம்தாள்	L	T	P	Credits	Total Marks
		3	0	0	3	100

நோக்கம்

மாணவர்களுக்குத்தமிழின்செவ்விலக்கியங்கள்மற்றும்காப்பியங்களைஅறிமுகப்படுத்துதல்.

பயன்

- ஈராயிரம்ஆண்டுகளுக்குமுந்தையதமிழின்செவ்விலக்கியங்களின்சிறப்பினைஉணர்தல்.
- பண்டையகாலத்தமிழ்மக்களின்அகமற்றும்புறவாழ்வியலையும்பண்பாட்டையும்அறிதல்.
- தமிழர்தம்அறச்சிந்தனைகளையும்அறவாழ்வியலைஅவர்கள்பேணியமுறையினையும்உணர்தல்.
- தமிழர்களுடையமெய்யியல்தத்துவங்களையும்கடவுள்பற்றியகோட்பாடுகளையும்உணர்தல்.
- நெடுங்கதைகளாகத்திகழ்ம்காப்பியங்களின்வழிபலப்பண்பாட்டுச்செய்திகளைஅறிதல்.

அலகு-ஒன்று : தமிழ்இலக்கியவரலாறு

1. சங்க இலக்கியங்கள்
2. அற இலக்கியங்கள்
3. பக்தி இலக்கியம்
4. காப்பியங்கள்

அலகு-இரண்டு : சங்கஇலக்கியம்

1. 'முளிதயிர்பிசைந்த' என்று தொடங்கும்குறுந் தொகைப்பாடல் (167)
2. 'நின்றசொல்லர்' என்று தொடங்கும் நற்றிணைப்பாடல் (1)
3. 'மனைநடுவயலை வேழம் சுற்றும் ' என்று தொடங்கும் ஐங்குறுநூற்றுப்பாடல் (11)
4. 'எம்வெங்காமம்இயைவதுஆயின்' என்று தொடங்கும் அகநானூற்றுப்பாடல் (15)
5. 'சுடர்தொடிகேளாய்' என்று தொடங்கும் கலித்தொகைப்பாடல் (51)
6. 'மண்டுஅமர்அட்ட' என்று தொடங்கும் புறநானூற்றுப்பாடல் (213)
7. 'நறவுவாய்உறைக்கும்நாகுமுதிர்'என்று தொடங்கும் சிறுபாணாற்றுப்படை பாடல் (51 - 67)

அலகு-மூன்று : அறஇலக்கியங்கள்

1. திருக்குறள்-நட்பாராய்தல், புலவிநுணுக்கம் (2 அதிகாரம்).
2. நாலடியார்-பொருட்பால்-மேன்மக்கள்- (5) பாடல்கள்

அலகு-நான்கு : பக்திஇலக்கியங்கள்**சைவம்-பன்னிருதிருமுறைகள்**

1. திருஞானசம்பந்தர்தேவாரம்-முதலாம்திருமுறை
'காதல்ஆகி, கசிந்து'என்றுதொடங்கும்பாடல்.
2. திருநாவுக்கரசர்தேவாரம்-ஐந்தாம்திருமுறை
'மாசில்வீணையும்மாலை'என்றுதொடங்கும்பாடல்.
3. சுந்தரர்தேவாரம்-ஏழாம்திருமுறை
'பொன்னார்மேனியனே' என்று தொடங்கும்பாடல்.

வைணவம்-நாலாயிரத்திவ்யப்பிரபந்தம்

1. பூதத்தாழ்வார்
'பெருகுமதவேழம்மாப்பிடிக்கு'என்றுதொடங்கும்பாடல்.
2. குலசேகராழ்வார்
'ஆனாதசெல்வத்துஅரம்பையர்கள்தற்குழ்'என்றுதொடங்கும்பாடல்.

அலகு-ஐந்து : காப்பியஇலக்கியங்கள்

1. சிலப்பதிகாரம்
மங்கலவாழ்த்துப்பாடல்முழுவதும்
2. சீவகசிந்தாமணி
கோவிந்தையார்இலம்பகம்முழுவதும்
3. கம்பராமாயணம்
திருவடித்தொழுதபடலம் (பாடல்எண் : 25 - 48)

பார்வைநூல்கள்

1. தமிழ்இலக்கியவரலாறு-மு.வ.
2. தமிழ்இலக்கியவரலாறு-மது. ச. விமலானந்தம்
3. சங்கஇலக்கியம்-ஒளவைசு. துரைசாமிப்பிள்ளை
4. சங்கஇலக்கியம் - புலியூர்கேசிகன்
5. திருக்குறள் - பரிமேலழகர்உரை
6. திருக்குறள் - மு.வ. உரை
7. நாலடியார் - கு. மதுரைமுதலியார்
8. சைவத்திருமுறைகள்-வர்த்தமான்பதிப்பகம்
9. நாலாயிரதிவ்வியப்பிரபந்தம்-வர்த்தமான்பதிப்பகம்
10. சிலக்கதிகாரம்-ஞா.மாணிக்கவாசகன்
11. சீவகசிந்தாமணி-துரைராசாராம்
12. கம்பராமாயணம்-கழகவெளியீடு.

பருவத்தேர்வுவினாத்தாள்அமைப்பு**மொத்தமதிப்பெண்கள்: 100****பகுதிஅ:** 10 வினாக்களுக்குத்தலா 2 மதிப்பெண்கள்**பகுதிஆ:** 7 வினாக்களில் 5 வினாக்களுக்குத்தலா 7 மதிப்பெண்கள்**பகுதிஇ:** 3 வினாக்களுக்குத்தலா 15 மதிப்பெண்கள்**காலம் : 3 மணிநேரம்.****- 20 மதிப்பெண்கள்****- 35 மதிப்பெண்கள்****- 45 மதிப்பெண்கள்**

SFR1102	FRENCH- II	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- To teach basic skills in written and spoken French.
- To encourage students' oral and written mastery of the language.

UNIT I

Acheter un billet - Les nombres au-delà de 100 - Les différents types de places (fumeur, non fumeur, aller-retour) - Les adjectifs démonstratifs - L'interrogation avec inversion - Les vêtements - L'entraînement DELF - Compréhension/Production écrite- Épreuves

UNIT II

Discuter les plats au restaurant - Les recettes, des plats et boissons différents, - les formules de cuisine, des recettes simples - des différents pays - Le passé récent - Les pronoms toniques - Il faut + infinitif, Le pronom - Faire des projets pour les vacances, décrire le temps - les lieux touristiques et le climat des différents pays - Le futur proche et les adverbes, le il - m personnel, le pronom y - Épreuves et entraînement DELF

UNIT III

Le passé composé - Les pronoms relatifs (qui, que) - Québec et son histoire - Parler du passé et de soi - Compréhension/ production écrite - Entraînement DELF - Épreuves

UNIT IV

Les verbes réfléchis - Les pronoms relatifs (dont, où) - L'impératif négatif - Compréhension/ production écrite - Entraînement DELF - Épreuves

UNIT V

L'imparfait - La place des pronoms doubles - Décrire les mœurs et les pays - La Réunion - Compréhension/ production écrite - Entraînement DELF - Épreuves

Max Hours.60**Text books:**

- Panorama De La Langue Française: Level 1 by Jacky Girardet, Jean-Marie Cridlig, CLE International, 2004.
- Krishnan, C & Albert Adeline, Le Tramway Volant - I, Saraswathi House Pvt Ltd, India, 2011.
- CAPELLE Guy; MENAND, Robert Taxi-1, Hachette, Paris, 2008.

Reference books:

- MERIEUX, Régine; LOISEAU, Yves, Connexions-1, Didier, Paris, 2004.
- MIQUEL, Claire, Vite et Bien-1, CLE International, Paris, 2009.
- POISSON QUINTON, Sylvie, SIREJOLS, Evelyne, Amical -1, CLE International, Paris, 2011

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each UNIT of internal choice; each carrying 16 marks**80 Marks**

SHN1102	HINIDI -II	L	T	P	Credits	Total Marks
		3	0	0	3	100

Unit- I

- (i) पत्य – Poetry
- (ii) गत्य – Prose
- (iii) एकांकी एवं नाटक – One Act Play and Drama
- (iv) कहानी एवं उपन्यास – Story and Novel

Unit -II

- (v) हिन्दी व्याकरण (Hindi Grammer)
1.सज़ं, 2. सर्वनाम, 3.विशेषण, 4.क्रिया-विशेषण, 5.काल, 6.लिंग, 7.वचन, 8.वाक्य-विचार, 9. शधुद लेखन.

Unit -III

- (vi) परिभाषिक शब्द – 250 आग्रेजी पारिभाषिक शब्दों को हिन्दी परिपाषिक शब्द
Translate from English to Hindi – 250 Official words.
- (vii) अनुवाद अभ्यास (Translation):

Unit -IV

- (viii) निबंध लेखन(Essay):
गाँधी, नेहरु, अंबेडकर, बगत सिंह, अब्दुल कलाम
- (ix) पत्र लेखन(Letter Writing):
आवेदन पत्र, रासकीय पत्र, अर्धशासकीय पत्र, प्रत्यावेदन पत्र, प्रतिवेदन पत्र
Application letter, Official letter, Semi-Official letter, Government letter.

Unit -V

- (x) संक्षेपण और विस्तारण (Comprehensions)
- (xi) लोकोक्तियाँ एवं मुहावरे (Proverbs)

SHS1110	GENERAL ENGLISH - II	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES:

- The paper provides opportunities for students to read and respond to representations of current issues through texts that present themes and topics that are familiar, insightful and informative. The thrust is on preparing students to effectively communicate by applying reflective thinking practices. Students will have an opportunity to improve their vocabulary related to immediate environment, practice speaking skills by discussing about issues based on reading texts, read texts that include everyday problems that provide opportunities to develop problem solving skills in cooperative learning situations, develop writing skills by summarising substance of a poems, letters and composition of dialogues and paragraphs.

UNIT 1 UNITY OF MINDS - A P J ABDUL KALAM**(9Hrs)**

Listening for details, Speaking - making a presentation, Reading for details and Global Comprehension UNITY of Minds by APJ Abdul Kalam -Vocabulary Binomials Writing: Writing compare contrast paragraphs by representing data given in pie chart, Tables; Writing Speeches. Vocabulary : Binomials, Affixes Language Focus : Active and Passive Voice, Punctuation. Critical Thinking : Comparing & Contrasting presenting information by including important characteristics on which the items should be compared or contrasted

**UNIT 2 LEAVE THIS CHANTING AND SINGING AND TELLING OF BEADS BY RABINDRANATH TAGORE AND
ENGINE TROUBLE BY R K NARAYANAN**
12 Hrs.

Listening for details Speaking: Giving impromptu speech based on topics given in the class for clarifying one's point of view. Reading for Comprehension and for overall idea -Leave this Chanting and Singing and Telling of Beads by Rabindranath Tagore and Engine Trouble by R K Narayanan, Vocabulary : Archaic words, phrases Writing: Language Focus Imperatives. Writing: Writing Instructions and recommendations based on quotations given as prompts, writing an advertisement Critical Thinking: Expressing point of view

UNIT 3 THE HAPPY PRINCE BY OSCAR WILDE**9Hrs**

Speaking Telephonic conversation, Drama In the class based on the story prescribed Reading for details and Global Comprehension The Happy Prince by Oscar Wilde Language Focus: Adjective- degrees of Comparison, Functional and personal Nouns Vocabulary : positive and negative connotations. Writing: Letter writing- personal letters Critical Thinking Self-regulation: Continuing improvement in thinking, involving monitoring one's cognitive process and correcting errors and biases as needed.

UNIT 4 TWO GENTLEMEN OF VERONA BY A J CRONIN**12 Hrs.**

Listening for Overall information of 'Anthem for Doomed Youth' by Wilfred Owen Speaking: Making requests and suggestions. Reading for details Two Gentlemen of Verona by A J Cronin, Vocabulary: Simile, metaphor, adjectives to describe people and their personalities. Idioms. Writing: Writing recommendations; Narratives based on prompts on plot and characters. Critical Thinking: identifying the subject of the investigation and presenting a well-articulated solution to the confusions or contradictions associated with the situation based on listening speaking tasks in the class. Creative writing - stories and poems Language Focus: Reported Speech

UNIT 5 THE AVENGER BY ANTON CHEKHOV**12 Hrs.**

Listening for specific details Speaking using imagination. Reading to identify factual and inferential information Writing: Imaginative writing by predicting. Vocabulary : Countable forms and meaning, foreign nouns and framing of plurals. Language focus: Modal verbs, use of would. Critical Thinking: Deductive reasoning- generating a valid prediction or conclusion by articulating the relationship between the prediction or conclusion

Max Hours.60**TEXT / REFERENCE BOOK**

P Bhaskaran Nair, C Radha Krishna Pillai, Geetha Rajeevan, CLN Prakash, Nadhini Nayar Reflections - An Anthology of Prose, Poetry and Fiction (2015) Foundation Books, Chennai . Foundation Books. ISBN 978-93-85386-008

Sen S , Mahendra etal. (2015) Communication and Language Skills . Foundation books. Chennai

<https://designteachengage.wisc.edu/course-activities-learner-interaction/sdc-activity-types-active-learning/>

<https://www.uen.org/rubric/previewRubric.html?id=1219>

<https://www.diigo.com/profile/Teachonlineuw?query=%22Critical+Thinking%22+rubric>

SBB1101	CELL BIOLOGY	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- Cell biology is the study of the structure and function of prokaryotic and eukaryotic cells. In this course the students will learn different areas of cellular biology including the structure and functions of cell, its organelles, synthesis and function of macromolecules such as carbohydrate, protein, lipid, DNA & RNA; membrane structure and function; bioenergetics; cellular communication; and microscopic techniques to understand the cell structure.

UNIT 1 FUNDAMENTALS OF CELL STRUCTURE**12 Hrs.**

Discovery of cells; Basic properties of cells; Different classes of cells – Prokaryotic and eukaryotic cells. Cell division: Cell cycle; mitosis; meiosis, binary fission.

UNIT 2 CELLULAR MEMBRANES AND MATRICES**12 Hrs.**

Chemical composition and fluidity of membranes; dynamic nature of membranes; transportation across cell membrane; membrane potentials; extracellular matrices – structure and function; cytoskeleton – structure and function.

UNIT 3 CELLULAR ORGANELLES IN ENERGY METABOLISM**12 Hrs.**

Mitochondria – structure and function; Chloroplast – structure and function. Structure of nucleus – nuclear membrane, nucleolus, chromatin, structure of nucleic acids

UNIT 4 CELLULAR ORGANELLES IN METABOLISM**12 Hrs.**

Endoplasmic reticulum – smooth & rough; function of endoplasmic reticulum; Golgi complex – structure and function; Ribosomes – Types, structure and function; Morphology and functions of peroxisomes and glyoxisomes; Plant cell vacuoles.

UNIT 5 TRANSPORT ACROSS CELL MEMBRANE**12 Hrs.**

Passive and active transports, Permeases, Sodium -potassium pumps, Ca²⁺ ATPase pump, ATP dependant proton pumps, co-transport, symport, antiport, Endocytosis and Exocytosis. Introduction to intra and extra cellular products of medicinal use.

Max Hours.60**Text Books**

- Freifelder D. 1985. Molecular Biology, Narosa Publishing House. New Delhi.
- Lewin B. 2007. Genes IX. Oxford University Press, London.
- Ajoy Paul. 2011. Textbook of Cell and Molecular Biology. Books and Allied Ltd.
- Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. 2008. Molecular Biology of Cell. 6th Edition. Garland Science, Taylor & Francis group Publishers.
- Harvey Lodish, Arnold Berk, S Lawrence Zipursky, Paul Matsudaira, David Baltimore, and James Darnell. 1995. Molecular Cell Biology. 3rd Edition. W.H. Freeman Publishers.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 questions of 2 marks each - No choice****20 Marks****PART B : 2 questions from each UNIT of internal choice; each carrying 16 marks****80 Marks**

SBB1201	IMMUNOLOGY	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- To know the fundamentals of innate and acquired Immunity .To understand how immune system fights and combats the infection and diseases. To get an insight about the principle mechanism of Immunity.

UNIT 1 IMMUNITY

History of Immunology – Host-parasite relationship – Immunity – Innate and acquired Immunity – Humoral and Cell-mediated Immunity .

UNIT 2 IMMUNE CELLS

Structure, Functions and Properties of: Immune Cells – Stem cell, T cell, B cell, NK cell, Macrophage, Neutrophil, Eosinophil, Basophil, Mast cell, Dendritic cell; and Immune Organs – BoneMarrow, Thymus, Lymph Node, Spleen, GALT, MALT, CALT

UNIT 3 ANTIGENS

Antigens – Types, properties – Immunoglobulins – Structure,types and Functions, Antigenic determinants on antibodies(Isotypic, allotypic, idiotypic); VDJ rearrangements; Complement – Classical and alternative pathways.

UNIT 4 ANTIBODY

Monoclonal antibodies, Antigen – Antibody reactions:Agglutination – Precipitation –Complement fixation – Immunofluorescence – ELISA, RIA.

UNIT 5 AUTOIMMUNITY, HYPERSENSITIVITY AND TRANSPLANTATION

AutoImmunity : Hypersensitivity reactions – Antibody mediated – Type I, Type II and Type III – cell mediated - Type IV; Transplantation immunology; Tumor immunology

Max Hours.60

TEXT / REFERENCE BOOKS

1. Zeev Pancer and Max D. Cooper, (2006), The Evolution of Adaptive Immunity , Ann. Rev.Immunol., 24: 497–518
2. Roitt Evan, Brostoff J. Male D. (1993) Immunology 6th Ed., Mosby & Co. London.
3. Roitt I. M. (1988) Essentials of Immunology, ELBS, London.
4. Roitt M. (1984) Essentials of Immunology, P. G. Publishers Pvt. Ltd., New Delhi.
5. Stites D. P., Stobo J. D., Fudenberg H. H. and Wells J. V., (1982), Basic and Clinical Immunology, 4th Ed., Lange Medical Publications, Maruzen Asia Pvt. Ltd., Singapore
6. Janeway Charles A., Paul Travers, Mark Walport, Mark Shlomchik. Immunobiologyinteractive. 2005. Garland Science Publishing. USA.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 100

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each - No choice

20 Marks

PART B : 2 questions from each UNIT of internal choice; each carrying 16 marks

80 Marks

SBB1202	INTERMEDIARY METABOLISM	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- This course aims at understanding the essential metabolic functions of the organism as well as consumption and storage of energy intermediary metabolism of main biomolecules and its regulatory mechanisms.

UNIT 1 BASIC THERMODYNAMICS**12 Hrs.**

Anabolism – catabolism, Enthalpy enthalpy free energy, forward and reverse reaction equilibrium state

UNIT 2 CARBOHYDRATE METABOLISM**12 Hrs.**

Glycolysis, TCA cycle and its energy production. Glycogen metabolism: Glycogenesis and Glycogenolysis, Alternative pathways: HMP pathway, gluconeogenesis

UNIT 3 LIPID METABOLISM**12 Hrs.**Fatty acid oxidation – α , β , ω oxidation. Biosynthesis of saturated and unsaturated fatty acids. Metabolism of cholesterol, triglycerides.**UNIT 4 PROTEIN METABOLISM****12 Hrs.**

Ketogenic and Glucogenic amino acids metabolism. Deamination, Transamination and Decarboxylation, Urea cycle.

UNIT 5 NUCLEIC ACID METABOLISM & ENERGY PRODUCTION**12 Hrs.**

Biosynthesis and degradation of purine and pyrimidine nucleotides. Mitochondrial Electron Transport Chain: Oxidative phosphorylation

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Fundamentals of Biochemistry, J.L. Jain, S.Chand publications, 2004.
2. Lehninger's Principles of Biochemistry (2000) by Nelson, David I. and Cox, M.M. Macmillan /Worth, NY.
3. Harper's Biochemistry Robert K. Murray, Daryl K. Granner, Peter A. Mayes, Victor W. Rodwell, 24th edition, Prentice Hall International. Inc.
4. Principles of Biochemistry, Geoffrey L. Zubay, 3rd edition William W. Parson, Dennis E. Vance, W.C. Brown Publishers, 1995.
5. Principles of Biochemistry, David L. Nelson, Michael M.Cox, Lehninger, 4th edition, W.H. Freeman and company.
6. Biochemistry, Lubert Stryer, 4th edition, W.H. Freeman & Co, 1995.
7. Fundamentals of Biochemistry (1999) by Donald Voet, Judith G.Voet and Charlotte W Pratt, John Wiley & Sons, NY.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A** : 10 questions of 2 marks each - No choice**20 Marks****PART B** : 2 questions from each UNIT of internal choice; each carrying 16 marks**80 Marks**

SBB4101	CELL BIOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	3	2	100

SUGGESTED LIST OF EXPERIMENT

1. Light Microscopy
2. Simple staining
3. Studying algal cell
4. Studying fungal cell
5. Studying plant cell (Onion cells)
6. Studying animal cell (Human cheek cells)
7. Studying mitotic cell division in root tips of *Allium cepa*
8. Identifying meiotic cell division

SBB4201	IMMUNOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	3	2	100

SUGGESTED LIST OF EXPERIMENT

1. Identification of human blood groups.
2. To perform Total Leukocyte Count of the given blood sample.
3. To perform Differential Leukocyte Count of the given blood sample.
4. Agglutination reaction
 - i) Widal test
 - ii) ASO test
 - iii) RA test
 - iv) CRP test
 - v) Pregnancy test (Direct/Indirect)
5. To perform immunodiffusion by
 - i. Single Radial Immunodiffusion
 - ii. Ouchterlony double diffusion.
6. To perform DOT ELISA.
7. To perform immunoelectrophoresis.

SBB2101	INTRODUCTION TO MOLECULAR BIOLOGY & GENETICS	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- This course provides you with further knowledge associated with molecular biology and inheritance at the molecular, cellular and phenotypic levels.

UNIT 1 INTRODUCTION**12 Hrs.**

Introduction and History of Microbial Genetics. DNA as a Genetic material. Physical structure and Chemical composition of DNA – RNA and its types RNA as a Genetic material. DNA Replication – Types and Experimental proof of replication – Enzymes involved in DNA replication

UNIT 2 CENTRAL DOGMA**12 Hrs.**

Prokaryotic Transcription, Translation. Genetic code – Regulation of gene expression in prokaryotes – lac Operon. Gene transfer mechanisms – Transformation, conjugation and Transduction. Plasmid – Characteristics and types.

UNIT 3 MENDELIAN GENETICS**12 Hrs.**

Mendel's work on transmission of traits, Genetic Variation, Molecular basis of Genetic Information. Interrelation between the cell structure and the genetics function, Mitosis, Meiosis (explaining Mendel's ratios).

UNIT 4 INHERITANCE**12 Hrs.**

Principles of Inheritance, Chromosome theory of inheritance, Laws of Probability, Pedigree analysis, Incomplete dominance and codominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Environmental effects on phenotypic expression, sex-linked inheritance. Linkage and crossing over, Cytological basis of crossing over, Molecular mechanism of crossing over, Recombination frequency as a measure of linkage intensity, two factor and three factor crosses, Interference and coincidence, Somatic cell genetics – an alternative approach to gene mapping.

UNIT 5 MUTATION**12 Hrs.**

Mutation – types of mutation – Molecular basis of mutation – Mutagenesis, Detection of mutants – Ames test, DNA repair mechanisms. Molecular basis of Mutations in relation to UV light and chemical mutagens, Detection of mutations: CLB method, Attached X method, DNA repair mechanisms.

Max Hours.60**TEXT / REFERENCE BOOKS**

1. David Freifelder (1995). Molecular Biology. Narosa Publishing House, New Delhi.
2. Peter Snustad D and Michael J Simmons (2003). Principles of Genetics. 3rd Edition, John Wiley & Sons, Inc., Publication, New Delhi.
3. Peter J Russel (2002). Genetics. Benjamin Cummings.
4. Robert H Tamarin (2002). Principles of Genetics. 7th Edition, Tata Mc GrawHill Publication, New Delhi.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A** : 10 questions of 2 marks each - No choice**20 Marks****PART B** : 2 questions from each UNIT of internal choice; each carrying 16 marks**80 Marks**

SMB2101	MICROBIAL ECOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- This course will introduce students about the interactions of these organisms with both the biotic and abiotic worlds will be discussed. Topics will include the roles of microorganisms in host-pathogen interactions in disease, the beneficial aspects of microorganisms in bioremediation and food production, and their application in biotechnology

UNIT 1**12 Hrs.**

Microorganisms habitat and their role in biogeochemical cycles and succession pattern Terrestrial Environment: Soil microflora. Aquatic Environment: Stratification & Microflora of Freshwater & Marine habitats. Atmosphere: Stratification of the Atmosphere, Aeromicroflora, Dispersal of Microbes. Animal Environment: Microbes in/on human body (Microbiomics) & animal (ruminants) body. Extreme Habitats: Extremophiles: Microbes thriving at high & low temperatures, pH, high hydrostatic & osmotic pressures, salinity, & low nutrient levels.

UNIT- 2**12 Hrs.**

Carbon cycle: Nitrogen cycle Ammonification, nitrification, denitrification & nitrate reduction. Phosphorous cycle: Phosphate immobilization and phosphate solubilization. Sulphur Cycle Microbes involved in sulphur cycle. Succession of microbial communities in the decomposition of plant organic matter

UNIT- 3**12 Hrs.**

Microbe–Microbe Interactions Mutualism, Synergism, Commensalism, Competition, Amensalism, Parasitism, Predation, Biocontrol agents. Microbe–Plant Interactions: Roots, Aerial Plant surfaces, Biological Nitrogen fixation (symbiotic/nonsymbiotic- biofertilizers) Microbe–Animal Interactions : Role of Microbes in Ruminants, Nematophagus fungi, Luminescent bacteria as symbiont

UNIT- 4**12 Hrs.**

Microbial Pathogenicity: Virulence factors of pathogens: enzymes, toxins (host specific and non specific) growth regulators, virulence factors in viruses (replicase, coat protein, silencing suppressors) in disease development. Effects of pathogens on host physiological processes (photosynthesis, respiration, cell membrane permeability, translocation of water and nutrients, plant growth and reproduction).

UNIT- 5**12 Hrs.**

Concept of plant disease- microbial plant diseases, types of plant pathogens, pathogenicity, symptoms, economic losses. Principles & practices involved in the management of plant diseases by different methods.

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA.
2. Atlas RM. (1989). Microbiology: Fundamentals and Applications. 2nd Edition, MacMillan Publishing Company, New York.
3. Madigan MT, Martinko JM and Parker J. (2009). Brock Biology of Microorganisms. 12th edition. Pearson/ Benjamin Cummings
4. Agrios GN. (2006). Plant Pathology. 5th edition. Academic press, San Diego,
5. Lucas JA. (1998). Plant Pathology and Plant Pathogens. 3rd edition. Blackwell Science, Oxford.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A** : 10 questions of 2 marks each - No choice**20 Marks****PART B** : 2 questions from each UNIT of internal choice; each carrying 16 marks**80 Marks**

SBB2103	CONCEPTS IN BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVE

- Explain the current scenario about biotechnology
- Describes the biotechnological methods in crop development and transgenic animal production
- Highlighting the application of industrial biotechnology
- Demonstrate the healthcare application of biotechnology
- Implementation of biotechnology in the protection of environment
- Discuss the ethical issues of biotechnology

UNIT 1 BIOTECHNOLOGY: AN OVERVIEW**12 Hrs.**

What is Biotechnology? – an interdisciplinary pursuit, old Vs new biotechnology, scope and importance, commercial potential, public perception of Biotechnology, Biotechnology in India and Global. Branches of biotechnology.

UNIT 2 ANIMAL & PLANT BIOTECHNOLOGY**12 Hrs.**

Biotechnology methods of crop improvement- plant tissue culture. Transgenic plants, applications of transgenic plants, transgenesis, transgenic animals,

UNIT 3 INDUSTRIAL BIOTECHNOLOGY**12 Hrs.**

Isolation and screening of micro-organisms, Bioreactors, food and beverage fermentation, production of antibiotics (β -lactum antibiotic), vitamin B12, Enzyme- amylase, protease, Biotransformation, SCP and its economical implications.

UNIT 4 MEDICAL BIOTECHNOLOGY**12 Hrs.**

Conventional vaccines, recombinant vaccines, DNA vaccines, monoclonal antibodies and their applications, interferons, drug designing, genetherapy, forensic medicine applications in human genetic research.

UNIT 5 ENVIRONMENTAL BIOTECHNOLOGY AND BIOETHICS**12 Hrs.**

Novel and better bioinsecticides. Biofertilizers, Biodegradation of Xenobiotic compounds. Legal aspects genetically manipulated organisms and environment, biosafety, Social, moral and Ethical Considerations, IPR.

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Satyanarayana. U. Biotechnology Books And Allied (p) Limited, 2013.
2. H.D. Kumar, Modern Concepts of Biotechnology, Vikas Publishing House Pvt Ltd, 1998.
3. P.K. Gupta, Elements of Biotechnology, Rastog Publications, 2003.
4. A.H. Patel, Industrial Microbiology, Macmillan Publishers, 1984

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 questions of 2 marks each - No choice****20 Marks****PART B : 2 questions from each UNIT of internal choice; each carrying 16 marks****80 Marks**

SMB2103	BIOINSTRUMENTATION	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- This course aims at understanding the principle and application of various instruments used in Biotechnology industries.

UNIT 1 MICROSCOPY**12 Hrs.**

Bright field and dark field microscopy, Fluorescence Microscopy, Phase contrast Microscopy, Confocal Microscopy, Electron Microscopy (Scanning and Transmission Electron Microscopy) and Micrometry.

UNIT 2 LAB EQUIPMENT**12 Hrs.**

Autoclave , Hot air oven , Incubator , Water Bath , Laminar air flow, BOD incubator, Centrifuges – Bench top , High speed , Ultra centrifuge, density gradient centrifugation . pH meter , Conductivity meter, Lyophilizer , McIntosh anaerobic jar , Biosensor, Metabolic shaker.

UNIT 3 CHROMATOGRAPHY AND ELECTROPHORESIS**12 Hrs.**

Principles and applications of Chromatography – Paper, Thin layer, Column, Ion-exchange, Gas and HPLC – Principle and applications of native polyacrylamide gel electrophoresis, SDS- polyacrylamide gelelectrophoresis, 2D gel electrophoresis, Isoelectric focusing, Zymogram preparation and Agarose gelelectrophoresis..

UNIT –IV PHOTOMETRY**12 Hrs.**

Colorimetry, Turbidometry, Spectrometry – UV & Visible spectrophotometer. Flame photometry- Micronutrient analysis.

UNIT BIOCHEMISTRY ANALYSIS**12 Hrs.**

Biochemical calculations-preparations of Molar solutions - Buffers- Phosphate, Acetate, TE, TAE- calculation of Normality ,PPM- Ammonium sulphate precipitation.

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Gedder , A. and L. E. Balser, John Wiley and Sons , Principles of applied Biomedical instrumentation.
2. Dean, Willard and Merrit , Instrumental Methods of analysis Asian Ed.
3. Fritschen, L. J and L. W . Gay, Springer, Verlag, Environmental Instrumentation, 1979, New York.
4. Boyer, Rodney, F. Benjamin and Cummins, Modern Experimental Biochemistry 2nd Edition.
5. E.Padmini., Biochemical Calculations and Biostatistics(2007) Books and Allied(P)Ltd., First Edtn

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A** : 10 questions of 2 marks each - No choice**20 Marks****PART B** : 2 questions from each UNIT of internal choice; each carrying 16 marks**80 Marks**

SBB4301	MOLECULAR BIOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	3	2	100

SUGGESTED LIST OF EXPERIMENT

1. Isolation of DNA from E. coli/ liver/ plant
2. Agarose gel electrophoresis of DNA
3. Restriction digests of DNA.
4. Isolation of plasmid
5. Separation of serum protein by SDS -PAGE
6. Western blotting

SBB4302	BIOINSTRUMENTATION LAB	L	T	P	Credits	Total Marks
		0	0	3	2	100

SUGGESTED LIST OF EXPERIMENT

1. Sterilization: principles & operations – Autoclave, Hot Air Oven, Filtration, Laminar Air Flow
2. Principles & operations of Incubators & Shakers
3. Principle & operation of Centrifuge
4. Principle & operation of pH meter
5. Principle & operation of Colorimeter
6. Principle & operation of Spectrophotometer
7. Electrophoresis techniques

SMB2201	SOIL & AGRICULTURAL MICROBIOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- The purpose of this course is to introduce students to scientific foundation of microorganisms and their relationship to agriculture and environment. The course will appraise the students about application/control of microbes for agriculture and how to design approaches to mitigate environmental pollutants

UNIT 1 SOIL MICROBES ASSOCIATION**12 Hrs.**

Distribution of microorganisms in nature – Microbial communities in soil- factors influencing the microbial density in soil- zymogenous and autochthonous flora in Soil- Microbial associations – symbiotic proto cooperation, ammensalism, Commensalism, syntrophism, parasitism and predation with suitable examples.

UNIT 2 DECOMPOSITION**12 Hrs.**

Microbial decomposition; cellulose, Hemi cellulose, lignin, pectin and chitin. –Factors influencing degradation- acetate utilization -bioconversion of organic wastes- sugarcane wastes- coir pith composition- composting, principles and Applications- conversion process

UNIT 3 DISEASES**12 Hrs.**

Role of enzymes and toxins in pathogenesis. Fungal diseases of plants: Rusts of wheat, linseeds; late blight of potato; red rot of sugarcane. Bacterial diseases of plants: Citrus canker, blight of rice. Viral diseases of plants: Leaf curl of Papaya, vein clearing of lady's finger

UNIT 4 APPLICATIONS**12 Hrs.**

Microorganisms in the decomposition of organic matter- carbon cycle – nitrogen Cycle- nitrogen fixing microorganisms- root nodule bacteria – non-symbiotic Nitrogen fixers – biofertilizers in agriculture- Rhizobium and phosphate solubilisers- Mycorrhizal association – phosphorous cycle

UNIT 5 BIOFERTILIZERS**12 Hrs.**

Bio fertilizers: Types, production and application - Mycorrhizae : Types and their application in agriculture and forestry. – Vermicomposting - Reclamation of waste agricultural land by microorganisms

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Soil Microbiology by Prof. N.S. Subba Rao, Fourth edition, Oxford and IBH Publishing CO. PVT., LTD., New Delhi
2. Introduction to soil microbiology. Alexander M. (1977) John Wiley & Sons, Inc., New York.
3. Modern Soil Microbiology, Dirk J, Elias V, Trevors JT, Wellington, EMH (1997) Marcel Dekker INC, New York.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A** : 10 questions of 2 marks each - No choice**20 Marks****PART B** : 2 questions from each UNIT of internal choice; each carrying 16 marks**80 Marks**

SMB2202	FOOD & DAIRY MICROBIOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- This course aims on studying interaction of microorganisms and food in relation to food-borne diseases, food spoilage and bioprocessing of food and dairy products.
- To make students learn about technologies to render foods and dairy products safe and analytical techniques for monitoring of food biological safety.

UNIT 1 FACTORS**12 Hrs.**

Intrinsic and extrinsic factors that affect growth and survival of microbes in foods, natural flora and source of contamination of foods in general.

UNIT 2 SPOILAGE**12 Hrs.**

Principles, Spoilage of vegetables, fruits, meat, eggs, milk and butter, bread, canned Foods

UNIT 3 PRESERVATION**12 Hrs.**

Principles, physical methods of food preservation: temperature (low, high, canning, drying), irradiation, hydrostatic pressure, high voltage pulse, microwave processing and aseptic packaging, chemical methods of food preservation: salt, sugar, organic acids, SO₂, nitrite and nitrates, ethylene oxide, antibiotics and bacteriocins

UNIT 4 FERMENTATION**12 Hrs.**

Dairy starter cultures, fermented dairy products: yogurt, acidophilus milk, kumiss, kefir, dahi and cheese, other fermented foods: dosa, sauerkraut, soy sauce and tampeh, Probiotics: Health benefits, types of microorganisms used, probiotic foods available in market.

UNIT 5 MICROBIAL DISEASES**12 Hrs.**

Food intoxications: *Staphylococcus aureus*, *Clostridium botulinum* and mycotoxins; Food infections: *Bacillus cereus*, *Vibrio parahaemolyticus*, *Escherichia coli*, Salmonellosis, Shigellosis, *Yersinia enterocolitica*, *Listeria monocytogenes* and *Campylobacter jejuni*.

HACCP, Indices of food sanitary quality and sanitizers

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Adams MR and Moss MO. (1995). Food Microbiology. 4th edition, New Age International (P) Limited Publishers, New Delhi, India.
2. Banwart JM. (1987). Basic Food Microbiology. 1st edition. CBS Publishers and Distributors, Delhi, India.
3. Davidson PM and Brannen AL. (1993). Antimicrobials in Foods. Marcel Dekker, New York.
4. Dillion VM and Board RG. (1996). Natural Antimicrobial Systems and Food Preservation. CAB International, Wallingford, Oxon.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 questions of 2 marks each - No choice****20 Marks****PART B : 2 questions from each UNIT of internal choice; each carrying 16 marks****80 Marks**

SMB2203	AIR AND WATER MICROBIOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- This course prepares students to apply microbiological techniques to monitor water and air quality, domestic and industrial water and wastewater treatment systems and site remediation project

UNIT 1 AEROMICROBIOLOGY**12 Hrs.**

Aeromicrobiology - Bioaerosols, Air borne microorganisms (bacteria, Viruses, fungi) and their impact on human health and environment, significance in food and pharma industries and operation theatres, allergens Air flora Droplet, droplet nuclei, and aerosols Air pollution: Chemical pollutants, their sources in air and effects on human health.

UNIT 2 AIR SAMPLE ANALYSIS**12 Hrs.**

Air sample collection and analysis Bioaerosol sampling, air samplers, methods of analysis Identification characteristics Methods of Air sampling and types of air samplers - A. Impact on solids, B. Impingement in liquid, C. Sedimentation D. Centrifugation, E. Precipitation F. Thermal Precipitation, CFU, culture media for bacteria and fungi.

UNIT 3 CONTROL**12 Hrs.**

Control measures Fate of bioaerosols, inactivation mechanisms – UV light, HEPA filters, desiccation, Incineration Air sanitation: Physical and chemical methods Air borne infections

UNIT 4 WATER MICROBIOLOGY**12 Hrs.**

Water Microbiology, Water borne pathogens, water borne diseases

UNIT 5 WATER ANALYSIS**12 Hrs.**

Microbiological analysis of water Sample Collection, Treatment and safety of drinking (potable) water, methods to detect potability of water samples: (a) standard qualitative procedure: presumptive test/MPN test, confirmed and completed tests for faecal coliforms (b) Membrane filter technique and (c) Presence/absence tests Precipitation, chemical disinfection, filtration, high temperature, UV light

Max Hours.60**TEXT / REFERENCE BOOKS**

1. da Silva N, Taniwaki MH, Junqueira VC, Silveira N, Nascimento MS, Gomes RAR (2012) Microbiological Examination Methods of Food and Water A Laboratory Manual, CRC Press
2. Atlas RM and Bartha R. (2000). Microbial Ecology: Fundamentals & Applications. 4th edition. Benjamin/Cummings Science Publishing, USA
3. Maier RM, Pepper IL and Gerba CP. (2009). Environmental Microbiology. 2nd edition, Academic Press
4. Hurst CJ, Crawford RL, Garland JL, Lipson DA (2007) Manual of Environmental Microbiology, 3rd edition, ASM press

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 questions of 2 marks each - No choice****20 Marks****PART B : 2 questions from each UNIT of internal choice; each carrying 16 marks****80 Marks**

SMB2204	INDUSTRIAL MICROBIOLOGY	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- The objective of this course to enable students to correlate metabolic aspects of industrially relevant microorganisms with the corresponding biotechnological products, and learn the basics of simple strategies for strain improvements encompassing both classical and metabolic engineering methods, design medium and downstream processing.

UNIT 1 HISTORY**12 Hrs.**

Brief history and developments in industrial microbiology Types of fermentation processes - Solid-state and liquid-state (stationary and submerged) fermentations; batch, fed-batch (Eg. Baker's yeast) and continuous fermentations

UNIT 2 BIO-REACTOR**12 Hrs.**

Components of a typical bio-reactor, Types of bioreactors-Laboratory, pilot- scale and production fermenters, constantly stirred tank and air-lift fermenters, Measurement and control of fermentation parameters - pH, temperature, dissolved oxygen, foaming and aeration

UNIT 3 UPSTREAM PROCESSING**12 Hrs.**

Sources of industrially important microbes and methods for their isolation, preservation and maintenance of industrial strains, strain improvement, Crude and synthetic media; molasses, corn steep liquor, sulphite waste liquor, whey, yeast extract and protein hydrolysates

UNIT 4 DOWNSTREAM PROCESSING**12 Hrs.**

Cell disruption, filtration, centrifugation, solvent extraction, precipitation, lyophilization and spray drying. Citric acid, ethanol, penicillin, glutamic acid, Vitamin B12 Enzymes (amylase, protease, lipase)
Wine, beer

UNIT 5 IMMOBILIZATION**12 Hrs.**

Methods of immobilization, advantages and applications of immobilization, large scale applications of immobilized enzymes (glucose isomerase and penicillin acylase)

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Patel A.H. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited
2. Okafor N. (2007). Modern Industrial Microbiology and Biotechnology. 1st edition. Bios Scientific Publishers Limited. USA
3. Waites M.J., Morgan N.L., Rockey J.S. and Highton G. (2001). Industrial Microbiology: An Introduction. 1st edition. Wiley – Blackwell
4. Glaze A.N. and Nikaido H. (1995). Microbial Biotechnology: Fundamentals of Applied Microbiology. 1st edition. W.H. Freeman and Company
5. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.
6. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.
7. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd..

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 questions of 2 marks each - No choice****20 Marks****PART B : 2 questions from each UNIT of internal choice; each carrying 16 marks****80 Marks**

SMB4401	SOIL & AGRICULTURAL MICROBIOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	3	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Study soil profile
2. Study microflora of different types of soils/ rhizosphere
3. Rhizobium as soil inoculants characteristics and field application
4. Azotobacter as soil inoculants characteristics and field applications
5. Isolation of cellulose degrading organisms
6. To study viral diseases in plants
7. To study bacterial and fungal diseases in plants
8. Isolation of rhizobia from root nodules of leguminous plants
9. Testing of nodulation ability of rhizobia.
10. Inoculation of seeds with rhizobia.
11. To study pesticidal activity of *Bacillus thuringiensis*.

SMB4402	FOOD MICROBIOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	3	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Detection of adulterants in spices, pulses, sugar, tea, milk and milk products
2. Detection of arsenic by microbiological methods
3. Detection of nicotinic acid by bioassay
4. Detection of number of bacteria in milk by SPC
5. Determination of quality of milk sample by methylene blue reductase test.
6. To demonstrate role of yeast in bread-making
7. Isolation of spoilage microorganisms from food
8. Isolation of pathogenic microorganisms from food

SMB3101	MEDICAL BACTERIOLOGY	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- This course aims at understanding important medically important bacteria its mode of infection, pathogenesis prophylaxis and treatment.

UNIT 1 INFECTION**12 Hrs.**

Infection-Sources of infection, method of transmission of infection, Factors predisposing to microbial pathogenicity, Types of infectious diseases. Normal Microbial flora of human body. Gram-positive pathogens *Staphylococcus*, *Streptococcus*, *Corynebacterium*, *Clostridium*.

UNIT 2 GRAM NEGATIVE PATHOGENS**12 Hrs.**

Gram negative pathogens- *Neisseria*, *E.coli*, *Klebsiella*, *Proteus*, *Salmonella*, *Shigella*, *Vibrio*, *Yersinia*.

UNIT 3 ACID FAST BACTERIS**12 Hrs.**

Acid fast bacteria-*Mycobacterium tuberculosis* and *M.lepreae*.

UNIT 4 SPIROCHETES**12 Hrs.**

Spirochetes-*Leptospira*, *Treponema*.

UNIT 5 OTHER MEDICALLY IMPORTANT ORGANISMS**12 Hrs.**

Mycoplasma. *Chlamydia*. *Helicobacter* and *Campylobacter*. Other important anaerobic pathogens.

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Medical Microbiology-David Green wood
2. Text book of Microbiology, Ananthanarayan & Jayaram Panicker
3. Jawetz-Medical Microbiology-Geo F.Brooks, Janet S Butel.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A** : 10 questions of 2 marks each - No choice**20 Marks****PART B** : 2 questions from each UNIT of internal choice; each carrying 16 marks**80 Marks**

SMB3102	MEDICAL VIROLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- This course aims at understanding important medically important virus its mode of infection, pathogenesis prophylaxis and treatment.

UNIT 1 GENERAL CONCEPTS**12 Hrs.**

General Concepts: Virus history, Diversity, shapes, sizes and components of genomes. Isolation and purification of viruses and components.

UNIT 2 INFECTION**12 Hrs.**

Consequences of virus infection to animals and human. Viral infection: affect on host macromolecules. Viral infection: establishment of the antiviral state. Viruses counter attack mechanisms.

UNIT 3 CLASSIFICATION**12 Hrs.**

Classification of viruses and nomenclatures.

Positive strand RNA viruses- Picornaviruses. Flaviviruses- West Nile virus and Dengue virus. Coronaviruses- SARS pathogenesis

Negative strand RNA viruses Paramyxoviruses. Orthomyxoviruses: Influenza pathogenesis and Bird flu. Rhabdoviruses: Rabies pathogenesis.

UNIT 4 RNA VIRUS**12 Hrs.**

dsRNA viruses- Reoviruses. Retroviruses: structure, classification, life cycle; reverse transcription. Retroviruses: HIV, viral pathogenesis and AIDS.

UNIT 5 DNA VIRUS**12 Hrs.**

Small DNA viruses: parvo- and polyomaviruses. Large DNA viruses: Herpes-ado-, and poxviruses. Miscellaneous viruses.

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Principles of Virology 2nd edition by S.J.Flint, L.W.Enquist,R.M.Krug,V.R. Racaniello, and A.M.Skalka.
2. Fields Virology 5th Edition by Bernard Fields, David Knipeand Peter Howley.
3. Medical Virology 4th edition by David O.White and FrankJ. Fenner.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A** : 10 questions of 2 marks each - No choice**20 Marks****PART B** : 2 questions from each UNIT of internal choice; each carrying 16 marks**80 Marks**

SMB3103	MEDICAL MYCOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- This course aims at understanding important medically important fungi its mode of infection, pathogenesis prophylaxis and treatment.

UNIT 1 CLASSIFICATION**12 Hrs.**

General characteristics & classification of fungi - Morphology & reproduction of fungi - Pathogenesis of fungal infections - Isolation & identification of fungi

UNIT 2 YEAST**12 Hrs.**

Yeasts and yeast like fungi of medical importance including Candida. - Cryptococcus, Malassezia, Trichosporon, Geotrichum, Saccharomyces etc. Mycelial fungi of medical importance including Aspergillus, Zygomycetes, Pseudoallescheria, Fusarium, Piedra, other dematiaceous hyphomycetes and other hyalohyphomycetes etc.

UNIT 3 DIMORPHIC FUNGI**12 Hrs.**

Dimorphic fungi including Histoplasma, Blastomyces, Coccidioides, Paracoccidioides, Sporothrix, Penicillium marneffeii etc. - Dermatophytes

UNIT 4 FUNGI DISEASES**12 Hrs.**

Fungi causing mycetoma, keratomycosis & otomycosis. - Pneumocystis jirovecii infection - Rhinosporidium seeberi & Loboa loboi - Actinomycetes & Nocardia.

UNIT 5 COMMON LAB CONTAMINANTS**12 Hrs.**

Common laboratory fungal contaminants- Mycetism & mycotoxicosis - Antifungal agents & in vitro antifungal susceptibility tests. - Hypersensitivity to fungi

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Patel A.H. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited
2. Okafor N. (2007). Modern Industrial Microbiology and Biotechnology. 1st edition. Bios Scientific Publishers Limited. USA
3. Waites M.J., Morgan N.L., Rockey J.S. and Higon G. (2001). Industrial Microbiology: An Introduction. 1st edition. Wiley – Blackwell
4. Glaze A.N. and Nikaido H. (1995). Microbial Biotechnology: Fundamentals of Applied Microbiology. 1st edition. W.H. Freeman and Company
5. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.
6. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.
7. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd..

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 questions of 2 marks each - No choice****20 Marks****PART B : 2 questions from each UNIT of internal choice; each carrying 16 marks****80 Marks**

SMB3104	PHYCOLOGY AND MEDICAL PARASITOLOGY	L	T	P	Credits	Total Marks
		3	1	0	4	100

COURSE OBJECTIVES

- This course aims at understanding important medically important parasite its mode of infection, pathogenesis prophylaxis and treatment. To understand the Algal diversity.

UNIT 1 CLASSIFICATION**12 Hrs.**

Algae in diversified habitats (terrestrial, fresh water, marine) thallus organization, cell ultrastructure, reproduction (vegetative, asexual, sexual) criteria for classification of algae: pigments, reserve food, flagella, modern classification.

UNIT 2 CLASSIFICATIONS & APPLICATIONS**12 Hrs.**

Salient features of protochlorophyta, chlorophyta, charophyta, xanthophyta, Bacillariophyta, phaeophyta and Rhodophyta with special reference to Microcystis, Hydrodictyon, Chara, Draparnaldiopsis, Sargassum, Dictyota, Batrachospermum. Algal blooms, algal biofertilizers; algae as food, feed and use in industry.

UNIT 3 PARASITOLOGY**12 Hrs.**

Parasitology – General Concepts – Introduction to Parasitology, Classification – Host parasite relationship. Laboratory techniques in parasitology-Blood –Thick and thin smear, Faeces –Examination for ova and cyst.

UNIT 4 PROTOZOOLOGY**12 Hrs.**

Protozoology: Pathogenic mechanisms, Disease transmissions, their life cycles and Lab Diagnosis of the following- *Entamoebahistolytica*, *Plasmodium vivax*, *Plasmodium falciparum*, *Leishmaniadonovani*, *Giardia lamblia*, *Trichomonasvaginalis*, *Balantidium coli*, *Toxoplasma gondii* and *Cryptosporidium parvum*.

UNIT 5 HELMINTHOLOGY**12 Hrs.**

Helminthology: Classification, Cestodes – *Taeniasolium*, *T. saginata*, *T. echinococcus*, trematodes – *Schistosoma haematobium*, *Fasciola hepatica*, Nematodes – *Ascaris*, *Anchylostoma*, *Trichuris*, *Enterobius* and *Wuchereria*- their life cycle, Transmission, pathogenicity and Lab Diagnosis.

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Text Book of Medical Parasitology by P. Chakraborty
2. Text Book of Parasitology By JayaramPanicker
3. Text Book of Medical Parasitology by Parija S.C.
4. Parasitology by K.D. Chatterjee

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each UNIT of internal choice; each carrying 16 marks**80 Marks**

SMB4501	BACTERIOLOGY AND VIROLOGY LAB	L	T	P	Credits	Total Marks
		0	0	3	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Collection and processing of clinical specimen for microbiological examination.
2. Staining techniques- Simple, Negative, Gram's, capsule, Spores(Organism – Bacillus, Enterobacter, Escherichia coli) Acid fast staining.
3. Study of composition and use of important differential media for identification of pathogenic bacteria: EMB Agar, McConkey agar, Mannitol salt agar, Deoxycholate citrate agar, TCBS
4. Isolation and identification of microorganisms from urine sample(E.coli, Proteus, Pseudomonas
5. Biochemical tests for bacterial identification(IMViC, TSI, nitrate reduction, urease production, coagulase and catalase tests.)
6. Preparation of dried filter paper discs for susceptibility assay and Antimicrobial activity by Kirby – Bauer disc diffusion technique.
7. Determination of MIC & MBC.
8. Preservation of bacterial cultures by various techniques
9. Studying isolation and propagation of animal viruses by chick embryo technique
10. Isolation and enumeration of bacteriophages (PFU) from water/sewage sample using double agar layer technique
11. To perform HBsAg by ELISA
12. To perform HIV Tridot method.

SMB4502	MYCOLOGY AND PARASITOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	3	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Identification of common fungus like Mucor, Rhizopus, Penicillium, Aspergillus by Lactophenol cotton blue mount examination.
2. Preparation of fungal media and Cultivation of fungi study of colony characters of yeast and mold.
3. Leishman staining for malarial parasites
4. Demonstration of permanent slide of Trichuris, Ascaris and Hookworm
5. Saline wet mount for observing ova and eggs of parasites.
6. Iodine wet mount for observing ova and eggs of parasites.
7. Concentration of stool samples by floatation method
8. Zinc sulphate conc. Method for stool sample
9. Demonstration of various parasites by permanent slides.
10. Concentration of stool sample by sedimentation method

SBB1002	RESEARCH METHODOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- This course aims at understanding the research terminology. Be aware of the ethical principles of research, ethical challenges and approval processes. Describe quantitative, qualitative and mixed methods approaches to research. Identify the components of a literature review process. Critically analyze published research.

UNIT 1**12 Hrs.**

Research methodology-basic concepts-types- definition of research problems- statistical methods- Correlation and Regression, Binomial, Poisson and Normal Distributions (mean and variance applications only) - Sampling Distributions: Tests based on t, F, Z and Chi square distributions- Analysis of Variance.

UNIT 2**12 Hrs.**

Research design-Nature and Classification of research designs, data classification, primary and secondary data, primary and secondary data- sources-advantages- Sampling- sampling concepts and methods

UNIT 3**12 Hrs.**

Principles of biophysical methods used for analysis. X-ray diffraction, Fluorescence, UV, ORD/CD, visible, NMR and ESR spectroscopy, Hydrodynamic methods, Atomic absorption, Plasma emission spectroscopy.

UNIT 4**12 Hrs.**

Principles and techniques of nucleic acid hybridization and cot curves, sequencing of proteins and nucleic acids, southern, northern and south-western blotting techniques, PCR, methods for measuring nucleic acids and protein interactions.

UNIT 5**12 Hrs.**

Principles and applications of tracer techniques in biology, radiation dosimetry, radio-active isotopes and half-life of isotopes, effect of radiation on biological systems, autoradiography, cerenkov radiation and liquid scintillation spectrometry

Max Hours.60**TEXT BOOK/ REFERENCES:**

1. Principles of biochemistry and molecular biology – Keith Wilson & John Walker
2. Biostatistics – Khan & Khanum

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A** : 10 questions of 2 marks each - No choice**20 Marks****PART B** : 2 questions from each UNIT of internal choice; each carrying 16 marks**80 Marks**

SMB3201	CLINICAL MICROBIOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- This course consists of instruction in practical application, and pathogenesis of clinical microbiology, including collection, setup, identification, susceptibility testing, and reporting procedures..

UNIT 1 COLLECTION AND TRANSPORT OF SAMPLE**12 Hrs.**

Selection, collection and transport of specimens – Blood, Urine, Sputum, CSF, Pus & Faeces – transport media and storage. Microscopic examination of specimen for Bacterial pathogens – simple, differential staining and motility. Cultivation and isolation of viable pathogens – Media used – differential, selective, enrichment and enriched media. Identification of organisms - Biochemical reaction – Sugar fermentation test - Susceptibility testing – MIC,- reporting of results & interpretation.

UNIT 2 FUNGAL AND PARASATIC SAMPLE COLLECTION**12 Hrs.**

Fungal samples– Direct Microscopic examination, culture media and incubation, Serological tests for fungi – Antifungal susceptibility testing.

Laboratory methods for parasitic infections – Diagnostic techniques for faecal, gastrointestinal and urogenital specimen.

UNIT 3 PROTOZOA**12 Hrs.**

Identification of Intestinal Protozoa – Amoeba, Blood protozoa – Malaria, Intestinal Helminthes: *Ascaris*, *Taenia*, *Entrobilus* and Blood Helminthes: *Wuchereria bancrofti*.

UNIT 4 VIROLOGY**12 Hrs.**

Laboratory methods in basic Virology- Detection of viral antigen (fluorescent antibody and solid phase immunoassays). Viral Serology- Special consideration- Hepatitis and AIDS.

UNIT 5 VIRAL CULTURE**12 Hrs.**

Viral culture- Media and cells used – Specimen processing – isolation and identification of viruses. Advanced techniques – automated methods – ELISA, RIA. Applications of Nucleic acid hybridization, PCR and blotting in diagnosis

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Diagnostic Microbiology, Bailey and Scott's., 1990. Eighth edition. The Mosby Company.
2. Medical laboratory techniques, Abdul Khader, 2003, First edition. Frontline Publications, Hyderabad.
3. Virology, Sawant, K.C., 2005, First edition, Dominant Publishers and distributors, Delhi.
4. Medical Parasitology, Rajesh Karyarkarte, Ajit Damla, 2004. Books and allied publishers Ltd. Kolkata.
5. Textbook of Medical Parasitology, Subash O. Barija , 1996. First edition. All India Publishers and Distributors Regd. 920 Poonamallee High Road, Chennai.
6. Rajesh Karyakarte and Ajith Damle (2005)Medical Parasitology, Books and Allied(P)Ltd.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 questions of 2 marks each - No choice****20 Marks****PART B : 2 questions from each UNIT of internal choice; each carrying 16 marks****80 Marks**

SMB1601	ADVANCES IN MICROBIOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- This course aims at understanding the physiology of prokaryotes, advances in ecology, evolution, and biotechnology.

UNIT 1 GENOMICS**12 Hrs.**

Salient features of sequenced microbial genomes, core genome pool, flexible genome pool and concept of pangenome, Horizontal gene transfer (HGT), Evolution of bacterial virulence - Genomic islands, Pathogenicity islands (PAI) and their characteristics

UNIT 2 METAGENOMICS**12 Hrs.**

Brief history and development of metagenomics, Understanding bacterial diversity using metagenomics approach, Prospecting genes of biotechnological importance using metagenomics Basic knowledge of viral metagenome, metatranscriptomics, metaproteomics and metabolomics.

UNIT 3 PLANT PATHOGENS**12 Hrs.**

Epiphytic fitness and its mechanism in plant pathogens, Hypersensitive response (HR) to plant pathogens and its mechanism, Type three secretion systems (TTSS) of plant and animal pathogens,

UNIT 4 NETWORK BIOLOGY**12 Hrs.**

Networking in biological systems, Quorum sensing in bacteria, Co-ordinated regulation of bacterial virulence factors, Basics of synthesis of poliovirus in laboratory, Future implications of synthetic biology with respect to bacteria and viruses

UNIT 5 BIOFILMS**12 Hrs.**

Biofilms: types of microorganisms, molecular aspects and significance in environment, health care, virulence and antimicrobial resistance

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Fraser CM, Read TD and Nelson KE. Microbial Genomes, 2004, Humana Press
2. Miller RV and Day MJ. Microbial Evolution- Gene establishment, survival and exchange, 2004, ASM Press
3. Bull AT. Microbial Diversity and Bioprospecting, 2004, ASM Press
4. Sangdun C. Introduction to Systems Biology, 2007, Humana Press
5. Klipp E, Liebermeister W. Systems Biology – A Textbook, 2009, Wiley –VCH Verlag
6. Caetano-Anolles G. Evolutionary Genomics and Systems Biology, 2010, John Wiley and Sons
7. Wilson BA, Salyers AA Whitt DD and Winkler ME (2011) Bacterial Pathogenesis- A molecular Approach, 3rd edition, ASM Press,
8. Bouarab K, Brisson and Daayf F (2009) Molecular Plant-Microbe interaction CAB International
9. Voit EO (2012) A First Course in Systems Biology, 1st edition, Garland Science.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 questions of 2 marks each - No choice****20 Marks****PART B : 2 questions from each UNIT of internal choice; each carrying 16 marks****80 Marks**

SMB1602	BIOFERTILIZERS AND BIOPESTICIDES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- This course aims at understanding adverse effects of plant production and protection chemicals on the biotic and abiotic components of environment To familiarize students with the microbes used as bio fertilizers for various crop plants and their advantages over chemical fertilizers.

UNIT 1**12 Hrs.**

Introduction and historical developments in Biofertilizers and biopesticides, Types of synthetic pesticides- impacts-pest and disease management - Importance of soil microorganisms – factors affecting the activities of soil microorganisms. - , Carbon and Nitrogen cycles- Biological nitrogen fixation - symbiotic and non-symbiotic microorganisms.

UNIT 2**12 Hrs.**

Bioinoculant Technology -Bioinoculants- various types- biofertilizer, biomanures and biopesticides-their importance in sustainable agriculture - organic farming and environmental health Historical development of Bioinoculants technology -bioinoculants technology development in India

UNIT 3**12 Hrs.**

Biofertilizers-broad grouping of biofertilizers -dinitrogen fixers, phosphorous solubilizers and P-mobilizers.Nitrogen fixing microorganisms.Diazotrophic bacteria and BGA-symbiotic- associative symbiotic and non- symbiotic groups. Biochemistry of dinitrogen fixation (BNF)- nitrogen fixation by Azotobacter, Rhizobium, Azorhizobium and Azospirillum-isolation of nitrogen fixing diazotrophs - screening for efficiency and selection as Bioinoculants.

UNIT 4**12 Hrs.**

Phosphorous solubilization by microorganism like bacteria and fungi - their importance in agriculture, mechanism of P -solubilization in soil ecosystem. Bacterial and fungal genera involved in P-solubilization –isolation, screening and testing the efficiency.

UNIT 5**12 Hrs.**

Biopesticides –various groups of bacterial, fungal and viral biocides- Bacillus thurengiensis, Trichoderma viride, NPV and GV- mode of action and the target pest and diseases.. Development of carrier based inoculants and storage under low temperature- importance of shelf life-methods for increasing shelf life using various low cost carrier materials.

Max Hours.60**TEXT/REFERENCES BOOKS**

1. Motsara, M.R. Bhattacharyya, P.andSrivastava, B. 1995 Biofertilizer- Technology, Marketing and Usage. Fertilizer Development & Consultant Organization , New Delhi.
2. SubbaRao, N.S., 1994. Biofertilizers in Agriculture and Agroforestry. Oxford & IBH, New Delhi. 3.Alexander, M. 1985. Introduction to soil Microbiology. John Wiley & Sons, New York.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each UNIT of internal choice; each carrying 16 marks**80 Marks**

SMB1603	FOOD FERMENTATION TECHNIQUES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To impart knowledge about the innovations in food processing technologies and their applications. To understand changes in the composition of food and comparison with conventional cooking methods. To know the need according to different foods and to food quality parameters and their maintenance during storage.

UNIT 1 HISTORY**12 Hrs.**

History and scope of fermented foods; definition and importance of fermented foods; Organisms used for production of fermented food products; Environmental parameters for fermentation process; Classification of fermentation processes for fermented foods.

UNIT 2 FERMENTED FOODS**12 Hrs.**

Fermented beverages- production of different types of wine and beer; Fermented foods of vegetables and fruits- Processing, microbiology, starter cultures, biochemistry, food safety of sauerkraut, pickles, Kimchi; Cereal and legume based fermented products bread, Soya Sauce, Koji, Tempeh, Miso, Natto, Tofu, Angkak; Indian products like Idli, Dosa, Bada

UNIT 3 FERMENTED DAIRY FOODS**12 Hrs.**

Microbiology of Fermented Dairy Products (Product Characteristics, Processing, Starter culture, Growth, Genetics) Buttermilk; Yogurt (probiotics, prebiotics, synbiotics); Acidophilus Milk; Bifidus Milk, Bulgarian milk; acidophilus milk; Kefir; Kummis; Cheeses; Properties and beneficial effects of probiotic and prebiotic.

UNIT 4 FERMENTED MEAT AND DRINKS**12 Hrs.**

Fermented meat and fish products; Microbial fermentation of tea, coffee and cacao. health aspects of fermented foods.

UNIT 5 FOOD PROCESSING**12 Hrs.**

Benefits and drawback of food processing, parameters for food processing. Processing of milk, vegetables, meat, oil processing, grind milling. Food additives-safety and their effects. Processing method- size reduction, mixing, separation and concentration of food components, High hydrostatic pressure, phytochemical processes. Effects of food processing on food nutrition.

Max Hours.60**TEXT / REFERENCE BOOKS**

1. James. M. Jay, Martin J. Loessner and David A. Golden, Food Microbiology, Springer Publication, 7th Edition, 2005.
2. Frazier, Food Microbiology, McGraw Hill Publication, 4th Edition, 2001
3. Shetty K., G. Paliyath et al. – Food Biotechnology – 2nd Edition- Taylor and Francis, 2006.
4. Kosikowski, F.V. 1997. Cheese and fermented milk foods. Frank Kosikowski and Vikram Mistry, Brooktondale, N. Y.
5. Fox, P.F. 1993. Cheese : chemistry, physics, and microbiology, London ; New York: Chapman & Hall,.
6. Wood, J. B. 1985. Microbiology of fermented foods. Volumes I and II. . Elsevier Applied Science Publishers. London, England
7. Joshi, V.K. and Pandey, A. Ed. 1999. Biotechnology. Food Fermentation, (2 Vol. set). Education Publ. New Delhi
8. Jay, J.M. (2008) Modern Food Microbiology (Sixth Edition). Aspen Publishers, Inc. Gaithersburg, Maryland

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A** : 10 questions of 2 marks each - No choice**20 Marks****PART B** : 2 questions from each UNIT of internal choice; each carrying 16 marks**80 Marks**

SMB1604	MANAGEMENT OF HUMAN MICROBIAL DISEASES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- The course provides the conceptual basis for understanding pathogens and the mechanisms by which they cause disease in the human body. It also provides opportunities to develop informatics and diagnostic skills, including the use and interpretation of laboratory tests in the diagnosis of infectious diseases..

UNIT 1 INFECTION**12 Hrs.**

Infectious and non-infectious diseases, microbial and non-microbial diseases, Deficiency diseases, occupational diseases, Incubation period, mortality rate, nosocomial infections

UNIT 2 DISEASES**12 Hrs.**

Respiratory microbial diseases, gastrointestinal microbial diseases, Nervous system diseases, skin diseases, eye diseases, urinary tract diseases, Sexually transmitted diseases: Types, route of infection, clinical systems and general prevention methods, study of recent outbreaks of human diseases (SARS/ Swine flu/Ebola) – causes, spread and control, Mosquito borne disease – Types and prevention

UNIT 3 TREATMENT**12 Hrs.**

Importance of personal hygiene (Typhoid Marry), judicious use of antibiotics, importance of completing antibiotic regimen, emergence of antibiotic resistance, current issues of MDR/XDR microbial strains. Treatment using antiviral agents: Mechanism of action of Amantadine, Acyclovir, Azidothymidine. Concept of HAART.

UNIT 4 VACCINES**12 Hrs.**

Importance, types of vaccines, vaccines available against microbial diseases, vaccination schedule (compulsory and preventive) in Indian context

UNIT 5 PREVENTIONS AND TREATMENT**12 Hrs.**

Types, causes, prevention, detection and treatment

TEXT / REFERENCE BOOKS

1. Ananthanarayan R. and Paniker C.K.J. (2009) Textbook of Microbiology. 8th edition, University Press Publication.
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication.
3. Goering R., Dockrell H., Zuckerman M. and Wakelin D. (2007) Mims' Medical Microbiology. 4th edition. Elsevier.
4. Willey JM, Sherwood LM, and Woolverton C.J. (2013) Prescott, Harley and Klein's Microbiology. 9th edition. McGraw Hill Higher Education.
5. Madigan MT, Martinko JM, Dunlap PV and Clark DP. (2014). Brock Biology of Microorganisms. 14th edition. Pearson International Edition.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A** : 10 questions of 2 marks each - No choice**20 Marks****PART B** : 2 questions from each UNIT of internal choice; each carrying 16 marks**80 Marks**

SBB1601	ADVANCED INSTRUMENTATION TECHNIQUES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- The primary objectives of this course are to develop the skills to understand the theory and practice of bioanalytical techniques. To provide scientific understanding of analytical techniques and detail interpretation of results.

UNIT 1**12 Hrs.**

NMR spectroscopy: Principle, Instrumentation, Solvents used in NMR, NMR signals in various compounds, Chemical shift, Spin-Spin coupling, Coupling constant, Nuclear magnetic double resonance, ^{13}C NMR, 1D and 2D NMR, NOESY and COSY techniques, Applications of NMR spectroscopy.

UNIT 2**12 Hrs.**

Mass Spectroscopy: Principle, Instrumentation of Mass Spectroscopy, Types of ionization like electron impact, chemical, field, FAB and MALDI, Analyzers of Quadrupole and Time of Flight, Mass fragmentation and its rules, Fragmentation of important functional groups like alcohols, amines, carbonyl groups and alkanes, Meta stable ions, McLafferty rearrangement, Ring rule, Isotopic peaks, Tandem Mass Instruments, Applications of Mass spectroscopy

UNIT 3**12 Hrs.**

Chromatography: Principle, Apparatus / Instrumentation, Chromatographic parameters, Factors involved, Endpoint determination and Applications of the following: a) Paper chromatography b) Thin Layer chromatography c) Ion exchange chromatography d) Column chromatography e) Gas chromatography f) GC-MS g) High Performance Liquid chromatography h) LC-MS i) High Performance Thin Layer chromatography k) Super critical fluid chromatography l) Affinity chromatography

UNIT 4**12 Hrs.**

Electrophoresis: Principle, Instrumentation and applications of the following: a) Paper electrophoresis b) Gel electrophoresis c) Capillary electrophoresis d) Zone electrophoresis e) Moving boundary electrophoresis

UNIT 5**12 Hrs.**

X ray Crystallography: Production of X rays, Different X ray methods, Bragg's law, Rotating crystal technique, X ray powder technique, Types of crystals, Interpretation of diffraction patterns and applications of X-ray diffraction.

TEXT / REFERENCE BOOKS

1. Prakash M and Arora CK. Laboratory instrumentation. Anmol Publications Pvt. Ltd.
2. Keith Wilson and John Walker (2000). Practical Biochemistry. 5th Edition, Cambridge University Press.
3. Practical Biochemistry by Boyer
4. Nelson DL and Cox MM. (2008). Lehninger Principles of Biochemistry, 5th Ed., W.H. Freeman and Company.
5. Willey MJ, Sherwood LM & Woolverton C J. (2013). Prescott, Harley and Klein's Microbiology. 9th Ed., McGraw Hill.
6. Karp G. (2010) Cell and Molecular Biology: Concepts and Experiments. 6th edition. John Wiley & Sons. Inc.
7. De Robertis EDP and De Robertis EMF. (2006). Cell and Molecular Biology. 8th edition. Lipincott Williams and Wilkins, Philadelphia.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A** : 10 questions of 2 marks each - No choice**20 Marks****PART B** : 2 questions from each UNIT of internal choice; each carrying 16 marks**80 Marks**

SBB1605	COMPUTER APPLICATION IN BIOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- This course aims to Covers basic computer concepts and Internet skills and uses a software suite, which includes word processing, spreadsheet, database, and presentation software to demonstrate skills.

UNIT 1**12 Hrs.**

Introduction to Computers: Introduction – Types of Computers – Characteristics of Computers. Generations of Computers - Classification of Computers – Programming Languages : Machine Language – Assembly Language – High level languages. Input Devices- Keyboard – Mouse - Types of mice – Connections – Mouse Pad - Trackball – Joystick -Out put Devices – Dot Matrix Printer – Inkjet – Laser Printer – LCD & LED Printers– Line Printer Auxiliary Storage Devices : Hard Disk – CD –DVD – primary memory

UNIT 2**12 Hrs.**

Overview of C: History of C – Importance of C – Basic structure of C programs. Constants, variables and data types: Character set – Keywords and identifiers – Constants– Variables – Declaration of storage classes. Operators and expression – Evaluation of expressions – Type conversions in expressions – Operator precedence and associativity – Mathematical functions. Managing input and output operations: Reading and writing a character – Formatted input and output.

UNIT 3**12 Hrs.**

Decision making and branching: Simple IF, IF-ELSE, Nesting of IF-ELSE, ELSE-IF ladder, Switch statements – GOTO statements. Decision making and looping: WHILE statement – DO statement – FOR statement – Jumps in loops. Arrays: Definition & Declaration – One dimensional – Two dimensional – Multi dimensional arrays – Dynamic arrays.

UNIT 4**12 Hrs.**

Character arrays and strings: Introduction – Declaring and initializing string variables – User – Defined functions: – Definition of functions – Return values and their types – Function calls – Function declaration – All category of functions – Nesting of functions Structures and Unions: Introduction – Accessing structure members – Structure initialization - Arrays of structures – Arrays within structures - Unions

UNIT 5**12 Hrs.**

Scope of bio informatics-internet basic-biological data analysis and applications sequences of data bases – application of bio informatics

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Fundamentals of computers science and Communication Engineering. Alexis Leon & Mathews Leon, Vikas Publishing House Pvt. Ltd., New Delhi (UNIT-I)
2. Programming in ANSI C, E. Balgurusamy Tata McGraw Hall, New Delhi, 4th edition.
3. Introduction to Bioinformatics by V.Kothekar, 2004 Dhruv publications, Delhi

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each UNIT of internal choice; each carrying 16 marks**80 Marks**

SMB1605	ENTREPRENEURIAL MICROBIOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- This course aims at understanding the basic of entrepreneur development in microbiology and the other process to initiate self-development in these industries

UNIT 1 ENTREPRENEUR DEVELOPMENT**12 Hrs.**

Entrepreneur development, activity, Institutes involved, Government contributions to entrepreneur, risk assessment. Industrial Microbiology, Definition, scope and historical development.

UNIT 2 MICROBIAL PRODUCTS**12 Hrs.**

Microbial cells as fermentation products- Baker's yeast, food and feed yeasts, Bacterial Insecticides, Legume Inoculants, Mushrooms, Algae. Enzymes as fermentation products- Bacterial and Fungal Amylases, Proteolytic Enzymes, Pectinases, Invertases and other enzymes.

UNIT 3 MUSHROOM CULTIVATION AND BIOFERTILIZERS**12 Hrs.**

Mushroom cultivation and Composting- Cultivation of *Agaricus campestris*, *Agaricus bisporus*, and *Volvariella volvacea*; Preparation of compost, filling tray beds, spawning, maintain optimal temperature, casing, watering, harvesting, storage. Biofertilizers- Historical background, Chemical fertilizers versus biofertilizers, organic farming. *Rhizobium* sp, *Azospirillum* sp, *Azotobacter* sp, as Biofertilizers.

UNIT 4 PATENTS**12 Hrs.**

Patents and secret processes, History of patenting, composition, subject matter and characteristics of a patent, Inventor, Infringement, cost of patent. Patents in India and other countries. Fermentation Economics.

UNIT 5 INDUSTRIAL PROCESS**12 Hrs.**

Brewing- Media components, preparation of medium, Microorganisms involved, maturation, carbonation, packaging, keeping quality, contamination, by products. Production of Industrial alcohol.

TEXT / REFERENCE BOOKS

1. Industrial Microbiology- L.E.Casida, jr, New age International publication.
2. Entrepreneurial Development in India- By Arora
3. Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom production technology- K.R.Aneja, New age International publication.

Max Hours.60**END SEMESTER EXAMINATION QUESTION PAPER PATTERN****Max. Marks : 100****Exam Duration : 3 Hrs.****PART A** : 10 questions of 2 marks each - No choice**20 Marks****PART B** : 2 questions from each UNIT of internal choice; each carrying 16 marks**80 Marks**

SMB1606	MICROBIAL DIVERSITY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- This course aims at understanding the diversity of microbes and their application.
- To develop an understanding of the importance of microorganisms beyond those of medical importance.
- To introduce students to the tools used to identify and characterize microorganisms

UNIT 1 CLASSIFICATION**12 Hrs.**

Microbial Systematics: General account of systematics, classification and nomenclature; Classification systems- artificial or phonetic, natural and phylogenetic; Species concept in microbiology, monophyletic, paraphyletic, polyphyletic; Newer approaches for exploring unculturable bacteria-molecular taxonomy, molecular phylogeny, molecular chronometers; Chemotaxonomy; Polyphasic taxonomy, Describing a new Prokaryotic species, Valid publication of names of bacterial taxa, Culture collection.

UNIT 2 BACTERIA**12 Hrs.**

Bacteria: Conventional and molecular systematics, and general discussion on the occurrence, diversity, characteristic features, significance and potential applications of various groups of bacteria according to Bergey's Manual of Systematic Bacteriology.

Archaea: Systematics, and occurrence, diversity, characteristic features, significance and potential applications of different groups of Archaea

UNIT 3 FUNGI**12 Hrs.**

Fungi: Modern trends of fungal classification and phylogeny. General features of fungi- cell structure; growth, environmental conditions for growth; nutrition and life cycle patterns, parasexuality and heterothallism.

UNIT 4 ALGAE**12 Hrs.**

Algae: Distribution; classification nutrition and culture; reproduction and life cycles. Protozoa: General account, structure, reproduction and classification of protozoa.

UNIT 5 VIROLOGY**12 Hrs.**

General Virology: Discovery of viruses, morphology and ultrastructure, capsids & their arrangements, viral genome – types and structures; nomenclature and classification of virus (Animal, plant, bacterial viruses). Virus related agents – viroids, prions.

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Dubey RC and Maheswari DK (2005). A Text book of Microbiology. S.Chand &Company Ltd., New Delhi.
2. Sundara Rajan S (2003). College Microbiology. Volume 1 & 2. Revised Edition, Vardhana Publications, Bangalore.
3. Powar CB and Dagainawala HF (2005). General Microbiology, Volume I & II, 8th Edition, Himalaya Publishing House, Mumbai.
4. Pelczar Tr. MJ, Chan ECS & Kreig NR (1993). Microbiology MC Graw-Hill Inc., New York.
5. Robert F Boyd (1984). General Microbiology. Times Mirror/Mosby College Publishers.
6. Prescott LM, JP Harley and DA Klein (1993). Microbiology, 2nd Edition, W M, C Brown Publishers.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 questions of 2 marks each - No choice****20 Marks****PART B : 2 questions from each UNIT of internal choice; each carrying 16 marks****80 Marks**

SBB1609	INTRODUCTION TO BIOINFORMATICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- The basic objective is to introduction to the basic practical techniques of bioinformatics and emphasis on the application of bioinformatics and biological databases to problem solving in real research problems.

UNIT 1 INTRODUCTION TO BIOINFOMATICS**12 Hrs.**

Introduction and history of bioinformatics – Internet, World Wide Web, Web browser, EMBnet, NCBI. File transfer protocol.

UNIT 2 MS ACCESS**12 Hrs.**

Database browsers and search engines. Introduction to MS access, making queries, Designing forms, Report design

UNIT 3 NUCLEOTIDE DATABASE**12 Hrs.**

Database-Definition, DBMS, Biological Databases – FASTA, Blast, Genbank, DNA sequence databases, Protein databases.

UNIT 4 PROTEIN DATABASE**12 Hrs.**

Entry formats, carbohydrate databases, Enzyme databases, Pathway databases. Relational database model. Theory on RDBMS. SQL.

UNIT 5 APPLICATIONS**12 Hrs.**

Application aspects – gene prediction, target searching – drug designing – E- cell, phylogenetic analysis, PERL, Chemoinformatics.

Max Hours.60**TEXT / REFERENCE BOOKS**

1. T.K.Altwood, D.J.Parry-smith Introduction to Bioinformatics Pearson Education (2004)
2. Bioinformatics for the beginners K.Mani & N.vijayaraj
3. Proteomics- Pennigton & Dunn (2002) Viva books publishers, New Delhi
4. Bioinformatics- A practical guide to the analysis of genes & protein 2nd ED Andreas,Baxevanis and Francis Ouellette.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 questions of 2 marks each - No choice****20 Marks****PART B : 2 questions from each UNIT of internal choice; each carrying 16 marks****80 Marks**

SMB1607	MEDICAL LABORATORY TECHNIQUES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- The main purpose of the program is to provide the students with the good knowledge of the basic techniques used in the laboratory.

UNIT 1 DISEASES**12 Hrs.**

Bacterial, Viral, Fungal and Protozoan Diseases of various human body systems, Disease associated clinical samples for diagnosis.

UNIT 2 COLLECTION OF SAMPLES**12 Hrs.**

Collection of clinical samples (oral cavity, throat, skin, Blood, CSF, urine and faeces) and precautions required. Method of transport of clinical samples to laboratory and storage.

UNIT 3 EXAMINATION OF SAMPLES**12 Hrs.**

Examination of sample by staining - Gram stain, Ziehl-Neelson staining for tuberculosis, Giemsa stained thin blood film for malaria Preparation and use of culture media - Blood agar, Chocolate agar, Lowenstein-Jensen medium, MacConkey agar, Distinct colony properties of various bacterial pathogens.

UNIT 4 SEROLOGICAL ANALYSIS**12 Hrs.**

Serological Methods - Agglutination, ELISA, immunofluorescence, Nucleic acid based methods - PCR, Nucleic acid probes

UNIT 5 ANALYSIS METHODS**12 Hrs.**

Typhoid, Dengue and HIV, Swine flu Testing for Antibiotic Sensitivity in Bacteria Importance, Determination of resistance/sensitivity of bacteria using disc diffusion method, Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method

Max Hours.60**TEXT / REFERENCE BOOKS.**

1. Ananthanarayan R and Paniker CKJ (2009)Textbook of Microbiology, 8th edition, Universities Press Private Ltd.
2. Brooks G.F., Carroll K.C., Butel J.S., Morse S.A. and Mietzner, T.A. (2013) Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication
3. Randhawa, VS, Mehta G and Sharma KB (2009) Practicals and Viva in Medical Microbiology 2nd edition, Elsevier India Pvt Ltd
4. Tille P (2013) Bailey's and Scott's Diagnostic Microbiology, 13th edition, Mosby Collee JG, Fraser, AG, Marmion, BP,

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 questions of 2 marks each - No choice****20 Marks****PART B : 2 questions from each UNIT of internal choice; each carrying 16 marks****80 Marks**

SMB1608	HUMAN PHYSIOLOGY	L	T	P	CREDITS	TOTAL MARKS
		3	0	0	3	100

COURSE OBJECTIVES

- This course aims to introduce the students to the Physiological concepts of homeostasis and control mechanisms and to study the functions of body systems- with emphasis on clinical relevance

UNIT 1 DIGESTIVE SYSTEM**12 Hrs.**

Structure of alimentary canal - salivary glands, pancreas, liver. Deglutition. Movements of alimentary canal and their regulations. Role of secretory fluids in digestion- salivary, gastric, pancreatic and intestinal juices and bile. Digestion and absorption of carbohydrates, lipids, proteins and nucleic acids.

UNIT 2 RESPIRATORY SYSTEM**12 Hrs.**

Respiratory System : Structure of the lung and airways. Mechanics of breathing -- role of respiratory muscles, glottis. Transport of gases in body - Partial pressure and composition of normal atmospheric gases. Hypoxia – types, effects.

UNIT 3 NERVOUS SYSTEM**12 Hrs.**

Outline of organization and basic functions (sensory, motor and association) of the nervous system. Structural organization of different parts of brain and spinal cord. Reflex action – definition, reflex arc, classification and properties; Autonomic nervous system. Chemical involved in the neural transmission.

UNIT 4 ENDOCRINE SYSTEM**12 Hrs.**

Classification of endocrine glands and hormones. Pituitary gland, Pineal, Thyroid, Adrenal, Pancreatic -- structure and function of the gland. Regulation of endocrine synthesis - Feedback mechanism.

UNIT 5 REPRODUCTIVE SYSTEM**12 Hrs.**

Primary and accessory sex organs and secondary sex characters. Structure of testis, endocrine functions, Spermatogenesis. Structure of ovary. Ovarian hormones and their functions. Oogenesis and ovulation. Formation and functions of corpus luteum. Physiology of puberty.

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Molecular Biology of the cells : Alberts et. al., Garland Publications Inc. NY
2. Cell and Molecular Biology by E D P de Robertis and E M F de Robertis.
3. Text book of Medical Physiology by A. C. Guyton and J. E. Harcourt.
4. Text book of Medical Physiology by Garong.
5. Text book of Biochemistry and Human Biology by Talwar.
6. Principles of anatomy and physiology by Tortora Grabowski, 10th edition

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A** : 10 questions of 2 marks each - No choice**20 Marks****PART B** : 2 questions from each UNIT of internal choice; each carrying 16 marks**80 Marks**

SMB1609	MARINE MICROBIOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- This course aimed to understand microbiology of marine environment with special emphasis on microbiological ecology, taxonomy, nutrient cycle, food microbiology and microbial biodegradation.

UNIT 1 INTRODUCTION**12 Hrs.**

Ecology of coastal, shallow and deep sea microorganism – importance and their significance. Diversity of microorganism - Archaea, bacteria, cyanobacteria, algae, fungi, viruses and actinomycetes in the mangroves and coral environs.

UNIT 2 ESTIMATION AND PRESERVATION**12 Hrs.**

Methods of studying the marine micro-organisms-Methods of collection, enumeration (total and viable counts), Isolation, culture & identification based on morphological, physiological and biochemical characteristics; Preservation of marine microbes; Culture collection Centers (ATCC, IMTECH, etc.). Microbial nutrition - influence of environment factors on microbial growth, activity and distribution

UNIT 3 DECOMPOSITION**12 Hrs.**

Microbial nitrogen fixation; Carbon, nitrogen and phosphorus cycle; Decomposition of organic matter; Bioleaching and bio-deterioration of natural and synthetic materials.

UNIT 4 MICROBIAL METABOLITES**12 Hrs.**

Microbes of Biotechnological importance; Primary and secondary metabolites (enzymes, antibiotics, organic acid, toxins etc.)

UNIT 5 SOILAGE**12 Hrs.**

Seafood microbiology - normal genera associated with fish, food spoilage, fish & human pathogens; Indicator of Pollution – faecal coliforms; Prevention & control.

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Pelczar MJ Jr., Chan ECS and Kreig NR. Microbiology, 5th Edition, Tata McGraw Hill, 1993.
2. G Reed, Prescott and Dunn's, Industrial Microbiology, 4th Edition, CBS Publishers, 1987. 3
3. M.T. Madigan and J.M. Martinko, Biology of Microorganisms, 11th Edition, Pearson Prentice Hall, USA, 2006.
4. Rheinheimer, G., 1980. Aquatic Microbiology, Johnwiley & Sons, pp. 235.
5. Elay, A.R.1992. Microbial food poisoning. Chapman and Hall London, 191 pp.
6. Ford, T.E., 1993. Aquatic microbiology. An ecological approach. Blackwell scientific publication, London, 168
7. Krichman, D.L., 2000. Microbial ecology of the oceans. Wiley –liss, NewYork, 542

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 questions of 2 marks each - No choice****20 Marks****PART B : 2 questions from each UNIT of internal choice; each carrying 16 marks****80 Marks**

SBB3203	PLANT BIOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- This course aims to impart the skills of Plant tissue culture and its applications

UNIT 1 MEDIA**12 Hrs.**

Plant Tissue culture – History, Plant tissue culture media, types, constituents and preparation of media, selection of suitable medium.

UNIT 2 CULTURE TECHNIQUES**12 Hrs.**

Protoplast culture and somatic hybridization, production of Haploid plants, Somaclonal variations, Clonal propagation (micro propagation) germplasm conservation and cryopreservation.

UNIT 3 GENE TRANSFER**12 Hrs.**

Genetic Engineering of plants – Gene transfer methods – vector mediated gene transfer, virus – mediated gene transfer, Direct or Vectorless DNA transfer.

UNIT 4 TRANSGENIC PLANTS**12 Hrs.**

Application of Transgenic plants – Resistance to biotic stresses – Insect resistance plant virus, bacteria and fungi resistance, abiotic stress – herbicide resistance plants.

UNIT 5 GREEN HOME TECHNOLOGY**12 Hrs.**

Molecular Marker Aided plant Breeding – Molecular markers, Molecular marker assisted selection, Arid & semi-arid plant Biotech, Green house & Green home technology.

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Dr. U. Sathyanarayana – Biotechnology. Books and Allied Publications
2. Winnacker, E.L. 1989: From genes to clones. Introduction to Gene Technology. VCH Weinheim.
3. Old, R.M. and S.B. Primrose. 1995. Principles of Gene Manipulation. Blackwell Scientific Publication. London.
4. Glick, B.K. and Pasternak, J.J. 2002. Molecular Biotechnology. Principles and applications of recombinant DNA. ASM Press, Washington.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A : 10 questions of 2 marks each - No choice****20 Marks****PART B : 2 questions from each UNIT of internal choice; each carrying 16 marks****80 Marks**

SBB1611	BIOSTATISTICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- This course aim to use and interpret results of, descriptive statistical methods effectively;
- Demonstrate an understanding of the central concepts of basic biomathematics and biostatistical theory.

UNIT 1 VARIABLES**12 Hrs**

Definitions in Statistics, Sample and Population, Variables: Discrete and Continuous, Collection, Classification and Tabulation of data, Bar diagrams and Pie diagrams, Histogram, Frequency curve and frequency polygon, Ogives.

UNIT 2 SAMPLING**12 Hrs**

Concept of Sampling and Sampling Distribution. Measures of Central tendency (Mean, Median, Mode), Measures of deviation (Standard deviation, variance and coefficient of variation).

UNIT 3 HYPOTHESIS**12 Hrs**

Test of significance, Hypothesis Testing, Null and Alternate Hypothesis, Level of significance, Confidence Limit Student, T and F Test, Chi-square test

UNIT 4 PROBABILITY**12 Hrs**

Probability and Distribution, Concepts and problems on probability, Binomial, Poisson, Normal Distribution and their applications

UNIT 5 REGRESSION**12 Hrs**

Simple Regression and Correlation, Concept of analysis of variance (one-way classification)

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Fundamentals of Biostatistics. by Irfan A Khan.
2. An introduction to Biostatistics. by PSS Sunder Rao.
3. Introduction to the Practice of Statistics by Moore and McCabe
4. Biostatistics : Gurumani
5. Biostatistics: Palanisamy

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 100****Exam Duration : 3 Hrs.****PART A** : 10 questions of 2 marks each - No choice**20 Marks****PART B** :2 questions from each UNIT of internal choice; each carrying 16 marks**80 Marks**

SBB1615	BIOETHICS, BIOSAFETY AND IPR	L	T	P	CREDITS	TOTAL MARKS
		3	0	0	3	100

COURSE OBJECTIVES

- To understand importance of bioethics and biosafety. To understand legal social and economic impacts of biotechnology. To understand regulatory guidelines and their importance. To understand importance of patent.
- To understand procedure to apply for patent.
- To understand procedure of assessment of biosafety for biotech foods. To understand ethical implications of biotechnology.

UNIT 1 INTRODUCTION TO BIOSAFETY**12 Hrs**

Definition of ethics and Bioethics, Ethics in Biotechnology(positive and negative effects with classical examples – Rice with Vitamin A, No-till Agriculture, cotton without insecticide, reduced need for fertilizer, biological pest control, slow ripening fruits and controlled ripening, fast growing trees and fishes.

UNIT 2 GMO**12 Hrs.**

Guidelines for research with transgenic organisms. Environmental impact of genetically modified organisms (beneficial and hazardous impact), Field trials with GMO, Containment levels. Biosafety protocol, Cartagena Biosafety protocol, Mechanism of implementation of biosafety guidelines. Biosafety and politics. Biosafety database.

UNIT 3 IMPLICATIONS OF BIOSAFETY**12 Hrs**

Awareness education on genetically engineered organism.-Transgene instability, gene flow, resistance/ tolerance of target organism, increase weedlessness, risks and uncertainty associated with Biotechnology. Containment levels and their impact on Environment- Containment- definition, types of containment, summary of recommended Biosafety levels for infectious agents, detail checklist–premises and lab equipment, Animal facilities, environment.

UNIT 4 GLP AND PATENTS**12 Hrs**

Gene technology laboratory. GLP and Bioethics- introduction, national Good Laboratory Practices (GLP), the GLP authority functions, Good Laboratory Practices- necessity, aspiration and responsibility. Procedure to apply patent, other intellectual properties viz copy rights, Rights, Plant breeder's rights, trade secrets/ trade symbol etc. WTO, TRIPS, PCT and GATT. IPR problems and its hindrance.

UNIT 5 ETHICS**12 Hrs.**

Ethics in clinical trials and Good Clinical Practices (GCP) – Definition of clinical trials and GCP, general information about clinical trials, need to conduct clinical trials, faces of clinical trials, institutional set ups for conducting clinical trials, ethics in clinical Biotechnology

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Safety Assessment by Thomas, J.A., Fuch, R.L. (2002), Academic Press.
2. Biological safety Principles and practices by Fleming, D.A., Hunt, D.L., (2000). ASM Press.
3. Biotechnology - A comprehensive treatise. Legal economic and ethical dimensions VCH.Bioethics by Ben Mepham, Oxford University Press, 2005.
4. Bioethics & Biosafety by R Rallapalli & Geetha Bali, APH Publication, 2007
5. Bioethics & Biosafety By Sateesh Mk (2008), Ik Publishers
6. Biosafety And Bioethics Rajmohan Joshi Publishers

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****PART A : 10 Questions of 2 marks each-No choice****Exam Duration : 3 Hrs.****20 Marks**

PART B : 2 Questions from each UNIT with internal choice, each carrying 16 marks**80 Marks**

SBB1616	NANOBIOTECHNOLOGY	L	T	P	CREDITS	TOTAL MARKS
		3	0	0	3	100

COURSE OBJECTIVES

- This course aims the wide range of applications of nanotechnology and its interdisciplinary aspect. Learn the principles governing the effect of size on material properties at the nanoscale, and perform quantitative analysis.
- Familiarize the students with native bionanomachinery in living cells for generating energy, motion, synthesizing biomolecules, and principles can be applied to design new biomolecules and bionanodevices.
- Gain a working knowledge in synthesis, fabrication, characterization.

UNIT 1 BASICS OF NANOTECHNOLOGY**12 Hrs.**

Introduction and Classification: What is nanotechnology – Classification of Nanostructures - 1D, 2D and 3 D nanomaterials – Nanoscale Architecture.

UNIT 2 SYNTHESIS OF NANOMATERIALS**12 Hrs.**

Synthesis of Nanomaterials: Top down – ball milling; Bottom up – co-precipitation – sol-gel – electrodeposition – using natural nanoparticles – chemical vapor deposition - biosynthesis of nanomaterials.

UNIT 3 NANOBIOMETRICS**12 Hrs.**

Nanobiometrics: Introduction – lipids as nano-bricks and mortar- Self assembled nanolayers - the bits that do things - proteins – DNA Computer

UNIT 4 NANOTECHNOLOGY IN NATURE**12 Hrs.**

Natural nanocomposites : Introduction - natural nanocomposite materials – biologically synthesized nanostructures – protein based nanostructure formation – Nanotechnology in Agriculture. Nanoanalytics: Quantum dot Biolabelling – Nanoparticle Molecular labels – Analysis of Biomolecular Structure by AFM.

UNIT 5 NANOBIOTECHNOLOGY**12 Hrs.**

Poly hydroxyalkonate particles produced by microbes-synthesis and potential application, cyanophycin inclusions-biosynthesis and application, Magnetotactic bacteria for natural synthesis of magnetic nanoparticles; Mechanism of formation- Magnetosomes in bacteria biochemistry and application Viruses as components for the formation of nanostructured materials- bacteriophages; Synthesis process, self-assembly and application

Max Hours.60**TEXT / REFERENCE BOOKS**

1. Hari Singh Nalwa - Encyclopedia of Nanotechnology, Journal of Nanoscience and Nanotechnology, 2011.
2. Bharat Bhushan, Springer Handbook of Nanotechnology, Springer, 2006.
3. Rao CNR et.al, Chemistry of nanomaterials : Synthesis, properties and applications, Wiley, 2006
4. Hari Singh Nalwa, Handbook of Nanostructured Biomaterials and Their Applications in Nanobiotechnology, American Scientific Pub, 2005.
5. Niemeyer, C.M., Mirkin, C.A., Nanobiotechnology, Wiley, 2003.
6. Ed. Challa S., S. R. Kumar, J. H. Carola, Nanofabrication towards biomedical application: Techniques, tools, Application and impact -Wiley, 2006..

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 100****PART A : 10 Questions of 2 marks each-No choice****PART B : 2 Questions from each UNIT with internal choice, each carrying 16 marks****Exam Duration : 3 Hrs.****20 Marks****80 Marks**

PROGRAMME: B.Sc. BIOTECHNOLOGY**CURRICULUM**

SEMESTER 1										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1.	Theory	STA 1101	Tamil - I	3	0	0	3	50	50	1
		SFR 1101	French – I					50	50	3
		SHN 1101	Hindi –I					50	50	4
2.	Theory	SHS 1109	General English-I	3	0	0	3	50	50	5
3.	Theory	SBB 1101	Cell Biology	4	0	0	4	50	50	7
4.	Theory	SBB 1102	Fundamentals of microbiology	4	0	0	4	50	50	8
5.	Theory	SBT 1001	Environmental Science	3	0	0	3	50	50	9
6.	Practical	SBB4101	Cell biology Lab	0	0		2	50	50	11
7.	Practical	SBB4102	Fundamentals of Microbiology Lab	0	0	4	2	50	50	11
Total Credits for Semester 1 – 21										
Total Marks for Semester 1 – 700										

SEMESTER 2										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1.	Theory	STA 1102	Tamil - II	3	0	0	3	50	50	12
		SFR 1102	French – II					50	50	14
		SHN 1102	Hindi –II					50	50	15
2.	Theory	SHS 1110	General English-II	3	0	0	3	50	50	16
3.	Theory	SMB 1102	Basic Biochemistry	4	0	0	4	50	50	18
4.	Theory	SBB 1201	Immunology	4	0	0	4	50	50	19
5.	Theory	SBB 1202	Intermediary Metabolism	3	0	0	3	50	50	20
6.	Practical	SMB4102	Basic Biochemistry Lab	0	0	4	2	50	50	21
7.	Practical	SBB4201	Immunology Lab	0	0	4	2	50	50	21
Total Credits for Semester 2– 21										
Total Marks for Semester 2 – 700										

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS
 CAE – CONTINUOUS ASSESSMENT EXAMINATION,
 ESE – END SEMESTER EXAMINATION

SEMESTER 3										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1.	Theory	SBB2101	Introduction to Molecular Biology & Genetics	4	0	0	4	50	50	22
2.	Theory	SBB2102	Genetic Engineering	4	0	0	4	50	50	23
3.	Theory	SBB2103	Concepts in Biotechnology	3	0	0	3	50	50	24
4.	Theory	SBB2104	Analytical techniques	3	0	0	3	50	50	25
5.	Theory		Elective	3	0	0	3	50	50	
6.	Practical	SBB4301	Molecular biology Lab	0	0	4	2	50	50	26
7.	Practical	SBB4302	Bioinstrumentation Lab	0	0	4	2	50	50	26
Total Credits for Semester 3– 21										
Total Marks for Semester 3 – 700										

SEMESTER 4										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1.	Theory	SBB2201	Environmental and Agricultural biotechnology	3	0	0	3	50	50	27
2.	Theory	SBB2202	Basic Industrial Biotechnology	3	0	0	3	50	50	28
3.	Theory	SBB2203	Food biotechnology	4	0	0	4	50	50	29
4.	Theory	SBB2204	Enzyme technology	4	0	0	4	50	50	30
5.	Theory		Elective	3	0	0	3	50	50	
6.	Practical	SBB4401	Soil & Agricultural biotechnology Lab	0	0	4	2	50	50	31
7.	Practical	SBB4402	Food Biotechnology Lab	0	0	4	2	50	50	31
Total Credits for Semester 4– 21										
Total Marks for Semester 4 – 700										

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS
 CAE – CONTINUOUS ASSESSMENT EXAMINATION,
 ESE – END SEMESTER EXAMINATION

SEMESTER 5										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1.	Theory	SBB3101	Medical Biotechnology	4	0	0	4	50	50	32
2.	Theory	SBB3102	Advanced Genetic Engineering	4	0	0	4	50	50	33
3.	Theory	SBB3103	Plant Biotechnology	3	0	0	3	50	50	34
4.	Theory	SBB3104	Animal Biotechnology	3	0	0	3	50	50	35
5.	Theory		Elective	3	0	0	3	50	50	
6.	Practical	SBB4501	Genetic Engineering Lab	0	0	4	2	50	50	36
7.	Practical	SBB4502	Plant and Animal Biotechnology Lab	0	0	4	2	50	50	36
Total Credits for Semester 5– 21										
Total Marks for Semester 5 – 700										

SEMESTER VI										
Sl. No.	Course Type	Course Code	Course Title	L	T	P	C	Marks		Page No.
								CAE	ESE	
1.	Theory	SBT1002	Research Methodology	3	0	0	3	50	50	37
2.	Theory	SMB3201	Clinical Microbiology	3	0	0	3	50	50	38
3.	Project	S30PROJ	Project	0	0	30	15	50	50	
Total Credits for Semester 6 – 21										
Total Marks for Semester 6 – 300										

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS
 CAE – CONTINUOUS ASSESSMENT EXAMINATION,
 ESE – END SEMESTER EXAMINATION

LIST OF ELECTIVES

ELECTIVE COURSES									
Sl. No.	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1	SBB1601	Advanced instrumentation Techniques	3	0	0	3	50	50	39
2	SBB1602	Biopharmaceutical Technology	3	0	0	3	50	50	40
3	SMB1603	Food Fermentation Techniques	3	0	0	3	50	50	41
4	SBB1604	Protein engineering	3	0	0	3	50	50	42
5	SBB1605	Cancer biology	3	0	0	3	50	50	43
6	SBB1606	Computer Application in Biology	3	0	0	3	50	50	44
7	SBB1607	Genomics and Proteomics	3	0	0	3	50	50	45
8	SBB1608	Metabolic Engineering	3	0	0	3	50	50	46
9	SBB1609	Introduction to Bioinformatics	3	0	0	3	50	50	47
10	SBB1610	Entrepreneurial biotechnology	3	0	0	3	50	50	48
11	SBB1611	Biostatistics	3	0	0	3	50	50	49
12	SBB1612	Molecular Modeling & Drug Design	3	0	0	3	50	50	50
13	SBB1613	Marine biotechnology	3	0	0	3	50	50	51
14	SMB1602	Biofertilizers and Biopesticides	3	0	0	3	50	50	52
15	SBB1615	Bioethics, Biosafety and IPR	3	0	0	3	50	50	53
16	SBB1616	Nanobiotechnology	3	0	0	3	50	50	54

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS

CAE – CONTINUOUS ASSESSMENT EXAMINATION,

ESE – END SEMESTER EXAMINATION

Semester	Theory courses (including elective courses)			Practical Courses (including Project)		
	Total No.	Total Credits	Total Marks	Total No.	Total Credits	Total Marks
1	5	17	500	2	4	200
2	5	17	500	2	4	200
3	5	17	500	2	4	200
4	5	17	500	2	4	200
5	5	17	500	2	4	200
6	2	6	500	1	15	100
Overall Total	27	91	3000	11	35	1100

Overall total credits for B.Sc.(Biotechnology) Programme	126
Overall total marks for B.Sc.(Biotechnology) Programme	4100

**PROGRAMME: B.Sc. BIOCHEMISTRY
CURRICULUM**

SEMESTER I									
Sl. No	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1.	STA1101 SFR1101 SHN1101	Tamil - I French - I Hindi - I	3	0	0	3	50	50	1 3 4
2.	SHS1109	General English – I	3	0	0	3	50	50	5
3.	SBC1001	Biomolecules	4	0	0	4	50	50	7
4.	SBB1102	Fundamentals of Microbiology	4	0	0	4	50	50	8
5.	SBT1001	Environmental Science	3	0	0	3	50	50	9
6.	SBC4101	Fundamentals of Biochemistry Lab	0	0	2	2	50	50	11
7.	SBB4102	Fundamentals of Microbiology Lab	0	0	2	2	50	50	11
Total Credits for Semester 1 – 21									
Total Marks for Semester 1 – 700									

SEMESTER II									
Sl. No	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1.	STA 1102 SFR 1102 SHN1102	Tamil – II French – II Hindi – II	3	0	0	3	50	50	12 14 15
2	SHS 110	General English – II	3	0	0	3	50	50	16
3.	SBB1101	Cell Biology	4	0	0	4	50	50	18
4.	SBB1201	Zoology	4	0	0	4	50	50	19
5.	SBC1202	Basics of Computers	3	0	0	3	50	50	20
6.	SBB4202	Cell Biology Lab	0	0	4	2	50	50	21
7.	SBC4201	Zoology Lab	0	0	4	2	50	50	21
Total Credits for Semester 2 – 21									
Total Marks for Semester 2 – 700									

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS
CAE – CONTINUOUS ASSESSMENT EXAMINATION,
ESE – END SEMESTER EXAMINATION

SEMESTER III									
S. No.	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1.	SBC2101	Molecular Biology I	4	0	0	4	50	50	22
2.	SCY1213	Chemistry I	3	0	0	3	50	50	23
3.	SBC2102	Enzymes	4	0	0	4	50	50	24
4.	SBC2103	Biophysical chemistry	3	0	0	3	50	50	25
5.		Elective I	3	0	0	3	50	50	
6.	SBB4301	Molecular Biology Lab	0	0	3	2	50	50	26
7.		Chemistry Lab	0	0	3	2	50	50	26
Total Credits for Semester 3 – 21									
Total Marks for Semester 3 – 700									

SEMESTER IV									
Sl. No.	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1.	SBC2201	Intermediary Metabolism I	4	0	0	4	50	50	27
2.	SCY1214	Chemistry II	3	0	0	3	50	50	28
3.	SBC2202	Molecular Biology II	3	0	0	3	50	50	29
4.	SBB1201	Immunology	4	0	0	4	50	50	30
5.		Elective II	3	0	0	3	50	50	
6.	SBB4201	Immunology Lab	0	0	3	2	50	50	31
7.	SBC4401	Enzymology Lab	0	0	3	2	50	50	31
Total Credits for Semester 4 – 21									
Total Marks for Semester 4 – 700									

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS
 CAE – CONTINUOUS ASSESSMENT EXAMINATION,
 ESE – END SEMESTER EXAMINATION

SEMESTER V									
Sl. No.	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1.	SBC3101	Intermediary Metabolism II	4	0	0	4	50	50	32
2.	SBC3102	Genetics	3	0	0	3	50	50	33
3.	SBC3103	Endocrinology	3	0	0	3	50	50	34
4.	SBC3104	Clinical Biochemistry	4	0	0	4	50	50	35
5.		Elective III	3	0	0	3	50	50	
6.	SBC4501	Clinical Biochemistry Lab	0	0	3	2	50	50	36
7.	SBC4502	Genetics Lab	0	0	3	2	50	50	36
Total Credits for Semester 5 – 21									
Total Marks for Semester 5 – 700									

SEMESTER VI									
Sl. No.	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1.	SBT1002	Research Methodology	3	0	0	3	50	50	37
2.	SBC3201	Plant Biochemistry	3	0	0	3	50	50	38
3.	S30PROJ	Project	0	0	30	15	50	50	
Total Credits for Semester 6 – 21									
Total Marks for Semester 6 – 300									

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS
 CAE – CONTINUOUS ASSESSMENT EXAMINATION,
 ESE – END SEMESTER EXAMINATION,

Semester	Theory courses (including elective courses)			Practical Courses (including Project)		
	Total No.	Total Credits	Total Marks	Total No.	Total Credits	Total Marks
1	5	17	500	2	4	200
2	5	17	500	2	4	200
3	5	17	500	2	4	200
4	5	17	500	2	4	200
5	5	17	500	2	4	200
6	2	6	500	1	15	100
Overall Total	27	91	3000	11	35	1100

Overall total credits for B.Sc.(Biochemistry) Programme	126
Overall total marks for B.Sc.(Biochemistry) Programme	4100

LIST OF ELECTIVES

ELECTIVE COURSES									
Sl. No.	Course Code	Course Title	L	T	P	C	Marks		Page No.
							CAE	ESE	
1	SBB2103	Concepts in Biotechnology	3	0	0	3	50	50	39
2	SMB1602	Biofertilizers and Biopesticides	3	0	0	3	50	50	40
3	SMB1603	Food Fermentation Techniques	3	0	0	3	50	50	41
4	SBB1601	Nutritional Biochemistry	3	0	0	3	50	50	42
5	SMB1605	Advanced instrumentation Techniques	3	0	0	3	50	50	43
6	SBB1609	Introduction to Bioinformatics	3	0	0	3	50	50	44
7	SMB1607	Medical Laboratory techniques	3	0	0	3	50	50	45
8	SMB1611	Biostatistics and probability	3	0	0	3	50	50	46
9	SMB1612	Human Physiology	3	0	0	3	50	50	47
10	SBB1615	Bioethics, Biosafety and IPR	3	0	0	3	50	50	48
11	SBB1607	Genomics and Proteomics	3	0	0	3	50	50	49
12	SBB1605	Cancer biology	3	0	0	3	50	50	50
13	SBB1602	Biopharmaceutical Technology	3	0	0	3	50	50	51
14	SBB1604	Protein engineering	3	0	0	3	50	50	52
15	SBB1608	Metabolic Engineering	3	0	0	3	50	50	53
16	SBB1616	Nanobiotechnology	3	0	0	3	50	50	54

L - LECTURE HOURS, T – TUTORIAL HOURS, P – PRACTICAL HOURS, C – CREDITS
 CAE – CONTINUOUS ASSESSMENT EXAMINATION,
 ESE – END SEMESTER EXAMINATION

ANNEXURE-II

APPROVED SYLLABUS FOR NEW ELECTIVES INTRODUCED IN 2018-2019

SBT 1609	INDUSTRIAL SAFETY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To promote safety in industries, reduce hazards and maintain high standards in industries. Also to help maintain healthy work practices and promote quality work keeping in mind environmental preservation.

UNIT 1 INDUSTRIAL SAFETY PRINCIPLES

9 Hrs.

History of Safety movement –Evolution of modern safety concept- general concepts of management – planning safety for optimization of productivity -productivity, quality and safety-line and staff functions for safety- budgeting for safety-safety policy. Incident Recall Technique (IRT), disaster control, job safety analysis, safety survey, safety inspection, safety sampling, evaluation of performance of supervisors on safety.

UNIT 2 ENVIRONMENTAL SAFETY

9 Hrs.

Hazardous waste management in India-waste identification, characterization and classification technological options for collection, treatment and disposal of hazardous waste-selection charts for the treatment of different hazardous wastes-methods of collection and disposal of solid wastes-health hazards-toxic and radioactive wastes- incineration and vitrification - hazards due to bio-process dilution- standards and restrictions – recycling and reuse.

UNIT 3 BIOLOGICAL AND ERGONOMICAL HAZARDS

9 Hrs.

Classification of Biohazardous agents – examples, bacterial agents, rickettsial and chlamydial agents, viral agents, fungal, parasitic agents, infectious diseases - Biohazard control program, employee health program- laboratory safety program-animal care and handling- biological safety cabinets - building design. Work Related Musculoskeletal Disorders –carpal tunnel syndrome CTS- Tendon pain-disorders of the neck- back injuries.

UNIT 4 OCCUPATIONAL PHYSIOLOGY

9 Hrs.

Man as a system component – allocation of functions – efficiency – occupational work capacity – aerobic and anaerobic work – evaluation of physiological requirements of jobs – parameters of measurements – categorization of job heaviness – work organization – stress – strain – fatigue – rest pauses – shift work – personal hygiene.

UNIT 5 BIOSAFETY

9 Hrs.

Biosafety issues in Biotechnology – primary containment for Biohazards – National and international biosafety guidelines and regulations – operation of biosafety guidelines and regulations of Government of India – Risk analysis – risk assessment – risk management.

Max. 45 Hours

TEXT / REFERENCE BOOKS

1. Heinrich H.W. Industrial Accident Prevention McGraw-Hill Company, New York, 1980.
2. Blake R.P., Industrial Safety, Prentice Hall Inc., New Jersey, 2nd Edition, 1963.
3. Hand book of "Occupational Safety and Health, National Safety Council, Chicago, 1982

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each - No choice

20 Marks

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

60 Marks

SBT 1610	GMP AND QUALITY CONCEPTS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

□ To introduce students about Good manufacturing practices quality concepts which would expose them to industrial scenario.

UNIT 1 INTRODUCTION

9 Hrs.

Basic Concepts: Quality concepts, Quality Control, Quality Assurance, Good Manufacturing Practices, Good Laboratory Practices, Responsibilities. Quality Control: Quality control laboratory: Responsibilities, good laboratory practices, routine controls, instruments, protocols.

UNIT 2 GMP

9 Hrs.

Good Manufacturing Practice. Legal requirements pertaining to GMP: GMP Guidelines, Standards, Regulatory agencies. Basic Components of GMP: Organization & Personnel, Premises, Equipments, Raw Materials, Complaints and recalls, Specifications, Self inspection.

UNIT 3 GLP

9 Hrs.

Good Laboratory Practice (GLP) – an overview and basic information, Scope. Principles of GLP: Test Facility Organization and Personnel, Quality Assurance Programme, Facilities, Test Systems, Test and Reference Items, Standard Operating Procedures, Performance of the Study, Reporting of Study Result, Storage and Retention of Records and Materials.

UNIT 4 INSPECTION

9 Hrs.

Inspections, Quality Audit and Quality System Reviews: Inspections, role of quality audit, role of inspectors, methods of inspection- routine, concise, follow-up and special inspections, frequency and duration of inspections, preparations for inspections, conduct, report and regulatory actions.

UNIT 5 REGULATION

9 Hrs.

Regulatory bodies – Need and role of regulatory bodies. Different regulatory bodies – FDA, HACCP and their scope. Importance of regulatory approval. ISO 9000 – regulations.

Max. 45 Hours

TEXT / REFERENCE BOOKS

1. Sidney H. Willig, Good manufacturing Practices for Pharmaceuticals, 5th Edition, Revised and Expanded, Marcel Dekker, Inc. New York, 2005.
2. Jose Rodriguez-Perez, The FDA and Worldwide Current Good Manufacturing Practices and Quality System requirements guidebook for finished pharmaceuticals, American Society for Quality, ASQ Quality Press, Milwaukee, Wisconsin, 2014.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each - No choice

20 Marks

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

60 Marks

SPR1307	RESOURCE MANAGEMENT TECHNIQUES	L	T	P	Credits	Total Marks
		2	1	0	3	100

COURSE OBJECTIVE

To develop in a student efficient and effective deployment of an organization's resources when they are needed. Such resources may include financial resources, inventory, human skills, production resources, or information technology.

UNIT 1 INTRODUCTION AND LINEAR PROGRAMMING 9 Hrs.

Operations Research (OR)- Nature – Characteristics – Phases - Role of OR in Decision making - Outline of OR Models Linear Programming – Formulation of L.P. problems –Solution by graphical method, simplex method, Two Phase Method, Big M methods, Dual Simplex method

UNIT 2 TRANSPORTATION AND ASSIGNMENT MODEL 9 Hrs.

Transportation problem – Initial Basic feasible solution- Northwest corner method, Least Cost method, Vogel's approximation method – Test for optimality-MODI method. Assignment problems- Hungarian assignment models- Travelling salesman problems

UNIT 3 RESOURCE SCHEDULING AND NETWORK ANALYSIS 9 Hrs.

Problem of Sequencing – Problem with N jobs and 2 machines N Jobs 3 machines N Jobs and m machines and 2 Jobs m machines (Graphical method). Project Management -Basic concepts–Network construction and scheduling Critical Path Method (CPM) & Program evaluation review technique (PERT) and resource leveling by network techniques, time – Cost trade off.

UNIT 4 INVENTORY CONTROL 9 Hrs.

Inventory Control – Various Types of inventory models – deterministic inventory models – Production model, Purchase model– with and without shortage- Economic Order Quantity (EOQ) – Buffer stock – Shortage quantity, Probabilistic inventory models – Quantity Discount and Price Breaks

UNIT 5 QUEUEING THEORY AND REPLACEMENT MODELS 9 Hrs.

Queuing theory – Poisson arrivals and exponential service times, Single channel models only, Replacement policy for items whose maintenance cost increases with time- Consideration of time value of money - Replacement policy- Individual, Group replacement of items that fail completely and suddenly.

Max. 45 Hours

TEXT / REFERENCE BOOKS

- 1.. R.Panneerselvam, Operation research, 2nd Edn., Prentice Hall, 2001.
2. S.D Sharma, Operation research Theory, Methods and Application, 17th Edn., Kedar Nath Ram Nath Publication, 2010.
3. Nita H Shah, Ravi M Gor & Hardik Soni, Operation research, 4th Edn., PHI, 2010.
4. Hamdy A.Taha, Operation Research, 8th Edn, PHI, 2008
5. Hiller & Liberman., Introduction to Operations Research, 5th Edition, Mc Graw Hill, 2001
6. Ravindran, Phillips & Solberg, Operations Research: principles and practice, 2nd Edn., Wiley India Lts, 2007
7. Ronald L. Rardin, Optimization in Operations Research, Prentice Hall, 1998

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each - No choice 20 Marks

PART B : 2 questions from each unit of internal choice; each carrying 12 marks 60 Marks

SHS1601	LIFE AND EMPLOYABILITY SKILLS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

The course aims at equipping students to be competent in facing the challenges in today's globalized context, by providing an insight to soft skills for success and life skills for survival at the workplace.

UNIT 1 **ACHIEVEMENT MOTIVATION** 9 Hrs.

Time Management - Positive and negative aspects of time log - Formula for successful time management.

UNIT 2 **SELF-AWARENESS AND EMPATHY** 9 Hrs.

Work-Life Balance – Project completion Techniques – Effective Planning and Organisation - Strategies to improve team communication.

UNIT 3 **DECISION MAKING** 9 Hrs.

Decision making techniques- types of decisions- Setting Goals and Plans - Problem Solving Techniques.

UNIT 4 **EFFECTIVE COMMUNICATION** 9 Hrs.

Non-verbal communication - means of communication – Personality development – Language and body language for interviews- Self Empowerment.

UNIT 5 **NEGOTIATION SKILLS** 9 Hrs.

Negotiation skills – skill acquisition strategies – effective persuading skills.

Max. 45 Hours

TEXT / REFERENCE BOOKS

1. Gravells, Ann. "Delivering Employability Skills in the Lifelong Learning Sector Further Education and Skills", United Kingdom: SAGE Publications Ltd, 2010.
2. Hind, David W.G., Stuart Moss, "Employability Skills," Business Education Publishers Ltd., United Kingdom :Tyne & Wear, 2005.
3. Rao M.S., "Enhancing Employability: Connecting Campus with Corporate", New Delhi: I K International Publishing House Pvt. Ltd, 2010

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each – No choice **20 Marks**

PART B : 2 questions from each unit of internal choice, each carrying 12 marks **60 Marks**

SHS1602	TECHNICAL WRITING FOR SCIENTISTS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

To provide with an introduction to professional writing as a disciplinary field.

UNIT 1 INTRODUCTION TO TECHNICAL WRITING

9 Hrs.

Technical Writing – Principles and procedure of technical writing; Role of a Technical writer, Various forms of Technical Writing

UNIT 2 ONLINE TOOLS

9 Hrs.

Printed documentation and Online Help Systems, Working with images and illustrations, designing graphic aids.

UNIT 3 PROCESS OF WRITING

9 Hrs.

Collecting and Organizing information, Drafting information verbally and visually, Producing Information, Documentation Process.

UNIT 4 REACHING THE AUDIENCE

9 Hrs.

Technical Writing Process Templates and Page design, Audience Profiling.

UNIT 5 PRESENTATION

9 Hrs.

Writing specialized forms as abstracts, instructions, proposals and project and lab reports

Max. 45 Hours

TEXT / REFERENCE BOOKS

1. Mike Markel's "Technical Communication", New York: Bedford/St. Martin's, 2009
2. Joseph M. Williams book Style: "Toward Clarity and Grace", Chicago, University of Chicago Press, 1995

END SEMESTER EXAM QUESTION PAPER PATTERN:

Max. Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each – No choice

20 Marks

PART B : 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SHS1603	PROFESSIONAL WRITING AND ADVANCED RHETORIC	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

To educate the learners on written communication and provide exposure to practical aspects of writing for wider audience and for scientific community.

UNIT 1 BASICS OF PROFESSIONAL COMMUNICATION

9 Hrs.

Technical Writing and Business communication (process, networks, importance, cultural variations, today's globalized workplaces), Practical aspects of communication, Principles and procedure of technical writing, Role of a Technical writer, attention to analyzing audience and purpose, Understanding and Inventing Pedagogies for Professional Writing.

UNIT 2 PROCESS OF PROFESSIONAL COMMUNICATION

9 Hrs.

Technical Writing Process Today, Genres of Technical Communication, Writing Proposals, Formats for Letters, Memos, abstracts, instructions, and proposals, and Email Messages.

UNIT 3 PRACTICAL ASPECTS OF PROFESSIONAL COMMUNICATION

9 Hrs.

Drafting and Documentation, Collecting and Organizing information, drafting information verbally and visually, Producing Information, Documentation Process, Argument, Persuasion, Propaganda, Audience and Style, Readers and Context of Use, The participatory model of writing.

UNIT 4 PROFESSIONAL ETHICS & STRATEGIES IN CHANGING SCENARIO

9 Hrs.

Ethics in Professional Communication, Applying theory to practice- analysis of papers and speeches, Writing on line-Principles while designing web sites, Creating effective presentation slides, Speech writing- basics, scrutiny and observation, Speech writing techniques and application.

UNIT 5 PROFESSIONAL COMMUNICATION & FUTURE

9 Hrs.

Future of Technical Communication, multimedia genre, Identity, Authority, and Learning to Write in New Workplaces, Writing work, technology, and pedagogy in the present era

Max. 45 Hours

TEXT / REFERENCE BOOKS

- Dubinsky, James, ed., "Teaching Technical Communication: Critical Issues for the Classroom". Bedford, 2004
- Hawk, Byron. "Toward a Post-Techne: or, Inventing Pedagogies for Professional Writing." (TCQ)
- Mara, Andrew and Byron Hawk. "Posthuman Rhetorics and Technical Communication."
- Henry, Jim. "Writing Workplace Cultures: An Archaeology of Professional Writing". SIUP, 2000.
- Johnson-Sheehan, Richard. "Technical Communication Today" 3rd ed. NY: Longman, 2010.
- Locker, Kitty O. and Donna S. Kienzler., "Business and Administrative Communication". 9th ed. McGraw Hill, 2010.
- Mike Markel's Technical Communication, New York: Bedford/St. Martin's, 2009
- Spilka, Rachel, ed. "Digital Literacy in/for Technical Communications". Routledge, 2009.
- Spinuzzi, Clay. "Tracing Genres through Organizations: A Sociocultural Approach to Information Design (Acting with Technology)". MIT, 2003

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each – No choice

20 Marks

PART B : 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SCI1619	DISASTER MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To create an awareness towards natural and man-made disasters, disaster preparedness and disaster management

UNIT 1 INTRODUCTION TO DISASTERS 12 Hrs.

Natural resources and its importance - understanding on fragile eco-system - characteristics and types of Disasters, Geological and Mountain Area Disasters: Earthquakes, Volcanic eruption, landslides - Wind and Water Related Natural Disaster: Floods, Droughts, Cyclones, Tsunamis - Man Made Disasters: Forest fires, Nuclear, Biological and Chemical disaster - Causes and effects - Disaster Profile of India - Disaster Management cycle.

UNIT 2 DISASTER PREPAREDNESS 8 Hrs.

Disaster management, mitigation and preparedness: Disaster Preparedness for People and Infrastructure, Community based Disaster Preparedness Plan - Roles & Responsibilities of Different Agencies and Government: Education, Communication & Training, Central, State, District and local administration, Armed Forces, Police, Para Military Forces, International Agencies, and NGO's - Disaster Mitigation: Strategies, Emerging Trends, Mitigation management and Role of Team and Coordination.

UNIT 3 REHABILITATION, RECONSTRUCTION & RECOVERY 10 Hrs.

Damage assessment - Development of Physical and Economic Infrastructure - Nature of Damage to Houses and Infrastructure due to Disasters - Funding Arrangements for Reconstruction - Monitoring and Evaluation of Rehabilitation Work: Training, Rescue and planning the rescue activities and rehabilitations - Role of Government and NGO's - Participative Rehabilitation Process: Case Studies

UNIT 4 DISASTER RESPONSE AND DISASTER MANAGEMENT 8 Hrs.

Disaster Response Plan: Communication, Participation and Activation of Emergency Preparedness Plans, Search, Rescue, Evacuation and other logistic management - Human Behaviour and Response Management: Psychological Response and Psychological Rehabilitation, Trauma and Stress Management, rumour and Panic Management, Medical and Health Response to Different Disasters - Relief Measures: Minimum Standard of Relief, essential components of Relief Management, and funding.

UNIT 5 RISK ASSESSMENT AND VULNERABILITY ANALYSIS 7 Hrs.

Hazard, Risk and Vulnerability: Concept and Relationship: Disaster Risk Reduction, People Participation in Risk Assessment - Vulnerability Analysis, Vulnerability Identification - Vulnerability profile of India - Strategies for Survival - Social Infrastructure for Vulnerability Reduction.

Max. 45 Hours

TEXT / REFERENCE BOOKS

- Bryant Edwards, "Natural Hazards", Cambridge University Press, U.K, 2005
- Carter, W. Nick, "Disaster Management, Asian Development Bank", Manila, 1991.
- Government of India, "Vulnerability Atlas of India", New Delhi, 1997.
- Sahni, Pardeep et.al. (eds.), "Disaster Mitigation Experiences and Reflections", Prentice Hall of India, New Delhi, 2002
- Sahni, Pardeep and Ariyabandu, Madhavi Malalgoda, 2012: "Disaster risk reduction in South Asia", Phi learning pvt. Ltd.- publisher, New Delhi, 2012.
- Sharma, R.K. & Sharma, G., (ed), "Natural Disaster", APH Publishing Corporation, New Delhi, 2005.
- Taori, K, "Disaster Management through Panchayati Raj", Concept Publishing Company, New Delhi, 2005.

Websites:

- NOAA Coastal Services Center, "Linking People Information and Technology",
- "Risk and Vulnerability Assessment Tool", at, <http://www.csc.noaa.gov/rvat/criticalEdd.html>

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each – No choice

20 Marks

PART B : 2 questions from each unit of internal choice, each carrying 12 marks

60 Marks

SBI1101	INTRODUCTION TO BIOINFORMATICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To enable the students to understand the tools used in Bioinformatics & how to use them. This will facilitate the students to undertake projects in modern biology.

UNIT 1 INTRODUCTION**9 Hrs.**

Introduction to bioinformatics, biological information, the Central Dogma, Bioinformatics: Definition and overview Bioinformatics, Branches of Bioinformatics, Aim, Scope and Research areas of Bioinformatics. Genome projects, human genome project- Databases and human chromosomes, role of Bioinformatics in biological sequences. Biological data- DNA sequence protein sequence, macromolecular structure. Challenges in bioinformatics.

UNIT 2 COMPUTING IN BIOINFORMATICS**9 Hrs.**

Introduction to internet-facilities used on the internet-www- web browsers, introduction to network basics- LAN, wan, network topology, protocol. Basic principles of computing in bioinformatics - database system, programming languages for bioinformatics- Perl, python. Introduction to computational biology.

UNIT 3 BIOLOGICAL DATABASES**9 Hrs.**

Databases and programs, Information retrieval from databases of nucleic acid and proteins. Pair wise alignment and database searching, Multiple Sequence Alignment database searching, DNA analysis, protein analysis, Data information and Knowledge Management, Concepts in Bioinformatics, Databases and Data Warehouses in Bioinformatics. Challenges, combining multiple types of data, Information Retrieval system in bioinformatics.

UNIT 4 TOOLS APPLICATIONS IN BIOINFORMATICS**9 Hrs.**

Bio-algorithms and Tools- Identifying genes, Overview of sequence annotation. Gene prediction methods- Human variation and disease identification, Visualizing and comparing nucleic acids and Protein Introduction to Phylogenetic analysis definition, concepts of tree, steps in constructing Phylogenetic analysis. Introduction to microarray.

UNIT 5 SOFTWARES IN BIOINFORMATICS**9 Hrs.**

Basic software tools used in bioinformatics - Sequence analysis- GCG, Emboss - Cn3D viewer- Rasmol, Swiss pdb viewer, Pymol, Jmol. Modeling- Discovery studio 2.0, Docking -Auto dock, HEX.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Des Higgins and Willie Taylor, Bioinformatics sequence structures and databases, by Oxford University press, 1st ed., 2000.
2. Atwood, Paey Smith, Introduction to bioinformatics, Woodhead Publisher Ltd., 2001.
3. Arthur M.Lesk, Introduction to bioinformatics, Oxford University Press, 2002.
4. David W. Mount, Bioinformatics: Sequences and genome analyses, Cold Spring Harbor Laboratory press, 2000.
5. Westhead, Parish and Twyman, Instant notes: Bioinformatics, 2003.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****Exam duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No choice**20 Marks****PART B :** 2 questions from each unit of internal choice; each carrying 12 marks**60 Marks**

SBI1207	PERL PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To understand the basics of PERL programming and its role and applications in Bioinformatics discipline.

UNIT 1 INTRODUCTION TO PERL PROGRAMMING**9 Hrs.**

Introduction to Perl for Bioinformatics- Comprehensive PERL Archive Network-Variables in Perl: Scalars, Arrays and Hashes. Basic structure of Perl language- a functional approach - constructing atgc.pl. tr/// function -text formatting - formatting numerical output with printf - trapping errors at run time - the s/// operator - the chop and chomp operators.

UNIT 2 INTRODUCTION TO ARRAYS AND HASHES**9 Hrs.**

Introduction to arrays and Hashes Variables - Printing hash data, accessing and removing elements. Special variable \$[Accessing elements in an array. Function list - reverse- sort- join- split- pop- push- shift- unshift-split function-advanced array operation - copying and creating arrays - populating arrays with sequential data - qw function - determination of the size of an array -counting arrays - accessing first element in an array, accessing last element in an array, accessing other elements in an array - adding elements to the end of an array - adding elements- removing elements - appending elements ,altering elements - array slices - splicing array - sorting arrays - reversing arrays - arrays from strings. Merging arrays, Transforming strings to arrays, transforming arrays to strings (Split and join functions).

UNIT 3 PERL REGULAR EXPRESSIONS AND CONTROL STRUCTURES.**9 Hrs.**

Perl regular expressions - special characters (+, *, ?, []) - regex operator - pattern modifier operator - conditional matching operator - range operator - match quantifiers - matching boundaries, grouping matching. Perl control statements - control structures - if statements - if-else - if-elsif - if-elsif-else - while loop - until loop -unless for loop - foreach loop -scoping of variables.

UNIT 4 FILES AND DIRECTORY MANIPULATIONS**9 Hrs.**

Files- Operating modes: read, write, append function- File variable, Die function- terminating a program, Reading complete file, Reading a file line by line, Closing a file. File test operators (d, e, l, r, s, w, x, B, T)- Manipulation Functions -link, unlink, rename, truncate, removing files. Directory Manipulation functions - mkdir, chdir, opendir, readdir, closedir, rmdir, chmod.

UNIT 5 INTRODUCTION TO PERL MODULES**9 Hrs.**

Introduction to modules and Subroutines- BioPerl module, Getopt: Long module and LWP: Simple Module-Cwd module - creating perl module tree, system function -Perl subroutines and functions. Introduction and applications of Common Gateway Interfaces (CGI).

Max. 45 Hours.**TEXT / REFERENCE BOOKS**

1. Harshawardhan P Bal, Perl Programming for Bioinformatics, Tata McGraw Hill Publishing Company Limited, 2003.
2. Tim Bunce and Alligator Descartes, Programming the Perl DBI, O'Reilly Media, USA, 2000.
3. Michael Moorhouse and Paul Berry, Bioinformatics, Biocomputing and PERL, John Wiley and Sons Ltd., UK, 2004.
4. James Tisdall, Beginning Perl for Bioinformatics, O'Reilly & Associates, USA, 2001.
5. Steven Holzner, PERL, Black Book, Dreamtech Publications, 2nd Edition, 2001.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs****PART A : 10 questions of 2 marks each - No choice****20 Marks****PART B : 2 questions from each unit of internal choice; each carrying 12 marks****60 Marks**

SBI1605	PYTHON	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To learn to appreciate the programming language that can be used for a wide variety of programming tasks and to expose the student to the standard scripting language. At the end of the course, the student will be developing adequate skills in programming and will be known to understand the implementation of various applications using powerful assortment of built-in types in python.

UNIT 1 INTRODUCTION TO PYTHON 9 Hrs.

Introduction to PYTHON- History -Features –installation - Setting up path -Working with Python -Basic Syntax –Operator

UNIT 2 VARIABLE AND DATA TYPES 9 Hrs.

Native datatypes – Booleans –Numbers – Strings - Bytes and byte arrays-Lists- Tuples – Sets - Dictionaries

UNIT 3 REGULAR EXPRESSIONS 9 Hrs.

Python regular expressions – Match function -Search function -Matching Vs Searching -Modifiers -Patterns.

UNIT 4 CONTROL STATEMENTS 9 Hrs.

Conditional Statements -If , If- else , Nested if-else , - Looping- For , While , Nested loops,- Control Statements- Break , Continue , Pass

UNIT 5 FUNCTIONS AND MODULES 9 Hrs.

Functions - Defining a function -Calling a function -Types of functions -Function Arguments -Anonymous functions -Global and local variables, Modules- Importing module -Math module -Random module -Packages – Composition

Max. 45 Hours

TEXT / REFERENCE BOOKS

1. Hetland., Beginning Python , Apress, 2008
2. Mark Pilgrim, Dive Into Python, Apress, 2004
3. Martin C. Brown, Python: The Complete Reference (English) ,McGraw-Hill/Osborne Media, 2001.
4. Mark Summerfield, Programming in Python 3 2nd ed (PIP3) - Addison Wesley ISBN: 0-321-68056-1,2009

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each - No choice 20 Marks

PART B : 2 questions from each unit of internal choice; each carrying 12 marks 60 Marks

SBM1304	BIOMATERIALS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- The course provides an intriguing insight in chemistry, engineering, biology and medicine that has a significant impact on biomaterials.
- It highlights the way in which modern biology and medicine is inextricably linked to scientific discipline and helping us to understand the complex world of biomaterials.

UNIT 1 INTRODUCTION AND METALS

9 Hrs

Biomaterials - Overview, Classification of biomaterials, Interfacial Phenomena and tissue response to biomaterials, Metals and alloys for orthopedic implants-Stainless steel, Cobalt chromium alloy, Titanium and its alloys, Precious metal alloys, Other metal alloys. Dental implants - materials, types and designs

UNIT 2 REPLACEMENT AND FIXATION DEVICES

9 Hrs

Bioelectric effect, Wolff's Law, Types of orthopedic fixation devices-pins, screws and plates, Intra Medullary and spinal nails. Interface Problems with artificial joints and various fixation methods, Hard tissue replacements - total hip and knee joint replacements. Soft Tissue replacements- Sutures -Tapes, Staples, Adhesives. Maxillofacial Implants

UNIT 3 POLYMERS AND APPLICATIONS

9 Hrs.

Polymers in biomedical use, Hydrogels, silicone rubber, biodegradable polymers, Polymer Sterilization, Deterioration of polymers

UNIT 4 BIOCERAMICS AND COMPOSITES

9 Hrs

Bioceramics, types and - bioactive resorbable, non - resorbable, bioceramic coatings on metallic and implants and bone bonding reactions on implantation. Hydroxyapatite - properties and applications. Composites - Types and Applications, Bioglass

UNIT 5 OPHTHALMOLOGY, CORROSION AND TESTS

9 Hrs

Ophthalmology- Introduction, Contact lenses, Eye shields, Viscoelastic solutions, Vitreous implants, Acrylate adhesives, Scleral buckling materials for retinal detachment, artificial tears. Corrosion, Biocompatibility and Hemocompatibility, Biological Tests. Material surface characterization

Max. 45 Hours

TEXT / REFERENCE BOOKS

1. Sujata V Bhat, Biomaterials, Narosa Publishing House, New Delhi, 2002.
2. Rolando Barbucci, Integrated Biomaterials Science, Plenum Publishers, New York, 2002.
3. A.F. Von Recum, Handbook of Biomaterials Evaluation - Scientific, Technical and Clinical Testing of Implant Materials, 1998.
4. 2nd Edition, Taylor & Francis, Philadelphia, 1999.
5. 4. J.B Park and R.S Lakes, Biomaterials: An Introduction, Second Edition, Plenum press, New York, 1992.
6. 5. Joseph D Bronzino, The Biomedical Engineering Hand Book, Vol - 11, CRC press, 2000.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each - No choice

20 Marks

PART B : 2 questions from each unit of internal choice; each carrying 12 marks

60 Marks

SBM1404	HOSPITAL MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- The paper provides opportunities for training and research in all aspects of hospital / health administration. It helps to promote scientific management of hospital and advancement of health care systems so as to make it rational, responsive and cost efficient.
- The student is thus educated in the development of high quality of hospital care in the community and the country so as to provide a satisfactory environment to the patient and clinical research

UNIT 1 **STANDARD OF HOSPITAL** 9 Hrs

- Concept of Hospital Management - Role of Administrator - Responsibilities of Administrator - Hospital Design
- Outlines for establishing Departmental Zones - Hospital Engineering

UNIT 2 **HOSPITAL ORGANIZATION** 9-Hrs.

- Organization of Out-Patient Services - Problems encountered in functioning of O.P Department - Organization of In- Patient Services - Casualty & Emergency Services - Organization and management of Operation theatres

UNIT 3 **SERVICES IN HOSPITAL** 9 Hrs

- Organization of Ancillary Services: Lab Services - Department of Physiotherapy & Occupational Therapy -
- Organization of Blood Transfusion Services - Department of Radio - diagnosis - Hospital Pharmacy

UNIT 4 **STERILIZATION AND HOSPITAL SAFETY** 9 Hrs

- Disease transmission, Sterilization and disinfection methods, Hospital safety - Radiation Safety, hazardous safety, safety disposal of biological waste - Maintenance of Equipments & Instruments.

UNIT 5 **SUPPORTIVE SERVICES IN HOSPITAL** 9 Hrs

- Organization and management of Nursing services and Dietary Services in hospital - House-keeping and maintenance - Medical Records - Staffing the hospital - Human resources management in hospital - Management Assisted by Computers: Reservation, Admission, Registration & Discharge Module

Max.45 Hours.

TEXT / REFERENCE BOOKS

1. Dr. L.L. Rao, Hospital Management. Annamalai University Press
2. R. D. Lele, Computers in Medicine, Tata McGraw Hill, 2008
3. Mohan Bansal, Medical informatics, Tata McGraw Hill, 2005

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each - No choice **20 Marks**

PART B : 2 questions from each unit of internal choice; each carrying 12 marks **60 Marks**

SBM1606	BIOMEMS AND NANOTECHNOLOGY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To enable the student to acquire adequate knowledge on micro mechanical devices and their applications in drug delivery and nanotechnology.

UNIT 1 INTRODUCTION**9 Hrs.**

MEMS – definition. Origin of MEMS – Types – Materials used and their properties. MEMS Technology. Applications in health care. Integrated MEMS and microsystem.

UNIT 2 PROCESSING: MICRO MACHINING TECHNOLOGY**9 Hrs.**

Lithography- etching- Ion implantation- wafer bonding- Integrated processing- Bulk micro machining- surface micro machining- coating technology and CVD-LIGA process.

UNIT 3 MICROSYSTEMS AND MICROFLUIDS**9 Hrs.**

General principles- Microsensors – Actuators- Electrostatic forces- Piezoelectric crystals – Intelligent materials and structures. Fundamentals of micro fluids, lab – on – a chip devices - Silicon and glass micromachining for micro total analysis systems. Surface chemistry in polymer microfluidic systems.

UNIT 4 APPLICATION IN MEDICINE**9 Hrs.**

Trends in MEMS for health care. Drug delivery systems - Biochip – Micro needles- Microelectrodes- Neural prosthesis – shape memory implants.

UNIT 5 BIOMEDICAL NANOTECHNOLOGY**9 Hrs.**

Nanotechnology- Medical applications of Nanotechnology- Drug synthesis and delivery- Nanofabrication methods – Nanomaterials in human body- Toxicity in nanomaterials.

Max. 45 Hours

TEXT / REFERENCE BOOKS

1. Tai-Ran Hsu, MEMS & Microsystem, Design and manufacture, Mc. Graw Hill 2002.
2. Malsch, Neelina H., ed., Biomedical Nanotechnology, Washington, DC: CRC Press, 2005
3. Marc J. Madou, Fundamentals of Microfabrication and Nanotechnology, 3rd Edition, Three-Volume Set, CRC Press 2011.
4. Mohamed Gad-el-Hak, The MEMS Handbook, CRC Press, 2005
5. Hocine Yahia, Shape Memory Implants Springer Verlag 2000.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A : 10** questions of 2 marks each - No choice**20 Marks****PART B : 2** questions from each unit of internal choice; each carrying 12 marks**60 Marks**

SBT 1610	GMP AND QUALITY CONCEPTS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

□ To introduce students about Good manufacturing practices quality concepts which would expose them to industrial scenario.

UNIT 1 INTRODUCTION**9 Hrs.**

Basic Concepts: Quality concepts, Quality Control, Quality Assurance, Good Manufacturing Practices, Good Laboratory Practices, Responsibilities. Quality Control: Quality control laboratory: Responsibilities, good laboratory practices, routine controls, instruments, protocols.

UNIT 2 GMP**9 Hrs.**

Good Manufacturing Practice. Legal requirements pertaining to GMP: GMP Guidelines, Standards, Regulatory agencies. Basic Components of GMP: Organization & Personnel, Premises, Equipments, Raw Materials, Complaints and recalls, Specifications, Self inspection.

UNIT 3 GLP**9 Hrs.**

Good Laboratory Practice (GLP) – an overview and basic information, Scope. Principles of GLP: Test Facility Organization and Personnel, Quality Assurance Programme, Facilities, Test Systems, Test and Reference Items, Standard Operating Procedures, Performance of the Study, Reporting of Study Result, Storage and Retention of Records and Materials.

UNIT 4 INSPECTION**9 Hrs.**

Inspections, Quality Audit and Quality System Reviews: Inspections, role of quality audit, role of inspectors, methods of inspection- routine, concise, follow-up and special inspections, frequency and duration of inspections, preparations for inspections, conduct, report and regulatory actions.

UNIT 5 REGULATION**9 Hrs.**

Regulatory bodies – Need and role of regulatory bodies. Different regulatory bodies – FDA, HACCP and their scope. Importance of regulatory approval. ISO 9000 – regulations.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Sidney H. Willig, Good manufacturing Practices for Pharmaceuticals, 5th Edition, Revised and Expanded, Marcel Dekker, Inc. New York, 2005.
2. Jose Rodriguez-Perez, The FDA and Worldwide Current Good Manufacturing Practices and Quality System requirements guidebook for finished pharmaceuticals, American Society for Quality, ASQ Quality Press, Milwaukee, Wisconsin, 2014.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A : 10 questions of 2 marks each - No choice****20 Marks****PART B : 2 questions from each unit of internal choice; each carrying 12 marks****60 Marks**

SBT 1611	BIOLOGY FOR ENGINEERS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To understand the essentials of basic biological principles

UNIT 1 INTRODUCTION TO CELLS**9 Hrs.**

Cell: Functional unit of living organisms - Cell theory - Prokaryotic and eukaryotic cell – bacterial, plant, animal cells - cell components - functions- cell organization – tissues - basic types -cell division: Mitosis, meiosis, cell cycle regulation

UNIT 2 SOCIAL IMPORTANCE**9 Hrs.**

Application of biological sciences and biotechnology to the society - human health care and medicines - pharmaceuticals and nutraceuticals -food and agriculture- pollution management and environment - Biofuels

UNIT 3 INTRODUCTION TO BIOMOLECULES**9 Hrs.**

Biomolecules - classification, salient features - biological significance - carbohydrates, proteins and aminoacids - lipids and fats - nucleic acids - vitamins-Enzymes

UNIT 4 HUMAN PHYSIOLOGY**9 Hrs.**

Human Physiology - Different systems associated with humans- Tissues, organ and physiology of the various systems: Digestive, respiratory, circulatory, skeletal, nervous, excretory and reproductive system - Artificial memory and neural network

UNIT 5 MEDICAL IMPORTANCE**9 Hrs.**

Infectious and non infectious diseases- causative agents, epidemiology, pathogenicity, control and prevention, treatment of AIDS, tuberculosis, Pathology of non infectious and genetic diseases and disorders - cancer, diabetes mellitus, cardiac diseases- neurological disorders-Parkinson's disease

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Satyanarayana, U. Biotechnology, 4th Edition, Books and Allied Pvt. Ltd. Kolkata, 2007.
2. Lehninger A.L, Nelson D.L, Cox .M.M, Principles of Biochemistry. CBS Publications 1993

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A : 10 questions of 2 marks each - No choice****20 Marks****PART B : 2 questions from each unit of internal choice; each carrying 12 marks****60 Marks**

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SCY1601	SPECTROSCOPY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

□ To make the students to understand the basic concepts about the analytical techniques

UNIT 1 UV-VIS SPECTROSCOPY**9 Hrs.**

Principles of radiation – Frank condon principle – Various electronic transitions (185-800 nm) – Beer-Lambert law – Instrumentation of single beam and double beam spectrophotometer – Woodward and Fieser rule – Applications of UV-Visible spectroscopy.

UNIT 2 IR AND RAMAN SPECTROSCOPY**9 Hrs.**

Principles of IR spectra – Instrumentation of IR spectroscopy – Force constant – Effect of hydrogen bonding – Applications of IR spectroscopy – Raman spectroscopy: Principle – Stokes line and antistokes line – Instrumentation – Applications of Raman spectroscopy.

UNIT 3 ¹H NMR AND ¹³C SPECTROSCOPY**9 Hrs.**

General introduction and definition: Chemical shift – Spin-spin interaction – Shielding mechanism – Coupling constants. Nuclear overhauser effect (NOE). Instrumentation of ¹H NMR and ¹³C spectroscopy.

UNIT 4 MASS SPECTROMETRY**9 Hrs.**

Principle of Mass spectra – Instrumentation – Principle of fragmentation – Nitrogen rule – McLafferty rearrangement – Representation of Mass spectrum – Applications of mass spectra.

UNIT 5 IMAGING TECHNIQUES**9 Hrs.**

Scanning electron microscopy – Energy dispersive X-ray spectroscopy – Transmission electron microscopy – Atomic force microscopy – Scanning tunneling microscopy – X-ray photoelectron spectroscopy.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Banwell C.N., and McCash E. M., "Fundamentals of Molecular Spectroscopy", 4th Edition, Tata McGraw Hill, 2000.
2. Silverstein R. M., and Webster F. X., "Spectroscopic Identification of Organic Compounds", 6th Edition, John Wiley & Sons, 2003.
3. Levine I. N., "Molecular Spectroscopy", John Wiley & Sons, 1974.
4. Williams D. H., and Fleming I., "Spectroscopic Methods in Organic Chemistry", 4th Edition, Tata McGraw-Hill Publishing Company, 1988.
5. Kemp W., "Applications of Spectroscopy", English Language Book Society, 1987.

END SEMESTER EXAM QUESTION PAPER PATTERN:**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each – No choice**20 Marks****PART B :** 2 questions from each unit of internal choice, each carrying 12 marks**60 Marks**

(10% problems may be asked)

SCY1602	ENERGY SOURCES	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To know the various sources of energy available and to face the future challenges arising due to energy crisis.

UNIT 1 GLOBAL AND INDIAN ENERGY SCENARIO**9 Hrs.**

Bio-fuels – Nuclear energy – Their utilization pattern in the past, present and future projections of consumption pattern. Power sector reforms – Restructuring of energy supply sector – Energy strategy for future.

UNIT 2 HYDROGEN ENERGY**9 Hrs.**

Hydrogen as a renewable energy source: Sources of Hydrogen – Fuel for Vehicles. Hydrogen Production: Direct electrolysis of water – Thermal decomposition of water – Biochemical methods of hydrogen production. Storage of Hydrogen: Gaseous, Cryogenic and Metal hydride.

UNIT 3 ELECTROCHEMICAL ENERGY**9 Hrs.**

Fuel cells: Principle of working, construction and applications of phosphoric acid fuel cell – Solid oxide fuelcell – Molten carbonate fuel cell – Polymer electrolyte membrane fuel cell. Batteries: Lead-acid battery – Nickel- cadmium battery – Lithium batteries – Nickel hydride batteries.

UNIT 4 BIOENERGY**9 Hrs.**

Thermo-chemical Conversion: Pyrolysis – Combustion – Gasification – Liquefaction. Bio-Chemical Conversion: Aerobic and Anaerobic conversion – Fermentation. Ethanol as a fuel for I.C. engines. Isolation of methane from Biogas and packing and its utilization.

UNIT 5 NUCLEAR ENERGY**9 Hrs.**

Nuclear Energy – Nuclear Chain reaction – Fuel enrichment – Different Types of Nuclear Reactors: Pressurised water reactor – Boiling water reactor – Fast Breeder reactor. Nuclear waste disposal – Nuclear Fusion.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Culp A. W., "Principles of Energy Conversion", 2nd Edition, McGraw-Hill, 1991.
2. Maths D. A., "Hydrogen Technology for Energy", Noyes Data Corp., 1976.
3. Linden D., Handbook: "Batteries and Fuel cell", Mc.Graw Hill, 1984.
4. Bansal N. K., and Kleeman M. K., "Renewable Sources of Energy and Conversion Systems", Tata McGraw Hill, 1990.
5. White L. P., "Biomass as Fuel", Academic Press, 1981.
6. Raymond Murray, Keith Holbert, "Nuclear Energy: An Introduction to the Concepts, Systems, and Applications of NuclearProcesses", 7th Edition, Elsevier Science & Technology, 2014.
7. Arniker H. J., "Essentials of Nuclear Chemistry", New Age Publications, 1996.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each – No choice**20 Marks****PART B :** 2 questions from each unit of internal choice, each carrying 12 marks**60 Marks**

(10% problems may be asked)

SPH1601	ENERGY PHYSICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

To expose the students to the basic principles of energy conversions, materials for energy conversion and energy storage devices.

UNIT 1 ENERGY AND THERMODYNAMICS**9 Hrs.**

Forms of Energy, Conservation of Energy, Entropy, Heat capacity, Thermodynamic cycles: Brayton, Carnot Diesel, Otto and Rankin cycle; Fossil fuels, time scale of fossil fuels and solar energy as an option,.

UNIT 2 ENERGY CONVERSION MATERIALS**9 Hrs.**

Single, poly – and amorphous silicon, GaAs, CdS, Cu₂S, CuInSe₂, CdTe etc. technologies for fabrication of single and polycrystalline silicon solar cells, amorphous silicon solar cells and tandem cells, solar cell modules, photovoltaic systems, space quality solar cells

UNIT 3 PHOTOVOLTAIC CONVERTORS**9 Hrs.**

Introduction- Photovoltaic effect-conversion of solar energy into electrical energy- behaviour of solar cells-basic structure and characteristics of solar cells-single, multi and thin film silicon solar cells-solar cell arrays- PV modules, generators-interfacing PV modules to loads, direct connection of load to PV modules and connection of PV modules to a battery and load together-energy storage alternatives to PV systems..

UNIT 4 THERMOELECTRIC CONVERTERS**9 Hrs.**

Thermoelectric effects, solid state description of thermoelectric effect, Kelvin's thermodynamic relations, analysis of thermoelectric generators, basic assumptions, temperature distribution and thermal energy transfer for generator, co-efficient of performance for thermoelectric cooling,.

UNIT 5 ENERGY STORAGE DEVICES**9 Hrs.**

Cuprates and MgB₂ superconductors and their properties, superconducting wires, Role of superconductor in Electric generator, Magnetic energy storage devices and power transmission. Energy storage systems, Faradaic and non-Faradaic processes, Types of capacitors and batteries, Comparison of capacitor and battery, Charge- discharge cycles, experimental evaluation using Cyclic voltammetry, and other techniques.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Richard C. Neville, "Solar energy conversion: The solar cell", Elsevier Science; 2 edition, 1995
2. Peter Aue, "Advances in Energy systems and technology", Academic Press, 1978.
3. Frank Kreith and Jang Kreider, "Principles of solar engineering", CRC Press; 2 edition, 2000.
4. A. E. Dixon & J. D. Leslie, "Solar energy conversion", Science Direct, 1999.
5. A.Goetzberger, V.U.Hoffmann, "Photovoltaic solar energy generation", Springer-Verlag, 2005.
6. Castaner, S.Silvestre, "Modelling Photovoltaic systems", Pspice John Wiley & Sons, 2002.
7. R.J.Komp, Practical Photovoltaics, "Electricity from solar cells", 3rd edition, Aatec Publ., 2001.
8. R.Messeiger, J.Ventre, "Photovoltaic systems Engg", 2nd edition, CRC Press, 2004.
9. Stanley W Angrist, "Direct energy conversion" (4th edition) –Allyn and Bacon, Inc., 1982
10. B. E. Conway, "Electrochemical supercapacitors", Kluwer Academic Press. *Springer US*, Apr 30, 1999
11. David Linden, "Handbook of Batteries and Fuel Cells", McGraw-Hill, 1984
12. A.G. Milnes and D. L. Feucht, "Heterojunction and metal – semiconductor junctions", Academic Press, 1972.
13. B.G. Streetman, "Solid state electronic devices", 5th Edition, Prentice Hall, 2000.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****PART A :** 10 questions of 2 marks each – No choice**PART B :** 2 questions from each unit of internal choice, each carrying 12 marks -**Exam Duration : 3 Hrs.****20 Marks****60 Marks**

(10% problems may be asked)

SPH1602	GEOPHYSICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

To provide a qualitative idea on the fundamentals of seismology and theoretical understanding of various physical properties of earth.

UNIT 1 SEISMOLOGY 9 Hrs.

Introduction-Seismology-P-waves-S waves, their velocities-the location of epicenters-Effect of Boundaries-Major discontinuities-.Seismic energy sources-Detectors-Interpretation of time and distance curves.-Derivation of properties from the velocities.

UNIT 2 INTERNAL STRUCTURE OF EARTH 9 Hrs.

Introduction-Seismic waves-Rayleigh waves and love waves-Study of earth by seismic waves-Earthquake seismology-Horizontal and vertical seismograph-Seismograph equation-Internal structure of earth..

UNIT 3 EARTHQUAKES AND GRAVITY 9 Hrs.

Earthquakes: Focus, Magnitude, Frequency-Detection and prediction-Gravity-Absolute and relative measurements of gravity-Worden gravimeter-Application of gravity methods.

UNIT 4 GEOMAGNETISM 9 Hrs.

Geomagnetism-Definitions, magnetic field,-Measurements Proton precession magnetometer, Alkali vapour magnetometer-Theory of Earth magnetism-Dynamo theory of earth magnetism-Magnetic surveying-application.

UNIT 5 GEOCHRONOLOGY AND GEOTHERMAL PHYSICS 9 Hrs.

Geochronology-Radioactivity of the earth-Radioactive dating of rocks and minerals-Geological time scale Geothermal Physics: Flow of heat to the surface of earth-Sources of heat within earth--Process of heat transport-Internal temperature of earth..

Max. 45 Hours

TEXT / REFERENCE BOOKS

1. Cook,A.H., "Physics of the Earth and Planets", I Ed, McMillan Press, London ,1973
2. William Lourie, "Fundamentals of Geophysics", II Ed, Cambridge University Press, 1982
3. Garland .G.D., "Introduction to Geophysics", 11 Ed, WB Saunder Company, London.1979
4. Ramachandra Rao M.B., "Out lines of Geophysical prospecting-A manual for Geologists", Prasaraanga University ofMysore, Mysore, 1975
5. Telford, W.M. Geldart, L. P. Sheriff R.E. and Keys .D.A., "Applied Geophysics", Oxford-IBH Publishing Co.Pvt.Ltd. NewDelhi. 1976
6. Rama Rao.B.S., Murthy I.V.R., "Gravity and magnetic methods of prospecting", Arnold Heinemann Publishers, New Delhi, 1978

END SEMESTER EXAM QUESTION PAPER PATTERN

Max. Marks : 80

Exam Duration : 3 Hrs.

PART A : 10 questions of 2 marks each – No choice **20 Marks**

PART B : 2 questions from each unit of internal choice, each carrying 12 marks - **60 Marks**

SPH1603	SPACE PHYSICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

To provide the Windows to the Universe, Solar System, and Planetary Atmospheres and also to expose the students to the instruments related with space physics.

UNIT 1 ASTRONOMY FUNDAMENTALS, TELESCOPES FOR ASTRONOMY 9 Hrs.

Radiation from space, radiation laws, Basic terminology used in astronomy, Introduction to the various types of astronomy: optical, radio, IR, UV, X-ray, γ ray, Gravitational etc. Introduction to Optical, IR, X ray, γ ray telescopes, brief description of the various instruments.

UNIT 2 RADIO TELESCOPES AND RECEIVERS 9 Hrs.

Antennas, Types of interferometers, array, Radio telescopes of the world including GMRT, Ooty, PRL, Radio telescope receivers, total power receiver, Dicke receiver, correlation receiver, noise temperature. Noise sources.

UNIT 3 SOLAR SYSTEM, TERRESTRIAL AND JOVIAN PLANETS 9 Hrs.

Origin of solar system, occurrence of planetary systems, celestial mechanics, properties of the sun. Orbital and physical characteristics, atmosphere, Studies of Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and their moons. Recent explorations of various planets..

UNIT 4 SCINTILLATION, PLASMA, IONIZATION 9 Hrs.

Interplanetary scintillation, interstellar scintillation, methods for probing solar wind, use of IPS in measurement of solar wind, study of irregularities in the interplanetary medium, properties of plasma at different distances from earth, photoionisation, cosmic ray ionization, meteoric ionization, various resonances in plasma, various waves in plasma, measurement procedures.

UNIT 5 DIAGNOSTIC TECHNIQUES FOR PROBING IONOSPHERE 9 Hrs.

Radio wave propagation in absence and presence of magnetic field, Formation of Chapman layer, Appleton Hartree equation and its explanation, propagation of radio waves at different frequencies. Ground based, balloonbased, space based techniques, Ionosonde, air glow, P.R.Radar, radio scintillation, magnetometer, Langmuir probe, electrostatic analyzer, mass spectrometer, radiosonde.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Glasstone. Van Nostrand, "**Sourcebook on the Space Sciences**", Princeton, N.J., 1965
2. John Daniel Kraus Cygnus, "Radio Astronomy: Quasar Books"; 2nd edition, 1986
3. W.N.Christiansen & J.A.Hogbom, "Radiotelescopes, Radio Telescopes", 1st edition, Cambridge University Press 1969
4. H.Karttunen, P.Kroger, H.Oja, M.Poutanen, K.J.Donner, "Fundamental Astronomy", Springer-Verlag; 2nd edition, 1994
5. N.Henbest, M.Marten, "The new Astronomy", Cambridge University Press, 1996
6. S.K.Alurkar, "Solar and Interplanetary Disturbances", World Scientific Publishing Company, 1997.
7. J.A.Ratcliffe, "An introduction to ionosphere and magnetosphere", Cambridge : Cambridge University Press, 1972
8. A.Giraud, M.Petit, "Ionosphere techniques and phenomena", First Edition, D. Reidel Pub Co, 1978.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.**

PART A : 10 questions of 2 marks each – No choice **20 Marks**

PART B : 2 questions from each unit of internal choice, each carrying 12 marks **60 Marks**

SPH1604	ASTROPHYSICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

To provide qualitative description of interesting astronomical aspect and evolution of structures in the Universe.

UNIT 1 GRAVITY**9 Hrs.**

Newtonian gravity and basic potential theory, Simple orbits – Kepler's laws and precession, flat rotation curve of galaxies and implications for dark matter, virial theorem and simple applications, role of gravity in different astrophysical systems,.

UNIT 2 RADIATIVE PROCESSES**9 Hrs.**

Overview of radiation theory and Larmor formula, Different radiative processes : Thomson and Compton scattering, Bremsstrahlung, Synchrotron [detailed derivations are not expected] Radiative equilibrium, Planck spectrum and properties; line widths and transition rates in QT of radiation, qualitative description of which radiative processes contribute in which waveband/ astrophysical system, distribution function for photons and its moments, elementary notion of radiation transport through a slab, concept of opacities.

UNIT 3 GAS DYNAMICS**9 Hrs.**

Equations of fluid dynamics; equation of state in different regimes [including degenerate systems]; Models for different systems in equilibrium, Application to White dwarfs/Neutron stars, Simple fluid flows including supersonicflow, example of SN explosions and its different phases.

UNIT 4 STELLAR SYSTEM**9 Hrs.**

Basic equations of stellar structure, Stellar energy sources; qualitative description of numerical solutions for stars of different mass, homologous stellar models, Stellar evolution, Evolution in the HR-Diagram.

UNIT 5 GALACTIC DYNAMICS**9 Hrs.**

Milky Way Galaxy, Spiral and Elliptical galaxies, Galaxies as self gravitating systems; spiral structure, Supermassive black holes, Active galactic nuclei.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Bradley W. Carroll, D.A.Ostlie, "Modern Astrophysics", Addison-Weseley, 1996.
2. Frank H. Shu, "The physical universe: An Introduction to Astronomy", University Science books, 1982.
3. Frank H. Shu, "The Physics of Astrophysics", Volume I and II, University Science books, 2010.
4. T. Padmanabhan, "Theoretical Astrophysics", Volumes I, II and III, Cambridge University Press; First edition, 2001.
5. Aramb Rai Choudhuri, "The Physics of fluids and plasmas", Cambridge University Press, 1998.
6. Martin. Harwit, "Astrophysical concepts", 3rd edition, Springer Science & Business Media, 1998.
7. James Binney & Michael Merrifield, "Galactic Astronomy", Princeton University Press, 1998.
8. James Binney & Scott Tremaine, "Galactic dynamics", 2nd edition, Princeton University Press, 2008.
9. A. K. Kembhavi and J. V. Narlikar, "Quasars and Active Galactic Nuclei", Cambridge University Press, 1999.
10. Bradley M. Peterson, "An Introduction to Active Galactic Nuclei", Cambridge University Press, 1997.

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each – No choice**20 Marks****PART B :** 2 questions from each unit of internal choice, each carrying 12 marks**60 Marks**

SPH1605	ATOMIC AND NUCLEAR PHYSICS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

To enable the students understand the laws that govern the structure and properties of the atom, molecules and the nucleus. Also to provide an introduction to the elementary particles.

UNIT 1 IONS, ELECTRONS AND ATOMIC STRUCTURE**9 Hrs.**

Detection of charged particles in electric and magnetic fields-Dunnigton's method for e/m-positive ray analysis: Thomson's parabola method-Bohr's atom model-Sommerfeld's relativistic atom model-the Vector atom model and the quantum numbers-comparison with quantum model. Coupling schemes: L-S coupling and j-j coupling-Pauli's exclusion principle-Magnetic moment due to (i) orbital motion of the electron (ii) due to spin-Sternand Gerlach experiment

UNIT 2 ATOMIC AND MOLECULAR SPECTRA**9 Hrs.**

Spin-orbit interaction in atomic spectra-fine structure and sodium doublet-Zeeman effect: experiment- classical result-Quantum mechanical explanation-anomalous Zeeman effect-Paschen Back effect-Stark effect (qualitative) Origin of a pure rotational spectra of a rigid linear molecule-vibrating diatomic molecule as a quantum harmonic oscillator-pure vibrational spectra-Spectroscopy (Schematic): Ultraviolet-Infrared-absorption-Raman.

UNIT 3 PROPERTIES OF NUCLEI AND RADIOACTIVITY**9 Hrs.**

Isobars, isotopes, mirror nuclei-Nuclear mass and binding energy-Parity-Nuclear spin-Mass defect and packing fraction-Stable nuclei-Nuclear size, nuclear magnetic moment-Electric quadrupole moment-Nuclear energy levels. Radioactivity: Range and stopping power of alpha particles.-Geiger-Nuttall law-Feature of alpha decay Tunnelling-Beta ray spectrum-Energetic of beta decay-Detection of neutrino-Gamma ray absorption in matter.

UNIT 4 NUCLEAR MODELS, FISSION AND FUSION**9 Hrs.**

Neutron: Discovery, Mass, Half life, Magnetic Moment, sources and detection-Shell model, Liquid drop theory-Nuclear fission-Spontaneous fission and potential barrier-Self sustaining Chain Reaction-Neutron balance in Nuclear Reactor-Uncontrolled chain reaction-Nuclear Fusion-radiation hazards and safety measures-Controlled fusion-Fusion in stars..

UNIT 5 ELEMENTARY PARTICLE PHYSICS**9 Hrs.**

Discovery of cosmic rays-primary and secondary rays-cosmic ray showers-discovery of positron-the mesons-origin of cosmic rays-the Big-Bang theory-thermal history of the Universe-Hubble's law-the future of the universe-dark matter. Particles and anti-particles-antimatter-the fundamental interactions-elementary-particle quantum numbers-conservation laws and symmetry-the Quark model-quantum chromodynamics-the standard model-unification of interactions-Grand unified theories. (Qualitative).

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. R.Murugesan and Kiruthiga Sivaprasath, "Modern Physics" 14thEd, S.Chand and Company Ltd, 2009
2. A.B. Gupta and Dipak Ghosh, "Atomic and Nuclear Physics", Books and Allied(P)Ltd, Calcutta, 1997
3. Ronald Gautreau and William Savin, "Modern Physics, Schaum's outline series, 2nd Ed., Tata McGraw Hill P.Ltd, 2004
4. K.Gopla Krishnan, Atomic and Nuclear Physics", 3rd Ed. ,MacMillan India Ltd. 1994
5. H.S.Mani and Mehta (G.K) , "Introduction to Modern Physics", Affiliated EWast-West Press, 1989
6. R.P.Feynmann, R.B. Leighton and M.Sands , "The Feynmann Lectures on Physics", Vol III, 7th Indian reprint, Narosa Pub. Ltd, 1992

END SEMESTER EXAM QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each – No choice**20 Marks****PART B :** 2 questions from each unit of internal choice, each carrying 12 marks**60 Marks**

SIT1402	MOBILE APPLICATION DEVELOPMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To develop applications for current and emerging mobile computing devices, performing tasks at all stages of the software development life-cycle.
- To learn how to utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.
- To design, implement and deploy mobile applications using an appropriate software development environment.

UNIT 1 INTRODUCTION AND UI INTERFACE**9 Hrs.**

Introduction to mobile technologies, mobile operation systems, Mobile devices-pros and cons, Introduction to Android, Versions, Features, Architecture, UI Widgets and Events handling, Layouts, Required tools-Eclipse, ADT, AVD, Application structure, AndroidManifest file, Android design philosophy, Creating Android applications.

UNIT 2 BUILDING BLOCKS AND DATABASES**9 Hrs.**

Introduction to Activities and Intents-Understanding Activity life cycle, Linking Activities, Passing Data, Toast, Displaying a Dialog Window and Notifications. Content Provider, Services, Broadcast receivers, accessing databases, sample applications, debugging and deploying app, publish in Playstore.

UNIT 3 C PROGRAMMING**9 Hrs.**

C- Data Types and Expressions, Decision Making and Looping, Objects and Classes, Property, Messaging, Categories and Extensions, Fast Enumeration – NSArray, NSDictionary, Methods and Selectors, Static & Dynamic objects, Exception handling, Memory management, Required Tools- Xcode, iOS Simulator, Instruments, ARC, frameworks.

UNIT 4 INTRODUCTION TO IOS**9 Hrs.**

Introduction to iPhone, History, Versions, Features, MVC Architecture, View Controller - Building the UI and Event handling, Application life cycle, Tab Bars, Story Boards and Navigation Controllers, Table View, Push Notification, Database handling, Debugging and Deployment, Publishing app in Appstore, sample applications.

UNIT 5 WINDOWS MOBILE APP DEVELOPMENT**9 Hrs.**

Introduction to Windows Phone 8, Application Life cycle, UI Designing and events, Building, Files and Storage, Network Communication, Push Notification, Background Agents, Maps and Locations, Data Access and storage, Introduction to Silverlight and XAML, Running and Debugging the App, Deploying and Publishing.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Reto Meier, "Professional Android Application Development", Wrox Edition.
2. <http://www.tutorialspoint.com/android/index.htm>
3. <http://developer.android.com/training/index.html>
4. Stephen G. Kochan, "Programming in COURSE OBJECTIVE C", Addison Wesley, 4th Edition.
5. David Mark, Jack Nutting and Jeff LaMarche, "Beginning iOS 5 Development", Apress Edition.
6. Baijian Yang, Pei Zheng, Lionel M. Ni, "Professional Microsoft Smartphone Programming", Wrox Edition.

END SEMESTER QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No Choice**20 Marks****PART B :** 2 questions from each unit of internal choice, each carrying 12 marks**60 Marks**

SIT1606	BIG DATA	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To understand the dominant software systems and algorithms for coping with Big Data.
- Apply appropriate analytic techniques and tools to analyze big data, create statistical models, and identify insights that can lead to actionable results
- To explore the ethical implications of big data research, and particularly as they relate to the web

UNIT 1 INTRODUCTION**9 Hrs.**

Introduction to Big Data – Challenges of Conventional Systems - Nature of Data - Small data-Medium data – Big Data – Small data vs Big data - Sources of Big Data- Big Data Characteristics – Big Data Analytics – Importance of Big Data, Big Data in the Enterprise – Big Data Enterprise Model – Building a Big Data Platform -Big data in Social and Behavioral sciences.

UNIT 2 HDFS, HADOOP AND HADOOP INFRASTRUCTURE**9 Hrs.**

Hadoop and Databases - Typical Datacenter Architecture - Adding Hadoop to the Mix - Key Benefit - Flexibility: Complex Data Processing - HDFS - Hadoop Infrastructure -Architecture – Different in Data Model and Computing Model – HDFS Files and Blocks , Components of HDFS - Hadoop framework - HDFS-Map Reduce Framework-Data Loading techniques-Hadoop Cluster Architecture-Hadoop Configuration files-Hadoop Cluster modes-Single Node-Multi Node-Fully distributed node.

UNIT 3 HADOOP MAP REDUCE FRAMEWORK**9 Hrs.**

Relationship between MapReduce and HDFS- Relationship between MapReduce and HDFS- Clients, Data Nodes, and HDFS Storage - MapReduce workloads.

Hadoop framework- Hadoop data types-Hadoop map reduce Paradigm-Map and Reduce Tasks-Map reduce Execution framework-Partitioners and Combiners-Input formats (Input Splits and Records, Text Input, Binary Input, Multiple Inputs)- Output Formats (TextOutput, BinaryOutPut, Multiple Output)- Hadoop Mapreduce programming-Advanced Map reduce concepts- Counters, Custom Writables-Unit testing framework-Error Handling-Tuning- Advanced Map reduce.

UNIT 4 HADOOP IMPLEMENTATION AND HADOOP ECO SYSTEM TOOLS**9 Hrs.**

Hadoop Implementation - Job Execution - Hadoop Data Types - Job Configurations - Input and Output Formats ECO system tools- Pig's Data Model, Pig Latin, Developing & Testing Pig Latin Scripts- Writing Evaluation, Filter, Load & Store Functions-Hive- Hive Architecture- Comparison with Traditional Database- HiveQL: Data Types, Operators and Functions- Hive Tables- Querying Data-Advance Hive, NoSQL Databases -HBase-Loading Data in Hbase-Querying Data in Hbase

UNIT 5 HADOOP PROJECT ENVIRONMENT**9 Hrs.**

HBase: Introduction to HBase, Client API's and their features, Available Client, HBase Architecture, MapReduce Integration. HBase: Advanced Usage, Schema Design, Advance Indexing, Coprocessors, Hadoop 2.0- MRv2 –YARN- NameNode High Availability, HDFS Federation, MRv2, YARN, Running MRv1 in YARN, Upgrade your existing MRv1 code to MRv2, Programming in YARN framework-cover Apache Oozie Workflow Scheduler for Hadoop

Max. 45 Hours**TEXT / REFERENCES BOOKS**

1. WA Gmob , "Big Data and Hadoop", Kindle Edition, 2013
2. Eric Miller, "A Overview of Map Reduce and its impact on Distributed Data", Kindle Edition, 2012.
3. Strata, " Big Data Now", O'Reily Media Inc., Kindle Edition, 2012.

END SEMESTER QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No Choice**20 Marks****PART B :** 2 questions from each unit of internal choice, each carrying 12 marks**60 Marks**

SIT1609	GAME PROGRAMMING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To provide introductions to event driven programming, game engine scripting, game engine class structures.
- Learning to plan and to report on a significant programming project.
- Learn to work in programming in teams, and learn to use standard game development environments, in particular the Unity3d development platform.

UNIT 1 3D GRAPHICS FOR GAME PROGRAMMING**9 Hrs.**

Coordinate Systems, Ray Tracing, Modelling in Game Production, Vertex Processing, Rasterization, Fragment Processing and Output Merging, Illumination and Shaders, Parametric Curves and Surfaces, Shader Models, Image Texturing, Bump Mapping, Advanced Texturing, Character Animation, Physics-based Simulation

UNIT 2 GAME DESIGN PRINCIPLES**9 Hrs.**

Character development, Story Telling, Narration, Game Balancing, Core mechanics, Principles of level design, Genres of Games, Collision Detection, Game Logic, Game AI, Path Finding.

UNIT 3 GAMING ENGINE DESIGN**9 Hrs.**

Renderers, Software Rendering, Hardware Rendering, and Controller based animation, Spatial Sorting, Level of detail, collision detection, standard objects, and physics

UNIT 4 GAMING PLATFORMS AND FRAMEWORKS**9 Hrs.**

Flash, DirectX, OpenGL, Java, Python, XNA with Visual Studio, Mobile Gaming for the Android, iOS, Game engines - Adventure Game Studio, DXStudio, Unity.

UNIT 5 GAME DEVELOPMENT**9 Hrs.**

Developing 2D and 3D interactive games using OpenGL, DirectX – Isometric and Tile Based Games, Puzzle games, Single Player games, Multi-Player games.

Max. 45 Hours**TEXT REFERENCE BOOKS**

1. David H. Eberly, "3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics" Morgan Kaufman, 2 Edition, 2006.
2. Jung Hyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC, 1st edition, 2011.
3. Mike McShaffry, "Game Coding Complete", Third Edition, Charles River Media, 2009.
4. Jonathan S. Harbour, "Beginning Game Programming", Course Technology PTR, 3 edition, 2009.
5. Ernest Adams and Andrew Rolings, "Fundamentals of Game Design", Prentice Hall 1st edition, 2006.

END SEMESTER QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A : 10 questions of 2 marks each - No Choice****20 Marks****PART B : 2 questions from each unit of internal choice, each carrying 12 marks****60 Marks**

SIT1608	GREEN COMPUTING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To study about existing green computing strategies
- fundamental challenges in achieving green operations of computing units
- Assess enterprise-wide and personal computing and computing related energy consumption.

UNIT 1 GREEN COMPUTING FUNDAMENTALS**9 Hrs.**

Green IT fundamentals: Business, IT, and the environment – Green computing: Carbon foot print - scoop on power – Green IT strategies: Drivers, Dimensions, and Goals – Environmentally responsible business: Policies, Practices and Metrics.

UNIT 2 GREEN ASSETS AND MODELING**9 Hrs.**

Green Assets: Buildings, data centers, networks and devices – Green business process management: Modeling, optimization and collaboration – Green enterprise architecture – Environmental intelligence – Green supply chains – Green information systems: Design and development models.

UNIT 3 GRID FRAMEWORK**9 Hrs.**

Virtualizing of IT systems – Role of electric utilities, telecommuting, teleconferencing and teleporting – Materials recycling – Best ways for green PC – Green data center – Green grid framework

UNIT 4 GREEN COMPLIANCE**9 Hrs.**

Socio-cultural aspects of green IT – Green enterprise transformation roadmap – Green Compliance: protocols, standards and audits –Emergent carbon issues: technologies and future. TheWayClimate SaversComputing Initiative Do - The Climate Savers Computing Initiative - What Green Computing Impact OrganizationSupplies - Green Computers Initiatives - Green Computing Impact Organization Overview - Green Electronics Council - Going Green Can Be Truly Challenging - The Green Grid Framework - The CSCI Top Secrets Revealed - The EPEAT Standards - To Have a Green Computer - Green Computing Means to Save Your Money and Your Business - Finances - Green Computing Initiative Platforms.

UNIT 5 CASE STUDIES**9 Hrs.**

The Environmentally Responsible Business Strategies (ERBS) – Case study scenarios for trial runs – Casestudies – Applying green IT strategies and applications to a home, hospital, packaging industry and telecom sector.

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Bhuvan Unhelkar, "Green IT Strategies and Applications- Using Environmental Intelligence", CRC Press, June 2011.
2. Woody Leonhard, Katherrine Murray, "Green Home computing for dummies", August 2009.
3. Warland & Pravin Varaiya, "High Performance Communication Networks", Jean Harcourt Asia Pvt. Ltd., II Edition, 2001.
4. Jason Harris, "Green Computing and Green IT- Best Practices on regulations & industry", Lulu.com, 2008.
5. Alin Gales, Michael Schaefer, Mike Ebbers, "Green Data Center: steps for the Journey", Shoff/IBM rebook, 2011.
6. John Lamb, "The Greening of IT", Pearson Education, 2009.

END SEMESTER QUESTION PAPER PATTERN**Max. Marks : 80****Exam Duration : 3 Hrs.****PART A : 10 questions of 2 marks each - No Choice****20 Marks****PART B : 2 questions from each unit of internal choice, each carrying 12 marks****60 Marks**

SCS1302	COMPUTER GRAPHICS AND MULTIMEDIA SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVES

- To gain knowledge to develop, design and implement two and three dimensional graphical structures
- To enable students to acquire knowledge of Multimedia compression and animations.
- To learn creation, Management and Transmission of Multimedia objects.

UNIT 1 BASICS OF COMPUTER GRAPHICS**9 Hrs.**

Output Primitives: Survey of computer graphics – Overview of graphics systems – Line drawing algorithm – Circle drawing algorithm – Curve drawing algorithm - Attributes of output primitives – Anti-aliasing.

UNIT 2 2D TRANSFORMATIONS AND VIEWING**8 Hrs.**

Basic two dimensional transformations – Other transformations – 2D and 3D viewing – Line clipping – Polygon clipping – Logical classification – Input functions – Interactive picture construction techniques.

UNIT 3 3D CONCEPTS AND CURVES**10 Hrs.**

3D object representation methods - B-REP , sweep representations, Three dimensional transformations. Curve generation - cubic splines, Beziers, blending of curves- other interpolation techniques, Displaying Curves and Surfaces, Shape description requirement, parametric function. Three dimensional concepts. Introduction- Fractals and self similarity- Successive refinement of curves, Koch curve and peano curves.

UNIT 4 METHODS AND MODELS**8 Hrs.**

Visible surface detection methods – Illumination models – Halftone patterns – Dithering techniques – Polygon rendering methods – Ray tracing methods – Color models and color applications.

UNIT 5 MULTIMEDIA BASICS AND TOOLS**10 Hrs.**

Introduction to multimedia - Compression & Decompression – Data & File Format standards – Digital voice and audio – Video image and animation. Introduction to Photoshop – Workplace – Tools – Navigating window – Importing and exporting images – Operations on Images – resize, crop, and rotate. Introduction to Flash – Elements of flash document – Drawing tools – Flash animations – Importing and exporting - Adding sounds – Publishing flashmovies – Basic action scripts – GoTo, Play, Stop, Tell Target

Max. 45 Hours**TEXT / REFERENCE BOOKS**

1. Donald Hearn, Pauline Baker M., "Computer Graphics", 2nd Edition, Prentice Hall, 1994.
2. Tay Vaughan, "Multimedia", 5th Edition, Tata McGraw Hill, 2001.
3. Ze-Nian Li, Mark S. Drew, "Fundamentals of Multimedia", Prentice Hall of India, 2004.
4. D. McClelland, L.U. Fuller, "Photoshop CS2 Bible", Wiley Publishing, 2005.
5. James D. Foley, Andries van Dam, Steven K Feiner, John F. Hughes, "Computer Graphics Principles and Practice, 2nd Edition in C, Addison Wesley, ISBN – 981-235-974-5
6. William M. Newman, Robert F. Sproull, "Principles of Interactive Computer Graphics", Second Edition, Tata McGraw-Hill Edition.

END SEMESTER QUESTION PAPER PATTERN**Max. Marks : 80 Exam Duration : 3 Hrs.****PART A :** 10 questions of 2 marks each - No Choice**20 Marks****PART B :** 2 questions from each unit of internal choice, each carrying 12 marks**60 Marks**



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SCHOOL OF BIO AND CHEMICAL ENGINEERING

DEPARTMENT OF BIOTECHNOLOGY

Board of Studies 2018-2019 (EVEN SEM)

Minutes of Meeting

Date: 01-12-2018 (Saturday)

10.00am-12.00pm

Chair-person : Dr.Ramesh Kumar, Prof and Head

Attendees **Dr. Parthiban.M.**, External Member
Professor and Head, Department of Animal Biotechnology, Madras
Veterinary college, Chennai 600007

Dr.P.Venkatachalam, External Member
Professor and Head, Department of Genetics, SRMC

Dr. Valli Nachiyar C, Internal member

Dr. Jayshree Nellore, Internal member

The Chair-person welcomed the members to table the agenda.

Item 1: To discuss on the modifications to the existing regulations (2015) of B.Tech Biotechnology and M.Tech (Biotechnology) to be implemented from 2019-2020.

- External member suggested in reducing the number of credits required for theory and introducing credits for internships and short-term professional courses.
- Dr.Jayshree suggested that the students need to be engaged more on practical's with laboratory assignments.
- Dr.Valli suggested in Improving the School-Industry Collaboration in Curriculum Development
- External member suggested to introduce Case method teaching to improve student learning,
- The need for updating the Practical syllabus was suggested by Dr.Ramesh

The suggestions were welcomed by the chair person

Item 2: To consider and approve the value added courses offered by the Department of Biotechnology

The Department of Biotechnology is offering the following value added courses:

- Introduction To Matlab
- Art Of Scientific Writing
- Bio Enterprenurship
- R Programming
- Mushroom Training

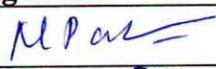
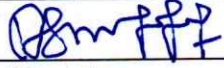
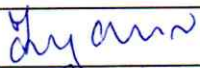
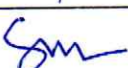
The syllabi of the courses were discussed in the Board of Studies of the Department of Biotechnology and the board has recommended the same for approval.

The detailed syllabi of the value added courses are given in Annexure 1.

The Academic Council may consider and approve the same.

Resolution:

After discussion the above item was approved.

External Member	Signature
Dr. Parthiban.M	
Dr.P.Venkatachalam	
Internal Member	Signature
Dr. Jayshree Nellore	
Dr.Valli Nachiyar	
Dr. Karthick Raja Namasivayam	



Dr.Ramesh Kumar
(Head of the Department)

HEAD OF THE DEPARTMENT
DEPARTMENT OF BIOTECHNOLOGY
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SCHOOL OF BIO AND CHEMICAL ENGINEERING

DEPARTMENT OF BIOTECHNOLOGY

*Organizes value added course
on*

ART OF SUCCESSFUL FOR SCIENTIFIC WRITING

OBJECTIVES:

Total: 30 Hrs

This course teaches students to become more effective writers, using practical examples and exercises.

COURSE CONTENT

Module 1: Ethics in Research Publication	6 Hrs
Module 2: Writing a Scientific Review Article	6 Hrs
Module 3: How to Write a Scientific research Article	6 Hrs
Module 4: How to Avoid plagiarism	6 Hrs
Module 5: Use of Drawing and Graphical Tools	6 Hrs

Outcomes:

- Students can get knowledge in scientific review article writing
- Students can get opportunities in E-Publishing Companies



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*Organizes value added course
on*

INTRODUCTION TO MATLAB FOR BIOSCIENCE

OBJECTIVES

- Courses cover the basics of MATLAB, tips, and tricks, and advanced techniques for specialized areas.
- To apply MatLab techniques in bioprocess engineering and computational biology.

TOTAL: 30 HRS

MODULE 1: DESKTOP, VARIABLES, AND DATA TYPES

6 HRS

Introduction to MATLAB, Creating Variables, Some Useful MATLAB Functions, Data Types.

MODULE 2: BASIC PLOTTING

6 HRS

Creating simple plots, Adding titles, axis labels, and annotations, Multiple data sets in one plot, Specifying line styles and colors.

MODULE 3: GRAPHICS WITH MATLAB

6 HRS

Basic 2D, 3D plots, Graphic handling

MODULE 4: PROGRAMMING WITH MATLAB

6 HRS

Applications of MATLAB Programming

MODULE 5: MATHEMATICAL COMPUTING WITH MATLAB

6HRS

Algebraic equations, Basic Symbolic Calculus, and Differential equations.

OUTCOMES:

- Able to use Matlab for interactive computations.
- Familiar with memory and file management in Matlab.
- Able to generate plots and export this for use in reports and presentations



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DEPARTMENT OF BIOTECHNOLOGY

Organizes value added course on

"BIO ENTREPRENEURSHIP"

OBJECTIVES

- Spirulina cultivation and its upscaling through economically feasible protocols.
- Identify the factors in the selection of a suitable site for Eucheuma farming and conduct test planting.
- the objective is to compost organic wastes, not for the disposal of solid organic wastes.

COURSE CONTENT

TOTAL : 30 HRS

Module 1: Spirulina Cultivation:

10 Hrs

Growing Conditions of Spirulina, Spirulina Cultivation, and Production, Harvesting of Spirulina, Cost, and Profits in Spirulina Farming.

Module 2: Seaweed cultivation:

10 Hrs

Site selection, installation of test plants, preparation of the farm site, construction of Eucheuma farm, management of Eucheuma farm, harvesting, drying, maintenance of the farm.

Module 3: Vermicomposting:

10 Hrs

Introduction, Materials for the preparation of Vermicompost, Vermicompost Production Methodology, Advantages of vermicompost, Pests, and Diseases of vermicompost

OUTCOMES

- The course will be an attempt to train the interested Students for all aspects of Spirulina, Seaweed, Vermicomposting at small and large scale upscaling, harvesting, drying, and processing.
- Source of income generation either independently or through integrating with progressive farmers and established entrepreneurs.



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DEPARTMENT OF BIOTECHNOLOGY

Organizes value added course on

Mushroom Farming

OBJECTIVES:

- To explain and apply the basic skills involved in the cultivation of edible mushrooms.
- To explain the post-harvest process of edible mushroom farming harvesting, packaging, preserving and having basic knowledge of marketing their mushrooms.

MODULE 1: Production of Oyster Mushrooms (*Pleurotus Florida*) – 15 Hours

1. Introduction to edible mushrooms.
2. Substrate Preparation, Sterilization: Boiling, Steam sterilization, chemical sterilization.
3. Oyster mushroom's Spawn Production.
4. Production Process and Maintenance of humidity, temperature, pest management
5. Harvesting and value-added products: Soup preparation, Mushroom powder.

MODULE 2: Production of Milky Mushrooms (*Calocybe spp*) – 15 Hours

1. Introduction to Milky mushroom
2. Substrate Preparation, Sterilization: boiling, Steam sterilization, chemical sterilization
3. Milky mushroom's Spawn Production using various substrates
4. Production Process: Spawning and casing
5. Harvesting and value-added products: Soup preparation, Mushroom powder
6. Cost-benefit analysis

OUTCOMES:

- Students can start a small-scale industry of Mushroom cultivation.
- Students study the morphology and types of Mushrooms.
- They are aware of the identification of edible and poisonous Mushrooms. Students will be able to produce spawn on their own.



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SCHOOL OF BIO AND CHEMICAL ENGINEERING

DEPARTMENT OF BIOTECHNOLOGY

*Organizes value added course
on*

"R Programming"

OBJECTIVES

- This course objective is to provide a practical introduction to the R programming language.
- Explore and understand how to use the R documentation.

COURSE CONTENT

TOTAL: 30 HRS

Module 1: The R Statistical Programming Language, The RStudio Integrated development environment (IDE)	6 Hrs
Module 2: Data importation methods, Basic R Data Types	6 Hrs
Module 3: Data processing and manipulation techniques.	6 Hrs
Module 4: External add-in packages for R, Summary statistic functions	6 Hrs
Module 5: Data visualizations using ggplot, Error types.	6 Hrs

OUTCOMES

By the end of this course, Students be able to:

- Download and install R and RStudio
- Navigate and optimize the R integrated development environment (IDE) RStudio
- Install and load add-in packages
- Import external data into R for data processing and statistical analysis



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SCHOOL OF BIO AND CHEMICAL ENGINEERING

DEPARTMENT OF BIOTECHNOLOGY

Board of Studies 2019-2020 (ODD SEM)

Minutes of Meeting

Date : 01-06-2019 (Saturday)

10.00am-12.00pm

Chair-person : **Dr. Wilson Aruni**

Attendees : **Dr. Chirayu Padhiar**, External Member
Senior Medical Director, Life Cell International Pvt., Chennai.

Dr. Parthiban.M., External Member
Professor and Head, Department of Animal Biotechnology,
Madras Veterinary college, Chennai 600007

Dr. Elizabeth Rani, External Member
Head of the Department, Department of Biotechnology,
Hindustan College of Arts and Science, Chennai

Dr. Ramesh kumar V, Internal member

Dr. Valli Nachiyar C, Internal member

Dr. Jayshree Nellore, Internal member

The Chair-person welcomed the members. He invited Dr.Ramesh Kumar, Head, Department of Biotechnology to table the agenda.

Agenda of the meeting; Syllabus revisions and implementation in 2019- 2020;

B Tech Biotechnology

- The total number of credits have been revised from 190 to 165
- Industry 4.0 course to be implemented
- Interdisciplinary project to be introduced in Semester VI
- Major shuffling in elective courses.



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M Tech Biotechnology

- The total number of credits have been revised from 94 to 68
- Industry 4.0 course to be implemented
- Major shuffling in elective courses.

Following which discussions were held as;

The Chairperson abridged the members that, as per AICTE norms for Engineering course, the total number of credits has to be reduced. Accordingly, the number of credits to be obtained in 2019 regulations would be 165. To attain this number of credits along with introduction of few mandatory courses, a major reshuffling has to be done.

Dr Ramesh Kumar suggested introduction of Fundamentals of Python Engineering (theory and practical) and Biomechanics in Semester I

Dr Parthiban recommended implementation of both theory and practical basic course, Microbiology and Cell Biology in Semester I.

Dr Valli Nachiyar suggested the experiments to be included in the lab course.

Dr Elizabeth Rani elaborated on the need of implementation of interdisciplinary projects. She reinstated the need of the Industry 4.0 course, so as to prepare the students according to the Industrial requirements.

Dr Jayshree Nellore expressed the implementation new elective courses to keep up with current advances in the field. This requires a major reshuffling in the elective courses.

M Tech Biotechnology

As per AICTE regulations, Dr Ramesh Kumar informed that the credits for have been revised from 94 to 68. The board accepted for a major reshuffling of elective courses.

Industry 4.0 to be implemented as per Dr Elizabeth Rani suggestion. Dr Parthiban insisted the need of Seminar classes for PG with credits to encourage students to learn and share the advances in the field.



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Meeting ended with vote of thanks to the Chair.

External Member	Signature
Dr. Chirayu Padhiar	
Dr. Prathiban M	
Dr. Elizabeth Rani	
Internal Member	Signature
Dr. Jayshree Nellore	
Dr. Valli Nachiyar	
Dr. Ramesh kumar V	

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Chennai-600 119

PRO VICE CHANCELLOR/CHAIR

B Tech

Sl. No.	Course Code	Course Title
1	SBTA3001	Marine Biotechnology
2	SBTA3002	Aquaculture
3	SBTA3003	Translational Biotechnology: From IPR to Licensing
4	SBTA3004	Biological Process in regulatory affairs
5	SBTA3005	Medical Biotechnology
6	SBTA3006	Neurobiology
7	SBTA3007	Food Processing Technology
9	SBTA3008	PERL for Bioinformatics
10	SBTA3009	Molecular Modelling and Drug design
11	SCHA3010	Bioprocess Instrumentation and Control

M Tech

Sl. No.	Course code	Course title
1	SBTA7001	Bioinformatics
2	SBTA7002	Molecular Modeling and Drug Designing
3	SBTA7003	Design and operation of bioreactors
4	SBTA7004	Pharmaceutical Biotechnology
5	SBTA7005	Biopharmaceuticals
6	SBTA7006	Advanced Bioinstrumentation
7	SBTA7007	Stem cell Research
8	SBTA7008	Cancer Biology
9	SBTA7009	Environmental Biotechnology
10	SBTA7010	Marine Biotechnology
11	SBTA7011	Bioethics, Biosafety and IPR
12	SBTA7012	Forensic Biotechnology
13	SBTA7013	Food and Nutraceuticals
14	SBTA7014	Scientific Approaches for Biotechnology

SCSA1102	FUNDAMENTALS OF PYTHON PROGRAMMING	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To understand why Python is a useful scripting language for developers.
- To learn how to use lists, tuples, and dictionaries in Python programs.
- To learn how to build and package Python modules for reusability.
- To learn how to read and write files in Python.
- To learn how to use exception handling in Python applications for error handling.
- To learn how to design and program Python applications.

UNIT 1 INTRODUCTION

9 Hrs.

History of Python- Introduction to the IDLE interpreter (shell) - Expressions – Data Types - Built-in function - Conditional statements - Iterative statements- Input/output - Compound Data Types - Nested compound statements – Introduction to Object Oriented Concepts.

UNIT 2 FILES AND EXCEPTIONS HANDLING, MODULES, PACKAGES

9 Hrs.

File Operations –Iterators - Exception handling - Regular Expressions- Creating Modules-Import Statement- Introduction toPIP-Installing Packages via PIP-Using Python Packages

UNIT 3 GUI PROGRAMMING

9 Hrs.

GUI Programming in Python - Introduction to GUI library - Layout management - Events and bindings - Fonts – Colours - Canvas - Widgets (frame, label, button, check box, entry, listbox, message, radiobutton, text, spinbox).

UNIT 4 DATABASE AND NETWORK

9 Hrs.

Database (using NoSQL): Connector Module –Cursor – Statements - Exceptions in database. Network connectivity: Socketmodule - Client – Server – Email – URL Access

UNIT 5 CASE STUDY

9 Hrs.

Web Programming using Python.
Image Processing – Facebook Analysis – Twitter Analysis.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Describe the Numbers, Math functions, Strings, List, Tuples and Dictionaries in Python
- CO2 - Do the decision Making and write functions in Python
- CO3 - Explain how to design GUI Applications in Python and evaluate different database operations
- CO4 - Design and develop Client Server network applications using Python
- CO5 - Design real life situational problems and think creatively about solutions of them.
- CO6 - Apply the best features of mathematics, engineering and natural sciences to program real life problems.

TEXT BOOKS/REFERENCE BOOKS

1. Daniel Liang Y., Introduction to Programming Using Python, Pearson, 2013.
2. Paul Gries, Jennifer Campbell, Jason Montojo, Practical Programming: An Introduction to Computer Science Using Python 3, Pragmatic Bookshelf, 2nd Edition, 2014.
3. Magnus Lie Hetland, Beginning Python: From Novice to Professional, Apress.

SBTA1101	MICROBIOLOGY AND CELL BIOLOGY	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVE

- The course aims to develop skills of the students in the area of Microbiology and Cell biology particularly to identify microbes, structure, metabolism and Cell Signaling pathways

UNIT 1 CLASSIFICATION AND MULTIPLICATION

9 Hrs.

Overview of history of Microbiology- Classification of Microbes - Systems of classification, Numerical taxonomy, Identifying characters for classification, General properties and principles of classification of microorganisms' Structural organization and multiplication of bacteria, viruses, algae and fungi.

UNIT 2 MICROBIAL NUTRITION, GROWTH AND METABOLISM

9 Hrs.

Nutritional requirements of bacteria and different media used for bacterial culture; growth curve. Mathematical nature and expression of microbial growth and different methods to quantitate bacterial growth, aerobic and anaerobic bioenergetics and utilization of energy for biosynthesis of important molecules.

UNIT 3 CONTROL OF MICROORGANISMS

9 Hrs.

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

UNIT 4 CELL ORGANELLES

9 Hrs.

Evolution of cell; Cell as a unit of living organism, evolution and structure of prokaryotic cell, evolution of eukaryotic cell -Structural and functional features of eukaryotic cell: cell organelles; endoplasmic reticulum, golgi complex, lysosomes, vacuoles, peroxisomes, mitochondria, chloroplast, cytoskeleton, microtubules, nucleus, extracellular matrix etc.

UNIT 5 CELL CYCLE AND APOPTOSIS

9 Hrs.

Cell cycle - An overview of cell cycle; Components of cell cycle control system; Intracellular and Extra-cellular control of cell division, Programmed cell death (Apoptosis), intrinsic & extrinsic pathways of cell death, Apoptosis in relation with Cancer, Viral disease (AIDS) & Organ transplant

Max.45 Hrs.

COURSE OUTCOMES On completion of the course, student will be able to

- CO1 - Familiar with overview and scope of microbiology.
- CO2 - Explore the systemic classification of microbes.
- CO3 - Study the methods for cultivation of organisms.
- CO4 - Understand the basic principles of cellular components.
- CO5 - Study the cell cycle principle.
- CO6 - Understand the application of microbiology and cell biology in biotechnology.

TEXT / REFERENCE BOOKS

1. Berg, Jeremy M., John L. Tymoczko, Lubert Stryer, J.M. Berg, J.L. Tymoczko and L. Stryer, Biochemistry International version, 2002.
2. Nelson D.L., Lehninger A.L. & Cox, M.M., Lehninger principles of Biochemistry, Macmillan, 2008.
3. Moat A.G., Foster J.W. & Spector, M. P. (Eds.), Microbial Physiology, John Wiley & Sons, 2003.
4. Alberts, Bruce, Dennis Bray, Karen Hopkin, Alexander D. Johnson, Julian Lewis, Martin Raff, Keith Roberts and Peter Walter. Essential Cell Biology, Garland Science, 2015.
5. Karp G., Cell and Molecular Biology: concepts and experiments, John Wiley & Sons, 2009.
6. Robertis De., Cell and Molecular Biology, 1987.
7. Lodish H., Berk A., Darnell J.E., Kaiser C.A., Krieger M., Scott M.P., Bretscher A., Ploegh H. and Matsudaira P., Molecular Cell Biology, Macmillan, 2008.

SBTA1102	BIOMECHANICS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To gather adequate knowledge the mechanics involved in human beings.
- To understand the fundamental principles related to mechanical actions of biological tissues

UNIT 1 INTRODUCTION

9 Hrs.

Biomechanics, History, Applications, Perspectives in Biomechanics; Rigid Body BioMechanics; Anatomical Concepts in Biomechanics., Fundamentals of Biomechanics, Anthropometric Considerations, Newtons Laws of motions

UNIT 2 MECHANICS OF HARD TISSUES

9 Hrs.

Whole body modeling, Structure of bones – Composition and properties of bones and relationship to structure – Elastic properties of bones, Bone fracture mechanics, Implants for bone fractures, Lubrication of joints.

UNIT 3 MECHANICS OF SOFT TISSUES

9 Hrs.

Tissue Mechanics-Structure and functions of cartilages, tendons, ligaments,, Mechanical Properties of Tissues, Biological materials, Pseudo elasticity, nonlinear stress-strain relationship, viscoelasticity and models, structure, function and mechanical properties of skin, ligaments and tendons, Mechanical testing of Soft tissue.

UNIT 4 CARDIOVASCULAR MECHANICS

9 Hrs.

Cardiovascular Physiology, Heart Valve Dynamics, Prosthetic Valve Dynamics. Mechanical properties of blood vessels –arteries, arterioles, capillaries, veins, blood flow: laminar and turbulent.

UNIT 5 APPLICATIONS OF BIOMECHANICS

9 Hrs.

Mechanics of spinal distraction rods, Biomechanics of human motion and control interfaces with application to limb orthotics and prosthetics. Design of hip prosthesis, Automated driver's training programme, Sports biomechanics.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the principles and mechanics of hard tissues.
- CO2 - Outline the principles of biofluid dynamics.
- CO3 - Explain the fundamentals of soft tissues
- CO4 - Apply the knowledge obtained in cardiovascular mechanics
- CO5 - Discover mechanics related to cardiovascular system.
- CO6 - Apply the knowledge gained to find solutions to various need in biomechanics

TEXT / REFERENCE BOOKS

1. Robert L.Huston, Principles of Biomechanics, CRC Press, 2005.
2. Ozkaya and Nordin, Fundamentals of Biomechanics: Equilibrium, Motion and Deformation, 2002.
3. Gardiner M. Dena, The principles of exercise therapy, CBS Publisher, 2000.
4. Fung Y.C., Bio-Mechanics - Mechanical Properties of Tissues, Springer-Verlag, 2000.
5. Subrata Pal, Textbook of Biomechanics, Viva Books Private Limited, 2009.
6. Bruce M. Koeppen and Bruce A. Stanton, Mosby, Berne & Levy Physiology, 6th Edition, 2009.

SCSA2102	FUNDAMENTALS OF PYTHON PROGRAMMING LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

SUGGESTED LIST OF EXPERIMENTS

1. Program to handle Input and Output statements
2. Program using Lists, Tuples, Dictionary and Sets
3. Program using conditional statements
4. Program using looping constructs
5. Program using functions and modules
6. Program using File handling
7. Program using Exception handling
8. GUI Programming using Python - Canvas Widget
9. GUI Programming using Python - Frame, label, button, check box, entry, listbox, message, radio button, text, spinbox
10. Database Programming using Python
11. Socket Programming using Python

CASE STUDIES

- Quora : Question similarity
- Amazon : Fashion Discovery Engine

SBTA2101	MICROBIOLOGY AND CELL BIOLOGY LAB	L	T	P	Credits	Total Marks
		0	0	4	2	100

COURSE OBJECTIVE

- To study the basic laboratory techniques of microbiology and cell biology

SUGGESTED LIST OF EXPERIMENTS

1. Microscopy– Description and operation of compound microscope, use of oil immersion objective. Micrometry
2. Staining Methods
 - Simple staining – *Bacillus* spp.
 - Differential staining – *Bacillus* and *E.coli*.
 - Special staining - Capsular staining
 - Fungal staining - Lactophenol cotton blue, staining of mold (*Penicillium*, *Aspergillus*).
3. Sterilization- Operation of autoclave, hot air oven, membrane filtration (demonstration only),
4. Culture transfer from solid to solid, solid to liquid and liquid to liquid: Checking of possible contamination.
5. Culture techniques
 - Culture media preparation- Nutrient broth, nutrient agar slant, potato dextrose agar.
6. Isolation and viable cell count of bacteria by Pour plant and spread plate method
7. Isolation of pure culture by streak plate method.
8. Bacterial motility (a) Hanging drop method (b) Stabbing method.
9. Antibiotics sensitivity assay
10. Study of chromosomal abnormalities (Permanent slides)
11. Study of cancer cell lines (Permanent slides)
12. Preparation of buccal smear for identification of Barr bodies
13. Study of Mitotic stages
14. Study of Meiotic stages

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand basic principles of microscopy and microscopic examination.
- CO2 - Determination of primary identification of bacteria and fungi by staining techniques.
- CO3 - Differentiate bacterial species by suitable macroscopic techniques.
- CO4 - Understand different sterilization techniques.
- CO5 - Differentiate cell cycle stages.
- CO6- Compare normal cells from cancer cells.



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

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SCHOOL OF BIO AND CHEMICAL ENGINEERING

DEPARTMENT OF BIOTECHNOLOGY

Board of Studies 2019-2020 (EVEN SEM)

Minutes of Meeting

Date: 01-12-2019 (Saturday)

Time: 10.00am-12.00pm

Chair-person : **Dr. Wilson Aruni**

Members : **Dr. Chirayu Padhiar**, External Member

Senior Medical Director, LifeCell International Pvt., Chennai.

Dr. Parthiban.M., External Member

Professor and Head, Department of Animal Biotechnology,

Madras Veterinary college, Chennai 600007

Dr. Elizabeth Rani, External Member

Head of the Department, Department of Biotechnology,

Hindustan College of Arts and Science, Chennai

Dr. Ramesh kumar V, Internal member

Dr. Valli Nachiyar C, Internal member

Dr. Jayshree Nellore, Internal member

The Chair-person welcomed the members. Dr.Ramesh Kumar, Head, Department of Biotechnology put forth the agenda of the meeting.

Agenda of the meeting; Syllabus revisions and implementation in 2019- 2020 even semester.
Following which discussions were held as;

The Chairperson abridged the members that, as per AICTE norms the implementation of Basis Electrical and Electronics Engineering and Workshop Practice course in semester II

Dr Ramesh Kumar suggested introduction of Principles and Calculations in Chemical Engineering in Semester II itself to introduce the basic concepts of Chemical Engineering.

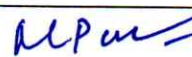
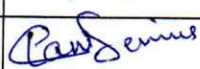
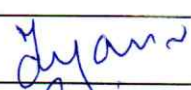
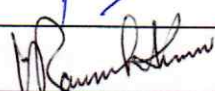
M Tech Biotechnology

Dr Jayshree Nellore recommended implementation of Advanced Genetic Engineering course theory and practical in the same semester to have a follow up. Dr Valli suggested that the Bioprocess lab experiments be included along with it, so as to make up with the number of credits required.

Industry 4.0 to be implemented as per Dr Elizabeth Rani suggestion.

Existing modules in 2015 regulations were modified with introduction of current topics and courses Advanced Molecular Biology and Genetic Engineering, Fermentation and Downstream processing, Enzyme and Protein Engineering to be implemented as per board suggestions.

Meeting ended with vote of thanks to the Chair.

External Member	Signature
Dr. Chirayu Padhiar	
Dr.Prathiban M	
Dr. Elizabeth Rani	
Internal Member	Signature
Dr. Jayshree Nellore	
Dr. Valli Nachiyar	
Dr. Ramesh kumar V	



(Dr.Aruni Wilson)

HEAD OF THE DEPARTMENT
DEPARTMENT OF BIOTECHNOLOGY
SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Jeppiaar Nagar, Rajiv Gandhi Salai
Chennai-600 119

SEEA1101	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To impart knowledge on the analysis of DC and AC Circuits.
- To gain knowledge about the working of electrical machines.
- To impart Knowledge on the operation of the basic electronic devices.

UNIT 1 D.C. CIRCUITS

9 Hrs.

Electrical Quantities - Ohm's law - Kirchoff's laws -Resistance in series and parallel combinations - Current and Voltage division rules - Mesh analysis and Nodal analysis.

UNIT 2 A.C. CIRCUITS

9 Hrs.

Sinusoidal functions - R.M.S and Average values for Sinusoidal waveform - Phasor representation - Sinusoidal excitation applied to purely resistive, inductive and capacitive circuits - RL , RC and RLC series circuits - power and power factor - Introduction to three phase circuits with balanced load.

UNIT 3 INTRODUCTION TO MACHINES

9 Hrs.

Construction and Principle of Operation of DC Generators - DC Motors - Single Phase Transformer - Single Phase Induction Motors - Stepper Motor.

UNIT 4 SEMICONDUCTOR DEVICES

9 Hrs.

VI Characteristics of PN-junction diodes and Zener diodes, BJT and its configurations – input/output Characteristics, Junction Field Effect Transistor – Drain and Transfer Characteristics, MOSFET – Depletion type and Enhancement type, Uni Junction Transistors - Silicon Controlled Rectifiers.

UNIT 5 DIGITAL ELECTRONICS

9 Hrs.

Number systems – Binary arithmetic - Boolean algebra, laws & theorems – Boolean Functions - Simplification of Boolean functions - Logic gates - Implementation of Boolean expressions using logic gate - Standard forms of Boolean expression.

MAX. 45 Hrs.

COURSE OUTCOMES; On completion of the course, student will be able to

- CO1 - Analyze electrical circuits using Kirchoff's Laws.
- CO2 - Compare the behaviour of R, L and C and their combinations in AC circuits.
- CO3 - Describe the construction and working principle of DC and AC machines.
- CO4 - Demonstrate the characteristics of various semi-conductor devices.
- CO5 - Understand the concept of digital electronics.
- CO6 - Recognize the importance of electronic devices.

TEXT / REFERENCE BOOKS

1. Mittle B.N. & Aravind Mittle, Basic Electrical Engineering, 2nd Edition, Tata McGraw Hill, 2011.
2. Theraja B.L., Fundamentals of Electrical Engineering and Electronics, 1st Edition, S.Chand & Co., 2009.
3. Smarajit Ghosh, Fundamentals of Electrical and Electronics Engineering, 2nd Edition, PHI Learning Pvt. Ltd, 2010.
4. Kothari D.P. and Nagrath I.J., Electrical Machines, 3rd Edition, Tata McGraw Hill Publishing Company Limited, 2006.
5. Sanjay Sharma, Electronic Devices and Circuits, 2nd Edition, S.K.Kataria & Sons, 2012.
6. John Bird, Electrical Circuit Theory and Technology, 4th Edition, Published by Taylor & Francis, 2010.

SMEA1102	ENGINEERING DRAWING	L	T	P	Credits	Total Marks
		1	0	4	3	100

COURSE OBJECTIVES

- To know the basics of Engineering Graphics.
- To make the student to possess the efficient drafting skill.
- To make the students to understand the importance of sectioning and concept of development.
- To learn about the orthographic and pictorial projections.

UNIT 1 LETTERING, DIMENSIONING AND GEOMETRICAL CONSTRUCTION 9 Hrs.

BIS - Lettering - Two systems of dimensioning - Dividing a straight line into any number of equal parts - Bisecting an angle and right angled triangle - Drawing a regular pentagon and hexagon given one side - Conic sections - ellipse, parabola, hyperbola by eccentricity method.

UNIT 2 PROJECTION OF POINTS AND LINES 9 Hrs.

Projection - Types of projection - Projection of points lying in four quadrants - Projection of lines (First angle projection only) - Projection of lines parallel and inclined to one or both the planes.

UNIT 3 PROJECTION OF SOLIDS 9 Hrs.

Projection of simple solids like prisms, pyramids, cylinder, cone with its axis perpendicular to HP, axis perpendicular to VP, axis inclined to HP.

UNIT 4 SECTION OF SOLIDS 9 Hrs.

Purpose of sectioning - Sectional views - Hatching - Section plane perpendicular to one plane and parallel to other plane - Section plane inclined to HP - Section plane inclined to VP - True shape of the section.

UNIT 5 DEVELOPMENT OF SURFACES AND ORTHOGRAPHIC PROJECTION 9 Hrs.

Need for development of surfaces - Types of development of surfaces - Development of pentagonal and hexagonal prisms - Development of cylinders - Development of pentagonal and hexagonal pyramids - Development of cones. Orthographic Projection- Free hand sketch –conversion of 3D into 2D.

Max.45 Hrs.

COURSE OUTCOMES On completion of the course, student will be able to

- CO1 - Identify the national standards related to the Engineering drawing based on BIS and construct conic sections and polygons.
- CO2 - Draw orthographic projections of points, lines.
- CO3 - Draw orthographic projections of solids
- CO4 - Draw orthographic section of solids and improve the Students visualization skill to develop new products.
- CO5 - Draw the development of surfaces and its applications in manufacturing industry.
- CO6 - Draw the orthographic view of solids and learn to convert pictorial into orthographic projection.

TEXT / REFERENCE BOOKS

1. Engineering drawing practice for schools and colleges, SP 46 – 1988
2. Natarajan K.V., A Text Book of Engineering Graphics, Dhanalakshmi Publishers, 21st Edition, 2012.
3. Bhatt N.D., Engineering Drawing, Charotar Publishing House, 53rd Edition, 2014.
4. Venugopal K., Prabhu Raja V., Engineering Graphics, New Age International Publishers, 15th Edition, 2018.

SCHA1211	PRINCIPLES AND CALCULATIONS IN CHEMICAL ENGINEERING	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To develop skills of the Students in the area of Chemical Engineering which will be necessary for certain other course offered in the subsequent semesters.
- To expose the students to various unit operations so as to enable them to improve the design and operation of the bioprocess plant.

UNIT 1 INTRODUCTION TO CHEMICAL ENGINEERING

9 Hrs.

Introduction to chemical engineering sciences and its role in the design & analysis of biological processes, overview of unit operations and processes in the chemical industry. Unit operations, schematic representations of unit operations, Fermentation Process (Ethanol), Agrochemical (Urea), Pharmaceutical (Penicillin). Unit process-alkylation, aromatization, calcination, chlorination, Trans-esterification.

UNIT 2 INTRODUCTION TO PROCESS CALCULATIONS

9 Hrs.

Introduction to chemical engineering, concepts of units and conversion factors, fundamental and derived units, basic chemical calculations, mole, mass, molecular weight, introduction to dimensional analysis, dimensionless numbers, dimensional analysis.

UNIT 3 MATERIAL BALANCES WITHOUT CHEMICAL REACTIONS

9 Hrs.

Material balance without chemical reaction – Distillation, Evaporation, Crystallization, Absorption, Drying, membrane operations and Mixing.

UNIT 4 MATERIAL BALANCES WITH CHEMICAL REACTIONS

9 Hrs.

Material Balance with chemical reaction-limiting reactant, excess reactant, conversion and selectivity. Recycle, purge and bypass operations.

UNIT 5 ENERGY BALANCE AND COMBUSTION

9 Hrs.

Introduction to thermophysics and thermo chemistry, heat capacities of solid, liquid and gases at constant pressure and volume, evaluation of enthalpy, standard heat of reaction, standard heat of combustion and standard heat of formation.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understanding the flow sheets of any process and symbols in unit operations and processes.
- CO2 - Learn the basic definitions, units, unit systems
- CO3 - Analyzing and converting the values from one-unit system to other unit system
- CO4 - Understanding the material balance calculations for with and without reaction.
- CO5 - Understanding the energy balance calculations for various reactions.
- CO6 - Material and Energy balance calculations for combined process equipment.

SMEA2201	WORKSHOP PRACTICE	L	T	P	Credits	Total Marks
		0	0	4	2	100

COUSE OBJECTIVE

- To provide the students with hands on experience on different trades of engineering like Plumbing work, fitting, carpentry, Foundry, welding and sheet metal.

SUGGESTED LIST OF EXPERIMENTS

Plumbing Works

- (a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, and elbows in household fittings.
- (b) Study of pipe connections requirements for pumps and turbines.
- (c) Preparation of plumbing line sketches for water supply and sewage works.
- (d) Hands-on-exercise:
Basic pipe connections – Mixed pipe material connection – Pipe connections with different joining components.
- (e) Demonstration of plumbing requirements of high-rise buildings.

CARPENTRY

Handling of carpentry tools, A practice in marking, sawing planing and chiseling to size. Making simple joints such as half- lap, dove-tail and mortise and tenon joints.

Use of modern materials such as plywood, chip board, novapan, laminated sheet (Demonstration only)

FITTING

Use of fitting tools-practice in marketing, fitting to size and drilling-making of simple mating and profiles such as V, Square, Dove-tail, Half-round joints.

WELDING

- i. Electric Arc Welding
 - a) Study on Edge preparation techniques for Arc welding
 - b) List of Welding Exercises
 1. Lap Joint 2. Butt Joint 3. Fillet Joint 4. Tee Joint 5. V Joint 6. Corner Joint
- ii. Study on gas welding and gas cutting
- iii. Study on TIG & MIG welding

FOUNDRY

- i. Sand testing - Grain fineness - Permeability test.
- ii. Study on Pattern Allowances
- iii. Preparation of green sand moulding
 1. Flanges 2. Glands 3. Bush 4. Dumbbell
- iv. Metal casting technique (Demonstration only)

SHEET METAL

Tools and equipment– practice.

Making rectangular tray, hopper, scoop, etc.

Mini project - Fabrication of a small cabinet, dust bin, etc.

Courses introduced in M Tech Biotechnology

SBTA5201	ADVANCED MOLECULAR BIOLOGY AND GENETIC ENGINEERING	L	T	P	C	Total marks
		3	*	0	3	100

Course Objectives

➤ The course provided a deep insight on to the various techniques involved in manipulation of DNA for its exhaustive use in the field of gene characterization, modification, cloning and transgenesis.

Unit 1 Introduction To Genetic Engineering And Cloning Strategies **9 hours**

Milestones in genetic engineering. Special molecular tools used in genetic engineering. Preparation of DNA: Isolation and purification of DNA and genes, modification of cut ends and ligation of transgene. Gene transfer techniques: physical, Chemical and biological methods. Integrative DNA transfer- Agrobacterium Ti and Ri plasmids, Protoplast fusion and organelle engineering. Expression and Characterization of transgene: genomic level, transcript level and translational level.

Unit 2 Advanced Molecular Biology Techniques- I **9 hours**

Hybridization techniques: Southern, Northern, Western, South western and North western. PCR Techniques: Different types including real time (syber green and Taqman chemistry). DNA fingerprinting: basic genetic principle. Single locus and multilocus DNA fingerprinting: Variable Number of Tandem repeats (VNTRs) Minisatellite sequences, Short Tandem Repeats (STRs) Micro Satellite Sequences, RFLP, RAPD, ISSR, AFLP. Genome mapping: Direct mapping, indirect mapping.

Unit 3 Advanced Molecular Biology Techniques II **9 hours**

DNA sequencing; Maxam and Gilbert chemical degradation method, Sanger and Coulson's enzymatic chain termination method, Next generation sequencing, Pyrosequencing, High throughput sequencing DNA foot printing, Chromosome Walking, Chromosome Jumping. Techniques for differential gene expression: DDRT and SSH. Isolation of genes and full length cDNA: 5' and 3' RACE basic technique and comparison with RLM RACE. Gene Silencing Techniques; Antisense RNA technology, Micro RNA- ShRNA, siRNA, technology; Construction of siRNA vectors. Site directed mutagenesis.

Unit 4 Genetically Modified Organisms **9 hours**

Application of genetic engineering in food (golden rice and other improved nutritional qualities), agriculture (herbicide resistance, salt/draught tolerance, insect resistance (Bt. protein), designer flowers), aquaculture (giant salmon), medicine (xenotransplantation and gene therapy), industry and environment (plants as bioreactors, vaccines, plantibodies, bioplastics and oil eating bacteria). Engineering novel traits in plants by antisense technology and RNAi technology, Creation of Transgenic plants- Seed terminator technology. Transgenic animals- Gene therapy. Transgenic microbes: Genetic manipulation of microorganisms. Transgenic organisms and Metabolic Engineering. Site direct mutagenesis.

Unit 5 Hazards And Impact Of GMOs **9 hours**

Negative impacts of genetic engineering and Present controversies on genetically modified organisms (GMOs). Biosafety Considerations: Biological risks, ethical issues, economic issues, legal issues. Biosafety regulations, norms for the release of genetically engineered organisms.

Total Number of Lectures: 45

SBTA5203	FERMENTATION AND DOWNSTREAM PROCESSING	L	T	P	C	Total marks
		3	*	0	3	100

Course Objectives:

- To understand and improve the knowledge on fermentation technology, growth kinetics, fermenter control process and various downstream process techniques.

Unit 1 Introduction To Fermentation Process **9 hours**

The range of fermentation processes – Bacteria and fungi isolation techniques, Strain, culture collection management Inoculum preparation, Scale up of the inoculum for Bacteria and fungi – Sterilization, Batch and Continuous sterilization of medium, Filter sterilization, Aseptic operation.

Unit 2 Microbial Growth Kinetics **9 hours**

Bacterial growth kinetics, monod model, primary and secondary metabolites. Continuous culture, Comparison of Continuous Batch and continuous culture. Design of a fermenter – ancillary equipment fermenter / Bioreactor types.

Unit 3 Instrumentation And Control **9 hours**

Fermentation control systems – manual and automatic control in fermentation processes. Architecture of Fermentation systems, temperature measurement and control, flow measurement and control, pressure measurement and control measurement of pH and dissolved oxygen and concentration sensors, Computer applications in fermentation technology. Artificial neural network.

Unit 4 Downstream Processing **9 hours**

Separation and recovery of fermented products- sedimentation, foam separation, precipitation, filtration, centrifugation, flocculation, coagulation- cell disruption –physical and chemical methods, liquid - liquid extraction - solvent recovery, two phase aqueous extraction, supercritical fluid extraction.

Unit 5 Purification Processes **9 hours**

Membrane separation processes, crystallization, drying, whole broth processing, Chromatography - Adsorption Chromatography, gel permeation, Affinity Chromatography, High performance liquid. Chromatography. Lyophilization.

Total Number of Lectures: 45

Course outcomes:

CO1: To introduce basic knowledge on fermentation process.

CO2: To discuss about various types medium sterilization.

CO3: To understand instrument and control system.

CO4: Understand the knowledge of various primary isolation techniques.

CO5: Evaluate an appropriate technique for novel downstream processing and its applications

CO6: Compare diverse biomolecules technique and principle of various chromatography techniques and its resolution

SBTA5202	ENZYME AND PROTEIN ENGINEERING	L	T	P	C	Total marks
		3	0	0	3	100

Course Objectives

- To make Students learn structural and functional relationships in proteins and altering their structure in order to function 'better'. To provide basic knowledge of enzyme technology and use of enzymes as tools in industry, agriculture and medicine

Unit 1 Protein Stability And Folding 9 hours

Overview of protein structure, Higher level structure, Protein stability, Mechanism of protein folding (types, level, thermodynamics, Anfinsen's dogma & Levinthal paradox & kinetics), Folding Rate, Molten globule; Techniques for studying of protein folding; Location and functions of Molecular chaperones, chaperonin and co-chaperons, HSP chaperone system in Ecoli & Human; Proteasomes and proteasome mediated protein degradation; Protein folding errors: Alzheimer's, prions and Mad Cow (BSE, CJD), Cystic Fibrosis and cancer. Polyketides and non-ribosomal peptides

Unit 2 Enzymes And Applications 9 hours

Production and purification of crude enzyme extracts from plant, animal and microbial sources; methods of characterization of enzymes; development of enzymatic assays. Techniques for Immobilization of enzymes and Overview of applications of immobilized enzyme system. Abzymes and their applications Enzyme electrodes, biosensors and their applications in industry, healthcare and environment, ELISA, EMIT

Unit 3 Protein Engineering 9 hours

Introduction to steps of Protein design and Engineering, protein splicing and its application; Solid phase peptide synthesis, Production of Novel Proteins; Random and site directed mutagenesis, Methods for Expressing Recombinant Proteins; Characterization of Proteins structure: Crystallography and X-Ray Diffraction, Spectroscopy (UV-VIS, NMR and Fluorescence Spectroscopy) and Calorimetric Methods.

Unit 4 Computational Methods In Protein Engineering 9 hours

Non canonical aminoacids in protein science and engineering, Fidelity mechanisms of the aminoacyl-tRNA synthetases, engineering with unnatural amino acid analogs, choice of protein scaffold for protein engineering, Application of molecular modeling and structure predictions to protein engineering, mechanical calculations and geometry optimization, De novo protein design, Energy status of a protein molecule. protein databases,

Unit 5 Applications Of Protein Engineering 9 hours

Alterations of substrate specificity and stereoslectivity of lipases and esterases, cofactor and substrate engineering for metabolic engineering and gene therapy, Combinational manipulation of polyketides and non ribosomal peptides; structure based engineering of PHA synthase enzymes and monomer supplying enzymes, Bioengineering of sequence repetitive polypeptides, application of protein folding to design new drug

Total Number of Lectures: 45

SCCA9501	INDUSTRY 4.0	L	T	P	C	Total Marks
		3	0	0	2	100

UNIT 1 TRANSFORMING TECHNOLOGIES IN BIOENGINEERING

7 Hrs.

Establishment of smart biotechnology factory, Artificial intelligence in Bioprocess technology, Omics – Big data analysis through automation, 3D bio printing for tissue engineering. Simulation tools, RSM and Box model. Cyber physical system based telemedicine, diagnosis and therapeutics through real time biosensors. Bionanotechnology. Intellectual Property rights (IPR): Case Studies.

UNIT 2 ADVANCEMENTS IN SUSTAINABLE BUILT ENVIRONMENT

7 Hrs.

Introduction – Technological developments in Architectural, Engineering and Construction (AEC) - Building Information Modelling (BIM) using Cloud computing technology and Internet of things (IoT) – Unmanned Aerial Vehicles, sensors – Additive manufacturing in construction – Concrete 3D printing – Materials used – Lightweight and functionally graded structures – Net Zero Energy buildings, Bioswales, Biofiltration pond, Ecosan systems- Recent developments in Waste water Management, Air pollution control, waste disposal – Integration of energy, water and environmental systems for a sustainable development- Emerging Technologies: Robot Highway- Vertical farming - Intellectual Property rights: Case studies

UNIT 3 SMART MANUFACTURING

8 Hrs.

Smart factories and interconnection, Smart Manufacturing – automation systems, Additive Manufacturing, Smart grids, Micro Electro Mechanical Systems (MEMS), Stealth technology, Metal Finishing, Self propelled vehicles, e mobility, Green fuels, drones – unmanned aerial vehicles(UAVs), aerodynamics. Robotic Automation and Collaborative Robots – Augmented reality and haptics, engineering cybernetics and artificial intelligence (AI), Disruptive Technologies – Frugal Innovations –Emerging Technologies - Autonomous Robots, Swam Robot, Modular Robotics, Space craft, Intellectual Property Rights (IPR): Case Studies.

UNIT 4 SMART WORLD

8 Hrs.

Smart Sensors and IIOT, Smart grid, Hybrid renewable energy systems, Electronics in Smart city, Integration of Sensors in Robots and Artificial Intelligence, 5G Technology, Communication protocols, Human-Machine Interaction, Virtual Reality, Quantum Computing: Changing trends in transistor technology. Processor, Emerging Trends: Deep Space, Swarm Robots, Cyborg, Geofencing, Pervasive Computing, Intellectual Property Rights- Case Studies.

UNIT 5 CYBER PHYSICAL SYSTEMS

8Hrs.

Introduction to Cyber Physical Systems (CPS), Architecture of CPS, Data science and technology for CPS, Prototypes of CPS, Emerging applications in CPS including social space, crowd sourcing, healthcare and human computer interactions, Industrial Artificial Intelligence, Deep Learning, Gamification, Networking systems for CPS applications, Wearable cyber physical systems and applications, Domain applications of CPS: Agriculture, Infrastructure, Disaster management, Energy, Transportation, Intellectual Property Rights (IPR) : Case Studies.

Max. 45 Hours

SBTA6201	GENETIC ENGINEERING AND BIOPROCESS LABORATORY	L	T	P	C	Total marks
		0	0	4	2	100

Course Objective:

- The objectives of this course are to provide students with the experimental knowledge of genetic engineering and Bioprocess

Genetic Engineering List of Experiments

1. Isolation of genomic DNA from leaf samples - CTAB Precipitation method
2. Estimation of DNA / RNA by UV spectrophotometry
3. Restriction digestion of DNA
4. Construction of restriction map - plasmids
5. DNA ligation
6. Polymerase Chain Reaction - Amplification of DNA of interest/ RAPD
7. Purification of PCR products- gel elution
8. Southern blotting / Western blotting / northern blotting
9. Cloning of PCR products (competitive cell preparation, CaCl₂ transformation, blue - white screening of transformants.

Bioprocess Engineering List Of Experiments

1. Isolation of Industrial important microorganism.
2. Medium Design by Plackett Burman Model.
3. Evaluation of microbial growth rate by Monod model
4. Preparation of Immobilization beads.
5. Cell disruption – sonication
6. Evaluation of rate of Filtration
7. TLC
8. Salting out
9. Dialysis
10. Column chromatography
11. Lyophilization

Course Outcomes:

- CO1: Students should be able to gain hands-on-experience on development of an ability to design and conduct genetic engineering and bioprocess experiments
- CO2: To analyze and interpret data
- CO3: To apply the laboratory skills to solve genetic engineering and bioprocess engineering problems
- CO4: Graduates perform competently in genetic engineering and bioprocess industries
- CO5: Development of research aptitude and technical skills to secure a job in genetic engineering and bioprocess engineering labs
- CO6: To evolve novel analytical methods in bioprocess for Biotechnology industries.

SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
SCHOOL OF BIO AND CHEMICAL ENGINEERING

DEPARTMENT OF BIOTECHNOLOGY

Board of Studies (BOS) Meeting

MINUTES OF BOARD OF STUDIES MEETING

Venue: Online Meeting

Date: 26-06-2020 (Friday) Time: 11.00am-12.15pm

BoS Panel of Members present in the meeting

Chair-person : Dr. Wilson Aruni

Attendees : Dr. Chirayu Padhiar, External Member
Senior Medical Director, LifeCell International Pvt., Chennai.

Dr. Parthiban.M., External Member
Professor and Head, Department of Animal Biotechnology,
Madras Veterinary college, Chennai 600007

Dr. Elizabeth Rani, External Member
Head of the Department, Department of Biotechnology,
Hindustan College of Arts and Science, Chennai

Dr. Ramesh kumar V, Internal member

Dr. Valli Nachiyar C, Internal member

Dr. Jayshree Nellore, Internal member

Dr. Karthick Raja Namasivayam, Internal member

The Chair-person welcomed the internal and external board members to the virtual meeting. He invited Dr. Ramesh kumar, Head, Department of Biotechnology to table the agenda. Following this, the agenda points were discussed as follows;

1. Agenda Item 1:

To confirm and approve the use of virtual labs provided by MHRD in B.Tech/M.Tech/B.Sc. curriculum as and when required, especially during COVID times.

Suggestions given by the members The members of BOS appreciated the virtual lab usage during these testing times. However, it was emphasized that hands-on experience would be given to the students at a later stage to impart the practical skill.

2. Agenda Item 2:

To confirm and approve the addition of new open elective courses for B.Tech and M.Tech programme

Suggestions given by the members The members discussed the prominent points associated to National Education Policy 2020 for curriculum development.

- Value based curriculum
- Attention towards AI, IoT, Industry 4.0
- Upgradation of faculty members and students
- Synchronization between academia and industry

Resolutions

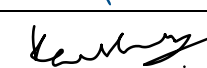
Industry 4.0 (Annexure 1 and Annexure 3) may be introduced and also synthetic biology (Annexure 2) can be included as companies around the world are harnessing the power of nature to solve problems in medicine, manufacturing and agriculture.

3. Any other points with the permission of Chair -Academic flexibilities with extra credits acquired through either advanced study of same courses or with procuring additional credits from additional courses as per student's choice - suggestion. Universal Human values was introduced as a mandate course

Head ask the suggestion to the External members for students undergoing specialization.

Resolutions: The BoS recommended that advanced courses/NPTEL courses can be selected for the specialization. Also recommend that the students can opt these courses at the end of the fourth semester subject to the condition prescribed by the Senate time to time.

The members had a brainstorming discussion and interaction among themselves. After discussion, fruitful suggestions were incorporated appropriately in the Curriculum and Syllabi. Based on the suggestions given by the members, BoS resolved to recommend the minutes to the Academic Council for further approval.

Internal Member	Designation	Signature
Dr. Ramesh kumar V	Head and Professor	
Dr. Valli Nachiyar C	Professor	
Dr. Jayshree Nellore	Professor	
Dr. Karthick Raja Namasivayam	Professor	


PRO VICE CHANCELLOR/CHAIR



HoD BIOTECHNOLOGY <biotechhod@sathyabama.ac.in>

HoD BIOTECHNOLOGY <biotechhod@sathyabama.ac.in>

Mon, Jun 29, 2021 at 9:05 AM

To: **Parthiban.M** <parthiban.m@tanuvas.ac.in>

Respected Sir,

I am pleased to share the minutes of Board of studies meeting held on 26th June 2020 for your kind approval

Regards

--

**Head,
Department of Biotechnology,
School of Bio and Chemical Engineering
Sathyabama Institute of Science and Technology
(Deemed to be University).
Chennai - 600 119.**

VISION OF THE DEPARTMENT

The department of Biotechnology envisages to empower the students with analytical skills and to create an ethical workforce, competent to transform the future with social consciousness on par with global standards.

MISSION OF THE DEPARTMENT

- M1. To enable the students to acquire technical skills in core aspects of Biotechnologies pertaining to the development of innovative technologies.
 - M2. To increase the employability of students by exposing them to various industrial, academic and research environment.
 - M3. To inculcate leadership and inter-personal skills by involving students in diversified activities.
 - M4. To instil the societal and ethical responsibility in our students.
- .

1 attachments

Minutes of meeting.pdf



172K



HoD BIOTECHNOLOGY <biotechhod@sathyabama.ac.in>

HoD BIOTECHNOLOGY <biotechhod@sathyabama.ac.in>

Mon, Jun 29, 2021 at 9:15 AM

To: **Chirayu Padhiyar** <chirayupadhiar@lifecell.in>

Respected Sir,

I am pleased to share the minutes of Board of studies meeting held on 26th June 2020 for your kind approval

Regards

--

**Head,
Department of Biotechnology,
School of Bio and Chemical Engineering
Sathyabama Institute of Science and Technology
(Deemed to be University).
Chennai - 600 119.**

VISION OF THE DEPARTMENT

The department of Biotechnology envisages to empower the students with analytical skills and to create an ethical workforce, competent to transform the future with social consciousness on par with global standards.

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- M1. To enable the students to acquire technical skills in core aspects of Biotechnologies pertaining to the development of innovative technologies.
 - M2. To increase the employability of students by exposing them to various industrial, academic and research environment.
 - M3. To inculcate leadership and inter-personal skills by involving students in diversified activities.
 - M4. To instil the societal and ethical responsibility in our students.
- .

1 attachments

Minutes of meeting.pdf



172K

Chirayu Padhiyar <chirayupadhiar@lifecell.in> Tue, June 30, 2021 at 9:00 AM

To: HoD BIOTECHNOLOGY <biotechhod@sathyabama.ac.in>

Dear Dr.Ramesh

I accept with pleasure the minutes of BoS shared.

Regards,

Dr.Chirayu Padhiar'

Senior Medical Director

LifeCell International Pvt Ltd.,

Chennai, India.

Annexure 1

New Course	INDUSTRY 4.0	L	T	P	C	Max. Marks
		2	0	2	2	100

UNIT 1 ADVANCED TECHNOLOGY AND ADVANCED MATERIALS

7 Hrs.

Advanced electro-optical sensing technology-active, passive multi-spectral and hyper spectral imaging; electronic beam steering; vacuum technology, surface and coating technology, health care technology, Nanotechnology- Nano mechanics, Nano optoelectronics; energy storage technology-next generation Li-based Batteries, Hydrogen storage, solar photovoltaics', Flexible electronics. Intellectual Property Rights - case studies governing/pertaining to Materials/Technology.

UNIT 2 TRANSFORMING TECHNOLOGIES IN BIOENGINEERING

7 Hrs.

Establishment of smart biotechnology factory, Artificial intelligence in Bioprocess technology, Omics – Big data analysis through automation, 3D bio printing for tissue engineering. Simulation tools, RSM and Box model. Cyber physical system based telemedicine, diagnosis and therapeutics through real time biosensors. Bio nanotechnology. Intellectual Property rights (IPR): Case Studies.

UNIT 3 ADVANCEMENTS IN SUSTAINABLE BUILT ENVIRONMENT

7 Hrs.

Introduction – Technological developments in Architectural, Engineering and Construction (AEC) - Building Information Modelling (BIM) using Cloud computing technology and Internet of things (IoT) – Unmanned Aerial Vehicles, sensors – Additive manufacturing in construction – Concrete 3D printing - Materials used - Lightweight and functionally graded structures - Net Zero Energy buildings, Bioswales, Biofiltration pond, Ecosan systems- Recent developments in Waste water Management, Air pollution control, waste disposal - Integration of energy, water and environmental systems for a sustainable development- Emerging Technologies: Robot Highway- Vertical farming - Intellectual Property rights: Case studies

UNIT 4 SMART MANUFACTURING

8 Hrs.

Smart factories and interconnection, Smart Manufacturing – automation systems, Additive Manufacturing, Smart grids, Micro Electro Mechanical Systems (MEMS), Stealth technology, Metal Finishing, Self-propelled vehicles, e mobility, green fuels, drones – unmanned aerial vehicles (UAVs), aerodynamics. Robotic Automation and Collaborative Robots – Augmented reality and haptics, engineering cybernetics and artificial intelligence (AI), Disruptive Technologies – Frugal Innovations – Emerging Technologies - Autonomous Robots, Swam Robot, Modular Robotics, Space craft, Intellectual Property Rights (IPR): Case Studies.

UNIT 5 SMART WORLD

8 Hrs.

Smart Sensors and IIOT, Smart grid, Hybrid renewable energy systems, Electronics in Smart city, Integration of Sensors in Robots and Artificial Intelligence, 5G Technology, Communication protocols, Human-Machine Interaction, Virtual Reality,

Quantum Computing: Changing trends in transistor technology: Processor, Emerging Trends: Deep Space, Swarm Robots, Cyborg, Geofencing, Pervasive Computing, Intellectual Property Rights- Case Studies.

UNIT 6 CYBER PHYSICAL SYSTEMS

8

Hrs.

Introduction to Cyber Physical Systems (CPS), Architecture of CPS, Data science and technology for CPS, Prototypes of CPS, Emerging applications in CPS including social space, crowd sourcing, healthcare and human computer interactions, Industrial Artificial Intelligence, Deep Learning, Gamification, Networking systems for CPS applications, Wearable cyber physical systems and applications, Domain applications of CPS: Agriculture, Infrastructure, Disaster management, Energy, Transportation, Intellectual Property Rights (IPR) : Case Studies.

COURSE OUTCOMES:

- CO1. Apply the basic concepts for electro optical sensing technology and selection of materials.
- CO2. Analyze the technology on AI and Big Data for biomedical applications.
- CO3. Elaborate the various technologies for sustainable built environment.
- CO4. Evaluate different smart manufacturing technologies for industrial robotics-based automation.
- CO5. Compare various advanced technologies for development of smart city.
- CO6. Build Cyber physical systems using AI for Industry, Agriculture and disaster management applications.

Max. 45 Hrs.

TEXT / REFERENCE BOOKS

1. William D. Callister, Materials Science and Engineering: An Introduction, John Willey and Sons Inc. Singapore, 2001.
2. Raghavan V., Physical Metallurgy: Principle and Practice, Prentice Hall India Pvt. Ltd., 2006.
3. Flavio Craveiro, Jose Pinto Duarte, Helena Bartolo and Paulo Jorge Bartolo, "Additive manufacturing as an enabling technology for digital construction: A perspective on Construction 4.0", Automation in Construction, Vol. 103, 2019.
3. Klaus Schwab, Fourth Industrial Revolution, Random House USA Inc., New York, USA, 2017.
4. Oliver Grunow, "SMART FACTORY AND INDUSTRY 4.0. The current state of Application Technologies", Studylab Publications, 2016.
5. Alasdair Gilchrist, "INDUSTRY 4.0: Industrial Internet of Things", Apress, 2016.
6. Sang C.Suh, U.John Tanik, John N Carbone, Abdullah Eroglu, "Applied Cyber-Physical Systems", Springer Publications, New York, 2013

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100
Hrs.

Exam Duration: 3

PART A: 11 Questions of 2 marks each-No choice

22 Marks

PART B: 2 Questions from each unit with internal choice, each carrying 13 marks

78

Mark

New Course Synthetic biology

Course objectives

The course familiarizes students to the rapidly developing field of synthetic biology. The components of synthetic biology are introduced and its commercial applications are elaborated.

Unit I : Introduction to Synthetic biology

Introduction to synthetic biology. Background of Gene Regulatory Mechanisms (Gene Parts- Gene Structure, Promoters, Terminators, Enhancers, Inducers, Repressors, Transcription Factors, Co-factors, transcriptional and post-transcriptional regulation, post-translational modifications). Genetic Engineering and Genome Editing

Unit II : Elements of synthetic biology - Tools

Gene shuffling for large scale pathway assembly and engineering; Choices for microbial hosts for industrial applications– bacteria, yeast, insect. Gene editing methods – CRISPR/ Cas; Gene sequencing – Pyrosequencing, Nanopore sequencing.

Unit III : Bacterial circuits and Biobricks

Bacterial circuits: feedback, feed-forward, toggle switch, signal propagators and band filter, synchronized oscillators. Introduction to Bio Bricks & its applications. Microarrays & systems biology - a basic introduction

Unit IV : Mathematical modeling, simulation & applications

Noise in Gene Expression. Mathematical Modeling and Simulation. Biosensors. Application of software tools for modelling gene expression. Commercial Applications - Biomedicine, Biomaterials, Biofuels and Bioremediation; Global events & competitions- iGEM, synbiobeta.

Unit V : Regulations & ethics

Safety & bioethics, legal & IP elements involved in synthetic biology applications for human, animals and plants.

Course outcome

On completion of the course, the student will be able to;

CO1 : Define synthetic biology and outline its components.

CO2 : Paraphrase the biological mechanisms as circuits.

CO3 : Articulate on the elements of synthetic biology

CO4 : Illustrate bacterial circuits and biobricks

CO5 : Appraise on the applications, regulations and ethics of synthetic biology

CO6 : Design biobricks and novel metabolic pathways.

Text Books/References:

1. Eric Davidson, The Regulatory Genome: Gene Regulatory Networks In Development And Evolution, Academic Press (2006).
2. Hamid Bolouri, Computational Modeling of Gene Regulatory Networks - A Primer, Imperial College Press (1st edition) (2008).
3. Freemont, P.S and Kitney, R.I. (2012). Synthetic Biology – a Primer. World Scientific Publishing Co pte Ltd
4. Singh, V and P.K. Dhar. (2015). Systems and Synthetic Biology. Springer publishing, Netherlands
5. Fu, P and Panke, S (2009). Systems Biology and Synthetic Biology. Wiley Publishing.

6. Covert, M.W. (2014). Fundamentals of Systems Biology: from Synthetic Circuits to Whole Cell Models. CRC Press
7. Konopka, A. K. (2006). Systems Biology: Principles, Methods, and Concepts. CRC Press.
8. Church, G and Regis, E. (2012). Regenesi: How Synthetic Biology will Reinvent Nature and Ourselves. Basic Books.
9. Standards for Plant Synthetic Biology -
<http://onlinelibrary.wiley.com/doi/10.1111/nph.13532/full>
10. Synthetic and Systems Biology for Microbial production of Commodity Chemicals –
11. <http://www.nature.com/articles/npjsba20169>.
12. Biotechnology and Synthetic Biology Approaches for Metabolic Engineering of Bioenergy Crops - <https://www.ncbi.nlm.nih.gov/pubmed/27030440>.
13. Microarray Data Analysis: Gene Expression Data Analysis. A Beginner's Guide by: Helen Causton (Imperial College), J Quackenbush and Alvis Brazma (The European Bioinformatics Institute).
14. A Practical Approach to Microarray Data Analysis (Hardcover) by Daniel P. Berrar (Editor), Werner Dubitzky (Editor), Martin Granzow (Editor).

Annexure 3

New Course	INDUSTRY 4.0	L	T	P	C	Max. Marks
		2	0	2	2	100

UNIT 1 TRANSFORMING TECHNOLOGIES IN BIOENGINEERING 7 Hrs.

Establishment of smart biotechnology factory, Artificial intelligence in Bioprocess technology, Omics – Big data analysis through automation, 3D bio printing for tissue engineering. Simulation tools, RSM and Box model. Cyber physical system based telemedicine, diagnosis and therapeutics through real time biosensors. Bionanotechnology. Intellectual Property rights (IPR): Case Studies.

UNIT 2 ADVANCEMENTS IN SUSTAINABLE BUILT ENVIRONMENT 7 Hrs.

Introduction – Technological developments in Architectural, Engineering and Construction (AEC) - Building Information Modelling (BIM) using Cloud computing technology and Internet of things (IoT) – Unmanned Aerial Vehicles, sensors – Additive manufacturing in construction – Concrete 3D printing - Materials used - Lightweight and functionally graded structures - Net Zero Energy buildings, Bioswales, Biofiltration pond, Ecosan systems- Recent developments in Waste water Management, Air pollution control, waste disposal - Integration of energy, water and environmental systems for a sustainable development- Emerging Technologies: Robot Highway- Vertical farming - Intellectual Property rights: Case studies

UNIT 3 SMART MANUFACTURING 8 Hrs.

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UNIT 4 SMART WORLD 8 Hrs.

Smart Sensors and IIOT, Smart grid, Hybrid renewable energy systems, Electronics in Smart city, Integration of Sensors in Robots and Artificial Intelligence, 5G Technology, Communication protocols, Human-Machine Interaction, Virtual Reality, Quantum Computing: Changing trends in transistor technology: Processor, Emerging Trends: Deep Space, Swarm Robots, Cyborg, Geofencing, Pervasive Computing, Intellectual Property Rights- Case Studies.

UNIT 5 CYBER PHYSICAL SYSTEMS

8Hrs.

Introduction to Cyber Physical Systems (CPS), Architecture of CPS, Data science and technology for CPS, Prototypes of CPS, Emerging applications in CPS including social space, crowd sourcing, healthcare and human computer interactions, Industrial Artificial Intelligence, Deep Learning, Gamification, Networking systems for CPS applications, Wearable cyber physical systems and applications, Domain applications of CPS: Agriculture, Infrastructure, Disaster management, Energy, Transportation, Intellectual Property Rights (IPR) : Case Studies.

Max. 45 Hrs

TEXT / REFERENCE BOOKS

1. William D. Callister, "Materials Science and Engineering, An Introduction, John Wiley and Sons Inc., Singapore, 2001.
2. V. Raghavan, "Physical Metallurgy: Principle and Practice,. Prentice Hall India Pvt Ltd, 2006.
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4. Klaus Schwab, "Fourth Industrial Revolution", Random House USA Inc, New York, USA, 2017.
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SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

SCHOOL OF BIO AND CHEMICAL ENGINEERING

DEPARTMENT OF BIOTECHNOLOGY

Board of Studies Minutes of Meeting

Date : 06-01-2021 (Wednesday)

10.00am-11.45pm

Chair-person : Dr. Wilson Aruni

Attendees : Dr. Chirayu Padhiar, External Member

Senior Medical Director, LifeCell International Pvt., Chennai.

Dr. Parthiban.M., External Member

Professor and Head, Department of Animal Biotechnology,

Madras Veterinary college, Chennai 600007

Dr. Ramesh kumar V, Internal member

Dr. Valli Nachiyar C, Internal member

Dr. Jayshree Nellore, Internal member

Dr. Karthick Raja Namasivayam, Internal member

The Chair-person welcomed the internal and external board members to the virtual meeting. He invited Dr.Ramesh kumar, Head, Department of Biotechnology to table the agenda. Following this, the agenda points were discussed as follows;

The minutes of the Board of Studies meeting held on, 2020 were communicated to the members. The comments received have been incorporated and placed for confirmation. The same was approved by the 16th Academic council.

1. Agenda item # 1 Implementation of Industry 4.0 and systems biology

The proposed new courses in the last BoS meeting, Industry 4.0 (SAIC4001), Industry 4.0 (SCCA9501) and systems biology (SBTA4002) is plan to implement in the 3rd , 2nd and 6th Semester for batch (Jan 2021 – May 2021)

Resolutions: The members approved the recommendations

2. Agenda item # 2 Addition of new open elective Courses for M.Tech/B.Tech Programme

The Head of the department highlighted the feedback from the Alumni for the incorporation of elective courses focus on Ecology and Evolution, Phylogenetics and bioentrepreneurship.

Resolutions:

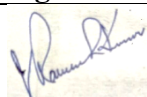
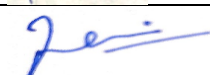
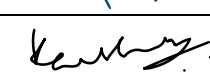
The BOS recommend for inclusion of the bioentrepreneurship course in B.Tech /M.Tech Programme of Biotechnology

Agenda item # 3 Implementation of skill development programme to provide hands-on-training in tools and techniques in Biotechnology and allied areas to generate skilled manpower.

Head pointed the skill development course conducted in association with Research Centres, Sathyabama Institute of Science and Technology

Resolutions: The BoS recommended the initiation taken by the department.

Dr. Ramesh, Professor thanked all the members for their kind cooperation and the meeting came to an end.

Internal Member	Designation	Signature
Dr. Ramesh kumar V	Head and Professor	
Dr. Valli Nachiyar C	Professor	
Dr. Jayshree Nellore	Professor	
Dr. Karthick Raja Namasivayam	Professor	


PRO VICE CHANCELLOR/CHAIR



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited "A" Grade by NAAC | 12B Status by UGC | Approved by AICTE

www.sathyabama.ac.in

Board of Studies 2021-2022 (ODD SEM)

Minutes of Meeting

Date: 3rd July 2021

Time: 11 am

Chair-person : Dr.Aruni Wilson

Attendees : Dr. Chirayu Padhiar, External Member
Senior Medical Director, LifeCell International Pvt., Chennai.
Dr. Parthiban.M., External Member
Professor and Head, Department of Animal Biotechnology,
Madras Veterinary college, Chennai 600007
Dr. Elizabeth Rani, External Member
Head of the Department, Department of Biotechnology,
Hindustan College of Arts and Science, Chennai
Dr. Ramesh kumar V, Internal member
Dr. Valli Nachiyar C, Internal member
Dr. Jayshree Nellore, Internal member

The Chair-person welcomed the members.

Agenda of the meeting; Syllabus revisions and implementation in 2021- 2022

Following which discussions were held as follows,

B.Tech Biotechnology

Agenda Item 1:

The syllabus for the course SAIC4001 Industry 4.0 was revised to SCCA9504 INDUSTRY 4.0 FOR BIO ENGINEERS (PROJECT BASED LEARNING APPROACH) under Regulations 2019 and the same was tabled before the board for approval.

Resolutions: The BoS sanctioned the proposal to revise the course syllabus and approved the same (Annexure 1)

Agenda Item 2: To consider and approve the starting of new course under CBCS from the academic year 2021-2022

The Head of the department explained the salient features contained in the syllabus for the new course Medical Genomics

Resolutions: The BOS members reviewed and has recommended the same for approval. The approved syllabus is in the annexure I

M.Tech Biotechnology

Agenda Item 3:

The syllabus for the course SCCA9501Industry 4.0 was revised to SCCA9501 INDUSTRY 4.0 FOR BIO ENGINEERS (PROJECT BASED LEARNING APPROACH) under Regulations 2019 and the same was tabled before the board for approval.

Resolutions: The BoS sanctioned the proposal to revise the course syllabus and approved the same (Annexure 1)

Based on the suggestions given by the members, BoS resolved to recommend the minutes to the Academic Council for further approval.

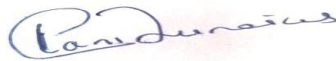
Members

Signature

Dr. Chirayu Padhiar



Dr. Elizabeth Rani



Dr. Aruni Wilson



Dr. Ramesh kumar V



Dr. Valli Nachiyar



Dr. Jayshree Nellore



ANNEXURE-1

SCCA9504	INDUSTRY 4.0 FOR BIO ENGINEERS <u>PROJECT BASED LEARNING APPROACH</u>	L	T	P	C	Max. Marks
		1	0	2	2	100

COURSE OBJECTIVE:

- To demonstrate the achievement of efficient and economically viable production without being hazardous to human health and environment. Learners will gain deep insights into how smartness is being harnessed from data and appreciate what needs to be done in order to overcome some of the challenges.

UNIT 1: MODELLING AND SIMULATION**6 Hours**

Introduction to Industry 4.0 - The Various Industrial Revolutions - Modeling Principles: Introduction, definition of modeling and simulation, different types of models, application of mathematical modeling.

Simulation: Introduction, Simulation Tools, Process Simulation Software Platforms and Applications, Trends in Process Simulation Engineering

UNIT 2: SMART INDUSTRY**6 Hours**

Road to Industry 4.0 - Green manufacturing, Robotic Automation, Industrial Applications- Manufacturing, Control, Maintenance and Assembly, RFID- Type, RFID system, applications, RFID in health care, Embedded Systems - Embedded firmware, Platform software design, Wireless design, Embedded testing, modeling & automation, Hardware platform design, Device Management, Monitoring – Industrial monitoring, condition monitoring, Health monitoring. Sensor Technology and its applications, AI in smart manufacturing, Smart Factory logistics

UNIT 3 BIG DATA ANALYTICS AS SERVICE PROVIDER**7 Hours**

Technologies for enabling Industry 4.0 - Role of data, information, knowledge and collaboration in future organizations. Big Data - Background - Programming- Python and R - Git - Docker - Pipelines - DNA and RNA Sequencing - Massively parallel sequencing - Applications - Next Generation Sequencing and its future and big data analytics in healthcare - Big Data Repositories - Cloud platforms and computing for automation - Embedded systems in healthcare - Digitization the future of healthcare - medical cyber-physical systems - Case study - Integration of Multi-Omics Big Data in Cardiovascular Risks and Diseases.

UNIT4 TISSUE ENGINEERING**6 Hours**

Introduction, Methods, Materials, Material characterization; Scaffolds: Natural and Artificial polymers, Hydrogels, Bioceramics, Scaffold fabrication, Self-assembly, 3D Bioprinting: Introduction, Workflow, Imaging, 3D modeling, CAD-based design, Bioink, Techniques; Bioreactors for Tissue Engineering: Effect of different Parameters, Conditions; Tissue engineering for Skin, Bone, Vasculature and Cornea, Synthesis of different Nanostructures, Characterization of Nanostructures, Nanostructures in Diagnosis and Therapy, Organ printing. Scaffold techniques and the efficiency of gene-editing tools and their ability to fill the existing gaps in stem cell and regenerative therapies. Regulatory framework in development and marketing tissue-based products

UNIT 5 PROTOTYPING – TESTING AND COMMUNICATION**20 Hours**

Applications and Case Studies - New ideas – centered design process – functional prototype - testing methods/ideas – prototyping and testbeds – proof of concept – assembly – prototyping apps – addressing the complex problems.

Max.45 Hours**COURSE OUTCOMES:**

- CO1. Articulate on the new age technologies in the modeling of biochemical engineering.
- CO2. Integrate different emerging technologies to evolve Smart Factories
- CO3. Deduce the components that lead to industrial digital revolution
- CO4. Ability to assess the developments in bioengineering.
- CO5. Criticize the professional and ethical issues in novel industrial technologies.
- CO6. Develop a prototype/ innovative ideas in the various fields of biochemical engineering.

TEXT / REFERENCE BOOKS

1. Diego Galar Pascual, Pasquale Daponte, Uday Kumar, Handbook of Industry 4.0 and SMART Systems, 1st Editio, CRC Press, 2020
2. Sider W.D., Seader J. D., and Lewin D.R., Product and Process Design principles, Synthesis, Analysis and Evaluation, 2nd Edition, John Wiley and Sons, 2010.
3. Thomas Varghese & K.M. Balakrishna, Nanotechnology: An Introduction to Synthesis, Properties and Applications of Nanomaterials, Atlantic, 2012
4. Uthayan Elangovan, Smart Automation to Smart Manufacturing: Industrial Internet of Things, Momentum Pr, 1st Edition, 2019.

END SEMESTER EXAMINATION PATTERN

Max Marks: 100

PROJECT PRESENTATION

SBTA4003	MEDICAL GENOMICS	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

The course has been designed to show how genomics will be used for patient care with genetic disorders, and the knowledge and skills required to treat them.

UNIT 1 Genetic disorders and therapy

9 Hrs.

Single gene disorders and Multifactorial disorders - conventional and contemporary methods: Pedigree analysis, Linkage mapping, Positional/structural and functional cloning; Bioinformatic analysis; Genetic polymorphism and disease susceptibility. Treatment of genetic disorders: Methods of therapy - Drug (recombinant proteins); Gene (Viral vectors, delivery methods, efficacy); Some examples (Thalassemia, Phenylketonuria, Cystic fibrosis).

UNIT II Diagnostic genetics

9 Hrs.

Cytogenetics/ Molecular methods; Screening for mutation/ chromosomal anomaly - Adult/Prenatal/New-born screening; Preimplantation screening (Assisted reproductive technology- in vitro fertilization and Embryo transfer); Forensic testing - DNA fingerprinting, paternity testing, individual identification. Genetic counselling: Prenatal/adult diagnosis of genetic disorders; Risks and benefits; Informed consent; Right of choice; Case studies.

UNIT III Functional genomics and animal models in human disease

9 Hrs.

cDNA/gene cloning; site-directed mutagenesis; mammalian tissue culture; cell line transfections; functional assays; Use of model organisms, methods for generation of transgenic animals/ knock-in, knockout models (microinjection, ES cell transformation); ENumutagenesis; RNAi approach.

UNIT IV CRISPR-Based Genome Engineering

9 Hrs.

Origins of CRISPR; CRISPR Knockout Basics (Experimental Design, Guide RNA design, Delivery into Cells, Genotyping, Validation); CRISPR Knockin (Inserting or Mutating DNA Sequences in the Genome); CRISPR Editing in Animal Models (Knockout and Knockin Strategies in Mice); CRISPR Screens (High throughput applications of CRISPR); CRISPR-Based Gene Therapy; The Future of CRISPR and Ethical Considerations (CRISPR in the Clinic, CRISPR Babies, Case-Studies)

UNIT V Pharmacogenetics

9 Hrs.

Genetic drug response profiles, the effect of drugs on Gene expression. Concept of individualized drug therapy, Drivers and the promise of personalized medicine, Strategies for application of pharmacogenomics to customize therapy, Barriers.

Max.45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

CO 1- Evaluate the genetic basis of disease

CO 2-Choose a genetic test that is appropriate for a given clinical scenario

CO 3- Assess the evolution of genomic technologies

CO 4-Appraise the applications CRISPR technology for research, gene-therapy and the discovery of novel therapeutics

CO 4-Criticise ethical problems pertaining to the use of transgenic models in biomedical research

CO 5-Distinguish the effect of genetic differences between individuals in the outcome of drug therapy and in drug efficacy and toxicity.

TEXT BOOKS/REFERENCE BOOKS

1. Klug WS, Cummings MR, Spencer CA, Palladino MA, Killian D. Concepts of genetics. 2019.
2. Kiselev PF, editor. CRISPR Technology: "the Revolutionary Breakthrough for Genetics & Evolution". 2017.
3. Church GM. Genome editing and engineering: from TALENs, ZFNs and CRISPRs to Molecular surgery. Cambridge University Press; 2018
4. Nussbaum RL, McInnes RR, Willard HF. Thompson & Thompson Genetics in Medicine Elsevier Health Sciences; 2015
5. Martin M. Zdanowicz, M.M. "Concepts in Pharmacogenomics" Second Edition, American Society of Health-System Pharmacists, 2017.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN**Max. Marks: 100****PART A:** 10 Questions of 2 marks each - No choice**PART B:** 2 Questions from each unit of internal choice; each carrying 16 marks**Exam Duration: 3 Hrs.****20 Marks****80 Marks**