ACADEMIC REGULATIONS
PROGRAM STRUCTURE
and
DETAILED SYLLABUS

Bachelor of Technology
(Bio Technology)

(Effective for the students admitted from the Academic Year 2014-15)

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
(Autonomous)

Gokaraju Rangaraju
Institute of Engineering and Technology, Hyderabad
Department of Bio Technology (B.Tech)
GR14 Regulations

Gokaraju Rangaraju Institute of Engineering &Technology 2014 Regulations (GR14 Regulations) are given hereunder. These regulations govern the programmes offered by the Department of Bio Technology with effect from the students admitted to the programmes in 2014-15 academic year.

1. **Programme Offered:** The programme offered by the Department is B.Tech in Bio Technology, a four-year regular programme.

2. **Medium of Instruction:** The medium of instruction (including examinations and reports) is English.

3. **Admissions:** Admission to the B.Tech in Bio Technology Programme shall be made subject to the eligibility, qualifications and specialization prescribed by the State Government/University from time to time. Admissions shall be made either on the basis of the merit rank obtained by the student in the common entrance examination conducted by the Government/University or on the basis of any other order of merit approved by the Government/University, subject to reservations as prescribed by the Government/University from time to time.

4. **Programme Pattern:**
   a) Each Academic year of study is divided into two semesters.
   b) Minimum number of instruction days in each semester is 90.
   c) The total credits for the Programme is 200.
   d) All the registered credits will be considered for the calculation of the final percentage of marks.

5. **Award of B.Tech Degree:** A student will be declared eligible for the award of B.Tech Degree if he/she fulfills the following academic requirements:
   a) A student shall be declared eligible for the award of B.Tech degree, if he/she pursues the course of study and completes it successfully in not less than four academic years and not more than eight academic years.
   b) A student has to register for all 200 credits and secure all credits.
   c) A student, who fails to fulfill all the academic requirements for the award of the degree within eight academic years from the date of admission, shall forfeit his/her seat in B.Tech course.

d) The degree of B.Tech in Bio Technology shall be conferred by Jawaharlal Nehru Technological University Hyderabad (JNTUH), Hyderabad, on the students who are admitted to the programme and fulfill all the requirements for the award of the degree.

6. Attendance Requirements:

a) A student shall be eligible to appear for the semester-end examinations if he/she puts in a minimum of 75% of attendance in aggregate in all the courses concerned in the semester.
b) Condonation of shortage of attendance in aggregate up to 10% (65% and above but less than 75%) in a semester may be granted. A committee headed by Dean, Academic Affairs shall be the deciding authority for granting the condonation.
c) Students who have been granted condonation shall pay a fee as decided by the Academic Council.
d) Shortage of Attendance more than 10% (attendance less than 65% in aggregate) shall in no case be condoned.
e) Students whose shortage of attendance is not condoned in any semester are detained and are not eligible to take their end examinations of that semester. They may seek re-registration for that semester when offered next with the academic regulations of the batch into which he/she gets re-registered.

7. Paper Setting, Evaluation of Answer Scripts, Marks and Assessment:

a) Paper setting and evaluation of the answer scripts shall be done as per the procedures laid down by the Academic Council from time to time.
b) Distribution and Weightage of Marks

S.No.		External	Internal	Total
1	Theory	70	30	100
2	Practical	50	25	75
3	Engineering Graphics	70	30	100
4	Industry Oriented Mini Project	50	25	75
5	Comprehensive Viva	100	-	100
6	Seminar	-	50	50
7	Project	150	50	200

c) Continuous Internal Evaluation and Semester End Examinations
The assessment of the student's performance in each course will be based on continuous internal evaluation and semester-end examinations. The marks for each of the component of assessment are fixed as shown in the following Table.

Assessment Procedure

S.No	Component of Assessment	Marks Allotted	Type of Assessment	Scheme of Examinations
1	Theory	30	Internal Exams & Continuous Evaluation	1) Two mid semester examinations shall be conducted for 20 marks each for duration of 2 hours. Average of the two mid exams shall be considered i) Subjective - 15 marks ii) Objective - 5 marks 2) Tutorials - 5 marks 3) Attendance - 5 marks
		70	Semester-end examination	The semester-end examination is for a duration of 3 hours
2	Practical	25	Internal Exams & Continuous Evaluation	1) Lab Internal :10 marks 2) Record : 5 marks 3) Continuous Assessment : 5 marks 4) Attendance : 5 marks
		50	Semester-end examination	The semester-end examination is for a duration of 3 hours.

d) Industry Oriented Mini Project: The Mini Project is to be taken up with relevance to Industry and is evaluated for 75 marks. Out of 75, 25 marks are for internal evaluation and 50 marks are for external evaluation. The supervisor continuously assesses the student for 15 marks (Attendance – 5 marks, Continuous Assessment – 5 marks, Report – 5 marks). At the

end of the semester, Mini Projects shall be displayed in the road show at the department level for the benefit of all students and staff and the same is to be evaluated by the Mini Project Review Committee for 10 marks. The Mini Project report shall be presented before Project Review Committee in the presence of External Examiner and the same is evaluated for 50 marks.
Mini Project Review Committee consists of HOD, Mini Project Coordinator and Supervisor.

e) **Comprehensive Viva:** The Comprehensive Viva shall be conducted by a Committee consisting of HOD and two senior faculty members of the department. The student shall be assessed for his/her understanding of various courses studied during the programme of study. The Viva-Voce shall be evaluated for 100 marks.

f) **Seminar:** For the seminar, the student shall collect information on a specialized topic and prepare a technical report and present the same to a Committee consisting of HOD, two senior faculty and the seminar coordinator of the department. The student shall be assessed for his/her understanding of the topic, its application and its relation with various courses studied during the programme of study for 50 marks.

g) **Major Project:** The project work is evaluated for 200 marks. Out of 200, 50 marks shall be for internal evaluation and 150 marks for the external evaluation. The supervisor assesses the student for 25 marks (Attendance – 5 marks, Continuous Assessment – 15 marks, Report – 5 marks). At the end of the semester, Projects shall be displayed in the road show at the department level for the benefit of all the students and staff and the same is to be evaluated by the Project Review Committee for 25marks. The external evaluation for Project Work is a Viva-Voce examination which is conducted by the Project Review Committee in the presence of external examiner and is evaluated for 150 marks.
Project Review Committee consists of HOD, Project Coordinator and Supervisor.

h) **Engineering Graphics**
- Two internal examinations, each is of 20 marks .The average of the two internal tests shall be considered for the award of marks.
- Submission of day to day work - 5 marks.
- Attendance - 5 marks.

8. **Recounting of Marks in the End Examination Answer Books:** A student can request for re-counting of his/her answer book on payment of a prescribed fee.

9. **Re-evaluation of the End Examination Answer Books:** A student can request for re-evaluation of his/her answer book on payment of a prescribed fee.

10. **Supplementary Examinations:** A student who has failed in an end semester examination can appear for a supplementary examination, as per the schedule announced by the College/Institute.

11. **Malpractices in Examinations:** Disciplinary action shall be taken in case of malpractices during Mid/ End-examinations as per the rules framed by the Academic Council.

12. **Academic Requirements:**
    a) A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each theory or laboratories if he/she securesnot less than 35% of marks in the Semester-end Examination and a minimum of 40% of the sum total of the Internal Evaluation and Semester-end examination taken together.
    b) A student shall be promoted from II year to III year; or from III year to IV year only if he/she fulfills the academic requirements of minimum credits from the following examinations whether the candidate takes the examination or not.

Phase	Minimum Credits	No. of Examinations				
		I-I	I-II	II-I	II-II	III-I
II to III Year	37	2 Regular 1 Supply	1 Regular 1 Supply	1 Regular —	--- ---	--- —
III to IV Year	62	3 Regular 2 Supply	2 Regular 2 Supply	2 Regular 1 Supply	1 Regular 1 Supply	1 Regular

13. Award of Class: After a student satisfies all the requirements prescribed for the completion of the Degree and becomes eligible for the award of B. Tech Degree by Jawaharlal Nehru Technological University Hyderabad, he/she shall be placed in one of the following four classes (the marks awarded are from the aggregate marks secured for the 200 credits):

Class Awarded	% of Marks Secured
First Class with Distinction	Marks ≥ 70%
First Class	60% ≤ Marks < 70%
Second Class	50% ≤ Marks < 60%
Pass Class	40% ≤ Marks < 50%

14. **Withholding of Results:** If the student has not paid dues to the Institute/ University, or if any case of indiscipline is pending against him, the result of the student (for that Semester) may be withheld and he will not be allowed to go into the next Semester. The award or issue of the Degree may also be withheld in such cases.

15. **Transfer of Students from the Constituent Colleges of JNTUH or from other Colleges/ Universities:** Transfer of students from the Constituent Colleges of JNTUH or from other Colleges/ Universities shall be considered only on case-to-case basis by the Academic Council of the Institute.

16. **Transitory Regulations:** Students who have discontinued or have been detained for want of attendance, or who have failed after having undergone the Degree Programme, may be considered eligible for re-admission/re-registration to the same or equivalent subjects as and when they are offered.

17. **General Rules**
    a) The academic regulations should be read as a whole for the purpose of any interpretation.
    b) In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Academic Council is final.
    c) In case of any error in the above rules and regulations, the decision of the Academic Council is final.
    d) The college may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the college.

Academic Regulations GR14 for B.Tech (Lateral Entry)

(Effective for the students admitted into II year from the Academic Year 2015-16)

1. All regulations as applicable for B.Tech Four year degree programme (Regular) will hold good for B.Tech. (Lateral Entry Scheme) except for the following rules:

a) Pursued a programme of study for not less than three academic years and not more than six academic years(para2(a))

b) Registered for 150 credits and secured 150 credits. The marks obtained in all 150 credits shall be considered for the calculation of the final percentage of marks (para2(b))

c) Students, who fail to fulfill all the academic requirements for the award of the degree within eight academic years from the year of their admission, shall forfeit their seat in B.Tech programme (para2(c))

2. Academic Requirements

A student shall be promoted from III year to IV year only if he/she fulfills the academic requirement of minimum credits from the following examinations whether the candidate takes the examination or not (para 12(b)).

Phase	Minimum Credits	No. of Examinations		
		II-I	II-II	III-I
III to IV Year	37	2 Regular 1 Supply	1 Regular 1 Supply	1 Regular —

3. Award of Degree or Class

After a student satisfies all the requirements prescribed for the completion of the Degree and becomes eligible for the award of B. Tech Degree by Jawaharlal Nehru Technological University Hyderabad, he/she shall be placed in one of the following four classes (the marks awarded are from the aggregate marks secured for the 150 credits):

Class Awarded	% of Marks Secured
First class with Distinction	Marks ≥ 70%
First class	60% ≤ Marks < 70%
Second class	50% ≤ Marks < 60%
Pass class	40% ≤ Marks < 50%

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY
B.Tech (BT) PROGRAMME STRUCTURE

I B.Tech (BT) — I Semester

Group	Sub-Code	Subject	L	T	P	Credits	Hours	Marks
BS	GR14A1013	Mathematics for Biotechnology-I	2	1	-	3	4	100
BS	GR14A1021	Fundamentals of Biology-I	3	1	-	4	5	100
BS	GR14A1008	Engineering Chemistry	2	1	-	3	4	100
ES	GR14A1023	Engineering Graphics	1	-	2	3	5	100
ES	GR14A1016	Instrumentation in Biotechnology	2	1	-	3	4	100
ES	GR14A1017	Fundamentals of Process Engineering Computations	2	1	-	3	4	100
HS	GR14A1024	Business Communication and Soft Skills	-	-	2	2	4	75
ES	GR14A1026	IT Workshop	-	-	2	2	4	75
BS	GR14A1030	Engineering Chemistry lab	-	-	2	2	4	75
		Total	**12**	**5**	**8**	**25**	**38**	**825**

I B.Tech (BT) — II Semester

Group	Sub-Code	Subject	L	T	P	Credits	Hours	Marks
BS	GR14A1014	Mathematics for Biotechnology-II	2	1	-	3	4	100
BS	GR14A1022	Fundamentals of Biology-II	3	1	-	4	5	100
BS	GR14A1006	Physics for Engineers	2	1	-	3	4	100
HS	GR14A1005	English	2	1	-	3	4	100
ES	GR14A1011	Computer Programming and Data structures	2	1	-	3	4	100
ES	GR14A1015	Fundamentals of Probability and Statistics	2	1	-	3	4	100
ES	GR14A1025	Engineering Workshop	-	-	2	2	4	75
BS	GR14A1029	Engineering Physics lab	-	-	2	2	4	75
ES	GR14A1028	Computer Programming and Data Structures lab	-	-	2	2	4	75
		Total	**13**	**6**	**6**	**25**	**37**	**825**

II B.Tech (BT) — I Semester

Group	Sub-Code	Subject	L	T	P	Credits	Hours	Marks
PC	GR14A2089	Biochemistry	3	1	-	4	5	100
PC	GR14A2090	Microbiology	3	1	-	4	5	100
BS	GR14A2091	Statistical methods for Bio Technology	3	1	-	4	5	100
PC	GR14A2092	Process Engineering Principles	3	1	-	4	5	100
HS	GR14A2104	Managerial Economics and Financial Analysis	2	1	-	3	4	100
PC	GR14A2093	Biochemistry Lab	-	-	2	2	4	75
PC	GR14A2094	Process Engineering Lab	-	-	2	2	4	75
PC	GR14A2095	Microbiology Lab	-	-	2	2	4	75
		Total	**-**	**-**	**-**	**25**	**36**	**725**
MC	GR14A2002	Value Education and Ethics	-	-	-	-	2	100
		Total	**14**	**5**	**6**	**25**	**38**	**825**

II B.Tech (BT) — II Semester

Group	Sub-Code	Subject	L	T	P	Credits	Hours	Marks
PC	GR14A2096	Analytical Methods in Biotechnology	2	1	-	3	4	100
PC	GR14A2097	Genetics and Molecular Biology	3	1	-	4	5	100
PC	GR14A2098	Chemical and Biochemical Thermodynamics	3	1	-	4	5	100
PC	GR14A2099	Cell Biology	3	1	-	4	5	100
PC	GR14A2100	Bioprocess Engineering	3	1	-	4	5	100
PC	GR14A2101	Analytical Methods in Biotechnology Lab			2	2	4	75
PC	GR14A2102	Bioprocess Engineering Lab	-	-	2	2	4	75
PC	GR14A2103	Cell Biology Lab			2	2	4	75
		Total	**-**	**-**	**-**	**25**	**36**	**725**
MC	GR14A2001	Environmental Science-			-	0	2	100
		Total	**14**	**5**	**6**	**25**	**38**	**825**

III B.Tech (BT) — I Semester

Group	Sub-Code	Subject	L	T	P	C	H	Marks
ES	GR14A3084	Transportation Phenomena in Bioprocess	2	1		3	4	100
ES	GR14A3085	Biochemical Reaction Engineering	3	1		4	5	100
ES	GR14A3086	Basic Industrial and Environmental Biotechnology	3	1		4	5	100
ES	GR14A3087	Enzyme Engineering and Technology	3	1		4	5	100
ES	GR14A3088	Genetic Engineering	3	1		4	5	100
ES	GR14A3089	Genetic Engineering Lab			2	2	4	75
ES	GR14A3090	Immunology Lab			2	2	4	75
ES	GR14A3091	Industrial Biotechnology Lab			2	2	4	75
		TOTAL	**14**	**5**	**6**	**25**	**36**	**725**

III B.Tech (BT) — II Semester

Group	Sub-Code	Subject	L	T	P	C	H	Marks
ES	GR14A3092	Plant Biotechnology	2	1		3	4	100
ES	GR14A3093	Heat Transfer in Bioprocess	3	1		4	5	100
ES	GR14A3094	Immunology	3	1		4	5	100
ES	GR14A3095	Mass Transfer Operations	3	1		4	5	100
		Open Elective	3	1		4	5	100
ES	GR14A3096	Bioinformatics						
ES	GR14A3097	Datastructures through C++						
ES	GR14A3098	Biomaterials						
ES	GR14A3099	Bio-informatics Lab			2	2	4	75
HS	GR14A3100	Advanced English Communication Skills Lab			2	2	4	75
SPW	GR14A3101	Industry Oriented Mini Project			2	2	4	75
		TOTAL	**14**	**5**	**6**	**25**	**36**	**725**

IV B.Tech (BT) — I Semester

Group	Sub-Code	Subject	L	T	P	C	H	Marks
ES	GR14A4122	Down Stream Processing	3	1		4	5	100
ES	GR14A4123	Bioethics, Biosafety and IPR	3	1		4	5	100
ES	GR14A4124	Biopharmaceutical Technology	2	1		3	4	100
		Elective -I	3	1		4	5	100
ES	GR14A4125	Crop Improvement						
ES	GR14A4126	Molecular Pathogenesis						
ES	GR14A4127	Cancer Biology						
		Elective -II	3	1		4	5	100
ES	GR14A4128	Structural Biology						
ES	GR14A4129	Biosensors and Bioelectronics						
ES	GR14A4130	Nano Biotechnology						
ES	GR14A4131	Down Stream Processing Lab			2	2	4	75
ES	GR14A4132	Plant Tissue Culture Lab			2	2	4	75
ES	GR14A4133	Biopharmaceutical Technology Lab			2	2	4	75
		TOTAL	**14**	**5**	**6**	**25**	**36**	**725**

IV B.Tech (BT) — II Semester

Group	Sub-Code	Subject	L	T	P	C	H	Marks
ES	GR14A4134	Animal Cell Science and Technology	2	1		3	4	100
		Elective -III	**2**	**1**		**3**	**4**	**100**
ES	GR14A4135	Food Science and Technology						
ES	GR14A4136	Molecular Modeling and Drug Designing						
ES	GR14A4137	Bioprocess Optimization						
		Elective -IV	**2**	**1**		**3**	**4**	**100**
ES	GR14A4138	Clinical Trials and Regulatory Affairs						
ES	GR14A4139	Creativity Innovation & Product Development						
ES	GR14A4140	Neurobiology and Cognitive Science						
ES	GR14A4141	Food Technology Lab			2	2	4	75
SPW	GR14A4142	Comprehensive Viva			2	2	4	100
SPW	GR14A4143	Seminar			2	2	4	50
SPW	GR14A4144	Major Project			10	10	10	200
		TOTAL	**6**	**3**	**16**	**25**	**34**	**725**

I-Year

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING CHEMISTRY

Course Code: GR14A1008 L:2 T:1 P:0 C:3
I Year I Semester

Unit-I
Water Technology: Sources of natural water, impurities, hardness: causes, types, expression, units, estimation of hardness of water using complex metric titration method, problems on hardness, Boiler feed water, boiler troubles(scale, sludge, carry over, Caustic Embrittlement, Boiler Corrosion). Internal reatment methods(carbonate, phosphate, calgon), Softening of water – Lime Soda, Ion-Exchange process. Alkalinity of water and its determination, Potable water- its characteristics and steps involved in Municipal Water Treatment, Chlorination-Break Point Chlorination, sterilization by ozonation. Desalination of Brackish water - Reverse Osmosis. Waste water-types of effluents, domestic and industrial effluents(on over view)

Unit-II
Electrochemistry & Corrosion: Concept of Conductances-specific, equivalent, molar conductances and their inter relation ships applications of conductance-conductometric titrations-(Strong acid Vs Strong Base and Weak Acid Vs Strong Base). EMF of a cell, Electrode- Single Electrode Potential, Standard Electrode potential, Electro chemical series and its applications, Electrochemical Cells-types, Galvanic cell: cell representation, Cell reactions, Cell EMF, Electrolytic cells, Concentration cell. Batteries-types Lithium Cell(Li-thionyl Chloride), Secondary cells: Pb-PbO_2 cell, Fuel cells: H_2-O_2 fuel cells and their applications.

Causes and effects of corrosion-types of corrosion- chemical (Dry) corrosion-types and their mechanism, Electrochemical (Wet) corrosion and its mechanism, factors affecting the rate of corrosion – nature of metal and nature of environment. Corrosion Control Methods-Cathodic Protection: Sacrificial Anodic, Impressed Current Cathodic protection. Metallic Coatings –Anodic and Cathodic coatings, Methods of application of metallic coatings- Hot Dipping method(Galvanisation), Cementation(Sheradising), Electroplating(Cu coating), Organic Coatings: Paints – its constituents and their functions.

Unit-III
Engineering Materials I: Cement-types-portland cement –composition, Setting & Hardening of Portland cement. Ceramics-types-ceramic products - white wares, Stone ware, properties and applications of ceramics. Refractories-classification,properties(refractoriness,RUL,thermal spalling, thermal conductivity) and their application.

Lubricants: Classification with examples, mechanisms of lubrication (thick film, thin film, extreme pressure), properties of lubricants- viscosity, flash point, fire point, cloud point, pour point (Definition and significance).

Unit-IV

Engineering Materials II: Electronic materials : Semi conductors, Preparation of Pure Ge and Si by Zone Refining, Czochralski Crystal Pulling, Doping Techniques-Epitaxy, Diffusion & ion implantation.

Polymer Materials: Monomer, polymer, types of polymerization-addition and condensation, Plastics-Thermoplastic resins, Thermo set resins. Compounding & fabrication of plastics (compression & Injection moulding), Preparation, Properties, Engineering applications of Hi Density Poly Ethylene(HDPE), Poly Vinyl Chloride(PVC), Bakelite & Nylon 6,6. Liquid Crystal Polymers and their applications, Organic Light Emmiting Diodes (an Over View). Biodegradable polymers-their advantages and their applications. Elastomers – preparation, properties and applications of Butyl rubber, Thiokol rubber, Styrene-Butadiene Rubber. Conducting Polymers-classification with examples-mechanism of conduction in trans poly acetylene and their applications. Rubber. Conducting Polymers-classification with examples-mechanism of conduction in trans poly acetylene and their applications.

Unit-V

Energy sources: Fossil Fuels: Coal –types, analysis of coal- proximate and ultimate analysis and their significance, Calorific value of fuel – HCV, LCV, Determination of Calorific Value using BOMB calorimeter, Theoretical calculation of Calorific Value by Dulong's formula, Numerical Problems. Petroleum-its composition-synthetic petrol – Bergius and Fischer Tropsch's process method , cracking (Definition) and its significance, knocking and its mechanism in Internal Combustion engines, Octane Rating of Gasoline, Composition, and applications of natural gas, LPG, CNG. Bio-fuels: preparation of Bio-diesel by transesterification method, advantages of Bio-fuel.

Teaching Methodologies

1. White Board with marker, OHP & Power Point Presentation
2. Conducting quizzes,
3. Conducting Experiments
4. Assignment uploaded in website.

Text Books

1. A text book of engineering chemistry by PC Jain and Monica Jain, Dhanpat Rai publishing company.

Reference Books

1. A text book of engineering chemistry by SS Dara and SS Umre, S Chand publications.
2. A text book of engineering chemistry by Dr Y Bharathi kumari and Dr Ch Jyothsna, VGS publications.
3. A text book of engineering chemistry by R.P.Mani, K.N.Mishra, B.Rama Devi, V.R.Reddy, cengage learning publications

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

MATHEMATICS FOR BIOTECHNOLOGY-I

Course Code: GR14A1013 L:2 T:1 P:0 C:3
I Year I Semester

Unit-I
Differential calculus: Differentiation. Applications of differentiation: tangent, normal, subtangent and subnormal. Introduction to partial differentiation and Euler's theorem.

Integral Calculus: Integration of different functions, methods of integration, integration by parts. Definite integrals and application to finding areas.

Unit-II
Matrices: Real matrices-symmetric, skew-symmetric, orthogonal matrices. Complex matrices: Hermitian, Skew-Hermitian, Unitary matrices. Elementary row transformation, rank, echelon form, normal form. Solution of Linear systems: consistency and inconsistency of system of equations.

Eigen values and eigen vectors: eigen values and eigen vectors of a matrix and their properties. Modal and spectral matrices. Cayley- Hamilton theorem (without proof) and its application to find the inverse and powers of a matrix. Properties of Eigen values and eigen vectors

Unit-III
Quadratic forms: Definition, positive definite, negative definite, indefinite, semi definite quadratic forms. Rank, index and signature of a quadratic form. Sylvester's law. Reduction of a quadratic form to canonical form.

Unit-IV
Ordinary Differential Equations of first order and first degree and their applications Formation of ODE. Solution of separable, homogeneous, Exact, linear and Bernoulli equations.

Applications: Newton's law of cooling, Law of natural growth and decay, orthogonal trajectories and geometrical applications.

Unit-V
Linear differential equations of second and higher order Equations with constant coefficients–particular integrals for functions of the type e^ax , cosax,sinax,x^m,x^m V(x)– Equations with variable coefficients (Cauchy's and Legendre's type)

Teaching methodologies

1. Tutorial sheets uploaded in website
2. NPTEL video lectures
3. Course handouts

Text Books

1. Higher Engineering Mathematics: C.Das Chawla-Asian Publishers

Reference Books

1. Introduction to Linear Algebra-Gilbert Strang
2. Schaum's outline series on Linear Algebra, Calculus and Differential equations
3. Higher Engineering Mathematics: B.S.Grewal-Khanna Publications
4. GRIET reference manual

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

INSTRUMENTATION IN BIOTECHNOLOGY

Course Code: GR14A1016 L:2 T:1 P:0 C:3
I Year I Semester

Unit-I
Introduction: ER spectrum, interaction with matter, Jablonski diagram, molecular energies, errors, significant figures, precision, accuracy, confidence limits.

Unit-II
Sterilization techniques: Principle and applications: Bunsen burner, autoclave, hot air oven, filtration, laminar air flow chamber, chemicals.

Unit-III
Preservation techniques: Principle and applications: Refrigeration Lyophilisation, Cryopreservation

Unit-IV
Detection techniques: Parts of a simple and compound microscope, Beer's law, Colorimeter Biosensors- basics.

Unit-V
Separation techniques: Basics of Centrifugation, filtration, Probes and sensors: Ph meter, thermometer, water bath, vortex mixer, biological incubators, DO electrode.

Teaching methodologies
1. OHP and Power Point presentations
2. Tutorial Sheets
3. Assignments

Text Books
1. Instrumental methods of chemical analysis- Gurudeep R Chatwal, sham K Anand , Himalaya publishing house
2. Instrumental methods of analysis, D. Skoog, 2003
3. Instrumental methods of analysis; Willard and H. Merrit, Phi, 1999

Reference Books
1. Hobert Willard DL Merritt& JRJA Dean, Instrumental methods of analysis, CBS publishers and distributors, 1992

2. Vogal, text book of quantitative inorganic analysis, 1990. Ewing , Instrumental methods of analysis , 1992
3. Microbiology by Pelczar

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

FUNDAMENTALS OF BIO PROCESS COMPUTATIONS

Course Code: GR14A1017 L:2 T:1 P:0 C:3
I Year I Semester

Unit-I
Stoichiometric relation: Basis of calculations, Methods of expressing compositions of mixtures and solutions, Density and specific gravity, Baume and API gravity scales.

Unit-II
Behavior of Ideal gases: Kinetic theory of gases, Application of ideal gas law, Gaseous mixtures, Gases in chemical reactions.

Unit-III
Vapor pressure: Liquefaction and liquid state, Vaporization, Boiling point, Effect of temperature on vapor pressure, Antoine equation, Vapor pressure plots, Estimation of critical properties, Vapor pressure of immiscible liquids and ideal solutions, Roult's law, Non-volatile solutes.

Unit-IV
Humidity and Saturation: Relative and percentage saturation or dew point, Wet bulb and dry bulb temperature, Use of humidity charts for engineering calculations.

Unit-V
Material balances: Tie substance, Yield, Conversion, Processes involving chemical reactions.
Material balance calculations: Material balance calculations involving drying, dissolution and crystallization. Processes involving recycle, bypass and purge.

Teaching methodologies
1. White board and marker
2. Power Point presentations
3. Tutorial Sheets
4. Assignments

Text Books

1. Chemical process principles, Part -I, Material and Energy Balance by Hougen O A, Watson K.M. and Ragatz R.A. John Wiley and Sons, New York, 1963, 2nd Ed.
2. Basic Principles and Calculation in Chemical Engineering by D.H. Himmelblau, 5th edn. PHI, 2001

Reference Books

1. Basic Principles and Calculations in Chemical Engineering: International Edition, Addison-Wesley, David M. Himmelblau / James B. Riggs; December 2003. ISBN13: 9780131233683 ISBN10: 0-13-123368-8
2. Stoichiometry by B.I. Bhatt and S.M. Vora (3rd edn.), Tata McGraw Hill Publishing company, Ltd. New Delhi (1996)

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

FUNDAMENTALS OF BIOLOGY-I

Course Code: GR14A1021 L:3 T:1 P:0 C:4
I Year I Semester

Unit-I
Introduction to Biological systems: Diversity in biological systems. Kingdom systems: Five-kingdom classification. Differences between Prokaryotes & Eukaryotes, General characters of Bacteria, Virus, Algae, Fungi and Protozoans, Ecosystem.

Unit-II
Plant Biology-I: Classification of Plant Kingdom. General characters of Bryophytes, Pteridophytes, Gymnosperms and Angiosperms.

Unit-III
Plant Biology-II: Concepts of Growth, Meristem, Plant growth regulators: Auxins, Gibberellins, Cytokinins, Absicic acid, Ethylene. Plant tissue culture technology.

Unit-IV
Animal Biology: Classification of Animal kingdom. General characters of invertebrates and vertebrates, Concepts of species.

Unit-V
Human Biology: Cells, Organ systems and functions:Digestive, Respiratory, circulatory, Endocrine system and Nervous systems.

Teaching methodologies
1. White board and marker
2. OHP and PPTs
3. Models and Charts

Text Books
1. Essential s of Biology and Biotechnology. Birbahadur.
2. Human Physiology (II Edition) vol1 &II, Medical Allied Agency, Kolkata.1987, Dr. C.C. Chatterjee.

Reference Books
1. Introduction to biology and biotechnology, second edition. K. Vaidyanath, K. Pratap Reddy and K. Satya Prasad, BS Publication.
2. H.G. Rehan and G. Reed, Biotechnology Vol. I and II

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING GRAPHICS

Course Code: GR14A1023 L:1 T:0 P:2 C:3
I Year I Semester

Unit-I
Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance – Drawing Instruments and their Use – Conventions in Drawing – Lettering – BIS Conventions. Curves used in Engineering Practice & their

Constructions: a) Conic Sections, b) Cycloid, Epicycloid and Hypocycloid, c) Involutes.

Scales: Different types of scales. Plain Scale, Diagonal Scale & Vernier Scale

Unit-II
Orthographic Projections: Principles of Orthographic ProjectionsConventions-First and Third Angle Projections. Projections of Points and Lines inclined to both planes, True lengths, traces.

Unit-III
Projections OS Planes: Plane parallel, perpendicular and inclined to one reference plane. Plane inclined to both the reference planes.
PROJECTIONS OF SOLIDS: Projections of Regular Solids inclined to both planes.

Unit-IV
Sections of Solids: Types of section planes, Section by a plane perpendicular to V.P., Section by a plane perpendicular to H.P.

Development of Surfaces: Development of Surfaces of Right Regular Solids – Prisms, Cylinder, Pyramid Cone and their parts.

Unit-V
Isometric Projections: Principles of Isometric Projection – Isometric Scale – Isometric Views – Conventions – Isometric Views of Lines, Plane Figures, Simple and Compound Solids – Isometric Projection of objects having non- isometric lines. Isometric Projection of Spherical Parts.

Transformation of Projections: Conversion of Isometric Views to Orthographic Views – Conventions.

Teaching methodology

1. Power point Presentations, Working models, white board & marker

Text Book

1. Engineering Drawing, N.D. Bhatt / Charotar
2. Engineering graphics with Auto CAD- R.B. Choudary/Anuradha Publishers

Reference Books

1. Engineering Drawing and Graphics, Venugopal / New age.
2. Engineering Drawing- Johle/Tata Macgraw Hill.
3. Engineering Drawing, Narayana and Kannaiah / Scietech publishers. Engineering Drawing, Narayana and Kannaiah / Scietech publishers.
4. Engineering Drawing – BasanthAgrawal/ C M Agrawal; 2e McGraw Hill Education

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

BUSINESS COMMUNICATION AND SOFT SKILLS

Course Code: GR14A1024 L:0 T:0 P:2 C:2
I Year I Semester

Unit-I
Just A Minute (JAM)

Unit-II
Phonetics: Introduction to speech sounds; identification of sound symbols; vowel and consonants

Unit-III
Role play: Introduction to role play; situation handling; non-verbal communication

Unit-IV
Debate: Introduction and features of Debate; Types of Debate; Understanding critical thinking; building sustainable arguments; assessing credibility of the argument; overcoming obstacles

Unit-V
Describing a Person, Situation, Process and Object

Unit-VI
Letter Writing Manual and Emailing; types and formats, content and body of the letter. Email etiquettes

Unit-VII
Report Writing Formats and types of reports

Unit-VIII
Mind Mapping Assimilation of thoughts; expansion of ideas on central idea; suggesting parameters to carry forward the thinking process without deviation

Reference Books
1. Business Communication; HorySankarMukerjee; Oxford University Press
2. Business Communication; Meenakshi Raman, Prakash Singh; Oxford University Press

3. English and Soft skills; SP DHanavel; Orient Blackswan
4. Soft Skills for Everyone; Jeff Butterfield; Cengage Learning
5. Communication Skills; Viva Career Skills Library
6. Personality Development and Soft Skills; Barun K Mitra; Oxford University Press
7. Six Thinking Hats, Penguin Books, Edward De Bono
8. English for Engineer's; AedaAbidi, RituChaudhry; Cengage Learning
9. Communication Skills ; Sanjay Kumar , Pushpalatha; Oxford University Press
10. Business English : The Writing Skills you need for today's work place: Geffner, Andrea: Fifth edition,Barron's Educational Series, Newyork

Software Used

1. Sky Pronunciation Suite
2. Clarity
3. Mastering English

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

IT WORKSHOP

Course Code: GR14A1026 L:0 T:0 P:2 C:2
I Year I Semester

PC Hardware
Introduces the students to a personal computer and its basic peripherals, installation of system software like MS Windows, Linux and the required device drivers. In addition hardware and software level troubleshooting process, tips and tricks would be covered. **The students should work on working PC to install Windows and Linux on the same PC. Students are suggested to work similar tasks in the Laptop scenario wherever possible.**

Internet & World Wide Web module introduces the different ways of hooking the PC on to the internet from home and workplace and effectively usage of the internet. Usage of web browsers, email, newsgroups and discussion forums would be covered. In addition, awareness of cyber hygiene, i.e., protecting the personal computer from getting infected with the viruses, worms and other cyber attacks would be introduced. Productivity tools module would enable the students in crafting professional word documents, spread sheets and slide presentations.

Task 1
Installation of OS Every student should install Ubuntu and RedHat Linux on the computer. Lab instructors should verify the installation and follow it up with viva

Task 2
Hands on experience on Open Office: Every student should install open office on the computer. Students would be exposed to create word documents with images, tables, formula and with additional word processing features, Power point presentation, Excel and access. Lab instructors should verify the installation and follow it up with viva.

Task 3
Internet Based Applications: Students customize their web browsers with the LAN proxy settings, bookmarks, search toolbars and pop up blockers. Students should know what search engines are and how to use the search engines. A few topics would be given to the students for which they need to search on Google.

Task 4

Networking-Network Infrastructure: Understand the concepts of Internet, intranet, and extranet, local area networks (LANs), wide area networks (WANs), wireless networking, network topologies and access methods.

Task 5

Network Hardware: Understand switches, routers, media types, static routing, dynamic routing (routing protocols), default routes; routing table and how it selects best route(s); routing table memory, network address translation (NAT).
Task 6: Network Protocols: Understand the Open Systems Interconnection (OSI) model, IPv4, IPv6-ipv4toipv6 tunneling protocols to ensure backward compatibility, dual IP stack, subnetmask, gateway, ports, packets, reserved address ranges for local use (including local loopback IP).

Task 7

Network Services: Understand names resolution, networking services, TCP/IP-Tools (such as ping), tracert, pathping, Telnet, IPconfig, netstat, reserved address ranges for local use (including local loopback IP), protocols.

Task 8

Database -Core Database Concepts: Understand how data is stored in tables, Understanding DML and DDL statements

Task 9

Creating and Insertion of Data: Understanding Data types, tables and how to insert data in to the tables.

Task 10

HTML Basic HTML Tags: Understand what are the tags used for creation of website

Task 11

Designing a Static web page: Understand how to create static web page.

Teaching Methodologies

1. Power Point presentations.
2. Assignments.
3. Hands on experiment.

Reference Books

1. Introduction to Information Technology, ITL Education Solutions Limited, Pearson Education.

2. Introduction to Computers, Peter Norton, 6/e Mc Graw Hill
3. Upgrading and Repairing, PC's 18th e, Scott Muller QUE, Pearson Education
4. Comdex Information Technology Course tool kit Vikas Gupta, WILEY Dreamtech
5. IT Essentials PC Hardware and Software Companion Guide, Third Edition by David Anfinson and Ken Quamme- CISCO Press, Pearson Education
6. PC Hardware and A+Handbook Kate J. Chase PHI(Microsoft)
7. ORACLE DATA BASE LOG PL/SQL Programming SCOTT URMAN, Tata Mc- Graw Hill
8. Introduction to Database Systems, C.J.Date Pearson Education.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING CHEMISTRY LAB

Course Code: GR14A1030 L:0 T:0 P:2 C:2
I Year I Semester

List Of Experiments

1. Estimation of Total Hardness in sample water by complexometry
2. Estimation of percentage available chlorine in Bleaching Powder.
3. Estimation of Fe2+ by permanganometry.
4. Determination of strength of an acid by potentiometric titration method
5. Determination of strength of an acid using conductometry.
6. Determination of Strength of an acid in Pb-Acid battery titrimetric method
7. Determination of percentage of Iron in Cement sample by colorimetry..
8. Estimation of Calcium in port land cement.
9. Determination of Viscosity of the given unknown liquid by Oswald's viscometer.
10. Determination of surface tention of the given unknown liquid by stalagnometer.
11. Preparation of Thiokol rubber.
12. Determination of percentage Moisture content in a coal sample.

Reference Books

1. Laboratory Manual on Engineering Chemistry, by Dr Sudha Rani, Dhanpat Rai Publishing house.
2. A Text book on Experiments and calculations in Engineering Chemistry, by SS Dara, S Chand publications.
3. Laboratory Manual of Organic Chemistry, by Raj K Bansal, Wiley Eastern Limited, New age international limited.
4. Engineering Chemistry practical manual prepared by faculty of engineering chemistry, GRIET(A) - (for college circulation only)

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

MATHEMATICS FOR BIOTECHNOLOGY-II

Course Code: GR14A1014 L:2 T:1 P:0 C:3
I Year II Semester

Unit-I
Laplace transforms and its application to Ordinary differential equations: Laplace transform of standard function – inverse Laplace transform – First shifting theorem, transform of derivatives and integrals – unit step function – second shifting theorem – differentiation and integration of transforms. Convolution theorem – periodic function – application of Laplace transforms to Ordinary differential equations.

Unit-II
Fourier series: Fourier series on the interval: determination of coefficients, Fourier series of even and odd functions, convergence. Fourier series on an arbitrary interval. Half range Fourier sine and cosine series using odd and even extensions.

Unit-III
Solution of a non-linear equation Bisection method, method of false position and Newton – Raphson method solution of linear system Gauss elimination and Gauss -Jordan methods.

Unit-IV
Interpolation Uniform data: finite differences- forward, backward and central differences. Relationship between difference operators. Differences of a polynomial. Newton's forward and backward interpolation formulae, Gauss forward and backward interpolation formulae.
Non-Uniform data: Lagrange formula.

Unit-V
Numerical Integration: Trapezoidal, Simpson's 1/3rd and Simpson's 3/8th Rules. Numerical Solution of initial value problems in ODE: Taylor's series method, Euler's method, Modified Euler's method, Runge-Kutta method of 4th order

Teaching methodologies
1. Tutorial sheets uploaded in website

2. NPTEL video lectures
3. Course handouts

Text Books

1. Higher Engineering Mathematics: C.Das Chawla-Asian Publishers

References Books

1. Schaum's outline series on Laplace Transforms.
2. Higher Engineering Mathematics: B. S. Grewal-Khanna Publications
3. GRIET reference manual

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

FUNDAMENTALS OF BIOLOGY-II

Course Code: GR14A1022 L:3 T:1 P:0 C:4
I Year II Semester

Unit-I
Biomolecules: Definition, functions and classification of carbohydrates-mono, di and polysaccharides. Lipids: definition, classification and functions. Amino acids: structures and functions. Proteins: structure and functions. Nucleic acids: nucleosides and nucleotides, Watson and Crick model of DNA, types of RNAs.

Unit-II
Photosynthesis: Chlorophyll as a trapper of solar energy. Ultra structure of chloroplast. Structures of chlorophyll and carotenes. Major photosynthetic pigments. Photosynthetic reaction centers, Hills reaction. PSI and PSII. Photophosphorylation- cyclic , non-cyclic and dark reaction. Mitochondria –structure and functions. Location of electron transport chain.

Unit-III
DNA Technology: Methodology, restriction enzymes, ligases. DNA Vectors - Plasmid viral. Introduction to transgenic plants and animals.

Unit-IV
Applications of Biotechnology-I: Importance of biofuels, bio fertilizers, bio pesticides, bio indicators and biosensors. Use of Bt-Toxin in agriculture. Applications of biotechnology in agriculture and animal husbandry

Unit-V
Applications of Biotechnology-II: Definition of enzymes, classification of enzymes, importance of microbial enzymes, monoclonal antibodies -types and applications. Single cell proteins (SCP) - bacterial SCPs, Algal SCPs and fungal SCPs. Nutritive values of SCPs and their applications.

Teaching methodologies
1. White board and marker
2. OHP and PPTs
3. Models and charts

Text Books

1. Essentials of Biology & Biotechnology. Bir Bahadur.
2. Introduction to biology and biotechnology, second edition. K. Vaidyanath, K.Pratap
3. Reddy, and K. Satya Prasad, BS Publication.

Reference Books

1. Human Physiology (IInd Edition) Vol 1 and II, Medical Allied Agency, Kolkata.1987, Dr. C.C. Chatterjee.
2. H.G Rehan and G. Reed , Biotechnology Vol I and Vol II.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

PHYSICS FOR ENGINEERS

Course Code: GR14A1006 L:2 T:1 P:0 C:3
I Year II Semester

Unit-I

Crystal Structures: Lattice points, Space lattice, Basis, Bravias lattice, unit cell and lattice parameters, Seven Crystal Systems with 14 Bravias lattices , Atomic Radius, Co-ordination Number and Packing Factor of SC, BCC, FCC, Miller Indices, Inter planer spacing of Cubic crystal system.

Defects in Crystals: Classification of defects, Point Defects: Vacancies, Substitution, Interstitial, Concentration of Vacancies, Frenkel and Schottky Defects, Edge and Screw Dislocations (Qualitative treatment), Burger's Vector.

Unit-II

Acoustics & Acoustic Quieting: Basic Requirement of Acoustically Good Hall, Reverberation and Time of Reverberation, Sabine's Formula for Reverberation Time(Qualitative Treatment), Measurement of Absorption Coefficient of a Material, Factors Affecting the Architectural Acoustics and their Remedies. Acoustic Quieting: Aspects of Acoustic Quieting, Methods of Quieting, Mufflers, Sound-proofing.

Ultrasonics: Introduction, Production of ultrasonic waves: Piezo electric & Magnetostriction methods, Properties of ultrasonic waves, Applications of ultrasonics: Introduction to NDT, Ultrasonic testing systems: pulse echo, trough transmission, Resonance systems and Ultrasonic testing methods: Contact and Immersion methods.

Unit-III

Dielectric Properties: Electric Dipole, Dipole Moment, Dielectric Constant, Polarizability, Electric Susceptibility, Displacement Vector, Types of polarization: Electronic, Ionic and Orientation Polarizations and Calculation of Polarizabilities (Electronic & Ionic) -Internal Fields in Solids, Clausius -Mossotti Equation, Piezo-electricity and Ferro- electricity.

Magnetic Properties: Magnetic Permeability, Magnetic Field Intensity, Magnetic Field Induction, Intensity of Magnetization, Magnetic Susceptibility, Origin of Magnetic Moment, Bohr Magnetron, Classification of Dia, Para and Ferro Magnetic Materials on the basis of Magnetic Moment, Hysteresis Curve on the basis of Domain Theory of Ferro Magnetism, Soft and Hard Magnetic Materials, Ferrites and their Applications.

Unit-IV

Lasers: Characteristics of Lasers, Spontaneous and Stimulated Emission of Radiation, Meta-stable State, Population Inversion, Einstein's Coefficients and Relation between them, Ruby Laser, Helium-Neon Laser, Semiconductor Diode Laser, Applications of Lasers.

Fiber Optics: Structure and Principle of Optical Fiber, Acceptance Angle , Numerical Aperture, Types of Optical Fibers (SMSI,MMSI,MMGI), Attenuation in Optical Fibers, Application of Optical Fibers, Optical fiber Communication Link with block diagram.

Unit-V

Nanotechnology: Origin of Nanotechnology, Nano Scale, Surface to Volume Ratio, Bottom-up Fabrication: Sol-gel Process; Top-down Fabrication: Chemical Vapor Deposition, Physical, Chemical and Optical properties of Nano materials, Characterization (SEM, EDAX), Applications.

Teaching Methodologies

1. Power Point Presentations
2. Assignments uploaded in website.

Text Books

1. Engineering Physics: P.K.Palanisamy, Scitech Publishers.
2. Engineering Physics: S.O.Pillai, New age International.
3. Applied Physics: T.Bhima Sankaram,G Prasad,BS Publications.

Reference Books

1. Solid State Physics: Charles Kittel, Wiley & Sons (Asia) Pte Ltd.
2. Fundamentals of physics: Halliday, Resnick, Walker.
3. Optical Electronics: A.J Ghatak and K. Thyagarajan, Cambridge University Press.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGLISH

Course Code: GR14A1005 L:2 T:1 P:0 C:3
I Year I Semester

Unit-I

1. Chapter entitled Sir C.V. Raman: A Path breaker in the saga of Indian Science from "Enjoying Every day English", Published by Sangam Books, Hyderabad.
2. Chapter Entitled Mother Teresa from "Inspiring Speeches and Lives", Published by Maruthi Publications, Guntur

Tutorial-1: Present a small biographical sketch of an inspiring personality
Tutorial-2: Prepare an essay on "Charity begins at home."

Unit-II

Grammar & Vocabulary Development: Articles: Types of Articles and their usages; Tense and Aspect; Subject and Verb Agreement; Prepositions

Vocabulary Development: Synonyms and Antonyms; One-word substitutes; prefixes and suffixes; words often confused; idioms and phrases.

Speaking & Writing skills: Information transfer: verbal to graphical presentation and from graphical presentation to verbal. Public Speaking: Body Language, Presentation Skills and its Features.

Tutorial-3: Worksheet on the usage of Tenses, Articles and Prepositions
Tutorial-4: Exercises on vocabulary
Tutorial-5: Interpretation of data from different formats

Unit-III

1. Chapter Entitled The Connoisseur from "Enjoying Every day English", Published by Sangam Books, Hyderabad
2. Chapter Entitled Sam Pitroda from "Inspiring Speeches and Lives", Published by Maruthi Publications, Guntur.

Tutorial-5: Story Analysis
Tutorial-6: Present a person who bears risk taking ability to solve the problems of people/society
Tutorial-7: Describe a strange event that occurred in your life

Unit-IV

1. Chapter Entitled Bubbling Well Road from "Enjoying Every day English", Published by Sangam Books, Hyderabad

2. Chapter Entitled Amartya Kumar Sen from "Inspiring Speeches and Lives", Published by Maruthi Publications, Guntur

Tutorial-9: Oral Presentation on "Does the quality of Unity in Diversity helped us to acquaint easily with the trends of globalization?"

Tutorial-10: Develop an essay "The ways to impart moral and ethical values amongst the students."

Unit-V

1. Chapter entitled The Cuddalore Experience from "Enjoying Every day English", Published by Sangam Books, Hyderabad
2. Chapter Entitled Martin Luther King Jr. (I have a dream) from "Inspiring Speeches and Lives", Published by Maruthi Publications, Guntur

Tutorial-11: Presentation on "The possible ways to educate students about Disaster Management."

Tutorial-12: Write or present "Is every present leader was a follower?"

Text Books

1. Enjoying Every day English by A. Rama Krishna Rao- Sangam Books
2. Inspiring Speeches and Lives by Dr.B. Yadava Raju, Dr.C. Muralikrishna, Maruthi Publications.

Reference Books

1. Murphy's English Grammar with CD, Murphy, Cambridge University Press.
2. Effective Technical Communication, M. Ashraf Rizvi, Tata McGraw Hill.
3. Technical Communication, Meenakshi Raman, Sangeeta Sharma, Oxford higher Education.
4. English for Engineers Made Easy, Aeda Abidi, Ritu Chaudhry, Cengage Learning.
5. Communicate or Collapse, Pushp Latha, Sanjay Kumar, PHI Learning Pvt.Ltd.
6. Communication Skills, Sanjay Kumar, Pushp Latha, Oxford Higher Education.
7. A Hand Book for Engineers, Dr. P. Eliah, BS Publications

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

COMPUTER PROGRAMMING AND DATA STRUCTURES

Course Code: GR14A1011 L:2 T:1 P:0 C:3
I Year II Semester

Unit-I
Introduction to Computers: Computer hardware and software, System Software, Program Development Steps, Algorithms, Flowcharts.

Introduction to C: Structure of C-Program, keywords, Identifiers, Data Types, Constants, variables, Operators, Expressions, Precedence and Order of Evaluation, Type Conversions and Type Casting .

Managing I/O: Input-Output statements, formatted I/O.

Unit-II
Decision making statements: if, if-else, if-else-if, nested if, switch

Iterative statements: while, do- while, for Unconditional statements: break, continue, go to.

Arrays: Introduction, One-dimensional arrays, Declaring and initializing arrays, Multidimensional arrays.
Strings: Introduction to Strings, String Handling Functions, Array of Strings.

Unit-III
Functions: Introduction, Function Definition, Function Declaration, Function Calls, Return values and their types, Categories of Functions, nested functions, Recursion, Storage Classes, Passing arrays to Functions.

Pointers: Pointers and Addresses, Pointer expressions and pointer arithmetic, Pointers and functions, Pointers and arrays, Pointers and strings, Array of pointers, Pointer to Pointers.

Unit-IV
Structures: Basics of Structures, Nested Structures, Arrays of Structures, Arrays within structures, Structures and functions, Self referential structures, Unions.

Files: Introduction, Types of Files, File Access Functions, I/O on Files, Random Access to Files, Error Handling, Command Line Arguments.

Unit-V
Sorting: Bubble sort, Merge sort, Insertion sort, Selection sort, Quick sort.

Searching: Linear Search, Binary Search.

Introduction to Data Structures: Stack operations using arrays: push and pop, Queue operations using arrays : insert, delete

Teaching methodologies

White board and marker, power point presentation

Text Books

1. The C Programming Language, BRIANW. KERNIGHAN Dennis M .Ritchie, Second Edition, PHI.
2. Programming in C, Pradip Dey, Manas Ghosh, Second Edition, Oxford University Press.
3. Computer Programming and Data structures by E. Balaguruswamy, published by Mc Graw Hill.

Reference Books

1. Data structures using C, A.K. Sharma, Pearson publication
2. Let Us C, Yashwanth Kanetkar, 10th Edition, BPB Publications.
3. C& Data structures, P. Padmanabham, B.S. Publications.
4. Computer science, A structured programming approach using C, B.A. Forouzan and R.F. Gilberg, Third edition, Thomson.
5. Programming with problem solving, J. A. Jones & K. Harrow, Dreamtech Press.
6. Programming in C, Stephen G. Kochan, III Edition, Pearson Education.
7. Data Structures and Program Designing in C, R. Kruse, C. L. Tondo, B P Leung, Shashi M, Second Edition, Pearson Education.
8. Programming in C, Ashok N. Kamthane, 2nd edition, Pearson Publication.
9. Introduction to Data Structures in C, Ashok N Kamthane , Pearson Publication.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

FUNDAMENTALS OF PROBABILITY & STATISTICS

Course Code: GR14A1015 L:2 T:1 P:0 C:3
I Year II Semester

Unit-I
Descriptive Statistics: Compilation, classification and tabulation- Graphical representation, Bar and pie diagrams, frequency polygon and ogives- measures of central tendency; Arithmetic mean, median and mode- measures of dispersion; Range, Standard deviation and Coefficient of variation.

Unit-II
Probability: Basic concepts in Probability - The axioms of probability – Conditional probability and independence of events – Addition and Multiplication theorems for two events– Bayes theorem, tree diagrams (Concepts without derivations).

Unit-III
Random variables: Definition Of random variable, discrete and continuous random variables – Distribution function and statement of its properties. Probability mass function, probability density function with illustrations - Mathematical expectation and variance of ar. v with examples and statement of their properties.

Unit-IV
Distributions: Binomial, Poisson, Uniform, Normal and Exponential distributions(definition, real life examples, Statements of their Mean, Mode and Varianceand problems).

Unit-V
Correlation & Regression: Fitting of Straight line, second degree parabola, Power and Exponential curves by principle of least squares. Product moment correlation coefficient and Spearman's rank correlation coefficient. Simple linear regression, Lines of Regression and Multiple regression for three variables only.

Teaching methodologies
1. Chalk &Talk
2. Slide Presentations

Text Books
1. Probability and statistics for engineers (ErwinMiller and John E.Freund), R.A Johnson and C.B.Gupta,Pearson education.

2. Biostatistics: A foundation for analysis in Health sciences,Danial W.W,Wiley series.

Reference Books

1. Fundamentals of Mathematical Statistics, S.C.Gupta, V.K.Kapoor, S. Chand .
2. Probability and Statistics, Dr. T. K.V. Iyengar, Dr. B. Krishna Gandhi et.al, S. Chand.
3. Probability and statistics, Murray R Spiegel, John JSchiller et al., Schaum's outline series.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING WORKSHOP

Course Code: GR14A1025 L:0 T:0 P:2 C:2
I Year II Semester

Unit-I
Carpentry Shop – 1:

1.1. Introduction to various types of wood such as Teak, Mango, Sheesham, etc. (Demonstration and their identification).

1.2. Demonstration, function and use of commonly used hand tools. Care, maintenance of tools and safety measures to be observed.
Job I Marking, sawing, planning and chiselling & their practice

1.3. Introduction to various types of wooden joints, their relative advantages and uses.
Job II Preparation of half lap joint
Job III Preparation of Mortise and Tenon Joint

1.4. Safety precautions in carpentry shop.

Unit-II
Fitting Shop – 2:

2.1. Introduction to fitting shop tools, common materials used in fitting shop.

2.2. Description and demonstration of simple operation of hack-sawing, demonstration and description of various types of blades and their specifications, uses and method of fitting the blade.
Job I Marking of job, use of marking tools and measuring instruments.
Job II Filing a dimensioned rectangular or square piece of an accuracy of + 0.5 mm
Job III Filing practice (production of flat surfaces). Checking by straight edge.
Job IV Making a cutout from a square piece of MS Flat using hand hacksaw such as T-fit and V-fit

2.3. Care and maintenance of measuring tools like callipers, steel rule, try square.

Unit-III
House wiring – 3:

3.1 Study, demonstration and identification of common electrical materials such as wires, cables, switches, fuses, PVC Conduits.

3.2 Study of electrical safety measures and demonstration about use of protective devices such as fuses, and relays including earthing.
Job I I dentification of phase, neutral and earth of domestic appliances

and their connection to two pin/three pin plugs.
Job II Preparation of a house wiring circuit on wooden board using fuse, switches, socket, holder, ceiling rose etc. in PVC conduit and PVC casing and capping wiring system.
Job III Two lamps in series and parallel connection with one way switch
Job IV Two lamps in series and one lamp in parallel connection with one way switch.
Job V Stair case lamp connection with two way switch.

Unit-IV

Tin- smithy – 4:

4.1 Introduction to tin -smithy shop, use of hand tools and accessories e.g. different types of hammers, hard and soft mallet, sheet and wire gauge, necessary allowance required during job fabrication, selection of material and specifications.
4.2 Introduction and demonstration of hand tools used in tin -smithy shop.
4.3 Introduction and demonstration of various raw materials used in sheet metal shop e.g. M.S. sheet, galvanized-iron plain sheet, galvanised corrugated sheet, aluminium sheets etc.
4.4. Preparation of a rectangle tray and open scoop/ funnel.

Reference Books

1. Workshop Technology I,II,III, by S K Hajra, Choudhary and A K Chaoudhary. Media Promoters and Publishers Pvt. Ltd., Bombay
2. Workshop Technology by Manchanda Vol. I,II,III India Publishing House, Jalandhar.
3. Manual on Workshop Practice by K Venkata Reddy, KL Narayana et al; MacMillan India Ltd.
4. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd.,New Delhi
5. Workshop Technology by B.S. Raghuwanshi, Dhanpat Rai and Co., New Delhi.
6. Workshop Technology by HS Bawa, Tata McGraw Hill Publishers, New Delhi.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGINEERING PHYSICS LAB

Course Code: GR14A1029 L:0 T:0 P:2 C:2
I Year II Semester

List of Experiments

1. Determine the energy gap of a given semiconductor.
2. Calculate the energy loss in a given Ferro magnetic material by plotting B-H curve.
3. Calculate the Numerical Aperture of a given optical fiber.
4. Determine the Dielectric constant and Curie temperature of PZT material.
5. Calculate the Acceptance angle of a given optical fiber.
6. Draw V-I & L-I Characteristics of LASER diode.
7. Determine the bending losses in a given optical fibers.
8. Determine the Air-gap losses in a given optical fibers.
9. Determine the Hall Coefficient in Ge semiconductor by using Hall Experimental setup.
10. Determine the carrier concentration, mobility of charge carrier in Ge semiconductor.
11. Measure Ac voltage and frequency through CRO.
12. Measure Resistance and Capacitance by using digital multimeter.
13. Diffraction Grating.
14. Newtons Ring.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

COMPUTER PROGRAMMING AND DATA STRUCTURES LAB

Course Code: GR14A1028 L:0 T:0 P:2 C:2
I Year II Semester

Task- I

a) The heights of three students are 165, 148, 154 cm. respectively. Write a c program to sort the heights of the students in descending order.
b) Write a C program to find the roots of a quadratic equation using if-else.
c) The program should request the user to input two numbers and display one of the following as per the desire of user.
   (a) sum of numbers
   (b) difference of numbers
   (c) product of the numbers
   (d) division of the numbers.

Write a C program using switch statement to accomplish the above task.

d) In a mathematical number sequence let the first and second term in the sequence are 0 and 1. Subsequent terms are formed by adding the preceding terms in the sequence. Write a C program to generate the first 10 terms of the sequence.

Task-II

a) Write a C program to construct pyramid of numbers.
b) The reliability of an electronic component is given by reliability $r=e^{-\lambda t}$ where λ is the component failure rate per hour and t is the time of operation in hours. Determine the reliability at various operating times from 0 to 3000 hours by plotting a graph using a C program. The failure rate λ is 0.001. Plot the graph with a special symbol.
c) Write a C program to accept the date of birth and the current date to find the age of the person . The output should specify the age of a person in terms of number of years, months and days.

Task-III

a) Write a C program to calculate the following Sum: Sum=1-x2/2!+x4/4!-x6/6!+x8/8!-x10/10!
b) For a certain electrical circuit with an induction (L) and Resistance (R) , the damped natural frequency is given by $f=\sqrt{(1/LC - R2/ 4C2)}$. Write a C program to calculate the frequency for different values of C starting from 0.01 to 0.1.

c) Write a C program to generate all the prime numbers between 1 and n, Where n is a value supplied by the user.

Task-I V

a) Write a C program to find both the largest and smallest number in a list of integers.
b) Write a C program to count the lines, words and characters in a given text.
c) Write a C program to sort the names of 5 students in the alphabetical order. Ex: Rita, Sneha, Priti, Briya, kitti as Briya , Kitti, Priti, Rita, Sneha

Task-V

a) Write a C program to print all the rotations of a given string.
Ex: Rotations of the string "NEWS" are NEWS
EWSN WSNE SNEW
b) Write a C program to perform the following operations:
i) To insert a sub-string in a given main string at a given position.
Ii) To delete n Characters from a given position in a given string.

Task-VI

a) Write a C program that uses functions to perform the following:
i) Transpose of a matrix
ii) Addition of Two Matrices
iii) Multiplication of two matrices

Task-VII

a) Write a C programs that use both recursive and non-recursive functions
i) To find the factorial of a given integer.
ii) To find the GCD (greatest common divisor) of two given integers.

Task-VIII

a) Using pointers, write a function that receives a character string and a character as argument and deletes all occurrences of this character in the string.
b) Write a function using pointer parameter that compares two integer arrays to see whether they are identical. The function returns 1 if they are identical, 0 otherwise.

Task-IX

a) Write a c program which accepts employee details like (outer structure : name, employid, salary and (inner structure : area, street number, houseno)).Display the employee names and id belonging to a particular area.

b) Write a C program that uses functions to perform the following operations:
   i) Addition of two complex numbers
   ii) Multiplication of two complex numbers

(Note: represent complex number using a structure.)

Task-X

a) Write a C Program to display the contents of a file.
b) Write a C Program merging of two files in a single file.
c) Write a C Program to append data into a file.
d) Write a C program to reverse the first n characters in a file.

(Note : The file name and n are specified on the command line.)

Task-XI

a) Write a C Program to Search for a given element using Linear & Binary Search Techniques.
b) Write a C Program to Sort a given list of integers using Bubble Sort Technique.

Task-XII

a) Write a C Program to Sort a given list of integers using Merge Sort Technique.
b) Write a C Program to Sort a given list of integers using Insertion Sort Technique.

Task-XIII

A) Write a C Program to Sort a given list of integers using Quick Sort Technique.
b) Write a C Program to Sort a given list of integers using Selection Sort Technique.

Task-XIV

a) Write a C program to implement the following using arrays.
   i) Push and pop operations of a stack
   ii) Insert and delete operations of a queue

Text Books

1. The C Programming Language, BRIANW. KERNIGHAN Dennis M.Ritchie, Second Edition, PHI.
2. Programming in C, Pradip Dey, Manas Ghosh, Second Edition, Oxford University Press.
3. Computer Programming and Data structures by EBalaguruswamy, published by Mc Graw Hill.

Reference Books

1. Data structures using C, A.K. Sharma,Pearson publication
2. Let Us C, Yashwanth Kanetkar, 10th Edition, BPB Publications.
3. C& Data structures, P.Padmanabham, B.S. Publications.
4. Computer science, A structured programming approach using C, B.A. Forouzan and R.F. Gilberg, Third edition, Thomson.
5. Programming with problem solving, J.A.Jones & K.Harrow, Dreamtech Press.
6. Programming in C, Stephen G.Kochan, III Edition, Pearson Education.
7. Data Structures and Program Designing, C,R.Kruse, C.L.Tondo, B P Leung, Shashi M, Second Edition, Pearson Education.
8. Programming in C, Ashok N Kamthane, 2nd edition, Pearson Publication.
9. Introduction to Data Structures in C, Ashok N Kamthane , Pearson Publication.

II-Year

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

BIOCHEMISTRY

Course Code: GR14A2089 L:3 T:1 P:0 C:4
II Year I Semester

Unit-II
Metabolism of Carbohydrates: Glycolysis, Glucogenesis, Citric acid cycle, Glycogen metabolism and HMP shunt

Unit-III
Bioenergetics: Redox potential Components in electron transport systems in mitochondria, respiratory chain. Oxidative phosphorylation, Energitics, High energy compounds.

Unit-IV
Protein Metabolism: Classification of amino acids, Chemical reactions and physical properties, Biosynthesis of amino acids (Glutamate pathway and Shikimate pathway) and degradation of amino acids.

UNIT-V
Fatty acid Metabolism and Nucleic acid Metabolism: Overview of Fatty acid metabolism, synthesis and degradation of fatty acids; significance of cholesterol and lipoproteins in lipid profile analysis. Nucleotides structure and de novo synthesis of nucleotides.

Teaching methodologies: The methodology is based on lectures about course topics and on a case study and examples related to the topic supported by slide projections. Tutorial Sheets and Assignments

Text Books
1. Biochemistry-Harper's IlInstrated by Murray, Granner et al
2. Biochemistry by Jeremy M. Berg, John L. Tymozko, LubertStryer, Fifth edition, W.H.Freeman and Company, 1514 pages

Reference Books
1. Lehninger Principles of Biochemistry Edition 4, Nelson, David L. Cox, Michael M. Lehninger, Albert L. W H Freeman & Co
2. Student Companion to Accompany Biochemistry, Richard I. Gumport, Jeremy M. Berg, Nancy Counts Gerber, Frank H. Deis, Jeremy Berg, W H Freeman & Co

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

MICROBIOLOGY

Course Code: GR14A2090 L:3 T:1 P:0 C:4
II Year I Semester

Unit-I
Introduction to Microbiology: Discovery of microorganisms. Theory of spontaneous generation, Germ theory of diseases; Major contribution and events in the field of Microbiology, Scope and relevance of Microbiology, Micro diversity.

Unit-II
Microbial Nutrition: Nutrition of micro organisms. nutritional classes of microbes, macro and micronutrients, their sources and physiological functions of nutrients. Growth factors and their functions in metabolism. Aerobic and anaerobic metabolism.

Cultivation of Microorganisms: Cultivation of microorganisms: culture media-synthetic, complex media, solidifying agents, types of media - selective, differential, enrichment and enriched media, pure culture methods-spread plate, pour plate and streak plate, special techniques for cultivation of anaerobes. . Influence of environmental factors on growth-solutes, water activity, pH, temperature, oxygen, osmotic pressure, radiation.

Unit-III
Identification & Preservation of Microbes:

1. Preservation of microorganisms: working and primary stock cultures-agar slants, agar stabs, spore preparation, use of sterile soil, cryo -preservation, lyophilisation, application and limitation of various methods.
2. Staining techniques: Stains and dyes, fixation, principle dyes, simple staining, differential staining, spore straining, flagella straining, colony characteristics.
3. Biochemical tests-sugar fermentations, IMVIC tests, catalase production etc.

Unit-IV
Introduction to Viruses: Virus properties, Structure of Viruses, Animal Virology, Plant Virology, Viruses of Arthropods, bacteria and other lower organisms, Classification of viruses (Bacterial, plant and animal replication with one example each), Identification and Assay of viruses (Bacterial, plant and animal viruses),

Replication in bacteria, plant and animal with one example each (in case of animal viruses the teaching include examples of DNA and RNA viral replication and that which replicate in the cytoplasm and nucleus), Applications of Virology in biotech industry.

Unit-V

Pathogenisity: Definition of infection, diseases and pathogens, virulence and virulence factors. Examples: influenza, toxin, tuberculosis, Antimicrobial chemotherapy, Antibiotics – mode of actions – antimicrobial resistance – Tests for sensitivity to antimicrobial agents.

Teaching methodologies

1. White board and marker
2. Lecture using OHP
3. Class discussion
4. Interactive teaching
5. Tutorials and Assignments

Text Books

1. Microbiology, Pelzer M.J. Chan ECE and Krieg NR. Tata McGraw Hill.
2. Introduction to Micro biology a case History approach, 3rd edition John. L. Ingram, Catherine A Ingram, Thomson Publications.

Reference Books

1. Biology of Micro organism. BROCK, Prentice Hall, International Inc.
2. General Microbiology. Hons.G.Schlege. Cambridge university press.
3. General Microbiology. Roger Y Stanier, Macmillan.
4. General Microbiology. Prescott and Dunn McGraw Hill Publishers.
5. Introduction to microbiology _ A case history approach 3rd edition ,John L. Ingram, Catherine A. Ingram Thomson Publishers.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

STATISTICAL METHODS FOR BIO TECHNOLOGY

Course Code: GR14A2091 L:3 T:1 P:0 C:4
II Year I Semester

Unit-I
Sampling distribution: Definition of Population and sample, Overview of types of sampling(Random, Purposive, SRS, Stratified and Systematic random samplings) - Sampling distribution, standard error, sampling distribution of mean (known and unknown) and proportions.

Unit-II
Estimation &Testing of Hypothesis: Point estimation – Interval estimation - Confidence interval for mean, difference of means and for proportions. Concepts of Null hypothesis, Alternative hypothesis, Critical region, Type I and Type II errors, one tail and two-tail tests, Level of significance

Unit-III
Parametric Tests: Tests of hypothesis for means (single and difference between means) in small and large sampling, Tests of hypothesis for proportion (single and difference between proportions) in large sampling, Chi-square test for testing goodness of fit ,F-test for equality of variances (Concept and problem solving).

Unit-IV
Design of Experiments: ANOVA(1-way &2-way), Concepts of CRD,RBD and LSD and problem solving .

Unit-V
Non parametric tests: Run test, Sign test, Wilcox on signed-rank test, median test, Mann-Whitney test, Chi-square test for testing in dependence of attributes.

Teaching methodologies
1. Chalk &Talk
2. Slide Projections

Text Books
1. Probability and statistics for engineers (ErwinMiller and John E.Freund), R.A Johnson and C.B.Gupta.
2. 2.Biostatistics: A foundation for analysis in Health Sciences,Danial W.W
3. Fundamentals of Applied Statistics, S.C.Gupta, V.K.Kapoor

Reference Books

1. Fundamentals of Mathematical Statistics, S.C.Gupta, V.K.Kapoor
2. Probability and statistics, Murray R Spiegel,John J Schiller et al.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

PROCESS ENGINEERING PRINCIPLES

Course Code: GR14A2092 L:3 T:1 P:0 C:4
IIYear I Semester

Unit-I
Application of Engineering principles in Biotech Industries-Introduction to unit operations and unit processes-application of transport phenomenon principles (momentum, mass and heat transfer) in bio processing. Units and dimensions, basic quantities and derived units. Conversion of units. Concept of mass and force,definition of gcanditsutility. Various equations of state including ideal gas law to evaluate P-V.T data, their application in process calculations by solving basics numerical problems.

Unit-II
Fluid mechanics: Properties of fluids, fluid statics, energy balance in fluid flow through pipes and cond units, Bernoulli's equation and its application, calculation of power required for pumping fluids. Examples from bioprocessing systems.

Rheology of fluids: Newton's law of viscosity. Concept of Newtonian and non - Newtonian fluids- Different types of non-Newtonian fluids with examples in bio processing. Measurement of viscosity using extrusion rheometer, plate and cone viscometer, coaxial cylinder viscometer.

Unit-III
Flow through pipes, average velocity, flow regimes, boundary layer concept. Laminar and turbulent flow-characterization by Reynold's number, pressure drop due to skin friction and form friction, friction factor chart, Hagen –Poiseuille equation. Brief introduction to flow of compressible fluids.

Unit-IV
Flow past immersed bodies: Definition of drag and drag coefficient. Friction in flow through beds of solids, derivation of friction factor equations and pressure drop expressions. Introduction of the concept of packed beds. Motion of particles through fluids, terminal velocity.

Unit-V
Flow measuring and monitoring systems- valves, bends, elbows, prevention of leaks, mechanical seals, stuffing box. Flow measuring devices-manometers, orifice meter, venture meter and rotameter.

Fluid transportation machinery: Different types of pumps, positive displacement pumps, reciprocating pumps, diaphragm pumps, peristaltic pumps. Calculation of pump horsepower.

Teaching methodology

The methodology is based on lectures about course topics and on a case study and examples related to the topic supported by derivations on writing board. Tutorial Sheets and Assignments

Text Books

1. Introduction to Biochemical Engineering, D.G.Rao, TataMcHill(2005)
2. Bio-process Engineering Principles, Pauline M.Doran. Academic press(1995)
3. Unit operations of chemical engineering, McCabe, W.L,Smith J.C., and HarriotP.,Mc-GrawHill,3rdEd.(1993).

References Books

1. “Technicalaspectsoftherheologicalpropertiesofmicrobialcultures”,-Charles,M(1978)in Advanmces in Biochemical Engineering, Ghose, T.K., Fiechter, A and Blake brough, N.(Eds),Spinger-Verlag,Berlin,pp.1-62
2. UnitoperationinFoodprocessing,Earle,R.L.(1996)PergamonPress, Oxford, PP.212-

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Course Code: GR14A2104 L:2 T:1 P:0 C:3
II Year I Semester

Unit-I
Introduction & Demand Analysis: Definition and Scope: Definition, Nature and Scope of Managerial Economics. Demand Analysis: Demand Determinants, Law of Demand and its exceptions. Elasticity of Demand: Definition, Types, Measurement and Significance of Elasticity of Demand. Demand Forecasting, Factors governing demand forecasting, methods of demand forecasting.

Unit-II
Production & Cost Analysis: Production Function – Isoquants and Isocosts, MRTS, Least Cost Combination of Inputs, Cobb-Douglas Production function, Laws of Returns, Internal and External Economies of Scale. Cost Analysis: Cost concepts. Break-even Analysis(BEA) -Determination of Break-Even Point (simple problems) - Managerial Significance.

Unit-III
Markets & New Economic Environment: Types of competition and Markets, Features of Perfect competition, Monopoly and Monopolistic Competition. Price-Output Determination in case of Perfect Competition and Monopoly.
Pricing: Objectives and Policies of Pricing. Methods of Pricing. Business: Features and evaluation of different forms of Business Organisation: Sole Proprietorship, Partnership, Joint Stock Company, Public Enterprises and their types. New Economic Environment: Changing Business Environment in Post-liberalization scenario.

Unit-IV
Capital Budgeting: Capital: Capital and its significance, Types of Capital, Estimation of Fixed and Working capital requirements, Methods and sources of raising capital. Capital Budgeting: features of capital budgeting proposals, Methods of Capital Budgeting: Payback Method, Accounting Rate of Return (ARR) and Net Present Value Method and Internal Rate of Return (IRR) (simple problems).

Unit-V
Introduction to Financial Accounting & Financial Analysis: Accounting Concepts and Conventions - Double-Entry Book Keeping. Accounting Cycle: Journal, Ledger, Trial Balance, Final Accounts (Trading Account, Profit and Loss Account

and Balance Sheet with simple adjustments). Financial Analysis: Analysis and Interpretation of Liquidity Ratios, Activity Ratios, Capital structure Ratios and Profitability ratios. Du Pont Chart.

Teaching methodologies

1. Lectures
2. Power Point presentations
3. Seminars
4. Working out problems on black/white boards,
5. Conducting tutorials
6. Giving homework and/or assignments etc.

Text Books

1. Aryasri: Managerial Economics and Financial Analysis, TMH, 2009.
2. Atmanand: Managerial Economics, Excel, 2008.

Reference Books

1. Ambrish Gupta, Financial Accounting for Management, Pearson Education, New Delhi.2009
2. H. Craig Peterson & W. Cris Lewis, Managerial Economics, PHI, 2009
3. Lipsey & Chrystel, Economics, Oxford University Press, 2009

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

BIOCHEMISTRY LABORATORY

Course Code: GR14A2093 L:0 T:0 P:2 C:2
II Year I Semester

List of Experiments
1. pH measurements and preparation of buffers
2. Qualitative tests for Carbohydrates
3. Estimation of sugars
4. Estimation of proteins by Lowry's method / Biuret method
5. Estimation of cholesterol by Zak's method
6. Determination of saponification number of lipids
7. Qualitative tests for Amino acids
8. Separation of sugars-Paper chromatography
9. Biochemical estimation of DNA by spectrophotometer
10. Biochemical estimation of RNA using Spectrophotometer

Teaching Methodologies
1. The style is expository (skill-building) with both the students and the instructor know the expected results. The approach is deductive; students use a fundamental principle to understand their results. Laboratory course is imparted in traditional, technique-oriented style with activities emphasizing mastery of the primary tools and techniques of the course, and reinforcing basic principles.
2. The descriptors are “predetermined”, “deductive”, and “given”.
3. The principle of the experiment is explained by Instructor before live demonstration this, is followed by issue of materials for lab

Text Book
1. Laboratory Manual in Biochemistry by J.Jayaraman New age International Publications.
2. Principles & Techniques of Practical Biochemistry 5th edition. K. Wilson &J.Walker, CambridgeUniversity Press, 2000.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

PROCESS ENGINEERING LABORATORY

Course Code: GR14A2094 L:0 T:0 P:2 C:2
II Year I Semester

List of Experiments

1. Performance test on single stage Centrifugal pump
2. Performance test on Multiple stage Centrifugal pump
3. Performance test on Reciprocating Pump
4. Calibration of Venturimeter
5. Calibration of Orifice Meter
6. Determination of Friction factor for a given pipe line
7. Determination of loss of head due to sudden contraction in pipe line
8. Determination of loss of head due to sudden expansion in pipe line
9. Determination of loss of head due to bends in pipe-line
10. Determination of loss of head due to valves in pipe line
11. Determination of flow rate through "V"
12. Verification of Bernoulli's Theorems

Teaching Methodologies

1. The style is expository (skill-building) with both the students and the instructor know the expected results. The approach is deductive; students use a fundamental principle to understand their results.
2. Laboratory course is imparted in traditional, techniques-oriented style with activities emphasize mastery of the primary tools and techniques of the course, and reinforce basic principles. The descriptors are "predetermined", "deductive", and "given".
3. The principle of the experiment is explained by Instructor before live demonstration, this is followed by issue of materials for lab

Text Books

1. Bioprocess Engineering Principles, Pauline M. Doran, Academic Press, 1995
2. Unit Operations of Chemical Engineering McCabe, WL,

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

MICROBIOLOGY LAB

Course Code: GR14A2095 L:0 T:0 P:4 C:2
II Year I Semester

List of Experiments

1. Safety measures in Laboratory.
2. Study of student microscope - Construction, working principle, Operating procedure, precautions while using the microscope. Use of oil immersion objective.
3. Study of aseptic techniques-preparation of cotton plugs for test tubes and pipettes, Wrapping of petri- plates and pipettes.
4. Sterilization techniques (lecture/demonstrations)
5. Preparation of culture media (a) Broth type of media (b) Solid media
6. Culture of microorganisms: (a) Broth (b) Pure culture techniques: Streakplate, pour plate and spread plate.
7. Isolation and preservation of bacterial culture.
8. Staining of bacteria - simple staining, gram staining spore staining and capsule staining.
9. Antibiotic test- Disc diffusion method, minimum inhibitory concentration.
10. Microbiological examination of water.
11. Biochemical tests:
    a. IMVIC test
    b. Catalase test
    c. Coagulase test
    d. Gelatinase test
    e. Oxidase test.
12. Determination of Bacterial growth by Turbidometry/ Colorimetry.
13. Factors affecting the bacterial growth -effects of temperature, pH.

Teaching Methodology

1. The style is expository (skill-building) with both the students and the instructor know the expected results.. The approach is deductive; students use a fundamental principle to understand their results.
2. Laboratory course is imparted in traditional, techniques-oriented style with activities emphasize mastery of the primary tools and techniques of the course, and reinforce basic principles. The descriptors are “predetermined”, “deductive”, and “given”.
3. The principle of the experiment is explained by Instructor before live demonstration, this is followed by issue of materials for lab

Text Books

1. Aneja K.R. Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom cultivation, New Age International, New Delhi.
2. Microbiological and applications, Laboratory, Manual in General Microbiology by Benson, McGraw Publications. First edition 2007
3. Laboratory manual in microbiology by P. Gunasekharan, Newage international Publishers.

Reference Books

1. J.G. Cappucin and N.Sherman, A Laboratory manual, 4th edition, Addison &Weslay, 1999

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

VALUE EDUCATION AND ETHICS

Course Code: GR14A2002 L:4 T:0 P:0 C:0
II Year I Semester

Unit-I
Values and self development –social values and individual attitudes, Work ethics, Indian vision of Moral and non-moral valuation, Standards and principles, Value judgments. Importance of cultivation of values, Sense of duty, Devotion, Self reliance, Confidence, Concentration, Truthfulness, Cleanliness, Honesty, Humanity, Power of faith, National unity, Patriotism, Love for nature, Discipline.

Unit-II
Personality and Behavior Development-Soul and scientific attitude, God and scientific attitude, Positive thinking, Integrity and discipline, Punctuality, Love and Kindness, Avoiding fault finding, Free from anger, Dignity of labor, Universal brotherhood and religious tolerance, True friendship, Happiness Vs suffering, love for truth, Aware of self destructive habits, Association and cooperation, Doing best, Saving nature.

Unit-III
Character and Competence-Science Vs God, Holy books Vs blind faith, Self management and good health, Equality, Nonviolence, Humanity, Role of women, All religions and same message, Mind your mind, Self control, Honesty, Studying effectively.

Unit-IV
Professional consciousness Ethics: Ethical Human conduct, Development of human consciousness, Implications of value based living, Holistic technologies, Production systems, Universal human order, Code of conduct.

Unit-V
Legislative procedures: Rights and Rules, Human Rights, Valuable groups, Copy rights, IPR, RTI Act, Lokpal, Ombudsman.

Text Books
1. Chakraborty,S.K., Values and Ethics for Originations Theory and Practice, Oxford University Press, New Delhi, 2001
2. R R Gaur, R Saugal, G P Bagaria, “A foundation course in Human values and Professional Ethics”, Excel books, New Delhi, 2010.

Reference Books

1. Frankena, W.K., Ethics, Prentice Hall of India, New Delhi, 1990.
2. Kapoor, S.K., Human rights under International Law and Indian Law, Prentice Hall of India, New Delhi, 2002.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

ANALYTICAL METHODS IN BIOTECHNOLOGY

Course Code: GR14A2096 L:2 T:1 P:0 C:3
II Year II Semester

Unit-I
Fermentation Techniques: Construction and applications of Fermentor, Instrumentation: Agitator, pH electrode, Temperature probe, air-flow rate, dissolved oxygen (DO) & CO2 analyser, Liquid flow rate, Incubator, humidity chamber, CO2 incubator.

Unit-II
Separation Techniques: Principle, instrumentation and applications Electrophoresis -Paper, Gel, Capillary;1D,2D, SDS, Pulsed Field.
Centrifugation- RPM,G-force on molecules, Low & High Speed centrifugation, Zonal, Density Gradient & Differential Centrifugation; Chromatography -Paper, Thin Layer, Gel filtration, Ion Exchange, GLC, HPLC.

Unit-III
Cell Disruption: Physical or Mechanical Disruption - Liquid Homogenization, Sonication, Freeze-Thaw, Mortar and Pestle. Instrumentation, Principle and applications

Unit-IV
Detection Techniques I: Microscopy: Bright Field, Dark Field, Fluorescent, Phase Contrast, Confocal, SEM, TEM.

Cell Counter: Microbial colony counter, Antibiotic zone reader, Coulter counter (for animal cell counting), FACS.

Unit-V
Detection Techniques II: Spectrophotometer UV-Vis, IR NMR, Absorption, Emission, Mass, Raman, Spectro-fluorometer, Elisa Reader.
PCR, UV Trans-illuminator, Gel Scanning & documentation, Autoradiography, Geiger Müller counters, Scintillation counters.

Teaching methodologies
The methodology is based on lectures about course topics and on a case study and examples related to the topic supported by derivations on writing board. Tutorial Sheets and Assignments

Text Books

1. Instrumental methods of chemical analysis-Gurudeep R Chatwal, sham K Anand , Himalaya publishing house
2. Instrumental methods of analysis, D. Skoog, 2003
3. Instrumental methods of analysis; Willard and H. Merrit, Phi, 1999

Reference Books

1. Hobert Willard DL Merritt& JRJA Dean, Instrumental methods of analysis, CBS publishers and distributers, 1992
2. Vogal, text book of quantitative inorganic analysis, 1990. Ewing, Instrumental methods of analysis , 1992.
3. Bioseparations by Shiv Shanker

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

GENETICS AND MOLECULAR BIOLOGY

Course Code: GR14A2097 L:3 T:1 P:0 C:4
II Year II Semester

Unit-I
Fundamentals of inheritance: Mendelian inheritance, monohybrid and di-hybrid ratios, Gene interactions, Multiple factor inheritance, polygenic traits, Inheritance of some human traits, Genes and environment.

Unit-II
Chromosome as the Heredity carriers: Structure of eukaryotic chromosome, Nucleosome model, Histone proteins, Euchromatin and Heterochromatin, Karyotyping. Linkage: Concept of linkage, Crossing over and Recombination in Prokaryotes, Transformation, Transduction, Conjugation, Sex linkage and sex linked traits.

Unit-III
Mutations: Origin of mutations, Classification of mutations, Mutagens and their types, Chromosomal aberrations-structural and numerical aberrations.

Unit-IV
DNA structure and replication: Central dogma of molecular biology, Structure of DNA, Deviations from Watson & Crick model, Denaturation and Melting curves, Enzymology of DNA replication, Semi conservative mechanism of DNA replication in E. coli .

Unit-V
Transcription, RNA processing and Translation: Transcription, apparatus and proteins involved in transcription, Prokaryotic and Eukaryotic transcription, m-RNA processing: capping, polyadenylation and splicing. Processing of r-RNA and t-RNA, The genetic code, Wobble hypothesis, Protein synthesis in prokaryotes and eukaryotes.

Teaching methodologies
The methodology is based on lectures about course, topics and on a case study and examples related to the topic supported by slide projection and video presentations. Tutorial Sheets and Assignments.

Text Books

1. Genetics by B.D Singh,
2. Genetics by Sarin,
3. Cell and Molecular Biology by Gerald Karp.

Reference Books

1. Principles of Genetics by A.G Gardner.
2. Genes VII by Lewin B (2000) Oxford University Press New York.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

CHEMICAL AND BIOCHEMICAL THERMODYNAMICS

Course Code: GR14A2098 L:3 T:1 P:0 C:4
II Year II Semester

Unit-I
Basic Concepts In Engineering Thermodynamics: First and Second law of thermodynamics; Calculation of Work, energy and property changes in reversible processes, Thermodynamics of flow processes; Power cycles and refrigeration cycles, Residual properties
Material Balance: Steady state and equilibrium, types of material balances, stoichiometry of growth and product formation, Electron balance, Theoretical oxygen demand.

Unit-II
Thermodynamic Properties of Fluids: Estimation of thermodynamic properties using equations of state; Maxwell relationships and their applications; Calculation of flow processes based on actual property changes

Unit-III
Phase equilibria: Criteria for phase equilibrium; Vapour-liquid equilibrium calculations for binary mixtures, liquid -Liquid equilibrium and Solid-liquid equilibrium

Unit-IV
Chemical Reaction Equilibria: Equilibrium criteria for homogeneous chemical reactions; Evaluation of equilibrium constant and effect of pressure and temperature on equilibrium constant; Calculation of equilibrium conversions and yields for single and multiple chemical reactions

Unit-V
Biochemical Thermodynamics: Energetics of Metabolic Pathways; Energy Coupling (ATP & NADH); Stoichiometry and energetic analysis of Cell Growth and Product Formation- elemental Balances, Degree of reduction concepts; available -electron balances; yield coefficients; Oxygen consumption and heat evolution in aerobic cultures; thermodynamic efficiency of growth.

Teaching methodologies

1. Teaching is a combination of lectures, Tutorial Sheets, Assignments, seminars, and examples related to the topic supported by derivations on writing board.
2. Use of case-study-led teaching, giving student learning with real-world relevance

Text Books

1. J M. Smith, H.C. Van Ness and M.M. Abbott. Introduction to Chemical Engineering Thermodynamics McGraw Hill
2. P.M. Doaran, Bioprocess Engineering Principles, Academic Press, 1995.

Reference Books

1. M.D. Koretsky, Engineering and Chemical Thermodynamics, John Wiley and Sons, 2004

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

CELL BIOLOGY

Course Code: GR14A2099 L:3 T:1 P:0 C:4
II Year II Semester

Unit-I
Cell Structure and Function: Discovery of cells; Basic properties of cells; Cell theory; Cell complexity, Cell size , shape class of cells; Prokaryotic &Eukaryotic Cells; Chemistry of the cell, role of carbon and water molecules; Plasma membrane -structure and function; cytoplasm and cytoskeleton; microtubules, microfilaments, intermediate filaments. Cell motility-cilia and flagella; Cell interactions-Adhesion junctions-Tight junctions-Gap junctions- Plasmodesmata.

Unit-II
Intracellular Compartments and Transport of Molecules: Structure and functions of Nucleus. Endoplasmic reticulum, Ribosomes, Golgi complex, Lysosomes, Peroxisomes, Chloroplast & Mitochondria.

1. Transport Across Cell Membranes: Passive and Active transport, Permeases, Types of Pumps, Lysosomal and Vacuolar membrane, Proton pumps, Co-transport, Symport, Antiport, Transport into Prokaryotic Cells, Endocytosis and Exocytosis.
2. Post Translocational Modifications and Transport of Macromolecules. Protein Glycosylation and other modifications. Sorting and macromolecular traffic within cells. Polarization of cells, trafficking in polarized cells.

Unit-III
Cell Division, Cell Differentiation & Development: Overview of the Cell Cycle, Interphase, Mitosis, Cytokinesis & Meiosis.Phragmoplast and Cleavage furrow, Animal Cell and Yeast Cell Division, Cell Cycle Control and Checkpoints. General Characteristics of Cell Differentiation, Differentiation in Unicellular & Multicellular Organism, Cytoplasmic determinants, Nucleoplasmic Interactions; Embryonic and adult stem cells and its biological Importance. Cell death and cell renewal-Programmed cell death-Stem cells- Embryonic stem cells and therapeutic cloning.

Unit-IV
Receptors and Signal Transduction: Cytosolic, nuclear & membrane bound receptors. Examples and types of Receptors. Chemo- receptors of bacteria (attractant & repellant). Concept of Secondary Messengers cAMP, cGMP, Protein Kinases, G proteins, Steroids & Peptide hormone regulation, Tissue specific regulation.

Unit-V

Basics of Cancer Biology: Introduction to cancer, Characteristics of Cancer Cells, Micro organisms and cancer. Role of Telomere and Telomerase in cancer pathogenesis.

Basics of Cancer Biology: Introduction to cancer, Characteristics of Cancer Cells, Micro organisms and cancer. Role of Telomere and Telomerase in cancer pathogenesis. Disruption of Cellular Pathways, Disruption in cell cycle, Disruption in cell signaling.

Teaching methodologies

The methodology is based on lectures about course topics and on a case study and examples related to the topic supported by slide projection and video presentations. Tutorial Sheets and Assignments

Text Books

1. The Cell by Cooper.
2. Cell & Molecular Biology by Gerald Karp (2nd Ed.) Wiley publishers.
3. Cell and Molecular Biology (1987), 8th Edn. De Robertis, E. D. P. and De Robertis, E.M.F. Jr.,Lea & Febiger, USA (Indian Edn.: K. M. Varghese Company, Bombay).
4. Molecular Cell Biology 3rd edn., (1995) Lodish, Baltimore, Berk, Lawrence, et al, Scientific American Books, N.Y.

Reference Books

1. The World of the cell by Becker, Reece, Poenie (3rd edition) Benjamin Publishers.
2. Molecular Biology of the cell by Bruce Alberts.
3. The Biochemistry of Cell Signaling-Ernst J.M.Helmreich. Oxford Press.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

BIOPROCESS ENGINEERING

Course Code: GR14A2100 L:3 T:1 P:0 C:4
II Year II Semester

Unit-I
Introduction to Bioprocesses: An overview of traditional and modern applications of biotechnology industry, outline of an integrated bioprocess and the various (upstream and downstream) unit operations involved in bioprocesses, generalized process flow sheets.

Unit-II
General requirements of fermentation processes
Media design: Medium requirements for fermentation processes, Media optimization techniques (Placket Burman Design); Thermal death kinetics of microorganisms, batch and continuous heat sterilization of liquid media, filter sterilization of liquid media, air sterilization; Basic design and construction of fermentor and ancillaries

Fermentation Processes: Main parameters to be monitored and controlled in fermentation process Aerobic and Anaerobic fermentation processes and their application in the biotechnology industry, behaviour of microbes in different Reactors (air lift, batch, continuous, fed batch condition), solid sub-strate, slurry fermentation and its applications.

Unit-III
Material balances: Law of conservation of mass, generalized mass balance equation, simplified form, procedure for material balance calculations, material balance with recycle, by pass and purge streams,

Unit-IV
Metabolic Stoichiometry and Energetics: Stoichiometry of cell growth and product formation; Elemental balances; degree of reduction of sub-strate and biomass, available electronbalance; yield coefficients of biomass and product formation, maintenance coefficients.

Unit- V
Kinetics of Microbial growth and Product formation: Phases of cell growth in batch cultures, simple unstructured kinetic models for microbial growth, monod model,

growth of filamentous organisms, growth associated(primary) and non-growth associated (secondary) product formation kinetics, leudeking- piret models, sub strate and product inhibition on cell growth and product formation, introduction to structured models for growth and product formation.

Teaching methodologies

1. Use of case-study-led teaching, giving student learning with real-world relevance
2. Teaching is a combination of lectures, tutorials, seminars, computer practice sessions and an extensive hands-on laboratory practical component
3. Video projector, PC, blackboard. Syllabus, tables, plots and text of exercise: distributed in class during the course

Text Books

1. P. M. Doran, Biochemical processprinciples,1st edition, AcademicPress,2008.
2. P. F. Stanbury, A.Whittaker, S.J.Hall, Principles of Fermentation technology,2nd Edition, Butter worth Heinemann
3. M. L. Shuler and F. Kargi, Bioprocess engineering, 2nd edition, Prentice Hall of India, 2009.
4. D.G.Rao, Introduction to Biochemical Engineering, McGraw-Hill,2005.
5. A.V.N.Swamy, Fundamentals of Biochemical Engineering,1stedition, BSPublications,2007.

Reference Books

1. J. E. Bailey and D. F. Ollis, Biochemical Engineering Fundamentals, 2nd edition, McGraw Hill, 1986
2. H. W. Blanch and D. S. Clark, Biochemical Engineering, 2nd edition, Marcel Dekker Publishers, 2007.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

ANALYTICAL TECHNIQUES IN BIOTECHNOLOGY LABORATORY

Course Code: GR14A2101 L:0 T:0 P:4 C:2
II Year II Semester

List of Experiments

1. Verification of Beer - Lambert's law using UV-Visible Spectrophotometer.
2. Isolation of DNA by centrifugation
3. Estimation of DNA by UV-Visible Spectrophotometer.
4. Estimation of RNA by UV-Visible Spectrophotometer.
5. Quantitative determination of proteins by UV-Visible Spectrophotometer.
6. Separation of Amino acids by Paper chromatography.
7. Separation of Amino acids by Thin layer chromatography.
8. Separation of Proteins by Paper chromatography.
9. Estimation of turbidity using UV-Visible Spectrophotometer.
10. Gel filtration chromatography for separation of molecules –pigments/proteins/lectins

Teaching methodology

1. The style is expository (skill-building) with both the students and the instructor knowing the expected results. The approach is deductive; students use a fundamental principle to understand their results. Laboratory course is imparted in traditional, techniques-oriented style with activities emphasizing mastery of the primary tools and techniques of the course, and reinforcing basic principles.
2. The descriptors are "predetermined", "deductive", and "given".
3. The principle of the experiment is explained by Instructor before live demonstration this is followed by issue of materials for lab.

References

1. K. Wilson and J. Walker, Principles and techniques of Practical Biochemistry, 5th edition, Cambridge University Press, Cambridge, 2000.
2. S.K. Sawhney and Randhir Singh, Introductory practical Biochemistry, 2nd edition, Narosa Publishing House, New Delhi, 2000.

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BIOPROCESS ENGINEERING LAB

Course Code: GR14A2102 L:0 T:0 P:4 C:2
II Year II Semester

List of Experiments

1. Microbial Culture Studies
   a. Isolation of useful microorganisms from natural samples- Soil and Water or Rhizobia
   b. Growth of organisms, estimation of Monod's parameters.
2. Media Formulation
   a. Formulation of simple and complex culture media.
   b. Media preparation for fermentation.
3. Immobilized enzyme reactions
   a. Techniques of enzyme immobilization- matrix entrapment, ionic and cross-linking
   b. Immobilization of whole cells (yeast) using Calcium Alginate method.
4. Enzyme isolation and assay of enzymatic activity
   a. Extraction of commercially important enzymes.
   b. Quantification of enzyme activity and specific activity.
5. Enzyme kinetics
   Estimation of Michaelis- Menten parameters, Effect of pH and temperature on enzyme activity.
6. Industrial Bio products: Production of Bio-products.

Teaching methodologies

1. Demonstration of experiments.
2. Explain the experiment prior to demonstration of experiment.
3. Laboratory material are given to the students.

Text Books

1. Arnold, Manual of industrial Microbiology and Biotechnology, ASM,2004.
2. J. Jayaraman, Laboratory manual in biochemistry, New age International publishers.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

CELL BIOLOGY LAB

Course Code: GR14A2103 L:0 T:0 P:4 C:2
II Year II Semester

List of Experiments

1. Introduction to Cells, Tissues and Microscopy.
2. Observation of Algal cells.
3. Observation of Fungal cells.
4. Study of Plant cells and tissues.
5. Study of specialized/Modified cells.
6. Observation of Mitotic events.
7. Study of Meiotic cells.
8. Effect of drugs/ chemicals on cell division.
9. Chromosomekaryotyping from metaphase plate.

Teaching methodology

1. The style is expository (skill-building) with both the students and the instructor know the expected results.. The approach is deductive; students use a fundamental principle to understand their results.
2. Laboratory course is imparted in traditional, techniques-oriented style with activities emphasize mastery of the primary tools and techniques of the course, and reinforce basic principles. The descriptors are “predetermined”, “deductive”, and “given”.
3. The principle of the experiment is explained by Instructor before live demonstrates this is followed by issue of materials for lab

Text Book

1. Laboratory Manual for Microbiology by P. Gunasekaharan, New age International Publishers.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENVIRONMENTAL SCIENCE

Course Code: GR14A2001 L:4 T:0 P:0 C:0
II Year II Semester

Unit-I

Introduction to Environment, Ecology and Ecosystems: Definition, Importance and Scope of environmental studies, Public awareness and participation. Ecology, concept of Ecosystem, classification of ecosystem, structure, components and function of ecosystem. Typical Ecosystem, Food chain, food web. Biodiversity- types and values.

Unit–II

Natural Resources: Definition, occurrence, classification of resources, Important natural resources for human society, Positive and negative effects of utilization of Water resources, Mineral resources, Forest resources, Energy resources, Land resources. Role of individuals in conservation of important natural resources.

Unit-III

Environmental Pollution: Definition, Classification of Pollution, Types of Pollution and Pollutants. Causes, effects and control of – Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution and Nuclear Pollution.

Unit–IV

Environmental Problems and Management Policies: Natural Disasters-Types, causes and effects; Global warming, Climate change-El Nino and La Nina, Ozone layer- location, role and degradation; Deforestation and desertification. Management: Technological solutions, Preventive methods, control techniques; Green Belt development, Rainwater harvesting, Renewable and alternate resources.

Unit-V

National Policy on Environment Protection and Sustainability: Air (Pollution and prevention) act 1981; Water (Pollution and prevention) Act 1974; Pollution Act 1977; Forest Conservation Act; Wildlife Protection Act; Municipal solid waste management and handling Act; Biomedical waste management and handling Act; Hazardous waste management and handling rules. Role of IT in environment, environmental ethics, environmental economics.

Sustainable development: Cause and Threats to sustainability; Strategies for achieving sustainable development; Concept of Green buildings and Clean Development Mechanism (CDM).

Teaching methodology

1. White board and marker
2. OHP and Field visit

Text Books

1. Text Book of Environmental Studies, ErachBarucha. University Press
2. Text book of Environmental Science and Technology by M.Anji Reddy 2007
3. Comprehensive environmental studies (for UG studies).J.P. Sharma, Laxmi publications, 2008

Reference Books

1. Biotechnology & Environmental Chemistry. Surinder Jeswal& Anupama Deswal, DhanpatRai & Co Pvt. Ltd.
2. A Text Book of Environmental Science. Aravind Kumar. APH Publishing Corporation.
3. Glimpses of Environment. Dr. KVSG. Murali Krishna. Environmental Protection Society

III-Year

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

TRANSPORTATION PHENOMENA IN BIOPROCESS

Course Code: GR14A3084 L:2 T:1 P:0 C:3
III Year I Semester

Unit-I

Momentum Transport-I: Mechanism of Momentum Transport: Newton's Law of Viscosity, Non-Newtonian fluids, theory of viscosity of liquids, time dependent viscosity, viscosity measurement (cone-and-plate viscometer, coaxial cylinder rotary viscometer, impeller viscometer), use of viscometers with biological reaction fluids, rheological properties of fermentation broth, factors affecting broth viscosity (cell concentration, cell morphology, osmotic pressure, product and substrate concentration),Velocity distribution in laminar flow and turbulent flow

Unit-II

Momentum Transport-II: Equation of change for isothermal system (equation of continuity, equation of motion, equation of mechanical energy), interphase transport in isothermal systems (friction factors for flow in tubes and in packed columns) mixing, mixing mechanism, power requirements in ungassed Newtonian and Non Newtonian fluids, gassed fluids, interaction between cell and turbulent Eddies, operating conditions for turbulent shear damage. Macroscopic Balances- mass, momentum and mechanical energy balances.

Unit-III

Energy Transport: Thermal conductivity and the mechanisms of energy transport- measurement of thermal conductivity, Fourier's law, steady state conduction, analogy between heat and momentum transfer. Temperature distribution with more than one independent variables- heating in a semi-infinite and finite slab, temperature distribution in turbulent flow-reference to stirred tank reactor, relationship between heat transfer, cell concentrations and stirring conditions

Unit-IV

Mass Transport: Diffusivity, theoryof diffusion, analogy between massheat and momentum transfer, role of diffusion in bio processing, film theory, concentration distribution with more than one independent variable- unsteady diffusion, boundary layer theory, concentration distribution in turbulent flow-Corrosion equation. Definition of binary mass transfer coefficients, transfer coefficients at high mass transfer rates-boundary layer theory, penetration theory

Unit-V

Oxygen Transport: Oxygen uptake in cell cultures, Factors affecting cellular oxygen demand, oxygen transfer from gas bubbles to aerobic culture, oxygen transfer infermenters. Factors affecting oxygen transport-sparging, stirring, medium properties, antifoam agents, temperature, mass transfer correlations, measurement of kLa - oxygen balance method, dynamic method.

Note: In all units relevant basic numerical problems should be practiced

Teaching Methods

1. Lectures, Tutorials and Seminars.
2. Assignments, Class tests.

Text Books

1. R.B. Bird, W.E. Stewart, E.N. Lightfoot, Transport Phenomena, John Wiley and sons, Singapore, 1994
2. P.M. Doran, Bioprocess Principles, Academic Press, 1995
3. Douglas S. Clark, Harvey W. Blanch, Biochemical Engineering, Third Edition Marcecel, Dekker, CRC Press. 2007.

References

1. M.L. Shuler and F. Kargi, Bioprocess Engineering: Basic concepts, 2nd edition, Prentice Hall of India, 2003

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

BIOCHEMICAL REACTION ENGINEERING

Course Code: GR14A3085 L:3 T:1 P:0 C:4
III Year I Semester

Unit-I
Basic concepts: Definition of bioreactor, fundamental principles, concept of energy and mass balances, and biological reaction modelling.

Unit-II
Classification of reactors and their configurations, application in submerged fermentation and solid state fermentation, classification based on Schuegerl, v components of bioreactors and operation of bioreactors.

Unit-III
Ideal reactors: Concepts of reactors based on flow characteristics, design of ideal reactors using material and energy balance. Batch reactor design. Definition of chemostat, turbidostat, single flow-single stage chemostat, single flow-multistage chemostat, recycle flow in chemostat, concepts of dilution rate productivity analysis.

Unit-IV
Non-ideal behaviour in reaction systems: Reasons for non-Ideal behaviour, concept of macro using RTD analysis (E-C-F functions), diagnosing the problems of non- ideal bioreactors.

Unit-V
Specific bioreactors analysis and scale-up: Application of tubular reactor concept in immobilized packed bed reactors, fluidized bed reactors. Design and analysis of fed-batch and air-lift bioreactors. Application in animal cell culture. Basic concept of scale-up, non-dimensional analysis.

Teaching Methodologies
1. Lectures, Tutorials and Seminars.
2. Assignments, Class tests and Power point presentations.

Text Books
1. O.Levenspiel, Chemical Reaction Engineering. 3rd edition, Wiley New York, 1992.

2. D.G. Rao, Introduction to Biochemical Engineering, McGraw-Hill, 2005.
3. H. Scott Fogler Elements of chemical reaction Engineering 3rd edition, Prentice- Hall of India Pvt ltd, 2004.

Reference Books

1. P.M. Doran Bioprocess Engineering Principles, Academic Press, 1995.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

BASIC INDUSTRIAL AND ENVIRONMENTAL BIOTECHNOLOGY

Course Code: GR14A3086 L:3 T:1 P:0 C:4
III Year I Semester

Unit-I
Primary Metabolites: Brief outlinesof production processes: Organic acids (e.g. citric acid, lactic acid); Amino acids (Glutamic acid, Phenylalanine); and Alcohols (Ethanol, Butanol)

Unit-II
Secondary Metabolites: Brief outline of production processes: Antibiotics (Penicillin's, Cephalosporin's, Streptomycin, Erythromycin), Vitamin (B12) and Steroids (no description of process)

Unit-III
Production of Commercially Important Enzymes: Proteases, Amylases Lipases, Cellulase and other commercially important enzymes for the food and pharmaceutical industry

Unit-IV
Biological treatment of waste Water: Aerobic and Anaerobic Systems-Biological processes for domestic and industrial waste water treatments; Aerobic systems - Activated sludge process, Trickling filters, Biological filters, Rotating biological contractors (RBC), Fluidized bed reactor (FBR), Expanded bed reactor, Inverse fluidized bed biofilm reactor (IFBBR) Packed bed reactors Air-sparged reactors, Anaerobic Systems - Contact digesters, Packed column reactors, UASB.

Unit-V
Bioremediation: Introduction, constraints and priorities of Bioremediation, Bio-stimulation of Naturally occurring microbial activities, Bio-augmentation, In situ, Ex situ, intrinsic & engineered bio-remediation,Solid phase bioremediation - land farming, Prepared beds, Soil piles, Phytoremediation. Composting, Bioventing &Bio-sparging; Liquidphase bioremediation - Suspended bioreactors, Fixed biofilm reactors. Xenobiotic compounds, biodegradation of Xenobiotic compounds.

TEACHING METHODOLOGIES

1. Class room lectures using OHP, LCD
2. Class room discussion, seminars.
3. Interactive teaching.

TEXT BOOKS

1. Biotechnology, 3rd edition by John E. Smith. Cambridge low price editions.
2. Industrial Microbiology: - J. E. Casida;
3. Environmental Biotechnology by S. K. Agarwal
4. Biodegradation & Bioremediation (1999), Martin Alexander, Academic press.

REFERENCES BOOKS

1. Prescott & Dunn's Industrial Microbiology by G. Reed, CBS Publishers & Distributors; 4th edition (1 December 2004)
2. Industrial Microbiology, A. H. Patel, Stanier R. Y., Ingram J.L., Wheelis. M.L., Painter R.R., General Microbiology Mc Millan Publications, 1989.
3. Environmental Biotechnology by A.K. Chatterjee
4. Environmental Biotechnology by S.N.Jogdand, Himalaya Publishing

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENZYME ENGINEERING AND TECHNOLOGY

Course Code: GR14A3087 L:3 T:1 P:0 C:4
III Year I Semester

Unit-I
Enzymes: Brief History: Definition; Enzymes as biocatalysts- Chemical nature of enzymes- role of coenzymes – comparison of enzymes with chemical catalysts- Classification with examples from each class; Functions of Enzymes; Theories of Enzyme substrate complex formation- Fischer's template theory, Koshland's theory, Sources of Enzymes; Application of enzymes in industrial, medical, pharmaceutical and food sectors. Enzyme isolation, purification and assay methods.

Unit-II
Enzyme Catalysis: Specific and general acid-base catalysis; covalent catalysis; Factors affecting the mechanism of enzyme catalysis, and factors affecting enzyme activity viz., pH, Temperature, ionic strength, chemical agents and radiation.

Unit-III
Enzyme Kinetics: Kinetics of single substrate reaction – Michelis-Menton equation; Brigg's-Halden equation, Kinetics for reversible reaction. The turnover number, kinetics- bi substrate reactions - ternary complex model, Ping- Pong mechanism.

Unit-IV
Enzyme Inhibition and Mechanisms: Various types of enzyme inhibition, (Inhibited enzyme kinetics-reversible and irreversible inhibition- kinetics of reversible enzyme inhibition- competitive, non- competitive, uncompetitive inhibition) Substrate and product inhibition, Mechanism of action of chymotrypsin, Glyceraldehyde 3-phosphate dehydrogenase, Isoenzyme, Carboxy peptidase etc.

Unit-V
Enzyme Immobilization: Enzyme immobilization methods (Physical and Chemical techniques for enzyme Immobilization – adsorption, matrix entrapment, encapsulation, cross-linking, covalent binding)Advantages and disadvantages of different Immobilization techniques, Internal and external mass transfer effects in immobilized enzyme reactions, particle diffusion and reaction,

Interaction between mass transfer and biochemical reaction. Concept of Thiele – modulus and effectiveness factor, operational stability and optimization;

Teaching methods

1. We use case-study-led teaching, so your learning has real-world relevance
2. Teaching is a combination of lectures, tutorials, seminars, computer practice sessions and an extensive hands-on laboratory practical component
3. Video projector, PC, blackboard. Syllabus, tables, plots and text of exercise: distributed in class during the course

Text Books

1. Trevor Palmer, Enzymes: Biochemistry, Biotechnology and clinical chemistry, Affiliated East West Press.
2. Biochemical Engineering. H.W. Blanch and D.S. Clark, Marcel – Dekker New york (1997).
3. Biochemical Engineering. J.M.Lee, Prentice- Hall, New Jersey (1992).

Reference Books

1. Biochemical engineering Fundaments. Bailey and Ollis. Second Edition, McGraw-Hill International Edition.
2. Mukesh Doble and Sathyanarayana N. Gummadi,Bochemical Engineering, Prentice Hall of India.2007
3. Enzymes : Dixon and Webb.(IRL Press) 2. Enzyme technology by Chaplin and Bucke. cambridgeUniverity Press
4. Syed Tanveer Ahmed Inamdar, Biochemical Engineering- Principles and Concepst, Prentice Hall of India.2007
5. Pauline. M.Doran, Bioprocess engineering principles, Academic press. 1995

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

GENETIC ENGINEERING

Course Code: GR14A3088 L:3 T:1 P:0 C:4
III Year I Semester

UNIT-I

Gene Regulation and Expression in Prokaryotes: Operon concept, Elements of operon, Structure and function of operons, Repressors, Activators, Inducers, Co-repressors; Lactose operon, Tryptophan operon, Function and Control.
Arabinose operon - structure, function and regulation, Bacillus subtilis-Sigma factors and Sigma switches. Gene Regulation in Eukaryotic system: Gene Regulation in eukaryotic system, Comparison with prokaryotic system, Gene regulation, Repetitive DNA, Gene rearrangement, Promoters, enhancers, gene amplification.

UNIT-II

DNA Technology-I: Purification of genomic DNA and RNA from living cells, Isolation of Plasmid DNA, Restriction enzymes-Classification, nomenclature, Modification enzymes-Phosphatases, Kinases, Ligase and Nuclease. Use of restriction enzymes, Targets of restriction enzymes and Isoschizomers, Restriction mapping. Ligation, homopolymer tailing, Linkers and DNA adapters.

UNIT-III

DNA Technology-II: Plasmids, Transposons, Vectors for gene transfer: Natural Vectors-types and functions; Plasmids- definition, Types, identification, Classification, Purification, Transfer of plasmids, Host restrictions in transfer. Transposable elements- definition, detection of Transposition in bacteria, Types of bacterial transposons, Mechanisms of transposition and excision, Applications of transpositions, Retro-transposons.
Cloning: Manipulation of purified plasmid, Artificial vectors-Construction of prototype vector, (pBR322); Different types of cloning vectors, Plasmid-pUC 19, λ Phage, Cosmids, Phagemids-M13, Expression vectors. Vectors for Genomic and cDNA library in genetic engineering; BACs, YACs and MACs and their uses. Genomic and cDNA Library- strategies, construction and application,

UNIT-IV

Cloning strategies, Expression and Detection of Clones:Introduction of DNA intoliving cells. Methods of gene transfer. Detection of clones and their expression, Expression in different host systems (E. coli, Yeast, Insect, Mammalian cells), High level expression of proteins,.

Blot Analysis-Southern, Northern and Western Blot, Dot Blot, Slot Blot, Immuno-detection, DNA Methylation, DNA hybridization, DNA sequencing.
Polymerase Chain Reaction (PCR), Principles of PCR, PCR Methodology, Designing PCR primers, Types of PCR- RT-PCR, Multiplex PCR, Identification of PCR Products, Applications of PCR technology.

UNIT-V

Applications of r-DNA Technology: Molecular markers-definition, function; Types of molecular markers and application, RFLP, RAPD, AFLP, 16S rRNA typing, Gene Chip and Microarray, Applications in disease profiles.
Gene Cloning in Medicine-Insulin, Blood Clotting, Factors VIII. Limitations and advantages of novel technologies in generation of transgenic animals, Introduction to Gene Therapy (Ex vivo and Invivo), Advantages and limitations of Gene Therapy, Case study of Adenosine de-aminase.

Teaching Methods

1. Lectures, Tutorials, Group Discussions and Seminars.
2. Assignments, Class tests and Mid Semester Exam and Quiz

Text Books

1. Old RW, Primrose SB, Principles of Gene Manipulation, An introduction to Genetic engineering, Blackwell, Scientific Publications, 1993
2. T.A. Brown, Gene Cloning.
3. P.K. Gupta, A Text Book of Cell and Molecular Biology, 4th edition. 2015, Rastogi Publication, New Delhi.

References

1. Ansubel FM., Brent A, Kingston AE, Moore DO, Current protocols in Molecular Biology, Greene Publishing Associates, NY, 1988.
2. Berger SL, Kimmer AR, Methods in Enzymology, Vol 152, Academic Press, 1987.
3. Molecular Cell Biology – Gerald Carp.4. Molecular Cloning- A laboratory manual 2ndFrietsch FE. &Maniatis (19890 Vol.I, II, III. Cold Spring Harbour NY.
4. GENES VIII by B.Lewin, Oxford University Press (2007)
5. Molecular Biotechnology: Principles and Applications of Recombinant DNA by Glick, Bernard R., Pasternak, Jack J., Publisher ASM Press (2002).
6. GENES X B. Lewin, by Jocelyn E Krebs, Elliot S , Goldstein, Stephen T, Kilpatric, 2011.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

GENETIC ENGINEERING LAB

Course Code: GR14A3089 L:0 T:0 P:2 C:2
III Year I Semester

LIST OF EXPERIMENTS

1. Isolation of Plant and Bacterial Genomic DNA
2. Isolation of Plasmid DNA
3. Visualization of plasmid DNA on Agarose Gel Electrophoresis
4. Restriction Digestion and Restriction mapping
5. DNA Ligation
6. Expression of β-galactosidase (lacZ) gene construct and α-complementation assay
7. Cloning of oligonucleotides in a plasmid vector
8. CaCl2 mediated Transformation and screening for positive recombinants.
9. Characterization of Proteins using SDS-Polyacrylamide gel electrophoresis.
10. Silver staining of proteins
11. Blotting Techniques for DNA - Southern blotting
12. Blotting Techniques for Protein - Western blotting.
13. Gene amplification by Polymerase Chain Reaction (PCR)
14. Demonstration of chemical mutagenesis

Teaching Methodology

1. Practical Demonstration (Hands on training)
2. The principle of the experiment is explained by Instructor before a live demonstration followed by individual hands-on experiment.
3. White board and Videos

Reference Books

1. Manual of methods for General Bacteriology-Phillip Gerhardt. Pub ASM.
2. Current Protocols in Molecular Biology by Frederick M. Ausubel.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

IMMUNOLOGY LAB

Course Code: GR14A3090 L:0 T:0 P:2 C:2
III Year I Semester

1. Differential (identification of cell types) & Total leukocyte counts of blood.
2. Agglutination: Heamagglutination& Blood typing/grouping.
3. Determination of Haemoglobin level by Sahali's method.
4. Immunoprecipitation
   a. Ouchterlony's immune diffusion technique.
   b. Measurement of antibody concentration by diffusion and electrophoresis method.
5. Counter Current Immunoelectrophoresis.
6. Enzyme Linked Immunosorbent Assay (ELISA).
7. Isolation & Viability determination of Lymphocytes from peripheral blood.
8. Immunoglobulin Purification
   a. Affinity chromatography method.
   b. Centrifugation method.
9. Raising of antibodies in animals polyclonal antibodies.
10. Identification of cell types and receptors Immunofluorescence.

Teaching Methodologies

1. Hand-on training techniques-oriented style with activities emphasizing mastery of the primary tools and techniques of the course, and reinforce basic principles.
2. The descriptors are "predetermined", "deductive", and "given".
3. The principle of the experiment is explained by Instructor before live demonstration this is followed by issue of materials for lab

Reference Books

1. A Practical guide to cellular and molecular research methods in immunology, John R. Gordon.
2. Lab manual in Biochemistry, Immunology and Biotechnology, ARTI NIGAM Publisher: McGraw-Hill Education.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

INDUSTRIAL BIOTECHNOLOGY LABORATORY

Course Code: GR14A3091 L:0 T:0 P:2 C:2
III Year I Semester

LIST OF EXPERIMENTS

1. Production of enzymes.
2. Production of drugs.
3. Production of proteins.
4. Production of food product.
5. Production of citric acid.
6. Production of alcohol.
7. Production of Biofuels.
8. Production of antibiotic.

Teaching Methodologies

1. Demonstration of experiments.
2. Explain the experiment prior to demonstration of experiment.
3. Laboratory material are given to the students.

Reference Books

1. Arnold, Manual of Industrial Microbiology and Biotechnology, ASM, 2004.
2. J. Jayaraman, Laboratory manual in Biochemistry, New Age Intl. Publishers.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

PLANT BIOTECHNOLOGY

Course Code: GR14A3092 L:2 T:1 P:0 C:3
III Year II Semester

Unit-I
Plant Tissue Culture: Introduction to plant tissue culture, Totipotency, tissue culture lab requirements, Sterilization methods, Media preparation, Inoculation, Incubation, Embryogenesis, Organogenesis and Micro propagation.

Unit-II
Application of Plant Tissue Culture: Soma clonal variations, Germplasm preservation and Haploid production.

Unit-III
Secondary Metabolites: Suspension cultures, Protoplast cultures, Production of secondary metabolites. Phytochemicals and applications.

Unit-IV
Gene transfer methods: Micro injection, Electroporation, Micro projectile gun, liposome transfection, Agrobacterium derived Ti and Ri vectors. Transgenic Plants: Development of Transgenic plants for insects, pests, herbicide and drought resistant varieties, nutritionally improved crop varieties.

Unit-V
Molecular Pharming: Production of therapeutic proteins, Plantibodies, Edible vaccines from plants.

Teaching Methodologies
1. OHP Projection &Videos
2. Class Discussions
3. Case Studies
4. Tutorial Sheets and Assignments

Text Books
1. Text book of Plant Biotechnology by Razdan
2. Plant Biotechnology by Ramawat.
3. Biotechnology by Kumaresan Saras Publication.

Reference Books

1. Crispeels, M.J. and Sadava, D.E., Plants, Genes and Crop Biotechnology, Jones and Bartlett Publishers (2nd Edition),2003.
2. Bhowjwani, S. S., Plant Tissue Culture: Application and Limitations.Amsterdam, Elsevier,1900.
3. Bernard R.Glick and John E.Thompson, Methods in plant Molecular Biology and Biotechnology, CRC Press,1993

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

HEAT TRANSFER IN BIOPROCESS

Course Code: GR14A3093 L:3 T:1 P:0 C:4
III Year II Semester

Unit-I
BASICS OF HEAT TRANSFER: Various modes of heat transfers, conduction, convection, and radiation. Mechanism of heat transfer by conduction, conductive heat transfer through a series of resistances.

Unit-II
CONDUCTIVE HEAT TRANSFER: Steady state and unsteady state heat transfer by conduction. Heat transfer through slab and cylinder. Concept of log mean radius for transfer through pipes. Extended surface heat transfer through fins etc.

Unit-III
CONVECTION: Dimensional analysis, Forced convection in pipe and other geometries, Natural convection - various correlation for evaluating heat transfer coefficients. Boiling and condensations. Mechanism of boiling: Film and nucleate boiling.

Unit-IV
HEAT TRANSFER EQUIPMENTS: Double pipe heat exchangers, Shell and tube heat exchangers, Pinfin heat exchangers-Overall transfer coefficient. Overview of various types of heat exchangers and concept of LMTD. Single and Multiple effect evaporators and problems on evaporators. Steam economy, Steam capacity, evaporators performance with various feedings viz, forward, backward and parallel.

Unit-V
Analogy between heat, mass and momentum transfer. Applications of heat transfer in bioprocessing-batch sterilization and design of continuous sterilizer.
* Relevant basic numerical problems will be dealt in the units.

Teaching Methodologies
1. White Board & Chalk
2. OHP Projection & Videos
3. Class Discussions
4. Case Studies
5. Tutorial Sheets and Assignments

Text Books

1. W.L. Mc Cabe and JC Smith, Unit Operations of Chemical Engineering, McGraw Hill, 5th edition, 1993.
2. P.M. Doran, Bioprocess Engineering Principles, Academic Press, 1995.

Reference Books

1. BIOTOL Series: Transport phenomena in bioprocesses, Verlag
2. D.G.Rao, Introduction to Biochemical Engineering, Tata Mc Graw Hill, 2005.
3. H.W.Blanch and DS Clark, Biochemical Engineering, Marced Dekav Inc.New York, 1996.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

IMMUNOLOGY

Course Code: GR14A3094 L:3 T:1 P:0 C:4
III Year II Semester

Unit-I
Introduction to Immune system: Lymphatic systems, lymph and lymph ducts, Innate and acquired immunity.

Unit-II
Organs of lymphatic system: primary lymphoid organs, thymus and bone marrow, Secondary lymphoid organs- Spleen, lymph node, mucosal systems.

Unit-III
Cells of the immune system: Classification, Structure and functions of various immune cells.

Unit-IV
Humoral immunity: B-cells production, activation, antibody development, genetics of immunoglobulin production, Nature and properties of antigens, antigen-antibody interactions and their diagnostic importance.

Unit-V
Cell mediated immunity: T-cell development, differentiation, activation and interactions. Hypersensitivity reactions: autoimmune disorders and immunity in transplantation.

Teaching Methodologies
1. OHP Projection & Videos
2. Class Discussions
3. Case Studies
4. Tutorial Sheets and Assignments

Text Book
1. Benjamin E and Leskowitz S, immunology Wiley LISS NY, 991.

Reference Book
1. P.J.Delves, S.J.Martin, Dennis.R.Burton, Ivan.M.Roitt, Roitte Essential Immunology,12th edition,2011,Wiley-Blackwell

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

MASS TRANSFER OPERATIONS

Course Code: GR14A3095 L:3 T:1 P:0 C:4
III Year II Semester

UNIT-I
Introduction to Mass Transfer and Diffusion: Introduction to Mass Transfer Operations, Fick's first law of diffusion, Gas diffusion and Liquiddiffusion (one component transferring to non – transferring component and equimolar counter diffusion), Distribution of gas and liquid components through solid, Diffusion of biological solutes in liquids, Diffusion in biological gels.

UNIT-II
Interphase Mass Transfer and Mass Transfer Coefficients: Interphase mass transfer with special reference to gas absorption, Convective mass transfer Coefficient (KL), Evaluation of KL using Sherwood number, Stanton number, Schmidt number and JD factor, Theories of mass transfer – Film theory, Penetration theory and Surface renewal theory, Case study-Oxygen mass transfer in production of penicillin.

UNIT-III
Gas - Liquid Operations: Absorption- Definition, Solubility of gases in liquids, Single stage (one component transferring) operation. Distillation-VLE, Single stage equilibrium system, Flash distillation, Differential distillation, Steam distillation, Continuous distillation (McCabe-Thiele method only). Liquid–Liquid Operations: Characteristics of solvent, Types of equilibrium systems, Single stage extraction, Multistage cross and counter current operations, Case study-Extraction of penicillin using butyl acetate/amyl acetate.

UNIT-IV
Solid–Liquid Operations: Leaching- Single stage leaching, Biological applications, Adsorption- Physical adsorption, Chemisorption, Adsorption hysteresis, Adsorption isotherm, Single stage operation, Fixed-bed adsorption. Gas–Solid Operations: Drying, Theory and principles of drying, Drying Kinetics, Drying rate, Mechanism of Batch drying - constant rate and falling rate periods, Various drying operations, Drying equipment, Criteria for selection of dryers, Case study-Drying of baker's yeast.

UNIT-V
Membrane Separation Processes: Dialysis, Hemodialysis, Gas permeation process, Introduction to types of flow in gas permeation, Equipment – Flat

membrane module, Hollow – fiber separation assembly, Reverse osmosis, Applications of reverse osmosis, Introduction to Ultra filtration and micro filtration. Crystallization: Introduction to crystallization, Theory and principles, Various crystallization equipment, Case study Crystallization of citric acid.

Teaching methods

- Use of case-study-led teaching
- Combination of lectures, tutorials, seminars
- Videos,White board. tables, plots and Exercises
- Tutorials, Assignments, and Class quiz/ test

Text Books

1. Robert E.Treybal, Mass Transfer Operations, 3rd edition, Mc.Graw Hill International, 1981.
2. Christi J. Geankoplis, Transport processes & Unit operations, 4th edition, Prentice Hall India Pvt.Ltd, 2003.
3. Mc Cabe, W.L, Smith J.C., and Harriot P., Unit operations of Chemical Engineering, 7th edition, Mc-Graw Hill, 2007.

Reference Books

1. Philip C. Wankat, Chapman and Hall, Rate Controlled Separations, 1985.
2. P.M. Doran, Bioprocess Engineering Principles, Academic Press 1995.
3. Judson King, Separation Processes, 2nd Edition, Mc Graw Hill Chemical Engineering series.
4. Philip A.Schweitzer, Handbook of Separation Techniques for chemical Engineering, 3rd edition, Mc Graw Hill.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

BIOINFORMATICS
(Open Elective)

Course Code: GR14A3096 L:3 T:1 P:0 C:4
III Year II Semester

UNIT-I
Introduction to Bioinformatics
Scope of Bioinformatics, Elementary commands and protocols, ftp, telnet, http. Special topics in Bioinformatics- Large scale sequencing methods Shotgun and Sanger method.

UNIT-II
Sequencing Alignment and Dynamic programming: Alignment – Local, Global alignment, Pair wise and multiple sequence alignments Dynamic programming in sequence alignments: Needleman- Wunsch& Smith- Waterman algorithm, Amino acid substitution Matrices (PAM, BLOSUM). Sequence similarity search with BLAST and FASTA

UNIT-III
Biological Databases: Primary databases: Introduction to Biological databases, Organization and management of databases NCBL, EMBL, DDBJ, Structure databases - PDB (Protein Data Bank)

Secondary databases: Introduction to Secondary Databases Organization and management of databases Swissprot, PIR

Biochemical databases: organization and Management of databases KEGG, BRENDA

UNIT-IV
Phylogenetic Analysis and Tree building: Introduction to Phylogenetics, Methods of Construction of Phylogenetic trees- Maximum Parsimony Method, Maximum likelihood method and Distance Methods, Significance of Multiple sequence alignment in phylogenetic analysis. Description of phylogenetic tress and Types of trees

UNIT-V
Introduction to Homology: Homology modelling of proteins (sequence to structure), Cn3D, Rasmol and SPDbV in homology modelling - case studies

Teaching methods

1. Case-study-led teaching
2. Combination of lectures, tutorials, seminars, computer practice sessions and an extensive hands-on laboratory practical component.
3. Video projector, PC, White board, text of exercise.
4. Tutorials, Assignments, and Class quiz/ test

Text Books

1. Bioinformatics Basics. Applications in Biological Science and Medicine byHooman H. Rashidi and LukasK.Buehler CAC Press 2000.
2. Bioinformatics. David Mount, 2000. CSH Publications
3. Bioinformatics – A Practical guide to the Analysis of Genes and Proteins. Andreas D.Baxevanis, B.F. Francis Ouellette
4. Bioinformatics methods and applications – S . C. Rastogi. PHI learning

Reference Books

1. Bioinformatics: A Machine Learning Approach P. Baldi. S. Brunak, MIT Press 1988.
2. Developing Bioinformatics Skills. Cynthia Gibbas& Per Jamberk
3. Genomics and Proteomics-Functional and Computational aspects. Springer Publications. Editior-SandorSuhai.
4. Bioinformatics- Methods and Protocols-Human Press. Stephen Misener, Stephen A. Krawetz.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

DATA STRUCTURES THROUGH C++

Course Code: GR14A3097 L:3 T:1 P:0 C:4
III Year II Semester

Unit-I
Introducing OOP, C++ Class Overview--Class Definition, Objects, Class Members, Constructors and destructors, Inline functions, static class members, friend functions, dynamic memory allocation and de allocation (new and delete), exception handling.

Unit-II
Function Overloading, Operator Overloading, Generic Programming- Function and class templates, Inheritance basics, base and derived classes, inheritance types, this pointer, runtime polymorphism using virtual functions, streams I/O.

Unit-III
Priority Queues – Definition, ADT, Realizing a Priority Queue using Heaps, Definition, insertion, Deletion, Application-Heap Sort.

Dictionaries: linear list representation, operations: insertion, deletion & searching, Hash table representation--hash functions, collision resolution strategies-separate chaining &open addressing--linear probing, quadratic probing, double hashing, rehashing, extendible hashing.

Unit-IV
Trees: Binary search trees, definition, ADT, implementation, operations-searching, insertion and deletion, Tree Traversals Techniques—In-Order, Pre-Order & Post-Order.
Balanced search trees (Part1)- AVL trees, definition, height of an AVL tree, representation, operations-insertion, deletion and searching, B-Trees---B-Tree of order m, height of a B-Tree, insertion, deletion and searching.

Unit-V
Balanced Search trees (Part II): Introduction to Red –Black trees and Splay Trees. Graphs: Representation of Graphs, Graph Traversal Techniques –BFS & DF.
Introduction to programming languages: Introduction to programming in R, basic concepts.

Teaching methodologies

1. Power Point presentations
2. White Board
3. Tutorial Sheets
4. Assignments

Text Books

1. Data structures, Algorithms and Applications in C++.,S.Sahni,University press (India) Pvt. Ltd, 2nd edition, Orient Longman Pvt. Ltd.
2. Object Oriented Programming with C++, E Balagurusamy, Mc Graw Hill Higher Education,Second edition.
3. A Beginner's Guide to R. Zuur, Alain, Ieno, Elena N., Meesters, Erik. Springer group.
4. R programming software: www.r-project.org.

Reference Books

1. Object Oriented Programming with C++, Subhash K U, Pearson
2. Data structures and Algorithms in C++, Michael T.Goodrich, R.Tamassia and D. Mount, Seventh Edition Wiley student edition, John Wiley and Sons.
3. Data Structures and Algorithms in C++, Third Edition, Adam Drozdek, Thomson
4. C++, The Complete Reference, 4th Edition, Herbert Schildt, TMH.
5. An Introduction to R. Online manual at Http://cran.r-project.org/manuals.html.

GOKARAJU RANGARAJU
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BIOMATERIALS
(Open Elective)

Course Code: GR14A3098 L:3 T:1 P:0 C:4
III Year II Semester

Unit-I

Introduction: General properties of materials, Classes of materials used in medicine- Metals, Polymers, Hydrogels, Biorestorable and Biodegradable Materials, Ceramics, Natural materials, composites thin films, grafts, Coatings medical fibers and Biological functional materials, Smart materials, Pyrolytic Carbon for long-term medical Implants, textured and Porous materials, non-fouling surfaces.

Unit-II

Biopolymers: Classification (nucleic acid, protein, polysaccharide), Manufacturing, chemistry and applications of polysaccharide such as dextran, xanthan, gellan, pullalane, chitin, chitosan, etc., structural characterization using protein sequencing by Edman degradation, mass spectrometer, optical tweezer (or atomic force microscopy).

Fermentative production of polyesters with special emphasis on polyhydroxyalkanoates, and biodegradable polymers such as polylactic acid, polyglycolide and polycaprolactone, lactoyllactic acid, Structure, physical and chemical properties including production of the above polymers.

Unit-III

Application of biocatalyst: Use of enzymes and microorganisms in biotransformation process, development of polymer precursors using Biotransformation processes Precursors: aromatic hydrocarbons, biological formation of specialty hydroxylated monomers, L-homophenylalanine production using membrane bioreactor.

Unit-IV

Types of nano biomaterial: Bioadhesive, composite biomaterial, evaluation of biocompatibility according to United States Pharmacopoeia, Biodegradable plastic, design, synthesis, characterization and application of nanomterials to biological and biomedical problems, Characterize, predict, and control the biological properties of nanobiomaterials

Unit-V

Applications of materials in medicine, Dentistry and Biology: Cardiovascular medical devices, Nonthrombogenic treatments and Strategies,

Dental implantation adhesive and Sealants, Ophthalmologic applications-intraocular lens implants, Orthopedic biomaterials, Artificial organs and tissues.

Teaching Methods

1. Case-study-led teaching
2. Combination of Lectures, NPTEL Videos, Tutorials, Seminars.
3. Videos, Whiteboard,Exercise
4. Tutorials, Assignments, and Class quiz/ test

Text Books

1. Biomaterials Science: An Introduction to Materials in Medicine Buddy D. Ratner, Frederick J.Schoen, Allan S. Hoffman, Jack E. Lemons.
2. Hench L LEthridgc E.C. Biomaterials, an interfacial approach, Academic press 1982.

Reference Books

1. Bronzino J D, The biomedical engineering handbook CRC Press.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

BIOINFORMATICS LAB

Course Code: GR14A3099 L:0 T:0 P:2 C:2
III Year II Semester

LIST OF EXPERIMENTS

1. Concept application of biological databases using programmes.
   a. Protein and gene sequence databases
   b. Structure databases
   c. Pathway databases
   d. Bibilographic databases
2. Sequence retrieval from biological database.
3. Sequence similarity searching of nucleotide sequences.
4. Sequence similarity searching of protein sequences.
5. Multiple sequence alignment and phylogenetic analysis.
6. Gene finder (Prediction)- Genescan, Genscan.
7. Restriction site analysis tools.
8. Protein visualization tools

Equipment

1. Computers
2. Internet connectivity
3. Bioinformatics software(Freeware-NCBI,EMBL, SWISSPRO; MMDB, PDB; KEGG, BRENDA; PUBMED, MEDLINE;CLUSTAL W; RASMOL).

Teaching Methodologies

1. Lectures and practicum.
2. Online Public Data Bases, PubMed, and materials (lecture's pdfs, selected articles) in cloud sharing.
3. Development of a project in the field of Bioinformatics

Reference Books

1. Sequence Analysis in a Nutshell: A Guide to Tools: A Guide to Common Tools and Databases by Scott Markel, Darryl Leon, Publisher: O'Reilly Media, January 2003.
2. Current protocols in bioinformatics, Edited by A.D.Baxevanis et.al., Wiley Publishers 2005.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED ENGLISH COMMUNICATION SKILLS LAB

Course Code: GR14A3100 L:0 T:0 P:2 C:2
III Year II Semester

Unit-I
Functional English
Starting a conversation, responding appropriately and relevantly. Body Language, Role play in different situations

Unit-II
Vocabulary
Synonyms & Antonyms, Word Roots, One word substitutes, Prefixes & Suffixes, Study of word origin, Idioms and Phrases, Analogy.

Unit- III
Group Discussion
Introduction to Group Discussion its features and qualities desired in a participant of Group Discussion.

Unit-IV
Presentation Skills
Knowing audience; acquiring content; organizing ideas; foreseeing the possible clarifications sought; adopting of appropriate medium; positive stage presence; Presenting and feedback

Unit-V
Letter Writing & Résumé Writing
Manual and Emailing; types and formats; content and body of the letter. Email etiquettes; Resume Writing, tools required for writing resume's, role of cover letter in a resume.

Unit-VI
Interview Skills
Introduction, various types of questions asked in an interview, qualities required to be a competent interviewee.

Unit-VII
Reading comprehension
Introduction, types of reading, qualities of a good reader

Unit-VIII
Technical Report Writing
Formats and types of reports

Reference Books

1. English language laboratories: A Comprehensive Manual; NiraKonar, PHI Learning Pvt.Ltd.,Delhi.
2. Effective Technical Communication: A Guide for Scientist and Engineers;Barun K. Mitra, OUP.
3. Great Answers to Though Interview Questions; Martin John Yate; Seventh Edition;Kogan Page.
4. Business Communication; HorySankarMukerjee;OUP.
5. Technical Communication, Meenakshi Raman, Sangeeta Sharma, Oxford higher Education.
6. Professional Presentations; Malcom Goodale; Cambridge University Press.
7. Murphy's English Grammar with CD, Murphy, Cambridge University Press.
8. Effective Technical Communication, M. Ashraf Rizvi, Tata McGraw Hill.
9. Communication Skills, Sanjay Kumar, PushpLatha, Oxford Higher Education.
10. Business communication; Second Edition,Prentice Hall of India , New Delhi.
11. English for Engineers Made Easy, AedaAbidi, Ritu Chaudhry, Cengage Learning.
12. Effective Business Communication ; Seventh Edition; Murphy, HertaA.,Herbert W. Hildebrandt, and Jane P.Thomas 2009,Tata Mc Graw-Hill Publishing Company Limited, New Delhi.

IV-Year

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

DOWNSTREAM PROCESSING

Course Code: GR14A4122 L:3 T:1 P:0 C:4
IV Year I Semester

UNIT -I
Role of Downstream Processing in Biotechnology: Role and importance of downstream processing in biotechnologicalprocesses. Problems and requirements of bioproduct purification. Economics of downstream processing in biotechnology, cost-cutting strategies, process design criteria for various classes of bioproducts (high volume, low value products and low volume, high Value products).

UNIT-II
Primary Separation and Recovery Process: Physico-chemical basis of bio-separation processes .Cell disruption by(Mechanical and non-mechanical methods, Chemical lysis, Enzymatic lysis, physical methods, Sonication, Types of Homogenizers, flocculation and sedimentation, centrifugation and Separation of particulate by filtration, Rotary Vacuum Filtration.

UNIT-III
Enrichment Operations: Precipitation methods (with salts, organic solvents, and polymers, extractive separations, aqueous twophase extraction, supercritical extraction). Membrane-based separations (micro and ultra-filtration), theory, design and configuration ofmembrane separation equipment applications.

UNIT-IV
Product Resolution / Fractionation: Electrophoresis of proteins and nucleic acids, 1D-2D Gels, Types of Electrophoretic techniques (Capillaryand Pulse field)Chromatographic techniques- Paper, TLC, Adsorption, Ion exchange, Gel filtration, affinity chromatographic separation processes, GC, HPLC, FPLC, Chromatofocusing electrophoretic separations.

UNIT-V
New and Emerging Technologies: Dialysis, Crystallization Pervaporation, super liquid extraction foam based separation. A case study with examples for processing of Two Industrial Products (Citric acid / Penicillin and Low volume high value product like recombinant proteins).

Teaching Methods

1. We use case-study-led teaching, so your learning has real-world relevance
2. Teaching is a combination of lectures, tutorials, seminars, computer practice sessions and an extensive hands-on laboratory practical component
3. Video projector, PC, blackboard. Syllabus, tables, plots and text of exercise: distributed in class during the course

Text Books

1. Wankat PC. Rate controlled separations, Elsevier, 1990.
2. Belter PA and Cussler E. Bioseparations, Wiley 1985.
3. Sivasankar, B. “Bioseparations: Principles and Techniques”. PHI, 2005

Reference Books

1. Product Recovery in Bioprocess Technology, BIOTOL.’ Series, VCH, 1990.
2. Asenjo J.M. Separation processes in Biotechnology, 1993, Marcel DekkereInc
3. M.R.Ladisch, Bioseparation engineering: Principles, Practice and Economics, Wiley Interscience 2001

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

BIOETHICS BIOSAFETY AND IPR

Course Code: GR14A4123 L:2 T:1 P:0 C:3
IV Year I Semester

UNIT-I
Bioethics: Introduction to Bioethics, Importance of Bioethics in biotechnology, Animal sciences, Pharmacy & Society.

UNIT-II
Biosafety: Concepts and Regulations, Biosafety methods in laboratories and industries.

UNIT III
Regulatory Protocols: GLP, GCP and GMP practices and regulatory affairs.

UNIT-IV
GMOs: Genetically modified Organisms and their usage in society, Special regulations, protocols in releasing GMOS, Cartagena protocol, Biotechnology and food safety-case study-BT cotton, BT-Brinjal.

UNIT-V
Intellectual property rights: Introduction to IPR, Importance-patent search, Drafting, filing patent, Case studies, Basmati rice, Turmeric etc. Trademarks: IPR Trade secrets, Copy rights, Trade marks and Legal implications.

Teaching Methods
1. Case-study-led teaching
2. Combination of Lectures, Presentation Slides, Tutorials, Seminars.
3. Videos, Whiteboard, text of exercise
4. Tutorials, Assignments, and Class quiz/ test

Text Books
1. Sasson A, Biotechnologies and Development UNESCO Publications,1988.
2. Sasson. A. Biotechnologies in developing countries present and future, UNESCO Publishers,1993.

Reference Books
1. Singh K. Intellectual Property Rights on Biotechnology, BC II,New Delhi.
2. P.Das and Gokul Das. Protection of Industrial Property Rights
3. V.Sree Krishna. Bioethics and Biosafety in Biotechnology. New Age International Publications.2007.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

BIOPHARMACEUTICAL TECHNOLOGY

Course Code: GR14A4124 L:2 T:1 P:0 C:3
IV Year I Semester

Unit-I
Introduction to Pharmaceuticals: History and definition of drugs, Sources of drugs- plants, animals, microbes, minerals. Different dosage forms, Routes of drug administration.

Unit-II
Pharmacodynamics: Physicochemical principles, Mechanism of drug action, drug receptors, physiological receptors, structural and functional families.

Unit-III
Pharmacokinetics and drug manufacturing processes: Drug absorption, Factors affecting drug absorption, Distribution of drugs, Bioavailability and Biotransformation of drugs, Good manufacturing practices, manufacturing facilities.

Unit-IV
Production and analysis of biopharmaceuticals: Production of therapeutic proteins, Hormones, Cytokines, Interferons, Interleukins I and II, Tumor necrosis factor (TNF), Nucleic acids.

Unit-V
Drug Delivery Systems, Applications of Biopharmaceuticals: Controlled and Sustained delivery of drugs, Biomaterial for sustained drug delivery, Liposome mediated drug delivery, Drug delivery methods for therapeutic proteins, Role of biopharmaceuticals in treatment of various health disorders.

Teaching Methodologies
1. Classroom lectures, seminars and tutorials.
2. Teaching with the help of laboratory techniques.

Reference Books
1. Biopharmaceuticals: Biochemistry n and Biotechnology – Gar Walsh(1998), John Wiley and Sons Ltd.
2. Remington's pharmaceutical sciences, (Mark publications and company Eston PA) (1980)
3. Theory and Practice of Industrial Pharmacy, (3rd Ed) Leon Lachman, Lea and Febiger (1986).

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

CROP IMPROVEMENT
(Elective -I)

Course Code: GR14A4125 L:3 T:1 P:0 C:4
IV Year I Semester

Unit-I

Crop Improvement: Identifying Crops with useful agronomic traits, and food quality.Conventional plant breeding strategies –Inbred lines, Pure-lines, Seed development, Hybridization, Heterosis.

Unit-II

Crop Productivity: Factors affecting productivity of crop plants: BioticStress-Pest Attacks, Viral and Bacterial Infections, Fungal Infection, Nematode infestation, Weeds. Abiotic Stress- Drought, Floods, Temperature, Salinity conditions.

Unit-III

Genetic Engineering for Increasing: Crop Productivity: Transgenicplants for stress tolerance and increase in productivity yield by genetic manipulation of photosynthesis, nitrogen fixation, nutrient uptake efficiency.
Quality Improvement: Transgenic plants for quality improvement of protein, lipid & carbohydrate content.Phytoremediation of contaminated soils. Risks and benefits of release of GM crops. Regulation of research and development of transgenic plants.Molecular Pharming (Plants as bioreactors, Plantibodies, edible vaccines)

Unit-IV

Molecular Markers For Crop Improvement: Random amplified polymorphic DNA (RAPD), Restriction fragment length polymorphism (RFLP), Amplified fragment length polymorphism (AFLP), Simple sequence repeats (SSR), Inter Simple sequence repeats (ISSR), Single strand conformation polymorphism (SSCP),Advantages and limitations of molecular markers and Quantitative trait loci (QTLs),Marker assisted selection (MAS), Construction of molecular maps in plants and applications,

Unit-V

Molecular Biology of Plant Processes: Tissue specific gene expression, Discovery / Cloning of Plant Genes: Probe based screening, Genomic and proteomic approaches, Concept of Gene Synteny.

Teaching Methodologies
White Board, Lectures, Videos, Tutorials, Quiz and Assignments.

Text Books
1. Biochemistry and Molecular Biology of Plants (Buchanan, B.B., Gruissem, W. and Jones, R.L eds.) 2000
2. Molecular Plant Breeding, Yunbi Xu, CABI Publishers, I edition, 2010 (ISBN-13:978-1845933920)

Reference Books
1. Principles of Plant Genetics and Breeding,George Acquaah, Blackwell-Wiley Publishers, I Edition, 2006 (ISBN-13: 978-1405136464)
2. Plant Molecular Breeding- Sheffield Biological Series, H. John Newbury, Blackwell Publishers, 2003 (ISBN-13:978-0849328138)

GOKARAJU RANGARAJU
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MOLECULAR PATHOGENESIS
(Elective -I)

Course Code: GR14A4126 L:3 T:1 P:0 C:4
IV Year I Semester

Unit-I
Introduction: Introduction to Pathogenesis; Components of microbial pathogenecity, Population genetics of Microbial pathogenesis; Methods to detect genetic diversity and structure in nature population, Epidemiology, Cryptic diseases.

Unit-II
Host Defenses: Host defense against pathogens; Clinical importance of understanding host defense, components of the host surface defense systems like skin, mucosa, eye, mouth, respiratory tract; Components of the systemic defense like tissues and blood.

Unit-III
Host-Pathogen Interaction: Virulence and virulence factors; Colonizing virulence factors; Factors damaging the host tissues; Virulence genes and regulation of virulence genes.

Unit-IV
Modulation of Immune Response: Modulation of immune response by vaccines, properties of vaccines, other immunomodulators.
Paradigms of pathogenesis: Diphtheria disease by colonization, Disease without colonization: Clostridium Botulium and Staphylococcus aureus, Intestinal infections: Shigella and E.coli infections, Vibrio cholera and Salmonella infections, fungal infections.

Unit-V
Modern Approaches to Control Pathogens: Classical approaches based on serotyping**;** Modern diagnosis based on highly conserved virulence factors, immune and DNA based techniques**;** Tuberculosis and other mycobacterium infections re emerging with vengeance.

Teaching Methodologies
1. White Board and marker.
2. Class Discussion.
3. Interactive teaching with case-study.
4. Tutorials and Assignments.

5. Slide Projection and video presentations.

Text Books

1. Iglewski B.H. and Clark V.L. Molecular basis of bacterial pathogenesis, Academic press,1990.
2. Janeway C.A.Jr and Travers P.T. Immunology, Blackwell J Scientigic Publishers, 1994.

Reference Books

1. Talaro K. and Talaro A. Foundations in Microbiology, W.C. Brown Publishers,1993.
2. Roitt I. Essentials of Immunology, 8th edition, Blackwell Scientific Publishers,1994.
3. Austyn J.M. and Wood K.J. Principles Cellular and Molecular Immunology, Oxford University Press,1993.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

CANCER BIOLOGY
(Elective -I)

Course Code: GR14A4127 L:3 T:1 P:0 C:4
IV Year I Semester

Unit-I
Fundamentals of Cancer Biology: Regulation of Cell cycle, mutations that cause changes in signal molecules, effects on receptor, signal switches, Tumour suppressor genes, modulation of cell cycle in cancer. Different forms of cancers, Diet and cancer.

Unit-II
Principles of Carcinogenesis: Chemical Carcinogenesis, Metabolism of Carcinogenesis, Targets of Chemical Carcinogenesis. X-Ray radiation - Mechanism of radiation carcinogenesis.

Unit-III
Molecular Cell Biology Of Cancer: Oncogenes, Retroviruses and Oncogenes, detection of Oncogenes, Growth Factor and Growth Factor receptors that are Oncogenes. Growth factors related to transformations.

Unit-IV
Principles of Cancer Metastasis: Clinical significances of invasion, Three-step theory of tumour cell invasion, Metastatic cascade, Basement Membrane disruption, Proteinases and tumour cell invasion.

Unit-V
Cancer Detection & Cancer Therapy: Prediction of aggressiveness of Cancer, Advances in Cancer detection. Different forms of therapy, Chemotherapy, radiation Therapy, and Immunotherapy: advantages and limitations. New approaches for Cancer Therapy.

Text Books
1. Maly B.W.J. Virology a practical approach, IRL Press, Oxford, 1987.
2. Dunmock N.J and Primrose.S.B., Introduction to modern Virology, Blackwel Scientific Publications. Oxford, 1988.

Reference Books

1. An Introduction to Cellular and Molecular Biology of Cancer, Oxford Medical publications, 1991.

Teaching Methodology

1. Practical Exposure
2. White board
3. Videos
4. Power point presentation
5. Guest lectures

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

STRUCTURAL BIOLOGY
(Elective –II)

Course Code: GR14A4128 L:3 T:1 P:0 C:4
IV Year I Semester

Unit - I

Introduction: Levels of structures in Biological macro-molecules, the chirality of bio-molecules; proteins, nucleic acids, carbohydrates and lipids, co-factors, vitamins and hormones.

Unit-II

Protein Folding and Bio-Molecular Interactions: Forces that determine protein and nucleic acid structure, basic problems. Types of proteins and interactions**,** Organized folds, folding mechanisms, Membrane proteins, molecular recognition, supra molecular interactions; Polypeptide chains; Observed values for rotation angles, hydrogen bonding, hydrophobic interactions and water structures; Ionic interactions, disulphide bonds. Functional importance of protein-protein and protein-nucleic acid interactions. Specific and non-specific DNA –protein complexes.

Unit - III

Structural Analysis of Macromolecules: Prediction of protein structure and nucleic acids; General characteristics of nucleic acid structure, geometric, glycosidic bond rotational isomers, backbone rotational isomers and ribose; Puckering forces stabilizing ordered forms, base pairing, base stacking; Tertiary structure of nucleic acids.

Unit -IV

Kinetics of Ligand Interactions: Biochemical kinetic studies; Uni-molecular reactions, simple bimolecular multiple intermediates; Steady state kinetics, Catalytic efficiency, Relaxation Spectrometry, Ribonuclease as an example.

Unit -V

Techniques for the Study of Biological Structure and Function: Size and shape of macro molecules; photons, absorbance and concentration. Circular dichroism: molecular chirality and structural transitions of macromolecules, method of direct visualization of macromolecules as hydrodynamic particles–macromolecular diffusion ultra-centrifugation, viscometry. X-ray crystallography; determination of molecular structures, X-ray fiber diffraction, electron microscopy; neutron scattering - light scattering, NMR spectroscopy.

Teaching Methodologies

1. White board
2. OHP & PPTs
3. Models and Charts

Text Books

1. Tinoco, I., Jr., Sauer, K., Wang, J.C., & Puglisi, J.D. (2001) Physical Chemistry: Principles and Applications in Biological Sciences, 4th ed. Prentice Hall.

Reference Books

1. Introduction to Protein Architecture, by A.M. Lesk

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

BIOSENSORS AND BIOELECTRONICS

Course Code: GR14A4129 L:3 T:1 P:0 C:4
IV Year I Semester

Unit-I
Introduction: Introduction to Biosensors, various components of biosensors. Types of biosensors: Biocatalysts based biosensors, bio-affinity based biosensors & microorganisms based biosensors, Biologically active material and analyte, Types of membranes used in biosensors.

Unit-II
Transducers in Biosensors: Various types of transducers, principles and applications - Calorimetric, Optical, Potentiometric/ Amperometric Conductometric/ Resistometric, Piezoelectric, semiconductors, Impedimetric, Mechanical and Molecular electronics based transducers, Chemiluminiscence based biosensors.

Unit-III
Application and uses of Biosensors: Biosensors in clinical chemistry, medicine and health care;**B**iosensors for veterinary, agriculture and food, Low cost- biosensor for industrial processes, **B**iosensors for environmental monitoring.

Unit-IV
Molecular Electronics : Molecular wires and switches, Assembly of photonic biomolecular memory store, Information processing.

Unit-V
Potential advantages & developments towards a Biomolecular Computer, Development of molecular arrays as memory stores, Commercial prospects for imolecular computing systems.

Teaching Methodology
Lectures, Power Point Presentations, Vedios, Tutorials, Quiz

Text Books
1. Aboul-Enein,H.V.,Stefan,R.andVanStaden,(1999) Chemiluminiscence - based biosensors – Anoverview CritRev.Anal.Chem.
2. Pearson,J.E.Gill, A., andVadgama. P.(2000) Analyticalaspects of biosensors Ann Clin. Biochem.

Reference Books

1. Roger,K.R and Gerlach, C.L.1~99. Update on environmental for biosensors. Env.Sci. Technol 33 500A-506A.
2. Bilitewski,U.Turner, A.P.F.2000 Biosensorsfor environmental monitoring Harwood, Amsterdam.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

NANO BIOTECHNOLOGY
(Elective II)

Course Code: GR14A4130 L:3 T:1 P:0 C:4
IV Year I Semester

Unit-I
Basic Concepts: Definition of nano scale with reference to biosystems; Scope and future prospects; Challenges of nanotechnology; Nanomaterial synthesis and properties.

Unit-II
Tools of Nanoscience: Scanning probe instrument; Spectroscopy; Electron Microscopy (SEM, TEM, STEM); Molecular Synthesis; Self-assembly; Polymerisation; Nanoscale lithography; E-beam lithography; XRD .

Unit-III
Smart Materials: Nano-biostructures- carbon nanotubes, bucky balls, nano wire; Heterogenous nano structures and composites; Protein-hybrid computers; Role of genetically Engineered polymer proteins.

Unit-IV
Applications: Drugs- Photodynamic therapy, Molecular motors, Neuroelectronic interphases, Development of nano luminiscent tags; Food industry - Food Processing; Environment - remediation of soil and water.

Unit-V
Biosynthesis of Designer Compounds: Designer biopolymers; Pro-collagen; DNA Polynode; RNA Topoisomerase; Protein magnetic materials.

Teaching Methodologies
1. Over Head Projector
2. White Board
3. Power Point Presentation
4. Demonstration
5. Class room participation

Text Books
1. M. Ratner and D.Ratner, Nanotechnology–a gentle introduction to the next big idea, Pearson Education, 2007.
2. R. R. Birge, Protein based computers, Scientific American, 1995.

Reference Books

1. L.E.Foster, Nanotechnology-Science, Innovation and opportunity, Person Education Inc, 2007.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

DOWNSTREAM PROCESSING LAB

Course Code: GR14A4131 L:0 T:0 P:2 C:2
IV Year I Semester

List of experiments

1. Cell disruption technique: Ultra-sonication.
2. Solid separation methods- Filtration, sedimentation, centrifugation and other product enrichment operations.
3. Isoelectric precipitation – Determination of Isoelectric point of proteins and isolation of proteins from aqueous systems by pH change.
4. Salting out.
5. Organic solvent mediated precipitation: concentration of proteins from aqueous systems by addition of organic solvents.
6. Ion exchange chromatography.
7. Gel filtration (Molecular sieving).
8. Affinity chromatography.

List of Equipment

1. Ultrasonicator
2. Glassware
3. Chromatography kits

Reference Books

1. P.A. Belter, E.L. Cussler and Wei-Houhu – Bioseparations – Downstream Processing For Biotechnology, Wiley Interscience Pun. (1988).
2. R.O. Jenkins, (Ed.) – Product Recovery in Bioprocess Technology – Biotechnology by Open Learning Series, Butterworth-Heinemann (1992).

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

PLANT TISSUE CULTURE LABORATORY

Course Code: GR14A4132 L:0 T:0 P:2 C:2
IV Year I Semester

LIST OF EXPERIMENTS

1. Good Laboratory Practices in Plant Tissue Culture
2. Sterilization Techniques
3. MS Media Preparation
4. Preparation of natural media using Coconut water and Potato extract
5. Explant Sterilization
6. Inoculation and Incubation of Explants
7. Regeneration of Seeds
8. Embryo Culture
9. Culture of Vegetative tissues
10. Explant Culture
11. Callus induction and Regeneration
12. Anther Culture

Recommended Readings

1. Principles of Plant Biotechnology- An Introduction of Genetic Engineering in Plants by S.H. Mantell, J.W. Mathews and R.A. Mckee, Blackwell Scientific Publications.
2. Plant Cell, Tissue, Organ Culture: Fundamental Methods by O.L. Gamborg and G.C. Phillips, Narosa Publication, House, New Delhi.
3. Plant Biotechnology and Tissue Culture: Principles and Perspective, Edited by. A. Kumar and V.A. Kumar, Introduction Book Distributing Company, Lucknow.
4. An Introduction to Plant Tissue Culture M.K. Razdan, Oxford and IBII Publishing Co. Pvt. Ltd., New Delhi.
5. Introduction to Plant Tissue Culture, Bhojwani and Rozdan
6. Plant Tissue Culture Concepts and Laboratory Exercises, by Robert N. Trigiano (Editor), Dennis J. Gray (Editor), Second Edition, Nov 1999. Publisher: CRC Press; 2 edition (10 November 1999) ISBN-10: 0849320291; ISBN-13: 978-0849320293

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

BIOPHARMACEUTICAL TECHNOLOGY LABORATORY

Course Code: GR14A4133 L:0 T:0 P:2 C:2
IV Year I Semester

LIST OF EXPERIMENTS

1. Limit test for iron
2. Limit test for lead
3. Limit test for chloride
4. Assay of pure drug iron
5. Assay of pure drug sodium bicarbonate
6. Assay of pure drug hydrogen peroxide
7. Assay of pure drug sodium chloride
8. Evaluation of pharmaceutical preparation: description, colour, texture, shape, dimensions: thickness, diameter, visible defect, etc.
9. Assay of marketed formulation – iron
10. Assay of marketed formulation – sodium bicarbonate
11. Assay of marketed formulation –hydrogen peroxide
12. Assay of marketed formulation – sodium chloride
13. Microscopic examination of herbal drugs: stomatal index, trichomes and calcium oxalate.
14. Biochemical analysis of herbal drugs:
    1. Test for presence of proteins
    2. Test for presence of carbohydrates
    3. Test for presence of lipids
    4. Test for presence of tannins
    5. Test for presence of Cholesterol

Text Books

1. Practical pharmacognosy by SB Gokhale, CK Kokate, - Nirali Prakashan Publications.
2. Practical Pharmaceutical chemistry-1 by AV Kasture, SG Wododkar, SB Gokhale- Nirali prakashan publications- (1st yr diploma in pharmacy)
3. Practical Biochemistry and clinical pathology by SR Kale, RR Kale- Nirali prakashan publications -(1st yr diploma in pharmacy)
4. Pharmacognosy by SB Gokhale, CK Kokate, AP Purohit - Nirali Prakashan Publications.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

ANIMAL CELL SCIENCE AND TECHNOLOGY

Course Code: GR14A4134 L:2 T:1 P:0 C:3
IV Year II Semester

Unit- I

Structure and Organization of animal cell; Equipments for animal cell culture technology; Primary and established cell line cultures; Introduction to the balanced salt solutions and simple growth medium. Brief discussion on the chemical, physical and metabolic functions of different constituents of culture medium. Role of carbon dioxide. Role of serum and supplements.

Unit-II

Measurement of viability and cytotoxicity; Parameters of growth and their measurement; Disaggregation of tissue and primary culture-enzymatic and non-enzymatic methods; Maintenance of cell culture. Scaling-up of animal cell culture.

Unit-III

Cell synchronization; Cell cloning and micromanipulation; Transfection; Application of animal cell culture.

Unit-IV

Stem cell cultures, Embryonic, adult and fetal stem cells; Embryonic stem cells and their applications; Stem cells in tissue engineering and regenerative medicine; Cell culture based vaccines.

Unit-V

Organ and histotypic cultures; Three dimensional cultures; Apoptosis Vs Necrosis; Detection of Apoptosis (Flow cytometry, Epi-fluorescent microscopy and Immunohistochemistry).

Text Books

1. Culture of Animal Cells, (3rd Edition), F1. Ian Froshney. Wiley-Liss.
2. Animal Cell Culture – Practical Approach, Ed. John R.W. Masters, OXFORD.

Reference Books

1. Cell Culture Lab Fax. Eds. M. Butler & M. Dawson, Bios Scientific Publications Ltd., Oxford.
2. Animal Cell Culture Techniques. Ed. Martin Clynes, Springer.
3. Methods in Cell Biology, Vol. 57, Animal Cell Culture Methods. Ed. Jenni P Mather and David Barnes. Academic Press.
4. Cell Growth and Division: A Practical Approach. Ed. R. Basega, IRL Press.

Teaching Methodology:

1. White board
2. Videos
3. Slide presentation
4. Power point presentation

Student evaluation and Assesment

1. Subjective and objective slip tests
2. Seminars
3. Group discussions

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

FOOD SCIENCE AND TECHNOLOGY
(Elective-III)

Course Code: GR14A4135 L:2 T:1 P:0 C:3
IV Year II Semester

Unit-I
Introduction to Food Science & Technology: Fundamentals of food science and technology. Interdisciplinary approach, Nutritive value of foods,Food as a source of energy, Food Health and disease.

Unit-II
Food Spoilage And Food Borne Diseases: Biochemical changes caused by micro-organisms, deterioration of various types of food product-Fish, milk and meat, during handling and processing. Food poisoning, Food borne infections and intoxications.

Unit-III
Food Preservation: Principles of food preservation: Physical, chemical and biological methods of preservations.

Unit-IV
Food Biotechnology: Enzymes in food industry, Nature and type of starters,Role of starters in Fermented foods, Fermentation of Milk products-Fermented soy and peanut milk, Fruit and cereal based beverages, Non beverage plant products. Mycoprotein production. Nutraceuticals. Natural sweeteners and artificial sweeteners and their role in controlling diseases and deficiencies, Pigments in food, food flavours, food additives and toxicants

Unit-V
Food Processing & Quality Assurance: Basic principles, unit operations, and equipment involved in the commercially important food processingmethods and unit operations; materials and containers used in food packaging. Methods of quality, assessment of food materials,fruits, vegetables, cereals, dairy products, meat, poultry. Food regulations, grades and standards, Concept of Codex Almentarious/HACCP/USFDA/ISO 9000 series etc. Food laws and standards.

Teaching Methodologies
1. Lecture using OHP
2. Class room discussion
3. Interactive teaching
4. Tutorials and Assignments

Text Books

1. Jay J.M. 1986. Modern Food Microbiology. 3rd Edn. VNR, New York.
2. Food processing and Preservation PHI private ltd,New Delhi
3. Food Microbiology fourth edition William C.Frazier, Tata Mc Graw Hill
4. Food Microbiology 2nd Edition, Michael P.Doyle ,ASM press
5. Fennema, O.R. Ed. 1976. Principles of Food Science: Part-I Food Chemistry. Marcel Dekker, New York.
6. Meyer, L.H. 1973. Food Chemistry. East-West Press Pvt. Ltd., New Delhi.
7. Charalambous, G. and Inglett, G. 1981. The Quality of Foods and Beverages. (2 vol. set). AcademicPress, New York.
8. Krammer, A. and Twigg, B.A. 1970. Quality Control for the Food Industry. 3rd Edn. AVI, Westport.
9. Ranganna, S. 1986. Handbook of Analysis and Quality Control for Fruits and Vegetable Products. TataMcGraw Hill, New Delhi.
10. Norman N.Potter, Joseph H.Hotchkiss. Food science.CBS Publishers, New Delhi.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

MOLECULAR MODELLING AND DRUG DESIGNING
(Elective-III)

Course Code: GR14A4136 L:2 T:1 P:0 C:3
IV Year II Semester

Unit-I
Introduction to Molecular Modelling: Introduction to Molecular Modelling. Use of different models, Areas of application – Single molecule calculation, assemblies of molecules. Reaction of the molecules. Drawbacks of mechanical models as compared to graphical models. Co-ordinate systems two-matrix, potential energy surface.

Unit-II
Empirical Force Field Models: Molecular mechanisms, energy calculations, bond stretch, angle bending, torsional term. Electrostatic interaction- Van der Waals interactions. miscellaneous interaction.

Unit-III
Molecular Dynamics: Introduction, Molecular Dynamics using simple models. Dynamics with continuous potentials. Constant temperature and constant dynamics. Conformation searching, Systematic search. Applications to protein folding.

Unit-IV
Comparative Protein Modeling: Modelling by Homology-the alignment, construction of frame work selecting variable regions, side chain placement and refinement, validation of protein models –Ramchandran plot, threading and ab-initio modeling. Analog Based Drug Design: Introduction to QSAR. lead module, linear and nonlinear modeled equations, biological activities, physicochemical parameter and molecular descriptors, molecular modelling in drug discovery.

Unit-V
Structure Based Drug Design: 3D pharmacophores,molecular docking, *de novo* ligand design, Free energies and solvation, electrostatic and non-electrostatic contribution to free energies.

Teaching Methodologies
Lectures, Chalk and Board, Videos, Guest Lectures, PPTs, Quiz and Tutorials

Text Books

1. Principles and applications of modelling by Leach
2. Molecular Modelling by Hans Pieter, Heltje & Gerd Folkens, VCH.

Reference Books

1. Chemical Applications of Molecular Modelling by Jonathan Goodman.
2. Computational Chemistry by Guy H, Grant & W. Graham Richards, Oxford University Press.April 1985.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

BIOPROCESS OPTIMIZATION
(Elective-III)

Course Code: GR14A4137 L:2 T:1 P:0 C:3
IV Year II Semester

Unit-I
Basic Concept: Overview of experimental design in biological processes, understanding of variables in biological processes.

Unit-II
Optimization Approaches: Non-statistical, statistical and numerical optimization-fundamental theory. Statistical Optimization:First order and second order designs, differences in approaches, general response surface analysis.

Unit-III
First Order Designs: Statistical experimental procedures for Plackett-Burman Taguchi's designs.

Unit-IV
Determination of: Optimal Conditions Method of Ridge analysis, Nelder-Mead simplex method, optimization of multi response biological systems.

Unit-V
Variance and Design: Variance minimizing design, mixed variable and multi response generalized distance function approaches for multi-response optimization. Self-directing optimization, case studies with single response and multi response analysis.

Teaching Methodologies
1. White board and marker
2. Lecture using OHP
3. Class discussion
4. Interactive teaching
5. Tutorials and Assignments

Text Books
1. B. Volesky and J. Vortuba, Modelling optimization of fermentation processes, Elsevier, Amsterdam,1992.
2. A.I. Khruri and J.A. Cornel, response surface design optimization, New York, 1987

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

CLINICAL TRIALS AND REGULATORY AFFAIRS
(Elective-IV)

Course Code: GR14A4138 L:2 T:1 P:0 C:3
IV Year II Semester

Unit-I
Introduction: to Clinical Trials, Data Protection Act and guidelines and codes of practice, Licensing authorities' roles and responsibilities of ICH, GCP, FDA, EU.

Unit-II
Development of IGH GCP guidelines, Role of Sponsor Monitor Investigator IRB, the INDIAN/ USA / EU Directives on GCP in clinical trials.

Unit-III
Ethics committee'simportance in clinical trials, recent development with regard to the INDIA/USA/EU. Ethics approval systems.

Unit-IV
Different stages of clinical trials, Confidentiality issues, Medicines for human use requirements and procedures in clinical research.

Unit-V
Regulatory affairs: Main concepts for clinical studies in human subjects, Current and future perspectives.
Regulatory guidelines for new product development, Requirements for gaining approval, US perspective and Indian guidelines.

Teaching Methodology
Theory lectures, Course material handouts,Guest lectures and Videos and through an e-learning system or ICT. Assignments and Quiz.

Text Books
1. Good Clinical Practices, Central Drugs Standard Control Organization, Govt. of India.
2. Drugs and Cosmetics Act, 1940.

Reference Books
1. International Clinical Trial, Volume 1&2 Dominique P.Brunier and Gerhaedt Nahler, Interpharm Press, Denver, Collorado.
2. Code of Federal Regulation by USFDA-Download
3. ICH-GCP Guidelines-Download
4. Biosafety issue related to genetically modified organism, Biotech Consortium India Limited, New Delhi.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

CREATIVITY, INNOVATION AND PRODUCT DEVELOPMENT
(Elective-IV)

Course Code: GR14A4139 L:2 T:1 P:0 C:3
IV Year II Semester

Unit-I
Introduction: The process of technological innovation, factors contributing to successful technological innovation. The need for creativity and innovation, creativity 'and problem solving, brain storming- different techniques.

Unit-II
Project Selection and Evaluation: Collection of ideas and purpose of project.- Selection criteria - screening ideas for new products (evaluation techniques).

UNIT-III
New Product Development: Research and new product development Patents - patent search

UNIT-IV
Patent Laws: Patent laws International code for patents - Intellectual property rights (IPR).

UNIT-V
New Product Planning I: Design of proto type - testing - quality standards Marketing research - introducing new products. Creative design - Model Preparation - Testing cost evaluation, Patent application.

Text Books
1. Harry B.Watton - New Product Planning. Prentice-Hall Inc. 1992.
2. P.N.Khandwalla - Fourth Eye (Excellence through Creativity) -Wheeler Publishing, Allahabad, 1992

Reference Books
1. Harry Nystrom - Creativity and Innovation -John Wiley & Sons 1979.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

NEUROBIOLOGY AND COGNITIVE SCIENCE
(Elective-IV)

Course Code: GR14A4140 L:2 T:1 P:0 C:3
IV Year II Semester

Unit-I
Introduction To Nervous System: Outline of central and peripheral nervous systems; Brain and Spinal cord; Blood Brain barrier.

Unit-II
Neuroanatomy: Structure and function of neurons and synapses; Glial cells; Myelination; signals produced by neurons; sensors-function; Molecular and cellular organization of neuronal differentiation; Characterization of neuronal cells.

Unit-III
Neurophysiology & Neurophamacology: Conduction of impulses by neurons; Correlation of sensory functions.Pharmaceutical mediator released by neurons; Hormones and their effects on neuronal functions.

Unit-IV
Neurological Disorders: Pathogenesis; Genetic basis of Neurological disorders; Disorders associated with the nervous system.

Unit-V
Behavioural Science: Neuronal mechanism and behavior; Animal behavior; Behavior in various environments.

Teaching Strategies
1. Over Head Projector
2. White Board
3. Power Point Presentation
4. Demonstration
5. Class room participation

Text Books
1. Mathews G.G. Neurobiology, 2nd edition, Blackwell Science, UK, 2000.
2. Gordon M. Shepherd G.M, and Shepherd Neurobiology, 3rd Edition Oxford University Press, USA, 1994

Reference Books

1. A.B. Schiebel Neurobiology of higher cognitive function, Guilford Press, 1990.
2. Mason P., Medical Neurobiology, Oxford University Press, 2011.

GOKARAJU RANGARAJU
INSTITUTE OF ENGINEERING AND TECHNOLOGY

FOOD TECHNOLOGY LAB

Course Code: GR14A4141 L:0 T:0 P:2 C:2
IV Year II Semester

List of Experiments

1. Determination of moisture content in food.
2. Determination of fat content in food.
3. Determination of protein content in food.
4. Vitamin C determination in food.
5. Preparation of casein from milk.
6. Determination of hardness in water
7. Enumeration and isolation of microorganisms in food.
8. Bacteriological examination of milk.
9. Enumeration of coliforms and E.Coli in foods using MPN method.
10. Production of any fermented food.

Teaching Methodologies

1. Demonstration of experiments.
2. Explain the experiment prior to demonstration of experiment.
3. Laboratory material are given to the students.

Text Books

1. Aneja K.R. Experiments in Microbiology, Plant pathology, Tissue culture andMushroom cultivation, New Age International, New Delhi.
2. Laboratory manual in microbiology by P. Gunasekharan, Newage international Publishers.

Reference Books

1. Food analysis laboratory manual by S.Suzanne Nielsen. Springer publication.