Amendments approved in the 26th Academic Council Meeting held on 25 July 2014

B.Tech Genetic Engineering
Curriculum and Syllabus – 2013-14

Syllabus for the courses Microbiology, Microbiology Laboratory, Immunology and Immunology Laboratory shall be same as that offered by the department of biotechnology (already approved) with the following codes:
BT1008 Microbiology 3-0-0-3 instead of BT1007
BT1009 Microbiology Laboratory 0-0-4-2 instead of BT1008.
BT1010 Immunology 3-0-0-3
BT1011 Immunology Laboratory 0-0-4-2
The course BT1007 Microbiology stands deleted.

SRM UNIVERSITY
(Under section 3 of UGC Act 1956)

B.Tech (Full Time) – Genetic Engineering
Curriculum & Syllabus
2013 - 2014

Volume – I
(all courses except open electives)

Faculty of Engineering & Technology
SRM University
SRM Nagar, Kattankulathur – 603 203

STUDENT OUTCOMES

The curriculum and syllabus for B.Tech programs (2013) conform to outcome based teaching learning process. In general, **ELEVEN STUDENT OUTCOMES** (a-k) have been identified and the curriculum and syllabus have been structured in such a way that each of the courses meets one or more of these outcomes. Student outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program. Further each course in the program spells out clear instructional objectives which are mapped to the student outcomes.

The student outcomes are:

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

B.Tech. Genetic Engineering
Curriculum – 2013
(Applicable for students admitted from the academic year 2013-14 onwards)

SEMESTER I						
Course code	**Category**	**Course name**	**L**	**T**	**P**	**C**
PD1001	G	SOFT SKILLS I	1	0	1	1
MA1011	B	MATRICES AND CALCULUS	3	2	0	4
PY1001	B	PHYSICS	3	0	0	3
PY1002	B	PHYSICS LABORATORY	0	0	2	1
CY1001	B	CHEMISTRY	3	0	0	3
CY1002	B	CHEMISTRY LABORATORY	0	0	2	1
LE1002	G	VALUE EDUCATION	1	0	0	1
CE1001	E	BASIC CIVIL ENGINEERING	2	0	0	2
COURSES FROM TABLE I						
Student shall register for minimum 20 credits in I semester and minimum 20 credits in II semester. However student shall have registered for all the courses enlisted under Semester I and II as well the courses in Table I by the time the registration process is complete in II semester. Keeping this in mind student shall register for the courses in I and II semesters.						

Legend:
L - Number of lecture hours per week
T - Number of tutorial hours per week
P - Number of practical hours per week
C - Number of credits for the course

Category of courses:
G - General
B - Basic Sciences
E - Engineering Sciences and Technical Arts
P - Professional Subjects

SEMESTER II						
Course code	**Category**	**Course name**	**L**	**T**	**P**	**C**
PD1002	G	SOFT SKILLS II	1	0	1	1
MA1012	B	MULTIPLE INTEGRALS AND DIFFERENTIAL EQUATIONS	3	2	0	4
PY1003	B	MATERIAL SCIENCE	2	0	2	3
CY1003	B	PRINCIPLES OF ENVIRONMENTAL SCIENCE	2	0	0	2
GN1001	B	CELL BIOLOGY AND CYTOGENETICS	3	0	0	3
BT1004	B	BIOCHEMISTRY	3	0	0	3
GN1002	B	CYTOGENETICS LABORATORY	0	0	4	2
BT1005	B	BIOCHEMISTRY LABORATORY	0	0	4	2
LE1001	G	ENGLISH	1	2	0	2
Student shall register for minimum 20 credits in I semester and minimum 20 credits in II semester. However student shall have registered for all the courses enlisted under Semester I and II as well the courses in Table I by the time the registration process is complete in II semester. Keeping this in mind student shall register for the courses in I and II semesters.						

TABLE I
COURSES WHICH CAN BE REGISTERED EITHER IN I OR II SEMESTER

SEMESTER I / II						
Course code	**Category**	**Course name**	**L**	**T**	**P**	**C**
CS1001	G	PROGRAMMING USING MATLAB	0	1	2	2
ME1001	E	BASIC MECHANICAL ENGINEERING	2	0	0	2
EE1001	E	BASIC ELECTRICAL ENGINEERING	2	0	0	2
EC1001	E	BASIC ELECTRONICS ENGINEERING	2	0	0	2
ME1004	E	WORKSHOP PRACTICE	0	0	3	2
ME1005	E	ENGINEERING GRAPHICS	0	1	4	3

NC1001/ NS1001/ SP1001/ YG1001	G	*NCC/NSS/NSO/YOGA	0	0	1	1

*NCC-National Cadet Corps
NSS-National Service Scheme
NSO-National Sports Organization (India)

SEMESTER III						
Course code	**Category**	**Course name**	**L**	**T**	**P**	**C**
LE1003/ LE1004/ LE1005/ LE1006/ LE1007	G	GERMAN LANGUAGE PHASE I / FRENCH LANGUAGE PHASE I/ JAPANESE LANGUAGE PHASE I / KOREAN LANGUAGE PHASE I / CHINESE LANGUAGE PHASE I	2	0	0	2
PD1003	G	APTITUDE I	1	0	1	1
GN1003	P	PRINCIPLES OF GENETICS	3	0	0	3
BT1007	P	MICROBIOLOGY	3	0	0	3
BT1010	P	IMMUNOLOGY	3	0	0	3
GN1004	P	MOLECULAR BIOLOGY OFGENE	3	0	0	3
CH1241	P	BASIC CHEMICAL ENGINEERING I – STOCHIOMETRY, THERMODYNAMICS AND HEAT TRANSFER	3	0	0	3
GN1005	P	TRAINING IN LABORATORY SAFETY	0	0	2	1
BT1008	P	MICROBIOLOGY LABORATORY	0	0	4	2
BT1011	P	IMMUNOLOGY LABORATORY	0	0	4	2
TOTAL			**18**	**0**	**11**	**23**
Total contact hours			**29**			

SEMESTER IV						
Course code	**Category**	**Course name**	**L**	**T**	**P**	**C**
LE1008/ LE1009/ LE1010/ LE1011/ LE1012	G	GERMAN LANGUAGE PHASE II / FRENCH LANGUAGE PHASE II/ JAPANESE LANGUAGE PHASE II / KOREAN LANGUAGE PHASE II / CHINESE LANGUAGE PHASE II	2	0	0	2
PD1004	G	APTITUDE II	1	0	1	1
MA1034	B	BIOSTATISTICS	3	1	0	4
CH1242	P	BASIC CHEMICAL ENGINEERING II – MECHANICAL OPERATION, MOMENTUM AND MASS TRANSFER	3	0	0	3
GN1006	P	MOLECULAR TECHNIQUES IN GENETIC ENGINEERING	3	0	0	3
BT1017	P	BIOPROCESS PRINCIPLES	3	0	0	3
E	P	DEPARTMENT ELECTIVE I	3	0	0	3
GN1007	P	MOLECULAR TECHNIQUES LABORATORY	0	0	4	2
GN1008	P	BIOPROCESS AND ENZYME TECHNOLOGY LABORATORY	0	0	4	2
TOTAL			**18**	**1**	**9**	**23**
Total Contact Hours			**28**			

SEMESTER V						
Course code	**Category**	**Course name**	**L**	**T**	**P**	**C**
PD1005	G	APTITUDE III	1	0	1	1
GN1009	P	RECOMBINANT DNA TECHNOLOGY	3	0	0	3
GN1010	P	HUMAN GENETICS	3	0	0	3
GN1011	P	PLANT GENETIC ENGINEERING	3	0	0	3
GN1012	P	ENZYME ENGINEERING	3	0	0	3
E	P	DEPARTMENT ELECTIVE II	3	0	0	3
E	P	OPEN ELECTIVE I	3	0	0	3

GN1013	P	RECOMBINANT DNA TECHNOLOGY LABORATORY	0	0	4	2
GN1014	P	PLANT GENETIC ENGINEERING LABORATORY	0	0	4	2
GN1047	P	INDUSTRIAL TRAINING I (Training to be undergone after IV semester)	0	0	1	1
TOTAL			**19**	**0**	**10**	**24**
Total Contact Hours			**29**			

SEMESTER VI						
Course code	**Category**	**Course name**	**L**	**T**	**P**	**C**
PD1006	G	APTITUDE IV	1	0	1	1
BT1027	P	BIOPROCESS ENGINEERING	3	0	0	3
GN1015	P	BIOSEPARATION ENGINEERING	2	0	0	2
GN1016	P	STEM CELL BIOLOGY AND GENE THERAPY	3	0	0	3
E	P	DEPARTMENT ELECTIVE III	3	0	0	3
E	P	OPEN ELECTIVE II	3	0	0	3
E	P	OPEN ELECTIVE III	3	0	0	3
GN1017	P	SEMINAR/WORKING MODEL	0	0	2	1
GN1018	P	GENE EXPRESSION LABORATORY	0	0	4	2
GN1019	P	BIOSEPARATION ENGINEERING LABORATORY	0	0	4	2
GN1049	P	MINOR PROJECT	0	0	2	1
TOTAL			**18**	**0**	**13**	**24**
Total Contact Hours			**31**			

SEMESTER VII						
Course code	**Category**	**Course name**	**L**	**T**	**P**	**C**
GN1020	P	ANIMAL CELL CULTURE AND TRANSGENIC TECHNOLOGY	2	0	0	2

GN1021	P	BIOINFORMATICS	3	0	0	3
GN1022	P	BIOENGINEERING INSTRUMENTATION	2	2	0	3
GN1023	P	RESEARCH METHODOLOGY	1	0	0	1
GN1024	P	ETHICAL ISSUES & INTELLECTUAL PROPERTY RIGHTS	1	0	0	1
E	P	DEPARTMENT ELECTIVE IV	3	0	0	3
E	P	DEPARTMENT ELECTIVE V	3	0	0	3
GN1025	P	COMPREHENSION I	0	0	2	1
GN1026	P	ANIMAL CELL CULTURE LABORATORY	0	0	4	2
GN1027	P	BIOINFORMATICS LABORATORY	0	0	4	2
GN1048	P	INDUSTRIAL TRAINING II (Training to be undergone after VI semester)	0	0	1	1
TOTAL			**15**	**2**	**11**	**22**
Total Contact Hours			**19**			

SEMESTER VIII						
Course code	**Category**	**Course name**	**L**	**T**	**P**	**C**
GN1050	P	MAJOR PROJECT / PRACTICE SCHOOL	0	0	24	12
TOTAL			**0**	**0**	**24**	**12**
Total Contact Hours			**24**			

DEPARTMENT ELECTIVES						
Course code	**Category**	**Course name**	**L**	**T**	**P**	**C**
		ELECTIVE 1				
GN1101		HUMAN PHYSIOLOGY	3	0	0	3
GN1102		PLANT PHYSIOLOGY	3	0	0	3
		ELECTIVE 2				
GN1103	P	MEDICAL BIOCHEMISTRY	3	0	0	3
GN1104	P	PLANT BIOCHEMISTRY	3	0	0	3
GN1105	P	GENES AND DISEASES	3	0	0	3
BT1056	P	BIOREACTOR DESIGN	3	0	0	3

		ELECTIVE 3				
GN1106		DEVELOPMENTAL GENETICS – ANIMAL	3	0	0	3
GN1107	P	DEVELOPMENTAL GENETICS - PLANT	3	0	0	3
GN1108	P	DIAGNOSIS OF GENETIC DISEASES	3	0	0	3
		ELECTIVE 4				
GN1109	P	CELL SIGNALING - ANIMAL	3	0	0	3
GN1110	P	CELL SIGNALING - PLANT	3	0	0	3
GN1111	P	GENETIC COUNSELING	3	0	0	3
		ELECTIVE 5				
GN1112	P	MOLECULAR MEDICINE	3	0	0	3
GN1113	P	FUNCTIONAL GENOMICS AND PROTEOMICS	3	0	0	3
GN1114	P	PHARMACOGENOMICS& PERSONALIZED MEDICINE	3	0	0	3

Summary of credits										
Category	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**	**Total**	**%**
G(Excluding open and departmental electives)	6	2	3	3	1	1			16	8.9
B(Excluding open and departmental electives)	12	19		4					35	19.5
E(Excluding open and departmental electives)	7	6							13	7.2
P (Excluding open and departmental electives)			20	13	17	14	16	12	92	51.1
Open Elective					3	6			9	5.0
Dep. Elective				3	3	3	6		15	8.3
Total	25	27	23	23	24	24	22	12	180	100

SEMESTER – I

PD1001	**SOFT SKILLS-I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	**1**	**0**	**1**	**1**
	Prerequisite				
	Nil				

PURPOSE	
To enhance holistic development of students and improve their employability skills.	
INSTRUCTIONAL OBJECTIVES	
1.	To develop inter personal skills and be an effective goal oriented team player.
2.	To develop professionals with idealistic, practical and moral values.
3.	To develop communication and problem solving skills.
4.	To re-engineer attitude and understand its influence on behavior.

UNIT I - SELF ANALYSIS **(4 hours)**

SWOT Analysis, Who am I, Attributes, Importance of Self Confidence, Self Esteem

UNIT II - ATTITUDE **(4 hours)**

Factors influencing Attitude, Challenges and lessons from Attitude.

Change Management

Exploring Challenges, Risking Comfort Zone, Managing Change

UNIT III - MOTIVATION **(6 hours)**

Factors of motivation, Self talk, Intrinsic & Extrinsic Motivators.

UNIT IV - GOAL SETTING **(6 hours)**

Wish List, SMART Goals, Blue print for success, Short Term, Long Term, Life Time Goals.

Time Management

Value of time, Diagnosing Time Management, Weekly Planner To do list, Prioritizing work.

UNIT V - CREATIVITY **(10 hours)**

Out of box thinking, Lateral Thinking

Presentation

ASSESSMENT

1. A practical and activity oriented course which has continuous assessment for 75 marks based on class room interaction, activities etc.
2. Presentation – 25 marks.

TEXT BOOK

1. *INSIGHT*, 2012, Career Development Centre, SRM Publications.

REFERENCES

1. Covey Sean, "*Seven Habits of Highly Effective Teens"*, New York, Fireside Publishers, 1998.
2. Carnegie Dale, "*How to win Friends and Influence People"*, New York: Simon & Schuster, 1998.
3. Thomas A Harris, "*I am ok, You are ok"* , New York-Harper and Row, 1972.
4. Daniel Coleman, "*Emotional Intelligence"*, Bantam Book, 2006.

PD1001 SOFT SKILLS-I I												
Course designed by		**Career Development Centre**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
					X		X	X		X		X
2.	Mapping of instructional objectives with student outcome				1		2	3		4		1
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		X		--		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

	MATRICES AND CALCULUS	L	T	P	C
MA1011	Total No. of Contact Hours = 75 Hours	3	2	0	4
	(Common to BT, BI, BME, BP, GE, FPE)				
	Prerequisite				
	Nil				

PURPOSE:

To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.

INSTRUCTIONAL OBJECTIVES:

1.	To apply advanced matrix knowledge to Engineering problems.
2.	To improve their ability in trigonometry.
3.	To equip themselves familiar with the concepts of Differential calculus
4.	To expose to the concept of integral calculus
5.	To familiarize with the applications of differential and integral calculus

UNIT I - MATRICES **(12 hours)**

Review types of matrices, properties. Inverse matrix Cramer's rule for solving a system of linear equations. – Rank of Matrix – Consistency and Inconsistency of a system of m linear equations in 'n' unknowns –Cayley Hamilton theorem – Eigen values and Eigen vectors of a real matrix.

UNIT II - TRIGONOMETRY **(12 hours)**

Review of complex numbers. De Moiver's theorem and its applications. Expansion of $\sin n\theta$, $\cos n\theta$ in terms of $\sin\theta$ and $\cos\theta$. Expansion of $\tan n\theta$ in terms of $\tan\theta$. Expansion of $\sin^n\theta$ and $\cos^n\theta$ in terms of sines and cosines of multiples of θ. Hyperbolic functions and inverse hyperbolic functions.

UNIT III - DIFFERENTIAL CALCULUS **(12 hours)**

Differentiation and Derivatives of simple functions – Successive Differentiation – Various forms of Algebraic and Trigonometric functions – Problems.

UNIT IV - INTEGRAL CALCULUS **(12 hours)**

Methods of integration – Definite integrals and its properties-Reduction formula for $e^{ax}x^n$, $\sin^n x$, $\cos^n x$, $\sin^n x\cos^m x$ (without proof)-Problems.

UNIT V - APPLICATIONS OF DIFFERENTIAL CALCULUS & INTEGRAL CALCULUS (12 hours)

Applications of differential calculus & integral calculus. Tangent & Normal-Radius of curvature – Velocity and acceleration . Integral calculus – Length & Area.

TEXT BOOKS

1. Kreyszig.E, "*Advanced Engineering Mathematics"*, 10th edition, John Wiley & Sons. Singapore, 2012.
2. Ganesan .K, Sundarammal Kesavan, Ganapathy Subramanian .K.S& Srinivasan .V, "*Engineering Mathematics"*, Gamma Publications, Revised Edition, 2013.

REFERENCES

1. Grewal .B.S, "*Higher Engg Maths"*, Khanna Publications, 42nd Edition, 2012.
2. Veerajan .T, "*Engineering Mathematics I"*, Tata McGraw Hill Publishing Co., New Delhi, 5th edition, 2006.
3. Kandasamy .P etal*., "Engineering Mathematics"*, Vol.I (4th revised edition), S.Chand &Co., New Delhi,2000.
4. Narayanan .S, Manicavachagom Pillay .T.K, Ramanaiah .G, "*Advanced Mathematics for Engineering students"*, Volume I (2nd edition), S.Viswanathan Printers and Publishers, 1992.
5. Venkataraman .M.K., "*Engineering Mathematics – First Year (2nd edition)"*, National Publishing Co., Chennai, 2000.

MA 1011 MATRICES AND CALCULUS												
Course designed by		**Department of Mathematics**										
1.	Student Outcome	a	B	c	d	e	f	g	h	i	j	k
		X				X						
2.	Mapping of instructional objectives with student outcome	1-5				1-5						
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		X		--		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

PY1001	PHYSICS	L	T	P	C
	Total Contact Hours-45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to provide an understanding of physical concepts and underlying various engineering and technological applications. In addition, the course is expected to develop scientific temperament and analytical skill in students, to enable them logically tackle complex engineering problems in their chosen area of application.

INSTRUCTIONAL OBJECTIVES

1.	To understand the general scientific concepts required for technology
2.	To apply the Physics concepts in solving engineering problems
3.	To educate scientifically the new developments in engineering and technology
4.	To emphasize the significance of Green technology through Physics principles

UNIT I – MECHANICAL PROPERTIES OF SOLIDS AND ACOUSTICS (9 hours)

Mechanical properties of solids: Stress-strain relationship – Hooke's law – Torsional Pendulum – Young's modulus by cantilever – Uniform and non-uniform bending –– Stress-strain diagram for various engineering materials – Ductile and brittle materials – Mechanical properties of Engineering materials (Tensile strength, Hardness, Fatigue, Impact strength, Creep) – Fracture – Types of fracture (Elementary ideas).

Acoustics: Intensity – Loudness – Absorption coefficient and its determination – Reverberation – Reverberation time – Factors affecting acoustics of buildings and their remedies – Sources and impacts of noise – Sound level meter – Strategies on controlling noise pollution – Ultrasonic waves and properties – Methods of Ultrasonic production (Magnetostriction and Piezoelectric) – Applications of Ultrasonics in Engineering and medicine.

UNIT II – ELECTROMAGNETIC WAVES, CIRCUITS AND APPLICATIONS(9 hours)

Del operator – grad, div, curl and their physical significances - displacement current –Maxwell's equations (derivation) – Wave equation for electromagnetic waves – Propagation in free space – Poynting theorem – Characteristic of Transverse electric and magnetic waves – Skin depth – Rectangular and circular waveguides – High powered vacuum-based cavity magnetrons – Applications including radars, microwave oven and lighting systems.

UNIT III – LASERS AND FIBER OPTICS (9 hours)

Lasers: Characteristics of Lasers – Einstein's coefficients and their relations – Lasing action – Working principle and components of CO_2 Laser, Nd-YAG Laser, Semiconductor diode Laser, Excimer Laser and Free electron Laser – Applications in Remote sensing, holography and optical switching – Mechanism of Laser cooling and trapping.

Fiber Optics: Principle of Optical fiber – Acceptance angle and acceptance cone – Numerical aperture – V-number – Types of optical fibers (Material, Refractive index and mode) – Photonic crystal fibers – Fiber optic communication – Fiber optic sensors.

UNIT IV – QUANTUM MECHANICS AND CRYSTAL PHYSICS (9 hours)

Quantum mechanics: Inadequacies of Classical Mechanics – Duality nature of electromagnetic radiation – De Broglie hypothesis for matter waves – Heisenberg's uncertainty principle –Schrödinger's wave equation – Particle confinement in 1D box (Infinite Square well potential). **Crystal Physics:** Crystal directions – Planes and Miller indices – Symmetry elements – Quasi crystals – Diamond and HCP crystal structure – Packing factor – Reciprocal lattice – Diffraction of X-rays by crystal planes – Laue method and powder method – Imperfections in crystals.

UNIT V – GREEN ENERGY PHYSICS (9 hours)

Introduction to Green energy – **Solar energy:** Energy conversion by photovoltaic principle – Solar cells – **Wind energy:** Basic components and principle of wind energy conversion systems – **Ocean energy:** Wave energy – Wave energy conversion devices – Tidal energy – single and double basin tidal power plants – Ocean Thermal Electric Conversion (OTEC) – **Geothermal energy:** Geothermal sources (hydrothermal, geo-pressurized hot dry rocks, magma) – **Biomass:** Biomass and bio-fuels – bio-energies from wastages – **Fuel cells**: H_2O_2 – **Futuristic Energy:** Hydrogen – Methane Hydrates – Carbon capture and storage (CCS).

* One problem sheet consisting of 10 to 15 problems is to be prepared for each unit and discussed in the class.
* Few problems based on design considerations related to appropriate branches of engineering can be incorporated in each problem sheet.

TEXT BOOKS

1. Thiruvadigal.J. D, Ponnusamy,S.Sudha.D and Krishnamohan M., "*Physics for Technologists"*, Vibrant Publication, Chennai, 2013.
2. Dattu R.Joshi, "*Engineering Physics*", Tata McGraw- Hill,New Delih,2010.

REFERENCES

1. Wole Soboyejo, "*Mechanical Properties of Engineered Materials*", Marcel Dekker Inc., 2003.
2. Frank Fahy, "*Foundations of Engineering Acoustics*", Elsevier Academic Press, 2005.
3. Alberto Sona, "*Lasers and their applications*", Gordon and Breach Science Publishers Ltd., 1976.
4. David J. Griffiths, "*Introduction to electrodynamics*", 3rd ed., Prentice Hall, 1999.
5. Leonard. I. Schiff, "*Quantum Mechanics"*, Third Edition, Tata McGraw Hill, 2010.
6. Charles Kittel, "*Introduction to Solid State Physics*", Wiley India Pvt. Ltd, 7th ed., 2007.
7. Godfrey Boyle, "*Renewable Energy: Power Sustainable Future*", 2nd edition, Oxford University Press, UK, 2004.

<table>
<tr><th colspan="13">PY1001 PHYSICS</th></tr>
<tr><td colspan="2">Course designed by</td><td colspan="11">Department of Physics and Nanotechnology</td></tr>
<tr><td rowspan="2">1.</td><td rowspan="2">Student Outcome</td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td></tr>
<tr><td>X</td><td></td><td>X</td><td></td><td>X</td><td></td><td></td><td></td><td></td><td></td><td>X</td></tr>
<tr><td>2.</td><td>Mapping of instructional objectives with student outcome</td><td>1</td><td></td><td>4</td><td></td><td>2</td><td></td><td></td><td></td><td></td><td></td><td>3</td></tr>
<tr><td rowspan="2">3.</td><td rowspan="2">Category</td><td colspan="2">General (G)</td><td colspan="2">Basic Sciences(B)</td><td colspan="4">Engineering Sciences and Technical Arts (E)</td><td colspan="3">Professional Subjects (P)</td></tr>
<tr><td colspan="2">--</td><td colspan="2">X</td><td colspan="4">--</td><td colspan="3">--</td></tr>
<tr><td>4.</td><td>Approval</td><td colspan="11">23rd Meeting of Academic Council, May 2013</td></tr>
</table>

	PHYSICS LABORATORY	L	T	P	C
PY1002	Total Contact Hours - 30	0	0	2	1
	Prerequisite				
	Nil				

PURPOSE

The purpose of this course is to develop scientific temper in experimental techniques and to reinforce the physics concepts among the engineering students

INSTRUCTIONAL OBJECTIVES

1.	To gain knowledge in the scientific methods and learn the process of measuring different Physical variables
2.	Develop the skills in arranging and handling different measuring instruments
3.	Get familiarized with experimental errors in various physical measurements and to plan / suggest on how the contributions could be made of the same order, so as to minimize the errors.

LIST OF EXPERIMENTS

1. Determination of Young's modulus of a given material – Uniform / Non-uniform bending methods.
2. Determination of Rigidity modulus of a given material – Torsion pendulum
3. Determination of dispersive power of a prism – Spectrometer
4. Determination of laser parameters – divergence and wavelength for a given laser source –laser grating/ Particle size determination using laser
5. Study of attenuation and propagation characteristics of optical fiber cable
6. Calibration of voltmeter / ammeter using potentiometer
7. Construction and study of IC regulation properties of a given power supply
8. Study of electrical characteristics of a solar cell
9. Mini Project – Concept based Demonstration

TEXT BOOKS

1. Thiruvadigal.J. D, Ponnusamy,S.Sudha.D. and Krishnamohan M., "*Physics for Technologists"*, Vibrant Publication, Chennai, 2013.
2. Shukla .R.K and Anchal Srivastava, "*Practical Physics*", 1st Edition, New Age International (P) Ltd, New Delhi, 2006.

REFERENCES

1. Souires .G.L, "*Practical Physics:"*4th Edition, Cambridge University, UK, 2001.
2. Chattopadhyay .D, Rakshit .P.C and Saha .B, "*An Advanced Course in Practical Physics*", 2nd ed., Books & Allied Ltd., Calcutta, 1990.

PY1002 PHYSICS LABORATORY												
Course designed by		Department of Physics and Nanotechnology										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		X	X			X						
2.	Mapping of instructional objectives with student outcome	1	3			2						
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		X		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

CY1001	CHEMISTRY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To enable the students to acquire knowledge in the principles of chemistry for engineering applications

INSTRUCTIONAL OBJECTIVES

1.	The quality of water and its treatment methods for domestic and industrial applications.
2.	The classification of polymers, different types of polymerizations, preparation, properties and applications of important polymers and FRPs.
3.	The phase rule and its application to one and two component systems.
4.	The principle, types and mechanism of corrosion and protective coatings.
5.	The classification and selection of lubricants and their applications.
6.	The basic principles, instrumentation and applications of analytical techniques

UNIT I - WATER TREATMENT **(9 hours)**

Water quality parameters: Physical, Chemical & Biological significance - Hardness of water - estimation of hardness (EDTA method) - Dissolved oxygen – determination (Winkler's method), Alkalinity - determination - disadvantages of using hard water in boilers: Scale, sludge formation - disadvantages - prevention - treatment: Internal conditioning - phosphate, carbon and carbonate conditioning methods - External: Zeolite, ion exchange methods - desalination - reverse osmosis and electrodialysis - domestic water treatment.

UNIT II - POLYMERS AND REINFORCED PLASTICS (9 hours)

Classification of polymers - types of polymerization reactions - mechanism of addition polymerization: free radical, ionic and Ziegler - Natta - effect of structure on the properties of polymers - strength, plastic deformation, elasticity and crystallinity -Preparation and properties of important resins: Polyethylene, PVC, PMMA, Polyester, Teflon, Bakelite and Epoxy resins - compounding of plastics - moulding methods - injection, extrusion, compression and calendaring - reinforced plastics - FRP – Carbon and Glass- applications.

UNIT III - PHASE EQUILIBRIA, LUBRICANTS AND ADHESIVES (9 hours)

Phase rule: Statement - explanation of the terms involved - one component system (water system only). Condensed phase rule - thermal analysis - two component systems: simple eutectic, Pb-Ag; compound formation, Zn-Mg.

Lubricants: Classification –solid, semi solid, liquid, emulsion- properties – selection of lubricants for different purposes, Adhesives: classification-natural, synthetic, inorganic- Adhesive action - applications.

UNIT IV - CORROSION AND ITS CONTROL (9 hours)

Corrosion: Basic concepts - mechanism of chemical, electrochemical corrosion - Pilling Bedworth rule – Types of Electrochemical corrosion - galvanic corrosion - differential aeration corrosion - pitting corrosion - stress corrosion – Measurement of corrosion (wt. loss method only) - factors influencing corrosion. Corrosion control: Cathodic protection - sacrificial anodic method - corrosion inhibitors. Protective coatings: surface preparation for metallic coatings - electro plating (copper plating) and electroless plating (Nickel plating) - chemical conversion coatings - anodizing, phosphating & chromate coating.

UNIT V - INSTRUMENTAL METHODS OF ANALYSIS (9 hours)

Basic principles, instrumentation and applications of potentiometry, UV - visible spectroscopy, infrared spectroscopy, atomic absorption spectroscopy and flame photometry .

TEXT BOOKS

1. Kamaraj .P & Arthanareeswari .M, "*Applied Chemistry", 9th Edition*, Sudhandhira Publications, 2012.
2. Dara .S.S, "*A Text book of Engineering Chemistry"*, 10th Edition, S.Chand & Company Ltd., New Delhi, 2003.

REFERENCES

1. Jain .P.C and Monika Jain, "*Engineering Chemistry*", Danpat Rai publishing company (P) Ltd, New Delhi, 2010.
2. Helen P Kavitha, "*Engineering Chemistry – I", Scitech* Publications, 2nd edition, 2008.

CY1001 CHEMISTRY												
Course designed by		Department of Chemistry										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		X	X	X		X						
2.	Mapping of instructional objectives with student outcome	1-6	1,5	3		2						
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		X		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

CY1002	CHEMISTRY LABORATORY	L	T	P	C
	Total Contact Hours - 30	0	0	2	1
	Prerequisite				
	Nil				

PURPOSE

To apply the concepts of chemistry and develop analytical skills for applications in engineering.

INSTRUCTIONAL OBJECTIVES

1. To enable the students to understand the basic concepts involved in the analyses.

LIST OF EXPERIMENTS

1. Preparation of standard solutions
2. Estimation of total, permanent and temporary hardness by EDTA method
3. Conductometric titration - determination of strength of an acid
4. Estimation of iron by potentiometry.
5. Determination of molecular weight of polymer by viscosity average method
6. Determination of dissolved oxygen in a water sample by Winkler's method
7. Determination of Na / K in water sample by Flame photometry (Demonstration)
8. Estimation of Copper in ore
9. Estimation of nickel in steel
10. Determination of total alkalinity and acidity of a water sample
11. Determination of rate of corrosion by weight loss method.

REFERENCES

1. Kamaraj & Arthanareeswari, Sudhandhira Publications "*Practical Chemistry*" (work book), 2011.
2. Helen .P Kavitha "*Chemistry Laboratory Manual*", Scitech Publications, 2008.

CY1002 CHEMISTRY LABORATORY												
Course designed by		**Department of Chemistry**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		X	X									X
2.	Mapping of instructional objectives with student outcome	1	1									1
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		X		--		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

LE1002	VALUE EDUCATION	L	T	P	C
	Total Contact Hours- 15	**1**	**0**	**0**	**1**
	Prerequisite				
	Nil				

PURPOSE

To provide guiding principles and tools for the development of the whole person recognizing that the individual is comprised of Physical, Intellectual, Emotional and Spiritual dimensions.

INSTRUCTIONAL OBJECTIVES

1.	To help individuals think about and reflect on different values.
2.	To deepen understanding, motivation and responsibility with regard to making personal and social choices and the practical implications of expressing them in relation to themselves, others, the community and the world at large
3.	To inspire individuals to choose their own personal, social, moral and spiritual values and be aware of practical methods for developing and deepening

UNIT I - INTRODUCTION **(3 hours)**

Definition, Relevance, Types of values, changing concepts of values

UNIT II - INDIVIDUAL AND GROUP BEHAVIOUR (3 hours)

Personal values – Self – Strengths (self-confidence, self-assessment, self-reliance, self-discipline, determination, self-restraint, contentment, humility, sympathy and compassion, gratitude, forgiveness) Weaknesses (Influences -- Peer pressure, familial and societal expectations, media)

UNIT III - SOCIETIES IN PROGRESS (3 hours)

Definition of society; Units of society; Communities – ancient and modern – Agents of change – Sense of survival, security, desire for comfort and ease sense of belonging, social consciousness and responsibility

UNIT IV - ENGINEERING ETHICS (3 hours)

Definition- Societies for engineers – Code of Ethics – Ethical Issues involved in cross border research -- Ethical and Unethical practices – case studies – situational decision making

UNIT V - SPIRITUAL VALUES (3 hours)

What is religion? -- Role of religion – Misinterpretation of religion – moral policing – Consequences -- Religion as spiritual quest – Aesthetics and religion

TEXT BOOK

1. Department of English and Foreign Languages SRM University, "*Rhythm of Life",* SRM Publications, 2013.

REFERENCE

1. *"Values (Collection of Essays)"*, Published by : Sri Ramakrishna Math, Chennai-4. 1996.

<table>
<tr><th colspan="13">LE1002 VALUE EDUCATION</th></tr>
<tr><th colspan="2">Course designed by</th><th colspan="11">Department of English and Foreign Languages</th></tr>
<tr><td rowspan="2">1.</td><td rowspan="2">Student Outcome</td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td></tr>
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<tr><td>2.</td><td>Mapping of instructional objectives with student outcome</td><td></td><td></td><td></td><td></td><td></td><td>1-3</td><td></td><td></td><td>1-3</td><td></td><td></td></tr>
<tr><td rowspan="2">3.</td><td rowspan="2">Category</td><td colspan="2">General (G)</td><td colspan="2">Basic Sciences(B)</td><td colspan="3">Engineering Sciences and Technical Arts (E)</td><td colspan="3">Professional Subjects (P)</td></tr>
<tr><td colspan="2">X</td><td colspan="2">--</td><td colspan="3">--</td><td colspan="3">--</td></tr>
<tr><td>4.</td><td>Approval</td><td colspan="11">23rd Meeting of Academic Council, May 2013</td></tr>
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CE1001	**BASIC CIVIL ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours=30	**2**	**0**	**0**	**2**
	Prerequisite				
	Nil				

PURPOSE	
To get exposed to the glimpses of Civil Engineering topics that is essential for an Engineer.	
INSTRUCTIONAL OBJECTIVES	
1.	To know about different materials and their properties
2.	To know about engineering aspects related to buildings
3.	To know about importance of surveying and the transportation systems
4.	To get exposed to the rudiments of engineering related to dams, water supply, and sewage disposal

UNIT I - BUILDING MATERILAS (6hours)

Introduction – Civil Engineering – Materials: Bricks – composition – classifications – properties –uses. Stone – classification of rocks – quarrying – dressing – properties –uses. Timber - properties –uses –ply wood. Cement – grades –types – properties –uses. Steel – types – mild steel – medium steel – hard steel – properties – uses – market forms. Concrete – grade designation – properties – uses.

UNIT II - MATERIAL PROPERTIES (6hours)

Stress – strain – types – Hook's law – three moduli of elasticity – poisons ratio – relationship – factor of safety. Centroid - center of gravity – problems in symmetrical sections only (I, T and channel sections). Moment of inertia, parallel, perpendicular axis theorems and radius of gyration (definitions only).

UNIT III - BUILDING COMPONENTS (6hours)

Building – selection of site – classification – components. Foundations –functions – classifications – bearing capacity. Flooring – requirements – selection – types – cement concrete marble – terrazzo floorings. Roof – types and requirements.

UNIT IV - SURVEYING AND TRANSPORTATION (6hours)

Surveying – objectives – classification – principles of survey. Transportation – classification – cross section and components of road – classification of roads. Railway – cross section and components of permanent way –functions. Water way – docks and harbor – classifications – components. Bridge – components of bridge.

UNIT V - WATER SUPPLY AND SEWAGE DISPOSAL (6hours)

Dams – purpose – selection of site – types –gravity dam (cross section only). Water supply – objective – quantity of water – sources – standards of drinking water – distribution system. Sewage – classification – technical terms – septic tank – components and functions.

TEXT BOOKS

1. Raju .K.V.B, Ravichandran P.T, "*Basics of Civil Engineering"*, Ayyappa Publications, Chennai, 2012.
2. Rangwala .S.C," *Engineering Materials"*, Charotar Publishing House, Anand, 2012.

REFERENCES

1. Ramesh Babu, "*Civil Engineering"* , VRB Publishers, Chennai, 2000.
2. National Building Code of India, Part V, "*Building Materials"*, 2005.
3. Surendra Singh, "*Building Materials"*, Vikas Publishing Company, New Delhi, 1996.

CE1001 - BASIC CIVIL ENGINEERING												
Course designed by		**Department of Civil Engineering**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		X				X						X
2.	Mapping of instructional objectives with student outcome	1-4				1-4						2-4
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		--		X				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

SEMESTER – II

PD1002	**SOFT SKILLS-II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	**1**	**0**	**1**	**1**
	Prerequisite				
	Nil				

PURPOSE

To enhance holistic development of students and improve their employability skills.

INSTRUCTIONAL OBJECTIVES

1.	To develop inter personal skills and be an effective goal oriented team player.
2.	To develop professionals with idealistic, practical and moral values.
3.	To develop communication and problem solving skills.
4.	To re-engineer attitude and understand its influence on behavior.

UNIT I - INTERPERSONAL SKILLS **(6 hours)**

Understanding the relationship between Leadership Networking & Team work, Realizing Ones Skills in Leadership, Networking & Team Work, and Assessing Interpersonal Skills Situation description of Interpersonal Skill.

Team Work

Necessity of Team Work Personally, Socially and Educationally

UNIT II - LEADERSHIP **(4 hours)**

Skills for a good Leader, Assessment of Leadership Skills

Change Management

Exploring Challenges, Risking Comfort Zone, Managing Change

UNIT III - STRESS MANAGEMENT **(6 hours)**

Causes of Stress and its impact, how to manage & distress, Understanding the circle of control, Stress Busters.

Emotional Intelligence

What is Emotional Intelligence, emotional quotient why Emotional Intelligence matters, Emotion Scales. Managing Emotions.

UNIT IV - CONFLICT RESOLUTION **(4 hours)**

Conflicts in Human Relations – Reasons Case Studies, Approaches to conflict resolution.

UNIT V - DECISION MAKING **(10 hours)**

Importance and necessity of Decision Making, process of Decision Making, Practical way of Decision Making, Weighing Positives & Negatives.

Presentation

ASSESSMENT

1. A practical and activity oriented course which has a continuous assessment for 75 marks based on class room interaction, activities etc.,
2. Presentation - 25 marks

TEXT BOOK

1. *"INSIGHT"*, Career Development Centre, SRM Publications, 2009.

REFERENCE

1. Covey Sean, "*Seven Habit of Highly Effective Teens"*, New York, Fireside Publishers, 1998.
2. Carnegie Dale, "*How to win Friends and Influence People"*, New York: Simon & Schuster, 1998.
3. Thomas A Harris, "*I am ok, You are ok"*, New York-Harper and Row, 1972.
4. Daniel Coleman, "*Emotional Intelligence"*, Bantam Book, 2006.

PD1002 - SOFT SKILLS-II												
Course designed by		**Career Development Centre**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
					X		X	X		X		
2.	Mapping of instructional objectives with student outcome				1		2	3		4		
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		X		--		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

MA 1012	**MULTIPLE INTEGRALS AND DIFFERENTIAL EQUATIONS**	**L**	**T**	**P**	**C**
	Total No. of Contact Hours - 75 Hours	**3**	**2**	**0**	**4**
	(Common to Bio group)				
	Prerequisite				
	Nil				

PURPOSE:

To impart analytical ability in solving mathematical problems as applied to the respective branches of Engineering.

INSTRUCTIONAL OBJECTIVES

1.	To understand maxima and minima of two and three variables.
2.	To expose to the concepts of Differential equations
3.	To expose to the concepts of Multiple integrals.
4.	To expose to the concept of vector calculus
5.	To expose to the concept of three dimensional analytical geometry.

UNIT I - FUNCTIONS OF SEVERAL VARIABLES (12 hours)

Functions of two variables – partial derivatives – total differentiation – Taylor's expansion – maxima and minima of functions of two and three variables - Jacobians.

UNIT II - DIFFERENTIAL EQUATIONS (12 hours)

Differential equations of first order–Linear equations of second order with constant coefficients and variable coefficients – method of variation of parameters.

UNIT III - MULTIPLE INTEGRALS (12 hours)

Double integration in Cartesian and polar coordinates – Change of order of integration –Triple integration in Cartesian coordinates.

UNIT IV - VECTOR CALCULUS (12 hours)

Review of Vector Algebra.Gradient, divergence and curl – solenoidal, and irrotational fields – directional derivatives – line integrals – surface integrals – volume integrals, Integral theorems (without proof) and its applications**-** cubes and parallelepipeds only

UNIT V - THREE DIMENSIONAL ANALYTICAL GEOMETRY (12 hours)

Direction cosines and direction ratios of a line – angle between two lines. Equation of a plane – equation of straight line – shortest distance between two skew lines – coplanar lines.

TEXT BOOKS

1. Kreyszig.E, *"Advanced Engineering Mathematics"*, 10th edition, John Wiley & Sons. Singapore, 2012.
2. Ganesan.E, Sundarammal Kesavan, Ganapathy Subramanian K.S.& SrinivasanV., *"Engineering Mathematics"*, Gamma publications, Revised Edition, 2013.

REFERENCES

1. Grewal .B.S, Higher *"Engineering Mathematics"*, Khanna Publications, 42nd Edition , 2012.
2. Veerajan. TS, *"Engineering Mathematics I"*, Tata McGraw Hill Publishing Co., New Delhi, 5th edition, 2006.
3. Kandasamy P etal. "*Engineering Mathematics"*, Vol.I (4th revised edition), S.Chand &Co., New Delhi, 2000.
4. Narayanan.S, Manicavachagom Pillay T.K., Ramanaiah G., "*Advanced Mathematics for Engineering students"*, Volume I (2nd edition), S.Viswanathan Printers and Publishers, 1992.
5. Venkataraman .M.K, "*Engineering Mathematics"* , First Year (2nd edition), National Publishing Co., Chennai, 2000.

MA 1012 MULTIPLE INTEGRALS AND DIFFERENTIAL EQUATIONS												
Course designed by		**Department of Mathematics**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		X				X						
2.	Mapping of instructional objectives with student outcome	1-5				1-5						
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		X		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

PY1003	MATERIALS SCIENCE	L	T	P	C
	Total Contact Hours - 60	2	0	2	3
	Prerequisite				
	Nil				

PURPOSE

The course introduces several advanced concepts and topics in the rapidly evolving field of material science. Students are expected to develop comprehension of the subject and to gain scientific understanding regarding the choice and manipulation of materials for desired engineering applications.

INSTRUCTIONAL OBJECTIVES

1.	To acquire basic understanding of advanced materials, their functions and properties for technological applications
2.	To emphasize the significance of materials selection in the design process
3.	To understand the principal classes of bio-materials and their functionalities in modern medical science
4.	To get familiarize with the new concepts of Nano Science and Technology
5.	To educate the students in the basics of instrumentation, measurement, data acquisition, interpretation and analysis

UNIT I – ELECTRONIC AND PHOTONIC MATERIALS (6 hours)

Electronic Materials: Fermi energy and Fermi–Dirac distribution function – Variation of Fermi level with temperature in intrinsic and extrinsic semiconductors – Hall effect – Dilute Magnetic Semiconductors (DMS) and their applications

Superconducting Materials: Normal and High temperature superconductivity – Applications.

Photonic Materials: LED – LCD – Photo conducting materials – Photo detectors – Photonic crystals and applications – Elementary ideas of Non-linear optical materials and their applications.

UNIT II – MAGNETIC AND DIELECTRIC MATERIALS (6 hours)

Magnetic Materials: Classification of magnetic materials based on spin – Hard and soft magnetic materials – Ferrites, garnets and magnetoplumbites – Magnetic bubbles and their applications – Magnetic thin films – Spintronics and devices (Giant magneto resistance, Tunnel magneto resistance and Colossal magneto resistance).

Dielectric Materials: Polarization mechanisms in dielectrics – Frequency and temperature dependence of polarization mechanism – Dielectric loss – Dielectric waveguide and dielectric resonator antenna – Piezoelectric, pyroelectric and ferroelectric materials and their applications.

UNIT III – MODERN ENGINEERING AND BIOMATERIALS (6 hours)

Modern Engineering Materials: Smart materials – Shape memory alloys – Chromic materials (Thermo, Photo and Electro) – Rheological fluids – Metallic glasses – Advanced ceramics – Composites.

Bio-materials: Classification of bio-materials (based on tissue response) – Comparison of properties of some common biomaterials – Metallic implant materials (stainless steel, cobalt-based and titanium-based alloys) – Polymeric implant materials (Polyamides, polypropylene, Acrylic resins and Hydrogels) – Tissue replacement implants – Soft and hard tissue replacements – Skin implants – Tissue engineering – Biomaterials for organ replacement (Bone substitutes) – Biosensor.

UNIT IV – INTRODUCTION TO NANOSCIENCE AND NANOTECHNOLOGY (6 hours)

Basic concepts of Nanoscience and Nanotechnology – Quantum wire – Quantum well – Quantum dot – fullerenes – Graphene – Carbon nanotubes – Material processing by chemical vapor deposition and physical vapor deposition – Principle of SEM, TEM, AFM, Scanning near-field optical microscopy (SNOM) – Scanning ion-conducting microscopy (SCIM) – Potential uses of nanomaterials in electronics, robotics, computers, sensors, sports equipment, mobile electronic devices, vehicles and transportation – Medical applications of nanomaterials.

UNIT V – MATERIALS CHARACTERIZATION (6 hours)

X-ray diffraction, Neutron diffraction and Electron diffraction– X-ray fluorescence spectroscopy – Fourier transform Infrared spectroscopy (FTIR) – Ultraviolet and visible spectroscopy (UV-Vis) – Thermogravimetric Analysis (TGA) – Differential Thermal Analysis (DTA) – Differential Scanning Calorimetry (DSC).

PRACTICAL EXPERIMENTS **(30 hours)**

1. Determination of resistivity and band gap for a semiconductor material – Four probe method / Post-office box
2. Determination of Hall coefficient for a semiconducting material
3. To study V-I characteristics of a light dependent resistor (LDR)
4. Determination of energy loss in a magnetic material – B-H curve
5. Determination of paramagnetic susceptibility – Quincke's method
6. Determination of dielectric constant for a given material
7. Calculation of lattice cell parameters – X-ray diffraction
8. Measurement of glucose concentration – Electrochemical sensor
9. Visit to Advanced Material Characterization Laboratory (Optional)

TEXT BOOKS

1. Thiruvadigal .J. D, Ponnusamy,S.Sudha.D. and Krishnamohan .M, "*Materials Sciences"*, Vibrant Publication, Chennai, 2013.
2. Rajendran.V, "*Materials Science*", Tata McGraw- Hill, New Delhi,2011.

REFERENCES

1. Rolf E. Hummel, "*Electronic Properties of Materials"*, 4th ed., Springer, New York, 2011.
2. Dennis.W Prather, "*Photonic Crystals Theory, Applications, and Fabrication"*, John Wiley & Sons, Hoboken, 2009.
3. James R. Janesick, "*Scientific Charge-Coupled Devices",* Published by SPIE - The International Society for Optical Engineering, Bellingham, Washington, 2001.
4. David .M Pozar, "*Microwave Engineering*", 3rd ed., John Wiley & Sons, 2005.
5. Silver.F and Dillion.D, "*Biocompatibility: Interactions of Biological and Implantable Materials*", VCH Publishers, New York, 1989.
6. Severial Dumitriu, "*Polymeric Biomaterials*" Marcel Dekker Inc, CRC Press, Canada 2001.
7. Cao .G, "*Nanostructures and Nanomaterials: Synthesis, Properties and Applications*", Imperial College Press, 2004.
8. Pradeep .T, "*A Text Book of Nanoscience and Nanotechnology*", Tata McGraw Hill, New Delhi, 2012.
9. Sam Zhang, "*Materials Characterization Techniques*", CRC Press, 2008.

PY1003 MATERIALS SCIENCE												
Course designed by		**Department of Physics and Nanotechnology**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		X	X		X	X						X
2.	Mapping of instructional objectives with student outcome	1	5		4	2						3
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		X		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

CY1003	**PRINCIPLES OF ENVIRONMENTAL SCIENCE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	2	0	0	2
	Prerequisite				
	Nil				

PURPOSE

The course provides a comprehensive knowledge in environmental science, environmental issues and the management.

INSTRUCTIONAL OBJECTIVES

To enable the students

1.	To gain knowledge on the importance of environmental education and ecosystem.
2.	To acquire knowledge about environmental pollution- sources, effects and control measures of environmental pollution.
3.	To understand the treatment of wastewater and solid waste management.
4.	To acquire knowledge with respect to biodiversity, its threats and its conservation and appreciate the concept of interdependence.
5.	To be aware of the national and international concern for environment for protecting the environment

UNIT I - ENVIRONMENTAL EDUCATION AND ECOSYSTEMS (6 hours)

Environmental education: Definition and objective. Structure and function of an ecosystem – ecological succession –primary and secondary succession - ecological pyramids – pyramid of number, pyramid of energy and pyramid of biomass.

UNIT II - ENVIRONMENTAL POLLUTION (6 hours)

Environmental segments – structure and composition of atmosphere - Pollution – Air, water, soil , thermal and radiation – Effects – acid rain, ozone layer depletion and greenhouse effect – control measures – determination of BOD, COD, TDS and trace metals.

UNIT III - WASTE MANAGEMENT (6 hours)

Waste water treatment (general) – primary, secondary and tertiary stages.
Solid waste management: sources and effects of municipal waste, bio medical waste - process of waste management.

UNIT IV - BIODIVERSITY AND ITS CONSERVATION (6 hours)

Introduction: definition - genetic, species and ecosystem diversity – bio diversity hot spots - values of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife – endangered and endemic species of India, Conservation of biodiversity: in-situ and ex-situ conservations.

UNIT V - ENVIRONMENTAL PROTECTION (6 hours)

National concern for environment: Important environmental protection acts in India – water, air (prevention and control of pollution) act, wild life conservation and forest act – functions of central and state pollution control boards - international effort – key initiatives of Rio declaration, Vienna convention, Kyoto protocol and Johannesburg summit.

TEXT BOOKS

1. Kamaraj.P & Arthanareeswari.M, "*Environmental Science – Challenges and Changes"*, 4th Edition, Sudhandhira Publications, 2010.
2. Sharma.B.K and Kaur, "*Environmental Chemistry",* Goel Publishing House, Meerut, 1994.

REFERENCES

1. De.A.K, "*Environmental Chemistry"*, New Age International, New Delhi, 1996.
2. Helen P Kavitha, "*Principles of Environmental Science*", Scitech Publications, 2nd Edition, 2008.

CY1003 – PRINCIPLES OF ENVIRONMENTAL SCIENCE												
Course designed by		Department of Chemistry										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
				X		X	X		X	X	X	
2.	Mapping of instructional objectives with student outcome			5		2	4		1,3	3	2, 5	
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		X		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

GN1001	CELL BIOLOGY AND CYTOGENETICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The course is aimed to make the students understand the structure and function of cell and its organelles. It also aims to introduce cytogenetic which forms the basis for other courses in genetics.

INSTRUCTIONAL OBJECTIVES

1.	To know the basics about cell and its evolution.
2.	To know about the structure and function of cell organelles
3.	To understand the transport systems, molecular motors, cell signaling and regulation of cell
4.	To know the basics of cytogenetic

UNIT I - OVERVIEW ON CELL AND LIFE (7 hours)

Origin and evolution of life, various theories and experiments on origin of life, microscope, chemistry of cell, cell theory, cell morphology and size, endosymbiosis, prokaryotes and eukaryotes.

UNIT II - CELL ORGANELLES – STRUCTURE AND FUNCTION (8 hours)

Plasma membrane , nucleus, nucleolus, mitochondria, chloroplast, ER, Golgi apparatus, peroxisomes, cytoskeleton and cell movement, ribosomes, lysosomes, centriole, cilia and flagella

UNIT III - TRANSPORT SYSTEMS AND MOLECULAR MOTORS (8 hours)

Control of Localization signals, protein sorting and transport, protein folding, vesicle transport, endocytosis and exocytosis, transport across membrane. Cytoskeletal motors, polymerization motors and rotary motors.

UNIT IV - REGULATION OF CELL AND CELL SIGNALLING (10 hours)

Cell cycle and regulation, mitosis and meiosis; cell - cell interaction, ECM, Cell junctions (Adhesion, Gap and tight), plasmodesmata, desmosomes, signal transduction, cell senescence – apoptosis and necrosis; an overview of specialized cells.

UNIT V - CYTOGENETICS (12 hours)

Heterochromatin, euchromatin, nucleosome, centrosome, giant chromosomes, polytene chromosome, lamp brush chromosome; chromosome numerical abnormalities, structural abnormalities, autosomes and allosomes, sex determination, karyotyping, X chromosome inactivation.

TEXT BOOKS

1. Verma .P.S & Agarwal .K, *"Cell Biology Genetics Molecular Biology Evolution & Ecology"*, S Chand Publication, 2004.
2. Gupta .P.K, "*Cytogenetics",* Rastogi Publications, 1995.

REFERENCES

1. Geoffrey M. Cooper, Robert E. Hausman., "*The Cell – A Molecular Approach*", Sinauer Associates, Inc.; 6 Edition, 2013.
2. Gerald Karp, "*Cell and Molecular Biology Concepts and Experiments*", Wiley 6th Edition, 2010.

GN1001 CELL BIOLOGY AND CYTOGENETICS												
Course designed by		Department of Genetic Engineering										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
			X	X			X					
2.	Mapping of instructional objectives with student outcome		1 & 4	5			1&4					
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		X		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

BT1004	BIOCHEMISTRY	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To provide an understanding of the functions of various biomolecules and their metabolism.

INSTRUCTIONAL OBJECTIVES

1. To study the structural and functional properties of carbohydrates, proteins, lipids and nucleic acids
2. To emphasize the role on biomolecules by providing basic information on specific metabolic diseases and their disorders

UNIT I - INTRODUCTION TO BIOCHEMISTRY (12 hours)

Introduction-Chemical Bonds-pH-Buffers-Carbohydrates-Lipids-Proteins.

UNIT II - METABOLISM OF CARBOHYDRATES (8 hours)

Introduction to Metabolism-Glycolysis-Citric acid cycle-Gluconeogenesis-Glycogen metabolism-Glycogenesis-Glycogenolysis-Biochemical aspects of Diabetes Mellitus.

UNIT III - PROTEIN METABOLISM (9 hours)

Introduction-Metabolism of amino acids-Transamination-Deamination-Metabolism of ammonia-Urea cycle-Biosynthesis of amino acids-Disorders of tyrosine (phenylalanine) metabolism.

UNIT IV - FATTY ACID METABOLISM AND NUCLEIC ACID METABOLISM

(8 hours)

Introduction-Fatty acid oxidation-Ketone bodies & Ketogenesis-Biosynthesis of Fatty acids-Eicosanoids-Cholesterol Biosynthesis-Lipoproteins-Disorders of Lipid metabolism-Nucleic acids: Biosynthesis of Purine and Pyrimidines-Degradation of purine nucleotides and pyrimidine nucleotides-Disorders of Purine and pyrimidine metabolism.

UNIT V - OXIDATIVE PHOSPHORYLATION **(8 hours)**

Introduction-Bioenergetics, High energy compounds, Biological oxidation-Electron transport chain, Oxidative phosphorylation, Chemiosmotic theory - Shuttle pathways – Glycerol phosphate Shuttle, Malate aspartate Shuttle –Shunt pathways.

TEXT BOOK

1. Jain.J.L, Jain, Nitin, Sunjay Jain, S. Chand Group "*Fundamentals of Biochemistry"*(M. E.), ISBN*:* 8121924537*.*

REFERENCES

1. Satyanarayana & U. Chakrapani,*"Biochemistry"* Books and Allied (p) Ltd., UISBN: 8187134801.
2. David L. Nelson, Albert Lester Lehninger, Michael M. Cox*"Lehninger Principles of Biochemistry"*, Edition 5, illustrated, W. H. Freeman, 2008.
3. Jeremy M. Berg, John L. Tymoczko, Lubert Stryer, *"Biochemistry"*Edition 7, W. H. Freeman, 2012.

BT1004 BIOCHEMISTRY												
Course designed by		Department of Biotechnology										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x			X							
2.	Mapping of instructional objectives with student outcome											
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		X		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

	CYTOGENETICS LABORATORY	L	T	P	C
GN1002	Total Contact Hours –60	0	0	4	2
	Prerequisite				
	Nil				

PURPOSE

The course is aimed at making the students to observe the chromosomes at different stages and forms in different cells under the microscope through appropriate techniques.

INSTRUCTIONAL OBJECTIVES

1.	To handle microscope effectively.
2.	To separate and differentiate the cell organelles by sub cellular fractionation.
3.	To observe the cell division in somatic, germinal and yeast cells
4.	To differentiate cytoplasm, nucleus, Barr bodies and chromosomes in a cell

LIST OF EXPERIMENTS

1. Microscopy and micrometry
2. Sub cellular fractionation
3. Observation of Mitosis in onion root tip
4. Observation of Meiosis in grasshopper testis
5. Observation of polytene chromosome
6. Barr body identification from buccal smear
7. Cytoplasm and nuclear staining
8. Observation of budding and binary fission in yeast
9. Microtome – sectioning of tissue

REFERENCES

1. Laboratory manual

GN1002 CYTOGENETICS LABORATORY														
Course designed by		**Department of Genetic Engineering**												
1.	Student outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X					X							
2.	Mapping of instructional objectives with student outcome	1,2,3 &4					1, 2, 3 &4							
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences &Technical Arts (E)					Professional Subjects (P)		
				X										
		--		--			--					X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

BT1005	BIOCHEMISTRY LABORATORY	L	T	P	C
	Total Contact Hours – 60	0	0	4	2
	Prerequisite				
	Nil				

PURPOSE

Provides an opportunity to experimentally verify the theoretical concepts already studied. It also helps in understanding the theoretical principles in a more explicit and concentrated manner

INSTRUCTIONAL OBJECTIVES

1.	Qualitative testing of carbohydrates, proteins, and lipids
2.	Students should be able to understand and develop their skills in accuracy and precision of analysis

LIST OF EXPERIMENTS

1. Stoichiometry-Normality-Molarity-Molality-Osmolarity-Osmolality.
2. Preparation of Buffers and measurement of pH.
3. Qualitative Analysis of Reducing Sugars: Aldohexoses-Glucose-Fruit Juice.
4. Qualitative analysis of Reducing Sugars: Ketohexoses-Fructose-Coca Cola.
5. Qualitative analysis of Reducing Sugars:Pentoses-Ribose.
6. Qualitative analysis of Reducing Disaccharides-Lactose-Milk.
7. Qualitative analysis of Non-reducing Disaccharides-Sucrose-Sugar Cane Juice.
8. Qualitative analysis of Polysaccharides-Starch.
9. Quantitative analysis of Sugars: Glucose Oxidase Method-Glucose-Sugar Cane Juice
10. Quantitative analysis of Proteins: Lowry's Method-BSA-Plasma
11. Quantitative analysis of Cholesterol: Zak's Method-Cholesterol Standard-Serum.
12. Thin Layer Chromatography of amino acids.

REFERENCES

1. Laboratory manual.

LE1001	**ENGLISH**	**L**	**T**	**P**	**C**
	Total Contact Hours-45	**1**	**2**	**0**	**2**
	Prerequisite				
	Nil				

PURPOSE

To help students achieve proficiency in English and develop their professional communication skills to meet the demand in the field of global communication to enable them to acquire placement anywhere with ease and confidence.

INSTRUCTIONAL OBJECTIVES

1.	To enable students improve their lexical, grammatical and communicative competence.
2.	To enhance their communicative skills in real life situations.
3.	To assist students understand the role of thinking in all forms of communication.
4.	To equip students with oral and appropriate written communication skills.
5.	To assist students with employability and job search skills.

UNIT I - INVENTIONS **(9 hours)**

1. Grammar and Vocabulary – Tense and Concord:
2. Listening and Speaking – Common errors in Pronunciation (Individual sounds); Process description (Describing the working of a machine, and the manufacturing process)
3. Writing – Interpretation of data (Flow chart, Bar chart)
4. Reading -- (Reading Comprehension -- Answering questions)

UNIT II - ECOLOGY **(9 hours)**

1. Grammar and Vocabulary – Error Analysis – Synonyms and Antonyms, Parallelisms
2. Listening and Speaking - Conducting Meetings
3. Writing – Notice, Agenda, Minutes , letters to the editor via email : Email etiquette
4. D Reading Comprehension – Summarizing and Note-making

UNIT III - SPACE **(9 hours)**

1. Grammar and Vocabulary – tense and concord; word formation
2. Listening and Speaking – Distinction between native and Indian English (Speeches by TED and Kalam) – accent, use of vocabulary and rendering;
3. Writing – Definitions and Essay writing
4. Reading Comprehension – Predicting the content

UNIT IV – CAREERS **(9 hours)**

1. Grammar and Vocabulary –Homonyms and Homophones
2. Listening and Speaking – – Group Discussion
3. Writing Applying for job, cover letter and resume
4. Reading, etymology (roots ; idioms and phrases), Appreciation of creative writing.

UNIT V - RESEARCH **(9 hours)**

1. Grammar and Vocabulary – Using technical terms, Analogies
2. Listening and Speaking -- Presentation techniques (Speech by the learner)
3. Writing – Project Proposal
4. Reading Comprehension -- Referencing Skills for Academic Report Writing (Research Methodology – Various methods of collecting data) Writing a report based on MLA Handbook

TEXTBOOK

1. Department of English and Foreign Languages. "*English for Engineers*", SRM University Publications, 2013.

REFERENCES

1. Dhanavel .S.P, "*English and Communication Skills for Students of Science and Engineering*"**,** Orient Blackswan Ltd., 2009.
2. Meenakshi Raman and Sangeetha Sharma**.** "*Technical Communication-Principles and Practice*", Oxford University Press, 2009.
3. Day .R.A, Scientific English:"*A Guide for Scientists and Other Professionals*", 2nd ed. Hyderabad: Universities Press, 2000.

LE1001 ENGLISH												
Course designed by		**Department of English and Foreign Languages**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
					X		X	X		X		
2.	Mapping of instructional objectives with student outcome				1-5		1-5	1-5		1-5		
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		X		--		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

SEMESTER I/II

CS1001	**PROGRAMMING USING MATLAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**0**	**1**	**2**	**2**
	Prerequisite				
	Nil				

PURPOSE

This Lab Course will enable the students to understand the fundamentals and programming knowledge in MATLAB.

INSTRUCTIONAL OBJECTIVES

1.	To learn the MATLAB environment and its programming fundamentals
2.	Ability to write Programs using commands and functions
3.	Able to handle polynomials, and use 2D Graphic commands

LIST OF EXPERIMENTS

1. Practicing MATLAB environment with simple exercises to familiarize Command Window, History, Workspace, Current Directory, Figure window, Edit window, Shortcuts, Help files.
2. Data types, Constants and Variables, Character constants, operators, Assignment statements.
3. Control Structures: For loops, While, If control structures, Switch, Break, Continue statements.
4. Input-Output functions, Reading and Storing Data.
5. Vectors and Matrices, commands to operate on vectors and matrices, matrix Manipulations.
6. Arithmetic operations on Matrices, Relational operations on Matrices, Logical operations on Matrices.
7. Polynomial Evaluation, Roots of Polynomial, Arithmetic operations on Polynomials.
8. Graphics: 2D plots, Printing labels, Grid & Axes box, Text in plot, Bar and Pie chart.

TEXT BOOK

1. Bansal .R.K, Goel .A.K, Sharma .M.K, "*MATLAB and its Applications in Engineering*", Pearson Education, 2012.

REFERENCES

1. Amos Gilat, *"MATLAB-An Introduction with Applications"*, Wiley India, 2009.
2. Stephen J.Chapman, *"Programming in MATLAB for Engineers"*, Cengage Learning, 2011.

CS1001 PROGRAMMING USING MATLAB												
Course designed by		**Department of Computer Science and Engineering**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		X	X									X
2.	Mapping of instructional objectives with student outcome	2,3	1-3									1
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		X		--		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1001	BASIC MECHANICAL ENGINEERING	L	T	P	C
	Total Contact Hours - 30	2	0	0	2
	Prerequisite				
	Nil				

PURPOSE

To familiarize the students with the basics of Mechanical Engineering.

INSTRUCTIONAL OBJECTIVES

1. To familiarize with the basic machine elements
2. To familiarize with the Sources of Energy and Power Generation
3. To familiarize with the various manufacturing processes

UNIT I - MACHINE ELEMENTS I **(5 hours)**

Springs: Helical and leaf springs – Springs in series and parallel. **Cams:** Types of cams and followers – Cam profile.

UNIT II - MACHINE ELEMENTS II **(5 hours)**

Power Transmission: Gears (terminology, spur, helical and bevel gears, gear trains). Belt drives (types). Chain drives. Simple Problems.

UNIT III - ENERGY **(10 hours)**

Sources: Renewable and non-renewable (various types, characteristics, advantages/disadvantages). **Power Generation:** External and internal combustion engines – Hydro, thermal and nuclear power plants (layouts, element/component description, advantages, disadvantages, applications). Simple Problems.

UNIT IV - MANUFACTURING PROCESSES I **(5 hours)**

Sheet Metal Work: Introduction – Equipments – Tools and accessories – Various processes (applications, advantages / disadvantages). **Welding:** Types – Equipments – Tools and accessories – Techniques employed -applications, advantages / disadvantages – Gas cutting – Brazing and soldering.

UNIT V - MANUFACTURING PROCESSES II **(5 hours)**

Lathe Practice: Types - Description of main components – Cutting tools – Work holding devices – Basic operations. Simple Problems. **Drilling Practice:** Introduction – Types – Description – Tools. Simple Problems.

TEXT BOOKS

1. Kumar.T, Leenus Jesu Martin and Murali.G, *"Basic Mechanical Engineering"*, Suma Publications, Chennai, 2007.
2. Prabhu.T. J, Jai Ganesh V. and Jebaraj.S, *"Basic Mechanical Engineering"*, Scitech Publications, Chennai, 2000.

REFERENCES

1. Hajra Choudhary.S.K, and HajraChoudhary, A. K., "*Elements of Workshop Technology", Vols. I & II*, Indian Book Distributing Company Calcutta, 2007.
2. Nag.P.K, "*Power Plant Engineering"*, Tata McGraw-Hill, New Delhi, 2008.
3. Rattan.S.S, "*Theory of Machines"*, Tata McGraw-Hill, New Delhi, 2010.

<table>
<tr><th colspan="13">ME1001 BASIC MECHANICAL ENGINEERING</th></tr>
<tr><td colspan="2">Course designed by</td><td colspan="11">Department of Mechanical Engineering</td></tr>
<tr><td rowspan="2">1.</td><td rowspan="2">Student Outcome</td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td></tr>
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<tr><td>2.</td><td>Mapping of instructional objectives with student outcome</td><td>1- 3</td><td></td><td></td><td></td><td>1- 3</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">3.</td><td rowspan="2">Category</td><td colspan="2">General (G)</td><td colspan="2">Basic Sciences(B)</td><td colspan="4">Engineering Sciences and Technical Arts (E)</td><td colspan="3">Professional Subjects (P)</td></tr>
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<tr><td>4.</td><td>Approval</td><td colspan="11">23rd Meeting of Academic Council, May 2013</td></tr>
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EE1001	BASIC ELECTRICAL ENGINEERING	L	T	P	C
	Total Contact Hours - 30	2	0	0	2
	Prerequisite				
	Nil				

PURPOSE

This course provides comprehensive idea about circuit analysis, working principles of machines and common measuring instruments.

INSTRUCTIONAL OBJECTIVES

1. Understand the basic concepts of magnetic circuits, AC & DC circuits.
2. Explain the working principle, construction, applications of DC & AC machines and measuring instruments.
3. Gain knowledge about the fundamentals of wiring and earthing

UNIT I – FUNDAMENTALS OF DC CIRCUITS (6 hours)

Introduction to DC and AC circuits, Active and passive two terminal elements, Ohms law, Voltage-Current relations for resistor, inductor, capacitor , Kirchhoff's laws, Mesh analysis, Nodal analysis, Ideal sources –equivalent resistor, current division, voltage division

UNIT II – MAGNETIC CIRCUITS (6 hours)

Introduction to magnetic circuits-Simple magnetic circuits-Faraday's laws, induced emfs and inductances

UNIT III – AC CIRCUITS (6 hours)

Sinusoids, Generation of AC, Average and RMS values, Form and peak factors, concept of phasor representation, J operator. Analysis of R-L, R-C, R-L-C circuits. Introduction to three phase systems - types of connections, relationship between line and phase values.

UNIT IV – ELECTRICAL MACHINES & MEASURING INSTRUMENTS (6 hours)

Working principle, construction and applications of DC machines and AC machines (1 - phase transformers, single phase induction motors: split phase, capacitor start and capacitor start & run motors). Basic principles and classification of instruments -Moving coil and moving iron instruments.

UNIT V – ELECTRICAL SAFETY, WIRING &INTRODUCTION TO POWER SYSTEM (6 hours)

Safety measures in electrical system- types of wiring- wiring accessories- staircase, fluorescent lamps & corridor wiring- Basic principles of earthing-Types of earthing- Simple layout of generation, transmission & distribution of power.

TEXT BOOK

1. Dash .S.S ,Subramani .S , Vijayakumar .K ,"*BasicElectrical Engineering*", First edition, Vijay Nicole Imprints Pvt.Ltd,2013.

REFERENCES

1. Smarajt Ghosh, "*Fundamentals of Electrical & Electronics Engineering*", Second edition, PHI Learning, 2007.
2. Metha .V.K, Rohit Metha, "*Basic Electrical Engineering*", Fifth edition, S.Chand & Co, 2012.
3. Kothari .D. P and Nagrath .I.J, "*Basic Electrical Engineering*", Second edition, Tata McGraw - Hill, 2009.
4. Bhattacharya .S.K, "*Basic Electrical and Electronics Engineering"*, First edition, Pearson Education, 2011.

EE1001 - BASIC ELECTRICAL ENGINEERING												
Course designed by		**Department of Electrical and Electronics Engineering**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		x				x						
2.	Mapping of instructional objectives with student outcome	1-3				1						
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		--		X				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

EC1001	BASIC ELECTRONICS ENGINEERING	L	T	P	C
	Total Contact Hours – 30	2	0	0	2
	Prerequisite				
	Nil				

PURPOSE

This course provides comprehensive idea about working principle, operation and characteristics of electronic devices, transducers, Digital Electronics and Communication Systems.

INSTRUCTIONAL OBJECTIVES

At the end of the course students will be able to gain knowledge about the

1. Fundamentals of electronic components, devices, transducers
2. Principles of digital electronics
3. Principles of various communication systems

UNIT I - ELECTRONIC COMPONENTS (4 hours)

Passive components – resistors, capacitors & inductors (properties, common types, I-V relationship and uses).

UNIT II - SEMICONDUCTOR DEVICES (7 hours)

Semiconductor Devices - Overview of Semiconductors - basic principle, operation and characteristics of PN diode, zener diode, BJT, JFET, optoelectronic devices (LDR, photodiode, phototransistor, solar cell, optocouplers)

UNIT III - TRANSDUCERS (5 hours)

Transducers - Instrumentation – general aspects, classification of transducers, basic requirements of transducers, passive transducers - strain gauge, thermistor, Hall-Effect transducer, LVDT, and active transducers – piezoelectric and thermocouple.

UNIT IV - DIGITAL ELECTRONICS (7 hours)

Number systems – binary codes - logic gates - Boolean algebra, laws & theorems - simplification of Boolean expression - implementation of Boolean expressions using logic gates - standard forms of Boolean expression.

UNIT V - COMMUNICATION SYSTEMS (7 hours)

Block diagram of a basic communication system – frequency spectrum - need for modulation - methods of modulation - principles of AM, FM, pulse analog and pulse digital modulation – AM / FM transmitters & receivers (block diagram description only)

TEXT BOOKS

1. Thyagarajan .T, SendurChelvi .K.P, Rangaswamy .T.R, *"Engineering Basics: Electrical, Electronics and Computer Engineering"*, New Age International, Third Edition, 2007.
2. Somanathan Nair .B, Deepa .S.R, "*Basic Electronics",* I.K. International Pvt. Ltd., 2009.

REFERENCES

1. Thomas L. Floyd, *"Electronic Devices",* Pearson Education, 9th Edition, 2011.
2. Rajput .R.K, *"Basic Electrical and Electronics Engineering"*, Laxmi Publications, First Edition, 2007.

EC1001 BASIC ELECTRONICS ENGINEERING												
Course designed by		**Department of Electronics and Communication Engineering**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		X										
2.	Mapping of instructional objectives with student outcome	1,2,3										
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		--		X				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1004	**WORKSHOP PRACTICE**	**L**	**T**	**P**	**C**
	Total contact hours - 45	**0**	**0**	**3**	**2**
	Prerequisite				
	Nil				

PURPOSE

To provide the students with hands on experience on different trades of engineering like fitting, carpentry, smithy, welding and sheet metal.

INSTRUCTIONAL OBJECTIVES

1. To familiarize with the basics of tools and equipments used in fitting, carpentry, sheet metal, welding and smithy
2. To familiarize with the production of simple models in the above trades.

UNIT I - FITTING **(9 hours)**

Tools & Equipments – Practice in filing.
Making Vee Joints, Square, Dovetail joints and Key making - plumbing.
Mini project – Assembly of simple I.C. engines.

UNIT II - CARPENTRY **(9 hours)**

Tools and Equipments- Planning practice.
Making Half Lap, Dovetail, Mortise &Tenon joints.
Mini project - model of a single door window frame.

UNIT III - SHEET METAL **(9 hours)**

Tools and equipments– practice.
Making rectangular tray, hopper, scoop, etc.
Mini project - Fabrication of a small cabinet, dust bin, etc.

UNIT IV - WELDING **(9 hours)**

Tools and equipments -
Arc welding of butt joint, Lap joint, Tee fillet.
Demonstration of gas welding, TIG & MIG welding.

UNIT V - SMITHY **(9 hours)**

Tools and Equipments –
Making simple parts like hexagonal headed bolt, chisel.

TEXT BOOK

1. Gopal .T.V, Kumar.T, and Murali .G, *"A first course on workshop practice – Theory, Practice and Work Book"*, Suma Publications, Chennai, 2005.

REFERENCE BOOKS:

1. Kannaiah .P, and Narayanan .K.C, "*Manual on Workshop Practice"*, Scitech Publications, Chennai, 1999.
2. Venkatachalapathy.V. S, "*First year Engineering Workshop Practice"*, Ramalinga Publications, Madurai, 1999.
3. Laboratory Manual.

ME1004 - WORKSHOP PRACTICE												
Course designed by		Department of Mechanical Engineering										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
			X	X				X				
2.	Mapping of instructional objectives with student outcome		1, 2	1, 2				1, 2				
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		--		X				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

ME1005	ENGINEERING GRAPHICS	L	T	P	C
	Total Contact Hours - 75	0	1	4	3
	Prerequisite				
	Nil				

First Angle Projection is to be followed - Practice with Computer Aided Drafting tools

PURPOSE

1.	To draw and interpret various projections of 1D, 2D and 3D objects
2.	To prepare and interpret the drawings of buildings

INSTRUCTIONAL OBJECTIVES

1.	To familiarize with the construction of geometrical figures
2.	To familiarize with the projection of 1D, 2D and 3D elements
3.	To familiarize with the sectioning of solids and development of surfaces
4.	To familiarize with the Preparation and interpretation of building drawing

UNIT I - FUNDAMENTALS OF ENGINEERING GRAPHICS (2 hours)

Lettering – Two dimensional geometrical constructions – Conics – Representation of three-dimensional objects – Principles of projections – Standard codes – Projection of points.

UNIT II - PROJECTION OF LINES AND SOLIDS (4 hours)

Projection of straight lines – Projection of planes - Projection of solids – Auxiliary projections.

UNIT III - SECTIONS AND DEVELOPMENTS **(3 hours)**

Sections of solids and development of surfaces.

UNIT IV - PICTORIAL PROJECTIONS **(4 hours)**

Conversion of Projections: Orthographic projection – Isometric projection of regular solids and combination of solids.

UNIT V - BUILDING DRAWING **(2 hours)**

Plan, Elevation and section of single storied residential (or) office building with flat RCC roof and brick masonry walls having not more than 3 rooms (planning / designing is not expected in this course) with electrical wiring diagram.

PRACTICAL **(60 hours)**

TEXT BOOKS

1. Venugopal.K and Prabhu Raja.V, "*Engineering Graphics"*, Eighth Edition (Revised), New Age International Publishers, Chennai, 2007.
2. Natarajan K.V, "*A Text Book of Engineering Graphics"*, 21st Edition, Dhanalakshmi Publishers, Chennai, 2012.
3. Jeyapoovan.T, "*Engineering Drawing and Graphics using AutoCAD"*, Vikas Publishing House Pvt. Ltd., New Delhi, 2010.

REFERENCES

1. Bethune.J.D, "*Engineering Graphics with AutoCAD 2013*", PHI Learning Private Limited, Delhi, 2013.
2. Bhatt.N.D, "*Elementary Engineering Drawing (First Angle Projection)"*, Charotar Publishing Co., Anand, 1999.
3. Narayanan K. L and Kannaiah.P, "*Engineering Graphics"*, Scitech Publications, Chennai, 1999.
4. Shah.M.B and Rana B. C, "*Engineering Drawing"*, Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2005.

ME1005 ENGINEERING GRAPHICS												
Course designed by		**Department of Mechanical Engineering**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
			X	X				X				
2.	Mapping of instructional objectives with student outcome		1-4	1-4				1-4				
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		--		X				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

NC1001/ NS1001/ SP1001/ YG1001	**NATIONAL CADET CORPS (NCC)/ NATIONAL SERVICE SCHEME (NSS)/ NATIONAL SPORTS ORGANIZATION (NSO) / YOGA**	**L**	**T**	**P**	**C**
	Total Contact Hours – 15 (minimum, but may vary depending on the course)	**0**	**0**	**1**	**1**
	Prerequisite				
	Nil				

PURPOSE

To imbibe in the minds of students the concepts and benefits of NCC/NSS/NSO/YOGA and make them practice the same

INSTRUCTIONAL OBJECTIVES

1. To enable the students to gain knowledge about NCC/NSS/NSO/YOGA and put the same into practice

NATIONAL CADET CORPS (NCC)

Any student enrolling as a member of National Cadet Core (NCC) will have to attend sixteen parades out of twenty parades each of four periods over a span of academic year.

Attending eight parades in first semester will qualify a student to earn the credits specified in the curriculum. Grading shall be done based on punctuality, regularity in attending the parades and the extent of active involvement.

NATIONAL SERVICE SCHEME (NSS)

A student enrolling as member of NSS will have to complete 60 hours of training / social service to be eligible to earn the credits specified in the curriculum.

Grading shall be done by the faculty member handling the course based on punctuality, regularity in attending the classes and the extent of active involvement.

NATIONAL SPORTS ORGANIZATION (NSO)

Each student must select one of the following games/sports events and practice for one hour per week. An attendance of 75% is compulsory to earn the credits specified in the curriculum. Grading shall be done by the faculty member handling the course based on punctuality, regularity in attending the classes and the extent of active involvement.

List of games/sports:

Basket Ball, Football, Volley Ball, Ball Badminton, Cricket, Throw-ball, Track events

Field events or any other game with the approval of faculty member.

YOGA

Benefits of Agnai Meditation -Meditation - Agnai, Asanas, Kiriyas, Bandas, Muthras

Benefits of santhi Meditation - Meditation Santhi Physical Exercises (I & II)

Lecture & Practice - Kayakalpa Yoga Asanas, Kiriyas, Bandas, Muthras

Analysis of Thought - Meditation Santhi Physical Exercises III & IV

Benefits of Thuriyam - Meditation Thuriyam Kayakalpa Asanas, Kiriyas, Bandas, Muthras

Attitude - Meditation Thuriyam Kayakalpa Asanas, Kiriyas, Bandas, Muthras

Importance of Arutkappy & Blessings - Meditation Thuriyam Kayakalpa Asanas, Kiriyas, Bandas, Muthras

Benefits of Blessings - Meditation Santhi Kayakalpa Asanas, Kiriyas, Bandas, Muthras

Assessment

An attendance of 75% is compulsory to earn the credits specified in the curriculum. Grading shall be done by the faculty member handling the course based on punctuality, regularity in attending the classes and the extent of active involvement.

REFERENCES

1. Yogiraj Vethathiri Maharishi, "*Yoga for Modern Age*", Vethathiri Publishers, 1989.
2. Vethathiri Maharishi.T, "*Simplified Physical Exercises*", Vethathiri Publishers, 1987.

NC1001/ NS1001/ SP1001/ YG1001		**NATIONAL CADET CORPS (NCC)/ NATIONAL SERVICE SCHEME (NSS)/ NATIONAL SPORTS ORGANIZATION (NSO)/YOGA**										
Course designed by		**NCC/NSS/NSO/YOGA UNITS**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
2.	Mapping of instructional objectives with student outcome				X					X		
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		X		--		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

SEMESTER – III

LE1003	**GERMAN LANGUAGE PHASE I**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	**2**	**0**	**0**	**2**
	Prerequisite				
	Nil				

PURPOSE

Germany offers infinite opportunities for students of engineering for higher studies, research and employment in Germany. B.Tech Students are offered German Language during their second year. Knowledge of the language will be helpful for the students to adjust themselves when they go for higher studies.

INSTRUCTIONAL OBJECTIVES

1.	To introduce the language, phonetics and the special characters in German language
2.	To introduce German culture & traditions to the students.
3.	By the end of Phase – I, the students will be able to introduce themselves and initiate a conversation..
4.	We endeavor to develop the ability among the students to read and understand small texts written in German
5.	To enable the students to elementary conversational skills.

UNIT I (**6 hours)**

Wichtige Sprachhandlungen: Phonetics – Sich begrüßen - Sich und andere vorstellen formell / informell - Zahlen von 1 bis 1 Milliarde - verstehen & sprechen **Grammatik:** regelmäßige Verben im Präsens - "sein" und haben im Präsens - Personalpronomen im Nominative

UNIT II **(6 hours)**

Wichtige Sprachhandlungen Telefon Nummern verstehen und sprechen Uhrzeiten verstehen und sagen Verneinung "nicht und kein" (formell und informell) **Grammatik** : Wortstellung – Aussagesatz – W-Frage und Satzfrage (Ja/Nein Frage) Nomen buchstabieren und notieren bestimmter und unbestimmter Artikel und Negativartikel im Nom. & Akkusativ

UNIT III **(6 hours)**

Wichtige Sprachhandlungen Tageszeiten verstehen und über Termine sprechen -Verabredungen verstehen - Aufgaben im Haushalt verstehen **Grammatik** Personalpronomen im Akkusativ und Dativ - W-Fragen "wie, wer, wohin,wo, was usw.- Genitiv bei Personennamen - Modalverben im Präsens "können, müssen, möchten"

UNIT IV **(6 hours)**

Wichtige Sprachhandlungen Sich austauschen, was man kann, muss – Bezeichnungen Lebensmittel – Mengenangaben verstehen – Preise verstehen und Einkaufzettel schreiben

Grammatik Wortstellung in Sätzen mit Modalverben – Konnektor "und" – "noch"-kein-------mehr – "wie viel, wie viele, wie alt, wie lange" –Possessivartikel im Nominativ.

UNIT V **(6 hours)**

Wichtige Sprachhandlungen Freizeitanzeigen verstehen – Hobbys und Sportarten Anzeigen für Freizeitpartner schreiben bzw. darauf antworten – Vorlieben und Abneigungen ausdrucken

Grammatik Verben mit Vokalwechsel im Präsens – Modalverben im Präsens " dürfen, wollen und mögen- "haben und sein" im Präteritum – regelmäßige Verben im Perfekt – Konnektoren "denn, oder, aber

TEXT BOOK

1. Studio d A1. Deutsch als Fremdsprache with CD.(Kursbuch und Sprach training).

REFERENCES

1. German for Dummies
2. Schulz Griesbach

<table>
<tr><th colspan="13">LE1003 GERMAN LANGUAGE PHASE I</th></tr>
<tr><td colspan="2">Course designed by</td><td colspan="11">Department of English and Foreign Languages</td></tr>
<tr><td rowspan="2">1.</td><td rowspan="2">Student Outcome</td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td></tr>
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<tr><td>2.</td><td>Mapping of instructional objectives with student outcome</td><td></td><td></td><td></td><td></td><td></td><td></td><td>1-5</td><td></td><td></td><td></td><td></td></tr>
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<tr><td colspan="2">X</td><td colspan="3">--</td><td colspan="3">--</td><td colspan="3">--</td></tr>
<tr><td>4.</td><td>Approval</td><td colspan="11">23rd Meeting of Academic Council, May 2013</td></tr>
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	FRENCH LANGUAGE PHASE I	L	T	P	C
LE1004	Total Contact Hours - 30	2	0	0	2
	Prerequisite				
	Nil				

PURPOSE

To enable the student learners acquire a basic knowledge of the French language and concepts of general French for everyday interactions and technical French at the beginner's level and also to get to know the culture of France.

INSTRUCTIONAL OBJECTIVES

1.	To enable students improve their grammatical competence.
2.	To enhance their listening skills.
3.	To assist students in reading and speaking the language.
4.	To enhance their lexical and technical competence.
5.	To help the students introduce themselves and focus on their communication skills.

UNIT I **(6 hours)**

1. Grammar and Vocabulary: Usage of the French verb "se presenter", a verb of self- introduction and how to greet a person- "saluer"
2. Listening and Speaking – The authentic sounds of the letters of the French alphabet and the accents that play a vital role in the pronunciation of the words.
3. Writing – correct spellings of French scientific and technical vocabulary.
4. Reading -- Reading of the text and comprehension – answering questions.

UNIT II **(6 hours)**

1. Grammar and Vocabulary – Definite articles , "prepositions de lieu" subject pron ouns
2. Listening and Speaking – pronunciation of words like Isabelle, presentez and la liaison – vous etes, vous appelez and role play of introducing each other – group activity
3. Writing – particulars in filling an enrollment / registration form
4. Reading Comprehension – reading a text of a famous scientist and answering questions.

UNIT III **(6 hours)**

1. Grammar and Vocabulary – verb of possession "avoir' and 1st group verbs "er", possessive adjectives and pronouns of insistence- moi, lui..and numbers from 0 to 20
2. Listening and Speaking –nasal sounds of the words like feminine, ceinture , parfum and how to ask simple questions on one's name, age, nationality, address mail id and telephone number.
3. Writing –conjugations of first group verbs and paragraph writing on self – introduction and introducing a third person.
4. Reading Comprehension – reading a text that speaks of one's profile and answering questions

UNIT IV **(6 hours)**

1. Grammar and Vocabulary –negative sentences, numbers from 20 to 69, verb "aimer"and seasons of the year and leisure activities.
2. Listening and Speaking – To express one's likes and dislikes and to talk of one's pastime activities (sports activities), je fais du ping-pong and nasal sounds of words – janvier, champagne
3. Writing- conjugations of the irregular verbs – faire and savoir and their usage. Paragraph writing on one's leisure activity- (passé temps favori)
4. Reading- a text on seasons and leisure activities – answering questions.

UNIT V **(6 hours)**

1. Grammar and Vocabulary – les verbes de direction- to ask one's way and to give directions, verbes- pouvoir and vouloir and 2nd group verbs , a droite, la premiere a gauche and vocabulary relating to accommodation.
2. Listening and Speaking – to read and understand the metro map and hence to give one directions – dialogue between two people.
3. Writing –paragraph writing describing the accommodation using the different prepositions like en face de, derriere- to locate .
4. Reading Comprehension -- a text / a dialogue between two on location and directions- ou est la poste/ la pharmacie, la bibliotheque?.....

TEXT BOOK

1. Tech French

REFERENCES

1. French for Dummies.
2. French made easy-Goyal publishers
3. Panorama

LE1004 FRENCH LANGUAGE PHASE I												
Course designed by		**Department of English and Foreign Languages**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
								X				
2.	Mapping of instructional objectives with student outcome							1-5				
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		X		--		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

LE 1005	JAPANESE LANGUAGE PHASE I	L	T	P	C
	Total Contact Hours- 30	**2**	**0**	**0**	**2**
	Prerequisite				
	Nil				

PURPOSE

To enable students achieve a basic exposure on Japan, Japanese language and culture. To acquire basic conversational skill in the language.

INSTRUCTIONAL OBJECTIVES

1.	To help students learn the Japanese scripts viz. hiragana and a few basic kanji.
2.	To make the students acquire basic conversational skill.
3.	To enable students to know about Japan and Japanese culture.
4.	To create an advantageous situation for the students to have better opportunity for employability by companies who have association with Japan.

UNIT I **(8 hours)**

1. Introduction to Japanese language. Hiragana Chart 1 - vowels and consonants and related vocabulary.
2. Self-introduction
3. Grammar – usage of particles wa, no, mo and ka and exercises
4. Numbers (1-100)
5. Kanji – introduction and basic kanjis – naka, ue, shita, kawa and yama
6. Greetings, seasons, days of the week and months of the year
7. Conversation – audio
8. Japan – Land and culture

UNIT II **(8 hours)**

1. Hiragana Chart 1 (contd.) and related vocabulary
2. Grammar – usage of kore, sore, are, kono, sono, ano, arimasu and imasu. Particles – ni (location) and ga. Donata and dare.
3. Numbers (up to 99,999)
4. Kanji – numbers (1-10, 100, 1000, 10,000 and yen)
5. Family relationships and colours.
6. Conversation – audio
7. Festivals of Japan

UNIT III **(5 hours)**

Hiragana Charts 2&3, double consonants, vowel elongation and related vocabulary
Lesson 3
Grammar - particles ni (time), kara, made and ne. Koko, soko, asoko and doko.
Time expressions (today, tomorrow, yesterday, day before, day after)
Kanji – person, man, woman, child, tree and book
Directions – north, south, east and west

UNIT IV **(5 hours)**

Grammar - directions,-kochira, sochira, achira and dochira. Associated vocabulary (mae, ushiro, ue, shita, tonari, soba, etc.)
Conversation – audio
Japanese art and culture like ikebana, origami, etc.

UNIT V **(4hours)**

Kanji – hidari, migi, kuchi
Japanese sports and martial arts

TEXT BOOK

1. First lessons in Japanese, ALC Japan.

REFERENCES

1. Japanese for dummies. Wiley publishing co. Inc., USA.
2. Kana workbook, Japan foundation.

LE1005 JAPANESE LANGUAGE PHASE I												
Course designed by		**Department of English and Foreign Languages**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
								X				
2.	Mapping of instructional objectives with student outcome							1-4				
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		X		--		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

LE1006	KOREAN LANGUAGE PHASE I	L	T	P	C
	Total Contact Hours-30	**2**	**0**	**0**	**2**
	Prerequisite				
	Nil				

PURPOSE

To enable students achieve a basic exposure on Korea, Korean language and culture. To acquire basic conversational skill in the language.

INSTRUCTIONAL OBJECTIVES

1.	To help students learn the scripts.
2.	To make the students acquire basic conversational skill.
3.	To enable students to know about Korean culture.
4.	To create an advantageous situation for the students to have better opportunity for employability by companies who have association with Korea.

UNIT I **(6 hours)**

Lesson 1 < Introduction to Korean Language >, Lesson2 < Consonants and Vowels >, <Basic Conversation, Vocabularies and Listening >

UNIT II (**10 hours)**

Lesson 3<Usage of "To be" >, Lesson 4 < Informal form of "to be">, Lesson 5 <Informal interrogative form of "to be">, Lesson 6 <To be, to have, to stay>, < Basic Conversation, Vocabularies and Listening >

UNIT III (**10 hours)**

Lesson 7 < Interrogative practice and Negation >, < Basic Conversation, Vocabularies and Listening >

UNIT IV **(4 hours)**

Lesson 8 < Korean Culture and Business Etiquette >, < Basic Conversation, Vocabularies and Listening

TEXT BOOK

1. Korean Through English 1(Basic Korean Grammar and Conversation).

REFERENCES

1. Bharati Korean (Intermediate Korean Grammar).
2. Hand-outs.
3. Various visual mediums such Movie CD, Audio CD.
4. Collection of vocabularies for engineering field.

LE1006KOREAN LANGUAGE PHASE I												
Course designed by		**Department of English and Foreign Languages**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
								X				
2.	Mapping of instructional objectives with student outcome							1-4				
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		X		--		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

LE1007	CHINESE LANGUAGE PHASE I	L	T	P	C
	Total contact hours- 30	2	0	0	2
	Prerequisite				
	NIL				

PURPOSE

To enable students achieve a basic exposure on China, Chinese language and culture. To acquire basic conversational skill in the language.

INSTRUCTIONAL OBJECTIVES

1.	To help students learn the Chinese scripts.
2.	To make the students acquire basic conversational skill.
3.	To enable students to know about China and Chinese culture.
4.	To create an advantageous situation for the students to have better opportunity for employability by companies who have association with china.

UNIT I

Introduction of Chinese Language

UNIT II

Phonetics and Notes on pronunciation

a) 21 Initials:

b p m f d t n l g k h j q x z c s zh ch sh r

b) 37 Finals:

a	o	e	i	u	ü
ai	ou	ei	ia	ua	üe
an	ong	en	ian	uai	üan
ang	eng	iang	uan	ün	
ao	er	iao	uang		
ie	uei(ui)				
in	uen(un)				
ing	ueng				
iong	uo				
iou(iu)					

c) The combination of Initials and Finals - Pinyin

UNIT III

Introduction of Syllables and tones

a) syllable=initial+final+tone

b) There are four tones in Chinese: the high-and-level tone, the rising tone, the falling-and-rising tone, and the falling tone. And the markers of the different tones.

UNIT IV

A. Tones practice

B. the Strokes of Characters

1. Introduction of Chinese Characters
2. The eight basic strokes of characters

UNIT V

1. Learn to read and write the Characters:

八(eight) 不(not) 马(horse) 米(rice) 木(wood).

2. **classes are organized according to several Mini-dialogues.**

TEXT BOOK

1. A New Chinese Course 1- Beijing Language and Culture University Press.

REFERENCES

1. New Practical Chinese Reader Textbook (1) – Beijing Language and Culture University Press.
2. 40 Lessons For Basic Chinese Course I – Shanghai Translation Press.
3. My Chinese Classroom - East China Normal University Press.

LE1007CHINESE LANGUAGE PHASE I												
Course designed by		**Department of English and Foreign Languages**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
								X				
2.	Mapping of instructional objectives with student outcome							1-4				
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		X		--		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

PD1003	APTITUDE-I	L	T	P	C
	Total Contact Hours - 30	1	0	1	1
	Prerequisite				
	Nil				

PURPOSE

To enhance holistic development of students and improve their employability skills.

INSTRUCTIONAL OBJECTIVES

1. To improve aptitude, problem solving skills and reasoning ability of the student.
2. To collectively solve problems in teams & group.

UNIT I – NUMBERS **(6 hours)**

Types and Properties of Numbers, LCM, GCD, Fractions and decimals, Surds

UNIT II - ARITHMETIC I **(6 hours)**

Percentages, Profit & Loss, Simple Interest & Compound Interest, , Clocks & calendars

UNIT III - ALGEBRA - I **(6 hours)**

Logarithms, Problems on ages

UNIT IV - MODERN MATHEMATICS - I **(6 hours)**

Permutations, Combinations, Probability

UNIT V - REASONING **(6 hours)**

Logical Reasoning, Analytical Reasoning

ASSESSMENT

1. Objective type – Paper based / Online – Time based test.

REFERENCE

1. Agarwal.R.S, *Quantitative Aptitude for Competitive Examinations,* S.Chand Limited 2011.
2. Abhijit Guha, *Quantitative Aptitude for Competitive Examinations,* Tata McGraw Hill, 3rd Edition, 2011.
3. Edgar Thrope, *Test Of Reasoning for Competitive Examinations,* Tata McGraw Hill, 4th Edition, 2012.
4. Other material related to quantitative aptitude

PD1003 – APTITUDE-I												
Course designed by		**Career Development centre**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		X			X							
2.	Mapping of instructional objectives with student outcome	1			2							
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		X		--		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

GN1003	**PRINCIPLES OF GENETICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

This course introduces the principles of genetics. It discusses the basics laws of inheritance, chromosome structure, cytological techniques, chromosome variation, linkage mapping and population genetics.

INSTRUCTIONAL OBJECTIVES

1.	To understand fundamental laws of genetics
2.	To know techniques in *insitu* genetic analysis for mutation and aberration studies
3.	To identify and relate phenotype to changes in chromosome structure and number
4.	To perform linkage analysis and recombination mapping
5.	To study population and analyse quantitative characters

UNIT I - MENDELIAN GENETICS **(8 hours)**

Mendel's experiments, monohybrid cross, dihybrid cross, trihybrid cross, principles of segregation - independent assortment; laws of probability, Chi-square analysis; gene interaction-epistasis; multiple alleles- ABO blood groups, lethal alleles, complementation analysis.

UNIT II - CYTOLOGY AND CYTOGENETIC TECHNIQUES (9 hours)

Chromosome structure and organization in eukaryotes; extranuclear inheritance - Organelle heredity, DNA in chloroplasts and mitochondria; cytogenetic methods- banding pattern, flow cytometry, CGH, FISH.

UNIT III - CHANGES IN CHROMOSOME STRUCTURE AND NUMBER (8 hours)

Changes in chromosome structure- deletions, duplications, inversions, translocations; mutagens and mutations- types and classification; chromosomal aberration- euploidy, aneuploidy, significance.

UNIT IV - LINKAGE AND RECOMBINATION MAPPING (10 hours)

Linkage, crossing over and recombination - cytological basis of crossing over; mapping - two and three factor cross; interference and coefficient of coincidence; somatic cell hybridization; mapping in bacteria by transformation, conjugation and transduction.

UNIT V - POPULATION GENETICS (10 hours)

Hardy-Weinberg law for gene frequency- frequencies of two alleles at single locus, application of Hardy-Weinberg, significance of Hardy-Weinberg principle, exceptions of Hardy-Weinberg; Inbreeding, panmictic index, types of inbreeding, inbreeding depression, heterosis- importance and use, polygenic inheritance- characteristics of quantitative traits, types.

TEXT BOOK

1. Dr. Gupta .P.K, "*Genetics",* 4th Rev.Ed (Ist Reprint), 2011.

REFERENCE

1. Gardner, Simmons, Snustad , "*Principles of Genetics*", John Wiley and Sons, Inc., 8th edition, 2003.

GN1003 PRINCIPLES OF GENETICS														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X	X			X							
2.	Mapping of instructional objectives with student outcome	1	1-3 & 5	1,2, 4&5			4							
3.	Category	General (G)		Basic Sciences(B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering			Applied Genetics	
													X	
5.	Approval	23rd Meeting of Academic Council, May 2013												

BT1007	**MICROBIOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

This course introduces the fundamentals of microbiology through the study of the characteristics of microorganisms, multiplication, growth in different media, metabolic pathways, effects of microbe and their control.

INSTRUCTIONAL OBJECTIVES

1.	To highlight the roles and characteristics of microorganisms
2.	To impart knowledge on the basic concept of replication in microorganisms
3.	To gain knowledge on the growth of microorganisms and impact of environment on their growth
4.	To evaluate explicitly, the metabolic pathways, role of microbes in public health, insight into the physical and chemical control of microorganisms.

UNIT I - INTRODUCTION TO MICROBIOLOGY (9 hours)

Characterization, Classification and Identification of microorganisms, Microscopic examination of Microorganisms morphology and fine structure of bacteria, cultivation of bacteria, reproduction & growth, pure cultures and cultural characteristics.

UNIT II - MICROBIAL PHYSIOLOGY AND GENETICS (9 hours)

Enzymes and their regulation, Microbial metabolism energy production, utilization of energy & biosynthesis, bacterial genetics.

UNIT III - MICROBIAL PHYSIOLOGY AND GENETICS (9 hours)

Fungi – importance, characteristics, morphology, reproduction, physiology cultivation & classification of fungi, molds & repair association with other organisms. Algae – importance of algae – characteristics of algae, classification protozoa: Ecology, importance, morphology, reproduction and classification of protozoa – control of microorganisms.

UNIT IV - VIRUSES OF BACTERIA, ANIMAL AND PLANTS (9 hours)

Bacteriophages- General characteristics-Morphology and structure, Classification and Nomenclature- Bacteriophages of *E.coli*– Replication -viruses of plants and animals- Structure- Replication- Classification- isolation and identification-fatal diseases associated with viruses in animals-viroids.

UNIT V - ENVIRONMENTAL AND INDUSTRIAL MICROBIOLOGY (9 hours)

Microbiology of soil – aquatic microbiology, Microbiology of domestic water and waste water. Microbiology of fuel and Industrial microbiology.

TEXT BOOK

1. Pelczar.J.R,Chan .E.C.S and Noel R.Krieg. "*Microbiology",* 5thEdition, Tata Mc GrawHill, 2006.

BT1007 MICROBIOLOGY														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X	X	X			X			X			
2.	Mapping of instructional objectives with student outcome	3	1	2	3			3, 4			3			
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts(E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
												X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

	IMMUNOLOGY	L	T	P	C
BT1010	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The course is aimed at introducing the science of immunology and provides a detailed study on the various types of immune systems, their classification, structure and mechanisms of immune activation

INSTRUCTIONAL OBJECTIVES

1.	To import gain knowledge on the immune system, their structure and classification, genetic control of antibody production.
2.	To understand about cellular immunology.
3.	To understand the mechanism of activation in hypersensitive immune reaction.

UNIT I - OVERVIEW OF THE IMMUNE SYSTEM (7 hours)

Innate Immunity, adaptive immunity, comparative immunity cells and organs the immune system – Antigens.

UNIT II - IMMUNOGLOBULIN STRUCTURE AND FUNCTIONS (8 hours)

Basic structures of Immunoglobulins – I g classes and biological activities, Antigenic determinants on Ig, B Cell receptor, Monoclonal antibodies – cytokines – complement system.

UNIT III - ANTIGEN – ANTIBODY INTERACTIONS (8 hours)

Antibody Affinity and activity – Precipitation reactions- agglutination reactions-Radio immunoassay-ELISA-Western blotting, Immunoprecipitation, Immuno fluroscence, immunoelectron microscopes, flow cytometers-MHC Antigen processing & presentations.

UNIT IV - T CELL & B CELL MATURATION, ACTIVATION & DIFFERENTIATION (12 hours)

T Cell receptor, T Cell maturation, activation and differentiation B Cell generation, activation and differentiation cell mediated effectors responses.

UNIT V - IMMUNE SYSTEM IN HEALTH & DISEASE (10 hours)

Leukocyte migration and inflammation, hypersensitive reactions, immune response to infection diseases vaccines.

TEXT BOOK

1. Thomas J. Kindt, Barbara A. Osborne, Richard A. Golsby, *"Kuby Immunology"*, WS.H. Freeman & Company, 6th Edition, 2006.

BT1010 IMMUNOLOGY														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X		X	X			X						
2.	Mapping of instructional objectives with student outcome	3		1-3	1-3			1-3						
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering		Plant Genetic Engineering			Applied Genetics		
												X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1004	MOLECULAR BIOLOGY OF GENE	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This subject discusses the fundamentals concepts of DNA, RNA, transcription, translation and RNA splicing. It provides insight into the regulation of prokaryotic and eukaryotic gene regulation

INSTRUCTIONAL OBJECTIVES

1.	To understand and apply nucleic acids characteristics in research
2.	To analyze transcription and regulation of gene expression
3.	To know the intricacies of eukaryotic gene expression and design experiments in research

UNIT I - DNA, RNA AND REPLICATION (8 hours)

Central dogma, structure of DNA and RNA, DNA topology, replication in prokaryote and eukaryote- types and functions of DNA polymerases, proof reading activity, 5'→ 3' exonuclease activity, topoisomerase activity, telomeric DNA replication, strand displacement model and rolling circle model, recombination – homologous recombination; site specific recombination.

UNIT II - TRANSCRIPTION OF mRNA, rRNA AND tRNA GENES (11 hours)

Fine structure of prokaryotic and eukaryotic gene; transcription of mRNA, rRNA, and tRNA in prokaryotes and eukaryotes - structure and function of the promoters in genes, RNA polymerases in prokaryote and eukaryote: types and function.

UNIT III - POST TRANSCRIPTIONAL MODIFICATIONS AND TRANSLATION (8 hours)

Post transcriptional processing of mRNA – 5'capping, splicing (including different types), polyadenylation, exon shuffling, RNA editing and mRNA transport. Genetic code and Wobble hypothesis; rules of genetic code, translation in prokaryote and eukaryote.

UNIT IV - GENE REGULATION IN PROKARYOTE (9 hours)

Principles of transcriptional regulation, gene expression in *E. coli*: transcriptional regulation, regulation after transcription initiation, positive and negative regulation, operon-*lac - trp – ara,* phage lambda gene regulation.

UNIT V - GENE REGULATION IN EUKARYOTE (9 hours)

Conserved mechanisms of transcriptional regulation, DNA sequence elements - operators - short sequence elements – enhancers – locus control regions – activators – repressors – insulators, DNA protein interactions: zinc fingers – leucine zipper – basic helix loop helix – helix turn helix, epigenetic regulation: histone modifications - chromatin remodeling - DNA methylation and imprinting, RNAs in gene regulation.

TEXT BOOK

1. Watson.J,*"Molecular Biology of Gene"*, Pearson publications, 5th edition.

REFERENCE

1. Benjamin Lewin*, "Gene VIII",* Pearson publications.

GN1004 MOLECULAR BIOLOGY OF GENE														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X	X	X		X		X					
2.	Mapping of instructional objectives with student outcome	1,2	1-3	2, 3	2,3		1							
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering		Plant Genetic Engineering			Applied Genetics		
		X		--			--		X			X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

CH1241	BASIC CHEMICAL ENGINEERING I – STOCHIOMETRY, THERMODYNAMICS AND HEAT TRANSFER	L	T	P	C
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

This course prepares the students to formulate and solve material and energy balances on chemical and biochemical process systems. This course helps the students to understand the laws of thermodynamics and its application in biochemical processes. modes of heat transfer and their applications

INSTRUCTIONAL OBJECTIVES

1.	To introduce the basic principles of process calculations, Material and Energy balance calculations
2.	To understand the basics of First and second laws of thermodynamics
3.	To familiarize the students with heat conduction phenomena, convective heat transfer phenomena and heat exchange equipments.

UNIT I - INTRODUCTION TO PROCESS CALCULATION (9 hours)

Units and dimensions, the mole unit, mole fraction (or percent) and mass fraction (or percent), analyses of a mixture, concentrations, basis of calculations, Basics of chemical equation and stoichiometry, limiting reactant, excess reactant, conversion, selectivity, yield. Basic concepts involved in material balance calculations, material balance problems without chemical reactions

UNIT II -MATERIAL & ELEMENTAL BALANCES FOR BIOCHEMICAL PROCESSES (9 hours)

Introduction -Growth of stoichiometry and elemental balances ,Energy balance for continuous ethanol fermentation ,Mass balance for production of penicillin ,Conservation of mass principle ,Acetic acid fermentation process ,Xanthan gum production, Stoichiometric coefficient for cell growth ,Embden–Meyerhoff–Parnas pathway

UNIT III - FIRST LAW OF THERMODYNAMICS (9 hours)

Basic concepts: work, energy, heat, internal energy, extensive and intensive properties, state and path functions, First law of thermodynamics, energy balance for closed systems, equilibrium, the reversible process, constant-v and constant-p processes, enthalpy, heat capacity, energy balances for steady-state flow processes.

UNIT IV - SECOND LAW OF THERMODYNAMICS (9 hours)

Statements, heat engines, Carnot's theorem, ideal-gas temperature scale; Carnot's equations, concept of entropy, entropy changes of an ideal gas undergoing a mechanically reversible process in a closed system, mathematical statement of the second law, entropy balance for open systems

UNIT V - BASCICS OF HEAT TRANSFER (9 hours)

Introduction to various modes of heat transfer, Fourier's law of heat conduction, effect of temperature on thermal conductivity, steady-state conduction, compound resistances in series, heat flow through a cylinder, Convection- Nature and forced convection, Individual heat transfer coefficient, Overall heat transfer coefficient and relation between them, LMTD, Radiation- Laws of block body radiation, Heat exchanger – types of heat exchanger.

TEXT BOOKS

1. David .M, Himmelblau, "*Basic Principles and Calculations in Chemical Engineering"*, 6th Edn., Prentice-Hall of India, New Delhi, 1998.
2. Smith.J.M, Van Ness.H.C, and Abbott M.M."*Introduction to Chemical Engineering Thermodynamics"*, 6th Edn., McGraw Hill International Edition, Singapore, 2001.
3. Warren L. Mccabe, Julian C. Smith and peter Harriott, "*Unit Operations of Chemical Engineering"*, *6th Edtion*., McGraw Hill International Edition, NewYork, 2001.

REFERENCE

1. Najapour.G.D, "*Biochemical Engineering and Biotechnology"*, Elsevier, 2007.

CH1241 BASIC CHEMICAL ENGINEERING I – STOCHIOMETRY, THERMODYNAMICS AND HEAT TRANSFER														
Course designed by		**Department of Chemical Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	L	m
		x				x				x		x		
2.	Mapping of instructional objectives with student outcome	1-3				1,3				1-3		1-3		
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		--			X			--		--		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1005	**TRAINING IN LABORATORY SAFETY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	**0**	**0**	**2**	**1**
	Pre-requisite				
	Nil				

PURPOSE

Students of Genetic Engineering will be spending most of their time working in the laboratories, either for practicals or for projects. Some experiments would involve the use of chemicals and equipments that require cautious handling. This course will train the students on how to safely handle the chemicals, equipments, and biological materials and also on how to dispose them safely into the environment.

INSTRUCTIONAL OBJECTIVES	
1.	To gain knowledge on lab ethics and honesty in carrying out the experiments
2.	To acquire knowledge on lab safety to keep the lab safe for everyone
3.	To know about personal safety to take care of oneself from the hazards of chemicals and equipments used
4.	To gain knowledge on environmental safety to safely dispose the toxic chemicals into the environment.

UNIT I - LABORATORY (2hours)

General rules - personal precautions - types of gloves - hygienic and clean working space - report minor and major accidents - report defective equipments - lab maintenance.

UNIT II - CHEMICAL AND RADIATION SAFETY (4 hours)

Handling different chemicals-(toxic, flammable, carcinogenic, cryogenics, compressed gases) - understanding MSDS - importance of labels (poison, radioactive, corrosive etc) - routes of entry - health hazards- protection and emergency action (first aid). Radioactive chemicals-types of radiation, safe handling and disposal, radiation counter.

UNIT III - BIOLOGICAL SAFETY (3 hours)

Biosafety levels (1-4) - types of samples, standard practices and handling - biosafety cabinets- containment/safe disposal of biohazardous samples- handling and disposal of recombinant/genetically modified organisms.

UNIT IV - BIO-INSTRUMENTATION (4 hours)

Safe handling and proper maintenance of instruments like pH meter, PCR machine, centrifuge, gel electrophoresis, UV transilluminator, micropipettes, importance of log book and reporting faulty instruments.

UNIT V - LAB ETHICS (2 hours)

Maintenance of good conduct both in research and with researchers - lab note book and maintenance – recording experimental data – importance of page numbers and dates – report loss of note book immediately – contents of each experiment (title, persons involved, statement of purpose, experimental design and reference, results with original data, conclusion, results should be repeatable).

REFERENCE

1. Laboratory manual

GN1005 TRAINING IN LABORATORY SAFETY														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
								X			X			
2.	Mapping of instructional objectives with student outcome							1,3,4			1,4			
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering		Plant Genetic Engineering			Applied Genetics		
		--		--			X		--			--		
5.	Approval	23rd Meeting of Academic Council, May 2013												

BT1008	**MICROBIOLOGY LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	**0**	**0**	**4**	**2**
	Prerequisite				
	Nil				

PURPOSE

Provides an opportunity to experimentally verify the theoretical concepts already studied. It also helps in understanding the theoretical principles in a more explicit and concentrated manner

INSTRUCTIONAL OBJECTIVES

1. To develop their skills in the preparation, identification and quantification of microorganisms
2. To develop their skills in the preparation, identification and quantification of microorganisms

LIST OF EXPERIMENTS

1. Sterilization techniques
2. Media preparation
3. Microscopy and Micrometry
4. Isolation, enumeration and purification of microbes from a given sample
5. Staining Techniques (Simple, Gram staining, spore staining)
6. Motility test by Hanging drop method
7. Biochemical Characterization of BacteriaOxidation/Fermentation TestCatalase, Oxidase and Urease TestsIMViC testHydrogen Sulfide Test and Nitrate Reduction Test.Casein and Starch Hydrolysis
8. Antibiotic Assay - Antimicrobial Sensitivity Test (Disc Diffusion Method)
9. Growth Kinetics (Bacterial Growth Curve)
10. Isolation of antibiotics producing bacteria
11. Isolation and characterization of plant microbes

REFERENCE

1. Laboratory Manual

BT1008 MICROBIOLOGY LABORATORY														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
			X	X		X								
2.	Mapping of instructional objectives with student outcome		1-2	1-2		1-2								
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		X			--			--		--		
5.	Approval	23rd Meeting of Academic Council, May 2013												

BT1011	IMMUNOLOGY LABORATORY	L	T	P	C
	Total Contact Hours - 60	0	0	4	2
	Prerequisite				
	Nil				

PURPOSE

Provides an opportunity to experimentally verify the theoretical concepts already studied. it also helps in understanding the theoretical principles in a more explicit and concentrated manner .

INSTRUCTIONAL OBJECTIVES

1.	Isolation of antibodies
2.	Purification of antibodies
3.	Immunoelectrophoresis

LIST OF EXPERIMENTS

1. Blood grouping
2. Leukocyte count
3. PBMC preparation and their enumeration
4. Production of polyclonal antibodies – preparation of antigen – protocol for immunization in rabbits
5. Methods of bleeding-purification of polyclonal antibodies
6. Antigen-antibody reaction-Haemagglutination, precipitation-Widal and VDRL
7. Immunodiffusion, Immunoelectrophoresis.
8. Affinity chromatography for antibody purification.
9. ELISA-DOT and plate ELISA
10. Western blotting

REFERENCE

1. Laboratory manual

BT1011 IMMUNOLOGY LABORATORY														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X		X		X								
2.	Mapping of instructional objectives with student outcome	1		4		2								
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		--			--			--		X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

SEMESTER - IV

LE1008	**GERMAN LANGUAGE PHASE II**	**L**	**T**	**P**	**C**
	Total Contact Hours- 30	**2**	**0**	**0**	**2**
	Prerequisite				
	LE1003-German Language Phase I				

PURPOSE

Familiarity in German language will be helpful for the students in preparing their resumes in German. Proficiency in the language will be an added asset for the students to have an edge in the present day highly competitive and global job market.

INSTRUCTIONAL OBJECTIVES

1.	To enable the students to speak and understand about most of the activities in the day to day life.
2.	The students will be able to narrate their experiences in Past Tense.
3.	The students will be able to understand and communicate even with German Nationals.
4.	By the end of Phase – II the students will have a reasonable level of conversational skills.

UNIT I **(6 hours)**

Wichtige Sprachhandlungen: Zimmersuche, Möbel

Grammatik: Verben mit trennbaren Vorsilben im Präsens und Perfekt. Verben mit trennbaren Vorsilben und Modalverben imPräsens. Verben mit untrennbaren Vorsilben im Perfekt. Unregelmäßige und gemischte Verben im Perfekt.

UNIT II **(6 hours)**

Wichtige Sprachhandlungen: Kleidung ,Farben , Materialien.

Grammatik : formelle Imperativsätze mit "Sie" informelle Imperativsätze Vorschläge mit "wir" – "sollen/wollenwir"—Soll ich? Modalpartikeln "doch" "mal" "doch mal.

UNIT III **(6 hours)**

Wichtige Sprachhandlungen : Sehenswürdigkeite (Prater, Brandenburger Tör,Kolossium, Eifeltürm)

Grammatik : Ortsangaben mit Akk. und Dativ "alle","man" Indefinitepronomen "etwas", "nichts",

UNIT IV **(6 hours)**

Wichtige Sprachhandlungen : Wegbeschreibung/ Einladung interkulturelle Erfahrung.

Grammatik : Verwendung von Präsens für zukünftigen Zeitpunkt.

UNIT V **(6 hours)**

Wichtige Sprachhandlungen: Essen und Trinken im Restaurant , Partyvorbereitung und Feier

Grammatik: Nomen aus Adjektiven nach "etwas"und "nichts" Nomen aus dem Infinitiv von Verben, zusammegesetzte Nomen und ihre Artikel. Adjektive im Nom. und Akk. nach unbestimmten Artikel, Negativartikel und Possessivartikel.

TEXT BOOK

1. Studio d A1. Deutsch als Fremdsprache with CD.(Kursbuch und Sprachtraining).

REFERENCES

1. German for Dummies
2. Schulz Griesbach

LE01008 GERMAN LANGUAGE PHASE II												
Course designed by		**Department of English and Foreign Languages**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
								x				
2.	Mapping of instructional objectives with student outcome							1-4				
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		X		--		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

LE1009	**FRENCH LANGUAGE PHASE II**	**L**	**T**	**P**	**C**
	Total Contact Hours- 30	**2**	**0**	**0**	**2**
	Prerequisite				
	LE1004- French Language Phase I				

PURPOSE

To enable the students communicate effectively with any French speaker and have a competitive edge in the international market.

INSTRUCTIONAL OBJECTIVES

1.	To enable students access information on the internet
2.	To receive and send e mails
3.	To assist students in gaining a certain level of proficiency to enable them to give the level 1 exam conducted by Alliance Française de Madras.
4.	To enhance their lexical and technical competence.

UNIT I **(6 hours)**

1. Grammar and Vocabulary: The second group verbs: Finir, rougir, grossir, grandir . "Les preposition de temps": à, en, le, de 7h à 8h, jusqu' à, vers.
2. Listening and Speaking – the semi- vowels: Voilà, pollutant. Writing –the days of the week. Months, technical subjects, time, "les spécialités scientifiques et l' année universitaire, paragraph writing about time table.
3. Reading -- Reading of the text and comprehension – answering questions

UNIT II **(6 hours)**

Grammar and Vocabulary – The adjectives, the nationality, feminine & masculine noun forms "les métiers scientifiques".

Listening and Speaking – Vowels: soirée, année, près de, très.

Writing – Countries name, nationality, "les métiers scientifiques", numbers from: 69 to infitive and some measures of unit.

Reading Comprehension – reading a text.

UNIT III **(6 hours)**

Grammar and Vocabulary – near future, The demonstrative adjectives, Express the aim by using the verb, Listening and Speaking –"La liaison interdite – en haut". Writing – some scientific terms, French expressions to accept an invitation. Sentence framing. Reading Comprehension – reading a text.

UNIT IV **(6 hours)**

Grammar and Vocabulary –the verbs: manger, boire , the partitive articles Listening and Speaking – "le 'e' caduc Writing- the food, the ingredients, fruits, vegetables, expression of quantity, paragraph writing about food habits. Reading – reading a text.

UNIT V **(6 hours)**

Grammar and Vocabulary – " les prepositions de lieu": au à la, à l', chez, the reflexives verbs, verbs to nouns. Listening and Speaking – "le 'e' sans accents ne se prononce pas. C'est un "e" caduc. Ex: quatre, octobre. " les sons (s) et (z)- salut , besoin. Writing –paragraph writing about one's everyday life, French culture. Reading Comprehension -- reading a text or a song.....

TEXT BOOK

1. Tech French

REFERENCES

1. French for Dummies
2. French made easy: Goyal publishers
3. Panorama

LE1009 FRENCH LANGUAGE PHASE II												
Course designed by		**Department of English and Foreign Languages**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
								x				
2.	Mapping of instructional objectives with student outcome							1-4				
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		X		--		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

LE 1010	JAPANESE LANGUAGE PHASE II	L	T	P	C
	Total Contact Hours- 30	2	0	0	2
	Prerequisite				
	LE1005- Japanese Language Phase I				

PURPOSE

To enable students to learn a little advanced grammar in order to improve their conversational ability in Japanese.

INSTRUCTIONAL OBJECTIVES

1.	To help students learn Katakana script (used to write foreign words)
2.	To improve their conversational skill.
3.	To enable students to know about Japan and Japanese culture.
4.	To improve their employability by companies who are associated with Japan.

UNIT I **(8 hours)**

Introduction to Verbs; Ikimasu, okimasu, nemasu, tabemasu etc.
Grammar – usage of particles de, o, to, ga(but) and exercises
Common daily expressions and profession.
Katakana script and related vocabulary.
Religious beliefs, Japanese housing and living style.
Conversation – audio

UNIT II **(8 hours)**

Grammar :Verbs –Past tense, negative - ~mashita, ~masen deshita..
i-ending and na-ending adjectives - introduction
Food and transport (vocabulary)
Japanese food, transport and Japanese tea ceremony.
Kanji Seven elements of nature (Days of the week)
Conversation – audio

UNIT III **(6 hours)**

Grammar - ~masen ka, mashou
Adjectives (present/past – affirmative and negative)
Conversation – audio

UNIT IV **(4 hours)**

Grammar – ~te form
Kanji – 4 directions
Parts of the body
Japanese political system and economy
Conversation – audio

UNIT V **(4 hours)**

Stationery, fruits and vegetables
Counters – general, people, floor and pairs

TEXT BOOK

1. First lessons in Japanese, ALC Japan.

REFERENCES

1. Japanese for dummies. Wiley publishing co. Inc., USA.
2. Kana workbook, Japan foundation.

LE1010 JAPANESE LANGUAGE PHASE II												
Course designed by		**Department of English and Foreign Languages**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
								x				
2.	Mapping of instructional objectives with student outcome							1-4				
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		X		--		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

LE1011	**KOREAN LANGUAGE PHASE II**	**L**	**T**	**P**	**C**
	Total Contact Hours-30	**2**	**0**	**0**	**2**
	Prerequisite				
	LE1006-Korean Language Phase I				

PURPOSE

To enable students achieve a basic exposure on Korea, Korean language and culture. To acquire basic conversational skill in the language.

INSTRUCTIONAL OBJECTIVES	
1.	To help students learn the scripts.
2.	To make the students acquire basic conversational skill.
3.	To enable students to know about Korean culture.
4.	To create an advantageous situation for the students to have better opportunity for employability by companies who have association with Korea.

UNIT I (**9 hours)**

Lesson 1 <Review of Vowels and Consonants>, Lesson2 < Various Usages of "To be">, Lesson3 < Informal form of "to be"><Basic Conversation, Vocabularies and Listening>

UNIT II (**9 hours)**

Lesson 4< Informal interrogative form of "to be">, Lesson 5 < To be, to have, to stay>, Lesson 5 < Advanced Interrogative practice>, Lesson 6 < Types of Negation>, <Basic Conversation, Vocabularies and Listening>

UNIT III (**9 hours)**

Lesson 7 < Honorific forms of noun and verb2>, Lesson8 < Formal Declarative2>, Lesson 9 < Korean Business Etiquette>, <Basic Conversation, Vocabularies and Listening>

UNIT IV (**3 hours)**

Lesson 10 <Field Korean as an Engineer1>, <Field Korean as an Engineer2><Basic Conversation, Vocabularies and Listening>

TEXT BOOK

1. Korean through English 2(Basic Korean Grammar and Conversation)

REFERENCES

1. Bharati Korean (Intermediate Korean Grammar)
2. Hand-outs
3. Various visual media such Movie CD, Audio CD, and music
4. Collection of vocabularies for engineering field.

LE1011KOREAN LANGUAGE PHASE II												
Course designed by		Department of English and Foreign Languages										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
								x				
2.	Mapping of instructional objectives with student outcome							1-4				
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		X		--		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

LE1012	CHINESE LANGUAGE PHASE II	L	T	P	C
	Total Contact Hours-30	2	0	0	2
	Prerequisite				
	LE1007-Chinese Language Phase I				

PURPOSE

To enable students achieve a basic exposure on China, Chinese language and culture. To acquire basic conversational skill in the language.

INSTRUCTIONAL OBJECTIVES

1.	To help students learn the Chinese scripts.
2.	To make the students acquire basic conversational skill.
3.	To enable students to know about China and Chinese culture.
4.	To create an advantageous situation for the students to have better opportunity for employability by companies who have association with china.

UNIT I

A) Greetings
Questions and answers about names
Introducing oneself
Receiving a guest
Making corrections

New

words:你˨˩˦you˧˩˨好˨˩˦good 'well˧˩˨工作˨˩˦work 'job˧˩˨人员˨˩˦personnel 'staff member˧˩˨请问˨˩˦May I ask…˧˩˨贵˨˩˦expensive 'valuable˧˩˨姓˨˩˦one's family name is ˧˩˨

B) Questions and answers about the number of people in a family
Expressing affirmation/negation
Questions and answers about the identity of a person same or not.

New words: 家ˆfamily 'homeˇ有ˆhaveˇ几ˆseveralˇ
爸爸 (fatherˇ**妈妈** (mother) 哥哥 (elderly brotherˇ

UNIT II

A. About places
B. About numbers
C. if one knows a certain person
D. Expressing apology
E. Expressing affirmation/negation
F. Expressing thanks.

New Words:

客人ˆguest,visitorˇ**这儿**ˆhereˇ中文ˆChineseˇ**对**ˆright, correctˇ学生ˆstudentˇ多ˆmany, a lotˇ

Grammar: Sentences with a verbal predicate

UNIT III

Introducing people to each other

A. Exchanging amenities
B. Making/Negating conjectures
C. Questions and answers about nationality

Grammar: Sentences with an adjectival predicate

UNIT IV

A) About places to go
Indicating where to go and what to do
Referring to hearsay.
Saying good-bye

B) Making a request
Questions and answers about postcodes and telephone numbers
Reading dates postcodes and telephone numbers
Counting Renmibi

Grammar: Sentences with a subject-verb construction as its predicate
Sentences with a nominal predicate

UNIT V

A. Asking and answering if someone is free at a particular time
B. Making proposals
C. Questions about answers about time
D. Making an appointment
E. Telling the time
F. Making estimations

TEXT BOOK

1. A New Chinese Course 1- Beijing Language and Culture University Press.

REFERENCES

1. *"New Practical Chinese Reader Textbook"* (1) – Beijing Language and Culture University Press
2. *"40 Lessons For Basic Chinese Course I"* – Shanghai Translation Press
3. *"My Chinese Classroom"*- East China Normal University Press

LE1012CHINESE LANGUAGE PHASE II												
Course designed by		**Department of English and Foreign Languages**										
1.	Student Outcome	a	b	c	D	e	f	g	h	i	j	k
								x				
2.	Mapping of instructional objectives with student outcome							1-4				
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		X		--		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

PD1004	**APTITUDE-II**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	**1**	**0**	**1**	**1**
	Prerequisite				
	Nil				
PURPOSE					
To enhance holistic development of students and improve their employability skills.					

INSTRUCTIONAL OBJECTIVES	
1.	To improve verbal aptitude, vocabulary enhancement and reasoning ability of the student.

UNIT I **(6 hours)**

Critical Reasoning – Essay Writing

UNIT II **(6 hours)**

Synonyms – Antonyms - Odd Word - Idioms & Phrases

UNIT III **(6 hours)**

Word Analogy - Sentence Completion

UNITIV **(6 hours)**

Spotting Errors - Error Correction - Sentence Correction

UNIT V **(6 hours)**

Sentence Anagram - Paragraph Anagram - Reading Comprehension

ASSESSMENT

1. Objective type – Paper based /Online – Time based test

TEXT BOOK

1. Personality Development -Verbal Work Book, Career Development Centre, SRM Publications

REFERENCE

1. Green Sharon Weiner .M.A & Wolf Ira K.*Barron's New GRE*, *19th Edition*. Barron's Educational Series, Inc, 2011.
2. Lewis Norman, *Word Power Made Easy*, Published by W.R.Goyal Pub, 2011.
3. Thorpe Edgar and Thorpe Showich, *Objective English.* Pearson Education 2012.
4. Murphy Raymond, "*Intermediate English Grammar*, (Second Edition), Cambridge University Press, 2012.

PD1004 - APTITUDE-II												
Course designed by		**Career Development Centre**										
1.	Student Outcome	a	b	c	D	e	f	g	h	i	j	k
								X				
2.	Mapping of instructional objectives with student outcome							1				
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		X		--		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

MA1034	BIOSTATISTICS	L	T	P	C
	Total No. of Contact Hours = 60 Hours	4	0	0	4
	Prerequisite				
	Nil				

PURPOSE:

To develop an understanding of the methods of probability and statistics which are used to model engineering problems.

INSTRUCTIONAL OBJECTIVES:

1.	To gain knowledge in measures of central tendency and dispersion
2.	To appropriately choose, define and/or derive probability distributions such as the Binomial, Poisson and normal distribution to solve engineering problems.
3.	To learn how to formulate and test the hypotheses about means, proportions and standard deviation to draw conclusions based on the results of statistical tests in large sample.
4.	To learn how to formulate and test the hypotheses about means, variances for small samples using t and F test for small sample and have knowledge on ANOVA
5.	To understand the fundamentals of quality control and the methods used to control systems and processes

UNIT I- INTRODUCTION TO BIO-STATISTICS (numerical problems only)
(12 hours)

Handling univariate and bivariate data - Measures of central tendency - Measures of dispersion -Skewness & Kurtosis - Correlation and Regression.

UNIT II- PROBABILITY & THEORETICAL DISTRIBUTIONS (12 hours)

Probability concepts - conditional probability - Baye's theorem - one - dimensional random variables - expectation, variance, moments. Theoretical distributions : Binomial, Poisson, Normal (Problems only).

UNIT III- TESTING OF HYPOTHESIS (12 hours)

Introduction - Large sample tests based on normal distribution - Test for single mean, difference between means - proportion, difference between proportion - standard deviation, difference between standard deviation -Chi-square test for goodness of fit - Independence of attributes.

UNIT IV- ANALYSIS OF VARIANCE (12 hours)

Small sample tests based on t and F distribution - Test for, single mean, difference between means, Paired t-test, test for equality of variances. ANOVA-one -way classification, Two-way classification.

UNIT V- STATISTICAL QUALITY CONTROL (12 hours)

Introduction - Process control - control charts for variables - X and R, X and s charts control charts for attributes : p chart, np chart, c chart.

TEXT BOOK

1. Gupta .S.C and Kapoor .V.K , "*Fundamentals of Mathematical Statistics",* 11th extensively revised edition, Sultan Chand & Sons, 2007.

REFERENCES:

1. Gupta .S.C& Kapoor .V.K, "*Fundamentals of Applied Statistics"*, Sultan Chand and Sons, New Delhi, 2003.
2. Ewans .W &Grant .G, "*Statistical Methods in Bio informatics - An Introduction"*, Springer, 2nd edition,2005.

MA 1034 BIOSTATISTICS												
Course designed by		**Department of Mathematics**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		X				X						
2.	Mapping of instructional objectives with student outcome	1-5				1-5						
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		X		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

CH1242	BASIC CHEMICAL ENGINEERING II – MECHANICAL OPERATION, MOMENTUM AND MASS TRANSFER	L	T	P	C
	Total conducting hours - 45	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE

This course gives the basic knowledge to the students about filtration and agitation operations and behavior of fluids. This course introduce basic principles of molecular diffusion and mechanical operations

INSTRUCTIONAL OBJECTIVES

1.	To understand the basic concepts of filtration and agitation and mixing
2.	To study the nature of fluids and flow characteristics.
3.	To familiarize the mass transfer operations like molecular diffusion
4.	To understand the principles extraction and distillation processes involved in industries.

UNIT I - FILTRATION AND AGITATIO N (10 hours)

Introduction to filtration: Principles of filtration process. filter media, filter aids. Theory of filtration - principles of cake filtration, pressure drop through filter cake, filter-medium resistance, constant pressure filtration, continuous filtration, constant rate filtration. Types of filtration - principle and working of rotary drum filters, suspended batch centrifuges, centrifugal filters. Principles of agitation, agitation equipment, flow patterns, Blending and mixing: blending of miscible liquids.

UNIT II - REACTION ENGINEERING (8 hours)

Principles of Homogeneous reactions – Rate equations- Estimation of rate constants using constant volume and constant pressure. Batch reactor-data for typical reactions – Arrherius equation- Non-elementary reaction kinetics-Multiple reactions-Yield Concepts.

UNIT III - FLUID FLOW PHENOMENA (9 hours)

Nature of fluids: incompressible and compressible, hydrostatic equilibrium, manometers, potential flow, boundary layer, the velocity field, laminar flow, Newtonian and non-Newtonian fluids, Newton's-law of viscosity, turbulence, Reynolds number and transition from laminar to turbulent flow, Eddy viscosity, flow in boundary layers, laminar and turbulent flow in boundary layers, boundary-layer formation in straight tubes.

UNIT IV - MOLECULAR DIFFUSION (8 hours)

Molecular diffusion, steady state molecular diffusion in fluids at rest and in laminar flow, molecular diffusion in gases, Molecular diffusion in liquid, Mass transfer theories- Film theory, boundary layer theory, Penetration theory, Mass Transfer coefficients, Effect of temperature and pressure on diffusivity.

UNIT V - MASS TRANSFER OPERATION (10 hours)

Distillation- flash, simple and stream distillation, Continuous distillation with reflex, MaCabe- thiele method. Extraction-Principle of Extraction, Staged and continuous extraction, Extraction equipments.

TEXT BOOK

1. Octave Levenspiel, "*Chemical Reaction Engineering"*, 3rd Edn., John Wiley & Sons, Singapore, 1999.
2. Warren L. Mccabe, Julian C. Smith and peter Harriott, "*Unit Operations of Chemical Engineering"*, *6th Edition*., McGraw Hill International Edition, NewYork 2001.

REFERENCES

1. Coulson .J.M, Richardson .J.F, Backhurst .J.R and Harker .J.M, "*Coulson & Richardson's Chemical Engineering"*, Vol. I, 6th Edition, Butter worth Heinemann, Oxford, 1999.

CH1242 BASIC CHEMICAL ENGINEERING II – MECHANICAL OPERATION, MOMENTUM AND MASS TRANSFER														
Course designed by		**Department of Chemical Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		x				x				x		x		
2.	Mapping of instructional objectives with student outcome	1-4				1- 4				1-4		1-4		
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		--			X			--		--		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1006	MOLECULAR TECHNIQUES IN GENETIC ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Pre-requisite				
	Nil				

PURPOSE

The course imparts the knowledge on the principles on nucleic acid isolation and purification and PCR application in genetic engineering. It also gives knowledge on history and latest methods of DNA sequencing. This course also deals with the protein – protein interaction and protein sequencing methods.

INSTRUCTIONAL OBJECTIVES

1.	To understand the principle of nucleic acid isolation.
2.	To understand the principles of PCR and their uses in genetic engineering.
3.	To gain a thorough knowledge about nucleic acid hybridization.
4.	To learn history of DNA sequencing and current methods and gene synthesis

UNIT I - NUCLEIC ACID ISOLATION AND AGAROSE GEL ELECTROPHORESIS (9 hours)

Conventional and kit methods for isolation of nucleic acids - Plasmid DNA – Genomic DNA from Bacterial cells, Plant cells, Animal cells – RNA isolation and mRNA purification – Agarose gel electrophoresis – Staining techniques – Pulse field gel electrophoresis

UNIT II - PCR TECHNIQUES (9 hours)

Principle of polymerase chain reaction (PCR) - Components of PCR reaction and optimization of PCR -Gene specific primer and degenerate primer – Inverse PCR, Hot-start PCR, Loop mediated PCR -, Reverse transcription PCR and Real time PCR. Chemistry of primer synthesis.

UNIT III - HYBRIDIZATION METHODS (9 hours)

Probes – Labeling of probes- Radioactive and non-radioactive probes - Detection techniques, Southern hybridization, Northern hybridization, Western blotting

UNIT IV - DNA SEQUENCING AND GENE SYNTHESIS (9 hours)

Sanger's method of DNA sequencing – Manual and automated methods. Pyrosequencing – massively parallel 454-sequencing, Illumina sequencing, SOLiD sequencing, single molecule sequencing.

UNIT V - PROTEIN TECHNIQUES (9 hours)

Electrophoresis of protein – native and denaturing conditions, capillary and gel electrophoresis, 2D gel electrophoresis, ELISA, yeast hybrid system – one hybrid system – two hybrid system, phage display.

TEXT BOOK

1. Joseph Sambrook, David William Russell "*Molecular cloning"*. 3rd Edition, CSHL Press, 2001.

REFERENCES

1. Frederick M. Ausubel, Roger Brent, Robert E. Kingston, David D. Moore, Seidman J. G., John A. Smith and Kevin Struhl, "*Current Protocols in Molecular Biology",* John Wiley& Son, Inc. 2003.
2. Daniel C. Liebler *"Introduction to Proteomics"***,** Humana Press, 2002.

GN1006 MOLECULAR TECHNIQUES IN GENETIC ENGINEERING														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X	X	X		X							
2.	Mapping of instructional objectives with student outcome	1-5	1-5	1-5	1-5		1- 5							
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		X		X			X			X		X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

BT1017	**BIOPROCESS PRINCIPLES**	**L**	**T**	**P**	**C**
	Total Contact Hours -45	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE

This subject puts emphasis on the basic engineering principles of bioprocess. It also highlights the modern application of biotechnological process and the role of bio process engineer in biotechnological industry.

INSTRUCTIONAL OBJECTIVES

1.	To study the historical development of bio process technology ,design of fermenter and types of fermentation process
2.	To gain knowledge about formulation of medium and principles of sterilization
3.	To study the stoichiometry and energetics of cell growth and product formation
4.	To evaluate the kinetics and mechanism of microbial growth

UNIT I - INTRODUCTION TO BIOPROCESS (8 hours)

Historical development of bioprocess technologies, role of bioprocess engineer in the biotechnology industry,, outline of an integrated bioprocess and the various (upstream and downstream) unit operations involved in bioprocesses, generalized process flow sheets. A brief survey of organisms, processes, products and market economics relating to modern industrial biotechnology- economics of citric acid manufacture.

UNIT II - FERMENTER & FERMENTATION PROCESS (9 hours)

Basic design and construction of fermenter and ancillaries- Tasks of fermenter, General requirements of fermentation processes; Isolation, preservation and improvement of industrially important microorganisms, inoculum development for industrial fermentations. Types of fermentations - An overview of aerobic and anaerobic fermentation processes and their application in the biotechnology industry, submerged and solid-state fermentation and its applications.

UNIT III - MEDIA DESIGN AND STERILIZATION KINETICS (9 hours)

Formulation of media for fermentation processes, Types of media- design and usage of various commercial media for industrial fermentations, media optimization- Plackett Burman screening method- Response surface methodology (RSM), Thermal death kinetics of micro organisms, batch and continuous heat sterilization of liquid media, filter sterilization of liquid media and air.

UNIT IV - METABOLIC STOICHIOMETRY AND ENERGETICS (9 hours)

Stoichiometry of cell growth and product formation, elemental balances, degrees of reduction of substrate and biomass available, electron balances, yield coefficient of biomass and product formation, maintenance coefficients, energetics analysis of microbial growth and product formation, oxygen consumption and heat evolution in aerobic cultures, thermodynamic efficiency of growth.

UNIT V-MICROBIAL GROWTH AND PRODUCT FORMATION KINETICS(10 hours)

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, Leudking - Piret models, substrate and product inhibition on cell growth and product formation.

REFERENCES

1. Stanbury.P.F, Whitaker .A and Hall .S.J, "*Principles of Fermentation Technology"*, 2nd Edition, Butterworth– Heinemann, 1995.
2. Pauline.M.Doran., "*Bioprocess Engineering Principles*;" Academic press, 2012.
3. Shuler.M.L and Kargi .F, "*Bioprocess Engineering: Basic Concept*" 2nd Edition, Pearson, 2002.
4. Bailey.J.E and Ollis .D.F, "*Biochemical Engineering Fundamentals"*, 2nd Edition, McGraw-Hill, 1986.
5. Blanch, H.W. and D.S. Clark. "*Biochemical Engineering",*. Marcel & Dekker, Inc., 1997.

BT1017 BIOPROCESS PRINCIPLES														
Course designed by		Department of Biotechnology												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		x				X				x	X			
2.	Mapping of instructional objectives with student outcome	3,4				1-4				1-4	2,3,4			
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		--			X			--		--		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1007	MOLECULAR TECHNIQUES LABORATORY	L	T	P	C
	Total Contact Hours - 60	0	0	4	2
	Prerequisite				
	Nil				

PURPOSE

The course imparts practical knowledge on Nucleic acid isolation, digestion and ligation. This course also gives knowledge on Transformation and recombinant selection

INSTRUCTIONAL OBJECTIVES

1.	To learn DNA isolation and electrophoresis
2.	To learn restriction digestion and ligation
3.	To learn PCR and PCR optimization
4.	To learn transformation and blue-white screening for recombinant clones

EXPERIMENTS

1. Agarose gel electrophoresis
2. Plasmid DNA isolation
3. Genomic DNA isolation
4. Quantification of nucleic acids
5. Restriction digestion
6. Designing gene specific primers using suitable software
7. PCR
8. Competent cell preparation
9. Transformation
10. Blue-white selection for recombinant clones

REFERENCES

1. Joseph Sambrook, David William Russell, "*Molecular cloning"* 3rd Edition, CSHL Press, 2001.
2. Laboratory Manual

GN1007 MOLECULAR TECHNIQUES LABORATORY														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X	X	X		X							
2.	Mapping of instructional objectives with student outcome	1- 4	1- 4	1- 4	1- 4		1- 4							
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering			Applied Genetics	
		X		X			X			X			X	
5.	Approval	23rd Meeting of Academic Council, May 2013												

	BIOPROCESS AND ENZYME TECHNOLOGY LABORATORY	**L**	**T**	**P**	**C**
GN1008	Total Contact Hours - 60	**0**	**0**	**4**	**2**
	Prerequisite				
	Nil				

PURPOSE

Enables the student to develop their skills in the field of microbial fermentation technology and enzyme kinetics.

INSTRUCTIONAL OBJECTIVES

1.	To develop their practical skills in microbial fermentation techniques.
2.	To evaluate enzyme kinetics.
3.	To carry out enzyme immobilized reaction.
4.	To develop the practical skills in solid substrate fermentation in wine production.

LIST OF EXPERIMENTS

1. Isolation of microbial enzymes from soil sample (Plate assay)
2. Media design and optimization technique (Plackett burman method)
3. Spectrophotometric estimation of protein and enzyme.
4. Effect of amount of enzyme in kinetics of enzyme
5. Effect of substrate concentration in kinetics of enzyme
6. Determination of optimum pH of enzyme
7. Determination of optimum temperature enzyme
8. Enzyme immobilization
9. Enzyme hydrolysis of substrate by immobilized method
10. Production of wine by solid state fermentation

REFERENCE

1. Laboratory Manual

GN1008 BIOPROCESS AND ENZYME TECHNOLOGY LABORATORY														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X									X		
2.	Mapping of instructional objectives with student outcome	1-4	1,2									1,4		
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering		Plant Genetic Engineering			Applied Genetics		
		--		--			X		--			--		
5.	Approval	23rd Meeting of Academic Council, May 2013												

SEMESTER - V

	APTITUDE-III	L	T	P	C
PD1005	Total Contact Hours - 30	**1**	**0**	**1**	**1**
	Prerequisite				
	Nil				

PURPOSE

To enhance holistic development of students and improve their employability skills.

INSTRUCTIONAL OBJECTIVES

1.	Understand the importance of effective communication in the workplace.
2.	Enhance presentation skills – Technical or general in nature.
3.	Improve employability scope through Mock GD, Interview

UNIT I **(6 hours)**

Video Profile

UNIT II **(6 hours)**

Tech Talk / Area of Interest / Extempore / Company Profile

UNIT III **(6 hours)**

Curriculum Vitae

UNIT IV **(6 hours)**

Mock Interview

UNIT V **(6 hours)**

Group Discussion / Case Study

ASSESSMENT

1. Objective type – Paper based / Online – Time based test
2. 50% marks based on test, 50 % based on Continuous Communication assessment

REFERENCE

1. Bovee Courtland and Throill John, *Business Communication Essentials: A skills-Based Approach to Vital Business English*. Pearson Education Inc., 2011.
2. Dhanavel.S.P, *English & Communication Skills for Students of Science and Engineering*. Orient Black Swan, 2009.
3. Rizvi M. Ashraf *Effective Technical Communication*, Tata McGraw-Hill Publishing Company Limited, 2006.

PD1005 – APTITUDE-III												
Course designed by		Career Development Centre										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
								X		X	X	
2.	Mapping of instructional objectives with student outcome							1,2,3		1,2		2,3
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		X		--		--				--		
4.	Approval	23rd Meeting of Academic Council, May 2013										

GN1009	RECOMBINANT DNA TECHNOLOGY	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To help the students to learn about different enzymes and vectors used in cloning and how to use them to design different cloning strategies for creating recombinant DNAs which are central to genetic engineering of any organisms including bacteria, plants and animals.

INSTRUCTIONAL OBJECTIVES

1.	To understand the functions of several enzymes and vectors used in cloning
2.	To be able to devise their own cloning strategies DNAs and PCR products
3.	To be able to construct cDNA and genomic DNA libraries
4.	To learn to construct recombinant DNAs suitable for expression and purification of recombinant proteins in *E.coli* and yeast
5.	To learn to construct expression vectors for plants and animal cells

UNIT I - MOLECULAR TOOLS FOR GENE CLONING (12 hours)

Restriction enzymes – introduction and types with examples, methylation sensitivity of restriction enzymes Dam, Dcm and CpG methylases, star activity of restriction enzymes, Ligases – Ecoli DNA ligase, T4 DNA ligase, T4 RNA ligase, polynucleotide kinase, phosphatases, DNA and RNA polymerases, reverse transcriptase, terminal transferase, DNAses-Exonuclease I, Exonucelase III, Mung Bean Nuclease. RNases-RNaseI, RNaseA, RNaseH, Topoisomerase.

UNIT II - VECTORS FOR GENE CLONING (8 hours)

Introduction to cloning vectors, plasmid biology, plasmid vectors (high copy and low copy), phage biology, phage vectors, cosmid vectors, phasmid vectors, BAC vectors and YAC vectors, yeast vectors.

UNIT III - CLONING TECHNIQUES (8 hours)

Cloning after restriction digestion - blunt and cohesive end ligation – creation of restriction sites by PCR- cloning using linkers and adapters - cloning after homopolymer tailing. Strategies for cloning PCR products – TA cloning -TOPO-TA cloning- Ligation free cloning.

UNIT IV - CONSTRUCTION OF GENE LIBRARIES (9 hours)

Construction of cDNA library- construction subtractive cDNA library – construction of genomic DNA library – BAC library – YAC library**.**

UNIT V - EXPRESSION OF RECOMBINANT PROTEIN (8 hours)

Construction of expression vectors for bacteria and yeast -general features, promoters used in expression vectors -cloning of genes in correct reading frame in expression vector- purification of recombinant protein using Histidine tag, GST tag, chitin binding domain and intein. Construction of expression vectors for plants and animal cells. Bias in codon use and codon optimization.

TEXT BOOK

1. Brown .T.A,*"Gene Cloning – An Introduction",* 4th Edition, Wiley-Blackwell, 2011.

REFERENCES

1. Joseph Sambrook, David William Russell "*Molecular cloning"*. 3rd Edition, CSHL Press, 2001.

GN1009 RECOMBINANT DNA TECHNOLOGYI														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X		X									
2.	Mapping of instructional objectives with student outcome	1-5	1-5		1-5									
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering		Plant Genetic Engineering			Applied Genetics		
		X		--			--		--			X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1010	HUMAN GENETICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This course emphasizes on the current theories of mechanisms of inheritance and their implications for both basic knowledge on human diseases and its application in genetic mapping and genetic testing.

INSTRUCTIONAL OBJECTIVES

1.	To import knowledge on inheritance patterns in simple and complex genetic disorders.
2.	To describe normal chromosome number, structure, and understand the cause and effect of alterations in chromosome number and/or structure
3.	To develop knowledge on identifying disease genes for new diseases using mapping techniques, linkage analysis and positional cloning.
4.	To understand the cause of disease at molecular level and association between mutation and disease.
5.	To develop knowledge required for managing genetic diseases and birth defects.

UNIT I - GENOME ORGANIZATION AND INHERITANCE (9hours)

Organization, Human multigene families and repetitive coding DNA, Extragenic repeated DNA sequences and transposable elements, Inheritance-Autosomal Dominant Inheritance-Autosomal Recessive Inheritance- Factors that May Complicate Inheritance Patterns- Consanguinity in Human Populations, Sex-Linked and Mitochondrial Inheritance, X inactivation- Sex-Linked Inheritance- Sex-Limited and Sex-Influenced Traits- Mitochondrial Inheritance.

UNIT II - MEDICAL GENETICS (9 hours)

The Chromosomal Basis of Human Disease- Nomenclature-Abnormalities of Chromosome Number and Structure - Pregnancy Loss, Cell cycle and Cancer genetics- Cancer Genes- Oncogenes, Activation of proto-oncogenes, Tumor suppressor genes.

UNIT III - GENETIC MAPPING AND GENE IDENTIFICATION (12 hours)

Genetic Markers. Physical Mapping – Low resolution physical mapping, High resolution physical mapping. Genetic Mapping – Two point mapping, Multipoint mapping. Family based Linkage analysis – Parametric and Nonparametric. Position Cloning - Position dependent and independent strategies, methods and Principle. Population genetics – Hardy Weinberg equilibrium - Sib pair analysis.

UNIT IV - MOLECULAR PATHOLOGY (8 hours)

Types and Nomenculature of Mutations – Loss of function mutations in p53 – Gain of function mutations in AAT. Copy number variations. Mosaicism. Molecular pathology: from gene to disease, disease to gene, chromosomal disorders.

UNIT V - MOLECULAR DIAGNOSTICS OF GENETIC DISEASES (7 hours)

Genetic Screening, Genetic Diagnosis, Molecular Tools for Screening and Diagnosis, Prenatal Diagnosis of Genetic Disorders and Congenital Defects, Pedigree analysis.

TEXT BOOK

1. Tom Strachan and Andrew P. Read, *"Human Molecular Genetics",* Garland Publishing, Incorporated, 2004.

REFERENCES

1. Jack J. Pasternak, *"An Introduction to Human Molecular Genetics",* Wiley-Liss, John Wiley & Sons, Inc., Second Edition 2005.
2. Jorde, Carey, Bamshad & White , *"Medical Genetics",* Mosby Elsevier Inc, 4th Edition, 2010.
3. Bruce R. Korf, *"Human Genetics and Genomics"*, Blackwell Science Ltd, Third Edition,2006.
4. Friedrich Vogel and Arno G. Motulsky "*Human Genetics: Principles and Approaches*", Springer, Third Edition, 1997.

GN1010 HUMAN GENETICS														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X	X			X							
2.	Mapping of instructional objectives with student outcome	3	3	4 & 5			4 & 5							
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		--			--			--		X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1011	**PLANT GENETIC ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

Today, the world population is growing at an alarming rate and hence agricultural production has to be increased to feed the growing population. Genetic engineering of plants offers new avenues in this regard by drastically enhancing the crop production through transformation of suitable genes. This course enlightens the students on how to create the transgenic crops and thus enhance productivity.

INSTRUCTIONAL OBJECTIVES	
1.	To learn how to work in plant tissue culture lab.
2.	To mass propagate the plants through tissue culture methods.
3.	To gain knowledge on the production of transgenic plants through various methods.
4.	To understand the applications of genetically modified crops in various fields.
5.	To know about legal issues concerned with cultivation and commercialization of transgenic plants.

UNIT I-INTRODUCTION TO PLANT TISSUE CULTURE (7 hours)

History-tissue culture lab-establishing aseptic conditions - types of media and their preparation -plant hormones-organogenesis –direct and indirect (meristem /shoot apex culture, callus and suspension culture)

UNIT II-TISSUE CULTURE METHODS AND THEIR APPLICATIONS (8 hours)

Significance and application of another culture,ovule culture, embryo culture - somatic embryogenesis-protoplast fusion- somaclonal variation-artificial seeds-micropropagation

UNIT III-METHODS OF PLANT TRANSFORMATION (10 hours)

Biology of *Agrobacteriumtumefaciens*- plant transformation methods - stable and transient -Agrobacterium-mediated,biolistic, PEG/liposome-mediated, electroporation, chloroplast transformation, protoplast transformation, site directed integration of transgene (zinc finger).

UNIT IV-PLANT TRANSFORMATION VECTORS (10 hours)

Binary and co-integrate vectors- gateway vectors - promoters - selectable and screenable markers - marker free transgenics -significance and applications.

UNIT V-TRANSGENIC PLANTS (10 hours)

Biotic and abiotic stress tolerant transgenic plants (Bt cotton, roundup ready soybean), blue rose, vitamin A fortified rice, metabolic engineering-oil and secondary metabolite production, production of edible vaccines and other biotech drugs in transgenic plants.

TEXT BOOK

1. Razdan .M.K, "*Introduction to Plant Tissue Culture"* second edition, Science Publishers, 2003.

REFERENCES

1. Adrian Slater, Nigel W. Scott, Mark R. Fowler, *"Plant Biotechnology-The Genetic Manipulation of Plants"* third edition, Oxford University Press, 2008.

GN 1011 PLANT GENETIC ENGINEERING														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
			X	X	X				X		X			
2.	Mapping of instructional objectives with student outcome		1-4	4			4	4,5			5			
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering		Plant Genetic Engineering			Applied Genetics		
		--		--			--		X			--		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1012	ENZYME ENGINEERING	L	T	P	C
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

The course should help the students to understand the basics of enzymes mechanisms of enzyme action and its application in the various fields. This course facilitates the students to troubleshoot the real time industrial problems with the help of their knowledge acquired on enzyme kinetics and various purification methods.

INSTRUCTIONAL OBJECTIVES	
1.	To understand about enzyme structure and its applications
2.	To acquire knowledge on the kinetics of single substrate enzymatic reactions.
3.	To have the ability to solve the enzyme kinetics related problems.
4.	To know about enzyme immobilization and its specialized application in the industry.
5.	To have the ability to assay the enzyme in the unknown samples.

UNIT I-INTRODUCTION TO ENZYMES (7 hours)

Introduction to Enzyme: Classification of enzymes, specificity of enzyme action - Structural Components of Enzymes : Active site and Allosteric site, Involvement of apoenzymes, prosthetic group, cofactors in activity of enzyme - Factors affecting enzyme activity - Application of enzyme in clinical diagnosis, enzyme therapy and in various industries.

UNIT II-MECHANISM AND KINETICS (10 hours)

Mechanism of enzyme action: Concept of active site and energetic of enzyme - Enzyme substrate complex formation: Lock and Key, Induced fit and transition model - Enzyme Kinetics: Single andmulti-substrate enzyme kinetics, Estimation of Michaelies-Menton parameter and turnover number, Significance of Michaelies-Menton parameters in industry.

UNIT III-ENZYME INHIBITION AND KINETICS (10 hours)

Enzyme Inhibition: Type of Inhibition, Kinetic model for different types of enzyme inhibition: Competitive inhibition, Uncompetitive and Noncompetitive inhibition, Enzyme deactivation kinetics, Allosteric regulation of enzyme. Current application of enzyme inhibitor in different fields

UNIT IV-ENZYME IMMOBILIZATION (10 hours)

Types of enzyme immobilization-matrix entrapment, ionic and cross linking, column packing; Analysis of mass transfer effects of kinetics of immobilized enzyme reactions; Analysis of Film and Pore Diffusion Effects on Kinetics of immobilized enzyme reactions;calculation of Effectiveness Factors of immobilized enzyme systems; Bioconversion studies with immobilized enzyme packed -bed reactors

UNIT V-ENZYME ASSAY **(8 hours)**

Photometric assays: Absorption, Turbidity and Fluorescence - Radiometric assays: Scintillation Proximity Assay (SPA) - Electrochemical assays using oxygen electrode and pH stat.

TEXT BOOK

1. Trevor Palmer and Philip L Bonner, "*Enzymes: Biochemistry, Biotechnology And Clinical Chemistry"* 2nd edition, Woodhead Publishing, 2007.

REFERENCES

1. Robert A. Copeland, "*Enzymes: A Practical Introduction to Structure, Mechanism, and Data Analysis"* 2nd edition, Wiley, John & Sons, 2001.
2. Robert Eisenthal and Michael J. Danson, "*Enzyme Assays: A Practical Approach"*, 2nd edition, Oxford University Press, 2002.
3. Paul F. Cook, Cleland .W.W, "*Enzyme Kinetics and Mechanism",* Garland Science, 2007.

GN1012 ENZYME ENGINEERING														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
			X			X								
2.	Mapping of instructional objectives with student outcome		5			1,23,4								
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		--			X			--		--		
5.	Approval	23rd Meeting of Academic Council, May 2013												

	RECOMBINANT DNA TECHNOLOGY LABORATORY	L	T	P	C
GN1013	Total Contact Hours – 60	**0**	**0**	**4**	**2**
	Prerequisite				
	Nil				

PURPOSE

This course offers an opportunity to practically learn all basic techniques of gene cloning right from DNA to verification cloning by restriction digestion, sequencing and BLAST.

INSTRUCTIONAL OBJECTIVES

1.	To learn to prepare DNA for cloning work
2.	To learn cloning of restriction fragment and PCR products
3.	To learn DNA sequencing

LIST OF EXPERIMENTS

1. DNA isolation for the vector and insert
2. Digestion and checking on the gel
3. Gel elution and setting up ligation
4. Transformation
5. Verification of cloning by colony PCR and patching the positive colonies
6. Plasmid isolation from PCR positive colonies
7. Confirmation of cloning by restriction digestion
8. Set up DNA sequencing reaction and purification of reaction product
9. Demo on DNA sequencing machine and loading for sequencing
10. Sequence Editing & confirmation of cloning by BLAST analysis

REFERENCES

1. Laboratory Manual.
2. Joseph Sambrook, David William Russell "*Molecular cloning"*. 3rd Edition, CSHL Press, 2001.

GN1013 RECOMBINANT DNA TECHNOLOGY LABORATORY														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X	X	X		X							
2.	Mapping of instructional objectives with student outcome	1-3	1-3	1-3	1-3		1-3							
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		--			--			--		X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1014	PLANT GENETIC ENGINEERING LABORATORY	L	T	P	C
	Total Contact Hours - 60	0	0	4	2
	Prerequisite				
	Nil				

PURPOSE

The objective of the course is to provide hands on training in engineering the transgenic plants and vectors for transformation. It has emerged as an important tool for crop improvement in agriculture. Biotechnology companies and research centers with crop improvement programs require expertise in recombinant DNA technology and plant genetic engineering and this would be advantageous to the students.

INSTRUCTIONAL OBJECTIVES

1.	To grow the plants aseptically in lab.
2.	To create a transgenic plant.
3.	To confirm the transgenic plants with assays.
4.	To Select and subculture the plant in the lab condition

LIST OF EXPERIMENTS

1. Preparation of Tissue Culture Media
2. Aseptic germination of seeds
3. Callus induction from leaf and seeds explants.
4. Transformation of *Agrobacterium* with binary vector
5. *Agrobacterium*-mediated transformation of tobacco leaf discs
6. Co-cultivation, selection, and regeneration of transgenic plants
7. Screening of transgenic plants by using GUS/GFP marker
8. Screening of transgenic plants by PCR.

REFERENCE

1. Lab Manual

GN1014 PLANT GENETIC ENGINEERING LABORATORY														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
			X	X	X				X		X			
2.	Mapping of instructional objectives with student outcome		1,2,3	4			4	4,5			5			
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering		Plant Genetic Engineering			Applied Genetics		
		--		--			--		X			--		
5.	Approval	23rd Meeting of Academic Council, May 2013												

	INDUSTRIAL TRAINING I (Training to be undergone after IV semester)	**L**	**T**	**P**	**C**
GN1047	2 week practical training in industry	**0**	**0**	**1**	**1**
	Prerequisite				
	Nil				
PURPOSE					
To provide hands-on experience at site / planning or design office where civil engineering projects are carried out					

INSTRUCTIONAL OBJECTIVES	
1.	Students have to undergo two – week practical training in Genetic Engineering / Life Science related project so that they become aware of the practical application of theoretical concepts studied in the class rooms.

Students have to undergo two-week practical training in Genetic Engineering / Life Science related project of their choice but with the approval of the department. At the end of the training student will submit a report as per the prescribed format to the department.

Assessment process

This course is mandatory and the student has to pass the course to become eligible for the award of degree. The student shall make a presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made. Marks will be awarded out of 100 and appropriate grades assigned as per the regulations.

GN1047 INDUSTRIAL TRAINING I												
Course designed by		Department of Genetic Engineering										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
					X		X	X	X	X	X	
2.	Mapping of instructional objectives with student outcome				1	1	1	1	1	1	1	
3.	Category	General (G)		Basic Sciences(B)		Engineering Sciences and Technical Arts (E)				Professional Subjects (P)		
		--		--		--				X		
4.	Approval	23rd Meeting of Academic Council, May 2013										

SEMESTER - VI

PD1006	**APTITUDE-IV**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	**1**	**0**	**1**	**1**
	Prerequisite				
	Nil				

PURPOSE

To enhance holistic development of students and improve their employability skills.

INSTRUCTIONAL OBJECTIVES

1.	To improve aptitude, problem solving skills and reasoning ability of the student.
2.	To collectively solve problems in teams & group.

UNIT I - ARITHMETIC II **(6 hours)**

Ratios & Proportions, Averages, Mixtures & Solutions

UNIT II - ARITHMETIC III **(6 hours)**

Time, Speed & Distance, Time & Work

UNIT III - ALGEBRA II **(6 hours)**

Quadratic Equations, Linear equations & inequalities

UNIT IV – GEOMETRY **(6 hours)**

2D Geometry, Trigonometry, Mensuration

UNIT V – MODERN MATHEMATICS II **(6 hours)**

Sets & Functions, Sequences & Series, Data Interpretation, Data Sufficiency

ASSESSMENT

1. Objective type – Paper based / Online – Time based test

REFERENCES

1. Agarwal.R.S,*"Quantitative Aptitude for Competitive Examinations",* S Chand Limited 2011
2. Abhijit Guha*, Quantitative Aptitude for Competitive Examinations,* Tata Mcgraw Hill, 3rd Edition
3. Edgar Thrope*, Test Of Reasoning For Competitive Examinations,* Tata Mcgraw Hill, 4th Edition
4. *Other material related to quantitative aptitude*

PD1006 - APTITUDE-IV												
Course designed by		**Career Development Centre**										
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k
		X			X							
2.	Mapping of instructional objectives with student outcome	1			2							
3.	Category	General (G)		Basic Sciences(B)			Engineering Sciences and Technical Arts(E)				Professional Subjects(P)	
		X										
4.	Broad Area	-		-			-					
		--		--			--				--	
5.	Approval	23rd Meeting of Academic Council, May 2013										

	BIOPROCESS ENGINEERING	L	T	P	C
BT1027	Total Contact Hours – 45	**3**	**0**	**0**	**3**
	Prerequisite				
	BT1015 –Bioprocess Principles				

PURPOSE

This subject deals with the design, analysis monitoring, modelling and simulation aspect of bioreactors.

INSTRUCTIONAL OBJECTIVES

1.	To strengthen the knowledge on design, performance and stability of bioreactors
2.	To understand the mass transfer process and bioreactor scale up
3.	To learn about the methods of on line and off line monitoring of bio process
4.	To acquire knowledge about the fundamentals of modeling and simulations of bio process

UNIT I-DESIGN AND ANALYSIS OF BIOREACTORS (9 hours)

Introduction to ideal reactors –performance equations, Non-ideal reactors- Tanks-in-series and Dispersion models-applications to design of continuous sterilizers; Design and operation of novel bioreactors-Air-lift loop reactors; Fluidized bed bioreactors; Stability analysis of bioreactors.

UNIT II-BIOREACTOR SCALE-UP (10 hours)

Transport phenomena in Bioprocess systems- Oxygen transfer in fermentation broth, Rheological effects, Regime analysis of bioreactor processes, Correlations for oxygen transfer; Scale-up criteria for bioreactors based on oxygen transfer and power consumption.

UNIT III-MONITORING OF BIOPROCESSES (9 hours)

On-line data analysis for measurement of physico-chemical and biochemical parameters; Methods of on-line and off-line biomass estimation; microbial calorimetry; Flow injection analysis for measurement of substrates, products and other metabolites; State and parameter estimation –Observer, Kalman filters, ANN; Computer-based data acquisition, monitoring and control-LABVIEW Software.

UNIT IV-RECOMBINANT CELL CULTIVATION (8 hours)

Recombinant cell culture processes- guidelines for choosing host-vector systems, plasmid stability and instability model, limits to over expression, Modeling of recombinant bacterial cultures; Bioreactor strategies for maximizing product formation. Bioreactor configurations for cultivation of animal and plant cells, Secondary metabolites from plant and animal cell cultures.

UNIT V-MODELLING AND SIMULATION OF BIOPROCESSES (9 hours)

Formulation of model, Study of Structured Models – Willam's two compartment model- Ramakrishna model- Metabolic model- Single cell model. Model simulation using MATLAB, SIMULINK and ISIM software packages, Dynamic simulation of batch, continuous and fed batch fermentation process,

TEXT BOOKS

1. Shuler.M.L and Kargi .F, "*Bioprocess Engineering: Basic Concepts*" 2nd Edition. Pearson, 2002.
2. Pauline.M.Doran., "*Bioprocess Engineering Principles*"; Academic press, 1995.

REFERENCES

1. Najaf pour.G.D, "*Biochemical Engineering and Biotechnology*", Elsevier, 2007.
2. Blanch.H.W and Clark D.S, "*Biochemical Engineering*". Marcal & Dekker, Inc., 1997.
3. James M Lee. "*Biochemical Engineering*", Prentice – Hall, 1992.
4. Bailey.J.E and Ollis.D.F, "*Biochemical Engineering Fundamentals*", 2nd Edition, McGraw-Hill, 1986.
5. Scragg.A.H, "*Bioreactors in Biotechnology*"- A Practical approach.
6. Alba .S, Humphrey E and Milli .N.R, "*Biochemical Engineering*" Academic Press, 1973.

BT1027 BIOPROCESS ENGINEERING														
Course designed by		Department of Biotechnology												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		x				X				x				
2.	Mapping of instructional objectives with student outcome	2-4				1-4				1-4				
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		--			X			--		--		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1015	BIOSEPARATION ENGINEERING	L	T	P	C
	Total Contact Hours – 30	2	0	0	2
	Prerequisite				
	Nil				

PURPOSE

The course provides a sound knowledge on the biomolecules separation from various biological systems. The detailed study with problematic approach on cell disruption of intracellular components, Filtration, Centrifugation. Analysis of protein content using PAGE, spectrophotometers and protein structure prediction using Mass spectrometry.

INSTRUCTIONAL OBJECTIVES	
1.	To analyze the biological activity of the sample and calculate the purity of the protein
2.	To calculate process-profit cost analysis for any purification techniques
3.	To understand the concept of Filtration, precipitation and extraction
4.	To choose suitable chromatographic techniques to purify the given protein sample
5.	To identify and quantify the protein separated using spectrometric analysis
6.	To design purification strategies for recombinant protein production.

UNIT I - SEPARATION OF BIOMOLECULES- INTRODUCTION (5 hours)

Overview of Unit operations involved in separation of biomolecules. Problems and requirements of bioproduct purification. Characteristics of biological mixtures, Biological activity - Analysis and purity, Process economics - Capital and operating cost analysis.

UNIT II - CELL DISRUPTION AND PRODUCT SEPARATION (6 hours)

Cell disruption methods for intracellular products, Product separation by flocculation, sedimentation and centrifugation techniques.

UNIT III - FILTRATION, PRECIPITATION AND EXTRACTION (6 hours)

Membrane based separations - Micro filtration and ultra-filtration theory, Precipitation methods (with salts, organic solvents, and polymers), organic and aqueous two-phase extraction.

UNIT IV - CHROMATOGRAPHIC AND ELECTROPHORETIC SEPARATION (7 hours)

Working principle and application of SDS PAGE, Electroelution, and Principles in various chromatographic techniques: Ion exchange (IEX), Chromotofocussing, Hydrophobic interaction (HIC), Gel filtration (GF), Reversed phase (RPC), Expanded bed adsorption (EBA), FPLC: Instrumentation and analysis of result.

UNIT V - CHALLENGES IN PROTEIN PURIFICATION (6 hours)

Membrane proteins: Purification of integral membrane proteins for structural and functional studies, Inclusion bodies: Solubilization of inclusion bodies, refoldingof solubilized recombinant proteins**.** Scale-up to large-scale purification. Protein Purification Strategies with examples,

TEXT BOOK

1. Belter .P.A and Cussler E, "*Bioseparations*", Wiley, 1985.

REFERENCE BOOK

1. Roger .G Harrison et al, "*Bioseparation Science and Engineering*" Oxford University Press, 2003.
2. Daniel C Liebler, Introduction to "*proteomics – A tools to new biology".* Humana Press, 2002.

GN1015 BIOSEPARATION ENGINEERING														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X			X								X
2.	Mapping of instructional objectives with student outcome	1-6	1,5			3-6								2-6
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering			Applied Genetics	
		--		--			X			--			--	
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1016	**STEM CELL BIOLOGY AND GENE THERAPY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

Stem Cell Biology and Gene Therapy are the recent advancements in the field of Genetic Engineering. The course introduces the students to the basics of stem cells and gene therapy. The students will also be aware of the therapeutic uses of stem cells and what kinds of future treatments are required in the field. The course also imparts advanced knowledge on gene therapy, viral and non-viral vectors and its construction. The course also helps students to know the applications and technical difficulties in developing a gene product.

INSTRUCTIONAL OBJECTIVES	
1.	To gain knowledge about different types of stem cells and their characteristics.
2.	To understand about embryonic stem cells and adult stem cells and the role of signalling pathways in the control of stem cell fate.
3.	To gain knowledge on cancer stem cells and understand the application of stem cells in treatment of different diseases and the recent advancements in the field of stem cell research.
4.	To know the history and types of gene therapy and the problems involved.
5.	To gain thorough knowledge about the different types of vectors, its working efficiency and analyse the significance of different methods of gene therapy.
6.	To understand the applications and technical difficulties of gene therapy in clinical use

UNIT I - STEM CELL BASICS (9 hours)

Origin of stem cells- Early development of embryo- Formation of stem cells- Totipotent, Pluripotent, Multipotent cells - Unique properties of stem cells. Types of stem cells-embryonic stem cells - adult stem cells – induced pluripotent stem cells- tumour stem cells-umbilical cord stem cells - similarities and differences between embryonic and adult stem cells. Laboratory tests to identify ES and adult stem cells

UNIT II - EMBRYONIC AND ADULT STEM CELLS (10 hours)

ES,EC,EG cells-Mouse embryonic stem cell differentiation. Adult stem cell differentiation –plasticity and transdifferentiation - different types of adult stem cells. Notch, Wingless-type (Wnt), Sonic hedgehog (Shh), and Smad pathways. Epigenetic control of stem cells – Zinc finger proteins control of stem cells.

UNIT III - CANCER STEM CELLS AND THERAPEUTIC APPLICATION OF STEM CELLS (9 hours)

Cancer stem cells – Cancer Biomarkers. Therapeutic applications – Parkinson's disease - cardiovascular disease - spinal cord injuries - diabetes –burns. Novel sources of stem cells-Recent advances in stem cells.

UNIT IV - PRINCIPLES, CONCEPTS AND TYPES OF GENE THERAPY (8 hours)

Gene therapy – Principles and Concepts. *Ex vivo* and *in vivo* gene therapy-somatic gene therapy – prenatal and fetal - preimplantation genetic diagnosis-germ line gene therapy.

UNIT V - VECTORS AND APPLICATIONS OF GENE THERAPY (9 hours)

Viral- Retro, adeno, adeno associated and herpes virus-non-viral agents. Gene therapy strategies - suicide, substrate reduction, ribozyme and secretion gene therapy. Genetic disorders- Gene therapy for diseases- cancer- cardiovascular - neurological disorders. Recent advances in gene therapy.

TEXT BOOKS

1. Peter J. Quesenberry, *"Stem Cell Biology and Gene Therapy"*, John Wiley & Sons, Inc., 1998.
2. Stewart Sell, *"Stem Cells Handbook".* Humana Press, 2004.
3. Robert Lanza, *"Essentials of Stem Cell Biology"*, 2nd Edition, Academic Press, 2009.

REFERENCES

1. Joseph Sambrook, David William Russell "*Molecular cloning"*. 3rd Edition, CSHL Press, 2001.
2. Daniel C. Liebler, *"Introduction to Proteomics",* Humana press, 2002.
3. Ann. A. Kiessling and Scott C. Anderson, *"Human Embryonic Stem Cells",2*nd Edition, Jones and Bartlett Learning, 2006.
4. Nancy Smith Templeton**, *"***Gene and Cell therapy"*,3rd Edition, CRC Press, 2009.
5. Evelyn B. Kelly. *"Gene Therapy"*, 1st Edition. Greenwood, 2007.

GN1016 STEM CELL BIOLOGY AND GENE THERAPY														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X		X	X		X	X	X	X	X		X	
2.	Mapping of instructional objectives with student outcome	1,2		2-4	2		3,5, 6	3,5	3,5	2,3, 5	2,3 ,5		3,5	
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		X			--			--		--		
5.	Approval	23rd Meeting of Academic Council, May 2013												

	SEMINAR/WORKING MODEL	L	T	P	C
GN1017	Total Contact Hours – 30	0	0	2	1
	Prerequisite				
	Nil				

PURPOSE

The main aim of this course is to incite the creativity and originality of thinking in students. Students either have to design a working model for a biological mechanism or give an oral power point presentation in any of the given topics in Genetic Engineering.

INSTRUCTIONAL OBJECTIVES

1.	To design a working model based on biological mechanism, which the students have studied in previous semesters which are related to bioengineering.
2.	To give an oral power point presentation in any given topic

WORKING MODEL

Working model will be made by the students individually or in groups with the given topic related to genetic engineering. The model should be dynamic and static models are not considered for final assessment. Working models are exhibited on a single day and are evaluated by the expert committee

SEMINAR

The students can select topics related to genetic engineering in consultation with faculty; they should present the topics in power point format. Seminars should be presented by the students individually. Presentation will be given weekly and reviewed by panel members

REFERENCE

1. Journals and Online resources.

GN1017 SEMINAR/WORKING MODEL														
Course designed by		Department of Genetic Engineering												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X							X	X	X	X	
2.	Mapping of instructional objectives with student outcome	1-2	1-2				1-2			1-2	1-2	1-2	1-2	
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		--			--			--		X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1018	GENE EXPRESSION LABORATORY	L	T	P	C
	Total Contact Hours – 60	0	0	4	2
	Prerequisite				
	Nil				

PURPOSE

This course offers an opportunity to practically learn RNA isolation, quantification and gene expression by PCR, real time PCR, Northern hybridization. This course also provide an opportunity to learn gene expression at protein leven in plants and bacteria.

INSTRUCTIONAL OBJECTIVES

1.	To learn RNA isolation, quantification and separation
2.	To learn gene expression at RNA level by PCR
3.	To learn gene expression at RNA level by real time PCR and PCR Northern hybridization
4.	To learn gene expression at protein level in bacteria
5.	To learn gene expression at protein level in plants

LIST OF EXPERIMENTS

1. RNA isolation
2. Conventional RT-PCR
3. Real time PCR
4. Formaldehyde gel electrophoresis of RNA
5. Dot blotting of total RNA
6. Probe labeling, purification
7. Hybridization, washing and detection
8. Transformation of *E.coli* with genes in expression vector
9. Time course study of induction of gene expression with IPTG
10. Transient GFP gene expression in plants (after agroinfiltration)

REFERENCES

1. Laboratory Manual.
2. Joseph Sambrook, David William Russell "*Molecular cloning",* 3rd Edition, CSHL Press, 2001.

GN1018 GENE EXPRESSION LABORATORY														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X	X			X							
2.	Mapping of instructional objectives with student outcome	1-5	1-5	1-5			1-5							
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		--			--			--		X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1019	BIOSEPARATION ENGINEERING LABORATORY	L	T	P	C
	Total Contact Hours - 60	**0**	**0**	**4**	**2**
	Prerequisite				
	Nil				

PURPOSE

This course should provide adequate hands on training on the techniques used to purify the proteins. It will help the students to choose proper methods to release the intracellular product. The students will acquire the knowledge on different types of chromatographic methods used for recombinant protein purification

INSTRUCTIONAL OBJECTIVES

1.	To choose proper cell disruption methods to release the intracellular product
2.	To analyze the activity of the enzyme using electrophoretic techniques
3.	To calculate the molecular weight of unknown protein using electrophoretic and chromatographic techniques
4.	To design the purification strategies for recombinant protein purification

LIST OF EXPERIMENTS

1. Cell disruption methods to extract intracellular protein : Mechanical and Chemical methods
2. Protein Precipitation methods : Using Salt and organic solvent
3. Dialysis of salt precipitated protein samples
4. Molecular weight determination of protein using SDS-PAGE
5. Enzyme activity determination of Zymography
6. Molecular weight determination of protein by Gel filtration chromatography
7. Purification of protein using Ion exchange chromatography
8. Purification of recombinant protein using affinity tags

COURSE ASSESSMENT

Continuous monitoring using the record book, Test and Viva voice

REFERENCE

1. Lab Manual

GN1019 BIOSEPARATION ENGINEERING LABORATORY														
Course designed by		Department of Genetic Engineering												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X			X								X
2.	Mapping of instructional objectives with student outcome	1,2,3, 4	2,4			1,3, 4								1,4
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering			Applied Genetics	
		--		--			X			--			--	
5.	Approval	23rd Meeting of Academic Council, May 2013												

	MINOR PROJECT	L	T	P	C
GN1049	Prerequisite	0	0	2	1
	Nil				

PURPOSE

This course will provide the opportunity to the students to make use of the knowledge obtained from the previous semester subjects and design a minor project of their choice and perform

INSTRUCTIONAL OBJECTIVES	
1.	To make the students think and perform the project exploiting the subjects studied in the previous semesters.

Students have to undergo minor project in Genetic Engineering / Life Science related titles of their choice but with the approval of the department. At the end of the project student will submit a report and as per the prescribed format to the department.

Assessment process

This course is mandatory and the student has to pass the course to become eligible for the award of degree. The student shall make a presentation before external examiner Marks will be awarded out of 100 and appropriate grades assigned as per the regulations.

GN1049 MINOR PROJECT														
Course designed by		Department of Genetic Engineering												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X	X	X	X	X	X	X	X	X	X	X	X
2.	Mapping of instructional objectives with student outcome	1	1	1	1	1	1	1	1	1	1	1	1	1
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		X		X			X			X		X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

SEMESTER - VII

GN1020	**ANIMAL CELL CULTURE AND TRANSGENIC TECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	**2**	**0**	**0**	**2**
	Prerequisite				
	Nil				

PURPOSE

This course aims at making students to learn about the animal cell culture techniques and different application aspects of cell culture in various fields.

INSTRUCTIONAL OBJECTIVES

1.	To know the properties and features of cultured animal cells.
2.	To learn scaling up methods using animal cell culture
3.	To analyse the methods involved in scaling up of animal cell culture and be aware of biosafety and biohazards involved in animal cell culture.
4.	To know the techniques in transgenic animal production.

UNIT I - BIOLOGY OF CULTURED ANIMAL CELLS (5 hours)

Cell culture –introduction, the use, advantages & disadvantages; Cell types & its characters, differentiation-Growth of cells in culture-Importance of aseptic techniques. Culture media & culture conditions; Maintenance and storage of cell cultures; Bio-safety and biohazards.

UNIT II - PRESERVATION AND CHARACTERIZATION OF CELL LINES (6 hours)

Primary culture, subculture – properties of different cell lines (HeLa, DU145 (prostate cancer), Lncap (prostate cancer), MCF-7 (breast cancer), Kidney cell lines, ESC lines, MSC lines -Cloning and selection-Cell separation and characterization-Differentiation-Transformation and Immortalization-Contamination- Cryopreservation techniques.

UNIT III - SCALING UP OF ANIMAL CELL CULTURE (6 hours)

Cell quantification methods-Cell viability measurements-Growth kinetics-Scale up of suspension & monolayer cultures-Air lift bioreactors.

UNIT IV - PRODUCTION OF TRANSGENIC ANIMALS (7hours)

Methodology of production of transgenic animals - retroviral vector method, transposon - DNA micro injection – ICSI, engineered embryonic stem cell method, oocyte culture - Dolly production, knockout mice generation. Markers used in animal transgenesis.

UNIT V - APPLICATIONS OF ANIMAL CELL CULTURE AND TRANSGENIC ANIMALS (6 hours)

Animal cells as bioreactors - therapeutic proteins - enzymes - vaccines- applications of transgenic animals for the production of recombinant proteins, better nutrition, transgenic animals- transgenic cattle - transgenic goat and pigs – transgenic chicken - bioindicator -ornamental transgenic fish- applications of various cell lines.

TEXT BOOKS

1. Ranga .M.M, "*Transgenic animals*", Agrobios (India), 2006.

REFERENCES

1. Freshney .R.I, "*Culture of Animal cells*",Wiley-Blackwell; 6th edition, 2010.
2. Srivastava *"Animal Biotechnology",* Oxford and IBH Publishing, 2005.

GN1020 ANIMAL CELL CULTURE AND TRANSGENIC TECHNOLOGY														
Course designed by		Department of Genetic Engineering												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X	X		X	X							
2.	Mapping of instructional objectives with student outcome	1-4	1-3 & 5	1,2 &4		3	4							
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering			Applied Genetics	
		--		X			--			--			--	
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1021	BIOINFORMATICS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The course imparts fundamental knowledge of bio informatics algorithms, tools and their applications. The study on PERL, R and Python would enable the students to understand programming and help in executing day- to- day research.

INSTRUCTIONAL OBJECTIVES

1.	To know about databases and their use
2.	To understand sequence alignment and programming
3.	To analyze the protein sequence using bioinformatics tools
4.	To understand the use of PERL, Python in programming and executing research
5.	To gain exposure to R and learn to use in day- to- day research

UNIT I - BIOLOGICAL DATABASES (6 hours)

Biological databases-primary sequence databases- Composite sequence databases- Secondary databases composite protein pattern databases-structure classification databases. Genome Information Resources: DNA sequence databases-specialized genomic resources. Gene prediction- tools and principles.

UNIT II - SEQUENCE ALIGNMENT (10 hours)

Database searching-algorithms and programs-comparing two sequences-identity, similarity, Gap penalties, Edit distance. BLAST -Variants. Global alignments: Needleman - Wunsch Algorithm, Local Alignments: Smith Waterman Algorithm, PAM and BLOSUM Scoring Matrices. Goal of multiple sequence alignment-Computational Complexity-manual methods-Simultaneous methods-progressive methods- Viewing MSA. Phylogenetic analysis: Concepts of trees, Distance matrix methods, Character based methods, construction of dendrogram - rooted and un-rooted tree representation - Phylogenetic trees – PHYLIP.

UNIT III - PROTEIN ANALYSIS: (10 hours)

Conserved domain analysis, Protein visualization tools, Prediction of protein structure and function-secondary and tertiary structure, Motifs and patterns. Ramachandran plot- validation of the predicted structure using- Ramachandran plot and other stereochemical properties. Study of Protein-ligand interactions, docking with examples, protein target prediction, identification of active sites and functional domain.

UNIT IV - BIOPERL AND BIOPYTHON (12 hours)

Using PERL to facilitate biological analysis - strings, numbers, variables- scalar, arrays and hashes. Basic input & output- File handles- Conditional Blocks & loops- Pattern matching- Arrays-Hashes. Biopython- variables, programming structure, scripts, examples with various applications.

UNIT V - INTRODUCTION TO R (7 hours)

Introduction about R, Vectors, Matrices, Arrays, Lists, Data frames, factors and tables.R programming structure, input output, string manipulation, doing math and simulations in R. Introduction to Bioconductor R packages- use of different R packages for various applications- examples.

TEXT BOOKS

1. Attwood .T.K, Parry-Smith D.J, "*Introduction to Bioinformatics*", Pearson Education, 1st Edition, 11th Reprint, 2005.
2. Norman Matloff, the Art of R Programming, No Starch Press, 2011.

REFERENCES

1. Murthy .C.S.V, "*Bioinformatics*", Himalaya Publishing House, 1st Edition, 2003.
2. Rastogi .S.C & others, "*Bioinformatics- Concepts, Skills, and Applications*", CBS Publishing, 2003.
3. Michael R Barnes & Ian C Gray, "*Bioinformatics for Geneticists*", John Wiley, 2003.

GN1021 BIOINFORMATICS														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X		X	X	X								
2.	Mapping of instructional objectives with student outcome	1		4&5	2	3								
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		--			--			--		X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

	BIOENGINEERING INSTRUMENTATION	L	T	P	C
GN1022	Total Contact Hours - 60	2	2	0	3
	Prerequisite				
	Nil				

PURPOSE

This course helps the students to understand the working principles of various instruments used in life sciences. This improves the practical skills of the students when they use these instruments during their research. It also assists the students to interpret the result of the experiments carried out using these equipments.

INSTRUCTIONAL OBJECTIVES

1.	To understand the working principle of various equipments
2.	To analyze the results of different spectrophotometer and identify the chemical nature of the samples.
3.	To analyze the results of MS spectrophotometer and able to calculate the mass by interpreting the results.
4.	To understand the differences in the application of different microscopic methods.

UNIT I - SPECTROSCOPIC METHODS I (8 hours)

Principle of Scanning UV-Visible spectrophotometer and its application, Principle and instrumentation of Infra-Red spectrophotometer

Tutorial: Analysis the sample IR spectrophotometer results and identifies the chemical nature of the sample **(4 hours)**

UNIT II - SPECTROSCOPIC METHODS II (10hours)

Principle and instrumentation of Nuclear Magnetic resonance spectroscopy (NMR), types of NMR, - Principle and instrumentation of Mass spectrometer and MALDI –TOF

Tutorial: Determination of mass of the sample using sample Mass Spectrophotometer result - Analysis sample NMR chromatogram and identify the chemical nature of the sample **(5 hours)**

UNIT III - CHROMATOGRAPHIC METHODS (10 hours)

Instrumentation of HPLC – Principle of different Modes of HPLC: Gas chromatography, Gel filtration and Ion exchange chromatography – Columns: Choice of column for different samples, Column packaging methods – Factors affecting the efficiency of HPLC

Tutorial: Determination of molecular weight of unknown protein using Gel filtration chromatogram – Method to increase the resolution of chromatogram by optimizing the operating parameter: explanation with sample chromatogram.

(5 hours)

UNIT IV - MICROSCOPIC METHODS I **(8 hours)**

Principles of Fluorescence Microscopy, Phase contrast Microscopy, Confocal Microscopy and Two photon excitation Microscopy – Difference in the application of fluorescence and confocal microscopy

Tutorial: Discuss about results of localization and co localization of fluorescence and confocal microscopy.- **(4 hours)**

UNIT V - MICROSCOPIC METHODS II **(10 hours)**

Confocal Microscopy: Live cell Imaging, Fluorescence Recovery After Photobleaching (FRAP) for Dynamic studies, Fluorescence Resonance Energy Transfer (FRET) for protein interaction studies, Emission finger printing – Principle of Electron Microscopy, Types of Electron Microscopy: TEM and SEM - Difference in the application of TEM and SEM.

Tutorial: Identify the sample using Emission finger printing sample result – Analysis sample FRET result for protein interaction studies **(6 hours)**

REFERENCES

1. John G Webster, "*Bioinstrumentation"*, Wiley, 2003.
2. Marrin C McMaser, "*HPLC: Practical approach"* 2nd*edition,* Wiley-Interscience, 2006.
3. Pedro R. Cutillas , John F. Timms, "*LC-MS/MS in Proteomics: Methods and Applications (Methods in Molecular Biology)",* Humana Press, 2010.
4. James Pawley, "*Handbook of Biological Confocal Microscopy",* Springer, 2006.
5. John Cavanagh, Wayne J. Fairbrother, Arthur G. Palmer III, Nicholas J. Skelton, Mark Rance, "*Protein NMR Spectroscopy, Second Edition: Principles and Practice",* Academic Press, 2006.

GN1022 BIOENGINEERING INSTRUMENTATION														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X				X				X			X	
2.	Mapping of instructional objectives with student outcome	1-4				2-4							1	
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		--			X			--		--		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1023	RESEARCH METHODOLOGY	L	T	P	C
	Total Contact Hours - 15	1	0	0	1
	Prerequisite				
	Nil				

PURPOSE

The course imparts knowledge and understanding about various research methodologies .This course helps in preparing students to perform research effectively. It also helps the students to gain knowledge on literature review and thesis writing.

INSTRUCTIONAL OBJECTIVES

1.	To know about different types of research
2.	To understand about research formulation
3.	To know about research designs and methodology
4.	To learn about presentations, thesis writing and publication of articles

UNIT I-OBJECTIVES AND TYPES OF RESEARCH (2 hours)

Motivation and objectives of research, types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical.

UNIT II-RESEARCH FORMULATION (4 hours)

Defining and formulating the research problem - Selecting the problem - Necessity of defining the problem - Importance of literature review in defining a problem – Literature review – Primary and secondary sources – reviews, monographs-patents – web as a source – searching the web - Critical literature review – Identifying gap areas from literature review - Development of working hypothesis.

UNIT III-RESEARCH DESIGN AND METHODS (3 hours)

Research design – Basic Principles- Need of research design –– Features of good design – Important concepts relating to research design – Observation and Facts, Development of Models. Developing a research plan - Exploration,Description, Diagnosis, Experimentation. Determining experimental and sample designs.

UNIT IV-PRESENTATION OF RESEACH FINDINGS (3 hours)

How prepare and give effective and professional PowerPoint presentation, dos and don't in PowerPoint presentation, Poster Presentation – methods and layout design using PowerPoint and Photoshop. (Assignments in preparation of PowerPoint and Poster presentation).

UNIT V-WRITING THESIS AND RESEARCH PAPERS (3 hours)

Structure and components of thesis and research articles– Significance – different steps in the preparation – Layout, structure, illustrations, tables and bibliography.

TEXT BOOK

1. Garg .B.L, Karadia .R, Agarwal .F and Agarwal, "*An introduction to Research Methodology"*, RBSA Publishers. U.K., 2002.

REFERENCES

1. William Lightfoot,*"A Comparative Study of Research Methodology"*, VDMverlag, 2008.
2. Wadehra .B.L,"*Law relating to patents, trademarks, copyright designs and geographical indications*" Universal Law Publishing 2000.

GN1023 RESEARCH METHODOLOGY															
Course designed by		Department of Genetic Engineering													
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m	
		X		X				X							
2.	Mapping of instructional objectives with student outcome	1		3&4				2							
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)			
												X			
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics			
		X		X			X			X		X			
5.	Approval	23rd Meeting of Academic Council, May 2013													

	ETHICAL ISSUES & INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
GN1024	Total Contact Hours - 15	1	0	0	1
	Prerequisite				
	Nil				

PURPOSE

The course focusses on the key issues in research ethics.

INSTRUCTIONAL OBJECTIVES

1.	To understand the ethical issues involved in doing research using animals.
2.	To understand the ethical issues involved in human research.
3.	To understand the ethical conduct in credit sharing, social and environmental responsibility.
4.	To understand the patenting systems in India and abroad.

UNIT I - ETHICAL ISSUES IN RESEARCH WITH ANIMALS (3 hours)

Ethical consideration in conducting research with animal subjects, ethical committee regulations,guidelines for the use of animal subjects. Alternatives to the use of animals in research.

UNIT II - ETHICAL ISSUES IN RESEARCH WITH HUMAN (3 hours)

Ethical committee, regulations, guidelines for the collection and use of blood, tissue and other samples from human, obtaining consent for collection, transparency in handling the samples, use of human subjects in research and clinical trials, voluntariness, competence.

UNIT III - ETHICS - CREDIT SHARING, SOCIETY AND ENVIRONMENT (3 hours)

Responsibilities and sharing of authorship in publishing and patenting research, integrity and quality of the data, ethical conduct in the labs, ethical issues related to the society and environment.

UNIT IV - INTELLECTUAL PROPERTY RIGHTS (3 hours)

Objectives of the patent system, Patentable inventions in India and abroad, Geographical indications and sui generis systems, Implications of TRIP, GATT agreements.

UNIT V - PATENTING (3 hours)

Salient features of patent law in India, the process of patenting in India and abroad, process of challenging and protecting patents, opportunities challenges for biogenetics - patent infringement.

TEXT BOOK

1. Emanuel .E.J, et al. "*Ethical and Regulatory Aspects of Clinical Research"*. Baltimore, MD: Johns Hopkins University Press. 2003.

REFERENCES

1. "*European Commission Directorate-General for Research"*. (2010) European Textbook on Ethics in Research. Luxembourg. Publications Office of the European Union. Available online at http://ec.europa.eu/research/science-society/document_library/pdf_06/textbook-on-ethics-report_en.pdf.

GN1024 ETHICAL ISSUES & INTELLECTUAL PROPERTY RIGHTS														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
								X			X			X
2.	Mapping of instructional objectives with student outcome							1-4			1-3			4
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		X		X			X			X		X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1025	COMPREHENSION I	L	T	P	C
	Total Contact Hours – 30	0	0	2	1
	Prerequisite				
	Nil				

PURPOSE

In this course, the students will be made to review the subjects taught in the earlier semesters.

INSTRUCTIONAL OBJECTIVES

1.	To emphasize the importance of basic core subjects taught in the previous semesters.
2.	To improve the technical knowledge, problem based learning, and principles of techniques.
3.	To counsel students to improve their basic knowledge so that they will be better prepared for the campus interview.

The salient features of the course contents in the course undergone during the previous semesters will be reviewed and periodical multiple choice based tests will be conducted to keep the students refreshed and be ready for competitive exams like GATE, DBT-JRF, CSIT-JRF, ICMR-JRF, ICAR-JRF.

SCHEME OF ASSESSMENT

Answers to objective questions will be evaluated.

GN1025 COMPREHENSION I														
Course designed by		Department of Genetic Engineering												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
			X	X			X	X					X	
2.	Mapping of instructional objectives with student outcome		1-3	1-3			1-3	1-3					1-3	
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering		Plant Genetic Engineering			Applied Genetics		
		X		X			X		X			X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1026	ANIMAL CELL CULTURE LABORATORY	L	T	P	C
	Total Contact Hours – 60	0	0	4	2
	Prerequisite				
	Nil				

PURPOSE

The course is aimed at making students to learn culturing of animal cells from various sources. It also helps them to characterize the cultured cells through different techniques.

INSTRUCTIONAL OBJECTIVES

1.	To learn preparation of media and culturing of animal cells
2.	To perform various assays and staining procedures for characterization of cells

LIST OF EXPERIMENTS

1. Preparation of culture media and sterilization
2. Trypsinization and sub culturing
3. Fibroblast culture from chick embryo.
4. Ficoll density centrifugation and lymphocyte culture
5. Eosin hematoxylin Staining
6. Live cell counting
7. Leukocyte culture
8. Culturing of spleen cells
9. MTT Assay
10. Immunohistochemistry

REFERENCES

1. Lab manual
2. Freshney R.L, "*Culture of Animal cells*" Wiley-Blackwell; 6thedition, 2010.

GN1026 ANIMAL CELL CULTURE LABORATORY														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X	X			X							
2.	Mapping of instructional objectives with student outcome	1&2	1 &2	1&2			1&2							
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering		Plant Genetic Engineering			Applied Genetics		
		--		X			--		--			--		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1027	BIOINFORMATICS LABORATORY	L	T	P	C
	Total Contact Hours – 60	0	0	4	2
	Prerequisite				
	Nil				

PURPOSE

This course imparts knowledge to the students on the practical use of bioinformatics tools, algorithms and programming to analyze the structure and functions of nucleic acids and proteins.

INSTRUCTIONAL OBJECTIVES

1.	To gain thorough practical knowledge on the use of bioinformatics tools
2.	To gain efficient training in the PERL, Python and R for the analysis of DNA and protein sequences.

LIST OF EXPERIMENTS

1. DNA and Protein sequence retrieval from biological databases (DNA: NCBI, DDBJ and EBI, Protein: PIR, PDB and EMBL)
2. Pair wise alignment and Multiple Sequence alignment
3. Phylogenetic tree construction- different methods and algorithms
4. Variants of BLAST
5. Protein structure prediction using RASMOL and MOL-MOL
6. Ramachandran Plot analysis
7. Protein docking and use
8. BIOPERL programming and use
9. BIOPYTHON programming and use
10. R programming and use
11. Knowledge and use of commercial and open ware softwares for bioinformatics

REFERENCE

1. Andreas D Baxevanis &Francis .B.F, *"Bioinformatics- A practical guide to analysis of Genes & Proteins"*, John Wiley, 2002.

GN1027 BIOINFORMATICS LABORATORY														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X			X								X	
2.	Mapping of instructional objectives with student outcome	1			2								2	
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering		Plant Genetic Engineering			Applied Genetics		
		--		--			--		--			X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

	INDUSTRIAL TRAINING II (Training to be undergone after VI semester)	L	T	P	C
GN1048	2 week practical training in industry	0	0	1	1
	Prerequisite				
	Nil				

PURPOSE

To provide hands-on experience at Industry or Research institute where Genetic Engineering / Life Science projects are carried out.

INSTRUCTIONAL OBJECTIVES

1. Students have to undergo two – week practical training in Genetic Engineering / Life Science related project so that they become aware of the practical application of theoretical concepts studied in the class rooms.

Students have to undergo two-week practical training in Genetic Engineering / Life Science related projects of their choice but with the approval of the department. At the end of the training student will submit a report as per the prescribed format to the department.

Assessment process

This course is mandatory and the student has to pass the course to become eligible for the award of degree. The student shall make a presentation before a committee constituted by the department which will assess the student based on the report submitted and the presentation made. Marks will be awarded out of 100 and appropriate grades assigned as per the regulations.

GN1048 INDUSTRIAL TRAINING II														
Course designed by		Department of Genetic Engineering												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
					X		X	X	X	X	X			
2.	Mapping of instructional objectives with student outcome				1	1	1	1	1	1	1			
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering			Applied Genetics	
		--		--			--			--			X	
5.	Approval	23rd Meeting of Academic Council, May 2013												

SEMESTER - VIII

	MAJOR PROJECT / PRACTICE SCHOOL	L	T	P	C
GN1050	Prerequisite	**0**	**0**	**24**	**12**
	Nil				

PURPOSE

This course will provide the opportunity to the students to make use of the knowledge obtained from the previous semester subjects and design a major project of their choice and perform.

INSTRUCTIONAL OBJECTIVES

1.	To make the students think and perform the project exploiting the subjects studied in the previous semesters.

Students have to undergo one semester project in Genetic Engineering / Life Science related titles of their choice but with the approval of the department. At the end of the project student will submit a report and as per the prescribed format to the department.

Assessment process

This course is mandatory and the student has to pass the course to become eligible for the award of degree. The student shall make a presentation before external examiner Marks will be awarded out of 100 and appropriate grades assigned as per the regulations.

GN1050 MAJOR PROJECT / PRACTICE SCHOOL														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X	X	X	X	X	X	X	X	X	X	X	X
2.	Mapping of instructional objectives with student outcome	1	1	1	1	1	1	1	1	1	1	1	1	1
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		X		X			X			X		X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

ELECTIVE 1

GN1101	**HUMAN PHYSIOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours -45	**3**	**0**	**0**	**3**
	Pre-requisite				
	Nil				

PURPOSE

To provide students with an understanding of the function, regulation of the human body, physiological integration of the organ systems and to maintain homeostasis. In addition, the course would help the students in understanding the molecular concepts involved in physiology.

INSTRUCTIONAL OBJECTIVES

1.	Know the experimental principles and methodologies involved in physiology.
2.	Gain knowledge in cellular processes involved in physiology.
3.	Understand the major elements and concepts that constitute neuro, muscular and endocrine systems.
4.	Understand the basic functions of cardiovascular and respiratory systems.
5.	Enable the students to appreciate the digestive and metabolic processes of macromolecules.

UNIT I - EXPERIMENTS AND MODELS IN PHYSIOLOGY (8 hours)

Methods and models in Experimental Physiology – Molecular and cellular techniques in experimental physiology. Osmosis, Active and Passive transport

UNIT II - NEUROPHYSIOLOGY AND ENDOCRINE SYSTEMS (12 hours)

Neuronal structure, functions, Membrane excitation, resting and action potentials. Neuronal communication – Neurotransmission – Synapses, Synaptic plasticity and Sensory reception. Organization of neuromuscular junctions - Neuronal control of muscle contraction – cardiac, skeletal and smooth muscles. Neuroendocrine systems – Peptide and steroid hormones – Cellular signaling - Physiological effects of hormones.

UNIT III - CARDIOVASCULAR AND RESPIRATORY PHYSIOLOGY (8 hours)

Blood-Components of Blood-Blood clotting factors. The Heart – Peripheral circulation-Cardiac cycle–Cardiac output. Physiology of Respiration- Gaseous exchange and Gaseous transport.

UNIT IV - GASTROINTESTINAL AND THERMOREGULATORY PHYSIOLOGY

(8 hours)

Alimentary system – Gastrointestinal secretions – Absorption – Energy metabolism. Thermogenesis – Regulation of body temperature.

UNIT V - RENAL AND REPRODUCTIVE PHYSIOLOGY (9 hours)

Glomerular filtration rate - Renal blood flow - Formation of Urine-Acid Base balance, Osmotic balance, Water balance. Male and Female Reproductive systems-Sexual reproduction – Sex determination – Oogenesis and Spermatogenesis – Fertilization – Reproductive cycle in Mammals.

TEXT BOOK

1. Boron .W.F and Boulpaep .EL, "*Medical Physiology"*, SaundersPublications,Updated Edition (2005).

REFERENCES

1. Randall, Burggren, French "*Animal Physiology"*– 4th edition.
2. Guyton .AC and Hall .J.E, "*Medical Physiology*", Saunders Publications, Eleventh Edition (2005).

GN1101 HUMAN PHYSIOLOGY														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X			X							x	
2.	Mapping of instructional objectives with student outcome	1,2	1-3			3							3-5	
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		--			--			--		X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1102	PLANT PHYSIOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This course introduces the fundamentals of plant physiology. It discusses the basic activities of a plant like transpiration, photosynthesis, respiration, photoperiods and its interaction with environment.

INSTRUCTIONAL OBJECTIVES

1.	To gain knowledge on basic physiological aspects of transpiration, respiration and photosynthesis
2.	To acquire knowledge on the applied aspects of plant-environment interaction physiology
3.	To gain a holistic approach on research related to plant genetic manipulation and plant - environment interaction

UNIT I - ABSORPTION OF WATER AND TRANSPIRATION (8 hours)

Terms-colloids, permeability, diffusion, osmosis, water potential, imbibitions and plasmolysis; Water absorption by plants-mechanism of water absorption; Transpiration, evaporation and guttation; Mechanism of transpiration; kinds of transpiration; stomata-diffusion through stomata; stomata opening and closing-theory of photosynthesis in guard cells, theory of starch glucose interconversion, theory of glycolate metabolism, theory of proton transport and hormonal regulation; antitranspirants.

UNIT II - GROWTH AND MINERAL NUTRITION (10 hours)

Growth regions and phases; role of auxin-apical dominance and cell division, shoot and root growth, xylem differentiation; Gibberellins-biosynthesis and translocation, mechanism of action; Cytokinins- biosynthesis and translocation, applications of cytokinins; biosynthesis, translocation and role of abscisic acid, ethylene, florigen, anthesin, vernalin and morphactins; mineral nutrition- solution, sand and hydrophonics culture; macro and micronutrients; mechanism of mineral salt absorption.

UNIT III - PHOTOSYNTHESIS AND NITROGEN METABOLISM (10 hours)

Structure of chloroplast, photosynthetic pigments; light and dark reaction; red drop and emerson's effect; C2, C3, C4 and CAM cycle; translocation of solutes-exchange between xylem and phloem; mechanism of solute translocation; Respiration-significance of photorespiration; respiratory quotient of carbohydrates, fats, proteins, succulents and organic acids; Nitrogen fixation-symbiotic and asymbiotic nitrogen fixation.

UNIT IV - PHOTOBIOLOGY AND PHOTOPERIODISM (8 hours)

Phytochrome- mode of action; photoperiodism- short day, long day and day neutral plants; photoperiodic induction; photoperiod and plant flowering-long day species flower under long day conditions; short day species flower under short day conditions; Vernalisation; mechanism of vernalisation.

UNIT V - PLANT-ENVIRONMENT INTERACTION (9 hours)

Physiology of plant movement; physiology of plant flowering, fruiting, seed germination; biology of dormancy; physiology of abiotic stress tolerance; physiology of biotic stress tolerance.

TEXT BOOK

1. Varma.V.K and Mohit Varma, "*Text book of plant physiology, biochemistry and biotechnology*", S Chand ltd (2008)

REFERENCES

1. Frank Salisbury and Cleon Ross, "*Plant Physiology*",Brooks Cole; 4th edition (1991)

<table>
<tr><th colspan="15">GN1102 PLANT PHYSIOLOGY</th></tr>
<tr><td colspan="2">Course designed by</td><td colspan="13">Department of Genetic Engineering</td></tr>
<tr><td rowspan="2">1.</td><td rowspan="2">Student Outcome</td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td><td>l</td><td>m</td></tr>
<tr><td>X</td><td>X</td><td></td><td></td><td>X</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2.</td><td>Mapping of instructional objectives with student outcome</td><td>1-3</td><td>1-3</td><td></td><td></td><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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<tr><td rowspan="2">4.</td><td rowspan="2">Broad Area</td><td colspan="3">Gene Cloning Technologies</td><td colspan="3">Cell Culture Technologies</td><td colspan="3">Biochemical Engineering</td><td colspan="3">Plant Genetic Engineering</td><td colspan="2">Applied Genetics</td></tr>
<tr><td colspan="3">--</td><td colspan="3">--</td><td colspan="3">--</td><td colspan="3">X</td><td colspan="2">X</td></tr>
<tr><td>5.</td><td>Approval</td><td colspan="13">23rd Meeting of Academic Council, May 2013</td></tr>
</table>

ELECTIVE II

GN1103	**MEDICAL BIOCHEMISTRY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

To make the students understand the clinical aspects of plasma enzymes and their diagnostic importance in several disorders. The course would give them a detailed idea about the biochemical and hormonal basis of metabolic disorders and inborn errors of metabolism.

INSTRUCTIONAL OBJECTIVES

1.	To gain fundamental understanding of biological fluids and their biochemical functions.
2.	To acquire knowledge on hormones and their biochemical functions.
3.	To understand about the biochemical basis of some metabolic disorders.

UNIT I- BODY FLUIDS AND COMPONENTS (8 hours)

Composition of blood and plasma components, Collection of blood, anticoagulants and preservatives. Transport of oxygen and carbon dioxide in blood and body fluids; acid- base balance of the body.

UNIT II- DISORDERS OF METABOLISM (12 hours)

Disorders of carbohydrate metabolism: Diabetes mellitus, Glucose tolerance test and Glycogen storage diseases. Disorders of Lipid metabolism- Physiologic importance of lipid and lipoproteins, sphingolipidosis, multiple sclerosis, apolipoproteins and familial hypercholesteremia. Disorders of amino acid metabolism - Phenylalanemia, homocystinuria, tyrosinemia, MSUD, phenylketonuria, alkaptonuria, albinism and animoacidurias.

UNITIII - XENOBIOTICS AND DRUG METABOLISM (7 hours)

Metabolic transformation of Xenobiotics. Drug metabolizing enzymes. Mechanism of drug action. Phases of detoxification – Phase I- oxidation, reduction, hydrolysis. Phase II- conjugation, Phase III- excretion. Factors that effect drug metabolism.

UNIT IV - ENDOCRINE HORMONE AND DISORDERS (9 hours)

General mechanism of action of hormones, chemistry, functions. Disorders of Growth hormone - Pituitary dwarfism. Gigantism and Acromegaly. Disorders of thymus gland- DiGeorge syndrome. Disorders of thyroid hormone- Myxedema and Grave's disease. Disorders of adrenal steroids - Addison's disease and Cushing's syndrome. Hypo and hypersecretion of PTH, insulin and glucagon.

UNIT V - CLINICAL DIAGNOSIS (9hours)

Liver function tests-Introduction, function of liver, test based on the abnormalities of bile pigment metabolism and excretory function of liver. Renal disorders, kidney function tests - urea clearance test and creatine clearance test. Gastric function tests- Resting contents, fractional gastric analysis, stimulation test. Principles of diagnostic enzymology, Clinical significance of diagnostic enzymes - aspartate aminotransferase, alanine aminotransferase, creatine kinase, aldolase and lactate dehydrogenase.

TEXT BOOK

1. Chatterjee .M.N, Rana Shinde"*Textbook of Medical Biochemistry"*, 7th edition, Jaypee Publishers 2007.

REFERENCES

1. Bhagavan .N.V, "*Medical Biochemistry"* Fourth Edition, Academic Press 2001.
2. Donald Voet, Judith G.Voet and Charlotte W Pratt, John Wiley & Sons, NY "*Fundamentals of Biochemistry",* 4th edition, VP & publishers 1999.
3. Burtis .C.A, Ashwood .E.R (eds.) Saunders WB Co. *"Tietz Fundamentals of Clinical Chemistry"* 5th edn.
4. Thomas M Devlin, A John Wiley, *"Text book of biochemistry"*, 4th edition, Inc publication, New York1997.
5. Harold varely, et al "*Practical Biochemistry*", Fifth Edition, CBS Publishers.

GN1102 PLANT PHYSIOLOGY														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X											
2.	Mapping of instructional objectives with student outcome	1,2	1-5											
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		--			--			--		X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1104	PLANT BIOCHEMISTRY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To impart knowledge on basic metabolic pathways in plants. To provide insight into primary and secondary metabolites with major and relatively minor functions in plants and humans.

INSTRUCTIONAL OBJECTIVES

1.	Gain knowledge on the metabolite function and biogenesis.
2.	Provide a platform for students to investigate metabolic pathways in plants.
3.	Help students to manipulate a pathway for any desired product

UNIT I-CARBOHYDRATE METABOLISM (7 hours)

Biosynthesis and functions of sucrose – Trehalose – Other oligosaccharides – Fructans – Starch – other reserve polysaccharides, plant cell wall polysaccharides.

UNIT II - NITROGEN METABOLISM (10 hours)

Nitrogen fixation – Nitrate uptake and reduction – Ammonia assimilation – Asparagine metabolism – aspartate family – branched chain amino acids – biosynthesis of proline and arginine – Sulfur amino acids – Histidine, Non-protein amino acids, Cyanogenic glycosides and glucosinolates, Auxins, cytokinins and ethylene.

UNIT III - LIPID METABOLISM (8 hours)

Fatty acid biosynthesis – Triacylglycerol synthesis – Membrane lipid biogenesis – Lipid catabolism – Cutins, suberins and waxes.

UNIT IV - ALKALOID AND TERPENOID METABOLISM (10 hours)

General pathway of alkaloid – monoterpenoid indole alkaloids – tropane alkaloids – benzylisoquinoline alkaloids –bisbenzylisoquinoline alkaloids, General pathway of terpenoid biosynthesis – Monoterpenoids – Sesquiterpenoids – Diterpenoids – Triterpenoids – Carotenoids – Polyterpenoids – Minor classes of terpenoids – Control and compartmentation of isoprenoid biosynthesis.

UNIT V - METABOLISM OF FLAVANOID, LIGNINS AND QUINONES (10 hours)

Shikimate/arogenate pathway – Phenylalanine/hydroxycinnamate pathway – Phenylpropanoid pathways –Hydroxycinnamate conjugates– Hydroxycoumarins – Hydroxybenzoates – Flavonoids – Lignins – Lignans and Neolignans – Tannins – Quinones.

TEXT BOOK

1. Dey .P.M and Harborne .J.B, "*Plant Biochemistry"*, Academic press.

REFERENCE

1. Bob B. Buchanan, Wilhelm Gruissem, and Russell L. Jones, "*Biochemistry and molecular biology of plants",* ASPB publications.

GN1104 PLANT BIOCHEMISTRY														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X	X		X								
2.	Mapping of instructional objectives with student outcome	1-3	1-3	3		1-2								
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		--			--			X		--		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1105	GENES AND DISEASES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To understand the genes that control or influence the heritable human diseases

INSTRUCTIONAL OBJECTIVES

1.	To understand the pattern of inheritance of heritable diseases
2.	To learn about the genetics of most prevalent cancers in India
3.	To learn about the genetics of metabolic disorders and disease of nervous system
4.	To learn about the genetics of ear, eye and blood disorders

UNITI - INTRODUCTION (8 hours)

Introduction to genetic versus non-genetic diseases, Importance of the genetics of heritable diseases Inheritance of genetic diseases - Dominance, Recessive, Codominance, Autosomal and Sex-linked.Nomenclature system for human gene mutation from Human Genome Variation Society. Databases – Online Mendelian Inheritance in Man, The Human Gene Mutation Database, Single Nucleotide Polymorphisms (dbSNP) database.

UNITII - GENETICS OF CANCER (10 hours)

Breast cancer, Cervical cancer, Oral cancer, leukemia, Colon cancer, Retinoblastoma, Prostate cancer.

UNITIII - GENETICS OF METABOLIC DISORDERS (10 hours)

Gaucher's disease, Maple Syrup disease, Phenylketonuria, Diabetes, Familial hypercholesterolemia.

UNITIV - GENETICS OF THE DISEASES OF NERVOUS SYSTEM (10 hours)

Alzeimer's disease, Huntington disease, Parkinson's Disease, Fragile X syndrome, Autism, Duchenne muscular dystrophy, Epilepsy.

UNIT IV - GENETICS OF EAR, EYE AND BLOOD DISORDERS (7 hours)

Thalassemia, Atherosclerosis, Glaucoma, Deafness, Pendred syndrome.

TEXT BOOK

1. Tom Strachan and Andrew P Read, "*Human Molecular Genetics*", 2nd edition York: Wiley-Liss, 1999.

REFERENCES

1. Genes and Diseases, NCBI Bookself, http://www.ncbi.nlm.nih.gov/books/bookres.fcgi/gnd/tocstatic.html.
2. Pagon RA et al.,"GeneReviews™ [Internet]".Seattle (WA): University of Washington, Seattle; 1993-.Available from: http://www.ncbi.nlm.nih.gov/books/NBK1116/.

GN1105 GENES AND DISEASES														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
			X	X			X							
2.	Mapping of instructional objectives with student outcome		1-4	1-4			1-4							
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering		Plant Genetic Engineering			Applied Genetics		
		--		--			--		--			X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

	BIOREACTOR DESIGN	L	T	P	C
BT1056	Total Contact Hours – 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

The course imparts advanced knowledge on bioreactor design for efficien utilization of the principles in bioprocess technology.

INSTRUCTIONAL OBJECTIVES	
To familiarize	
1.	To understand the basic concepts of bioreactor design
2.	To learn about the Air-driven bioreactors and bioreactors for plant and animal cell cultivation
3.	To study about the solid state bioreactors and instrumentation control of bioreactors

UNIT I - BIOREACTOR DESIGN (9 hours)

Types of Bioreactor, Stirred tank bioreactors, Design equations for BATCH, CSTR, FED BATCH reactor, Monod model for a chemostat, Multistage fermenter.

UNIT II – AIR DRIVEN BIOREACTORS (9 hours)

Airlift bioreactors – Design and construction of the airlift - loop reactor, Hydrodynamics, Three - phase flow, Mixing, Oxygen transfer, Design and construction of Bubble column fermenter, Design and operation of Fluidized bed bioreactor.

UNIT III - PLANT AND ANIMAL CELL BIOREACTORS (9 hours)

Design consideration for plant cell cultivation -plant cell bioreactors- STR, ALR, BC, rotary drum, spin filter, process strategies, Animal cell bioreactors -Bubble Columns and Air-Lift Reactors, Fluidized Bed Bioreactors, Membrane Bioreactor Design -Cell Recycle Membrane Reactors.

UNIT IV - SOLID STATE FERMENTATION BIOREACTORS (9 hours)

Solid-State Bioreactor Fundamentals: selection and design of SSF reactors, Heat and mass transfer in SSF reactors, types- Unaerated and Unmixed- Forcefully-Aerated Bioreactors Without Mixing, Rotating-Drum and Stirred-Drum Bioreactors, Continuously-Mixed, Forcefully-Aerated Bioreactors, Intermittently-Mixed Forcefully-Aerated Bioreactors.

UNIT V - INSTRUMENTATION CONTROL OF BIOREACTORS (9 hours)

Bioreactor sensor characteristics, Temperature measurement control, principles of dissolved oxygen measurement and control, principles of pH / redox measurement and control, deduction and prevention of foam, determination of biomass and application of biosensors. Off –gas analysis - Steady - state

balancing, Derived quantities based on combined gas analysis and gas mass balancing techniques, Gas analyzers.

REFERENCES

1. Scragg, "*Bioreactors in Biotechnology*", Ellis Horwood series, 1991.
2. Klaas Van't Riet, Johannes Tramper, "*Basic Bioreactor Design*", 2nd ed., Marcel Dekker, Inc., New York, 1991.
3. Henry C. Vogel, "*Fermentation and biochemical engineering handbook: principles, process design, and equipment*", Noyes Publications, 1983.
4. David Mitchell, Nadia Krieger, Marin Berovic, "*Solid-State Fermentation Bioreactors :Fundamentals of Design and Operation*", Springer-Verlag Berlin Heidelberg ,2006.
5. Regine Eibl, Dieter Eibl, Ralf Pörtner, *Cell and Tissue Reaction Engineering: Principles and Practice*, Springer, 2008.
6. Saurabh Chattopadhyay, Sunita Farkya, Ashok K. Srivastava, and Virendra S. Bisaria "*Bioprocess Considerations for Production of Secondary Metabolites by Plant Cell Suspension Cultures",* Biotechnology and Bioprocess Engineering, 7: 138-149, 2008.

<table>
<tr><th colspan="15">BT1056 BIOREACTOR DESIGN</th></tr>
<tr><th colspan="2">Course designed by</th><th colspan="13">Department of Biotechnology</th></tr>
<tr><td rowspan="2">1.</td><td rowspan="2">Student Outcome</td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td><td>l</td><td>m</td></tr>
<tr><td>x</td><td></td><td></td><td></td><td>X</td><td></td><td></td><td></td><td>x</td><td>x</td><td></td><td></td><td></td></tr>
<tr><td>2.</td><td>Mapping of instructional objectives with student outcome</td><td>3,4</td><td></td><td></td><td></td><td>1-4</td><td></td><td></td><td></td><td>1-4</td><td>2,3,4</td><td></td><td></td><td></td></tr>
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<tr><td colspan="2"></td><td colspan="3"></td><td colspan="5"></td><td colspan="3">X</td></tr>
<tr><td rowspan="2">4.</td><td rowspan="2">Broad Area</td><td colspan="3">Gene Cloning Technologies</td><td colspan="3">Cell Culture Technologies</td><td colspan="3">Biochemical Engineering</td><td colspan="3">Plant Genetic Engineering</td><td colspan="2">Applied Genetics</td></tr>
<tr><td colspan="3">--</td><td colspan="3">--</td><td colspan="3">X</td><td colspan="3">--</td><td colspan="2">--</td></tr>
<tr><td>5.</td><td>Approval</td><td colspan="13">23rd Meeting of Academic Council, May 2013</td></tr>
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ELECTIVE 3

GN1106	**DEVELOPMENTAL GENETICS- ANIMAL**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

The course imparts detailed knowledge on the role of genes in animal development. It provides a genetic perspective on body patterening, development of different organ systems and about regeneration and ageing.

INSTRUCTIONAL OBJECTIVES

1.	To gain knowledge on the functions of developmental genes.
2.	To understand body axes formation, tissue differentiation and organ development.
3.	To get an overview of genetic basis of regeneration and ageing.

UNIT I - INTRODUCTION TO DEVELOPMENTAL GENETICS (5 hours)

Origin of developmental biology, evolutionary embryology, role of developmental genes, cell division, differentiation and growth, embryological origin of gene theory, genomic imprinting

UNIT II - PATTERENING THE BODY PLAN (10 hours)

Drosophila development, syncytium, maternal determinants, pair-rule genes, segment identity – Vertebrate (Xenopus, Zebrafish and Mouse) body plan, setting up body axes, specification of germ layers, antero-posterior patterning, organizer and neural induction, neural crest cells – Other model systems: sea urchin, slime mold, nematode

UNIT III - MORPHOGENESIS, CELL DIFFERENTIATION AND ORGANOGENESIS (10 hours)

Blastula formation, gastrulation movements, neural tube formation, cell migration, models of cell differentiation, plasticity of gene expression, vertebrate limbs, paraxial and intermediate mesoderm, lateral plate mesoderm, endodermal organs, neuronal migration, synapse formation

UNIT IV - SEX DETERMINATION AND REGENERATION (10 hours)

Primordial germ cells, embryonic stem cells, germ cell migration, fertilization, sex determination, molecular sex differentiation, X-chromosome inactivation, limb and organ regeneration, regenerative capacity, planarian regeneration

UNIT V - GROWTH AND AGEING (10 hours)

Growth, organ size control, genetic errors of human development, mitochondria and ageing, biology of senescence

TEXT BOOK

1. Gilbert.S.F, "*Developmental Biology*",Sinauer Associates, Inc., Ninth Edition , 711pp, 2012.

REFERENCES

1. Wolpert, L. &Tickle, C. "*Principles of Development*", Oxford University Press, Fourth Edition (2010), 720pp.
2. Slack.J.M.W, "*Essential Developmental Biology*", Wiley-Blackwell, Third Edition , 448pp, 2012.

GN1106 DEVELOPMENTAL GENETICS – ANIMAL														
Course designed by		**Department of Biotechnology**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
			X				X							
2.	Mapping of instructional objectives with student outcome		1,2,3				2,3							
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		--			--			--		X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1107	DEVELOPMENTAL GENETICS - PLANT	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This course introduces the fundamentals of plant developmental genetics. It discusses the basic aspects of signal transduction, induction and genetics of embryo, shoot and root and seed development.

INSTRUCTIONAL OBJECTIVES

1.	Gain knowledge on basic developmental aspects of plant that can be transformed into research application.
2.	Apply the modular approach and regulatory networks present in a cell.
3.	Possess requisites for plant signal transduction research.

UNIT I - PRINCIPLES OF PLANT DEVELOPMENT (9 hours)

Novel features of plant growth and development; concept of plasticity in plant development; signal transduction –receptors and G-proteins; cyclic AMP cascade; phospholipid and Ca2+-calmodulin cascade; MAP kinase cascade; two component sensor-regulator system.

UNIT II - LIGHT AND HORMONAL CONTROL (9 hours)

Light and hormonal control of plant development –phytochromes and cryptochromes; molecular mechanisms of light perception, signal transduction and gene regulation; biological clocks - genetic and molecular determinants; hormone signal perception, transduction and gene regulation.

UNIT III - EMBRYOGENESIS (9 hours)

Embryogenesis - microsporangium and microsporogenesis; megasporangium and megasporogenesis; fertilization- apomixes, parthenocarpy; embryogenesis-molecular and genetic determinants; male sterility- cell lineages and positional information; seed dormancy and germination; meristem establishment and maintenance.

UNIT IV - SHOOT, LEAF AND ROOT DEVELOPMENT (9 hours)

Shoot,Leaf and Root Development –organization of shoot apical meristem (SAM); cell to cell communication; molecular analysis of SAM; leaf development and differentiation; organization of root apical meristem (RAM); root hair and trichome development.

UNIT V - FLORAL DEVELOPMENT AND SENESCENCE (9 hours)

Floral Induction and Development –inflorescence and floral determination; molecular genetics of floral development and floral organ differentiation; sex determination; senescence and programmed cell death (PCD) – senescence and its regulation; hormonal and environmental control of senescence; PCD in the life cycle of plants

TEXT BOOK

1. Stephen H. Howell, *"Molecular genetics of plant development",* Cambridge University press (2000).

GN1107 DEVELOPMENTAL GENETICS PLANT														
Course designed by		Department of Genetic Engineering												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X	X										
2.	Mapping of instructional objectives with student outcome	1	2,3	2,3										
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		--			--			X		X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1108	DIAGNOSIS OF GENETIC DISEASES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

To learn about various diagnostic strategies to detect large deletions in chromosomes, metabolic defects, mutations in genes, changes in gene expression at RNA and protein level, protein truncation, and splicing variants.

INSTRUCTIONAL OBJECTIVES

1.	To gain knowledge of basic cytogenetic techniques.
2.	To learn about biochemical method used to detect metabolic changes.
3.	To learn about molecular methods to detect changes in the DNA
4.	To learn about molecular methods to detect changes in the RNA and protein.

UNIT I - CYTOGENETIC METHODS **(9 hours)**

Karyotyping – G Banding for translocations - Spectral Karyotyping – FISH – FACS – Importance of Pre implantation genetic diagnosis.

UNIT II - BIOCHEMICAL METHODS **(9 hours)**

Quantitative determination of metabolites by Spectrophotometry, HPLC, LC-MS, Enzyme assays for metabolic disorders.

UNIT III - DNA BASED MOLECULAR METHODS **(11 hours)**

PCR, Allele Specific PCR, PCR–RFLP, Dot blot and Southern hybridization, SSCP, DNA Sequencing, Exome Sequencing, targeted sequencing, Whole genome resequencing

UNIT IV - RNA BASED D MOLECULAR METHODS **(9 hours)**

Semi quantitative RT-PCR, Real time PCR, Dot blot and Northern hybridization, Microarray for diagnosis, Transcriptome sequencing.

UNIT V - PROTEINS BASED MOLECULAR METHODS **(7 hours)**

PAGE and in-gel staining, SDS-PAGE, Western Blotting, ELISA, Radioimmunoassay, Tandem Mass Spectrophotometry

TEXT BOOK

1. Rob Elles, Roger Mounfold, "*Molecular Diagnosis of Genetic Diseases*", 2dn Edition, Human Press, 2010.

GN1108 DIAGNOSIS OF GENETIC DISEASES														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
				X										
2.	Mapping of instructional objectives with student outcome			1-4										
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		--			--			--		X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

ELECTIVE IV

GN1109	**CELL SIGNALING - ANIMAL**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

The module will help to describe various diagnostic testing strategies to use in both the cytogenetics and molecular genetics laboratory to detect aberrations and also to ascertain the RNA and proteins qualitative and quantitatively.

INSTRUCTIONAL OBJECTIVES

1.	To understand key concepts about cellular signaling mechanisms and the major signaling pathways.
2.	To impart knowledge about secondary messengers involved in metabolic regulation.
3.	To learn key concepts involved in mechanisms that control gene activity.

UNIT I-CELL SIGNALING AND SHORT-TERM CELLULAR RESPONSES

(9 hours)

The basic elements of cellular signaling systems – Extracellular messengers and their receptors.

UNIT II-GPCR AND THEIR SECOND MESSENGERS (9 hours)

Signal transduction by GPCRs- inhibitory and stimulatory responses-second messengers: cAMP, cGMP, protein kinases, specificity of G-Protein coupled receptor responses. Role of GPCRs in sensory perception, Ion channel receptors –Phospholipase C - Phosphatidyl inositol pathway - Role of Calcium in cell sigaling – role of Nitric oxide in Cell signaling.

UNIT III-PROTEIN-TYROSINE PHOSPHORYLATION IN CELL SIGNALING

(9 hours)

Protein tyrosine kinases, Ras-MAP kinase pathway, Insulin receptor pathway, JAK-STAT pathway.

UNIT IV-CONVERGENCE, DIVERGENCE AND CROSSTALKS AMONG SIGNALING PATHWAYS (9 hours)

Integration of cellular responses – Regulation of a metabolic pathway by multiple second messengers.

UNIT V-SIGNALING PATHWAYS THAT CONTROL GENE ACTIVITY (9 hours)

TGF-β signaling, cytokine receptors- JAK-STAT pathway, NF-κB transcription factors, Matrix metalloproteinases- Wnt signaling pathway, Hedgehog pathway, Notch/Delta signaling pathway. Programmed cell death – Extrinsic and Intrinsic pathways of apoptosis.

TEXT BOOK

1. Alberts, Bray, Lewis, Raff, Roberts, and Watson *"Molecular Biology of the Cell",* Third Edition.
2. Gerald Karp, *"Cell Biology"* 6th edition.

REFERENCES

1. Alberts, Bray, Hopkin, Johnson, Lewis, Roff, Raff, Robertis, Walter *"Essentials of cell biology*", 3rd edition.
2. Lodish et al., "*Molecular Cell Biology"* W.H. Freeman and Company, 2007.

GN1109 CELL SIGNALING - ANIMAL														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
			X	X		X		X					X	
2.	Mapping of instructional objectives with student outcome		2	3		1		1, 2					1-3	
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering		Plant Genetic Engineering			Applied Genetics		
		--		--			--		--			X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1110	CELL SIGNALING – PLANT	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The purpose of the course is to provide fundamental understanding of cell to cell communication, cell signaling in response to light, hormone, and biotic and abiotic stress.

INSTRUCTIONAL OBJECTIVES

1.	To apply the acquired knowledge in plant genomics research
2.	To investigate intricacies in plant cell – cell signaling.
3.	To study the plant cell – environment interaction.

UNIT I - PRINCIPLES AND LIGHT RESPONSIVE SIGNAL TRANSDUCTION (9 hours)

Signal transduction – cell to cell, environment and plant response, photoreceptor regulation and activity, regulation of transcription factors, light-responsive transcription factors, light-quality-specific signaling, organ-specific responses, networks involved in the photoperiod response

UNIT II - HORMONE RESPONSIVE SIGNAL TRANSDUCTION (10 hours)

Synthesis and accumulation – transport- signal transduction – auxins – cytokinins – GA – brassinosteroids – ethylene – ABA – JA – SA.

UNIT III - BIOTIC STRESS RESPONSIVE SIGNAL TRANSDUCTION (9 hours)

Ca^{2+} signaling, MAPK signaling, signaling via plant peroxidases, reactive oxygen species signaling, signaling by microRNAs, hormone regulated signaling.

UNIT IV - ABIOTIC STRESS RESPONSIVE SIGNAL TRANSDUCTION (9 hours)

Oxygen-deprivation signaling in plants, signaling by miRNAs, hormone regulated signaling.

UNIT V - SIGNAL TRANSDUCTION IN GROWTH AND DEVELOPMENT (8 hours)

Signaling to the actin cytoskeleton during cell morphogenesis and patterning, stem cell signaling, signaling in plant gravitropism, signaling in phototropism, sugars, signaling, and plant development, hormone action in seed maturation, dormancy, and germination.

TEXT BOOK

1. Dierk Scheel C. Wasternack, "*Plant signal transduction"*, Oxford University Press, 2002

REFERENCES

1. Autor Sopory .S.K, "*Signal transduction in plants: current advances",* Kluwer Academic / Plenum Publishers, 2001.

GN1110 CELL SIGNALING PLANT														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X	X	X			X						
2.	Mapping of instructional objectives with student outcome	1	1	2	2			2						
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering		Plant Genetic Engineering			Applied Genetics		
		--		--			--		X			--		
5.	Approval	23rd Meeting of Academic Council, May 2013												

GN1111	GENETIC COUNSELING	L	T	P	C
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

The aim of the course is to enable the students to acquire basic knowledge on genetic counseling and guidance. It also helps them to be aware about when and how patients should be referred further for genetic investigations.

INSTRUCTIONAL OBJECTIVES

1.	To understand that certain conditions or diseases can have genetic causes.
2.	To gain clinical applicable knowledge in genetics with a focus on genetic guidance.
3.	To gain knowledge and understanding of how genetic diseases influence both individual and family.

UNIT I-INTRODUCTION (9 hours)

Historical Overview, Definition, and Models of Genetic Counseling. Components of Genetic Counseling Interaction. Providers of Genetic Counseling. Professional and Educational Landmarks in Genetic Counseling.

UNIT II-PEDIGREE ANALYSIS (9 hours)

Interpretation of Genetic case - Pedigree Analysis, Consent form, Family History – Verbal and Non verbal Communication – Psychological Aspects of patient- Case documentation.

UNIT III-STRATEGIES FOR COUNSELING (9 hours)

Characteristics and Systems of Family. Comparison of Family therapy – Medical therapy. Structuring the Genetic counseling session.

UNIT IV-GENETIC COUNSELING FOR SPECIFIC DISEASE (9 hours)

Genetic counseling in autosomal dominant disease – DiGeorge syndrome. Genetic counseling in Recessive disease – Deafness.

UNIT V-GENETIC COUNSELING FOR X LINKED DISORDERS (9 hours)

Genetic counseling in X-linked dominant disease – Fragile X syndrome. Genetic counseling in X-linked recessive disease - Haemophilia.

TEXT BOOK

1. Wendy R. Uhlmann, Jane L. Schuette, Beverly Yashar, "*A Guide to Genetic Counseling*", 2nd Edition.

REFERENCES

1. Bonnie S. LeRoy, Patricia M. Veach, Dianne M. Bartels "*Genetic Counseling Practice: Advanced Concepts and Skills".*
2. Patricia McCarthy Veach, Bonnie S. LeRoy, Dianne M. Bartels"*Facilitating the Genetic Counseling Process: A Practice Manual*".

<table>
<tr><th colspan="15">GN1111 GENETIC COUNSELLING</th></tr>
<tr><td colspan="2">Course designed by</td><td colspan="13">Department of Genetic Engineering</td></tr>
<tr><td rowspan="2">1.</td><td rowspan="2">Student Outcome</td><td>a</td><td>b</td><td>c</td><td>d</td><td>e</td><td>f</td><td>g</td><td>h</td><td>i</td><td>j</td><td>k</td><td>l</td><td>m</td></tr>
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<tr><td>2.</td><td>Mapping of instructional objectives with student outcome</td><td></td><td>1-4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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<tr><td>5.</td><td>Approval</td><td colspan="13">23rd Meeting of Academic Council, May 2013</td></tr>
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ELECTIVE V

GN1112	MOLECULAR MEDICINE	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

The course imparts advanced knowledge on use of biological molecules as medicine in human health care sector employing biotechnology. A brief outline on drug discovery and pharmacological aspects, and importance on the molecular aspects of infectious diseases and gene therapy will be focused.

INSTRUCTIONAL OBJECTIVES

1.	To focus and impart advanced knowledge on the molecular basis of diseases.
2.	To know the protein functional defects in diseases
3.	To obtain a brief knowledge on molecular pharmacology
4.	To understand about molecular aspects of infectious diseases and Molecular Therapeutics.
5.	To gain awareness about molecular level of drug delivery system and gene therapy.

UNIT I – INTRODUCTION (7 hours)

Introduction to Molecular Medicine: Overview of the subject, Molecular mechanisms in development and differentiation, Molecular and biomedical aspects of ageing.

UNIT II - GENE AND PROTEIN DEFECTS AND DISEASES (10 hours)

Abnormal protein function and diseases, Diseases of DNA repair and genomic instability, RNA processing and disease, Oncology-Chromosomal translocations and leukemia, Skin cancer, renal carcinoma, Coagulation and haemophilia, Gene defects and drug action in Atherosclerosis, Cystic fibrosis, Alzheimer's and Huntington's diseases.

UNIT III - MOLECULAR PHARMACOLOGY (10 hours)

Drug discovery - Drug design and development, Clinical trials, Molecular pharmacology -Pharmacokinetics and Pharmacodynamic studies, Drug elimination kinetics.

UNIT IV - MOLECULAR ASPECTS OF INFECTIOUS DISEASES (10 hours)

Virulence, virulence factors and virulence associated factors. Intracellular pathogens: Bacillary dysentery, Extracellular pathogens: Botulism and tetanus, Viral pathogens: Dengue hemorrhagic fever

UNIT V - MOLECULAR BIOTECHNOLOGY (8 hours)

Antibodies - design production, engineering, Peptides and derivatives as therapeutic agents, Nanotechnology and pharmaceuticals, Drug delivery systems.

REFERENCES

1. Gary Walsh "*Proteins – Biochemistry and Biotechnology*" Wiley, 2002.
2. Robert A. Meyers "*Encyclopedia of Molecular Cell Biology and Molecular Medicine*" (Ed) – Vol I, II ed. VCH, 1996.
3. Barry Halliwell "*Free Radicals in Health and Disease*", Oxford, 2007.
4. Eduardo.A, Groisman, "*Principles of Bacterial pathogenesis*", Academic press, 2001.

GN1112 MOLECULAR MEDICINE														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
			X	X			X				X		X	
2.	Mapping of instructional objectives with student outcome		2,4	1,3,4,5			5				4,5		2,3,4,5	
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		--			--			--		X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

	FUNCTIONAL GENOMICS AND PROTEOMICS	L	T	P	C
GN1113	Total Contact Hours - 45	3	0	0	3
	Prerequisite				
	Nil				

PURPOSE

This course imparts advanced knowledge on the methods to study gene expression at the genome and proteome levels. The detailed analysis of the techniques involved for quantifying gene and protein expression will enable students to perform the assays for detection of gene expression. Additionally they would be able to study the application of the techniques in various fields.

INSTRUCTIONAL OBJECTIVES

1.	To know about the functional organization of the genome and proteome
2.	To understand and apply the techniques of genomics and proteomics to study gene and protein expression respectively
3.	To apply the techniques to study differential gene expression
4.	To perform a correlation between gene expression and its corresponding protein profile
5.	To be able to analyze and interpret large datasets of gene expression data

UNIT I - GENOME ORGANIZATION AND GENE EXPRESSION (8 hours)

Introduction, genetic elements that control gene expression, constitutive and inducible gene expression, correlation between mRNA and protein abundance, functional genomic analysis using forward genetics and reverse genetics.

UNIT II - TRANSCRIPTOME ANALYSIS (10 hours)

mRNA as a subject of gene expression studies, traditional approaches for analysis of gene expression –transcriptional run off assays, RT-PCR, DNase protection assay,differential display PCR, Genome wide measurement of gene expression – SAGE, Massively Parallel Signature Sequencing, Microarrays, interpretation of RNA analyses, relationship of DNA and mRNA levels.

UNIT III - PROTEOME ANALYSIS (10 hours)

Introduction, protein databases,2D gel electrophoresis, MALDI-TOF analysis, MASCOT analysis, Mass spectroscopy, peptide mass fingerprinting, peptide sequence analysis by tandem mass spectrometry, SELDI protein chip technology, proteomic analysis of post translational modifications experimental approaches for protein-protein interaction mapping, differential and quantitative proteomics.

UNIT IV-COMPARATIVE GENOMICS (9 hours)

Orthologs and paralogs, Comparative genomics of bacteria and horizontal gene transfer, Comparative genomics of mitochondrial genomes and eukaryotes, applications of comparative genomics.

UNIT V-APPLICATIONS OF FUNCTIONAL GENOMICS AND PROTEOMICS (8 hours)

Introduction, applications of genomics in understanding basis of polygenic disorders, pharmacogenomics, Medical proteomics-biomarker discovery and its importance, Pharmaceutical proteomics-role of proteomics in drug development, applications of proteomics for the analysis of genetically modified plants.

TEXT BOOK

1. Jonathan Pevsner "*Bioinformatics and Functional Genomics*" Wiley-Blackwell, 2nd edition.
2. Daniel C. Liebler "Introduction to Proteomics" Humana Press, 2002.

REFERENCES

1. Primrose .S.B, Twayman .R.M, "*Principles of Gene Manipulation and Genomics*" Blackwell publishing, 7th edition, 2006.
2. Twayman.R.M, "*Principles of Proteomics*" (Advanced text series), Taylor and Francis, 1st edition, 2004.

GN1113 FUNCTIONAL GENOMICS AND PROTEOMICS														
Course designed by		**Department of Genetic Engineering**												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
		X	X				X							
2.	Mapping of instructional objectives with student outcome	2	2,3,4				2,3,4,5							
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		--			--			--		X		
5.	Approval	23rd Meeting of Academic Council, May 2013												

	PHARMACOGENOMICS AND PERSONALIZED MEDICINE	L	T	P	C
GN1114	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite				
	Nil				

PURPOSE

The course provides fundamental knowledge in pharmacogenomics and implementation of pharmacogenomic studies in personalized medicine. The detailed study on human drug response, drug metabolizing enzymes and research activities carried out so far in the field of personalized medicine will be focused.

INSTRUCTIONAL OBJECTIVES

1.	To apply knowledge on current challenges of health care landscape through personalized medicine.
2.	To understand the drug dose response relationships with pharmacogenetics.
3.	To obtain a broad education necessary to understand the pharmacogenomics in drug is metabolizing and non-drug metabolizing variants.
4.	To know about application of pharmacogenomics in personalized medicine.
5.	To update knowledge from research papers in personalized medicine.

UNIT I-INTRODUCTION (6 hours)

History and Basic principles of Pharmacogenomics and personalized medicine, the current challenges of healthcare landscape driving the pharmaceutical industry to personalized medicine, personalized medicine – A Way Forward.

UNIT II-HUMAN DRUG RESPONSE: (10 hours)

Pharmacological profile of Human drug response, pharmacokinetics in pharmacogenetics, Drug-dose response relationships in pharmacogenetics, the genetic profile of Human drug response, Twin studies in pharmacogenomics.

UNIT III-DRUG METABOLIZING ENZYME VARIANTS (10 hours)

Alcohol intolerance and alcohol metabolism, cyclophosphamide polymorphic biotransformation, glucose – 6 – phosphate dehydrogenase deficiency, Parathion poisoning and paraoxan polymorphism, acetylation polymorphism, fish odor syndrome, glucocorticoid remediable aldosteronism, lactose intolerance, pyridoxine responsive anaemia.

UNIT IV-APPLICATION OF PHARMACOGENOMICS: (10 hours)

Pharmacogenetic applications in Epilepsy, Alzheimer's disease. Psychiatric disorders, HIV, Cardiovascular diseases, Obesity, Inflammatory bowel syndrome.

UNIT V-RESEARCH IN PERSONALIZED MEDICINE (9hours)

Impact of Genetic polymorphism on clinical response to antithrombotics, Pharmacogenomics of drug metabolizing enzymes and transporters: Implication for cancer therapy, Individualization of antiretroviral therapy.

REFERENCES

1. Nadine Cohen, "*Pharmacogenomics and personalized medicine*", Humana press, 2010.
2. Wendell W Weber, "*Pharmacogenetics"*, Oxford University Press, 2008.
3. Kena J Lanham et al, "*Impact of Genetic polymorphism on clinical response to antithrombotics, Pharmacogenomics and personalized medicine"*, Dove press 2010; 3: 87-89.
4. Jing li et al, "*Pharmacogenomics of drug metabolizing enzymes and transporters: Implic ation for cancer therapy, Pharmacogenomics and personalized medicine",* Dove press 2011; 4: 11-33.
6. Rebecca Pavlos et al, "*Individualization of antiretroviral therapy, Pharmacogenomics and personalized medicine"*, Dove press 2012; 5: 1-17.

GN1114 PHARMACOGENOMICS AND PERSONALIZED MEDICINE														
Course designed by		Department of Genetic Engineering												
1.	Student Outcome	a	b	c	d	e	f	g	h	i	j	k	l	m
			X	X			X				X		X	
2.	Mapping of instructional objectives with student outcome		3	2,4			2,3,4				1,3,4		1,5	
3.	Category	General (G)		Basic Sciences (B)			Engineering Sciences and Technical Arts (E)					Professional Subjects(P)		
												X		
4.	Broad Area	Gene Cloning Technologies		Cell Culture Technologies			Biochemical Engineering			Plant Genetic Engineering		Applied Genetics		
		--		--			--			--		X		
5.	Approval	23rd Meeting of Academic Council, May 2013												