

# **Integrated M.Tech Programmes in Converging Technologies**

- **Nanoscience and Nanotechnology (INN)**
- **Bioinformatics and Biotechnology (IBB)**
- **Information and Communication Technology (IIT)**
- **Cognitive and Neurosciences (ICN)**
- **Environmental Science and Technology (IET)**

**Programme Code: ICT**

**Duration – 5 Years**

**Programme Structure  
And  
Curriculum & Scheme of Examination  
With  
Choice Based Credit System (CBCS)**

**AMITY UNIVERSITY  
R A J A S T H A N**

## Credit Summary Sheet

<b>Integrated M.Tech Converging Technology</b>					
<b>Semester</b>	<b>CC</b>	<b>DE</b>	<b>VA</b>	<b>OE</b>	<b>Total</b>
1	20	3	4	-	27
2	20	-	8	-	28
3	24	-	4	-	28
4	23	-	4	-	27
5	20	-	4	3	27
6	20	-	4	3	27
7	19	3	4	-	26
8	19	-	4	-	23
9&10	40	-	-	-	40
<b>Total</b>	<b>205</b>	<b>6</b>	<b>36</b>	<b>6</b>	<b>253</b>

## **Program Learning Outcomes: PLO**

**M Tech Converging Technologies programme is designed to prepare graduates to attain the following program outcomes:**

**PLO1:** To develop an ability to understand multiple scientific fields in depth and logically work to integrate them for a common goal.

**PLO2:** Gain an ability to plan and conduct multidisciplinary experiments, interpret data and provide well informed conclusions.

**PLO3:** To develop an approach of problem solving, product development, scientific advancement, innovation and paradigm shift in scientific world.

**PLO4:** To produce individuals which may innovate and improvise the existing tools to develop altogether new products to address fundamental scientific issues.

## Program Structure

<b>Integrated M.Tech Converging Technology : I- SEMESTER</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Lectures (L) Hours Per Week</b>	<b>Tutorial (T) Hours Per Week</b>	<b>Practical (P) Hours Per Week</b>	<b>Credits</b>
ICT101	Properties of Matter, Thermal Physics and Optics	CC	3	1	-	4
ICT102	Fundamentals Inorganic & Organic Chemistry	CC	3	1	-	4
ICT103	Biochemistry & Molecular Biology	CC	3	1	-	4
ICT104	Programming language fundamental & Programming in C	CC	3	1	-	4
ICT121	Properties of Matter, Thermal Physics and Optics-Lab	CC	-	-	2	1
ICT122	Fundamentals Inorganic & Organic Chemistry-Lab	CC	-	-	2	1
ICT123	Biochemistry & Molecular Biology-Lab	CC	-	-	2	1
ICT124	Programming language fundamental & Programming in C-Lab	CC	-	-	2	1
DE Electives: DE for 10+2 PCB is ICT105 & for PCM is ICT106						
ICT105	Foundation Course in Mathematics	DE	3	-	-	3
ICT106	Foundation Course in Biology	DE				
BCS 101	English	VA	1	-	-	1
BSS105	Understanding Self for Effectiveness – I	VA	1	-	-	1
FLT 101	Foreign Language - I	VA	2	-	-	2
FLG 101	French					
FLS 101	German					
FLC 101	Spanish Chinese					
	<b>TOTAL</b>					<b>27</b>

<b>Integrated M.Tech Converging Technology : II- SEMESTER</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Lectures (L) Hours Per Week</b>	<b>Tutorial (T) Hours Per Week</b>	<b>Practical (P) Hours Per Week</b>	<b>Credits</b>
ICT201	Semiconductor, Electronic devices & Applications	CC	3	-	-	3
ICT202	Physical Chemistry	CC	3	-	-	3
ICT203	Cell Biology & Genetics	CC	3	1	-	4
ICT204	Object Oriented Programming in C++	CC	3	-	-	3
ICT205	Calculus	CC	3	-	-	3
ICT221	Semiconductor, Electronic devices & Applications-Lab	CC	-	-	2	1
ICT222	Physical Chemistry-Lab	CC	-	-	2	1
ICT223	Cell Biology & Genetics-Lab	CC	-	-	2	1
ICT224	Object Oriented Programming in C++-Lab	CC	-	-	2	1
EVS001	Environmental Sciences	VA	4	-	-	4
BCS 201	English	VA	1	-	-	1
BSS205	Understanding Self for Effectiveness – II	VA	1	-	-	1
FLT 201 FLG 201 FLS 201 FLC 201	Foreign Language - II French German Spanish Chinese	VA	2	-	-	2
	<b>TOTAL</b>					<b>28</b>

<b>Integrated M.Tech Converging Technology : III- SEMESTER</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Lectures (L) Hours Per Week</b>	<b>Tutorial (T) Hours Per Week</b>	<b>Practical (P) Hours Per Week</b>	<b>Credits</b>
ICT301	Electrodynamics and Quantum Mechanics	CC	3	-	-	3
ICT302	Atomic, Molecular and Nuclear Spectroscopy	CC	3	-	-	3
ICT303	Developmental Biology	CC	3	1	-	4
ICT304	Programming in JAVA	CC	3	1	-	4
ICT305	Differential Equations	CC	3	-	-	3
ICT 306	Instrumentation in Biology	CC	3			3
ICT321	Atomic, Molecular and Nuclear Spectroscopy Lab	CC	-	-	2	1
ICT322	Developmental Biology Lab	CC	-	-	2	1
ICT323	Programming in JAVA Lab	CC	-	-	2	1
ICT324	Instrumentation in Biology Lab	CC	-	-	2	1
BCS301	Communication Skills-I	VA	1	-	-	1
BSS305	Understanding Self for Effectiveness – III	VA	1	-	-	1
FLT301 FLG301 FLS301 FLC301	Foreign Language - III French German Spanish Chinese	VA	2	-	-	2
	<b>TOTAL</b>					<b>28</b>

<b>Integrated M.Tech Converging Technology : IV- SEMESTER</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Lectures (L) Hours Per Week</b>	<b>Tutorial (T) Hours Per Week</b>	<b>Practical (P) Hours Per Week</b>	<b>Credits</b>
ICT401	Statistical and Solid state Physics	CC	3	-	-	3
ICT402	Quantum Chemistry	CC	3	-	-	3
ICT403	Fundamentals of Bioinformatics	CC	3	-	-	3
ICT404	Database management System	CC	3	-	-	3
ICT405	Statistical methods	CC	3	-	-	3
ICT 406	Workshop Practice	CC	-	-	2	1
ICT 407	Microbiology		3	-	-	3
ICT421	Fundamentals of Bioinformatics Lab	CC	-	-	2	1
ICT422	Database management System Lab	CC	-	-	2	1
ICT423	Microbiology Lab	CC		-	4	2
BCS401	Communication Skills-II	VA	1	-	-	1
BSS405	Understanding Self for Effectiveness – IV	VA	1	-	-	1
FLT401 FLG401 FLS401 FLC401	Foreign Language - IV French German Spanish Chinese	VA	2	-	-	2
	<b>TOTAL</b>					<b>27</b>

<b>Integrated M.Tech Converging Technology : V- SEMESTER</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Lectures (L) Hours Per Week</b>	<b>Tutorial (T) Hours Per Week</b>	<b>Practical (P) Hours Per Week</b>	<b>Credits</b>
ICT501	Advanced Genetic Engineering	CC	3	-		3
ICT502	Fundamentals of Nanoscience and Nanotechnology	CC	3	-		3
ICT503	Fundamentals of Information and communication technology	CC	3	-		3
ICT504	Fundamentals of Cognitive and Neuroscience	CC	3	-		3
ICT 505	Fundamentals of Environment Science and Technology	CC	3	-		3
OE	Open Elective	OE	3	-	-	3
ICT521	Advanced Genetic Engineering Lab	CC	-	-	2	1
ICT522	Fundamentals of Nanoscience and Nanotechnology Lab	CC	-	-	2	1
ICT523	Fundamentals of Information and communication technology Lab	CC	-	-	2	1
ICT524	Fundamentals of Cognitive and Neuroscience Lab	CC	-	-	2	1
ICT525	Fundamentals of Environment Science and Technology Lab	CC	-	-	2	1
BCS501	Communication Skills-III	VA	1	-	-	1
BSS505	Understanding Self for Effectiveness – V	VA	1	-	-	1
FLT501 FLG501 FLS501 FLC501	Foreign Language - V French German Spanish Chinese	VA	2	-	-	2
	<b>TOTAL</b>					<b>27</b>

<b>Integrated M.Tech Converging Technology : VI- SEMESTER</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Lectures (L) Hours Per Week</b>	<b>Tutorial (T) Hours Per Week</b>	<b>Practical (P) Hours Per Week</b>	<b>Credits</b>
ICT601	Nanotechnology in biology and medicine	CC	3	-	-	3
ICT602	Functional and Comparative Genomics	CC	3	-	-	3
ICT603	Artificial Intelligence	CC	3	-	-	3
ICT604	Cognitive Neurology	CC	3	-	-	3
ICT 605	Environmental Systems Modeling	CC	3	-	-	3
OE	Open elective	OE	3	-	-	3
ICT621	Nanotechnology in biology and medicine Lab	CC	-	-	2	1
ICT622	Functional and Comparative Genomics Lab	CC	-	-	2	1
ICT623	Artificial Intelligence Lab	CC	-	-	2	1
ICT624	Cognitive Neurology Lab	CC	-	-	2	1
ICT 625	Environmental Systems Modeling Lab	CC	-	-	2	1
BCS601	Communication Skills-IV	VA	1	-	-	1
BSS605	Understanding Self for Effectiveness –VI	VA	1	-	-	1
FLT601 FLG601 FLS601 FLC601	Foreign Language - VI French German Spanish Chinese	VA	2	-	-	2
	<b>TOTAL</b>					<b>27</b>

<b>Integrated M.Tech Converging Technology : IBB (VII – SEMESTER)</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Lectures (L) Hours Per Week</b>	<b>Tutorial (T) Hours Per Week</b>	<b>Practical (P) Hours Per Week</b>	<b>Credits</b>
IBB701	Advanced Computational Biology	CC	3	-	-	3
IBB702	R & Bioconductor	CC	3	-	-	3
IBB703	Bioprocess Engineering and technology	CC	3	-	-	3
IBB704	Advanced Immunotechnology	CC	3	-	-	3
IBB 705	Research Methodology	CC	3	-	-	3
IBB721	Advanced Computational Biology Lab	CC	-	-	2	1
IBB722	R & Bioconductor Lab	CC	-	-	2	1
IBB723	Bioprocess Engineering and technology	CC	-	-	2	1
IBB 724	Advanced Immunotechnology Lab	CC	-	-	2	1
<b>DE Electives: Student has to select 1 course from the list of following DE electives</b>						
IBB730	Nanomaterial Design and applications	DE	3	-		3
IBB731	Modern operating systems	DE	3	-		3
IBB732	Psychology of mind	DE	3	-		3
IBB733	Energy Safety and hazard control	DE	3	-		3
BCS701	Communication Skills-V	VA	1	-	-	1
BSS705	Understanding Self for Effectiveness – VII	VA	1	-	-	1
FLT701	Foreign Language - VII	VA	2	-	-	2
FLG701	French					
FLS701	German					
FLC701	Spanish					
	Chinese					
	<b>TOTAL</b>					<b>26</b>

<b>Integrated M.Tech Converging Technology : INN (VII – SEMESTER)</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Lectures (L) Hours Per Week</b>	<b>Tutorial (T) Hours Per Week</b>	<b>Practical (P) Hours Per Week</b>	<b>Credits</b>
INN701	Nanodevices and Nanosensors	CC	3	-	-	3
INN702	Nanophotonics	CC	3	-	-	3
INN703	Nanomaterial Design and applications	CC	3	-	-	3
INN 704	Nanoelectronics	CC	3	-	-	3
INN 705	Research Methodology	CC	3	-	-	3
INN 721	Nanodevices and Nanosensors Lab	CC	-	-	2	1
INN722	Nanophotonics Lab	CC	-	-	2	1
INN723	Nanomaterial Design and applications Lab	CC	-	-	2	1
INN 724	Nanoelectronics Lab	CC	-	-	2	1
<b>DE Electives: Student has to select 1 course from the list of following DE electives</b>						
INN730	Advanced Immunotechnology	DE	3	-	-	3
INN731	Modern operating systems	DE	3	-	-	3
INN732	Psychology of mind	DE	3	-	-	3
INN733	Energy Safety and hazard control	DE	3	-	-	3
BCS701	Communication Skills-V	VA	1	-	-	1
BSS705	Understanding Self for Effectiveness – VII	VA	1	-	-	1
FLT701	Foreign Language - VII	VA	2	-	-	2
FLG701	French					
FLS701	German					
FLC701	Spanish					
	Chinese					
	<b>TOTAL</b>					<b>26</b>

<b>Integrated M.Tech Converging Technology : IIT (VII – SEMESTER)</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Lectures (L) Hours Per Week</b>	<b>Tutorial (T) Hours Per Week</b>	<b>Practical (P) Hours Per Week</b>	<b>Credits</b>
IIT701	Satellite Communication	CC	3	-	-	3
IIT702	Optical Fiber Communication	CC	3	-	-	3
IIT703	Modern operating systems	CC	3	-	-	3
IIT 704	Signal and Image Processing	CC	3	-	-	3
IIT 705	Research Methodology	CC	3	-	-	3
IIT 721	Satellite Communication Lab	CC	-	-	2	1
IIT722	Optical Fiber Communication Lab	CC	-	-	2	1
IIT723	Modern operating systems Lab	CC	-	-	2	1
IIT 724	Signal and Image Processing Lab	CC	-	-	2	1
<b>DE Electives: Student has to select 1 course from the list of following DE electives</b>						
IIT730	Advanced Immunotechnology	DE	3	-	-	3
IIT731	Nanomaterial Design and applications	DE	3	-	-	3
IIT732	Psychology of mind	DE	3	-	-	3
IIT733	Energy Safety and hazard control	DE	3	-	-	3
BCS701	Communication Skills-V	VA	1	-	-	1
BSS705	Understanding Self for Effectiveness – VII	VA	1	-	-	1
FLT701 FLG701 FLS701 FLC701	Foreign Language - VII French German Spanish Chinese	VA	2	-	-	2
	<b>TOTAL</b>					<b>26</b>

<b>Integrated M.Tech Converging Technology : ICN (VII – SEMESTER)</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Lectures (L) Hours Per Week</b>	<b>Tutorial (T) Hours Per Week</b>	<b>Practical (P) Hours Per Week</b>	<b>Credits</b>
ICN701	Principle and techniques of neurosciences	CC	3	-	-	3
ICN702	Psychology of mind	CC	3	-	-	3
<b>ICN703</b>	<b>Introduction to dynamical system for neuroscience</b>	<b>CC</b>	<b>3</b>	<b>1</b>	<b>-</b>	<b>4</b>
ICN 704	Neuroanatomy	CC	3	-	-	3
ICN 705	Research Methodology	CC	3	-	-	3
<b>ICN 721</b>	<b>Neuroscience Lab</b>	<b>CC</b>	<b>-</b>	<b>-</b>	<b>6</b>	<b>3</b>
<b>DE Electives: Student has to select 1 course from the list of following DE electives</b>						
ICN730	Advanced Immunotechnology	DE	3	-	-	3
ICN731	Nanomaterial Design and applications	DE	3	-	-	3
ICN732	Modern operating systems	DE	3	-	-	3
ICN733	Energy Safety and hazard control	DE	3	-	-	3
BCS701	Communication Skills-V	VA	1	-	-	1
BSS705	Understanding Self for Effectiveness – VII	VA	1	-	-	1
FLT701	Foreign Language - VII	VA	2	-	-	2
FLG701	French					
FLS701	German					
FLC701	Spanish					
	Chinese					
	<b>TOTAL</b>					<b>26</b>

<b>Integrated M.Tech Converging Technology : IET (VII – SEMESTER)</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Lectures (L) Hours Per Week</b>	<b>Tutorial (T) Hours Per Week</b>	<b>Practical (P) Hours Per Week</b>	<b>Credits</b>
IET701	Environmental Impact Assessment	CC	3	-	-	3
IET702	Energy management and technology	CC	3	-	-	3
IET703	Energy Safety and hazard control	CC	3	-	-	3
IET 704	Atmospheric Science	CC	3	-	-	3
IET 705	Research Methodology	CC	3	-	-	3
IET721	Environmental Impact Assessment Lab	CC	-	-	2	1
IET722	Energy management and technology Lab	CC	-	-	2	1
IET723	Energy Safety and hazard control Lab	CC	-	-	2	1
IET 724	Atmospheric Science lab	CC	-	-	2	1
<b>DE Electives: Student has to select 1 course from the list of following DE electives</b>						
IET730	Advanced Immunotechnology	DE	3	-	-	3
IET731	Nanomaterial Design and applications	DE	3	-	-	3
IET732	Modern operating systems	DE	3	-	-	3
IET733	Psychology of mind	DE	3	-	-	3
BCS701	Communication Skills-V	VA	1	-	-	1
BSS705	Understanding Self for Effectiveness – VII	VA	1	-	-	1
FLT701 FLG701 FLS701 FLC701	Foreign Language - VII French German Spanish Chinese	VA	2	-	-	2
	<b>TOTAL</b>					<b>26</b>

<b>Integrated M.Tech Converging Technology : IBB (VIII – SEMESTER)</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Lectures (L) Hours Per Week</b>	<b>Tutorial (T) Hours Per Week</b>	<b>Practical (P) Hours Per Week</b>	<b>Credits</b>
IBB801	Pearl and python	CC	3	-	-	3
IBB802	Data Mining	CC	3	-	-	3
IBB803	Protein Engineering	CC	3	-	-	3
IBB804	Animal and Plant biotechnology	CC	3	-	-	3
<b>IBB805</b>	<b>IPR &amp; Drug Regulatory Affairs</b>	<b>CC</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>3</b>
IBB821	Pearl and python Lab	CC	-	-	2	1
IBB822	Data Mining Lab	CC	-	-	2	1
IBB823	Protein Engineering Lab	CC	-	-	2	1
IBB824	Animal and Plant biotechnology Lab	CC	-	-	2	1
BCS801	Communication Skills-VI	VA	1	-	-	1
BSS805	Understanding Self for Effectiveness – VIII	VA	1	-	-	1
FLT801 FLG801 FLS801 FLC801	Foreign Language - VIII French German Spanish Chinese	VA	2	-	-	2
	<b>TOTAL</b>					<b>23</b>

<b>Integrated M.Tech Converging Technology : INN (VIII – SEMESTER)</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Lectures (L) Hours Per Week</b>	<b>Tutorial (T) Hours Per Week</b>	<b>Practical (P) Hours Per Week</b>	<b>Credits</b>
INN801	Nanomedicine and Nanotoxicology	CC	3	-	-	3
INN802	Optoelectronic Devices	CC	3	-	-	3
INN803	Nanocomposites	CC	3	-	-	3
INN804	Nanotechnology Business Applications and Commercialization	CC	3	1	-	4
<b>INN805</b>	<b>IPR &amp; Drug Regulatory Affairs</b>	<b>CC</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>3</b>
INN821	Nanomedicine and Nanotoxicology Lab	CC	-	-	2	1
INN822	Optoelectronic Devices Lab	CC	-	-	2	1
INN823	Nanocomposites Lab	CC	-	-	2	1
BCS801	Communication Skills-VI	VA	1	-	-	1
BSS805	Understanding Self for Effectiveness – VIII	VA	1	-	-	1
FLT801 FLG801 FLS801 FLC801	Foreign Language - VIII French German Spanish Chinese	VA	2	-	-	2
	<b>TOTAL</b>					<b>23</b>

<b>Integrated M.Tech Converging Technology : IIT (VIII – SEMESTER)</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Lectures (L) Hours Per Week</b>	<b>Tutorial (T) Hours Per Week</b>	<b>Practical (P) Hours Per Week</b>	<b>Credits</b>
IIT801	Microwave Engineering	CC	3	-	-	3
IIT802	Mobile computing	CC	3	-	-	3
IIT803	Network Security and cryptography	CC	3	-	-	3
IIT804	Electronic Commerce	CC	3	-	-	3
IIT805	IPR & Drug Regulatory Affairs	CC	3	-	-	3
IIT821	Microwave Engineering Lab	CC	-	-	2	1
IIT822	Mobile computing Lab	CC	-	-	2	1
IIT823	Network Security and cryptography Lab	CC	-	-	2	1
IIT824	Electronic Commerce Lab	CC	-	-	2	1
BCS801	Communication Skills-VI	VA	1	-	-	1
BSS805	Understanding Self for Effectiveness – VIII	VA	1	-	-	1
FLT801 FLG801 FLS801 FLC801	Foreign Language – VIII French German Spanish Chinese	VA	2	-	-	2
	<b>TOTAL</b>					<b>23</b>

<b>Integrated M.Tech Converging Technology : ICN (VIII – SEMESTER)</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Lectures (L) Hours Per Week</b>	<b>Tutorial (T) Hours Per Week</b>	<b>Practical (P) Hours Per Week</b>	<b>Credits</b>
ICN801	Neurolinguistics	CC	3	1	-	4
ICN802	Clinical Neurosciences	CC	3	-	-	3
ICN803	Computational Neurosciences	CC	3	-	-	3
ICN804	Neuroimaging methods in cognitive neuroscience	CC	3	-	-	3
ICN805	IPR & Drug Regulatory Affairs	CC	3	-	-	3
ICN821	Neuroscience Lab	CC	-	-	6	3
BCS801	Communication Skills-VI	VA	1	-	-	1
BSS805	Understanding Self for Effectiveness – VIII	VA	1	-	-	1
FLT801	Foreign Language - VIII	VA	2	-	-	2
FLG801	French					
FLS801	German					
FLC801	Spanish					
	Chinese					
	<b>TOTAL</b>					<b>23</b>

<b>Integrated M.Tech Converging Technology : IET (VIII – SEMESTER)</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Lectures (L) Hours Per Week</b>	<b>Tutorial (T) Hours Per Week</b>	<b>Practical (P) Hours Per Week</b>	<b>Credits</b>
IET801	Waste water treatment	CC	3	-	-	3
IET802	Environmental pollution and legislation	CC	3	-	-	3
IET803	Environmental Engineering	CC	3	-	-	3
IET804	Separation Processes in Environmental Applications	CC	3	-	-	3
<b>IET805</b>	<b>IPR &amp; Drug Regulatory Affairs</b>	<b>CC</b>	<b>3</b>	<b>-</b>	<b>-</b>	<b>3</b>
IET821	Waste water treatment Lab	CC	-	-	2	1
IET822	Environmental pollution and legislation Lab	CC	-	-	2	1
IET823	Environmental Engineering Lab	CC	-	-	2	1
IET824	Separation Processes in Environmental Applications Lab	CC	-	-	2	1
BCS801	Communication Skills-VI	VA	1	-	-	1
BSS805	Understanding Self for Effectiveness – VIII	VA	1	-	-	1
FLT801 FLG801 FLS801 FLC801	Foreign Language - VIII French German Spanish Chinese	VA	2	-	-	2
	<b>TOTAL</b>					<b>23</b>

<b>Integrated M.Tech Converging Technology : IX &amp; X – SEMESTER</b>						
<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>Lectures (L) Hours Per Week</b>	<b>Tutorial (T) Hours Per Week</b>	<b>Practical (P) Hours Per Week</b>	<b>Credits</b>
ICT 901	Project with converging technology approach & domain approach	CC	-	-	-	60

# PROPERTIES OF MATTER, THERMAL PHYSICS AND OPTICS

Course Code: ICT101

L:3,T:1,P:2, C:5

## Course Objective:

Aim of this course is to introduce the students to fundamentals of graduate level physics, which form the basis of all applied science and engineering.

## Course Contents:

**Module I: Properties of Matter: Elasticity:** Hook's Law, Young's Modulus, Bulk Modulus, Shear Modulus, Poisson's ratio, Relations between elastic constants. Twisting couple on a Cylindrical Rod, Bending of Beams, Bending moments, Cantilever.

**Module II: Viscosity:** Viscosity, Critical velocity, Flow of a Liquid through a Capillary Tube, Poiseuille's equation, Capillaries in series and parallel, Stoke's Formula.

**Surface Tension:** Molecular Forces, Surface energy, Shape of drops, Pressure difference across a Curved Surface, Expression for Excess Pressure on a curved surface, Film of Water between two Glass plates, Shape of liquid meniscus in a capillary tube, Capillary action, Rise of liquid in a conical Capillary tube, Vapor pressure and Surface tension.

## Module III: Thermal Physics:

Concept of thermodynamic state, the first law of thermodynamics: heat and work, internal energy. second law of thermodynamics: concept of entropy and temperature, principle of increase of entropy. thermodynamic variables: enthalpy, Helmholtz potential, Gibbs free energy, Phase transformations: first order and second order, Clausius-Clapeyron equation. Production of low temperature: Joule-Thomson experiment, regenerative cooling, cooling by adiabatic demagnetization.

**Module IV: Optics I: Diffraction of light:** Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at a single slit, Fraunhofer diffraction due to Double slit, N Slits, Diffraction pattern discussion due to Transmission Grating.

**Resolving Power:** Geometrical and spectral resolution, distinction between magnification and resolution, Rayleigh's criterion for the limit of resolution, resolving power of plane diffraction grating, resolving power of a prism.

**Module V: Optics II: Polarization of light:** Concept of polarization, polarization by reflection, Brewster's law, polarization by refraction, pile of plates, double refraction, Huygens explanation of double refraction through uniaxial crystals, Nicol prism, phase retardation plates, elliptically and circularly polarized light, detection of plane, elliptically and circularly polarized light and optical rotation - laws of rotation of plane of polarization. **Laser system:** Spontaneous & stimulated emission, absorption, Einstein coefficients (only definitions), population inversion, optical & electrical pumping, cavity resonators, properties of lasers, Ruby laser, Helium- Neon laser, uses of laser, idea of holography (qualitative treatment only). **Optical fibers:** Structure and types of fibers, fiber optic communication system.

## Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

## Text & References:

- **Berkeley Physics Course Vol 1 & 3**
- **Engineering Physics Malik & Singh Mcgraw Hill Education Pvt. Ltd, 2013.**
- Thermodynamics, Kinetic, Theory of Gases and Statistical Mechanics-Sears. **THIRD EDITION**, **Publisher:** Addison Wesley.
- **"OPTICS" by AJAY GHATAK** - 3rd ed. "Tata McGraw Hill **Publishing** Company Limited" New Delhi.

# Fundamentals Inorganic & Organic Chemistry

Course Code: ICT102

L:3,T:1,P:2, C:5

## THEORY

### Course Objective:

Aim of this course is to introduce the students to fundamentals of inorganic and organic chemistry which form the basis of all branches of applied sciences and engineering.

### Course Contents:

#### Module I: Polymers

Inorganic Polymers: Homo and heterocatenated inorganic polymers. Polyphosphazenes: synthetic routes and bonding features. Polysilanes: sigma bond delocalization in polysilanes and its implications. Structural aspects and applications of boranes and silicones. Organic polymers: Mechanism of addition and condensation polymerization, copolymerization and coordination polymerization, Zeigler – Natta catalysts, thermosetting and thermoplastic polymers, Synthesis and applications of Dacron, terylene, Nylon 66, Bakelite, melamine and polyacrylonitriles.

#### Module II: Mechanism of Organic Reactions

Mechanism of Organic Reactions: Homolytic and Heterolytic bond fission. Types of organic reactions, electrophiles and nucleophiles. Reactive intermediates: generation, structure and reactivity of carbocations, carbanions, free radicals, carbenes, arynes and nitrenes.

#### Module III: Stereochemistry

Stereochemistry: Concept of stereoisomerism, structural representation of stereoisomers, Elements of symmetry, chirality, enantiomers, stereogenic centre, optical activity, optical activity of molecules with two stereogenic centre: diastereoisomers, threo and erythro isomers, meso compounds, resolution, inversion, retention and racemization, IUPAC conventions for optical and geometrical isomers, geometrical isomerism in oximes and alicyclic compounds. Conformations and conformational analysis – ethane, n-butane and cyclohexane. Resolution of racemates - chemical and enzymatic methods.

#### Module IV: Arenes and Aromaticity

Conjugation and aromaticity, structure of benzene, Huckel's (4n+2) rule and its applications to aromatic hydrocarbons. Mechanism of electrophilic substitution (halogenation, nitration, sulphonation, Friedel-Crafts reaction). Effect of substituent groups (inductive, mesomeric and hyperconjugative effects), Activating and deactivating groups, directive influence and orientation.

#### Module V: Transition metal complexes and Organometallics

Transition metal complexes: Crystal field theory, basic concepts, crystal field effects in tetrahedral and octahedral geometry, pairing energies, weak field and strong field case, crystal field stabilization energy, factors affecting magnitude of 10Dq, high and low spin complexes, evidences for crystal field stabilization, tetragonal distortions, electronic spectra and magnetism. Organometallics: EAN rule, metal carbonyls – synthesis, bonding and structure, metallocenes – synthesis and properties, Homogeneous and heterogeneous catalysis.

### Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

### Text & References:

- Morrison R. T. and Boyd R. N.(2014) Organic Chemistry,7<sup>th</sup> edition, Pearson.
- Smith M. B. and March J.(2007) Reaction Mechanisms and structure, 6<sup>th</sup> edition, Wiley and Sons publications.
- Finar I. L. (1963) Organic Chemistry :The fundamental Principles, 4<sup>th</sup> edition,Longmans.
- Lee, J. D. (1991) Concise Inorganic Chemistry, 4<sup>th</sup> edition, Chapman and Hall.
- Cotton F. A. and Wilkinson G.(1972) Advanced Inorganic Chemistry, 3<sup>rd</sup> edition, Interscience Publishers
- Charles E. Carraher Jr.(2010) Introduction to Polymer Chemistry, 2<sup>nd</sup> edition, CRC press.
- Shriver D. F. and Atkins A. W. (1999) Inorganic Chemistry, 3<sup>rd</sup> Edition, ELBS, Oxford Press.
- Kalsi P. S. , Stereochemistry , New Age International.

# BIOCHEMISTRY AND MOLECULAR BIOLOGY

Course Code: ICT103

L:3,T:1,P:2 C:05

## THEORY

### Course Objective:

The course aims on understanding of the relationships between structure and function in the major classes of biochemical and molecular pathways. It augurs understanding on central metabolic process and the role of enzymes in modulating pathways.

### Course Contents:

#### Module I: Foundations of Biochemistry

Cellular foundations, Chemical foundations, Physical foundations, Genetic foundations, Evolutionary foundations. Weak interactions in aqueous solutions, Ionization, Buffer.

#### Module II: Proteins and Enzymes

Amino acids, classifications of amino acid, Peptides and proteins, Structure of proteins – primary, secondary, tertiary and quaternary, protein denaturation and folding. Introduction to enzymes, Mechanism of action of enzymes. Introduction: General characteristics of enzymes, definition of coenzyme, holoenzyme, prosthetic groups, classification. Catalysis: homogeneous and heterogeneous catalysis, Biocatalysis, Chemical Kinetics: Rates & orders of reactions factors effecting reaction rates .Enzyme Kinetics: Substrate, active site, transition state, activation energy.

#### Module III: Carbohydrates, lipids and Nucleic acids

Structure of monosaccharides, stereoisomerism and optical isomerism of sugars, mutarotation. important derivatives of monosaccharides, di- and tri-saccharides. Lipids - classification, nomenclature, structure and properties of saturated and unsaturated fatty acids, Structural lipids. DNA Structure, Polynucleotide Chains, Hydrogen Bonding, Double Helix, Minor and Major Grooves, Circular DNA, Topoisomerases, Supercoiling in DNA, RNA structure, Complex tertiary RNA structures.

#### Module IV: DNA replication and Repair

Chemistry of DNA synthesis, Mechanism of DNA polymerase, Replication fork, Specialization of DNA polymerases, DNA synthesis at the replication fork, Initiation of DNA replication, Binding and unwinding: origin selection and activation by the initiator protein, Finishing replication. Replication errors and their repair, DNA damage, Repair and tolerance of DNA damage

#### Module V: Transcription and Translation

RNA polymerases and the transcription cycle,  $\sigma$ -factor, Transcription cycle in bacteria – Initiation, elongation and termination. Genetic code, Messenger RNA, Transfer RNA, Ribosomes, Mechanisms of translation - Initiation, elongation and termination.

### Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

### Text & References:

- Principles of Biochemistry, A.L. Lehninger, D.L. Nelson, M.M. Cox, Worth Publishing
- Harper's Biochemistry, K. Robert, M.D. Murray, D.K. Granner, P.A. Mayes and V.I. Rodwell, McGraw-Hill/Appleton and Lange.
- Watson J. D, Gann A, Baker T. A, Levine M, Bell S.P, Losick R (2013). Molecular Biology of the gene (7<sup>th</sup> edition).

## Programming language fundamental & Programming in C

Course Code: ICT104

L:3,T:1,P:2, C:5

### Course Objective:

The primary objective of this course is to understand all the components of C, including the C language, the C Preprocessor, and the C Standard Library. An understanding of some advanced practical issues, including memory management, testing and debugging, complex declarations and expression evaluation, building and using libraries, and evaluating tradeoffs, such as size vs. speed and speed vs. complexity.

### Course Contents:

#### Module I: Computer Fundamentals

Application software, System Software, Compilers, Interpreters etc. Number System-Binary, Hexadecimal, Octal, and Decimal. Conversion from one number system to another.

#### Module II: Introduction to 'C' Language

Character set, Variables Identifiers, Data type, Arithmetic operation, Constant, operators, Expression, Assignments, basic input/output statements, Simple 'C. Programs.

Decision making in program, Relational Logical operators, if statements, if -else, nested if-else statements, Switch, case loop, Do-While, While, for loop and nesting of loops.

#### Module III: Arrays and Functions

One Dimensional Arrays, Arrays Manipulation, Sorting, Searching, Passing Arguments, call by value and call by references, Recursion and recursive functions.

#### Module IV: Pointers

Pointers: Declaration, Pointer assignments, initialization, Pointers and Dynamic Memory Allocation, Discuss Array of Pointers .

#### Module V: Structure and Union

Structure definition, Declaration, structure Assignments, Arrays in structure, Structure Arrays, Pointer Structure, Nested Structure, Arrays and Arrays of Structure, Union

### Evaluation:

Components	Other Components	Attendance	MTE	ESE
Weightage (%)	15	10	5	70

### Text & References:

#### Text:

- Problem Solving through C language, E. Balagurusamy, TMH publication.
- Peter Nortons, "Introduction to Computers", TMH

#### References:

- Let us C, Yashwant Kanetkar, BPB Publication.
- P.K. Sinha, "Computer Fundamentals", BPB Publications
- V. Rajaraman, "Computer Fundamentals", Prentice Hall
- Dromey. G, "How to Solve it by Computer, Prentice Hall
- Peter Nortons, "DOS Guide" , Prentice Hall
- Gottfried, "Programming in C", Schaum, Tata McGraw Hill
- Y. Kanetkar, "Let us C", BPB Publications
- Y. Kanetkar, "Understanding Pointers" , BPB Publications
- Schidlt, "The Complete Reference of C", Tata McGraw Hill

## Foundation Course in Mathematics

Course Code: ICT105

L:3,T:0,P:0, C:3

### Course Objective:

The knowledge of Mathematics is necessary for a better understanding of almost all disciplines. Here our intention is to make the students acquainted with the concept of basic topics from Mathematics.

### Course Contents:

#### Module 1: Complex Numbers

Definition, real and imaginary parts, complex conjugate, representation of a complex number in a plane, modules and argument of a complex number, algebra of a complex numbers, cube root of unity.

#### Module 2: Sequences and Series

Sequences, series (finite and infinite)  $n^{\text{th}}$  term, arithmetical progression (A.P.) sum of  $n$  terms of an A.P. arithmetic mean (A.M.), Geometric progression (G.P) sum of  $n$  terms and infinite terms of a G.P., Geometric mean (G.M.), Harmonic progression (H.P.) Harmonic Mean (H.M.) Relation between A.M., G.H, H.M, series representation of exponential functions, logarithmic functions,  $\log_e (1 + x)$  and  $\log_e (1 - x)$ .

#### Module 3: Permutation and Combination and Binomial Theorem

Fundamental principle of counting, Factorial notation, Permutation as an arrangement, meaning of  $P(n,r)$ . Combination-meaning of  $C(n,r)$ , Applications of permutation and combinations. Statement and proof of Binomial theorem of positive integral exponent. General and middle terms in Binomial expansions. Properties of Binomial coefficients.

#### Module 4: Matrices and Determinants

Multiplication of matrices, rank of matrix, elementary row and column transformation, inverse of a matrix, solution of linear equations in two or three variables using inverse of a matrix; Determinants of a square matrix, properties of determinates

#### Module 5: Co-ordinate Geometry of two-dimensional

Point: definition, Cartesian system of coordinates in a plane, distance and section formula, condition for collinearity of three points in a plane, equation of a straight line slope form, intercept form, two point form, general form: parallel and perpendicular line, intercept of a line, angle between two lines. Standard and general forms of circle, equation of a circle when and points of a diameters points of intersection of a line and a circle, condition of tangency of a line and a circle, conic section: definition, focus, directrix, eccentricity, equations of parabola, ellipse and hyperbola.

### Examination Scheme:

Components	A	CT	HA/ S/V/Q	EE
Weightage (%)	5	15	10	70

CT: Class Test, HA: Home Assignment, S/V/Q: Seminar/Viva/Quiz, EE: End Semester Examination; Att: Attendance

### Text & References:

- H. K. Das, Higher Engineering Mathematics, S. Chand Publishing.
- Erwin Kreyszig, Advanced Engineering Mathematics, Wiley.
- B. V. Ramana, Higher Engineering Mathematics, Tata Mc.Graw Hill Edu.
- Mathematics, text book for XI, NCERT.

## • Foundation Course in Biology

Course Code: ICT106

L:3,T:0,P:0, C:3

### THEORY

#### Course Objective:

The objective of the course is to provide students an understanding of the very basic molecules of life-DNA,RNA, proteins and how these molecules, when form further complex molecules like carbohydrates, vitamins and lipids, then functioning of body takes place.

#### Course Contents:

##### Module1. Diversity in Living World

What is living?; Biodiversity; Need for classification; Three domain of life; Taxonomy & Systematics; Concept of species and taxonomical hierarchy; Binomial nomenclature; Tools for study of Taxonomy– Museums, Zoos, Herbaria, Botanical gardens. Five kingdom classification; Salient features and classification of Monera; Protista and Fungi into major groups; Lichens; Viruses and Viroids. Salient features and classification of plants into major groups.

##### Module2. Cell Structure and functions

Cell; the basic unit of life. Biomolecules – Lipids, polysaccharides, Proteins, and nucleic acids. Enzymes and cofactors, their classification, chemistry, mechanism of action and factors affecting enzyme activity. Cell cycle and cell division, stages of mitosis and meiosis, and their significance.

##### Module3. Biology and Human Welfare

Health and Disease: Pathogens; parasites causing human diseases (Malaria, Filariasis, Ascariasis, Typhoid, Pneumonia, common cold, amoebiasis, ring worm); Basic concepts of immunology–vaccines; Cancer, HIV and AIDS; Adolescence, drug and alcohol abuse. Improvement in food production: Plant breeding, tissue culture, single cell protein, Biofortification; Apiculture and Animal husbandry.

##### Module4. Genetics and Evolution

Principles of inheritance and variation – Mendals laws, inheritance of one gene and two gene, sex determination, mutation and genetic disorders. Molecular basis of inheritance – DNA, RNA, Replication, Transcription, Genetic code, Translation, regulation of gene expression, DNA fingerprinting, Human Genome Project. Evolution – Origin of life, theory of evolution of life forms, Evidences for evolution, Adaptive radiation, Biological evolution, Hardy-Weinberg principle.

##### Module5. Biotechnology and Its Applications

Principles and process of Biotechnology: Genetic engineering (Recombinant DNA technology). Application of Biotechnology in health and agriculture: Human insulin and vaccine production, gene therapy; Genetically modified organisms- Bt crops; Transgenic Animals; Biosafety issues– Biopiracy and patents.

#### Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

#### Text & References:

- Biology Text book for class XI, NCERT.
- Biology Text book for class XI, NCERT.
- Berg, Jeremy M., John L. Tymoczko, and Lubert Stryer. "Biochemistry." 475–477] (WH Freeman and New York, 2011) (2002).
- Lodish, Harvey. Molecular cell biology. Macmillan, 2008.

## Properties of Matter, Thermal Physics and Optics –Lab

Course Code: ICT121

C: 01

### List of Experiments:

1. To determine the wavelength of sodium light by Newton's rings method.
2. To determine the dispersive power of the material of prism with the help of a spectrometer.
3. To determine the specific rotation of sugar by Bi-quartz or Laurent half shade polarimeter.
4. To determine the speed of ultrasonic waves in liquid by diffraction method.
5. To determine the width of a narrow slit using diffraction phenomena.
6. To determine the temperature coefficient of platinum wire, using a platinum resistance thermometer and a Callender & Griffith's bridge.
7. To determine the value of specific charge (ratio of  $e/m$ ) of an electron by Thomson method.
8. To determine the internal resistance of Leclanche cell with the help of Potentiometer.
9. To determine the resistance per unit length of a Carey Foster's bridge wire and also to find out the specific resistance of a given wire.
10. To plot graph showing the variation of magnetic field with distance along the axis of a circular coil carrying current, and hence estimate the radius of the coil.
11. To determine the value of acceleration due to gravity ('g') in the laboratory using bar pendulum.
12. To determine the moment of inertia of a flywheel about its own axis of rotation.
13. To determine the density of material of the given wire with the help of sonometer.

### Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

## Fundamentals of Inorganic and Organic Chemistry Practicals

Course Code: ICT122

C: 01

### List of Experiments

1. To synthesize phenol formaldehyde resin.
2. To synthesize urea formaldehyde resin.
3. Iodometry titration: Estimation of sodium thiosulphate and potassium dichromate.
4. Volumetric analysis: Oxidation reduction titration using  $\text{KMnO}_4$  and  $\text{K}_2\text{Cr}_2\text{O}_7$ .
5. Preparation of chrome alum.
6. Qualitative analysis of inorganic mixtures, containing not more than four ionic species (excluding insoluble substances).
7. Purification of organic compounds by crystallization (from water or alcohol).
8. Purification of liquid organic compounds by distillation.
9. Qualitative Analysis: Separation, purification and identification of compounds of binary mixture, derivative preparation and confirmatory tests.
10. To synthesize the paracetamol and determine percentage yield of the product.

### Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

### Reference books:

1. Vogel A.I., "A Textbook of Quantitative Inorganic Chemistry", Longman
2. Vogel A.I., "A Textbook of Practical Organic Chemistry", Longman

**BIOCHEMISTRY AND MOLECULAR BIOLOGY LAB**

Course Code: ICT123

C: 01

**List of Experiments**

1. Preparation of bacterial genomic DNA
2. Agarose gel electrophoresis
3. Preparation of plant genomic DNA
4. Preparation of plasmid DNA
5. Estimation of protein
6. Estimation of carbohydrate
7. Estimation of DNA
8. Estimation of RNA

**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

## Programming language fundamental & Programming in C-Lab

Course Code: ICT124

C: 01

1. Write a program to find the area and perimeter of (I) square (ii) rectangle.
2. Write a Program to find the sum of first n natural numbers.
3. Write a program to calculate the average of n numbers.
4. Write a program to check whether the number is even or odd.
5. Write a program to find largest of three numbers.
6. Write a program to swap the values of two given variables.
7. Write a program to find the square of a given number.
8. Write a program to calculate the roots of a quadratic equation.
9. Write a program to compute the sum of squares of n natural numbers.
10. Write a program to reverse a given number and also calculate the number of digits in the number.
11. Write a program to calculate the sum of digits of a given number.
12. Write a program to calculate the factorial of a given positive number.
13. Write a program to generate fibonaaci series upto n terms.
14. Write a program to find the GCD and LCM of two given positive numbers.
15. Write a program to print first n prime numbers.
16. Write a program to print 1 if input character is capital, 2 if input character is a lowercase alphabet, 3 if input character is a digit and 4 if some other special character.
17. Write a C program to check whether a number is an Armstrong number.
18. Write a C program to find the power of a number.
19. Write a C program to find the sum of n terms of the series:  $n \cdot n^2/2! + n^3/3! - n^4/4! + \dots$
20. Write a C program to find the maximum/minimum number in a given array.
21. Write a C program to search a number in an array using linear search.
22. Write a C program to sort a given array using Bubble sort.
23. Write a C program to concatenate two one-dimensional arrays.
24. Write a C program to add, subtract and multiply two m by n matrices.
25. Write a C program to detect the occurrence of a character in a given string.
26. Write a C program to count the number of characters in a given string with and without using strlen () function,
27. Write a C program to copy the contents of one string to another with and without using strcpy () function.
28. Write a C program to determine whether the entered character string is palindrome or not.
29. Write a C program to enter the marks, address of several students and prepare the mark sheet of each student. Use structures.
30. Write a C program to calculate net salary / printing of salary statement of an employee. Use Structures.
31. Write a C program to calculate the factorial of a number using recursion.
32. Write a C program to generate a fibonacci series using recursion.

### Examination Scheme:

IA				EE	
A	PR	LR	V	PR	V
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

**ENGLISH****Course Code:** BCS 101**L:1, T:0, P:0, C:1****Course Objective:**

The course is intended to give a foundation of English Language. The literary texts are indented to help students to inculcate creative & aesthetic sensitivity and critical faculty through comprehension, appreciation and analysis of the prescribed literary texts. It will also help them to respond form different perspectives.

**Course Contents:****Module I: Vocabulary**

Use of Dictionary

Use of Words: Diminutives, Homonyms &amp; Homophones

**Module II: Essentials of Grammar - I**

Articles

Parts of Speech

Tenses

**Module III: Essentials of Grammar - II**

Sentence Structure

Subject -Verb agreement

Punctuation

**Module IV: Communication**

The process and importance

Principles &amp; benefits of Effective Communication

**Module V: Spoken English Communication**

Speech Drills

Pronunciation and accent

Stress and Intonation

**Module VI: Communication Skills-I**

Developing listening skills

Developing speaking skills

**Module VII: Communication Skills-II**

Developing Reading Skills,Developing writing Skills

**Module VIII: Written English communication**

Progression of Thought/ideas,Structure of Paragraph,Structure of Essays

**Module IX: Short Stories**

Of Studies, by Francis Bacon

Dream Children, by Charles Lamb

The Necklace, by Guy de Maupassant

A Shadow, by R.K.Narayan

Glory at Twilight, Bhabani Bhattacharya

**Module X: Poems**

All the Worlds a Stage

Shakespeare

To Autumn

Keats

O! Captain, My Captain.

Walt Whitman

Where the Mind is Without Fear

Rabindranath Tagore

Psalm of Life

H.W. Longfellow

**Examination Scheme:**

Components	A	CT	HA	EE
Weightage (%)	05	15	10	70

**Text & References:**

- Madhulika Jha, Echoes, Orient Long Man
- Ramon & Prakash, Business Communication, Oxford.
- Sydney Greenbaum Oxford English Grammar, Oxford.
- Successful Communications, Malra Treece (Allyn and Bacon)
- Effective Technical Communication, M. Ashraf Rizvi.

\* 30 hrs Programme to be continued for Full year

## UNDERSTANDING SELF FOR EFFECTIVENESS - I (UNDERSTANDING SELF FOR EFFECTIVENESS)

**Course Code:** BSS105

**L:1, T:0, P:0, C:1**

### **Course Objective:**

This course aims at imparting:  
 Understanding self & process of self exploration  
 Learning strategies for development of a healthy self esteem  
 Importance of attitudes and its effective on personality  
 Building Emotional Competence

### **Course Contents:**

#### **Module I: Self: Core Competency**

Understanding of Self  
 Components of Self – Self identity  
 Self concept  
 Self confidence  
 Self image

#### **Module II: Techniques of Self Awareness**

Exploration through Johari Window  
 Mapping the key characteristics of self  
 Framing a charter for self  
 Stages – self awareness, self acceptance and self realization

#### **Module III: Self Esteem & Effectiveness**

Meaning and Importance  
 Components of self esteem  
 High and low self esteem  
 Measuring your self esteem

#### **Module IV: Building Positive Attitude**

Meaning and nature of attitude  
 Components and Types of attitude  
 Importance and relevance of attitude

#### **Module V: Building Emotional Competence**

Emotional Intelligence – Meaning, components, Importance and Relevance  
 Positive and Negative emotions  
 Healthy and Unhealthy expression of emotions

#### **Module VI: End-of-Semester Appraisal**

Viva based on personal journal  
 Assessment of Behavioural change as a result of training  
 Exit Level Rating by Self and Observer

### **Examination Scheme:**

Components	SAP	A	Mid Term Test (CT)	VIVA	Journal for Success (JOS)
<b>Weightage (%)</b>	20	05	20	30	25

### **Text & References:**

- Davis, K. Organizational Behaviour,

- Hoover, Judhith D. (2002). Effective Small Group and Team Communication, Harcourt College Publishers.
- Charles: Team Management, Dick, Mc Cann & Margerison, Edition, viva books (1992)
- Bates, A. P., & Julian, J. Sociology - Understanding Social Behaviour
- Dressler, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G. (1985). Oxford Textbook of Public Health, Vol. 4.
- LaFasto & Larson. (2001). When Teams Work Best, Response Books (Sage), New Delhi.
- Pfeiffer J W. (1996). Theories and Models in Applied Understanding Self for Effectiveness, Vol 2, Group Pfeiffer & Company.
- Smither R. D. (1994). The Psychology of Work and Human Performance, Harper Collins College Publishers.

## FRENCH - I

Course Code: FLT 101

L:2, T:0, P:0, C:2

### Course Objective:

To familiarize the students with the French language

- with the phonetic system
- with the syntax
- with the manners
- with the cultural aspects

### Course Contents:

#### Module A: pp. 01 to 37: Unités 1, 2, Unité 3 Objectif 1,2

Only grammar of Unité 3: objectif 3, 4 and 5

#### Contenu lexical: Unité 1: Découvrir la langue française : (oral et écrit)

1. se présenter, présenter quelqu'un, faire la connaissance des autres, formules de politesse, rencontres
2. dire/interroger si on comprend
3. Nommer les choses

#### Unité 2: Faire connaissance

1. donner/demander des informations sur une personne, premiers contacts, exprimer ses goûts et ses préférences
2. Parler de soi: parler du travail, de ses activités, de son pays, de sa ville.

#### Unité 3: Organiser son temps

1. dire la date et l'heure

#### Contenu grammatical:

1. organisation générale de la grammaire
2. article indéfini, défini, contracté
3. nom, adjectif, masculin, féminin, singulier et pluriel
4. négation avec « de », "moi aussi", "moi non plus"
5. interrogation : Inversion, est-ce que, qui, que, quoi, qu'est-ce que, où, quand, comment, quel(s), quelle(s)  
Interro-négatif : réponses : oui, si, non
6. pronom tonique/disjoint- pour insister après une préposition
7. futur proche

#### Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

#### Text & References:

- le livre à suivre : Campus: Tome 1

## GERMAN - I

**Course Code:** FLG 101

**L:2, T:0, P:0, C:2**

### **Course Objective:**

To enable the students to converse, read and write in the language with the help of the basic rules of grammar, which will later help them to strengthen their language.

To give the students an insight into the culture, geography, political situation and economic opportunities available in Germany

### **Course Contents:**

#### **Module I: Introduction**

Self introduction: heissen, kommen, wohnen, lernen, arbeiten, trinken, etc.

All personal pronouns in relation to the verbs taught so far.

Greetings: Guten Morgen!, Guten Tag!, Guten Abend!, Gute Nacht!, Danke sehr!, Danke!, Vielen Dank!, (es tut mir Leid!),

Hallo, wie geht's?: Danke gut!, sehr gut!, prima!, ausgezeichnet!,  
Es geht!, nicht so gut!, so la la!, miserabel!

#### **Module II: Interviewspiel**

To assimilate the vocabulary learnt so far and to apply the words and phrases in short dialogues in an interview – game for self introduction.

#### **Module III: Phonetics**

Sound system of the language with special stress on Diphthongs

#### **Module IV: Countries, nationalities and their languages**

To make the students acquainted with the most widely used country names, their nationalities and the language spoken in that country.

#### **Module V: Articles**

The definite and indefinite articles in masculine, feminine and neuter gender. All Vegetables, Fruits, Animals, Furniture, Eatables, modes of Transport

#### **Module VI: Professions**

To acquaint the students with professions in both the genders with the help of the verb “sein”.

#### **Module VII: Pronouns**

Simple possessive pronouns, the use of my, your, etc.

The family members, family Tree with the help of the verb “to have”

#### **Module VIII: Colours**

All the color and color related vocabulary – colored, colorful, colorless, pale, light, dark, etc.

#### **Module IX: Numbers and calculations – verb “kosten”**

The counting, plural structures and simple calculation like addition, subtraction, multiplication and division to test the knowledge of numbers.

“Wie viel kostet das?”

#### **Module X: Revision list of Question pronouns**

W – Questions like who, what, where, when, which, how, how many, how much, etc.

### **Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>CT2</b>	<b>C</b>	<b>I</b>	<b>V</b>	<b>A</b>
<b>Weightage (%)</b>	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:**

- Wolfgang Hieber, Lernziel Deutsch
- Hans-Heinrich Wangler, Sprachkurs Deutsch
- Schulz Griesbach, Deutsche Sprachlehre für Ausländer
- P.L Aneja, Deutsch Interessant- 1, 2 & 3
- Rosa-Maria Dallapiazza et al, Tangram Aktuell A1/1,2
- Braun, Nieder, Schmöe, Deutsch als Fremdsprache 1A, Grundkurs

**SPANISH – I**

Course Code: FLS 101

L:2, T:0, P:0, C:2

**Course Objective:**

To enable students acquire the relevance of the Spanish language in today's global context, how to greet each other. How to present / introduce each other using basic verbs and vocabulary

**Course Contents:****Module I**

A brief history of Spain, Latin America, the language, the culture...and the relevance of Spanish language in today's global context.

Introduction to alphabets

**Module II**

Introduction to 'Saludos' (How to greet each other. How to present / introduce each other).

Goodbyes (despedidas)

The verb *llamarse* and practice of it.

**Module III**

Concept of Gender and Number

Months of the years, days of the week, seasons. Introduction to numbers 1-100, Colors, Revision of numbers and introduction to ordinal numbers.

**Module IV**

Introduction to *SER* and *ESTAR* (both of which mean To Be).Revision of 'Saludos' and 'Llamarse'. Some adjectives, nationalities, professions, physical/geographical location, the fact that spanish adjectives have to agree with gender and number of their nouns. Exercises highlighting usage of *Ser* and *Estar*.

**Module V**

Time, demonstrative pronoun (Este/esta, Aquel/aquella etc)

**Module VI**

Introduction to some key AR /ER/IR ending regular verbs.

**Examination Scheme:**

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:**

- Español, En Directo I A
- Español Sin Fronteras

**CHINESE – I****Course Code:** FLC 101**L:2, T:0, P:0, C:2****Course Objective:**

There are many dialects spoken in China, but the language which will help you through wherever you go is Mandarin, or Putonghua, as it is called in Chinese. The most widely spoken forms of Chinese are Mandarin, Cantonese, Gan, Hakka, Min, Wu and Xiang. The course aims at familiarizing the student with the basic aspects of speaking ability of Mandarin, the language of Mainland China. The course aims at training students in practical skills and nurturing them to interact with a Chinese person.

**Course Contents:****Module I**

Show pictures, dialogue and retell.

Getting to know each other.

Practicing chart with Initials and Finals. (CHART – The Chinese Phonetic Alphabet Called “Hanyu Pinyin” in Mandarin Chinese.)

Practicing of Tones as it is a tonal language.

Changes in 3<sup>rd</sup> tone and Neutral Tone.

**Module II**

Greetings

Let me Introduce

The modal particle “ne”.

Use of Please ‘qing’ – sit, have tea ..... etc.

A brief self introduction – Ni hao ma? Zaijian!

Use of “bu” negative.

**Module III**

Attributives showing possession

How is your Health? Thank you

Where are you from?

A few Professions like – Engineer, Businessman, Doctor, Teacher, Worker.

Are you busy with your work?

May I know your name?

**Module IV**

Use of “How many” – People in your family?

Use of “zhe” and “na”.

Use of interrogative particle “shenme”, “shui”, “ma” and “nar”.

How to make interrogative sentences ending with “ma”.

Structural particle “de”.

Use of “Nin” when and where to use and with whom. Use of guixing.

Use of verb “zuo” and how to make sentences with it.

**Module V**

Family structure and Relations.

Use of “you” – “mei you”.

Measure words

Days and Weekdays.

Numbers.

Maps, different languages and Countries.

**Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>CT2</b>	<b>C</b>	<b>I</b>	<b>V</b>	<b>A</b>
<b>Weightage (%)</b>	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:**

- “Elementary Chinese Reader Part I” Lesson 1-10

# Semiconductor, Electronic devices & Applications

Course Code: ICT201

L:3,T:1,P:2, C:5

**Course objective:** The main aim of the course is to give concept of Electronics which are useful for research and industrial application.

## Content:

### Module I

Energy band theory of crystals, energy band structure of insulators, semiconductors and

metals. Mobility and conductivity, Electrons and holes in Intrinsic Semiconductor, Elementary properties of Germanium and Silicon, Donor and Acceptor Impurities, Extrinsic semi-conductors, Generation and recombination of charges, diffusion.

### Module II:

The p-n junction diode, depletion region, p-n junction diode as a rectifier, current components of a p-n diode, Ideal Voltage Ampere characteristics, semiconductor photodiode, photovoltaic effect light emitting diodes, Half-wave and Full-wave rectifiers, ripple factor, efficiency, voltage regulation, inductor filters, capacitor filters, L and pie section filters, regulated power supplies

### Module III

Bipolar Junction transistors, bipolar transistor action, basic principle of operation open circuited transistor, transistor biased in the active region, current components in a transistor, characteristic curves in common emitter, common base and common collector configuration, expressions of a transistor in h-parameters. Transistor as an amplifier, characteristics of an amplifier.

### Module IV

Feed-back concepts and Oscillators. Elementary information about Field Effect transistor, thyristors, opto-electronic devices and display devices.

### Module V

Logic gates (AND, OR, NOT, XOR, NAND and NOR) Logic operation of logic gates using diodes and transistors. Introduction to integrated Circuits (IC). (7)

## Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

## Text & References

- Jacob Millman and Christos C. Halkias Integrated electronics, volume I, *Publisher:* McGraw Hill Education (India) Private Limited; *2edition*
- G.K. Mithal, Electronics Devices and circuits, *Vol 1, Khanna Publishers, 1997Edition*
- R.P. Punagin, Basic Electronics, *1st Edition Volume-IV, Publisher : Tata McGraw - Hill*
- Donald A. Neamen, Semiconductor Physics and Devices, *Volume IV (2nd Edition) Publisher: Tata McGraw Hill Education Private Limited*

# Physical Chemistry

Course Code: ICT202

L:3,T:1,P:2, C:5

## THEORY

### Course Objective:

Aim of this course is to introduce the students to fundamentals of physical chemistry which are the basic need for further research and development in any field of science and engineering.

### Course Contents:

#### Module I: Liquid State

Liquid State: Structural differences between solids, liquid and gases. Properties of liquid: Vapor pressure, viscosity and surface tension and their variation with temperature

#### Module II: Solid State

Solid State: Difference between crystalline and amorphous solids, isotropy and anisotropy, Symmetry in crystal systems, space lattice, unit cell. Laws of crystallography- (i) Laws of constancy of interfacial angles, (ii) Law of rationality of indices, (iii) law of symmetry Bravais lattices. Bragg's equation. Imperfections in crystals.

#### Module III: Colloidal State

Colloidal State: Difference between true and colloidal solution, Classification: lyophilic and lyophobic colloids, preparation of colloidal solutions, Tyndall effect, Brownian effect, electrophoresis and electro-osmosis, general applications of colloids, Surfactants, micelles and their classification, critical micelle concentration (CMC). Method of determination of CMC.

#### Module IV: Phase Equilibria

Definitions of terms: phase, component, and degrees of freedom, one component system- water and sulphur, Restricted phase rule, condensed systems, Simple eutectic systems and thermal analysis via cooling curves. Two component system-lead and silver system (Pattinson process for desilverisation of lead).

#### Module V: Chemical Kinetics

Rate of a reaction and factors influencing the rate of a reaction, Order and molecularity of a chemical reaction, Mathematical representations of order of reaction: zero, first, second and pseudo order reactions, Determination of the order of reaction-differential method: integration, half-life period and isolation method. Experimental methods of chemical kinetics: conductometric, potentiometric and optical methods. Effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy, Expression for the rate constant based on equilibrium constant and thermodynamics.

### Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

### Text & References:

- Castellan G. W. (1995) Physical Chemistry, 3<sup>rd</sup> edition, Narosa.
- Atkins P. W. and Paula J. de, Atkin's Physical Chemistry, Oxford University Press.

- Puri B. R., Sharma L. R. and Pathania M.S.(1999) Principles of Physical Chemistry.
- McQuarrie D. A. and Simon J. D., Physical Chemistry: A Molecular Approach, Univ. Science Books.

## Cell Biology & Genetics

Course Code: ICT203

L:3,T:1,P:2, C:5

### THEORY

#### Course Objective:

Cell Biology and genetics plays a central role to connect the different fields of biotechnology, which is highly interdisciplinary. The objective of the present course is to understand the structure and function of the cellular and subcellular components of cells and tissues with the help of these recent techniques.

#### MODULE 1.

**Cells: The fundamental units of life:** Unity and diversity of cells, Cells under the microscope, Prokaryotic and eukaryotic cell, Model organism

**Chemical components of cells:** Chemical bonds, Small molecules in cells, Macromolecules in cells

#### MODULE 2.

**Membrane structure:** The lipid bilayer, Membrane proteins

**Transport across cell membrane:** Principles of transmembrane transport, Transporters and their functions, Ion channels and the membrane potential, Ion channels and nerve cell signalling

#### MODULE 3.

**Intracellular compartments and protein transport:** Membrane enclosed organelles, Protein sorting, Vesicular transport, Secretory pathways, Endocytic pathways

**Cell signalling:** General principles of cell signalling, G-protein couples receptors, Enzyme coupled receptors

**Cytoskeleton:** Intermediate filaments, Microtubules, Actin filaments, Muscle contraction

#### MODULE 4.

**The cell division cycle:** Overview of the cell cycle, The cell-cycle control system, G<sub>1</sub> phase, S phase, M phase, Mitosis, Cytokinesis, Control of cell number and cell size

#### MODULE 5.

**Sexual reproduction and the power of genetics:** The benefits of sex, Meiosis and fertilization, Mendel and the laws of inheritance, Genetics as an experimental tool

#### Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

#### Text & References:

- Alberts, B., Bray, D., Hopkin, K., Johnson, A., Lewis, J., Raff, M., Roberts & Walter, P. (2013). Essential cell biology. Garland Science IV edition.

# Object Oriented Programming in C++

Course Code: ICT204

L:3,T:1,P:2, C:5

## Course Objective:

C++ is one of the most widely used programming languages for solving problems. The objective of this course is to provide object oriented programming fundamentals using C++. Topics to be covered include fundamentals of syntax & semantics of C++, loops & decisions, functions, classes and structures and features of classes such as overloading and inheritance, files, streams, pointers etc.

## Course Contents:

### Module I: Overview of C++

What is Object Oriented Programming, Characteristics of OOP, Difference between C and C++.

Basics:-Input/Output in C++ using cin/cout, Preprocessor Directives, Data Types-Integer, Float, character, Enumerated data types, library functions, comments, storage classes, type conversion, arithmetic operators, arrays and strings

### Module II: Loops and Decisions

Relational operators, Logical operators, Decisions-if, if-else and switch. Loops-for, while, do-while and nested loops, precedence summary, break, continue and goto statements.

Functions: Simple functions, passing arguments to functions, returning values from functions, reference arguments, returning by reference, Overloaded functions

### Module III: Structures

A simple Structure, specifying the Structure, defining the structure variable, accessing members of structure, structure within structure, accessing structure members using pointers

Classes and objects: A simple class, C++ objects as physical objects, Constructors, Destructors, objects as function arguments, returning objects from functions, static class data, array as class data member, array of objects.

### Module IV: Operator Overloading & Inheritance

Overloading unary operator, Overloading binary operator, data conversion. Inheritance: Derived and Base class, Derived class Constructor, types of Inheritance , Abstract base class , public and private Inheritance, level of Inheritance

### Module V: Pointers and Virtual functions

Pointers and Arrays, pointers and strings, pointers and functions, pointers to objects, virtual functions, friend functions, static functions, this pointer

## Evaluation:

Components	Other Components	Attendance	MTE	ESE
Weightage (%)	15	10	5	70

## Text & References:

- The complete reference C++, Herbert Schildt
- Programming with C++, Ravi Chandran
- Mastering C++, Venugopal
- Programming in C++, SCHAUM's series

**Calculus****Course Code: ICT205****L:3,T:0,P:0, C:3****Course Objective:**

This subject provides students with an in-depth education in the conceptual foundations of Mathematics. It allows them to apply mathematics to converging technology and a variety of other disciplines in engineering and outside. Combined with a strong education in mathematics, sciences, and the liberal arts it prepares students to be leaders in converging technology, applications to other disciplines, and research.

**Course Contents:**

## Module-I

Limits and Continuity: Definition; Rate of Change, Limit, functions of one variable, function of a function: Rules for Finding Limits (simple problems), Continuity, simple examples of discontinues functions.

## Module-II

Derivatives: Definition: differentiability, differentiation by abridges method (simple algebraic and trigonometrical functions), differentiation rules (sum, difference, product, division of two functions) differential functions and logarithmic functions, partial differentiation of functions of one or two variable.

## Module-III

Applications of Derivatives: Mean Value tucromsRolles, Cauchy and Lagrange's, maxima and minima of one variable, indeterminate form: L' Hospital rule, Euler's formula.

## Module-IV

Integration: Integral as converse of differentiation, indefinite integral, integration by substitution, integration of product of two functions, definite integrals: properties and problems, substitution in definite integrals

## Module-V

Nnumerical integration, Trapezoidal rule, 1/3rd Simpsons rule and 3/8th Simpson's rule, area of circle, parabola ex, log ex.

**Evaluation:**

Components	Other Components	Attendance	MTE	ESE
Weightage (%)	15	10	5	70

## Recommended Books:

1. Calculus by Thomas and finny, Pearson Education Asia, 1999.

## Semiconductor, Electronic devices & Applications: Lab

**Course Code: ICT221**

**C: 01**

**List of Experiments:**

1. To determine the wavelength of prominent lines of mercury spectrum using plane transmission grating.
2. To determine the thickness of a given wire by Wedge method.
3. To determine the wavelength of He-Ne laser light using single slit.
4. To determine the frequency of an electrically maintained tuning fork by Melde's method.
5. To study the variation of magnetic field along the axis of Helmholtz coil and to find out reduction factor.
6. To draw the V – I characteristics of a forward and reverse bias PN junction diode.
7. To determine the frequency of AC mains using sonometer.
8. To determine the energy band-gap of Germanium crystal using four probes method.
9. To draw V – I characteristics of a photocell and to verify the inverse square law of radiation.
10. To determine the acceleration due to gravity ('g') using Keter's reversible pendulum.
11. To study the characteristics of photo voltaic cell (solar cell).

**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

## Physical Chemistry Practicals

Course Code: ICT 222

L

C:01

### List of Experiments

1. To draw the pH-titration curve of strong acid versus strong base.
2. Determination the viscosity of given liquid by Ostwald's viscometer.
3. Determination of the strength of strong and weak acids in a given mixture conductometrically.
4. Determination of surface tension of liquid.
5. Application of surface tension method in mixture analysis.
6. Heat of neutralization of a strong acid and a strong base.
7. To determine the partition coefficient of iodine between carbon tetrachloride and water.
8. To study the adsorption of acetic acid on activated charcoal.
9. To construct the phase diagram for two component system.

### Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

### Reference Books:

1. Finlay A. and Kitchener J.A., "Practical Physical Chemistry, Longman
2. Shoemaker D.P. and Garland C.W., "Experimental Physical Chemistry", McGraw-Hill

## CELL BIOLOGY & GENETICS LAB

**Course Code: ICT223**

**C: 01**

### List of Experiments

11. Microscopy: Light microscopy, Bright field, Phase contrast
12. Study of chromoplasts, chloroplast in plant cell
13. Isolation of chloroplast from spinach
14. Study of apoptosis
15. Mitosis
16. Meiosis
17. Study of apoptosis
18. Cell quantification
19. Cell viability

### Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

## Object Oriented Programming in C++-Lab

Course Code: ICT224

C: 01

### List of experiments:

1. WAP to calculate factorial of a given number n.
2. WAP to check whether a number is prime or not.
3. WAP to print Fibonacci series of 'n' numbers, where n is given by the programmer.
4. WAP to do the following:
  - a. Generate the following menu:
    1. Add two numbers.
    2. Subtract two numbers.
    3. Multiply two numbers.
    4. Divide two numbers.
    5. Exit.
  - b. Ask the user to input two integers and then input a choice from the menu. Perform all the arithmetic operations which have been offered by the menu. Checks for errors caused due to inappropriate entry by user and output a statement accordingly.
5. WAP to read a set of numbers in an array & to find the largest of them.
6. WAP to implement bubble sort using arrays.
7. WAP to sort a list of names in ascending order.
8. WAP to read a set of numbers from keyboard & to find sum of all elements of the given array using a function.
9. WAP to implement bubble sort using functions.
10. WAP to exchange contents of two variables using call by value.
11. WAP to exchange contents of two variables using call by reference.
12. WAP to find the sum of three numbers using pointer to function method.
13. WAP to display content of an array using pointers.
14. Calculate area of different geometrical figures (circle, rectangle, square, triangle) using function overloading.
15. WAP to add two complex numbers using friend function.
16. WAP to maintain the student record which contains Roll number, Name, Marks1, Marks2, Marks3 as data member and getdata(), display() and setdata() as member functions.
17. WAP to increment the employee salaries on the basis of their designation (Manager-5000, General Manager-10000, CEO-20000, worker-2000). Use employee name, id, designation and salary as data member and inc\_sal as member function (Use array of object).
18. Write a class bank, containing data member: Name of Depositor, A/c type, Type of A/c, Balance amount. Member function: To assign initial value, To deposit an amount, to withdraw an amount after checking the balance (which should be greater than Rs. 500) , To display name & balance.
19. WAP to define nested class 'student\_info' which contains data members such as name, roll number and sex and also consists of one more class 'date', whose data members are day, month and year. The data is to be read from the keyboard & displayed on the screen.
20. WAP to generate a series of Fibonacci numbers using copy constructor, where it is defined outside the class using scope resolution operator.
21. Write a class string to compare two strings, overload (==) operator.
22. Write a class to concatenate two strings, overload (+) operator.
23. Create a class item, having two data members x & y, overload '-' (unary operator) to change the sign of x and y.
24. Create a class Employee. Derive 3 classes from this class namely, Programmer, Analyst & Project Leader. Take attributes and operations on your own. WAP to implement this with array of pointers.
25. Create two classes namely Employee and Qualification. Using multiple inheritance derive two classes Scientist and Manager. Take suitable attributes & operations. WAP to implement this class hierarchy.

### Examination Scheme:

IA				EE	
A	PR	LR	V	PR	V
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

# Environmental Sciences

**Course Code: EVS001**

**L:4,T:0,P:0, C:4**

## Course Objective:

The term environment is used to describe, in the aggregate, all the external forces, influences and conditions, which affect the life, nature, behaviour and the growth, development and maturity of living organisms. At present a great number of environment issues, have grown in size and complexity day by day, threatening the survival of mankind on earth. A study of environmental studies is quite essential in all types of environmental sciences, environmental engineering and industrial management. The objective of environmental studies is to enlighten the masses about the importance of the protection and conservation of our environment and control of human activities which has an adverse effect on the environment.

## Course Contents:

### Module I: The multidisciplinary nature of environmental studies

Definition, scope and importance

Need for public awareness

### Module II: Natural Resources

#### Renewable and non-renewable resources:

Natural resources and associated problems

Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

### Module III: Ecosystems

Concept of an ecosystem

Structure and function of an ecosystem

Producers, consumers and decomposers

Energy flow in the ecosystem

Ecological succession

Food chains, food webs and ecological pyramids

Introduction, types, characteristic features, structure and function of the following ecosystem:

- a. Forest ecosystem
- b. Grassland ecosystem
- c. Desert ecosystem
- d. Aquatic ecosystems (ponds, streams, lakes, rivers, ocean estuaries)

**Module IV: Biodiversity and its conservation**

Introduction – Definition: genetic, species and ecosystem diversity

Biogeographical classification of India

Value of biodiversity: consumptive use, productive use, social, ethical aesthetic and option values

Biodiversity at global, national and local levels

India as a mega-diversity nation

Hot-spots of biodiversity

Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts

Endangered and endemic species of India

Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity

**Module V: Environmental Pollution**

Definition

□ □ □ Causes, effects and control measures of:

- a. Air pollution
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear pollution

Solid waste management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution.

Pollution case studies.

Disaster management: floods, earthquake, cyclone and landslides.

**Module VI: Social Issues and the Environment**

From unsustainable to sustainable development

Urban problems and related to energy

Water conservation, rain water harvesting, watershed management

Resettlement and rehabilitation of people; its problems and concerns. Case studies.

Environmental ethics: Issues and possible solutions

Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.

Wasteland reclamation

Consumerism and waste products

Environmental Protection Act

Air (Prevention and Control of Pollution) Act

Water (Prevention and control of Pollution) Act

Wildlife Protection Act

Forest Conservation Act

Issues involved in enforcement of environmental legislation

Public awareness

**Module VII: Human Population and the Environment**

Population growth, variation among nations

Population explosion – Family Welfare Programmes

Environment and human health

Human Rights

Value Education

HIV / AIDS

Women and Child Welfare

Role of Information Technology in Environment and Human Health

Case Studies

### Module VIII: Field Work

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

Visit to a local polluted site – Urban / Rural / Industrial / Agricultural

Study of common plants, insects, birds

Study of simple ecosystems-pond, river, hill slopes, etc (Field work equal to 5 lecture hours)

### Examination Scheme:

Components	CT	HA	S/V/Q	A	EE
Weightage (%)	15	5	5	5	70

### Text & References:

- Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
- Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380 013, India, Email:mapin@icenet.net (R)
- Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
- Clark R.S., Marine Pollution, Clarendon Press Oxford (TB)
- Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
- De A.K., Environmental Chemistry, Wiley Eastern Ltd.
- Down to Earth, Centre for Science and Environment (R)
- Gleick, H.P. 1993. Water in Crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
- Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
- Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
- Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
- Mckinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web enhanced edition. 639p.
- Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
- Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
- Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
- Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
- Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
- Survey of the Environment, The Hindu (M)
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (R)
- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)
- Wanger K.D., 1998 Environnemental Management. W.B. Saunders Co. Philadelphia, USA 499p

# ENGLISH

**Course Code:** BCS 201

**L:1, T:0, P:0, C:1**

**Course Objective:**

The course is intended to give a foundation of English Language. The literary texts are indented to help students to inculcate creative & aesthetic sensitivity and critical faculty through comprehension, appreciation and analysis of the prescribed literary texts. It will also help them to respond form different perspectives.

**Course Contents:**

**Module I: Vocabulary**

Use of Dictionary

Use of Words: Diminutives, Homonyms & Homophones

**Module II: Essentials of Grammar - I**

Articles

Parts of Speech

Tenses

**Module III: Essentials of Grammar - II**

Sentence Structure

Subject -Verb agreement

Punctuation

**Module IV: Communication**

The process and importance

Principles & benefits of Effective Communication

**Module V: Spoken English Communication**

Speech Drills

Pronunciation and accent

Stress and Intonation

**Module VI: Communication Skills-I**

Developing listening skills

Developing speaking skills

**Module VII: Communication Skills-II**

Developing Reading Skills

Developing writing Skills

**Module VIII: Written English communication**

Progression of Thought/ideas

Structure of Paragraph

Structure of Essays

**Module IX: Short Stories**

Of Studies, by Francis Bacon

Dream Children, by Charles Lamb

The Necklace, by Guy de Maupassant

A Shadow, by R.K.Narayan

Glory at Twilight, Bhabani Bhattacharya

**Module X: Poems**

All the Worlds a Stage	Shakespeare
To Autumn	Keats
O! Captain, My Captain.	Walt Whitman
Where the Mind is Without Fear	Rabindranath Tagore
Psalm of Life	H.W. Longfellow

**Examination Scheme:**

<b>Components</b>	<b>A</b>	<b>CT</b>	<b>HA</b>	<b>EE</b>
<b>Weightage (%)</b>	05	15	10	70

**Text & References:**

- Madhulika Jha, Echoes, Orient Long Man
- Ramon & Prakash, Business Communication, Oxford.
- Sydney Greenbaum Oxford English Grammar, Oxford.
- Successful Communications, Malra Treece (Allyn and Bacon)
- Effective Technical Communication, M. Ashraf Rizvi.

## **UNDERSTANDING SELF FOR EFFECTIVENESS - II (PROBLEM SOLVING AND CREATIVE THINKING)**

**Course Code:** BSS205

**L:1, T:0, P:0, C:1**

### **Course Objective:**

To enable the students:

Understand the process of problem solving and creative thinking.

Facilitation and enhancement of skills required for decision-making.

### **Course Contents:**

#### **Module I: Thinking as a tool for Problem Solving**

What is thinking: The Mind/Brain/Behaviour

Critical Thinking and Learning:

Making Predictions and Reasoning

Memory and Critical Thinking

Emotions and Critical Thinking

Thinking skills

#### **Module II: Hindrances to Problem Solving Process**

Perception

Expression

Emotion

Intellect

Work environment

#### **Module III: Problem Solving**

Recognizing and Defining a problem

Analyzing the problem (potential causes)

Developing possible alternatives

Evaluating Solutions

Resolution of problem

Implementation

Barriers to problem solving:

- Perception
- Expression
- Emotion
- Intellect
- Work environment

#### **Module IV: Plan of Action**

Construction of POA

Monitoring

Reviewing and analyzing the outcome

#### **Module V: Creative Thinking**

Definition and meaning of creativity

The nature of creative thinking

- Convergent and Divergent thinking
- Idea generation and evaluation (Brain Storming)
- Image generation and evaluation
- Debating

The six-phase model of Creative Thinking: ICEDIP model

**Module VI: End-of-Semester Appraisal**

Viva based on personal journal

Assessment of Behavioural change as a result of training

Exit Level Rating by Self and Observer

**Examination Scheme:**

<b>Components</b>	<b>SAP</b>	<b>A</b>	<b>Mid Term Test (CT)</b>	<b>VIVA</b>	<b>Journal for Success (JOS)</b>
<b>Weightage (%)</b>	20	05	20	30	25

**Text & References:**

- Michael S. (1999). How to be a Better Problem Solver, Kogan Page, New Delhi.
- Geoff P. (1999). How to be a Better at creativity; by: Kogan Page, New Delhi, (1999)
- Richard Y. C., & Keith P., (1998). Wheeler Publishing, New Delhi.
- Phil Lowe Koge (1996). Page: Creativity and Problem Solving, New Delhi,
- Pfeiffer, J. W., (1996). Theories and Models in Applied Understanding Self for Effectiveness, Management Pfeiffer & Company.
- Bensley, A. D. (1998). Critical Thinking in Psychology – A Unified Skills Approach, Brooks/Cole Publishing Company.

## FRENCH - II

Course Code: FLT 201

L:2, T:0, P:0, C:2

### Course Objective:

To enable the students to overcome the fear of speaking a foreign language and take position as a foreigner speaking French.

To make them learn the basic rules of French Grammar.

### Course Contents:

**Module A: pp.38 – 47: Unité 3: Objectif 3, 4, 5, 6**

**Module B: pp. 47 to 75 Unité 4, 5**

### Contenu lexical:

#### Unité 3: Organiser son temps

1. donner/demander des informations sur un emploi du temps, un horaire  
SNCF – Imaginer un dialogue
2. rédiger un message/ une lettre pour ...
  - i) prendre un rendez-vous/ accepter et confirmer/ annuler
  - ii) inviter/accepter/refuser
3. Faire un programme d'activités  
imaginer une conversation téléphonique/un dialogue  
Propositions- interroger, répondre

#### Unité 4: Découvrir son environnement

1. situer un lieu
2. s'orienter, s'informer sur un itinéraire.
3. Chercher, décrire un logement
4. connaître les rythmes de la vie

#### Unité 5 : s'informer

1. demander/donner des informations sur un emploi du temps passé.
2. donner une explication, exprimer le doute ou la certitude.
3. découvrir les relations entre les mots
4. savoir s'informer

### Contenu grammatical:

1. Adjectifs démonstratifs
2. Adjectifs possessifs/exprimer la possession à l'aide de :
  - i. « de » ii. A+nom/pronom disjoint
3. Conjugaison pronominale – négative, interrogative -  
construction à l'infinitif
4. Impératif/exprimer l'obligation/l'interdiction à l'aide de « il  
faut... »/ «il ne faut pas... »
5. passé composé
6. Questions directes/indirectes

### Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

### Text & References:

- le livre à suivre : Campus: Tome 1

**GERMAN – II**

Course Code: FLG 201

L:2, T:0, P:0, C:2

**Course Objective:**

To enable the students to converse, read and write in the language with the help of the basic rules of grammar, which will later help them to strengthen their language.

To give the students an insight into the culture, geography, political situation and economic opportunities available in Germany

Introduction to Grammar to consolidate the language base learnt in Semester I

**Course Contents:****Module I: Everything about Time and Time periods**

Time and times of the day.

Weekdays, months, seasons.

Adverbs of time and time related prepositions

**Module II: Irregular verbs**

Introduction to irregular verbs like to be, and others, to learn the conjugations of the same, (fahren, essen, lesen, schlafen, sprechen und ähnliche).

**Module III: Separable verbs**

To comprehend the change in meaning that the verbs undergo when used as such

Treatment of such verbs with separable prefixes

**Module IV: Reading and comprehension**

Reading and deciphering railway schedules/school time table

Usage of separable verbs in the above context

**Module V: Accusative case**

Accusative case with the relevant articles

Introduction to 2 different kinds of sentences – Nominative and Accusative

**Module VI: Accusative personal pronouns**

Nominative and accusative in comparison

Emphasizing on the universal applicability of the pronouns to both persons and objects

**Module VII: Accusative prepositions**

Accusative prepositions with their use

Both theoretical and figurative use

**Module VIII: Dialogues**

Dialogue reading: 'In the market place' 'At the Hotel'

**Examination Scheme:**

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:**

- Wolfgang Hieber, Lernziel Deutsch
- Hans-Heinrich Wangler, Sprachkurs Deutsch
- Schulz Griesbach, Deutsche Sprachlehre für Ausländer
- P.L Aneja, Deutsch Interessant- 1, 2 & 3
- Rosa-Maria Dallapiazza et al, Tangram Aktuell A1/1,2
- Braun, Nieder, Schmöe, Deutsch als Fremdsprache 1A, Grundkurs

**SPANISH – II****Course Code:** FLS 201**L:2, T:0, P:0, C:2****Course Objective:**

To enable students acquire more vocabulary, grammar, Verbal Phrases to understand simple texts and start describing any person or object in Simple Present Tense.

**Course Contents:****Module I**

Revision of earlier modules.

**Module II**

Some more AR/ER/IR verbs. Introduction to root changing and irregular AR/ER/IR ending verbs

**Module III**

More verbal phrases (eg, Dios Mio, Que lastima etc), adverbs (*bueno/malo, muy, mucho, bastante, poco*). Simple texts based on grammar and vocabulary done in earlier modules.

**Module IV**

Possessive pronouns

**Module V**

Writing/speaking essays like my friend, my house, my school/institution, myself...descriptions of people, objects etc, computer/internet related vocabulary

**Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>CT2</b>	<b>C</b>	<b>I</b>	<b>V</b>	<b>A</b>
<b>Weightage (%)</b>	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:**

- Español, En Directo I A
- Español Sin Fronteras

**CHINESE – II**

Course Code: FLC 201

L:2, T:0, P:0, C:2

**Course Objective:**

Chinese is a tonal language where each syllable in isolation has its definite tone (flat, falling, rising and rising/falling), and same syllables with different tones mean different things. When you say, “ma” with a third tone, it mean horse and “ma” with the first tone is Mother. The course aims at familiarizing the student with the basic aspects of speaking ability of Mandarin, the language of Mainland China. The course aims at training students in practical skills and nurturing them to interact with a Chinese person.

**Course Contents:****Module I**

Drills

Practice reading aloud

Observe Picture and answer the question.

Tone practice.

Practice using the language both by speaking and by taking notes.

Introduction of basic sentence patterns.

Measure words.

Glad to meet you.

**Module II**

Where do you live?

Learning different colors.

Tones of “bu”

Buying things and how muchit costs?

Dialogue on change of Money.

More sentence patterns on Days and Weekdays.

How to tell time. Saying the units of time in Chinese. Learning to say useful phrases like – 8:00, 11:25, 10:30 P.M. everyday, afternoon, evening, night, morning 3:58, one hour, to begin, to end ..... etc.

Morning, Afternoon, Evening, Night.

**Module III**

Use of words of location like-li, wais hang, xia

Furniture – table, chair, bed, bookshelf,.. etc.

Description of room, house or hostel room.. eg what is placed where and how many things are there in it?

Review Lessons – Preview Lessons.

Expression ‘yao’, ‘xiang’ and ‘yaoshi’ (if).

Days of week, months in a year etc.

I am learning Chinese. Is Chinese difficult?

**Module IV**

Counting from 1-1000

Use of “chang-chang”.

Making an Inquiry – What time is it now? Where is the Post Office?

Days of the week. Months in a year.

Use of Preposition – “zai”, “gen”.

Use of interrogative pronoun – “duoshao” and “ji”.

“Whose”??? Sweater etc is it?

Different Games and going out for exercise in the morning.

**Module V**

The verb “qu”

- Going to the library issuing a book from the library
- Going to the cinema hall, buying tickets
- Going to the post office, buying stamps
- Going to the market to buy things.. etc
- Going to the buy clothes .... Etc.

Hobby. I also like swimming.

Comprehension and answer questions based on it.

#### Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

#### Text & References:

- “Elementary Chinese Reader Part I” Lesson 11-20

**ELECTRODYNAMICS AND QUANTUM MECHANICS****Course Code: ICT301****Credit Units: 03****Course Objective:**

Aim of this course is to introduce the students to fundamentals of spectroscopy which are the help in structure elucidation of chemical compounds.

**Module I Special Relativity:**

Special Relativity: empirical evidence for the constancy of  $c$ , frames of reference; Lorentz transformations; relativity of simultaneity; twin and other paradoxes, transformation laws for velocity, momentum, energy; mass-energy equivalence.(7)

**Module II Electrodynamics:**

Electromagnetic Induction and Maxwell's Equation:-Faraday's law of electromagnetic induction. Differential form of Faraday's law, Mutual inductance, mutual inductance two circular loops, self inductance of a solenoid of finite length and winding thickness, self inductance of a straight conductor. Energy stored in an inductor and in the magnetic field. transient behaviors of LR circuit. Displacement current, Modified Ampere's law Maxwell's equations in differential and integral form. Maxwell's equations in material media, Boundary conditions for electric and magnetic fields at vacuum-dielectric and vacuum-metal boundaries. (8)

**Module III Quantum Mechanics:**

Operators in quantum mechanics: Linear operator unitary operator, function operator, Adjoint of an operator, self adjointness, eigen values and eigen functions of self adjoint operator, Normalization of eigen functions, Completeness and closure relation.(5)

Introduction to Schrodinger wave Mechanics: Postulates of quantum – mechanics Schrodinger's equation, the wave function and its interpretation, the operator position , momentum and kinetic energy in one dimension, commutator, commutation relation involving position and momentum, uncertainty relation, compatible operator, Hamiltonian operator, eigen functions and eigen values, expectation value of dynamical variables, time dependent one-dimensional Schrodinger equation for a free particle and for a particle in a potential  $V(x,t)$ . Relationship between the wave – function of a particle and measurement of its position, normalization condition for the wave function, Boundary and continuity conditions on the wave function. (7)

The time independent Schrodinger equation, and Stationary state solution, particle in one dimensional box, eigen function and eigen values, discrete energy levels, uncertainty product, generalization to three dimensions and degeneracy of levels. Finite potential well, Calculation of reflection and transmission coefficients. Tunnel Effect, Qualitative discussion of the application to decay, Square well potential problem calculation of transmission coefficient. Simple harmonic oscillator (One dimensional case, qualitative discussion of its eigen function, energy eigen values, Zero point energy, parity symmetric and anti-symmetric wave functions with graphical representation. (10)

Schrodinger's equation for a spherically symmetric potential, Rigid rotator, Schrödinger's equation for a one electron atom in spherical polar coordinates, separation of variables, orbital momentum and quantization, spherical harmonics, energy levels of H atom, ground state and excited state wave functions, comparison with Bohr model.(5)

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

***Recommended Books:***

1. University Fundamental Physics – Alonso and Finn vol. 1 Published by Addison-Wesley (1975)
2. Electricity and Magnetism- Berkeley Series: Vol. 2. E.M. Purcell
3. Feynman, Richard P, Robert B.Leighton, and Matthew L. sands Lectures on Physics. Vol: 3 Addison – Wesley 2 Edition.
4. Arthur Beiser, Concepts of Modern Physics by, Mc-craw Hill.
5. P.M. Mthew, K Venkatensan, A Text book of quantum –Mechanics: Tata Mc. Graw hill co.
6. G. Arulldhas, “Quantum-Mechanics” PHI hearing private ltd.

**ATOMIC, MOLECULAR AND NUCLEAR SPECTROSCOPY****Course Code: ICT302****Credit Units: 03****Course Objective:**

Aim of this course is to introduce the students to fundamentals of spectroscopy which are the help in structure elucidation of chemical compounds.

**Course Contents:****Module I: Ultra-violet and visible spectroscopy**

Introduction, absorption law, instrumentation, theory of electronic spectroscopy, types of electronic transitions, concept of chromophore and auxochrome, types of absorption bands, Woodward-Fieser rule for calculating absorption maximum in unsaturated compounds, fluorescence and phosphorescence, applications of UV-violet spectroscopy.

**Module II: Infra-red spectroscopy**

Introduction, theory of molecular vibrations, number of fundamental vibrations, factors influencing vibrational frequencies, finger print region, application of IR spectroscopy in Hydrocarbons, unsaturated hydrocarbons, aromatic, halogen, alcohols and phenols, ethers, carbonyl compound for structure elucidation.

**Module III: Nuclear magnetic resonance spectroscopy**

Number of signals, instrumentation, chemical shift, shielding and deshielding effects peak area and proton counting, splitting of signals, spin-spin coupling, calculating the ratio in the heights of the signals, proton exchange reaction, coupling constant,  $C^{13}$  nmr spectroscopy,  $F^{19}$  nmr, application of NMR Spectroscopy.

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Text & References:**

1. Fundamentals of molecular chemistry – Colin N. Banwell
2. Spectrometric identification of organic compounds – R. M. Silverstein
3. Organic Spectroscopy – William Kemp, F.X. Webster

**DEVELOPMENTAL BIOLOGY****Course Code: ICT303****Credit Units: 04****Course Objective:****Course Contents:****Module I: Developmental Biology of Plants**

Vegetative Phase of Plant Development, Meristems, Shoot, Root apical meristems, Primary, Secondary, Auxillary, Intercalary, Floral and Inflorescence meristems, Leaf development, Arrangement of Leaf Primordia and their genetic programming, Root Development, Root tip developmental zones, Root apical meristems and Cell differentiation.

**Module II: Developmental Biology of Plants**

Structure of flower, Development of male gametophyte, Microsporangium, Anther wall, Sporogenous tissue, Development process, Megasporangium and development of female gametophyte, Pollination and fertilization, Endosperm, Embryo development in Monocotyledons and Dicotyledons, Embryogenesis and establishment of the essential features of the mature plant, Axial and radial patterning, Seed-structure and development.

**Module III: Developmental Biology of Animals**

Structure of the gametes: Sperm and The Egg, Fertilization, Gamete fusion: Fusion of the genetic material, Rearrangement of the egg cytoplasm, Early development, Cleavage: Definitions, Planes and Patterns, Blastulation and Morulation, Gastrulation: Definition, Morphogenic cell movements and significance

**Module IV Developmental Biology of Animals**

Regeneration: Limb and organ regeneration, Stem cells: Types and Applications, Animal cloning, Nuclear embryonic transfer techniques, Nuclear transfer technique, Embryonic clone and Teratology

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Text & References:****Text:**

1. Plant Physiology – Taiz & Zeiger 4<sup>th</sup> edition
2. The Plant Cell Journal Vol. 16, 2004 [www.plantcell.org](http://www.plantcell.org)
3. Developmental Biology – Walpert
4. Embryology of Angiosperms – Bojwani & Bhatanagar
5. Developmental Biology - Veer Bala Rastogi, Vishal Publications Jalandhar

## PROGRAMMING IN JAVA

**Course Code: ICT304**

**Credit Units: 04**

### **Course Objective:**

The objective of the course is to give proficiency in developing multithreaded applications and applets in Java, in-depth knowledge of object oriented concepts, developing GUI applications in Java, creation of packages and applet programming.

### **Module I: Introduction to Java**

Introduction to object oriented Programming: Basic concepts, benefits of OOPS, application of OOPS. Java evolution: history, features, c. c++ & Java a comparison. Java and www HW & SW requirements for Java, Structure of simple Java program. Java tokens, statements Java virtual machine, command line arguments, programming style, constants & variables, symbolic constants. Various operators in Java (arithmetic, relational, logical, assignment' increment, decrement, conditional, bitwise & special operator); arthritic expressions & there evaluation.

### **Module II: Introduction of Classes**

Decision making and Branching: Decision making with if statement, if else statement, Nesting of if else statements. while statement, do statement and for statement. Jump in loops. Classes, objects and methods. Defining a class, object and methods. Defining a class, Adding variables and methods. Creating objects, accessing class members, Constructors, Method overloading, Static members, Nesting of methods, Inheritance, Extending a class, Overriding methods. Final variables and methods, Final classes. Finalize methods, Abstract methods and classes.

### **Module III: Introduction of Packages**

Arrays and String: Arrays- one dimensional array, Creating an array, Two dimensional arrays, Strings and wrapper class. Defining interface, Multiple inheritance, Extending interfaces, Implementing interface, Accessing interface variable. Packages: Java API packages using system packages, Naming convention, Creating packages, Accessing a package, Using a package, Adding a class to a package, Hiding classes.

### **Module IV: Exception Handling and Multithreaded programming**

Exception-Handling; Fundamentals, Exception Types, Uncaught Exceptions, Using try and catch, Nested try Statements, Java's Built-in Exceptions.

Multithreaded programming; Creating threads, Extending the thread crass, Stopping and blocking a thread, Life cycle of a thread, Using thread method, Thread exceptions, Thread priorities, Implementing the runnable interface, Implementing with the thread class.

### **Module IV: Applet programming**

Applet programming; Local and Remote applet, How applet differ from application, Preparing to write an applet, building applet code, applet life cycle, creating and executable applet. Designing a Web page, adding applet to HTML file, Running the applet. More about applet tag. Passing parameters to applets. HTML tags.

**Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>Q/HA.</b>	<b>ATTD.</b>	<b>EE</b>
<b>Weightage (%)</b>	15	10	5	70

**Text & References:*****Text:***

- Herbert Schildt, “Java 2:The Complete Reference” , Fifth edition, Tata McGraw-Hill Education

***References:***

- E. Balaguruswamy, “Programming with JAVA- A primer”, Tata McGraw-Hill Education
- Deitel & Deitel, “Java How to Program”, Pearson Education Limited

**DIFFERENTIAL EQUATIONS****Course Code: ICT305****Credit Units: 03****Course Objective:**

The objective of this course module is to acquaint the students with differential equations by order, linearity, and homogeneity, complex numbers, analytic function, complex integration, open mapping theorem and to get them familiar with various important applications in evaluating real integrals and model real-life applications using differential equations.

**Course Contents:****Module I: Differential Equation**

Differential equations of first order and first degree, variables separable, homogeneous equations. Linear equations and equations reducible to linear form. Exact differential equations and equations reducible to exact forms. Exact differential equations and equations which can be made exact. Linear Differential Equations with Constant Coefficients Complementary function, Particular Integral, General solution. Homogeneous linear Differential Equations with variable Coefficients.

**Module II: Equations of the First order but not of first Degree**

Equations solvable for  $y$ ,  $x$ ; Equations may be homogeneous in  $x$  and  $y$ , Equations may be of first degree in  $x$  and  $y$  (Clairaut's & Lagrange's forms)

**Module III: Partial Differential Equations of The first order**

Formation of PDE, Equations solvable by direct integration, Linear equations of the first order, Non-linear equations of the first order, Charpit's method.

**Module IV: Boundary Value Problems**

Eigen values and Eigen functions problems, Sturm-Liouville boundary value problem, solution of Laplace, Wave and Diffusion equations by separation of variables.

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Recommended Books:**

1. H. K. Das, Advanced Engineering Mathematics, S. Chand & Co.
2. J.L. Bansal and H.S. Dhama, Differential Equations, Vol. I & II Jaipur Pub. House, Jaipur.
3. Frank Ayres, Theory and Problems of Differential Equations. McGraw-Hill Book Co. 1972.
4. Erwin Kreyszig, Advanced Engineering Mathematics. John Wiley & Sons, New York, 1999.
5. E.A. Coddington, An Introduction to Ordinary Differential Equations. Prentice Hall of India Pvt. Ltd., New Delhi, 1968.
6. W.E. Boyce and P.C. Dippima, Elementary Differential Equations and Boundary Value Problems. John Wiley & Sons, New York, 1986.

**INSTRUMENTATION IN BIOLOGY****Course Code: ICT306****Credit Units: 03****Course Objective:**

The students will be exposed to techniques and instruments that are used in biotech industries.

**Course Contents:****Module I: Electrophoresis**

Agarose Gel Electrophoresis, SDS-PAGE, Isoelectric Focusing, Two-Dimensional Electrophoresis, Capillary Electrophoresis,

**Module II: Chromatography**

Adsorption Chromatography (Paper Chromatography, TLC), Molecular Exclusion Chromatography, Ion-Exchange Chromatography, Affinity Chromatography, HPLC and Gas Chromatography.

**Module III: Spectroscopy**

UV and visible spectroscopy, Infrared and Atomic absorption spectroscopy, fluorescence spectroscopy, Nuclear Magnetic Resonance and Electron Spin Resonance spectroscopy,

**Module IV Molecular Biology Technique**

PCR, RT-PCR, Southern blotting, Western Blotting, Northern Blotting, Immunotechniques ELISA, Immunoelectrophoresis, Rocket Electrophoresis.

**Examination Scheme:**

<b>Components</b>	<b>CT</b>	<b>Attendance</b>	<b>Assignment/ Project/Seminar/Quiz</b>	<b>EE</b>
<b>Weightage (%)</b>	15	5	10	70

**Text & References:****Text:**

- Wilson, K. and Walker, J. 2008. Principles and techniques of biochemistry and molecular biology. 6th Ed., Cambridge University press, New Delhi.
- Sawhney, S. K. and Singh, R. 2011. Introductory practical biochemistry, 2nd Ed., Narosa publishing house New Delhi.
- Upadhyay, A., Upadhyay, K. and Nath, N. 2010. *Biophysical Chemistry (Principles and Techniques)*. Himalaya Publishing House Pvt. Ltd, Mumbai.

**ATOMIC, MOLECULAR AND NUCLEAR SPECTROSCOPY LAB****Course Code: 321****Credit Units: 1**

Exp. 1 To determine wave length of maximum absorption of solution of  $\text{KMnO}_4$  using a spectrophotometer.

Exp. 2 Verify Beer's law and apply it to find the concentration of the given unknown solution.

Exp. 3 To determine the concentration of ferrous ions in a given sample spectrophotometrically by O-phenanthroline method.

Exp. 4 Determine the concentration of iron in the given sample of water by colorimetric method using KCNS as colour developing agent.

Exp. 5 Determination of reaction rate constant of acid catalyzed hydrolysis of ester.

Exp. 6 To determine the composition of a liquid mixture A and B (acetic acid and water) by surface tension method.

Exp. 7 Compare the cleansing powers of two samples of a detergent.

Exp. 8 Determination of  $R_f$  value of amino acids by TLC and identify the amino acids present.

Examination Scheme:

Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment	Practical Record	Viva
15	10	05	35	15	10	10

**DEVELOPMENTAL BIOLOGY LAB****Course Code : ICT322****Credit Units: 01****Course Contents :****Module I**

To determine the viability of pollen grains and seeds using tetrazolium salt (TTC) test  
 Study of germination of pollen tube from pollen grains using Brewbaker's medium

**Module II**

Microscopic slide preparation of pollen grain and ovule of angiosperms  
 Study of different types of ovules and endosperms present in angiosperms

**Module III**

To study different stages of embryo development.

**Module IV**

Different stages in animal development with the observation of prepared slides

**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**PROGRAMMING IN JAVA LAB****Course Code : ICT323****Credit Units: 01**

1. Create a “Hello, World” program that simply prints out that statement.
2. Write a program that prints three arguments taken from the command line.
3. Write a program that prints values from 1 to 100.
4. Write a Java program to compute & print factorial of any given number.
5. Write a Java program to compute the sum of digits of a given integer.
6. Write a Java program to calculate & print first N Fibonacci numbers.
7. Write a Java Program to reverse the digits of a numbers.
8. Create a class with a default constructor (one that takes no arguments) that prints a message. Create an object of this class.
9. Design and write a Java program to define a class called Rectangle that contains members for representing its length and breadth. Provide members to get and set these attributes.
10. Design a class to represent a bank account. Include the following members:
  - Data members:
    - Name of the depositor
    - Account number
    - Type of account
    - Balance amount in the account
  - Methods:
    - To assign initial values
    - To deposit an amount
    - To withdraw an amount after checking balance
    - To display the name and balance
11. Write a simple program to call a method called simple from a main function. The method simple should accept an integer as an argument and calculate the square of the number in the method simple.
12. Write a Java program to add two integers and two float numbers. When no arguments are supplied, give a default value to calculate the sum. Use method overloading to achieve this.
13. Write a program to perform mathematical operations. Create a class called AddSub with methods to add and subtract. Create another class called MultDiv that extends from AddSub class to use the member data of the superclass. MultDiv should have methods to multiply and divide. A main method should access the method and perform the mathematical operations.
14. Write a Java Program to demonstrate use of Inheritance through vehicle, two wheeler, four wheeler and three-wheeler class.
15. Write a Java Program to demonstrate runtime polymorphism with the help of abstract classes.
16. Write a Java Program to demonstrate runtime polymorphism with the help of interfaces.
17. Write a java program to display the use of all access modifiers with the help of two packages
18. Write an interface with a method called display. Implement this method I a class to display two names.
19. Write a small program to catch Negative Array Size Exception. This exception is caused when the array is initialized to negative values.
20. Write a program to handle Null Pointer Exception and use the finally clause to display a message to the user.
21. Write a Java program to create 5 threads by extending Thread class.
22. Write a Java program to create 5 threads by implementing Runnable interface.

23. Write applets to draw the following shapes:
- (i) Cone
  - (ii) Cylinder
  - (iii) Cube
24. Write an applet to display a face.
25. Write an HTML program using different tags.

**Examination Scheme:**

<b>IA</b>				<b>EE</b>	
<b>A</b>	<b>PR</b>	<b>LR</b>	<b>V</b>	<b>PR</b>	<b>V</b>
5	10	10	5	35	35

Note: IA –Internal Assessment, EE- External Exam, PR- Performance, LR – Lab Record, V – Viva.

**INSTRUMENTATION IN BIOLOGY LAB****Course Code : ICT 324****Credit Units: 01****Course Contents :****Module I**Agarose Gel electrophoresis,  
SDS-PAGE**Module II**

Chromatography –Paper Chromatography and Thin Layer Chromatography

**Module III**

Spectrophotometer techniques

**Module IV**PCR,  
ELISA  
Immunoelectrophoresis**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**COMMUNICATION SKILLS - I****Course Code: BCS 301****Credit Units: 01****Course Objective:**

To form written communication strategies necessary in the workplace.

**Course Contents:****Module I: Introduction to Writing Skills**

Effective Writing Skills

Avoiding Common Errors

Paragraph Writing

Note Taking

Writing Assignments

**Module II: Letter Writing**

Types

Formats

**Module III**

Memo

Agenda and Minutes

Notice and Circulars

**Module IV: Report Writing**

Purpose and Scope of a Report

Fundamental Principles of Report Writing

Project Report Writing

Summer Internship Reports

**Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>CT2</b>	<b>CAF</b>	<b>V</b>	<b>GD</b>	<b>GP</b>	<b>A</b>
<b>Weightage (%)</b>	20	20	25	10	10	10	5

CAF – Communication Assessment File

GD – Group Discussion

GP – Group Presentation

**Text & References:**

- Business Communication, Raman –Prakash, Oxford

- Creative English for Communication, Krishnaswamy N, Macmillan
- Textbook of Business Communication, Ramaswami S, Macmillan
- Working in English, Jones, Cambridge
- A Writer's Workbook Fourth edition, Smoke, Cambridge
- Effective Writing, Withrow, Cambridge
- Writing Skills, Coe/Rycroft/Ernest, Cambridge
- Welcome!, Jones, Cambridge

**UNDERSTANDING SELF FOR EFFECTIVENESS - III**  
**(INTERPERSONAL COMMUNICATION)**

**Course Code: BSS305**

**Credit Units: 01**

**Course Objective:**

This course provides practical guidance on:

Enhancing personal effectiveness and performance through effective interpersonal communication

Enhancing their conflict management and negotiation skills

**Course Contents:**

**Module I: Interpersonal Communication: An Introduction**

Importance of Interpersonal Communication

Types – Self and Other Oriented

Rapport Building – NLP, Communication Mode

Steps to improve Interpersonal Communication

**Module II: Behavioural Communication**

Meaning and Nature of behavioural communication

Persuasion, Influence, Listening and Questioning

Guidelines for developing Human Communication skills

Relevance of Behavioural Communication for personal and professional development

**Module III: Interpersonal Styles**

Transactional Analysis

Life Position/Script Analysis

Games Analysis

Interactional and Transactional Styles

**Module IV: Conflict Management**

Meaning and nature of conflicts

Styles and techniques of conflict management

Conflict management and interpersonal communication

**Module V: Negotiation Skills**

Meaning and Negotiation approaches (Traditional and Contemporary)

Process and strategies of negotiations

Negotiation and interpersonal communication

## **Module VI: End-of-Semester Appraisal**

Viva based on personal journal

Assessment of Behavioural change as a result of training

Exit Level Rating by Self and Observer

### **Text & References:**

- Vangelist L. Anita, Mark N. Knapp, Inter Personal Communication and Human Relationships: Third Edition, Allyn and Bacon
- Julia T. Wood. Interpersonal Communication everyday encounter
- Simons, Christine, Naylor, Belinda: Effective Communication for Managers, 1997 1<sup>st</sup> Edition Cassel
- Goddard, Ken: Informative Writing, 1995 1<sup>st</sup> Edition, Cassell
- Harvard Business School, Effective Communication: United States of America
- Foster John, Effective Writing Skills: Volume-7, First Edition 2000, Institute of Public Relations (IPR)
- Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.

**FRENCH - III****Course Code: FLT 301****Credit Units: 02****Course Objective:**

- To provide the students with the know-how
- To master the current social communication skills in oral and in written.
- To enrich the formulations, the linguistic tools and vary the sentence construction without repetition.

**Course Contents:****Module B: pp. 76 – 88 Unité 6****Module C: pp. 89 to103 Unité 7****Contenu lexical: Unité 6: se faire plaisir**

1. acheter : exprimer ses choix, décrire un objet (forme, dimension, poids et matières) payer
2. parler de la nourriture, deux façons d'exprimer la quantité, commander un repas au restaurant
3. parler des différentes occasions de faire la fête

**Unité 7: Cultiver ses relations**

1. maîtriser les actes de la communication sociale courante  
(Salutations, présentations, invitations, remerciements)
2. annoncer un événement, exprimer un souhait, remercier, s'excuser par écrit.
3. caractériser une personne (aspect physique et caractère)

**Contenu grammatical:**

1. accord des adjectifs qualificatifs
2. articles partitifs
3. Négations avec de, ne...rien/personne/plus
4. Questions avec combien, quel...
5. expressions de la quantité
6. ne...plus/toujours - encore
7. pronoms compléments directs et indirects
8. accord du participe passé (auxiliaire « avoir ») avec l'objet direct
9. Impératif avec un pronom complément direct ou indirect
10. construction avec « que » - Je crois que/ Je pense que/ Je sais que

**Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>CT2</b>	<b>C</b>	<b>I</b>	<b>V</b>	<b>A</b>
<b>Weightage (%)</b>	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:**

- le livre à suivre : Campus: Tome 1

**GERMAN - III****Course Code: FLG 301****Credit Units: 02****Course Objective:**

To enable the students to converse, read and write in the language with the help of the basic rules of grammar, which will later help them to strengthen their language.

To give the students an insight into the culture, geography, political situation and economic opportunities available in Germany

**Course Contents:****Module I: Modal verbs**

Modal verbs with conjugations and usage

Imparting the finer nuances of the language

**Module II: Information about Germany (ongoing)**

Information about Germany in the form of presentations or “Referat”– neighbors, states and capitals, important cities and towns and characteristic features of the same, and also a few other topics related to Germany.

**Module III: Dative case**

Dative case, comparison with accusative case

Dative case with the relevant articles

Introduction to 3 different kinds of sentences – nominative, accusative and dative

**Module IV: Dative personal pronouns**

Nominative, accusative and dative pronouns in comparison

**Module V: Dative prepositions**

Dative preposition with their usage both theoretical and figurative use

**Module VI: Dialogues**

In the Restaurant,

At the Tourist Information Office,

A telephone conversation

**Module VII: Directions**

Names of the directions

Asking and telling the directions with the help of a roadmap

### **Module VIII: Conjunctions**

To assimilate the knowledge of the conjunctions learnt indirectly so far

#### **Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>CT2</b>	<b>C</b>	<b>I</b>	<b>V</b>	<b>A</b>
<b>Weightage (%)</b>	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

#### **Text & References:**

- Wolfgang Hieber, Lernziel Deutsch
- Hans-Heinrich Wangler, Sprachkurs Deutsch
- Schulz Griesbach, Deutsche Sprachlehre für Ausländer
- P.L Aneja, Deutsch Interessant- 1, 2 & 3
- Rosa-Maria Dallapiazza et al, Tangram Aktuell A1/1,2
- Braun, Nieder, Schmöe, Deutsch als Fremdsprache 1A, Grundkurs

**SPANISH – III****Course Code: FLS 301****Credit Units: 02****Course Objective:**

To enable students acquire knowledge of the Set/definite expressions (idiomatic expressions) in Spanish language and to handle some Spanish situations with ease.

**Course Contents:****Module I**

Revision of earlier semester modules

Set expressions (idiomatic expressions) with the verb *Tener, Poner, Ir....*

Weather

**Module II**

Introduction to *Gustar...* and all its forms. Revision of *Gustar* and usage of it

**Module III**

Translation of Spanish-English; English-Spanish. Practice sentences.

How to ask for directions (using *estar*)

Introduction to IR + A + INFINITIVE FORM OF A VERB

**Module IV**

Simple conversation with help of texts and vocabulary

En el restaurante

En el instituto

En el aeropuerto

**Module V**

Reflexives

**Examination Scheme:**

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:**

- Español, En Directo I A
- Español Sin Fronteras -Nivel Elemental

**CHINESE – III****Course Code: FLC 301****Credit Units: 02****Course Objective:**

Foreign words are usually imported by translating the concept into Chinese, the emphasis is on the meaning rather than the sound. But the system runs into a problem because the underlying name of personal name is often obscure so they are almost always transcribed according to their pronunciation alone. The course aims at familiarizing the student with the basic aspects of speaking ability of Mandarin, the language of Mainland China. The course aims at training students in practical skills and nurturing them to interact with a Chinese person.

**Course Contents:****Module I**

Drills

Dialogue practice

Observe picture and answer the question.

Introduction of written characters.

Practice reading aloud

Practice using the language both by speaking and by taking notes.

Character writing and stroke order

**Module II**

Measure words

Position words e.g. inside, outside, middle, in front, behind, top, bottom, side, left, right, straight.

Directional words – beibian, xibian, nanbian, dongbian, zhongjian.

Our school and its different building locations.

What game do you like?

Difference between “hii” and “neng”, “keyi”.

**Module III**

Changing affirmative sentences to negative ones and vice versa

Human body parts.

Not feeling well words e.g. ; fever, cold, stomach ache, head ache.

Use of the modal particle “le”

Making a telephone call

Use of “jiu” and “cal” (Grammar portion)

Automobiles e.g. Bus, train, boat, car, bike etc.

Traveling, by train, by airplane, by bus, on the bike, by boat.. etc.

#### Module IV

The ordinal number “di”

“Mei” the demonstrative pronoun e.g. mei tian, mei nian etc.

use of to enter to exit

Structural particle “de” (Compliment of degree).

Going to the Park.

Description about class schedule during a week in school.

Grammar use of “li” and “cong”.

Comprehension reading followed by questions.

#### Module V

Persuasion-Please don't smoke.

Please speak slowly

Praise – This pictorial is very beautiful

Opposites e.g. Clean-Dirty, Little-More, Old-New, Young-Old, Easy-Difficult, Boy-Girl, Black-White, Big-Small, Slow-Fast ... etc.

Talking about studies and classmates

Use of “it doesn't matter”

Enquiring about a student, description about study method.

Grammar: Negation of a sentence with a verbal predicate.

#### Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

#### Text & References:

- “Elementary Chinese Reader Part I, Part-2” Lesson 21-30

**Statistical and Solid state Physics****Course Code: ICT 401****Credit Units: 03****Course objectives:**

To understand the basic principles of statistical and solid state physics. These principles and their application to physics are presented in this course.

**Course Contents:**

Basic Principles, Canonical and Grand Canonical ensembles:

Concept of statistical distribution, phase space, density of states Liouville's theorem, systems and ensemble, entropy in statistical mechanics Connection between thermodynamic and statistical quantities, micro canonical ensemble, equation of state, specific heat and entropy of a perfect gas, using micro canonical ensemble. (7)

Canonical ensemble, thermodynamic functions for the canonical ensemble, calculation of means values, energy fluctuation in a gas, grand canonical ensemble, thermodynamic functions for the grand canonical ensemble, density fluctuations. (6)

Partition functions and Statistics: Partition functions and properties, partition function for an ideal gas and calculation of thermodynamic quantities, Gibbs Paradox, validity of classical approximation, determination of translational, rotational and vibration contributions to the partition function of an ideal diatomic gas. Specific heat of a diatomic gas, ortho and para hydrogen. (10)

Identical particles and symmetry requirement, difficulties with Maxwell- Boltzmann statistics, quantum distribution functions, Bose Einstein and Fermi- Dirac statistics and Planck's formula, Bose Einstein condensation, liquid He<sub>4</sub> as a Boson system. (7)

Statistical mechanism of solid: Fermi-Dirac distribution function, density of states, temperature dependence of Fermi energy, specific heat, use of Fermi-Dirac statistics in the calculation of thermal conductivity and electrical conduction band, Drude theory of light, absorption in metals. (7)

Band Theory: Block theorem, Kronig Penny model, effective mass of electrons, Wigner-Seitz approximation, NFE model, tight binding method and calculation of density for a band in simple cubic lattice. (5)

**Recommended Books:**

1. Huang: Statistical Mechanics. 2<sup>nd</sup> ed wiley, 1987
2. Reif: Fundamentals of Statistical and Thermal Physics, McGrawhill
3. Kittel: Elementary statistical mechanics.
4. Palteros: Solid State Physics.
5. Levy: Solid State Physics.

## Quantum Chemistry

**Course Code: ICT 402**

**Credit Units: 03**

### Course objectives:

The understanding of chemical phenomena at the microscopic level requires a knowledge of the principles of quantum mechanics. These principles and their application to chemistry are presented in this course.

### Course Contents:

#### Module I: Introduction to Exact Quantum Mechanical Results

Introduction to Schrodinger, Equation and the postulates of Quantum Mechanics. Discussion of solutions of the Schrodinger Equation to some model systems viz. particle in a box, the harmonic oscillator, The rigid rotor, the hydrogen atom, including shapes of atomic orbital's; orbital and spin angular momenta; tunneling.

#### Module II: Approximate Methods

The Variation Theorem, operator algebra Linear vibration Principle, Perturbation Theory (First order and non-degenerate). Application of variation method and perturbation, theory of helium atom.

#### Module III: MOT

Huckels Theory of conjugated system, bond order and charge density calculation, Application to ethylene, Butadiene, Cyclopropenyl radical, cyclobutadiene etc. Introduction to extended Huckel Theory.

### Recommended Books:

1. J. P. Lowe and K. Peterson, Quantum Chemistry Academic Press.
2. D. A. McQuarrie, Quantum Chemistry Viva Books Pvt. Ltd.: New Delhi.
3. R. G. Mortimer, Mathematics for Physical Chemistry Elsevier.
4. F. L. Pilar, Elementary Quantum Chemistry, Dover Publication Inc.: New York.
5. P. W. Atkins and J. de Paula, Atkin's Physical Chemistry, Oxford University Press.
6. I. L. Levine, Quantum Chemistry, Prentice-Hall Inc., New Jersey.

## Fundamentals of Bioinformatics

**Course Code: ICT 403**

**Credit Units: 03**

**Course Objective:**

The objective is to describe data models and database management systems with an emphasis on biologically important techniques to store various data on DNA sequencing structures, genetic mapping, phylogenetic analysis. Multiple sequence alignment, protein structure prediction, and comparative genome analysis.

**Course Contents:**

**Module I:**

The NCBI, sequence databases, sequence retrieval, sequence file formats, submitting DNA, protein sequences and sequence assembly.

**Module II**

Exact string matching -classical comparison based methods, semi numerical string matching, suffix trees - construction and application, Databases and rapid sequence analysis –Blast and Fasta , sequence comparison by statistical content; Dynamic programming alignment -The number of alignments, shortest and longest paths in a network, global distance and similarity alignments, Fitting one sequence onto the other, trace backs, parametric sequence comparison

**Module III**

Global and local alignments, scoring matrices-pam and blosum and gap penalties, filtering, position specific scoring matrices, internet resources , uses of multiple sequence alignment programs and methods pattern searching programs, family and superfamily representation & profit analysis.

**Module IV**

Trees-representation of sequences, tree interpretation, Distance – additive, ultrameric and nonadditive distances, tree building methods, phylogenetic analysis, parsimony, Bootstrap, maximum likelihood trees, estimating the rate of change, likelihood and trees; analysis software.

**Module V**

Annotation, ESTs – databases, comparative genome analysis clustering, gene discovery, protein identification, physical properties, motifs and patterns, structure, folding classes, structure classification; Structure databases– PDB and MMDB, visualizing structural information, Docking of Molecules, structure prediction in proteins, prediction of buried residues in proteins, RNA secondary structure – minimum free-energy structures, Genome analysis, genome rearrangements with inversions, gene identification, gene expression, expression analysis, gene identification and functional classification.

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Text & References:*****Text:***

- Essentials of Genomics and Bioinformatics by C.W. Sensen, John Wiley and Sons
- Bioinformatics: Sequence and Genome Analysis by D.W. Mount, Cold Spring Harbor Laboratory Press.
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins by A.D. Baxevanis and B.F.F Ouellette, Wiley – interscience.

***References:***

- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology by D. Gusfield, Cambridge University Press
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit by G. Von Heijne and G. Von Heijne, Academic Press.
- Computational Molecular Biology: An Algorithmic Approach by P.A. Pevzner, MIT Press
- Computer Methods for Macromolecular Sequence Analysis by R.F. Doolittle, J.N, Abelson, M.I. Simon, Academic press
- Essentials of Genomics and Bioinformatics C.W. Sensen, John Wiley and Sons Inc.
- Introduction to Computational Biology: Maps, Sequences and Genomes by M. Waterman, Chapman and Hall
- Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit by G. V. Heijne and G.V. Heijne, Academic Press.

## Database management System

**Course Code: ICT 404**

**Credit Units: 03**

### Course Objective:

The objective of this course is to expose the students to the fundamentals & basic concepts in Data Base Management Systems. This course discusses architecture of Database Systems with concept of relational model & ER model. This course explains techniques for database design, Normalization and database Query.

### Course Contents:

#### Module I: Introduction to DBMS

Definition of DBMS, Data Independence, DBMS Architecture, Levels, Database Administrator, File System Approach Vs DBMS Approach, Advantages of Using a DBMS, Data Models, Schemas, and Instances.

#### Module II: Relational Database & ER Model

Relational System, Codd's Rule, Relational Model, Optimization, Tables and Views, Entity, Types of Entity, Weak Entity Attributes, Entity sets, Entity – Relationship Diagrams. Degree and Cardinality, Specialization, Generalization, Aggregation. Reduction of an E-R Schema to Tables.

#### Module III: Relational Model Objects

Domains and Relations, Relations and predicates, Relational Data Integrity; Primary Key, Candidate Key, Foreign Key and their rules; Relational operators, Referential Integrity Constraints, Relational Algebra, Relational Calculus.

#### Module IV: Database Design

Definition Of Functional Dependencies, Process Of Normalization, First Normal Form, Second Normal Form, Third Normal Form. Boycee Codd Normal Form, Fourth Normal Form, Fifth Normal Form.

#### Module V: Structured Query Language and PL/SQL

Objects in RDBMS , SQL Components (DDL, DML, DCL), SQL Data Definition and Data Types, Specifying Basic constraints in SQL, Schema change statement (Alter, Drop) Basic queries in SQL (Select...from...where.... group by.... having.... order by...), More complex queries in SQL (Joins, Subqueries, Correlated query), DML (Insert, Update, Delete, Merge), Transaction Control Language (TCL), Data Control Language (DCL), Views. Introduction and Structure of PL/SQL program, Control Statements, Stored Procedure, and triggers.

### Text

- Elmasari, Navathe, “Fundamentals of Database Systems”, Addison Wesley.
- Korth, Silbertz, Sudarshan, “Database Concepts”. McGraw Hill.
- Majumdar & Bhattacharya, “Database Management System”, Tata McGraw Hill.
- Date C J.” An Introduction to Database Systems”, Addison Wesley.

### References:

- Introduction to Database Systems, Bipin C Desai, Galgotia
- Oracle 9i The Complete Reference, Oracle Press

**Statistical methods****Course Code: ICT 405****Credit Units: 03****Course Objective:**

The course aims to develop competency and expertise in the application of statistical methods applied to biological data obtained in experimental techniques, methodology and the safe laboratory practice.

**Course Contents:****Module I**

Statistics and Biostatistics: Preliminary concepts. Measures of Central Tendency: Mean, Median, Mode  
Measures of Dispersion: Range, Standard deviation, Variance

**Module II**

Probability: Random Experiments, Trial and Event, Sample Space, Mutually Exclusive or Disjoint Events, Mutually Exhaustive Events, Equally Probable Events, Complementary Event, Classical definition of Probability, Statistical definition of Probability, Axiomatic definition of Probability, Addition theorem, Multiplication theorem, Conditional Probability, Bayes' Theorem. Expectation.

**Module III: Continuous Distribution**

Normal Distribution, Properties of Normal distribution

**Module IV: Correlation**

Bivariate distribution Correlation, Types of Correlation, Simple Correlation Coefficient for ungrouped data, Properties and Interpretation of Correlation Coefficient, Coefficient of determination, Scatter diagram, Standard Error, Probable error of Correlation Coefficient. Rank correlation, Some examples.

**Module V: Regression**

Definition, Regression lines and Regression Coefficients, Properties of Regression Coefficients, Some examples. Method of least square: Fitting of straight line

**Module VI: Introduction to the following Statistical terms**

Parameter, Statistic, Null hypothesis, Alternative hypothesis, Critical region, Type1 Error, Type 11 Error, Level of significance, P-value and its applications. Test of Significance for Small samples: One sample t-test, Paired t-test, Degrees of freedom for t-test, F test for equality of Population variances, Degrees of freedom for F-test. Test of Significance for Large samples: Normal test for sample mean and population mean, Normal test for two sample means. Chi-square Test: Test of goodness of fit, Test of Independence of attributes, Degrees of freedom for Chisquare test, Coefficient of contingency, Yates' correction for continuity. Analysis of Variance: One way and Two way (only Examples).

**Examination Scheme:**

<b>Components</b>	<b>CT</b>	<b>Attendance</b>	<b>Assignment/ Project/Seminar/Quiz</b>	<b>EE</b>
<b>Weightage (%)</b>	15	5	10	70

**Text & References:*****Text:***

- Introduction to Biostatistics, Ronald N. Forthfer and Eun Sun Lee, Publisher: Elsevier.
- Statistical Methodology, S.P. Gupta, Publisher: S. Chand & Co.
- Fundamentals of Statistics, S.C. Gupta. Publisher: S.Chand & Co.

***References:***

- Biostatistics: A manual of Statistical Methodology for use in Health, Nutrition and Anthropology, K. Visweswara Rao. Publisher: Jaypee Brothers
- Biostatistics: A foundation for analysis in the Health Sciences, W.W. Daniel, Publisher: John Wiley and Sons
- Fundamentals of Mathematical Statistics, S.C. Gupta and V.K. Kapoor, Publisher: S.Chand & Co.
- Statistical Analysis, Kaushal, T.L. Publisher: Kalyani Publishers
- Statistical Methods, Potri, D. Kalyani Publishers.
- Mathematical Statistics, H.C. Saxena, and V.K. Kapoor: S. Chand & Company
- Biostatistics, P.N. Arora and P.K. Malhan, Publisher: Himalaya Publishing House.

**Workshop Practice****Course Code: ICT 406****Credit Units: 03****Course Objective:**

After learning the course the students should be able to understand applications of hand tools and power tools. Understand the operations of machine tools. Select the appropriate tools required for specific operation. Comprehend the safety measures required to be taken while using the tools.

**MODULE –I Casting Processes:**

Principles of metal casting: Pattern materials, types and allowance; Study of moulding, sand moulding, tools, moulding materials, classification of moulds, core, elements of gating system, casting defects, e.g. die-casting, permanent mould casting.

**MODULE –II Smithy and Forging:**

Basic operation e.g. upsetting, flattening, drawing, drop forging, press forging

**Bench Work and Fitting**

Fitting, sawing, chipping, thread cutting (die), tapping; Study of hand tools, Marking and marking tools.

**MODULE –III Metal joining:**

Welding principles, classification of welding techniques; Oxyacetylene Gas welding, equipment and field of application, Arc-welding, metal arc, Flux: composition, properties and function; Electrodes, Brazing and soldering.

**MODULE –IV Sheet Metal Work:**

Introduction of tools and equipment; metals used for sheets, standard specification for sheets, spinning, bending, embossing and coining.

**Project work-I:** Preparation of a real life job using the processes practiced in Workshop practice.

**Text Books:**

1. Manufacturing Process by Raghuvanshi, Publisher: New Age International
2. Manufacturing Technology by P.N.Rao, Publisher : TMH publications

**Reference Books:**

1. Workshop Technology by Hazra-Chowdhary
2. Production Engineering by R.K.Jain
3. Workshop Technology by Chapman

# MICROBIOLOGY

**Course Code: ICT 407**

**Credit Unit:03**

## Course Objective:

An introduction to microorganisms, their morphology, reproduction, cultivation, metabolism, genetics, ecology of microorganisms and their relationships to health and environment

## Course Contents:

### Module I

Introduction (bacteria, fungi, algae, protozoa and viruses), Contribution of Scientists, Koch's Postulates, methods in Microbiology -Principles of microbial nutrition, Culture media, Theory and practice of sterilization, pure culture techniques, Enrichment culture techniques and Microbial lab techniques.

### Module II

Prokaryotic structure and function - Microbial nutrition and growth - Arithmetic and Geometric Growth expression, mathematical expression of growth, growth curve, measurement of growth and growth yields, synchronous growth, continuous culture, Diauxic growth, culture collection and maintenance of cultures.

### Module III

Microbial evolution, systematics and taxonomy - new approaches to bacterial taxonomy, classification including ribotyping, characteristics of primary domains, taxonomy, nomenclature and Bergey's manual, ribosomal RNA sequencing, microbial regulation of gene expression (attenuation and negative regulation with e.g. *trp* and *lac* operon), transfer of genetic material: plasmids, transposons, transduction, transformation and conjugation .

### Module IV

Host-parasite relationship -Normal micro flora of skin, oral cavity, gastrointestinal tract; entry of pathogens into the host, types of toxins (Exo, endo, entro) and their mode of actions, Plant -Microbe Interactions, Microbial pathogenesis -Disease reservoirs; Epidemiological terminologies; Infectious disease transmission

### Module V

Chemotherapy/antibiotics -Antimicrobial agents, sulfa drugs, antibiotics -penicillin and cephalosporins, broad spectrum antibiotics, antibiotics from prokaryotes. antifungal antibiotics; mode of action, resistance to antibiotics

## Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

## Text & References:

### Text:

- Pelczar, M.J., Chan, E.C.S. & Kreig, N.R. (2001). Microbiology 6<sup>th</sup> Ed. Tata McGraw Hill.
- Prescott, L.M. (2014). Microbiology, 9<sup>th</sup> Ed. McGraw by Hill Higher Education.

### References:

- Stanier, R. Y., Ingraham, J.L., Wheelis M.L. & Painter, P.R. (2005). General Microbiology, 5<sup>th</sup> Ed. McMillan,
- Atlas, R.M. (1997). Principles of Microbiology 2<sup>nd</sup> Ed. WMT Brown Publishers.
- VanDemark, P.J. & Batzing, B.L. Menlo Park (1987). *The microbes: an introduction to their nature and importance*, Benjamin/Cummings Publishing Co.
- Tortora, G. J., Funke, B. R. and Case, C.L. (1994).Microbiology 5<sup>th</sup> Ed. Benzamin Cummings Inc. California.

**Fundamentals of Bioinformatics Lab****Course Code: ICT 421****Credit Units: 01****Course Objective:**

To demonstrate the techniques and soft wares used for sequence analysis, alignment, structure prediction of the proteins and other compounds and finding the phylogenetic relationships

**Course Contents:****Module I**

Basics of sequence analysis Retrieving a sequence-nucleic acid/Protein

**Module II**

Local and Global Alignment- concepts Pair wise sequence alignment, multiple sequence alignment

Dynamic Programming – Smith Watermann Algorithm Needleman Wunsch Algorithm

**Module III**

Motif and pattern searching, Structure prediction, Protein structure classification resources, Structure superposition tools, Energy minimization and simulated annealing

**Module IV**

Phylogenetic prediction and analysis

**Module V**

Docking small molecules/peptides in active site of protein. Use of automated docking procedures. Free energy calculation.

**Module VI**

Finding transcription regulatory signals

**Examination Scheme:**

<b>IA</b>			<b>EE</b>			
<b>Class Test (Practical Based)</b>	<b>Mid Term Viva</b>	<b>Attendance</b>	<b>Major Experiment</b>	<b>Minor Experiment/Spotting</b>	<b>Practical Record</b>	<b>Viva</b>
15	10	05	35	15	10	10

**Database management System Lab****Course Code: ICT 422****Credit Units: 01****Course Contents:****Module I**

Database creation using DDL and DML.

**Module II**

Defining the primary and secondary keys.

**Module III**

Implementation of selection, projection and joins (internal and external) with SQL and Perl.

**Module IV**

Normalization of databases with SQL and Perl

**Module V**

Implementation of transactions and schedules.

**Module VI**

Detection of association rules and knowledge recovery.

## Examination Scheme:

IA				EE			
Class (Practical Based)	Test	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15		10	05	35	15	10	10

**Microbiology Lab****Course Code: ICT 423****Credit Units: 02****Course Contents:****Module I**

Preparation of culture media for cultivation of specific microorganism. Isolation of microbes from air, soil and water samples, their identification by staining techniques – simple staining, differential Gram staining, lacto phenol cotton blue staining for fungi

**Module II**

Biochemical test – Indole test, methyl red test, voges proskaeur test, citrate utilization, starch hydrolysis, protease, catalase test and oxidase test. Identification of microbes in water samples; standard plate count, presumptive and confirmed coli form test, BOD and COD

**Examination Scheme:**

<b>IA</b>				<b>EE</b>			
<b>Class Test (Practical Based)</b>	<b>Mid Term Viva</b>	<b>Term Attendance</b>	<b>Attendance</b>	<b>Major Experiment</b>	<b>Minor Experiment/Spotting</b>	<b>Practical Record</b>	<b>Viva</b>
15	10	05		35	15	10	10

**COMMUNICATION SKILLS - II****Course Code : BCS 401****Credit Units: 01****Course Objective:**

To teach the participants strategies for improving academic reading and writing.

Emphasis is placed on increasing fluency, deepening vocabulary, and refining academic language proficiency.

**Course Contents:****Module I: Social Communication Skills**

Small Talk

Conversational English

Appropriateness

Building rapport

**Module II: Context Based Speaking**

In general situations

In specific professional situations

Discussion and associated vocabulary

Simulations/Role Play

**Module III: Professional Skills**

Presentations

Negotiations

Meetings

Telephony Skills

**Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>CT2</b>	<b>CAF</b>	<b>V</b>	<b>GD</b>	<b>GP</b>	<b>A</b>
<b>Weightage (%)</b>	20	20	25	10	10	10	5

CAF – Communication Assessment File

GD – Group Discussion

GP – Group Presentation

**Text & References:**

- Essential Telephoning in English, Garside/Garside, Cambridge
- Working in English, Jones, Cambridge
- Business Communication, Raman –Prakash, Oxford
- Speaking Personally, Porter-Ladousse, Cambridge
- Speaking Effectively, Jermy Comfort, et.al, Cambridge
- Business Communication, Raman –Prakash, Oxford

**UNDERSTANDING SELF FOR EFFECTIVENESS - IV  
(RELATIONSHIP MANAGEMENT)**

**Course Code : BSS405**

**Credit Units: 01**

**Course Objective:**

To understand the basis of interpersonal relationship.

To understand various communication style.

To learn the strategies for effective interpersonal relationship.

**Course Contents:**

**Module I: Understanding Relationships**

Importance of relationships

Role and relationships

Maintaining healthy relationships

**Module II: Bridging Individual Differences**

Understanding individual differences

Bridging differences in Interpersonal Relationship – TA

Communication Styles

**Module III: Interpersonal Relationship Development**

Importance of Interpersonal Relationships

Interpersonal Relationships Skills

Types of Interpersonal Relationships

**Module IV: Theories of Interpersonal Relationships**

Theories: Social Exchange, Uncertainty Reduction Theory

Factors Affecting Interpersonal Relationships

Improving Interpersonal Relationships

**Module V: Impression Management**

Meaning & Components of Impression Management

Impression Management Techniques (Influencing Skills)

Impression Management Training-Self help and Formal approaches

**Module VI: End-of-Semester Appraisal**

Viva based on personal journal

Assessment of Behavioural change as a result of training

Exit Level Rating by Self and Observer

**Text & References:**

- Vangelist L. Anita, Mark N. Knapp, Inter Personal Communication and Human Relationships: Third Edition, Allyn and Bacon
- Julia T. Wood. Interpersonal Communication everyday encounter

- Simons, Christine, Naylor, Belinda: Effective Communication for Managers, 1997 1<sup>st</sup> Edition Cassell
- Goddard, Ken: Informative Writing, 1995 1<sup>st</sup> Edition, Cassell
- Harvard Business School, Effective Communication: United States of America
- Foster John, Effective Writing Skills: Volume-7, First Edition 2000, Institute of Public Relations (IPR)
- Beebe, Beebe and Redmond; Interpersonal Communication, 1996; Allyn and Bacon Publishers.

**FRENCH - IV****Course Code: FLT 401****Credit Units: 02****Course Objective:**

To enable students:

- To develop strategies of comprehension of texts of different origin
- To present facts, projects, plans with precision

**Course Contents:****Module C: pp. 104 – 139: Unités 8, 9****Contenu lexical: Unité 8: Découvrir le passé**

1. parler du passé, des habitudes et des changements.
2. parler de la famille, raconter une suite d'événements/préciser leur date et leur durée.
3. connaître quelques moments de l'histoire

**Unité 9: Entreprendre**

1. faire un projet de la réalisation: (exprimer un besoin, préciser les étapes d'une réalisation)
2. parler d'une entreprise
3. parler du futur

**Contenu grammatical:**

1. Imparfait
2. Pronom « en »
3. Futur
4. Discours rapporté au présent
5. Passé récent
6. Présent progressif

**Examination Scheme:**

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:**

- le livre à suivre : Campus: Tome 1

**GERMAN - IV****Course Code: FLG 401****Credit Units: 02****Course Objective:**

To enable the students to converse, read and write in the language with the help of the basic rules of grammar, which will later help them to strengthen their language.

To give the students an insight into the culture, geography, political situation and economic opportunities available in Germany.

Introduction to Advanced Grammar Language and Professional Jargon

**Course Contents:****Module I: Present perfect tense**

Present perfect tense, usage and applicability

Usage of this tense to indicate near past

Universal applicability of this tense in German

**Module II: Letter writing**

To acquaint the students with the form of writing informal letters.

**Module III: Interchanging prepositions**

Usage of prepositions with both accusative and dative cases

Usage of verbs fixed with prepositions

Emphasizing on the action and position factor

**Module IV: Past tense**

Introduction to simple past tense

Learning the verb forms in past tense

Making a list of all verbs in the past tense and the participle forms

**Module V: Reading a Fairy Tale**

Comprehension and narration

- Rotkäppchen
- Froschprinzessin
- Die Fremdsprache

**Module VI: Genitive case**

Genitive case – Explain the concept of possession in genitive

Mentioning the structure of weak nouns

**Module VII: Genitive prepositions**

Discuss the genitive prepositions and their usage: (während, wegen, statt, trotz)

**Module VIII: Picture Description**

Firstly recognize the persons or things in the picture and identify the situation depicted in the picture;

Secondly answer questions of general meaning in context to the picture and also talk about the personal experiences which come to your mind upon seeing the picture.

**Examination Scheme:**

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:**

- Wolfgang Hieber, Lernziel Deutsch
- Hans-Heinrich Wangler, Sprachkurs Deutsch
- Schulz Griesbach, Deutsche Sprachlehre für Ausländer
- P.L Aneja, Deutsch Interessant- 1, 2 & 3
- Rosa-Maria Dallapiazza et al, Tangram Aktuell A1/1,2
- Braun, Nieder, Schmöe, Deutsch als Fremdsprache 1A, Grundkurs

## **SPANISH - IV**

**Course Code: FLS 401**

**Credit Units: 02**

### **Course Objective:**

To enable students acquire working knowledge of the language; to give them vocabulary, grammar, voice modulations/intonations to handle everyday Spanish situations with ease.

### **Course Contents:**

#### **Module I**

Revision of earlier semester modules

Introduction to Present Continuous Tense (Gerunds)

#### **Module II**

Translation with Present Continuous Tense

Introduction to Gustar, Parecer, Apetecer, doler

#### **Module III**

Imperatives (positive and negative commands of regular verbs)

#### **Module IV**

Commercial/business vocabulary

#### **Module V**

Simple conversation with help of texts and vocabulary

En la recepcion del hotel

En el restaurante

En la agencia de viajes

En la tienda/supermercado

**Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>CT2</b>	<b>C</b>	<b>I</b>	<b>V</b>	<b>A</b>
<b>Weightage (%)</b>	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:**

- Español Sin Fronteras (Nivel – Elemental)

**CHINESE – IV****Course Code: FLC 401****Credit Units: 02****Course Objective:**

How many characters are there? The early Qing dynasty dictionary included nearly 50,000 characters the vast majority of which were rare accumulated characters over the centuries. An educate person in China can probably recognize around 6000 characters. The course aims at familiarizing the student with the basic aspects of speaking ability of Mandarin, the language of Mainland China. The course aims at training students in practical skills and nurturing them to interact with a Chinese person.

**Course Contents:****Module I**

Dialogue Practice

Observe picture and answer the question

Pronunciation and intonation

Character writing and stroke order.

Electronic items

**Module II**

Traveling – The Scenery is very beautiful

Weather and climate

Grammar question with – “bu shi .... Ma?”

The construction “yao ... le” (Used to indicate that an action is going to take place)

Time words “yiqian”, “yiwai” (Before and after).

The adverb “geng”.

**Module III**

Going to a friend house for a visit meeting his family and talking about their customs.

Fallen sick and going to the Doctor, the doctor examines, takes temperature and writes prescription.

Aspect particle “guo” shows that an action has happened some time in the past.

Progressive aspect of an action “zhengzai” Also the use of “zhe” with it.

To welcome someone and to see off someone .... I can't go to the airport to see you off... etc.

#### **Module IV**

Shipment. Is this the place to check luggage?

Basic dialogue on – Where do you work?

Basic dialogue on – This is my address

Basic dialogue on – I understand Chinese

Basic dialogue on – What job do you do?

Basic dialogue on – What time is it now?

#### **Module V**

Basic dialogue on – What day (date) is it today?

Basic dialogue on – What is the weather like here.

Basic dialogue on – Do you like Chinese food?

Basic dialogue on – I am planning to go to China.

#### **Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>CT2</b>	<b>C</b>	<b>I</b>	<b>V</b>	<b>A</b>
<b>Weightage (%)</b>	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

#### **Text & References:**

- “Elementary Chinese Reader, Part-2” Lesson 31-38

**ADVANCED GENETIC ENGINEERING****Course Code: ICT501****Credit Units: 03****Course Objective:**

A complete understanding of molecular techniques like DNA sequencing, restriction mapping, PCR for the cloning and expression of genes implication can be obtained through the course. The successful application of biotechnology largely depends on these advanced molecular techniques.

**Module I: Basic introduction, tools and specialized enzymes:**

Basic Introduction, Host controlled restriction modification system (Nomenclature, Type I-IV restriction endonucleases, Isoschizomers); DNA Methyltransferases; DNA polymerases; Special case of thermo-stable DNA polymerases in context to PCR. (History, concept, enzymology, and applications).

**Module II: Cloning vectors:**

Plasmids based vectors; Lambda based vectors and derivatives (Insertion vectors, replacement vectors, cosmids, Specialized cloning vectors (e.g. TOPO, TA cloning).

**Module III: DNA Libraries:**

Isolation and purification of nucleic acid (genomic/plasmid DNA and RNA), DNA libraries; Construction of cDNA library, Construction of Genomic library, Screening and preservation of DNA libraries. Expression libraries: Screening of expression libraries.

**Module IV: Heterologous gene expression (bacteria and yeast):**

Expression vectors: Structure and function, Advances in engineering of genes (codon optimization, translational enhancers, mRNA stabilizing factors), vectors (targeting signals, selection markers, purification and solubility tags) and hosts for overexpression and analysis.

**Module V: Automation and robotic advances in genetic engineering**

DNA sequencing - Sanger method of DNA sequencing (Manual and automated), Maxam Gilbert method. Example from Human Genome Project and other sequencing projects, PCR machines, imaging and gel documentation system.

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Text & References:****Text:**

- Recombinant DNA by J.D. Watson et al., W.H. Freeman and Company
- Recombinant DNA Technology by T. A. Brown
- Principles of Gene Manipulation: An Introduction to Genetic Engineering by R.W. Old and S. B Primrose, Blackwell Science Inc

**References:**

- Molecular Biotechnology: Principles and Applications of Recombinant DNA by B.R. Grick and J.J. Pasternak, ASM Press
- Molecular and Cellular Cells Methods in Biology and Medicine by P.B. Kaufman, W. Wu, D. Kim and C.J. Cseke, CRC Press.
- "Milestones in Biotechnology: Classic Papers on Genetic Engineering" by J.A. Bavies and W.S.
- Reznikoff, Butterworth Heinemann.

## FUNDAMENTALS OF NANOSCIENCE AND NANOTECHNOLOGY

**Course Code: ICT502**

**Credit Units: 03**

**Course objective:** Nanotechnology is one of the most important and influential fields in today's scenario. It holds tremendous potential and has shown significant impact on both basic and applied sciences. The major objective of this course is to introduce this contemporary area to the students.

### Module-I

Introduction: History- The purple of Cassius, the Lyncurgus cup, Michael Faraday and "divided metals", Richard Feynman, His theory and predictions, Moore's Law, Miniaturization of microprocessors. , the story of the Damascus sword. What is "nano"? Comparison with familiar objects. From nanoscience to nanotechnology: Eric Drexler.

### Module-II

Nanoscience: The multidisciplinary science, Bottom-up and top-down approach of research with examples, Different types of Nanomaterials, one-dimensional: CNTs, its types and characteristics; Two-dimensional: Nanofilms, nanosheets, nanowalls.

### Module-III

Properties of Nanomaterials, Different types of Nanomaterials and their Size, Quantum effects. Seeing Nanomaterials: Microscopes( SEM, TEM, STM, AFM) How do the different types of microscope work with Nanomaterials. Preparation of Nanomaterials: Physical Method (hydrothermal and solvothermal ) Chemical methods, Biological methods (Green synthesis using plants, microbes & other living organisms).

### Module-IV

Nanobiotechnology: Nanomedicine, Nanocosmetics, Textiles, Nanosensors ((biological, chemical, Biosensors, Gas sensors, mechanical ), Drug delivery, Cancer therapy, Tissue engineering, water purification, Lab-on-a-chip (LOC), nanocomputers, DNA computer, MRI with magnetic nanoparticles. Current trends of research in Nanobiotechnology, particularly health sciences.

### Module-V

**Dosage-dependent effects** (stimulatory or inhibitory) of different synthetic nanomaterials (gold, silver and variants of carbon nanotubes) on morphophysiological and molecular responses of the plants. **Acquisition of** nanomaterials by roots, intracellular localization and their mobilization to aerial parts. **Effects of** nanomaterials on homeostasis of essential macro-and micro elements. **Nanofertilizers**, nanoherbicides and nanopesticides. **Omic technologies** for deciphering nanomaterials-mediated responses of the plants. **Toxicity, environmental** implications of nanomaterials and safety issues. **Current trends** and future perspective of Nanobiotechnology for enhancing growth and development and/or yield potential of crop species for sustainable agriculture. **Potential** applications of Nanobiotechnology for alleviating biotic and/or abiotic stress responses of the crop species for sustainable agriculture.

### Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Suggested Readings:**

- Manasi Karkare.Nanotechnology: Fundamentals and Applications.2008. I.K. International K. Eric Drexler ,Chris Peterson and Gayle Pergamit.Unbounding the future: The Nanotechnology Revolution. 1991.William Morrow and Company, Inc., New York.
- C N R Rao.Nanoworld: An Introduction to nanoscience and Technology.2010. Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore.
- Manzer H.Siddiqui, M.H.Al –Whabhi, F. Mohammad ( Editors).Nanotechnology and Plant Sciences.2015.Springer.
- C.M. Niemeyer and C.A. Mirkin .Nanobiotechnology . 2012. Wiley-VCH
- C.M. Niemeyer and C.A. Mirkin .Nanobiotechnology-II . 2012. Wiley-VCH
- Nanobiotechnology: Concepts, Applications and Perspectives by Christof M. Niemeyer and Chad A. Mirkin, First Wiley 2006, ISBN: 978-3-527-60591-0.
- Nanobiotechnology II: More Concepts and Applications by Chad A. Mirkin and Christof M. Niemeyer, Wiley 2007, ISBN: 978-3-527-31673-1.
- Nano: The essentials - Understanding the nanoscience and technology by T. Pradeep, Tata McGraw-Hill Publishing Company Limited 2008, ISBN-10:0-07-154829-7 / 0071548297.

**FUNDAMENTALS OF INFORMATION AND COMMUNICATION****Course Code: ICT503****Credit Units: 03****Course Objective:**

The objective of this course is to acquaint the students with the basic of Information and Communication. This course covers basic underlying concepts and techniques used most recently. This course will help the students to learn various communication techniques. They will learn about traditional communication structure, its modulation, multiplexing and other important parameters. They will also learn significance of various network topologies, hardware and protocols deployed at each OSI and TCP/IP model layer.

**Course Contents:****Module I: Introduction to Information Technology**

Basic Concept of Information Technology, Data Processing: Data & Information, Types of Computer, Block Diagram of Computer, Von-Neumann Architecture, Computer Hardware V/s Software, Data Representation, Binary, Decimal, Octal, Hexadecimal Representation and their inter conversions, Information Technology Applications: Home, Education, Science & Medicine, Engineering and Entertainment.

**Module II: Introduction to Communication Technology**

Basic concept of Communication and their components, Communication Representation and types of communication flow.

Basic Network Components, Types of connections, Topology and their types, Network Types.

Internet History, Electronic Mail, FTP, SMTP, POP.

**Module III: Network Models**

TCP/IP: Protocols, Layers and their applications, addressing scheme of TCP/IP, OSI: Layers and their applications.

**Module IV: Communication Signals and their transmissions**

Analog and Digital Signals, Components: Sine Wave, Phase, Wavelength, Time V/S Frequency, and Bandwidth.

Transmission Impairment, Performance Measurement, Transmission Modes.

Transmission Conversion: Digital to Digital, Analog to Digital, Digital to Analog and Analog to Analog.

**Module V: Transmission Media and Switching Techniques**

Types of Media: Guided and Unguided. Packet switching V/S Circuit switching Network, Error Detection and Correction.

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Text & References:**

*Text:*

- Raja Raman V., "Fundamental of Computers", Prentice Hall of India, New Delhi.
- Computer Networks by Andrew S. Tanenbaum, PHI.

**References:**

- Data Communication & Networking, by Behrouz A. Forouzan, 4th Edition.
- Data & Computer Communications by William Stallings, PHI, 10th Edition.

**FUNDAMENTALS OF COGNITIVE AND NEUROSCIENCE****Course Code: ICT504****Credit Units: 03**

**Course Objective:** The objective of this course is to acquaint the students with the basics of cognitive and neuroscience. This course covers basic underlying concepts and techniques used most recently. This course will help the students to learn various approaches of cognitive and neuroscience.

1. **Cognitive Science:** Introduction, defining Cognition, Historical and Futuristic perspectives. **(2)**
2. **Interdisciplinary relevance:** with psychology, philosophy, neuroscience, linguistics, anthropology, Computer Science, sociology and biology. **(3)**
3. **Exploring Mind:** Multiple approaches. The Representational theory of mind and theories of Mental Representation. **(4)**
4. **Approaches to Cognitive science:** Logic, Rules, Concepts, Analogies, Images, Connections. **(6)**
5. **Cognitive Development:** Life span development, Piagetion Perspective, Core knowledge perspective, Vygotskion Perspective, Information processing perspective. **(5)**
6. **Extensions to Cognitive Science I:** (a) Perception (b) Attention (c) Pattern recognition (d) Consciousness **(7)**
7. **Extensions to Cognitive Science II:** (a) Memory (b) Representation of Knowledge (c) Language (d) Mental Imagery **(7)**
8. **Extensions to Cognitive Science III:** (a) Thinking (b) Problem Solving (c) Creativity (d) Human Intelligence (e) Artificial Intelligence **(7)**
9. **Cognitive Science and Societal Dynamics** **(2)**
10. **Research Methods in Cognitive Science** **(2)**

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Recommended Books:**

1. Thagard P. (2005) Mind: Introduction to Cognitive Science. MIT Press.
2. Kolak, D.et.al (2006) Cognitive Science: an introduction to Mind and brain
3. Solso R.L. (2001) Cognitive Psychology Delhi: Pearson Education.
4. Berk, L.E. (2003) Child development Delhi: Pearson Education
5. Matlin, M.W. (2002). Cognition, USA, Wadsworth, Thomson Learning.

**FUNDAMENTALS OF ENVIRONMENTAL SCIENCE AND TECHNOLOGY****Course Code: ICT 505****L:4,T:0,P:0,C:4****Course Objectives:**

The primary objective of this course is to provide students with the essential fundamentals and foundation of environmental science various technologies. It emphasizes on understanding and knowledge about the growing evidence of local and global pollution to limit human impact on the environment.

**Course Contents:****MODULE I: ENVIRONMENTAL POLLUTION & CONTROL**

**Air Pollution** –Concept of air pollution. Classify different types of air pollutants, sources, effects, behavior, sink & control of air pollutants – CO, NO<sub>x</sub>, HC, SO<sub>x</sub>, ozone and particulates.

Effect of pollutants on human & environment: photochemical smog, acid rain, ozone depletion.

**Water Pollution** – Classification of Pollutants, types, sources, water quality parameters such as color, conductivity, turbidity, total solids, hardness, alkalinity, chlorine, fluoride, nitrate, phosphate, DO, BOD, COD, oil and grease, phenol, heavy metals, pesticides, and microbes. Technologies for Treatment of industrial effluents with special focus on use of biological methods. Basic concept and design principles of various wastewater treatment units Advanced waste water treatment techniques.

**Soil Pollution** – Composition of soil, soil formation processes, soil profile, soil properties, classification. Soil pollution due to release of wastewater, storage and dumping of solid and hazardous wastes, application of fertilizers and pesticides etc. Solid erosion control and soil pollution control techniques.

**Solid Waste Pollution** –Types of solid Waste –agricultural waste, municipal waste, biomedical waste, industrial waste, e-waste waste treatment and disposal methods open dumping, thermal processes such as incineration, composting, sanitary land filling etc. Solid waste management strategies such as reduce, reuse remanufacture. recycle and repair, methods, recovering energy from wastes

**Hazardous wastes** – Classification, radioactive, biomedical & chemical, treatment and disposal – Physical, chemical and biological processes.

**Marine Pollution** – Causes, effects and control of marine pollution, coastal zone management.

**MODULE II: CHEMICAL TOXICOLOGY**

Toxic chemicals in the environment, impact of toxic chemicals on enzymes, health impact of toxic chemicals. Toxicity of metals such as arsenic, cadmium, lead, chromium, mercury, selenium, beryllium Toxicity of inorganic compounds such as oxides of nitrogen, sulphur dioxide, ozone, asbestos and pesticides

**MODULE III: ECO-FRIENDLY POLYMERS**

Polymer synthesis, Environmental degradation of polymers Photodegradable polymers, hydrolysis and hydro-biodegradable polymers. Biopolymers and bioplastics, thermal degradation of plastics during recycling.

**MODULE IV: GREEN TECHNOLOGY**

Introduction to concept of green technology, Basic principles of green technology such as minimization of environmental degradation, zero greenhouse gas emissions, zero waste generation, conservation of water resources, conservation of natural resources, conservation of energy and usage of renewable sources (solar, wind, etc). Concept of Atom economy, Tools of Green technology such as development of alternative fuels, green buildings, design and application of chemical products and processes to eliminate hazardous waste generation, reuse of waste water etc.

**MODULE V: ENVIRONMENTAL BIOTECHNOLOGY**

Bioaccumulation, biodegradation, Bioremediation, bioleaching, Biomethanation.

**MODULE VI: ENVIRONMENTAL LAWS**

Environmental Legislation- Historical overview, National and International conventions and treaties. Environmental Acts and Rules-Important Acts and rules such as Water Prevention and Control of Pollution Act, 1974, Water Cess Act 1977 and the Rules under the Act, The Air (Prevention & Control of Pollution Act, 1981 and the corresponding Rules. The Environment (Protection Act, 1986) and the concerned Rules, Forest and Wildlife Acts such as Biodiversity Conservation Act and the rules there under and other such Acts and the concerned rules.

**MODULE VII: ENVIRONMENTAL IMPACT ASSESSMENT**

Concept of Environmental Impact Assessment (EIA), MOEF guidelines for conducting EIA, basic steps for overall evaluation and environmental clearance. Scoping: Scoping techniques used in EIA, listing and prioritizing significant issues. Baseline Data Generation: Scoping of suitable sampling sites, detailed methodology of baseline data collection for air, water, noise, biodiversity and socio-economic environmental components. Data analysis. Impact Assessment: Using mathematical models for evaluation of impacts of different environmental constituents such as air, water and noise Environmental Management Plan: Basic concept of EMP, preparation of EMP and its implementation such as development of green belt.

### **MODULE VIII: ENVIRONMENTAL MANAGEMENT SYSTEMS**

*Concept of environment Management system (EMS), evolution of environment management system, Plan-Do-Check-Act cycle*

*ISO 14001 Standards: Environmental Policy, Environmental management planning, implementation and operation, Monitoring and Measurement, Management Review*

*Environmental Auditing: Concept, Steps involved in auditing, types of audit, conducting audit, corrective actions taken by industries.*

#### **Examination Scheme:**

<b>Components</b>	<b>CT</b>	<b>HA</b>	<b>S/V/Q</b>	<b>A</b>	<b>EE</b>
<b>Weightage (%)</b>	15	5	5	5	70

#### **Text books &References:**

1. Ecology and Environment- P.D. Sharma
2. Ecology of Natural resources –Ramade
3. Fundamentals of Ecology: E. P. Odum
4. Modern concepts in Ecology: H. D. Kumar
5. Heinsohn, R.J., Kabel, R.L., Sources and Control of Air Pollution, Prentice-Hall, 1999.(Chapter 9. Atmospheric Dispersion)
6. Wisner, B., Blaikie, P., Cannon, T. and Davis, I. (2004). At Risk 2nd Edition: Natural Hazards, People's Vulnerability and Disasters. Routledge.
7. Uberoi N.K. (2002). "Environmental Management", New Delhi, Excel Books.

**ADVANCED GENETIC ENGINEERING LAB****Course Code: ICT 521****Crédit Unit: 01****Course Contents:**

1. Isolation of Bacterial genomic DNA
2. Primer designing and amplification of gene of interest using polymerase chain reaction
3. Purification of the amplified DNA by column purification
4. Ligation
5. Restriction digestion
6. Preparation of competent cells using  $\text{CaCl}_2$  method.
7. Transformation of DNA using  $\text{CaCl}_2$  based heat shock method.

**Examination Scheme:**

<b>IA</b>				<b>EE</b>			
<b>Class (Practical Based)</b>	<b>Test</b>	<b>Mid Term Viva</b>	<b>Atten dance</b>	<b>Major Experiment</b>	<b>Minor Experiment/Spotting</b>	<b>Practical Record</b>	<b>Viva</b>
15		10	05	35	15	10	10

**Note:** Minor variation could be there depending on the examiner.

**FUNDAMENTALS OF NANOSCIENCE AND NANOTECHNOLOGY – LAB****Course Code: ICT 522****Crédit Unit: 01****Course Contents:**

1. OHS in nanotechnology.
2. Chemicals preparation, handling (aqua regia) and role in washing glass-wares for metal nanoparticles synthesis.
3. Green synthesis of gold and silver nanoparticles.
4. Demonstration of SPR properties of silver nanoparticles.
5. Demonstration of SPR properties of gold nanoparticles.
6. Construction of bimetallic nanoparticles and their studies on their optical properties.
7. Interaction of nanoparticles with biological cells (Haemolysis or antimicrobial activities).
8. Loading of fluorescent molecules on nanoparticles.
9. Preparation of antimicrobial polymeric films.
10. Synthesis of Nanoparticles by physical method & Chemical Method.
11. Green synthesis of Nanoparticles using Plant system from Leaves, fruit, callus etc.
12. Characterization of Nanoparticles using UV Visible Spectroscopy, XRD, FTIR.
13. Visualization of Nanomaterials using SEM, TEM, AFM.
14. To check the bioactivity of Nanomaterials on various pathological Fungi and Bacteria.
15. To check the effect of Nanomaterials on Plant germination parameters.

**Examination Scheme:**

<b>IA</b>				<b>EE</b>			
<b>Class (Practical Based)</b>	<b>Test</b>	<b>Mid Term Viva</b>	<b>Attendance</b>	<b>Major Experiment</b>	<b>Minor Experiment/Spotting</b>	<b>Practical Record</b>	<b>Viva</b>
15		10	05	35	15	10	10

**Note:** Minor variation could be there depending on the examiner.

**FUNDAMENTALS OF INFORMATION AND COMMUNICATION TECHNOLOGY  
LAB**

**Course Code: ICT523**

**Credit Units: 01**

**Course Contents:**

**List of Experiments**

1. To test Binary, Decimal, Octal, Hexadecimal Representation and their inter conversions.
2. To test and implement Peer to Peer model.
3. To test and implement Client –Server.
4. To test and implement BUS, Ring and Star Topology.
5. To configure and test working of switch.
6. To demonstrate working of router configuration.
7. To build small LAN using various network components.
8. Identify and compare different transmission media.
9. Demonstration of FTP, SMTP and HTTP Protocols.
10. Test of Ping and trace out commands.
11. Simulation of Data traffic and congestion.
12. Identification of IP address.

**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**FUNDAMENTALS OF COGNITIVE AND NEUROSCIENCE LAB****Course Code: ICT524****Credit Units: 01**

- Test of intelligence
- Muller iyer illusion test
- Span of attention
- Mirror drawing test
- Strooptest

**Recommended Book:** Experiments in Psychology by Akbhar Hussain.

**Examination Scheme:**

<b>IA</b>			<b>EE</b>			
<b>Class Test (Practical Based)</b>	<b>Mid Term Viva</b>	<b>Attendance</b>	<b>Major Experiment</b>	<b>Minor Experiment/Spotting</b>	<b>Practical Record</b>	<b>Viva</b>
15	10	05	35	15	10	10

## Fundamentals of Environment Science and Technology Lab

**Course Code: ICT 525**

**Credit Units: 01C:1**

**Course Objective:** The main aim of this course is to understand the importance of sampling and laboratory work in the study of Environmental Sciences and is committed to educate the student in laboratory skills and hopes that they will take full advantage of this opportunity.

### LIST OF EXPERIEMNTS

1. Determination of Alkalinity in the water sample.
2. Determination of dissolved oxygen (DO) in the water sample.
3. Determination of Biological Oxygen Demand (BOD) in the water sample.
4. Determination of chemical oxygen demand (COD) in the water sample.
5. Determination of pH, Conductivity and turbidity in some drinking water sample and preparation of report.
6. Determination of residual chlorine in the water sample.
7. Determination of pH and conductivity of soil/ sludge samples.
8. Determination of moisture content of soil sample.
9. Determination of Total dissolved solids in water / effluent sample.
10. Preparation of Urea-Formaldehyde polymer.
11. To determine a)  $\lambda$  max of the solution of  $\text{KMnO}_4$  b) Verify Beer's law and find out the concentration of unknown solution by spectrophotometer.
12. To determine the concentration of iron in water sample
13. Determine concentrations of gaseous pollutants in air samples such as  $\text{SO}_2$  and  $\text{NO}_x$  by usage of high volume samplers with gas kit attachments of  $\text{NO}_x$  and  $\text{SO}_2$  and lab analysis through colorimetric methods.
14. To determine the concentration of particulate matter in the ambient air using High volume Samplers( $\text{PM}_{10}$  and  $\text{PM}_{2.5}$ ).

### Text & reference books:

- Lab Book on General Chemistry. LAP LAMBERT Academic Publishing, OmniScriptum GmbH & Co. KG, Germany ISBN 9783-659-52374-8. 2014. Era Upadhyay.
- Handbook of environmental management and technology: Gwendolyn Holmes.

### Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**COMMUNICATION SKILLS - III****Course Code: BCS 501****Credit Units: 01****Course Objective:**

To equip the participant with linguistic skills required in the field of science and technology while guiding them to excel in their academic field.

**Course Contents:****Module I**

Reading Comprehension

Summarising

Paraphrasing

**Module II**

Essay Writing

Dialogue Report

**Module III**

Writing Emails

Brochure

Leaflets

**Module IV: Introduction to Phonetics**

Vowels

Consonants

Accent and Rhythm

Accent Neutralization

Spoken English and Listening Practice

**Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>CT2</b>	<b>CAF</b>	<b>V</b>	<b>GD</b>	<b>GP</b>	<b>A</b>
<b>Weightage (%)</b>	20	20	25	10	10	10	5

CAF – Communication Assessment File

GD – Group Discussion

GP – Group Presentation

**Text & References:**

- Effective English for Engineering Students, B Cauveri, Macmillan India
- Creative English for Communication, Krishnaswamy N, Macmillan
- A Textbook of English Phonetics, Balasubramanian T, Macmillan

**UNDERSTANDING SELF FOR EFFECTIVENESS - V  
(GROUP DYNAMICS AND TEAM BUILDING)**

**Course Code: BSS505**

**Credit Units: 01**

**Course Objective:**

To inculcate in the students an elementary level of understanding of group/team functions.  
To develop team spirit and to know the importance of working in teams.

**Course Contents:**

**Module I: Group formation**

Definition and Characteristics  
Importance of groups  
Classification of groups  
Stages of group formation  
Benefits of group formation

**Module II: Group Functions**

External Conditions affecting group functioning: Authority, Structure, Org. Resources, Organizational policies etc.  
Internal conditions affecting group functioning: Roles, Norms, Conformity, Status, Cohesiveness, Size, Inter group conflict.  
Group Cohesiveness and Group Conflict  
Adjustment in Groups

**Module III: Teams**

Meaning and nature of teams  
External and internal factors effecting team  
Building Effective Teams  
Consensus Building  
Collaboration

**Module IV: Leadership**

Meaning, Nature and Functions  
Self leadership  
Leadership styles in organization  
Leadership in Teams

**Module V: Power to empower: Individual and Teams**

Meaning and Nature  
Types of power  
Relevance in organization and Society

**Module VI: End-of-Semester Appraisal**

Viva based on personal journal  
Assessment of Behavioural change as a result of training  
Exit Level Rating by Self and Observer

**Text & References:**

- Organizational Behaviour, Davis, K.
- Hoover, Judith D. Effective Small Group and Team Communication, 2002, Harcourt College Publishers
- Dick, Mc Cann & Margerison, Charles: Team Management, 1992 Edition, viva books
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressers, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- LaFasto and Larson: When Teams Work Best, 2001, Response Books (Sage), New Delhi
- J William Pfeiffer (ed.) Theories and Models in Applied Understanding Self for Effectiveness, Vol 2, Group (1996); Pfeiffer & Company
- Smither Robert D.; The Psychology of Work and Human Performance, 1994, Harper Collins College Publishers

**FRENCH - V****Course Code: FLT 501****Credit Units: 02****Course Objective:**

To furnish some basic knowledge of French culture and civilization for understanding an authentic document and information relating to political and administrative life.

**Course Contents:****Module D: pp. 131 – 156 Unités 10, 11****Contenu lexical: Unité 10: Prendre des décisions**

1. Faire des comparaisons
2. décrire un lieu, le temps, les gens, l'ambiance
3. rédiger une carte postale

**Unité 11: faire face aux problèmes**

1. Exposer un problème.
2. parler de la santé, de la maladie
3. interdire/demander/donner une autorisation
4. connaître la vie politique française

**Contenu grammatical:**

1. comparatif - comparer des qualités/ quantités/actions
  2. supposition : Si + présent, futur
  3. adverbe - caractériser une action
  4. pronom "Y"

**Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>CT2</b>	<b>C</b>	<b>I</b>	<b>V</b>	<b>A</b>
<b>Weightage (%)</b>	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:**

- le livre à suivre : Campus: Tome 1

**GERMAN - V****Course Code: FLG 501****Credit Units: 02****Course Objective:**

To enable the students to converse, read and write in the language with the help of the basic rules of grammar, which will later help them to strengthen their language.

To give the students an insight into the culture, geography, political situation and economic opportunities available in Germany

Introduction to Advanced Grammar and Business Language and Professional Jargon

**Course Contents:****Module I: Genitive case**

Genitive case – Explain the concept of possession in genitive

Mentioning the structure of weak nouns

**Module II: Genitive prepositions**

Discuss the genitive prepositions and their usage: (während, wegen, statt, trotz)

**Module III: Reflexive verbs**

Verbs with accusative case

Verbs with dative case

Difference in usage in the two cases

**Module IV: Verbs with fixed prepositions**

Verbs with accusative case

Verbs with dative case

Difference in the usage of the two cases

**Module V: Texts**

A poem 'Maxi'

A text Rocko

**Module VI: Picture Description**

Firstly recognize the persons or things in the picture and identify the situation depicted in the picture;

Secondly answer questions of general meaning in context to the picture and also talk about the personal experiences which come to your mind upon seeing the picture.

**Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>CT2</b>	<b>C</b>	<b>I</b>	<b>V</b>	<b>A</b>
<b>Weightage (%)</b>	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:**

- Wolfgang Hieber, Lernziel Deutsch
- Hans-Heinrich Wangler, Sprachkurs Deutsch
- Schulz Griesbach, Deutsche Sprachlehre für Ausländer
- P.L Aneja, Deutsch Interessant- 1, 2 & 3
- Rosa-Maria Dallapiazza et al, Tangram Aktuell A1/1,2
- Braun, Nieder, Schmoe, Deutsch als Fremdsprache 1A, Grundkurs

**SPANISH - V****Course Code: FLS 501****Credit Units: 02****Course Objective:**

To enable students acquire working knowledge of the language; to give them vocabulary, grammar, voice modulations/intonations to handle everyday Spanish situations with ease.

**Course Contents:****Module I**

Revision of earlier semester modules

**Module II**

Future Tense

**Module III**

Presentations in English on

Spanish speaking countries'

Culture

Sports

Food

People

Politics

Society

Geography

**Module IV**

Situations:

En el hospital

En la comisaria

En la estacion de autobus/tren

En el banco/cambio

### **Module V**

General revision of Spanish language learnt so far.

### **Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>CT2</b>	<b>C</b>	<b>I</b>	<b>V</b>	<b>A</b>
<b>Weightage (%)</b>	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

### **Text & References:**

- Español Sin Fronteras, Greenfield

**JAPANESE - V****Course Code: FLJ 501****Credit Units: 02****Course Objective:**

To enable the students to converse, read and write language comfortably and be able to converse using different patterns and forms taught throughout. Students are taught and trained enough to get placed themselves in Japanese companies.

**Note:** Teaching is done in roman as well as Japanese script.

**Course Contents:****Module I**

Dictionary form of the verbs, Joining of verbs

Negative form of verbs

Potential form

**Module II**

Joining of many actions together

Usage of dictionary form of the verbs in sentences

Introducing colloquial language.

**Module III**

Direct form of the speech, quotations,

Expressing thoughts

Actions and reasoning

**Module IV**

Conclusion

Receiving and giving things, favour etc.

Different forms like 'tara' form.

**Module V**

Revision of the whole syllabus

**Learning Outcome**

- Students can speak and use different patterns, ways to describe a particular situation and can converse comfortably in mentioned situations throughout.
- Students can appear in the interviews for placements in Japanese companies.

**Methods of Private study /Self help**

- Teaching will be supported by handouts, audio-aids, and self-do assignments and role plays.
- Use of library, visiting and watching movies in Japan and culture center every Friday at 6pm.

**Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>CT2</b>	<b>C</b>	<b>I</b>	<b>V</b>	<b>A</b>
<b>Weightage (%)</b>	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:*****Text:***

- Teach yourself Japanese

***References:***

- Shin Nihongo no kiso 1

**CHINESE – V****Course Code: FLC 501****Credit Units: 02****Course Objective:**

What English words come from Chinese? Some of the more common English words with Chinese roots are ginseng, silk, dim sum, fengshui, typhoon, yin and yang, T'ai chi, kung-fu. The course aims at familiarizing the student with the basic aspects of speaking ability of Mandarin, the language of Mainland China. The course aims at training students in practical skills and nurturing them to interact with a Chinese person.

**Course Contents:****Module I**

Drills

Dialogue practice

Observe picture and answer the question.

Pronunciation and intonation.

Character writing and stroke order

**Module II**

Intonation

Chinese foods and tastes – tofu, chowmian, noodle, Beijing duck, rice, sweet, sour....etc. Learning to say phrases like – Chinese food, Western food, delicious, hot and spicy, sour, salty, tasteless, tender, nutritious, good for health, fish, shrimps, vegetables, cholesterol is not high, pizza, milk, vitamins, to be able to cook, to be used to, cook well, once a week, once a month, once a year, twice a week.....

Repetition of the grammar and verbs taught in the previous module and making dialogues using it.

Compliment of degree “de”.

**Module III**

Grammar the complex sentence “suiran ... danshi....”

Comparison – It is colder today than it was yesterday.....etc.

The Expression “chule....yiwai”. (Besides)

Names of different animals.

Talking about Great Wall of China

Short stories

#### **Module IV**

Use of “huozhe” and “haishi”

Is he/she married?

Going for a film with a friend.

Having a meal at the restaurant and ordering a meal.

#### **Module V**

Shopping – Talking about a thing you have bought, how much money you spent on it? How many kinds were there? What did you think of others?

Talking about a day in your life using compliment of degree “de”. When you get up? When do you go for class? Do you sleep early or late? How is Chinese? Do you enjoy your life in the hostel?

Making up a dialogue by asking question on the year, month, day and the days of the week and answer them.

#### **Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>CT2</b>	<b>C</b>	<b>I</b>	<b>V</b>	<b>A</b>
<b>Weightage (%)</b>	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

#### **Text & References:**

- “Elementary Chinese Reader ” Part-II Lesson 39-46

**NANOTECHNOLOGY IN BIOLOGY AND MEDICINE****Course Code: ICT 601****Credit Units: 03**

**Course objective:** The combination of biology and nanotechnology has led to a new generation of nano-devices that make it possible to characterize the chemical, mechanical, and other molecular properties, as well as discover novel phenomena and biological processes occurring at the molecular level. These advances provide science with a wide range of tools for biomedical applications in therapeutic, diagnostic, and preventive medicine. Major objective of this course is to introduce students to recent applications of nanotechnology in biology and medicine.

**Course contents****Module I: Introduction to Nanobiotechnology and Nanomedicine**

Overview of Nanobiotechnology and Nanomedicine, their developments, nanomaterials used in biology and medicine, rules governing the health and safety standards related to the use of chemicals and Nanobiotechnology and Nanomedicine.

**Module II: Nano-Bio interface and its importance**

Physical, chemical and biological concepts at Nano-Bio interface. Stability of nanomaterials in biological system, *in-vivo* and *in-vitro* applications of various nanomaterials and conceptual understanding microscopies and spectroscopic techniques. Biological barriers to nanocarrier-mediated delivery of therapeutic and imaging agents, nanoparticle contrast agents for molecular magnetic resonance imaging. Nanotechnology in cancer.

**Module III: Nanotoxicity and societal implications**

Fundamentals of nanomaterials and toxicity evaluation: cyto-toxicity, geno-toxicity, *in-vivo* tests/assays. Recent developments in nanotoxicity and basic concept of green synthesis. From the first industrial revolution to the nano revolution, implications of Nanoscience and nanotechnology on Society, Nano policies, Nano arms race, public perception and public involvement in the nano discourse, Harnessing nanotechnology for economic and social development.

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Books:**

- Nanotechnology in Biology and Medicine: Methods, Devices, and Applications by Tuan Vo-Dinh, Tuan Vo-Dinh, CRC Press, ISBN: 9780849329494 - CAT# 2949.
- Nanobiotechnology: Concepts, Applications and Perspectives by Christof M. Niemeyer and Chad A. Mirkin, First Wiley 2006, ISBN: 978-3-527-60591-0.
- Nanobiotechnology II: More Concepts and Applications by Chad A. Mirkin and Christof M. Niemeyer, Wiley 2007, ISBN: 978-3-527-31673-1.
- Nano: The essentials - Understanding the nanoscience and technology by T. Pradeep, Tata McGraw-Hill Publishing Company Limited 2008, ISBN-10:0-07-154829-7 / 0071548297.

## Functional and Comparative genomics

**Course Code : ICT602**

**Credit Units:3**

### Course Objective:

The recent proliferation of genomic data has transformed biology, making previously laborious and expensive experiments easier and cheaper, enabling new avenues of inquiry, and fundamentally altering our understanding of biology and medicine. This course will introduce you to the questions that can be asked and answered with genomic data, and to the computational tools available to analyze that data.

### Module I: Introduction to Genome and Gene families

Genome projects, Human genome organization, introduction to transcriptomics, proteomics. Human genome browser- ENSEMBLE. Mitochondrial genome, CpG islands. Gene families: Multigene families – Classical gene families, families with conserved domains, Gene superfamilies, Repetitive DNA and transposable elements, Origin of gene families.

### Module II: Genome sequencing techniques and applications

Basic genome sequencing techniques, Next-Generation sequencers, Sequencing strategies and the shotgun method Massive parallel sequencing and its applications.

### Module III: Comparative Genomics

Overview of prokaryotic and eukaryotic genomes, C-value, number of genes and complexity of genomes, Conservation and diversity of genomes, Comparative genomics as an aid to gene mapping and study of human disease genes.

### Module IV: Functional genomics

Functional Genomics: Sequence-Based Approaches, MicroarrayBased Approaches, Comparison of SAGE and DNA Microarrays. Differential display, Protein functions on genome-wide scale, Knock-out analysis, Anti-sense and RNA interference (RNAi).

### Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

### Text Book & References:

1. Richard J Reece (2003), Analysis of Genes and Genomes, Wiley Publications,
2. Mount, D. (2004) “Bioinformatics: Sequence and Genome Analysis”; Cold Spring Harbor Laboratory Press, New York.
3. Baxevanis, A.D. and Francis Ouellette, B.F. (1998) “Bioinformatics – a practical guide to the analysis of Genes and Proteins”; John Wiley & Sons, UK.
4. Comparative genomics: empirical and analytical approaches to gene order dynamics, map alignment and the evolution of gene families by Sankoff, D. & Nadeau, J.H., Netherlands, Kluwer Academic Publishers, 2000.

**ARTIFICIAL INTELLIGENCE****Course Code: ICT 603****Credit Units: 03****Course Objective:**

The primary objective of this course is to provide an introduction to the basic principles, techniques, and applications of Artificial Intelligence. The emphasis of the course is on teaching the fundamentals and not on providing a mastery of specific commercially available software tools or programming environments. Upon successful completion of the course, you will have an understanding of the basic areas of artificial intelligence search, knowledge representation, learning and their applications in design and implementation of intelligent agents for a variety of tasks in analysis, design, and problem-solving. You will also be able to design and implement key components of intelligent agents of moderate complexity in Java and/or Lisp or Prolog and evaluate their performance. Graduate students are expected to develop some familiarity with current research problems and research methods in AI by working on a research or design project.

**Course Contents:****Module I: Introduction**

AI and its importance, AI Problem, Application area.

**Module II: Problem Representations**

State space representation, problem-reduction representation, production system, production system characteristics, and types of production system.

**Module III: Heuristic Search Techniques**

AI and search process, brute force search, depth-first search, breadth-first search, time and space complexities, heuristics search, hill climbing, best first search, A\*, AO\* algorithm, constraint satisfaction, and beam search.

**Module IV: Knowledge Representation issues using predicate logic**

Representation and mapping, knowledge representation mechanism, inheritable knowledge, Propositional logic: syntax and semantics, First Order Predicate Logic (FOPL).

**Module V: Expert System**

Basic understanding of Fuzzy Logic, Artificial Neural Network, Perceptron, Natural Language Processing, Pattern Recognition, Robotics, LISP and Prolog. The role of Artificial intelligence in Biotechnology. Introduction to Bio-inspired computing.

**Examination Scheme:**

Components	CT	A/Q	Attd	EE
Weightage (%)	15	05	5	70

**Text & References:****Text:**

- Artificial Intelligence – II Edition, Elaine Rich, Kevin Knight TMH.

**References:**

- Foundations of Artificial Intelligence and Expert Systems, V S Janakiraman, K Sarukesi, P Gopalakrishnan, Macmillan India Ltd.
- Introduction to AI and Expert System, Dan W. Patterson, PHI.

**Cognitive Neurology****Course Code: ICT 604****Credit Units: 03****Course Objectives:**

This course explores the cognitive and neural processes that support attention, vision, language, motor control, navigation, and memory. It introduces basic neuroanatomy, and behavioral measures of cognition, and discusses methods by which inferences about the brain bases of cognition are made. We also consider evidence from patients with neurological diseases and from normal human participants.

**Module 1: Evolution and Development of the nervous system**

Adult Neurogenesis, Genesis and patterning of Primate Cerebral Cortex, Neuronal Migration, Stem Cell plasticity, Structural Functional Plasticity of Hippocampus and Sex and Stress hormones.

**Module 2: Sensory System**

Neural Coding and Decision-Making Mechanisms, Functional Subdivisions and Processing streams of Primate auditory cortex, Neuronal Correlates of Visual Attention and Perception, Short Term Memory for the Rapid Deployment of attention.

**Module 3: Motor Systems**

Cortical Mechanisms Sub-serving Object Grasping, Action Understanding and Imitation, Basal ganglia and Cerebellar Circuits within the Cerebral cortex, Basal Ganglia and the Control of Action, Representation of Action, Sensorimotor Transformation Transformations in the Posterior Parietal Cortex, Motor Learning and Memory For Reaching and Pointing.

**Module 5: Perception**

Origin of perception (Retinal Ganglion Diversity and the Creation of Parallel Visual Pathways)

**Module 6: Brain Mechanisms of Emotion**

Theories of Emotion, Limbic System Concept, The amygdala & associated brain Circuits.

**Module 7: Memory Systems**

Types of Memory and amnesia, The search for the engram, The temporal lobes and declarative memory, The striatum and procedural memory, The neocortex and working memory.

**Module 8: Molecular mechanisms of learning and memory (6)**

Procedural learning.

Simple Systems: Invertebrate models of learning.

Vertebrate models of learning.

The molecular basis of long term memory.

**Reference Books:**

11. Kandel E.R., Schwartz J.H., Jessell T.M. Principles of Neuroscience, 4th edition Newyork: McGraw-Hill,2000.
12. Michael S. Gazzaniga, The Cognitive Neurosciences III, 3rd edition.
13. Bear M.F, Connors B.W, Paradiso M.A, Neuroscience Exploring the brain, Third edition, Lippincott, Williams & Wilkins.

**ENVIRONMENTAL SYSTEMS MODELLING****Course Code: ICT 605****Credit Units: 03****Course Objective:**

The course will provide a basic introduction to environmental modeling, categorize different environmental models and provide insights into the use of computer models in environmental sciences. It will give the students a good understanding of the strengths and limitations of models required for critical analysis of environmental problems. Students will develop a comprehensive understanding of software, hardware related to applications of different categories of models in environmental sciences and will learn to use the models to diagnose current problems and forecast future scenarios.

**Course Contents:****Module I**

Environmental systems-an introduction, an overview of mathematical models applied to various environmental issues, Concept, Need, Scope and objectives of environmental modelling

**Module II**

What is a model?, Model classification – Brief review of different types of models: Physical models, Conceptual models, Mathematical Models

Data analysis techniques using statistical software such as SPSS/R -Measurements of central tendency (Arithmetic Mean, Median and Mode), testing of statistical hypotheses, ANOVA, correlation, rank correlations, brief introduction to non-parametric statistics.

**Probability** – Concept, Bayes' theorem. Probability Distributions - Binomial, Poisson and Normal.

**Module III**

Simulation models: Mechanistic Models, Empirical Models, Stochastic Models; Heuristic Models, Deterministic Models; Model Fitting, Model Calibration, Model structure including basic idea of processes and spatial and temporal scales used in the model; Model components: Equations, Input Data, Parameters Values; Implementation

**Module IV**

Comparing model predictions with observational data

Validation of models: Examples

Population Dynamics Predator-Prey (Lotka-Volterra methods)

Compartment Flow models: Example

**Module V**

Uncertainty in the model: Uncertainty in model outputs, Uncertainty due to Parameter errors, Input data and equation Errors, Monte Carlo simulations; Determining Model Uncertainty and Sensitivity using Monte Carlo simulations;

Variability in the model – Variance and other statistical approaches to assess variability in model outputs, temporal and spatial variability in the model outputs, the use of multiple models, statistical approaches, and evaluate appropriateness of these methods and how to utilize them.

**Module VI**

Air Quality Modeling: An overview; Objectives and aim of modeling, approaches to model building, components of air quality models, data quality of inputs to air quality models, classification of models; Gradient transport model; Eddy diffusion model; Gaussian Plume model – Point, line, area and multiple source models; Applications of Gaussian plume model such as fugitive dust modeling; Source apportionment modeling using methods such as principal component analyses, positive matrix factorization etc. Eulerian models-Multi-scale, three

dimensional prognostic models simulating atmospheric chemical reactions and transformation of gaseous and particulate pollutants. Evaluation of model performance, assess accuracy and utilization of modeled data.

### Examination Scheme:

Components	CT	HA	S/V/Q	A	EE
Weightage (%)	15	5	5	5	70

### Text & References:

- Smith J. and Smith P. (2007). Introduction to Environmental Modelling. Oxford: Oxford University Press.
- Keesman K. (1993) Modelling change in environmental systems. Chichester : Wiley
- Morrison J. and Morecroft M.D. (2006) Plant growth and climate change. Oxford; Ames, Iowa: Blackwell Pub.
- Hardisty J. (1993) Computerised environmental modelling: a practical introduction using Excel, Chichester: Wiley.
- A. Ramaswami et al, "Integrated Environmental Modelling", John Wiley, 2005.
- J. Schnoor, "Environmental Modelling", John Wiley , New York, 1996.
- M.Z. Jacobson, "Fundamentals of Atmospheric Modelling", Cambridge University Press, 2005.
- S.C. Chapra, "Surface water quality modelling", McGraw Hill., New York.
- Schnelle, K. B. and Dey, P.R., "Atmospheric Dispersion Modelling Compliance (1999) Guide", McGraw-Hill.
- Turner, D.B, Workbook of Atmospheric Dispersion Estimates", 2nd ed., 1994 Ann Arbor, MI: Lewis Publishers.
- Benarie, M.M. (1980). Urban Air Pollution Modelling (Cambridge, MA: The MIT Press).

**NANOTECHNOLOGY IN BIOLOGY AND MEDICINE LAB****Course Code: ICT 621****Credit Units: 01****List of experiments:**

1. OHS for nanobiotechnology and nanomedicine.
2. Green synthesis of gold and silver nanoparticles and their SPR properties.
3. Use of biological molecules in preparation of metal nanoparticles.
4. Control of composition of nanoparticles with amino acids for biological applications.
5. Characterization of surface properties of nanoparticles.
6. Preparation of fluorescent capped nanoparticles for imaging applications.
7. Constriction of nano-zymes and investigation of nano-zyne like behaviour of nanoparticles.

**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**Functional and Comparative Genomics –Lab****Course Code: ICT622****Credit Unit: 01****Course Objective:**

The laboratory experiments in Functional and comparative genomics would certainly help to comprehend the theoretical aspects of the subject.

**Course Contents:**

1. To identify the biophysical and chemical properties of protein using Prot param.
2. Multiple Sequence Alignment using Clustal w.
3. Determination of three dimensional Structures – In silico study.
4. Inference of protein functions from structure.
5. Protein ligand interactions studies using pymol.

**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**Note: Minor variation could be there depending on the examiner.**

**Artificial Intelligence Lab****Course Code: ICT 623****Credit Units: 01**

- 1 Study of PROLOG. Write the following programs using PROLOG
- 2 Write a program to solve 8 queens problem
- 3 Solve any problem using depth first search.
- 4 Solve any problem using best first search.
- 5 Solve 8-puzzle problem using best first search
- 6 Solve Robot (traversal) problem using means End Analysis
- 7 Solve traveling salesman problem.

**Books for Reference :**

- Artificial Intelligence: A Modern Approach,. Russell & Norvig. 1995, Prentice Hall.
- Artificial Intelligence, Elain Rich and Kevin Knight, 1991, TMH.
- Artificial Intelligence-A modern approach, Staurt Russel and peter norvig, 1998, PHI.
- Artificial intelligence, Patrick Henry Winston:, 1992, Addition Wesley 3 Ed.,
- Introduction to prolog.

**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**COGNATIVE NEUROLOGY LAB****Course Code: ICT 624****Credit Units: 01**

**Objective:** Introduction to experimental methods used in behavioral neuroscience research. This laboratory course provides practical training in the foundations of Cognitive Neuroscience, that is, the science of brain and behavior, studied through experiments with human participants. Students will engage in theoretical work and practical experiments addressing behavioral, cognitive, and physiological processes as well as relationships between different behavioral processes. Students will also learn how to report research data.

**Course Contents:**

**Module 1:** This course is about how Cognitive Neuroscientists study how the mind, body, and brain work.

**Module 2:** A major portion of this work will be done on computers; some activities will include writing and using small computer programs that will record participants' responses, or analyze the data.

**Module 3:** Introduction to OpenSesame - is a program to create experiments for psychology, neuroscience, and experimental economics.

**Module 4:** Design basic experiment of reaction time, memory and decision making and learn to record participants response data.

**Module 5:** Get familiarity with an overview of basic techniques in systems neuroscience i.e EEG, EMG, fMRI etc and write a detailed report on each technique including their principle and application.

**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**ENVIRONMENTAL SYSTEMS MODELLING LAB****Course Code: ICT 625****Credit Units: 01**

**Course Objectives:** The main aim of this course is to understand the importance of understanding and using effective data analyses and modeling techniques in the study of Environmental Sciences to properly interpret environmental data in order to understand environmental related problems and help in effective decision making to solve the problem. The course is committed to educating the students in using appropriate software for different data analyses techniques in computer laboratory and hopes that they will take full advantage of this opportunity.

**LIST OF EXPERIEMNTS**

1. Plotting time series with different averaging times .
2. Daily means from hourly means — processing wind direction data
3. Usage of box plots
4. Hierarchical clustering
5. The polarFreq function
6. The polarPlot and polarCluster functions
7. Usage of Scatterplots, pie-charts
8. Linear Trend Analyses
9. The linear Relation function
10. Model evaluation — the modStats function
11. Preparing data to compare sites, for model evaluation and intervention analysis
12. Analysis f of different meteorological parameters
13. The WindRose and PollutionRose functions
14. The Percentile Rose function

**Text & reference books:**

1. R Core Team (2016). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL <https://www.R-project.org/>.
2. Carslaw, D. C. and K. Ropkins, (2012) openair -an R package for air quality data analysis. Environmental Modelling & Software. Volume 27-28, 52-61.
3. IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.
4. Advance Excel.

## COMMUNICATION SKILLS - IV

**Course Code:** BCS 601

**Credit Units:** 01

**Course Objective:**

To enhance the skills needed to work in an English-speaking global business environment.

**Course Contents:**

**Module I: Business/Technical Language Development**

Advanced Grammar: Syntax, Tenses, Voices

Advanced Vocabulary skills: Jargons, Terminology, Colloquialism

Individualised pronunciation practice

**Module II: Social Communication**

Building relationships through Communication

Communication, Culture and Context

Entertainment and Communication

Informal business/ Technical Communication

**Module III: Business Communication**

Reading Business/ Technical press

Listening to Business/ Technical reports (TV, radio)

Researching for Business /Technology

**Module IV: Presentations**

Planning and getting started

Design and layout of presentation

Information Packaging

Making the Presentation

**Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>CT2</b>	<b>CAF</b>	<b>V</b>	<b>GD</b>	<b>GP</b>	<b>A</b>
<b>Weightage (%)</b>	20	20	25	10	10	10	5

CAF – Communication Assessment File

GD – Group Discussion

GP – Group Presentation

**Text & References:**

- Business Vocabulary in Use: Advanced Mascull, Cambridge
- Business Communication, Raman –Prakash, Oxford
- Business Communications, Rodgers, Cambridge
- Working in English, Jones, Cambridge
- New International Business English, Jones/Alexander, Cambridge

**UNDERSTANDING SELF FOR EFFECTIVENESS - VI**  
**(STRESS AND COPING STRATEGIES)**

**Course Code: BSS605**

**Credit Units: 01**

**Course Objective:**

To develop an understanding the concept of stress its causes, symptoms and consequences.

To develop an understanding the consequences of the stress on one's wellness, health, and work performance.

**Course Contents:**

**Module I: Stress**

Meaning & Nature

Characteristics

Types of stress

**Module II: Stages and Models of Stress**

Stages of stress

The physiology of stress

Stimulus-oriented approach.

Response-oriented approach.

The transactional and interactional model.

Pressure – environment fit model of stress.

**Module III: Causes and symptoms of stress**

Personal

Organizational

Environmental

**Module IV: Consequences of stress**

Effect on behaviour and personality

Effect of stress on performance

Individual and Organizational consequences with special focus on health

**Module V: Strategies for stress management**

Importance of stress management

Healthy and Unhealthy strategies

Peer group and social support

Happiness and well-being

**Module VI: End-of-Semester Appraisal**

Viva based on personal journal

Assessment of Behavioural change as a result of training

Exit Level Rating by Self and Observer

**Text & References:**

- Blonna, Richard; Coping with Stress in a Changing World: Second edition
- Pestonjee, D.M, Pareek, Udai, Agarwal Rita; Studies in Stress And its Management
- Pestonjee, D.M.; Stress and Coping: The Indian Experience
- Clegg, Brian; Instant Stress Management – Bring calm to your life now

**FRENCH - VI****Course Code: FLT 601****Credit Units: 02****Course Objective:**

To strengthen the language of the students both in oral and written so that they can:

- i) express their sentiments, emotions and opinions, reacting to information, situations;
- ii) narrate incidents, events;
- iii) perform certain simple communicative tasks.

**Course Contents:****Module D: pp. 157 – 168 – Unité 12****Unité 12: s'évader**

- 1. présenter, caractériser, définir
- 2. parler de livres, de lectures
- 3. préparer et organiser un voyage
- 4. exprimer des sentiments et des opinions
- 5. téléphoner
- 6. faire une réservation

**Contenu grammatical:**

- 1. proposition relative avec pronom relatif "qui", "que", "où" - pour caractériser
- 2. faire + verbe

**Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>CT2</b>	<b>C</b>	<b>I</b>	<b>V</b>	<b>A</b>
<b>Weightage (%)</b>	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:**

- le livre à suivre : Campus: Tome 1

**GERMAN - VI****Course Code: FLG 601****Credit Units: 02****Course Objective:**

To enable the students to converse, read and write in the language with the help of the basic rules of grammar, which will later help them to strengthen their language.

To give the students an insight into the culture, geography, political situation and economic opportunities available in Germany

Introduction to Advanced Grammar and Business Language and Professional Jargon

**Course Contents:****Module I: Adjective endings**

Adjective endings in all the four cases discussed so far

Definite and indefinite articles

Cases without article

**Module II: Comparative adverbs**

Comparative adverbs as and like

**Module III: Compound words**

To learn the structure of compound words and the correct article which they take

Exploring the possibility of compound words in German

**Module IV: Infinitive sentence**

Special usage of 'to' sentences called zu+ infinitive sentences

**Module V: Texts**

A Dialogue: 'Ein schwieriger Gast'

A text: 'Abgeschlossene Vergangenheit'

**Module VI: Comprehension texts**

Reading and comprehending various texts to consolidate the usage of the constructions learnt so far in this semester.

**Module VII: Picture Description**

Firstly recognize the persons or things in the picture and identify the situation depicted in the picture;

Secondly answer questions of general meaning in context to the picture and also talk about the personal experiences which come to your mind upon seeing the picture.

**Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>CT2</b>	<b>C</b>	<b>I</b>	<b>V</b>	<b>A</b>
<b>Weightage (%)</b>	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:**

- Wolfgang Hieber, Lernziel Deutsch
- Hans-Heinrich Wangler, Sprachkurs Deutsch
- Schulz Griesbach, Deutsche Sprachlehre für Ausländer
- P.L Aneja, Deutsch Interessant- 1, 2 & 3
- Rosa-Maria Dallapiazza et al, Tangram Aktuell A1/1,2
- Braun, Nieder, Schmöe, Deutsch als Fremdsprache 1A, Grundkurs

**SPANISH – VI****Course Code: FLS 601****Credit Units: 02****Course Objective:**

To enable students acquire working knowledge of the language; to give them vocabulary, grammar, voice modulations/intonations to handle everyday Spanish situations in Present as well as in Present Perfect Tense with ease.

**Course Contents:****Module I**

Revision of the earlier modules

**Module II**

Present Perfect Tense

**Module III**

Commands of irregular verbs

**Module IV**

Expressions with **Tener que** and **Hay que**

**Module V**

En la embajada

Emergency situations like fire, illness, accident, theft

**Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>CT2</b>	<b>C</b>	<b>I</b>	<b>V</b>	<b>A</b>
<b>Weightage (%)</b>	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:**

- Español, En Directo I A
- Español Sin Fronteras

**JAPANESE - VI****Course Code: FLJ 601****Credit Units: 02****Course Objective:**

To enable the students to converse in the language with the help of verbs and the usage of different sentence patterns, which help them to strengthen the language.

Students are taught and trained enough to get placed in Japanese companies.

**Note:** The teaching is done in roman as well as Japanese script. 10 more kanjis are introduced in this semester.

**Course Contents:****Module I: Polite form of verbs**

Expressing feelings with the polite forms of verb.

**Module II: Potential form**

Ability of doing or not doing something

**Module III: Conjunctions**

Joining two sentences with the help of *shi* and *mo*

**Module IV: Intransitive Verbs**

Sentence patterns of indirect speech

**Module V: Feelings and expressions**

Regret, existence etc.

**Learning Outcome**

- Students can speak the language with the use of different forms of verb.

**Methods of Private study/ Self help**

- Hand-outs, audio -aids, assignments and role-plays will support classroom teaching.
- Students are encouraged to watch Japanese movies at Japan Cultural and information center.

**Examination Scheme:**

<b>Components</b>	<b>CT1</b>	<b>CT2</b>	<b>C</b>	<b>I</b>	<b>V</b>	<b>A</b>
<b>Weightage (%)</b>	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:**

- Shin Nihon-go no Kiso Lesson No. 26 to 30.
- All vocabulary and topics taught are from the above-mentioned book.

**CHINESE – VI****Course Code: FLC 601****Credit Units: 02****Course Objective:**

Chinese emperor Qin Shi Huang – Ti who built the great wall of China also built a network of 270 palaces, linked by tunnels, and was so afraid of assassination that he slept in a different palace each night. The course aims at familiarizing the student with the basic aspects of speaking ability of Mandarin, the language of Mainland China. The course aims at training students in practical skills and nurturing them to interact with a Chinese person.

**Course Contents:****Module I**

Drills

Dialogue practice

Observe picture and answer the question.

Pronunciation and intonation.

Character writing and stroke order.

**Module II**

Going out to see a science exhibition

Going to the theatre.

Train or Plane is behind schedule.

Indian Economy-Chinese Economy

Talking about different Seasons of the Year and Weather conditions. Learning to say phrases like-spring, summer, fall, winter, fairly hot, very cold, very humid, very stuffy, neither hot nor cold, most comfortable, pleasant .... etc.

**Module III**

Temperature – how to say – What is the temperature in May here?

- How is the weather in summer in your area?
- Around 30 degrees
- Heating, air-conditioning

- Is winter in Shanghai very cold?

Talking about birthdays and where you were born?

The verb “shuo” (speak) saying useful phrases like speak very well, do not speak very well, if speak slowly then understand if speak fast then don't understand, difficult to speak, difficult to write, speak too fast, speak too slow, listen and can understand, listen and cannot understand ... etc.

Tell the following in Chinese – My name is .... I was born in ... (year). My birthday is ..... Today is ... (date and day of the week). I go to work (school) everyday. I usually leave home at . (O'clock). In the evening, I usually ..... (do what)? At week end, I ..... On Sundays I usually ..... It is today..... It will soon be my younger sister's birthday. She was born in ..... (year). She lives in ..... (where). She is working (or studying)..... where... She lives in ..... (where.)

### Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

### Text & References:

- Elementary Chinese Reader Part-2,3 ; Lesson 47-54

**Advanced Computational Biology****Course Code: IBB 701****Credit Units: 03****Course Objective:**

The objective is to describe how molecular data can be used to construct a phylogenetic tree and Characterize the rates and causes of nucleotide substitutions. The aim is also to explain how a gene/protein family arises and the mechanisms which underlie evolution at the molecular level.

**Course Contents:****Module I: Phylogenetic prediction**

Phylogenetic trees: Phylogenetic representations, Definition and description, various types of trees, Methods of phylogenetic analysis: Distance method (UPGMA, The Neighbour Joining, The Fitch/Margoliash method) and Character-based methods (Maximum Parsimony, Maximum Likelihood).

**Module II: Tree Evaluation and packages**

Approaches for tree reconstruction: Character optimization, delayed and accelerated transformation, Reliability of trees, Bootstrap, jackknife, decay, randomization tests. Applications of phylogeny analyses, Comparison of Phylogenetic Trees obtained using DNA seq. Vs. protein seq. Vs. Full genomes. Softwares for phylogenetic analysis: Survey of software programs available for phylogenetic analysis

**Module III Protein structure prediction**

Protein structure prediction: Protein structures,  $\alpha$ - Helix,  $\beta$ -Sheet, Loops and coils, Protein secondary structure prediction methods: The Chou-Fasman and GOR methods, Neural Network models and Nearest-Neighbor methods. Tertiary structure prediction methods: Molecular modelling, Threading, Ab initio structure prediction,

**Module IV Protein-Protein interaction**

Protein structure prediction softwares, Protein Structural Visualization. Ramachandran plot, Forces in protein interactions. Classes of Protein Structure, Protein structure classification databases: SCOP, CATH, FSSP, HSSP, MMDB, SARF database.

**Module V Systems Biology**

Systems Biology: Overview, Networks and Graphs, Network structure and dynamics. Micro array – definition, Applications of Micro Arrays in systems biology. Self organizing maps and Connectivity maps - definition and its uses. Networks and Pathways – Types and methods. Metabolic networks.

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Text & References:**

- Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology by D. Gusfield. Publisher: Cambridge University Press
- Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins A.D. Baxevanis and B.F.F. Ouellette. Publisher: Wiley-interscience.
- Bioinformatics: Sequence and Genome Analysis by D.W. Mount. Cold Spring Harbor Laboratory Press
- Computational Modeling of Genetic and Biochemical Networks by J.M. Bower and H. Bolouri. MIT Press
- Computational Molecular Biology: An Algorithmic Approach by P.A. Pevzner. Publisher: MIT Press
- Computer Methods for Macromolecular Sequence Analysis by R.F. Doolittle, J.N, Abelson, M.I. Simon. Publisher: Academic press
- Essentials of Genomics and Bioinformatics by C.W. Sensen. John Wiley and Sons Inc.

## R AND BIOCONDUCTOR

**Course Code: IBB 702**

**Credit Units: 03**

**Course Objective:**

R package provides a complete, comprehensive set of tools that can meet the data analysis needs. The course is designed to familiarize students with the skills necessary to produce simple reports and data sets as well as providing an understanding of how R analyses and views data. The students will also work on R which is a language and environment for statistical computing and graphics. provides a wide variety of statistical (linear and nonlinear modelling, classical statistical tests, time-series analysis, classification, clustering, ...) and graphical techniques, and is highly extensible

**Course Contents:**

**Module I: R Basics:**

Introduction and preliminaries of R, Simple manipulations; numbers and vectors, Objects, data their modes and attributes, Ordered and unordered factors, Arrays and matrices, Lists and data frames, grouping, loops and conditional execution, Writing your own functions, reading data from files.

**Module II: Statistics in R**

Probability distributions, hypothesis testing, Statistical models in R (SLR/MLR), Graphical procedures, Packages.

**Module III: Bioconductor**

Introduction to BioConductor, Installing and maintaining bioconductor, BioConductor Packages importation and QC, normalization, exprSets, filtering, data analysis options, annotation, GO/pathways/graphs.

**Module IV: Biostrings and NGS application of R**

IUPAC nomenclature in sequences, Functions, data reading, single sequence, multiple sequence analysis, data extraction for analysisEdgeR. Application of machine learning on biological data. Calculating genomic features, codons, and cluster analysis. Working on FASTA, FASTQ file

**Module V: Case Studies**

Limma, Case study on Microarray Classification, incorporating biological metadata in genomic analyses, Statistical modeling of differential gene expression data Visualizing genomic data, applying machine learning clustering and classifying methods to genomic data.

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Text & References:**

*Text:*

- Delwiche, Lora D. and Susan J. Slaughter (1998), The Little SAS Book, Second Edition, Cary, NC: SAS Institute, Inc. ISBN: 1-58025-239-7.

*References:*

- Cody, Ron (1999), Cody's Data Cleaning Techniques Using SAS Software, Cary, NC: SAS Institute, Inc. ISBN: 1-58025-600-7.
- Cody, Ronald P. and Jeffrey K. Smith (1997), Applied Statistics and the SAS Programming Language, Prentice Hall Engineering, Science and Math, ISBN: 0-13-743642-4.
- Gilmore, Jodie (1999), Painless Windows: A Handbook for SAS Users, Second Edition, Cary, NC: SAS Institute, Inc. ISBN: 1-58035-238-9.

**BIOPROCESS ENGINEERING & TECHNOLOGY****Course Code: IBB 703****Credit Units: 03****Course Objective:**

The objective of the course is to apply the principles of biochemical engineering in large scale cultivation of microorganism for production of important products.

**Course Contents:****Module I**

Advantage of bioprocess over chemical process. Basic principle in bioprocess technology. Bioseparation, Large scale recombinant protein production, Media formulation, Cell culture techniques; Inoculum development and aseptic transfers. Different types of pumps, valves, and line materials, piping conventions etc. used in Biochemical Process

**Module II**

Process technology for the production of primary metabolites, eg. biomass, ethanol, acetone-butanol, citric acid, amino acids, polysaccharides and plastics.

**Ethanol:** production by batch, continuous and cell recycle adopted by various technologies practiced in Indian distilleries using molasses and grains. Computation of fermentation efficiency, distillation efficiency and overall efficiency of ethanol production, recovery, uses, glucose effect etc. Power alcohol – definition, uses, merits and demerits of various technologies for its production.

**Amino Acid:** Genetic Control of metabolic pathway. **Lysine:** Indirect and direct fermentation – mechanism of ph of metabolic block in accumulation of L- lysine by inhibition and repression mechanism.

**Module III** Biomass, Bakers and distillers yeast production using various raw materials, “bios” factors for growth, Crabtree effect, harvesting, different forms and uses.

What are mushroom, different forms of common mushroom production from agro based raw materials and uses. Biofertilizers, biocompost and biopesticides

**Module IV**

Production of secondary metabolites – penicillin, cephalosporins, streptomycin, tetracycline etc. Metabolites from plant and animal cell culture

**Penicillin:** Classification, various penicillin as precursor and ‘R’ – side chain, penicillinase, 6-APA, penicillin production, harvest and recovery, uses of various forms etc.

**Streptomycin:** chemical structure, production, harvest and recovery, use by-product of streptomycin fermentation etc.

**Tetracycline:** chemical structure, production, harvest and recovery, use by-product of tetracycline fermentation etc.

**Module V**

Microbial production of industrial enzymes – glucose isomerase, penicillin acylase, cellulase, amylase, lipase, protease etc.

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
<b>Weightage (%)</b>	15	5	10	70

**Text & References:**

- Biochemical Engineering- Kinetics, Mass Transport, Reactors and Gene Expression, W F Weith, John Wiley and Sons Inc
- Biochemical Engineering, S Aiba, A E Humphery and N F Millis, University of Tokyo Press
- Bioprocess Engineering Basic Concepts, M.L. Shuler and F. Kargi, Prentice Hall
- Bioprocess Engineering, B.K. Lydersen, K.L. Nelson, B.K. Lydersen and N. D’Elia, John Wiley and Sons Inc.
- Bioprocess Engineering Principles, P Doran, Academic Press

**ADVANCED IMMUNOTECHNOLOGY****Course Code: IBB 704****Credit Units:03****Course Objective:**

Role of antibody engineering in biomedical applications and the importance of immunogenetics in disease processes, tissue transplantation and immune regulation are some of the areas of attributes of this course which can help the students to understand the biotechnology related to human kind.

**Course Contents:****Module I: Introduction**

Concept of immunity- Innate and acquired, Active and Passive immunity, Cell mediated and Humoral immunity, Primary and secondary immune response, Clonal nature of Immune Response.

**Module II:**

Immune system: Central and peripheral immune system

Primary lymphoid organs: Thymus and Bone marrow, T and B cell development

Secondary lymphoid organs: Spleen, lymphnode and MALT

Hematopoiesis, Cells of the immune system- Eosinophils, Neutrophils, Basophils, B and T-lymphocytes, macrophages, Null cells, dendritic cells, Mast cells.

**Module III:**

Nature and biology of Antigen: Immunogen vs. Antigen, factors affecting immunogenicity, Hapten and carriers, Adjuvants, Super antigens

Antibody structure in relation to function and antigen-binding; Types of antibodies and their structures: isotypes, allotypes, idiotypes. Monoclonal antibodies: production and applications, Generation of antibody diversity

**Module IV**

MHC: Structure of MHC class I, II, exogenous and endogenous antigen presentation by MHC, MHC restriction, Self-tolerance in relation to MHC.

Autoimmunity and autoimmune diseases, Role of MHC in autoimmune diseases

Transplantation immunology, immunosuppressive therapy, tissue typing, immunologically privileged sites.

**Module V**

Complement system

Vaccines

Tumor immunology

Concept of inflammation and hypersensitivity

Antigen - antibody interaction based diagnostics: agglutination and precipitation, ELISA, RIA, IFA

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Text & References:****Text:**

Owen J., Punt J., and Stranford Sharon (2013): Kuby's Immunology, 7<sup>th</sup> Edition, Macmillan higher education, New York. ISBN-13: 978-1-4292-1919-8.

Delves P., Martin S., Burton D. and Roitt I.(2006): Roitt's Essential Immunology, 11<sup>th</sup> Edition, Blackwell Publishers, Oxford.

**References:**

•. Abbas AK, Lichtman AH, Pillai S (2010) Cellular and Molecular Immunology, 6<sup>th</sup> Edition, Saunders Elsevier, ISBN:978-0-8089-2411-1

## RESEARCH METHODOLOGY

**Course Code: IBB 705**

**Credit Units:03**

**Course Objective:**

To develop understanding of information and library science research issues in the domain of bioinformatics through review of journal articles, invited talks, and critical group discussions of methods. The main objectives for this course are to develop: familiarity with information and library science-oriented problems in the biomedical sciences, an understanding of research methods in the biomedical domain, critical thinking and evaluation skills and presentation and summarization skills.

**Course Contents:**

**Module I**

Introduction: Science, Scientific Field and Biological research, Role of a researcher in different stages of the carrier, Routes to academic and commercial funding. Identification of the International and National Research Journals in the area of Biotechnology that are indexed in Scopus and with their SCI Impact factor. Literature search for the Reviews by the authorities and Research articles in high impact journals. Literature search for the Reviews by the authorities and Research articles in high impact journals. Brain storming session on the state-of the art technologies. Brain storming session on the state-of the art technologies.

**Module II**

Identification of the research problem, Formulation of a hypothesis, Review of the literature in the identified research area, Identification of the Model species, Selection of the research materials and resources. Methodologies to be employed for different research projects- Morpho physiology. Methodologies to be employed for different research projects-Molecular biology. Methodologies to be employed for different research projects-Statistical analysis.

**Module III:**

Selection of the research material with minimum intrinsic variability. Collection of data from technical and biological replicates. Statistical analysis of the data to compute the statistical differences between the treatments. Presenting the results in Power point. Introduction to Image J. Use of Image J for quantification of morphometric traits. Introduction to Photoshop. Preparation of a high-resolution figures for publication-Line diagrams, histograms and composite figures.

**Module IV**

Developing a draft manuscript -Introduction. Developing a draft manuscript –Material & Methods. Developing a draft manuscript –Results and Discussion. Developing a draft manuscript –Supplementary information. Developing a draft manuscript –References cited. Correct usage (grammar) of Scientific English and developing flexibility in writing skills to avoid plagiarism. Write a covering letter and response to reviewers' comments (both negative and positive). Developing oration skills for presentation in Seminar and conference.

**Module V**

Plan for a draft research proposal for possible funding. Review of the literature (national and international) in the proposed research area. Contribution made as Project Investigator (PI) in the area of proposed research proposal. Research publications by PI in SCI and/or Scopus listed journals. Defining clear objectives (not more than 3) in the proposed research proposal. Budget preparation for funding with details for Instruments, consumables, staff, travel and other miscellaneous expenses. Identification of the funding bodies for research grant in the identified area by funding bodies in India. Development of International collaboration

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Text & References:**

**Text:**

- Statistical Methods By S.P. Gupta

**References:**

- Research Methodology Methods and Techniques by C.R. Kothari
- Statistics(Theory and Practice) by B.N. Gupta
- Research Methodology Methods and statistical Techniques by Santosh Gupta

**ADVANCED COMPUTATIONAL BIOLOGY LAB****Course Code: IBB 721****Credit Units: 01****Module I:**

Biological Databases: Format & databases of Nucleic Acids & Proteins(GENBANK, EMBL, DDBJ, PIR, UNIPROT, PDB, SCOP, CATH, PRINT, Pfam etc) .

**Module II:**

**Sequence analysis**, Pairwise and multiple sequence analysis

**Module III:****Phylogenetic Analysis**

Tree Building using different tools, Tree evaluation, Phylip Package, MEGA.

**Module IV****Protein Structure Prediction**

Protein Secondary structure prediction, tertiary structure prediction, structure evaluation and validation, Ramachandran plot.

**Module V: Metabolic Pathway databases**

Protein interaction databases, visualizing protein interaction networks, predicting interaction.

**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**R AND BIOCONDUCTOR LAB****Course Code: IBB 722****Credit Units: 02****Course Contents:****Module I**

Statistical Analysis using R, GPU computing. Regression, SLR (Simple linear regression), MLR (Multiple linear regression), Testing methods (Z Test, F Test, T Test, Chi Square test)

**Module II**

Analysis using R packages of Bioconductor, Limma, Affy etc. and their application in Bioinformatics.

**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**BIOPROCESS ENGINEERING & TECHNOLOGY LAB****Course Code: IBB 723****Credit Units: 01****Course Contents:****Module I**

Isolation of industrially important micro organisms for microbial processes.

**Module II**

Determination of Thermal Death Point and Thermal death time of micro organisms for design of a sterilizer

**Module III**

Determination of growth curve of a supplied micro organism and also determine substrate degradation profile and to compute specific growth rate and growth yield from the data obtained.

**Module IV**

Comparative studies of ethanol production using different substrates.

**Module V**

Production of single cell protein

**Module VI**

Production and estimation of alkaline protease

**Module VII**

Sauer Krant fermentation

**Module VIII**

Use of alginate for cell immobilization

**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**ADVANCED IMMUNOTECHNOLOGY -Lab****Course Code: IBB 724****Credit Units:01****Course Objective:**

The objectives of the course is to understand the principles of immune function and immunization and to provide advanced training in modern cellular and molecular immunology, with emphasis on the interface between the basic and clinical aspects of the subject.

**Course Contents:****Module I**

Blood film preparation and identification of cells, Differential leucocyte count, Total leucocyte count, preparation of serum and plasma.

**Module II**

Lymphoid organs and their location in mice

**Module III**

Ouchterlony Double diffusion Test, Immunoelectrophoresis, ELISA:- DOT or SANDWICH

**Module IV**

Purification of IgG through affinity chromatography

**Module V**

Agglutination based tests: WIDAL Test, Identification of blood group

**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**Note:** Minor variation could be there depending on the examiner.

## Nanodevices & Nanosensors

**Course Code: INN 701**

**Credit Units:03**

### **Module I INORGANIC AND ORGANIC ENABLED SENSORS**

Introduction-types of sensors-Mechanical, optical, spintronic, bioelectronic and biomagnetic sensors-surface modification-surface materials and interactions and its examples

### **Module II SENSOR CHARACTERISTICS AND PHYSICAL EFFECTS**

Introduction to sensors, static Characteristics and dynamic characteristics, Physical effects : - Photoelectric Effect, Photoluminescence Effect, Electroluminescence Effect , Chemiluminescence Effect, Doppler Effect , Hall Effect, thermoelectric effect, magneto-optical phenomena

### **Module III NANOMACHINES AND NANOBARCODES, NANOBIOSENSORS**

Cantilevers, CarbonNanotube Biosensors –FRET Based DNANanosensors. Ion Channel Switch Biosensor Technology -Electronic Nanobiosensors -Electrochemical Nanobiosensors, Quartz Nanobalance, Viral Nanosensors, PEBBLE Nanosensors , Microneedle-Mounted Biosensors Optical Biosensors, Nanowire (NW) Biosensors, Nanoscale Erasable Biodetectors

DNA Nanomachines for Molecular Diagnostics -Nanobarcodes Technology -Nanobarcode Particle Technology for SNP Genotyping -Qdot Nanobarcode for Multiplexed Gene Expression Profiling - BiobarcodeAssay for ProteinsSingle-Molecule Barcoding System for DNA Analysis Nanoparticle Based Colorimetric DNA Detection Method, Electronic Nose & Tongue

### **Module IV MICRO/NANO DEVICES**

Introduction MEMS and NEMS definitions, Taxonomy of Nano-and Microsystems-Synthesis and Design. Classification and considerations, Biomimetics, Biological analogies, and design–Biomimetics Fundamentals, Biomimetics for NEMS and MEMS, Nano-ICs and Nanocomputer architectures.

Quantum Structures and Devices: Quantum dots and wires, Nanowires- Synthesis Methods, physical properties, characterization methods and applications. Engineered multifunctional nanowires as novel biosensing tools.

### **Module V FUTURE NANOSYSTEMS**

Nano machines, nano robots, electronics based on CNT, molecular Electronics. Quantum Computation: Future of Meso/Nanoelectronics? -Interfacing with the Brain, towards molecular medicine, Lab-on-BioChips- Guided evolution for challenges and the solutions in NanoManufacturing technology

#### **Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
<b>Weightage (%)</b>	15	5	10	70

#### **Reference and Text Books:**

1. K. Gosser, P. Glosekotter and J. Dienstuhl, “Nanoelectronics and Nanosystems-From Transistors to Molecular Quantum Devices” , Springer, 2004.
2. Herve Rigneault, Jean-Michel Lourtioz, Claude Delalande, Ariel Levenson, “Nanophotonics”, ISTE.
3. W.R.Fahrmer, “Nanotechnology and Nanoelectronics – Materials, Devices and Measurement Techniques” Springer, 2006 13
4. Sensors: Micro & Nanosensors, Sensor Market trends (Part 1&2) by H. Meixner.

## Nanophotonics

**Course Code: INN 702**

**Credit Units:03**

### Module I:

Photons and Electrons: Similarities and Differences: Free-Space Propagation, Confinement of Photons and Electrons, Propagation Through a Classically Forbidden Zone: Tunneling, Localization under a Periodic Potential: Bandgap, Cooperative Effects for Photons and Electrons, Nanoscale Optical Interactions: Axial Nanoscopic Localization, Lateral Nanoscopic Localization.

### Module II:

Quantum Wells, Quantum Wires, Quantum Dots, Quantum Rings, Manifestation of Quantum Confinement: Optical Properties, Examples, Quantum-Confined Stark Effect, Dielectric Confinement Effect, Quantum-Confined Structures as Lasing Media.

### Module III:

Basic Concepts, Theoretical Modeling, Features, Methods of Fabrication, Photonic Crystal Optical Circuitry, Nonlinear Photonic Crystal, Photonic Crystal Fibers, Photonic Crystal and Optical Communications, Photonic Crystal Sensors.

### Module IV:

Near-Field Bioimaging, Nanoparticles for Optical Diagnostics and Targeted Therapy, Semiconductor Quantum Dots for Bioimaging

### Module V:

Nanoclinics for Optical Diagnostics and Targeted Therapy, Nanoclinic Gene Delivery, Nanoclinics for Photodynamic Therapy.

### Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

### Reference Books

1. Nanophotonics- Paras N. Prasad Wiley Inter Science 2004
2. Nanophotonics- Edited by Herice Rigneault, Jean-Michel Lourtiriz, Claude Delalande, Ariel Leuenson ISTE

## Nanomaterial Design and applications

**Course Code: INN 703**

**Credit Units:03**

**Module I:** Introduction 1. Definitions and course organization 2. Historical development of nanomaterials 3. Classification of nanomaterials II. Fundamentals 1. Size & Scale Units Scaling Atoms, Molecules, Clusters and Supramolecules 2. Structure and Bonding in Nanomaterials Chemical Bonds (types and strength) Intermolecular Forces Molecular and Crystalline Structures Hierarchical Structures Bulk to Surface transition, surface reconstruction 2 Self assembly and thermodynamics

**Module II:** Properties and Size dependence of properties Chemical Optical, vibrational, thermal Electrical Magnetic Mechanical Theoretical Aspects-e.g. density functional theory

**Module III:** Nanomaterial Synthesis Chemical routes Electrochemical methods Vapor growth Thin films methods: chemical vapor deposition, physical vapor deposition (sputtering, laser ablation), Langmuir-Blodgett growth Mechanical methods: ball milling, mechanical attrition Sol-gel methods Special nanomaterials: carbon nanotubes, fullerenes, nanowires, porous silicon Bio-inspired synthesis Nanocomposite fabrication Nanolithography

**Module IV:** Nanomaterial characterization techniques Scanning and Transmission Electron Microscopy Scanning Probe Microscopies: Atomic Force, scanning tunneling microscopy Diffraction and scattering techniques Vibrational spectroscopy Surface techniques VI.

**Module V** Applications Nano-electronics Nano optics Nanoscale chemical- and bio-sensing Biological/bio-medical applications Photovoltaic, fuel cells, batteries and energy-related applications High strength nanocomposites Nanoenergetic.

### Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

### Reference and Text Books

Nanomaterials- Synthesis, Properties and Applications, Edited by A.S. Edelstein and R.C. Cammarata, Institute of Physics Publishing, London, 1998 (paper back edition)

Nanochemistry: A Chemical Approach to Nanomaterials, by G. Ozin and A. Arsenault, RSC Publishing, 2005

Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nanoscience, Edward L. Wolf, Wiley-VCH, 2nd Reprint (2005).

### Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Nanoelectronics****Course Code: INN 704****Credit Units:03****Module I:**

Basics of Nanoelectronics, Capabilities of Nanoelectronics, Physical Fundamentals of Nanoelectronics, Basics of Information Theory, Tools for Micro and Nano Fabrication, Basics of Lithographic, Techniques for Nanoelectronics

**Module II:**

Quantum Electron Devices, Short Channel MOS Transistor, Split Gate Transistor, Electron Wave Transistor, Electron Spin Transistor, Quantum Cellular Automate, Quantum Dot Array, Principles of Single Electron Transistor (SET), SET Circuit Design, Comparison between FET and SET Circuit Design

**Module III:**

Nanoelectronics with Tunneling Devices and Superconducting Devices, Tunneling Element Technology, RTD: Circuit Design based RTD, Molecular Electronics, Flux Quantum Devices, Application of Superconducting Devices

**Module IV:**

Memory Devices, Ferroelectric Random Access Memory, Fe-RAM Circuit Design, Ferroelectric Thin Film Properties and Integration,

**Module V:**

Sensors, Nano Ferroelectrics and Multiferroic Sensors, Calorimetric Sensors, Electrochemical Cells, Surface and Bulk Acoustic Devices, Gas Sensitive FETs, Resistive Semiconductor Gas Sensors

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Reference Books**

1. Nanoelectronics and Nanosystems, Karl Goser, Peter Glosekotter, Jan Dienstuhl., Springer, 2004
2. 2. Nanoelectronics and information technology: Advanced electronic materials and novel devices (2<sup>nd</sup> edition) Rainer Waser (ed.) Wiley VCH Verlag Weinheim (2005)
3. Nanotechnology: basic science and emerging technologies – Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons, Burkhard Raguse, Overseas Press (2005).

## RESEARCH METHODOLOGY

**Course Code: INN 705**

**Credit Units:03**

**Course Objective:**

To develop understanding of information and library science research issues in the domain of bioinformatics through review of journal articles, invited talks, and critical group discussions of methods. The main objectives for this course are to develop: familiarity with information and library science-oriented problems in the biomedical sciences, an understanding of research methods in the biomedical domain, critical thinking and evaluation skills and presentation and summarization skills.

**Course Contents:**

**Module I**

Introduction: Science, Scientific Field and Biological research, Role of a researcher in different stages of the carrier, Routes to academic and commercial funding. Identification of the International and National Research Journals in the area of Biotechnology that are indexed in Scopus and with their SCI Impact factor. Literature search for the Reviews by the authorities and Research articles in high impact journals. Literature search for the Reviews by the authorities and Research articles in high impact journals. Brain storming session on the state-of the art technologies. Brain storming session on the state-of the art technologies.

**Module II**

Identification of the research problem, Formulation of a hypothesis, Review of the literature in the identified research area, Identification of the Model species, Selection of the research materials and resources. Methodologies to be employed for different research projects- Morpho physiology. Methodologies to be employed for different research projects-Molecular biology. Methodologies to be employed for different research projects-Statistical analysis.

**Module III:**

Selection of the research material with minimum intrinsic variability. Collection of data from technical and biological replicates. Statistical analysis of the data to compute the statistical differences between the treatments. Presenting the results in Power point. Introduction to Image J. Use of Image J for quantification of morphometric traits. Introduction to Photoshop. Preparation of a high-resolution figures for publication-Line diagrams, histograms and composite figures.

**Module IV**

Developing a draft manuscript -Introduction. Developing a draft manuscript –Material & Methods. Developing a draft manuscript –Results and Discussion. Developing a draft manuscript –Supplementary information. Developing a draft manuscript –References cited. Correct usage (grammar) of Scientific English and developing flexibility in writing skills to avoid plagiarism. Write a covering letter and response to reviewers’ comments (both negative and positive). Developing oration skills for presentation in Seminar and conference.

**Module V**

Plan for a draft research proposal for possible funding. Review of the literature (national and international) in the proposed research area. Contribution made as Project Investigator (PI) in the area of proposed research proposal. Research publications by PI in SCI and/or Scopus listed journals. Defining clear objectives (not more than 3) in the proposed research proposal. Budget preparation for funding with details for Instruments, consumables, staff, travel and other miscellaneous expenses. Identification of the funding bodies for research grant in the identified area by funding bodies in India. Development of International collaboration.

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
<b>Weightage (%)</b>	15	5	10	70

**Text & References:**

- Statistical Methods By S.P. Gupta
- Research Methodology Methods and Techniques by C.R. Kothari
- Statistics(Theory and Practice) by B.N. Gupta
- Research Methodology Methods and statistical Techniques by Santosh Gupta

**Nanodevices & Nanosensors****Course Code: INN 721****Credit Units:01**

- Synthesis of quantum dots from inorganic sources for designing optical sensor
- Synthesis of quantum dots from organic sources for designing optical sensor
- Cyclic voltammetric analysis of electrochemical sensor
- Immobilization and bioimprinting for sensor design

**Recommended Books:** Handbook of modern sensor Fraden Jacob ISBN 978-1-4419-6466-3  
edn 4<sup>th</sup>.

**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**Note:** Minor variation could be there depending on the examiner.

**Nanophotonics Lab****Course Code: INN 722****Credit Units:01**

1. Synthesis of Nanostructured films of Bi, Te and Se using electrodeposition.
2. Synthesis of Nanostructured films of  $\text{Bi}_2\text{Te}_3$ ,  $\text{Bi}_2\text{SeTe}_2$ ,  $\text{Bi}_2\text{Se}_2\text{Te}$  and  $\text{Bi}_2\text{Se}_3$  using electrodeposition.
3. Structural analysis using X-ray diffraction.
4. Analysis of morphology using scanning electron microscopy.
5. Absorbance and Transmission studies using UV-Vis spectroscopy.
6. Calculation of Band Gap using UV-Vis spectroscopy.
7. Investigation of the effect of nanostructures on the absorbance and transmission spectrum of the synthesized films due to change in bandgap.

**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**Note:** Minor variation could be there depending on the examiner.

**NANOMATERIAL DESIGN AND APPLICATIONS LAB****Course Code: INN 723****Credit Units:01**

1. Demonstration about OHS and WHS in nanotechnology.
2. Preparation of aqua regia, its handling and role in washing glass-wares for metal nanoparticles synthesis.
3. Synthesis of silver nanoparticles with tyrosine amino acid and observation of their surface plasmon resonance (SPR) properties.
4. Neem extract mediated silver nanoparticles synthesis and analysis of their optical properties.
5. Dye degradation using silver nanoparticles synthesised in experiment 3 and 4.
6. Preparation of metal oxide nanoparticles and their characterization.
7. Interaction of silver nanoparticles nanoparticles with red blood cells.
8. Interaction of silver nanoparticles nanoparticles with bacterial cells and their antimicrobial potential.
9. Preparation of nanoparticles containing polymeric film.

**Examination Scheme:**

<b>IA</b>			<b>EE</b>			
<b>Class Test (Practical Based)</b>	<b>Mid Term Viva</b>	<b>Attendance</b>	<b>Major Experiment</b>	<b>Minor Experiment/Spotting</b>	<b>Practical Record</b>	<b>Viva</b>
15	10	05	35	15	10	10

**Note:** Minor variation could be there depending on the examiner.

## Nanoelectronics Lab

**Course Code: INN 724**

**Credit Units:01**

1. Synthesis of Nanostructured films of Bi, Te and Sb using electrodeposition.
2. Synthesis of Nanostructured films of  $\text{Bi}_2\text{Te}_3$ ,  $\text{SbBiTe}_3$  and  $\text{Sb}_2\text{Te}_3$ .
3. Structural and Compositional analysis using X-ray diffraction and X-ray photoelectron spectroscopy.
4. Morphology analysis using scanning electron microscopy.
5. Investigation of I-V characteristics of the synthesized films for determination of electrical conductivity.
6. Investigation of the effect of quantum confinement on the electrical conductivity of the synthesized films.

### Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**Note:** Minor variation could be there depending on the examiner.

# Principle & Techniques of Neuroscience

**COURSE CODE: ICN -701**

**Credits 03**

## **Module 1: Neuroanatomy & Neurophysiology**

Neuroanatomy & Neurophysiology of cerebral cortex including lobes, corpus callosum, limbic system, basal ganglia, Thalamus, hypothalamus, pituitary, cerebellum, brain stem, spinal cord and autonomic nervous system. The Blood Supply of the Brain; Blood Vessels of the Brain: Major Blood Vessels, Circle of Willis, Anterior Cerebral Artery, Middle Cerebral Artery, Posterior Cerebral Artery, Lenticulostriate Arteries.

## **Module 2: Electro physiology**

Electrophysiology Principle, Patch Clamping, Voltage Clamping, Current Clamping, The patch-clamp technique, Sharp electrode technique Extracellular recording: Single-unit recording, Multi-unit recording, Field potentials, Amperometry, Solid-supported membrane (SSM)-based Method, Bioelectric recognition assay (BERA). Electroencephalography (EEG) Principle, Medical application and Research use, advantage, disadvantage with other neurological techniques, Mechanism, Sequential montage, Referential montage, Average reference montage, Laplacian montage, Limitations.

**Module 3 :** Introduction to Brain mapping, Current atlas tools of brain mapping, Talairach coordinates, whole brain atlas: Normal brain, Cerebro vascular diseases (stroke or brain), Neoplastic diseases, degenerative diseases, inflammatory or infectious disease.

## **Module 4: Radio-Imaging Techniques**

Principle of X-ray imaging techniques, Film & processing image, spectroscopy, digital imaging; Conventional tomography, Principles of CT imaging, detector assembly, pixel-voxel concept, image display, spiral CT, Multi slice; Basic principles & physics of MRI, Parameter of image processing, T1, T2 concept, imaging protocols, MRI spectroscopy; Basic principles & physics of ultrasound and Doppler

## **Module 5: Neurons & Glial cells**

Introduction to neurons, the neuron Doctrine, Components of neurons, Classification of neurons, The Nissl and Golgi stains, types of neurons, Cytology of neurons, Dendrites structure and function, Axons structure and functional aspects, ultrastructure, Myelination and synapses, Structure and function of Glial cells, Different types of glial cells: astrocytes, - type I & II astrocytes, fibrous and protoplasmic astrocytes, Function of glial cells: oligodendrocyte and microglial cells.

## **Recommended Books:**

1. Gray's Anatomy
2. Guy ton
3. Clinical neurophysiology – U K Mishra
4. Clinical Electroencephalography – U K Mishra & J Kalita
5. Atlas of Brain mapping
6. Radio physics of Christenson

## **Examination Scheme:**

Components	Mid Term Test	Attendance	Class test/ Assignment/ Project/ Seminar/Quiz	End term Exam
Weightage (%)	15	5	10	70

## Psychology of Mind

**Course Code : ICN 702**

**Credits 03**

**Course Objective:**

This course will help the students to understand the basic concepts of individual psychology from affective, behavioural and cognitive perspectives.

**Course Contents:**

**Module I: The Science of Psychology**

Definitions and goals, modern perspectives: Psychodynamic, Behavioural, Humanistic, Cognitive, Socio-cultural, Evolutionary

Personality: Definition, Theories, Measurement

**Module II: Sensory system and Perception**

Neural coding and decision making mechanisms, Functional subdivisions and processing streams of primate cortex, neuronal correlates of visual attention and perception, origin of perception (retinal ganglion diversity and the creation of parallel visual pathways)

**Module III: Learning and Memory**

Learning and synaptic plasticity, Perceptual learning, classical conditioning, instrumental conditioning, relational learning

**Module IV: Neurological disorders**

Tumors, Seizure Disorders, Cerebrovascular accidents, Disorders of development, Degenerative disorders

**Module V: Other disorders**

Schizophrenia, Affective disorders, Anxiety disorders, ADHD, Substance Abuse Disorders

**Examination Scheme:**

Components	Mid Term Test	Attendance	Class test/ Assignment/ Project/ Seminar/Quiz	End term Exam
Weightage (%)	15	5	10	70

## Introduction to dynamical system for neuroscience

**Course Code ICN703**

**Credits: 04**

**Course Objectives:** This course will help the students to understand relationship between structure and function of brain, dynamical systems and Electrophysiology of Neurons. It will also give a clear understanding of various neurological and psychiatric conditions.

**Module I:** Relationship between structure and function of the brain; the rise of neuroscience as a distinct discipline, history, logic of cerebral organization; localization and lateralization of functions; approaches and methodologies of clinical and cognitive neuropsychologists

**Module II:** Neurons, What Is a Spike, Where Is the Threshold, Why Are Neurons Different, and Why Do We Care, Building Models. Dynamical Systems, Phase Portraits, Bifurcations, Hodgkin Classification, Neurocomputational properties, Building Models.

**Module III:** Electrophysiology of Neurons, Nernst Potential, Ionic Currents and Conductances, Equivalent Circuit, Resting Potential and Input Resistance, Voltage-Clamp and I-V Relation, Conductances, Voltage-Gated Channels, Activation of Persistent Currents, Inactivation of Transient Currents, Hyperpolarization-Activated Channels.

**Module IV:** The Hodgkin-Huxley Model, Hodgkin-Huxley Equations, Action Potential, Propagation of the Action Potentials, Dendritic Compartments, Summary of Voltage-Gated Currents.

**Module V:** Assessment and Interventions: Neuropsychological profile of various neurological and psychiatric conditions: Parkinson's disease, cortical and subcortical dementias, Alzheimer's dementia, AIDS and its intervention, Functional human brain mapping: QEEG, EP & ERP, PET, SPECT, fMRI.

### **Texts and reference books:**

Eugene M. Izhikevich (2007) Dynamical Systems in Neuroscience: The Geometry of Excitability and Bursting The MIT Press Cambridge, Massachusetts.

Kelso, J. S. (1997). Dynamic patterns: The self-organization of brain and behavior. MIT press.

### **Examination Scheme:**

Components	Mid Term Test	Attendance	Class test/ Assignment/ Project/ Seminar/Quiz	End term Exam
Weightage (%)	15	5	10	70

## Neuroanatomy

**Course Code ICN704**

**Credits: 03**

### Course Objective:

To develop understanding of anatomy of brain, different lobes of brain. The main objectives for this course are to develop familiarity with various pathways of nervous system, neuropathology and social behavior.

**Module I:** Overview of the Course, Anatomy of the brain: Major anatomical sub-divisions of the human brain.

**Module II:** The surface anatomy and interior structures of cortical and subcortical regions; anatomical connectivity among the various regions

**Module III:** Lobes of the brain: Frontal, Temporal, Parietal, Occipital lobes, its functions and syndromes.

**Module IV:** Cranial Nerve Nuclei, Cranial Nerve Pathways, Basal Ganglia & Nigrostriatal Pathway, Mesolimbic & Mesocortical Pathways, Hypothalamus & Autonomic Nervous System, Limbic System & Affective Disorders.

**Module V:** Learning & Memory, Demyelinating Disorders, Neuropathology, Social Behavior and Autism, Sleep & Sleep Disorders.

### Texts and reference books:

1. Mtui, E., Gruener, G., & FitzGerald, M. T. (2011). Clinical Neuroanatomy and Neuroscience E-Book. Elsevier Health Sciences
2. Jones Jr, H. R., Burns, T., Aminoff, M. J., & Pomeroy, S. (2013). The Netter Collection of Medical Illustrations: Nervous System, Volume 7, Part 1-Brain e-Book. Elsevier Health Sciences
3. Mai, J. K., Majtanik, M., & Paxinos, G. (2015). Atlas of the human brain. Academic Press
4. Foundations of physiological psychology (6th ed.). New Delhi: Pearson Education Inc. Gazaaniga, M. S. (1984).
5. Handbook of cognitive neuroscience. New York: Plenum Press. Golden, C.J. & Charles, C.T. (1981).

### Examination Scheme:

Components	Mid Term Test	Attendance	Class test/ Assignment/ Project/ Seminar/Quiz	End term Exam
Weightage (%)	15	5	10	70

**RESEARCH METHODOLOGY****Course Code: ICN 705****Credit Units:03****Course Objective:**

To develop understanding of information and library science research issues in the domain of bioinformatics through review of journal articles, invited talks, and critical group discussions of methods. The main objectives for this course are to develop: familiarity with information and library science-oriented problems in the biomedical sciences, an understanding of research methods in the biomedical domain, critical thinking and evaluation skills and presentation and summarization skills.

**Course Contents:****Module I**

Introduction: Science, Scientific Field and Biological research, Role of a researcher in different stages of the carrier, Routes to academic and commercial funding. Identification of the International and National Research Journals in the area of Biotechnology that are indexed in Scopus and with their SCI Impact factor. Literature search for the Reviews by the authorities and Research articles in high impact journals. Literature search for the Reviews by the authorities and Research articles in high impact journals. Brain storming session on the state-of the art technologies. Brain storming session on the state-of the art technologies.

**Module II**

Identification of the research problem, Formulation of a hypothesis, Review of the literature in the identified research area, Identification of the Model species, Selection of the research materials and resources. Methodologies to be employed for different research projects- Morpho physiology. Methodologies to be employed for different research projects-Molecular biology. Methodologies to be employed for different research projects-Statistical analysis.

**Module III:**

Selection of the research material with minimum intrinsic variability. Collection of data from technical and biological replicates. Statistical analysis of the data to compute the statistical differences between the treatments. Presenting the results in Power point. Introduction to Image J. Use of Image J for quantification of morphometric traits. Introduction to Photoshop. Preparation of a high-resolution figures for publication-Line diagrams, histograms and composite figures.

**Module IV**

Developing a draft manuscript -Introduction. Developing a draft manuscript –Material & Methods. Developing a draft manuscript –Results and Discussion. Developing a draft manuscript –Supplementary information. Developing a draft manuscript –References cited. Correct usage (grammar) of Scientific English and developing flexibility in writing skills to avoid plagiarism. Write a covering letter and response to reviewers' comments (both negative and positive). Developing oration skills for presentation in Seminar and conference.

**Module V**

Plan for a draft research proposal for possible funding. Review of the literature (national and international) in the proposed research area. Contribution made as Project Investigator (PI) in the area of proposed research proposal. Research publications by PI in SCI and/or Scopus listed journals. Defining clear objectives (not more than 3) in the proposed research proposal. Budget preparation for funding with details for Instruments, consumables, staff, travel and other miscellaneous expenses. Identification of the funding bodies for research grant in the identified area by funding bodies in India. Development of International collaboration.

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Text & References:**

- Statistical Methods By S.P. Gupta
- Research Methodology Methods and Techniques by C.R. Kothari
- Statistics(Theory and Practice) by B.N. Gupta
- Research Methodology Methods and statistical Techniques by Santosh Gupta
- Scientific journals and magazines

**Neuroscience Lab****COURSE CODE: ICN 721****Credits 03****List of Experiments:**

1. OpenSesame programme, gaze cuing experiment using OpenSesame
2. Techniques of Electroencephalography
3. Study of brain mapping, Current atlas tools of brain mapping, Talairach coordinates, whole brain atlas: Normal brain, Cerebro vascular diseases (stroke or brain), Neoplastic diseases, degenerative diseases, inflammatory or infectious disease.
4. Study of X-ray radiography imaging techniques, Principles and Conventional tomography imaging analysis.
5. Principle & Techniques of MRI
6. Principle & Techniques of ultrasound and Doppler
7. Depression and Anxiety
8. Learning disability
9. Dichotic listening task
10. PGI memory test
11. Creative thinking
12. Trail making test,
13. Stroop test, Finger Tapping test.
14. Study of Eye and vestibular sensory organ anatomy
15. EEG
16. Case Studies

**Recommended Books:**

1. Clinical Electroencephalography – U K Mishra & J Kalita
2. Atlas of Brain mapping
3. Radio physics of Christenson
4. Aids to the exam of PNS by MRC
5. Elect Roding in clinical neurology by MJ Amino ff
6. EEG – basic principles, clinical applications & related fields by Ernst niedermeyer & F L Da Silva

**Examination Scheme:**

<b>Components</b>	<b>Mid Term Test</b>	<b>Attendance</b>	<b>Class test/ Assignment/  Project/ Seminar/Quiz</b>	<b>End term Exam</b>
<b>Weightage (%)</b>	15	5	10	70

# Environmental Impact Assessment

**Course Code: IET 701**

**L:3, T:0, P:2, C:3**

**Course Objectives:** Environmental Impact Assessment (EIA) is an important tool for public and private development and planning decisions toward creating a sustainable society. In this course, students learn EIA theories, methods, regulations and its historical process with several case studies. Scientific aspects such as predictions and evaluation methods as well as democratic aspects relating to public participation will be explained. We will also explore “strategic environmental assessment” as new areas of EIA. In addition to lectures, presentations by students will be conducted.

## Learning Outcomes

Having successfully completed this module, you will be able to demonstrate knowledge and understanding of:

- The need for both a multi-disciplinary and an interdisciplinary approach in advancing knowledge and understanding of Earth systems, drawing, as appropriate, from the natural and the social sciences
- The processes which shape the natural world at different temporal and spatial scales and their influence on and by human activities
- The terminology, nomenclature and classification systems used in environmental science
- Methods of acquiring, interpreting and analysing environmental science information with a critical understanding of the appropriate contexts for their use
- Issues concerning the availability and sustainability of resources, for example, the different value sets relating to the Earth's resources as commodities and/or heritage
- The contribution of environmental science to debate on environmental issues and how knowledge of these forms the basis for informed concern about the Earth and its people
- The contribution of environmental science to the development of knowledge of the world we live in
- The applicability of environmental science to the world of work

**Prerequisites:** Basic understanding about environmental systems.

## Course Contents:

### Module I

#### Environmental Impact Assessment (EIA):

Introduction, definitions and concepts, rationale and historical development of EIA.

#### Broad components of EIA:

Initial environmental examination, environmental impact statement, environmental appraisal, environmental impact factors and areas of consideration. Pertinent institutional information, unique pollution problems, existing visual quality, public participation techniques. Composite consideration, potential cultural resources, potential visual impacts, geographical study area.

### Module II

#### Methodologies of EIA:

Measurement of environmental impact, organization, Scope and methodologies of EIA pertinent environmental factors. Six generic steps, descriptive checklists, simple interaction matrix, stepped matrix, uniqueness ratio, habitat evaluation system. Public involvement techniques, comprehensive environmental impact study, various project types, archaeological properties, leachate testing, evaluation species, proposing agency, EIA Models.

### Module III

**Environmental audit:** Definitions and concepts, partial audit, compliance audit, methodologies and regulations.

#### Status of EIA in India:

EIA Regulations in India, TOR for Hydropower, Projects and other projects. Case studies from hydropower projects, hazardous industries and mining.

### Module IV

#### Environmental management:

Principles, problems and strategies; Review of political, ecological and remedial actions. Future strategies; multidisciplinary environmental strategies, the human, planning, decision-making and management dimensions.

EMAS regulations.

## Module V

### Introduction to ISO 14000, LCA and Carbon trading

Components of ISO 14000, Life cycle assessment. Energy foot printing, Food foot printing and Carbon foot printing. GHG emissions, global warming, climate change and Carbon credits, CDM, Initiatives in India; Sustainable development; Future scenarios

### Examination Scheme:

Components	CT	HA/S/V/Q	Attendance (A)	EE
Weightage (%)	15	10	5	70

### Text & References:

1. L. W. Canter, Environmental Impact Assessment, 2nd Ed., McGraw-Hill, 1997.
2. P. Judith and G. Eduljee, Environmental Impact Assessment for Waste Treatment and Disposal Facilities, John Wiley & Sons, 1994.
3. G. Burke, B. R. Singh and L. Theodore, Handbook of Environmental Management and Technology, 2nd Ed., John Wiley & Sons, 2000.
4. C. H. Eccleston, Environment Impact Statements: A Comprehensive Guide to Project and Strategic Planning, John Wiley & Sons, 2000.
5. R. Welford, Corporate Environmental Management - Systems and Strategies, Universities Press, 1996.
6. K. Whitelaw and Butterworth, ISO 14001: Environmental System Handbook, 1997.
7. The Economist Intelligence Unit, Best Practices - Environment, Universities Press, 1993.
8. R. Therivel, John Glasson, Andrew Chadwick, Introduction to Environmental Impact Assessment (Natural and Built Environment), Routledge, 2005.

## Energy Management and Technology

**Course Code:** IET 702

**L:3, T:0, P:2, C:3**

**Course Objectives:** The course will help to understand and appreciate the energy crisis and environmental concerns associated with the energy management, and the importance of energy conservation, to acquire the skills of energy efficiency analysis and energy management in the routinely used thermal and electrical energy systems, to understand the energy conservation and management technologies and strategies.

**Learning outcomes:** On completion of this course, the student will be equipped with:

1. awareness on the energy crisis and environmental concerns and on the importance of energy efficiency, conservation and management
2. knowing the techniques and having the skills for the energy conservation and management in the thermal energy systems
3. knowing the techniques and having the skills for the energy conservation and management in the electrical energy systems
4. Basic knowledge on energy monitoring and auditing, and on the energy management systems
5. Exposure to the most used energy planning and management softwares.

**Prerequisites:** Basic understanding about Energy resources and use.

**Course Contents:**

### Module I

Introduction: Overview of non-renewable energy resources, new and renewable energy resources; Overview of energy technologies; Energy crisis and environmental concerns; Principles of energy conservation and management.

### Module II

Energy conservation and management in thermal systems: Fuels and combustion; Boilers, Internal combustion engines and furnaces; Waste heat recovery systems; Turbines and DG sets; Steam system and condensate systems; Insulation; Heat exchangers; Cooling towers and circulating cooling water systems.

### Module III

Energy conservation and management in electrical systems: Electrical motors and drives; Pumps, Fans and Blowers; Air compressors and compressed air systems; Buildings and space heating and lighting systems; HVAC systems.

### Module IV

Energy management: Supply side and demand side energy management; Energy management systems.

### Module V

Energy monitoring and auditing; Case Studies

**Examination Scheme:**

Components	CT	HA	S/V/Q	A	EE
Weightage (%)	15	5	5	5	70

**Text & References:**

1. Practical guide to energy conservation – a ready reckoner on energy conservation measures; Petroleum Conservation Research Association (2009).
2. Indian Energy Board-2012; World Energy Council.
3. Reay DA, Industrial energy conservation; Pergamon Press (1979).
4. White LC, Industrial Energy Management and Utilization; Hemisphere Publishers; (1988).
5. Eastop TD and Croft DR, Energy Efficiency for Engineers and Technologists; Longman-Scientific and Technical Series (1988).

# Energy Safety and hazard Control

**Course Code: IET 703**

**L:3, T:0, P:2, C:3**

**Course Objectives:** This course is designed to inform students of best practices in the control of hazardous energy/lockout safety. Engineering, administrative and personal protective equipment control techniques to protect worker safety and health will be emphasized throughout the course. This course is well suited for individuals new to the field of safety and looking for a high level overview of general hazards.

**Learning outcomes:** On completion of this course, the students will be able to determine any companies' lockout/tagout compliance issues based on OSHA's 1910.147: Control of Hazardous Energy (lockout/tagout).

**Prerequisites:** Basic understanding about occupational hazards.

**Course Contents:**

## Module I

Fundamentals of Safety and Accident Prevention; Introduction to Hazardous Energy, Lockout/Tagout, The Occupational Safety and Health Administrations (OSHA).

## Module II

Explain fundamental procedures to follow for establishing and working under locks and tags; Describe the differences in energy control roles between authorized and affected employees.

## Module III

Determine whether a lockout or tagout device meets requirements for appearance, strength and durability; Identify the limitations of using tags without locks; Define the procedures for applying and removing locks and tags.

## Module IV

OSHA requirements for temporary removal of locks or tags, group lockouts and tagouts, shift change turnover, and training of outside service personnel; Define the OSHA requirements for training and retraining.

## Module V

Occupational Safety and Health in India; OSH organization in India; OSH Challenges; OSH legislation.

**Examination Scheme:**

Components	CT	HA	S/V/Q	A	EE
Weightage (%)	15	5	5	5	70

**Text & References:**

- Comprehensive Energy Management - Safe Adaptation, Predictive Control and Thermal Management. Editors: Watzenig, Daniel, Brandstätter, Bernhard (Eds.). ISBN 978-3-319-57445-5. 2018.
- Technology and Energy Sources Monitoring: Control, Efficiency, and Optimization. Jozef Flizikowski and Kazimierz Bielinski. 9781466626645. 2012.
- Lockout/Tagout Fact Sheet. OSHA.(2002)
- Evaluation of Fire and Rescue Services.  
<https://www.osha.gov/Publications/OSHA3925.pdf>.

## ATMOSPHERIC SCIENCE

**Course Code: IET 704**

**L:3, T:0, P:2, C:3**

**Module I:** Elementary concepts of atmospheric sciences: structure of the atmosphere and its composition, pressure and its variation with height, variation of temperature with height, Equation of state for dry and moist air, Adiabatic and Isothermal Processes, Humidity Parameters, Virtual Temperature, Standard Atmosphere.

**Module II:** Laws of thermodynamics, Entropy, Potential Temperature, Pseudo-adiabatic Process, Equivalent Temperature, Equivalent Potential Temperature, Clausius – Clapeyron Equation, Stability and Instability, Thermodynamic Diagram: T - gram, Uses of thermodynamic diagrams, Precipitable Water Vapor, Rate of Precipitation, Role of Convective Available Potential Energy (CAPE) and Convective Inhibition Energy (CINE) in thunderstorm development. Dew, Frost, Fog, Clouds, Precipitation, Airmass, Fronts, Tornado, Cyclones, Waterspouts, Dust Storm.

**Module III:** Radiative Transfer in the Atmosphere- Temperature of the Sun and spectral distribution of solar radiation, geographical and seasonal distribution of incoming solar radiation, outgoing radiation, net radiation, terrestrial heat balance, long wave radiation, black body radiation budget of radiation energy. Passage of solar radiation through the atmosphere, Atmospheric Windows, emissivity, Absorption spectra of atmospheric gases, optically thick and thin approximations, aerosol scattering, calculations of radiative heating and cooling.

**Module IV:** Terrestrial radiation and its passage through the atmosphere. Raleigh and Mie scattering. Role of atmospheric dust in radiation balance, effect of volcanoes. Satellite imaginary, greenhouse gases (e.g., CO<sub>2</sub>, H<sub>2</sub>O, CH<sub>4</sub>, etc.), and optical phenomena rainbows, halos.

**Module V:** Definition of weather and climate, physical factors of climate, earth-sun relationship, ecliptic and equatorial plane, rotation of the earth, seasons, climatic controls. Climatic classification: methods of Koppen and Thornthwaite. Microclimate- basic concepts. Radiation climatology of the earth's atmosphere, Indian climatology: Climate zones of India; pressure, wind, temperature and rainfall distribution during the four seasons. Western disturbances, fog, thunderstorm, hail, cold waves, subtropical jet stream, south-west and north-east monsoon, interaction of low and high latitude disturbances.

### Examination Scheme:

Components	CT	HA	S/V/Q	A	EE
Weightage (%)	15	5	5	5	70

### Text and reference Books:

17. Atmospheric Science: An Introductory Survey: J.M Wallace and P.V. Hobbs, 2nd edition, Academic Press, 2006
18. An Introduction to Atmospheric radiation: K.N. Liou 2nd edition Academic Press, 2002.

**RESEARCH METHODOLOGY****Course Code: IBB 705****Credit Units:03****Course Objective:**

To develop understanding of information and library science research issues in the domain of bioinformatics through review of journal articles, invited talks, and critical group discussions of methods. The main objectives for this course are to develop: familiarity with information and library science-oriented problems in the biomedical sciences, an understanding of research methods in the biomedical domain, critical thinking and evaluation skills and presentation and summarization skills.

**Course Contents:****Module I**

Introduction: Science, Scientific Field and Biological research, Role of a researcher in different stages of the carrier, Routes to academic and commercial funding. Identification of the International and National Research Journals in the area of Biotechnology that are indexed in Scopus and with their SCI Impact factor. Literature search for the Reviews by the authorities and Research articles in high impact journals. Literature search for the Reviews by the authorities and Research articles in high impact journals. Brain storming session on the state-of the art technologies. Brain storming session on the state-of the art technologies.

**Module II**

Identification of the research problem, Formulation of a hypothesis, Review of the literature in the identified research area, Identification of the Model species, Selection of the research materials and resources. Methodologies to be employed for different research projects- Morpho physiology. Methodologies to be employed for different research projects-Molecular biology. Methodologies to be employed for different research projects-Statistical analysis.

**Module III:**

Selection of the research material with minimum intrinsic variability. Collection of data from technical and biological replicates. Statistical analysis of the data to compute the statistical differences between the treatments. Presenting the results in Power point. Introduction to Image J. Use of Image J for quantification of morphometric traits. Introduction to Photoshop. Preparation of a high-resolution figures for publication-Line diagrams, histograms and composite figures.

**Module IV**

Developing a draft manuscript -Introduction. Developing a draft manuscript –Material & Methods. Developing a draft manuscript –Results and Discussion. Developing a draft manuscript –Supplementary information. Developing a draft manuscript –References cited. Correct usage (grammar) of Scientific English and developing flexibility in writing skills to avoid plagiarism. Write a covering letter and response to reviewers' comments (both negative and positive). Developing oration skills for presentation in Seminar and conference.

**Module V**

Plan for a draft research proposal for possible funding. Review of the literature (national and international) in the proposed research area. Contribution made as Project Investigator (PI) in the area of proposed research proposal. Research publications by PI in SCI and/or Scopus listed journals. Defining clear objectives (not more than 3) in the proposed research proposal. Budget preparation for funding with details for Instruments, consumables, staff, travel and other miscellaneous expenses. Identification of the funding bodies for research grant in the identified area by funding bodies in India. Development of International collaboration.

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Text & References:**

- Statistical Methods By S.P. Gupta
- Research Methodology Methods and Techniques by C.R. Kothari
- Statistics(Theory and Practice) by B.N. Gupta
- Research Methodology Methods and statistical Techniques by Santosh Gupta

## Environmental Impact Assessment Lab

**Course Code: IET 721**

**Credits: 01**

- Baseline Studies for any project
- EIA procedures
- Study and Model of EIA for chemical industries.
- Study and Model of EIA for construction projects.
- Study and Model of EIA for hydroelectric projects.
- Study and prepare ISO 14000 chart for an industry.
- Study and Model of EIA for mining projects.
- Minor Project on Environmental Management Plan.

**Examination Scheme:**

<b>Components</b>	<b>Minor Project</b>	<b>Q/A</b>	<b>Attendance (A)</b>	<b>EE</b>
<b>Weightage (%)</b>	15	10	5	70

**Text & References:**

1. John G. Rau and David C. Wooten (Ed), Environmental Impact Analysis. Handbook, McGraw Hill Book Company, 1980.
2. Canter R. L., Environmental Impact Assessment, Mc Graw Hill International. Edition, 1997.

## Energy Management and Technology Lab

**Course Code: IET 722**

**Credits: 01**

- Energy monitoring and auditing
- Energy Plus Simulation software

### Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**Note:** Minor variation could be there depending on the examiner.

### Text & References:

1. Practical guide to energy conservation – a ready reckoner on energy conservation measures; Petroleum Conservation Research Association (2009).
2. D.B. Jani , Lab manual\_Energy Economics and Managemen. Gujarat Technological University – GTU(2018).
3. Scott Horowitz, Jeff Maguire, Paulo Cesar Tabares-Velasco, Jon Winkler, and Craig Christensen. EnergyPlus and SEEM Modeling Enhancements via Software-toSoftware Comparison Using NREL’s BEopt Test Suite. NREL, U.S. Department of Energy.

## Energy Safety and hazard Control Lab

**Course Code: IET 723**

**Credits: 01**

- Application of energy control procedures
- Case studies

### Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**Note:** Minor variation could be there depending on the examiner.

### Text & References:

1. Energy Management Handbook. Wayne C. Turner. Oklahoma State University. The Fairmont Press, Inc. Lilburn, Georgia. 2001.
2. Practical guide to energy conservation – a ready reckoner on energy conservation measures; Petroleum Conservation Research Association (2009).
3. D.B. Jani , Lab manual\_Energy Economics and Management. Gujarat Technological University – GTU(2018).

## Atmospheric Science Lab

**Course Code: IET 724**

**Credits: 01**

1. **Clouds classification and Observations:** Students would be shown slides of all 10 major types of clouds and by end of the Lab training it is expected from students to be able to identify real weather clouds.
2. 2. Demonstration and detailed instructions of **High-Performance Computing (HPC)** Facility and its use in Atmospheric Science.
3. 3. Simulation and Visualization of Weather and climate data.
4. 4. Field observation.
5. 5. **Thermodynamics:** Tephigram analysis and interpretation. Energy diagram and their interpretation. Interpretation of Physical state of the atmosphere with the help of tephigram from real-time observations of India Meteorological Department (IMD), Govt. of India.
6. 6. Visualization and Display of Atmospheric Data: Grid Analysis and Display System (**GrADS**)
  - a) Introduction of Grid Analysis and Display System
  - b) Reading writing control files for data display
  - c) Data display, reading and plotting of binary and netcdf data from weather forecasting models. Weather Maps using GrADS.
  - d) OpenGRADS and PYGRADS
7. Visit of Amity COAST's **Sky Radiometer** Facility and interpretation and demonstration of the Sky Radiometer data.
8. Hands on with **Black carbon monitoring instrument (aethalometer)** installed at Amity COAST.

### Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**Note:** Minor variation could be there depending on the examiner.

## COMMUNICATION SKILLS - V

**Course Code:** BCS 701

**Credit Units: 01**

### **Course Objective:**

To facilitate the learner with Academic Language Proficiency and make them effective users of functional language to excel in their profession.

### **Course Contents:**

#### **Module I**

Introduction to Public Speaking  
Business Conversation  
Effective Public Speaking  
Art of Persuasion

#### **Module II: Speaking for Employment**

Types of Interview  
Styles of Interview  
Facing Interviews-Fundamentals and Practice Session  
Conducting Interviews- Fundamentals and Practice Session  
Question Answer on Various Dimensions

#### **Module III**

Resume Writing  
Covering Letters  
Interview Follow Up Letters

#### **Module IV: Basic Telephony Skills**

Guidelines for Making a Call  
Guidelines for Answering a Call

#### **Module V: Work Place Speaking**

Negotiations  
Participation in Meetings  
Keynote Speeches

#### **Examination Scheme:**

Components	CT1	CT2	CAF	V	GD	GP	A
<b>Weightage (%)</b>	20	20	25	10	10	10	5

CAF – Communication Assessment File

GD – Group Discussion

GP – Group Presentation

#### **Text & References:**

- Jermy Comfort, Speaking Effectively, et.al, Cambridge
- Krishnaswamy, N, Creative English for Communication, Macmillan
- Raman Prakash, Business Communication, Oxford.
- Taylor, Conversation in Practice

## **UNDERSTANDING SELF FOR EFFECTIVENESS- VII (INDIVIDUAL, SOCIETY AND NATION)**

**Course Code:** BSS 704

**Credit Units:** 01

### **Course Objective:**

This course aims at enabling students towards:  
Understand the importance of individual differences  
Better understanding of self in relation to society and nation  
Facilitation for a meaningful existence and adjustment in society  
Inculcating patriotism and national pride

### **Course Contents:**

#### **Module I: Individual differences & Personality**

Personality: Definition & Relevance  
Importance of nature & nurture in Personality Development  
Importance and Recognition of Individual differences in Personality  
Accepting and Managing Individual differences (adjustment mechanisms)  
Intuition, Judgment, Perception & Sensation (MBTI)  
BIG5 Factors

#### **Module II: Managing Diversity**

Defining Diversity  
Affirmation Action and Managing Diversity  
Increasing Diversity in Work Force  
Barriers and Challenges in Managing Diversity

#### **Module III: Socialization**

Nature of Socialization  
Social Interaction  
Interaction of Socialization Process  
Contributions to Society and Nation

#### **Module IV: Patriotism and National Pride**

Sense of pride and patriotism  
Importance of discipline and hard work  
Integrity and accountability

#### **Module V: Human Rights, Values and Ethics**

Meaning and Importance of human rights  
Human rights awareness  
Values and Ethics- Learning based on project work on Scriptures like- Ramayana, Mahabharata, Gita etc.

#### **Module VI: End-of-Semester Appraisal**

Viva based on personal journal  
Assessment of Behavioural change as a result of training  
Exit Level Rating by Self and Observer

**Text & References:**

- Davis, K. Organizational Behaviour,
- Bates, A. P. and Julian, J.: Sociology - Understanding Social Behaviour
- Dressler, David and Cans, Donald: The Study of Human Interaction
- Lapiere, Richard. T – Social Change
- Lindzey, G. and Borgatta, E: Sociometric Measurement in the Handbook of Social Psychology, Addison – Welsley, US.
- Rose, G.: Oxford Textbook of Public Health, Vol.4, 1985.
- Robbins O.B.Stephen; Organizational Behaviour

**FRENCH - VII****Course Code: FLT 701****Credit Units: 02****Course Objective:**

Revise the portion covered in the first volume, give proper orientation in communication and culture.

**Course Contents:****Module A: Unités 1 – 3: pp. 06 - 46****Contenu lexical: Unité 1:** Rédiger et présenter son curriculum vitae

- Exprimer une opinion
- Caractériser, mettre en valeur
- Parler des rencontres, des lieux, des gens

**Unité 2:** Imaginer - Faire des projets

- Proposer - conseiller
- Parler des qualités et des défauts
- Faire une demande écrite
- Raconter une anecdote
- Améliorer son image

**Unité 3:** Exprimer la volonté et l'obligation

- Formuler des souhaits
- Exprimer un manque/un besoin
- Parler de l'environnement, des animaux, des catastrophes naturelles

**Contenu grammatical:**

1. Le passé : passé composé/imparfait
2. Pronoms compléments directs/indirects, y/en (idées/choses)
3. Propositions relatives introduites par qui, que, où
4. Comparatif et superlatif
5. Le conditionnel présent
6. Situer dans le temps
7. Féminin des adjectifs
8. La prise de paroles : expressions
9. Le subjonctif : volonté, obligation

**Examination Scheme:**

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:**

- le livre à suivre : Campus: Tome 2

**GERMAN - VII****Course Code: FLG 701****Credit Units: 02****Course Objective:**

To enable the students to converse, read and write in the language with the help of the basic rules of grammar, which will later help them to strengthen their language.

To give the students an insight into the culture, geography, political situation and economic opportunities available in Germany

Introduction to Advanced Grammar and Business Language and Professional Jargon

**Course Contents:****Module I: Dass- Sätze**

Explain the use of the conjunction “-that”, where verb comes at the end of the sentence

**Module II: Indirekte Fragesätze**

To explain the usage of the “Question Pronoun” as the Relative Pronoun in a Relative Sentence, where again the verb falls in the last place in that sentence.

**Module III: Wenn- Sätze**

Equivalent to the conditional “If-” sentence in English. Explain that the verb comes at the end of the sentence.

**Module IV: Weil- Sätze**

Explain the use of the conjunction “because-” and also tell that the verb falls in the last place in the sentence.

**Module V: Comprehension texts**

Reading and comprehending various texts to consolidate the usage of the constructions learnt so far in this semester.

**Module VI: Picture Description**

Firstly recognize the persons or things in the picture and identify the situation depicted in the picture;

Secondly answer questions of general meaning in context to the picture and also talk about the personal experiences which come to your mind upon seeing the picture.

**Examination Scheme:**

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:**

- Wolfgang Hieber, Lernziel Deutsch
- Hans-Heinrich Wangler, Sprachkurs Deutsch
- Schulz Griesbach, Deutsche Sprachlehre für Ausländer
- P.L Aneja, Deutsch Interessant- 1, 2 & 3
- Rosa-Maria Dallapiazza et al, Tangram Aktuell A1/1,2
- Braun, Nieder, Schmöe, Deutsch als Fremdsprache 1A, Grundkurs

**SPANISH - VII****Course Code:** FLS 701**Credit Units: 02****Course Objective:**

To enable students acquire working knowledge of the language; to give them vocabulary, grammar, expressions used on telephonic conversation and other situations to handle everyday Spanish situations with ease.

**Course Contents:****Module I**

Revision of earlier semester modules

**Module II**

Zodiac signs. More adjectives...to describe situations, state of minds, surroundings, people and places.

**Module III**

Various expressions used on telephonic conversation (formal and informal)

**Module IV**

Being able to read newspaper headlines and extracts (Material to be provided by teacher)

**Module V**

Negative commands (AR ending verbs)

**Module VI**

Revision of earlier sessions and introduction to negative ER ending commands, introduction to negative IR ending verbs

**Examination Scheme:**

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:**

- Español En Directo I A, 1B
- Español Sin Fronteras
- Material provided by the teacher from various sources

# CHINESE – VII

**Course Code:** FLC 701

**Credit Units: 02**

## **Course Objective:**

The story of Cinderella first appears in a Chinese book written between 850 and 860 A.D. The course aims at familiarizing the student with the basic aspects of speaking ability of Mandarin, the language of Mainland China. The course aims at training students in practical skills and nurturing them to interact with a Chinese person.

## **Course Contents:**

### **Module I**

Drills

Dialogue practice

Observe picture and answer the question.

About china part –I Lesson 1, 2.

### **Module II**

Pronunciation and intonation

Character Writing and stroke order.

### **Module III**

Ask someone what he/she usually does on weekends?

Visiting people, Party, Meeting, After work....etc.

### **Module IV**

Conversation practice

Translation from English to Chinese and vice-versa.

Short fables.

### **Module V**

A brief summary of grammar.

The optative verb “yuanyi”.

The pronoun “ziji”.

## **Examination Scheme:**

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

## **Text & References:**

- “Kan tu shuo hua” Part-I Lesson 1-7

## PEARL AND PYTHON

**Course Code: IBB 801**

**Credit Units: 03**

### Course Objective:

The objective is to do advance programming in PERL for bioinformatics how use handle large files and databases to extract information by using various modules of PERL programming. Apart from Perl Programming Python language introduction and its application in bioinformatics is an important objective of the course.

### Course Contents:

#### Module I

Reading proteins from files, finding motifs, counting nucleotides, exploding strings into arrays, Operating on strings. Introduction to BioPerl, Installation of Various Basic Packages, Modules and Widgets, Internet-related Libraries

#### Module II

A program to simulate DNA mutation, generating random DNA, Analyzing DNA, Translating DNA into proteins. Using Random DNA find the relation between randomly generated and naturally occurring DNA, RNA and Protein sequence on various parameters.

#### Module III

Course Introduction, Introduction to scripting, An Introduction to Python, Numbers and operators, Testing Python Scripts, Variables and Data types, Complex data types: strings, tuples (Accessing tuples, Operations, Working, Functions and Methods), lists, and dictionaries (Accessing values in dictionaries, Working with dictionaries, Properties, Functions).

#### Module VI

Decisions and Loops, Functions, Objects and Classes, Modules: Importing module, Math module, Random module, Packages, Composition, Advanced Python testing, File Access: Printing on screen, reading data from keyboard, Opening and closing file, Reading and writing files, Functions,

#### Module V

Text processing and Regular Expressions, Application of Python on machine learning, Accessing Databases, working with Biopython modules, Network Programming, Web applications.

### Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

### Text & References:

- Beginning Perl for Bioinformatics, Book by James Tisdall Shroff Publishers & Distributors, 01-Jan-2001
- Mastering Perl for Bioinformatics, James Tisdall, O'Reilly & Associates, Inc. Sebastopol, CA, USA ©2003
- Patrick O'Brien, Beginning Python for Bioinformatics, O'Reilly, 2002.
- Alex Martelli, Python in a Nutshell, O'Reilly, 2006.
- Cynthia Gibas, Per Jambeck, Developing Bioinformatics Computer Skills, O'Reilly, 2001.
- Harvey M. Deitel, Python: How to Program, Prentice Hall, 2002

**DATA MINING****Course Code: IBB 802****Credit Units: 03****Course Objective:**

The course is designed to introduce data mining and its related elements to the students. In striving to achieve this objective, the course uses besides others, lectures on various important aspects like Graph theory, different algorithms etc.

**Course Contents:****Module I**

Knowledge Discovery in Databases, Concept of datamining, Need of datamining, Data mining functionalities, Data generation and types of data.

**Module II**

Concept of Data Warehouse, Data Warehouse Architecture, Online Analytical Processing (OLAP), Development of Data Warehouse life cycle.

**Module III**

Data preprocessing, Basic methods of data cleaning, data integration and Transformation, Data reduction, data resampling techniques, Discretization and Concept Hierarchy Generation

**Module IV**

Data mining Primitives, Data Mining Query Language, Mining Complex Type of data: Multimedia database, Mining Spatial database, Mining text database, Architecture of data mining system, multidimensional data mining.

**Module V**

Working on WEKA and KNIME software for classification, regression algorithms and their application on data sciences.

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Text & References:**

- Data Mining: Multimedia, Soft Computing, and Bioinformatics by Mitra, Sushmita Acharya, Tinku, John Wiley & Sons Inc
- Bioinformatics: The Machine Learning Approach by Pierre Baldi, SrenBrunak
- Data Mining in Bioinformatics, Series: Advanced Information and Knowledge Processing, by Wang, J.T.L.; Zaki, M.J.; Toivonen, H.T.T.; Shasha, D.E. (Eds.)2005, XI, 340 p. , Springer publications

## PROTEIN ENGINEERING

**Course Code: IBB 803**

**Credit Units: 03**

**Course Objective:**

The aim of the course is to teach the students the basic methodology of recombinant DNA technology leading to the generation of genetically engineered proteins, protein folding and its characterization. The course would also emphasize the requirement of protein engineering technique in the generation of novel proteins for specific purposes of industrial importance.

**Course Content:**

**Module 1:** Introduction to protein engineering, structure and properties of amino acids, primary, secondary, tertiary and quaternary structure of proteins Engineering of Macromolecules, Basics of protein engineering, Rationale, Assumptions for protein engineering, Key biocatalyst properties. Mutational effects on protein folding: methodology, application and interpretation. Protein engineering for stability.

**Module 2:** Methods in Protein Engineering, library construction methods. Rational design, Evolutionary protein design, Use of genetic engineering to protein engineering, Site-specific and multiple amino acid substitutions, Functional and structural consequences and limitations, DNA shuffling, Error prone PCR. Phage display, cell surface display and cell-free display methods for screening the engineered protein candidates.

**Module 3:** De novo design of catalysts & artificial proteins: Approaches used in designing and constructing novel proteins.

**Module 4:** Structure – function relationships of proteins, Structure and function of an antibody; structure of hemoglobin, muscle proteins, G Protein, Protein structure and folding; Mechanism of folding; Molecular chaperons, Heat shock protein, case study of misfolded prions.

**Module 5:** Drugs-protein interactions and Design, Rational structure-based drug design. Protein engineered biomaterials, Protein-DNA interactions; drug-DNA interactions; Databases of sequences and structure for protein and DNA, public domain softwares for visualizing and modeling biomolecules. Protein engineering benefits in industry and medicine.

**Examination Scheme:**

Components	H/Q	S	CT	EE
Weightage (%)	10	10	10	70

**Text & References:**

**Text and reference:**

- Protein Engineering Protocol: Methods in Molecular Biology, Vol. 352 Muller, Kristian.
- Protein Engineering in Industrial Biotechnology, Lilia Alberghina (Editor), Hard wood academic Publisher.
- Plant Protein Engineering: edited by Peter R Shewry and Steven Gutteridge, Press Syndicate of the University of Cambridge.
- Protein Engineering Hand book Vol, Stefan Lutz, Uwe Theo Bornscheuer.

**ANIMAL AND PLANT BIOTECHNOLOGY****Course Code: IBB 804****Credit Units: 03****Course Objective:**

The application of Plant Biotechnology covers major areas related to commercial applications. Regeneration of plants through *in vitro* techniques offers a practical strategy for micro propagation. Importance will also be given to areas like *in vitro* fertilization, animal cell and tissue culture, hormone vaccine and important enzyme production through animal biotechnology.

**Course Contents:****Module I**

Plant tissue culture media, Role of phytohormones, Plant regeneration pathways, An overview of protoplast culture, Cell culture and suspension culture

**Module II**

Genetic engineering in plants: transformation vectors, gene transfer techniques, vector mediated and vector less gene transfer, transgenic crop with new traits, insect and disease resistance.

**Module III: Cell culture**

Introduction, Culture media – Natural and defined media, Primary culture – Steps, Mechanical and enzymatic disaggregation, Cell lines – Maintenance of cell line, Tissue and organ culture, Cryopreservation, Contamination

**Module IV:**

Hybridoma technology - Polyclonal and monoclonal antibodies, Hybridoma technology for monoclonal antibody production. In vitro fertilization and embryo transfer – Principles, Steps, Advantages and disadvantages of IVF-ET. Transgenic animals - Introduction, Gene transfer methods. Biopharming - transgenic animals as bioreactors for producing therapeutic proteins. Animal cloning – Somatic cell nuclear transfer (Dolly).

**Module V:**

Bioethical issues related to plant and animal biotechnology

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Text & References:**

- An Introduction to Plant Tissue Culture, M.K. Razdan, Oxford and IBH Publishing
- Experiments in Plant Tissue Culture, J.H. Dodds and L.K. Roberts, Cambridge University Press
- Plant Biotechnology and Transgenic Plants, K.M.O. Caldenty, W.H. Barz and H.L. Wills, Marcel Dekker
- Plant Biotechnology, J. Hammond, P.McGarvy and V. Yusibov, Springer Verlag.
- Ramdass, P. (2014). Animal Biotechnology Recent concepts and developments. MJP publishers
- Masters, J. R. (Ed.). (2000). Animal cell culture: a practical approach (pp. 3-10). New York: Oxford University Press.
- Freshney, R. I. (Ed.). (1986). Animal cell culture: a practical approach (Vol. 8). Oxford: IRL press.

**IPR & Drug Regulatory Affairs****Course Code: IBB 805****Credit Units: 03**

**Course Objective:** Various types of Intellectual Property Rights Patentable Subject History of Indian Patent Protection, Patent filing procedure in India, Opposition- pre-grant opposition and post-grant opposition, Patent filing procedure under PCT, advantages, patent search and literature and Salient features of Indian Patents are discussed in detail.

**Module I** Introduction, Types of Intellectual Property Rights (Patents, Trademarks, Copyrights, Geographical Indications Industrial Designs and Trade secrets), Patentable Subject Matter (Novelty, NonObviousness, Utility, enablement and Best mode)

**Module II** History of Indian Patent Protection, Rationale behind Patent System, Objectives and Advantages of Patent System, and future challenges. Indian Patents Act 1970, Definitions and Key Terminology, Types of Patent applications, Inventions not patentable (section 3 and 4).

b) Patent filing procedure in India (Patent Prosecution), Specifications (Provisional and Complete), Claims- types of claims and legal importance of claims, Grant of patent, Rights of Patentee and coowners

c) Opposition- pre-grant opposition and post-grant opposition, Anticipation, Infringement, Compulsory Licensing, revocation of patents, and power of Controller.

d) Patent filing procedure under PCT, advantages, patent search and literature

**Module III**

a) Salient features of Indian Patents (Amendments) Act 1999, 2002 and 2005. US and European Patent System,

b) Background, Salient Features and Impact of International Treaties / Conventions like

i. Paris Convention, Berne convention

ii. World Trade Organization (WTO)

iii. World Intellectual Property Organization (WIPO)

iv. Trade Related Aspects of Intellectual Property Rights (TRIPS)

v. Patent Co-operation Treaty (PCT), Madrid Protocol

**Module IV** Pharmaceutical Regulatory Procedures in India: Hierarchy and working flow of FDA in India, Role of DCGI / CDSCO in drug control, Drug Control Authority and its documentation in the state.

**Module V** National drug regulatory requirements, national drug policy, drug and cosmetic act and rules, over view of schedule M, schedule Y, US FDA guidelines on IND, new drug approvals(NDA), ANDA approvals, SUPAC Changes, SNDA & post marketing surveillance. Overview of GMP, GLP, ISOs- Production design, certification.

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Suggested Books:**

1. Drug Regulatory Affairs by Dr. N.S. Vyawahare and SachinItkar, NiraliPrakashan.
2. Pharmaceutical Regulatory Affairs by C.V.S. Subrahmanyam & J. ThimmaSetty, VallabhPrakashan.
3. Quality Assurance of Pharmaceutics Vol I & II of WHO publications, 1999.
4. GMPs by Mehra
5. How to Practice GMP by P.P.Sharma.
6. GMP of Pharmaceuticals by Willing and Stoker.
7. Good Manufacturing Practices for Pharmaceuticals, S.H. Wiling, Vol. 78, Marcel Decker.
8. Drugs and Cosmetics act by Vijay Malik.

**PEARL AND PYTHON LAB****Course Code: IBB 821****Credit Units: 01****Course Contents:****Module I**

Introduction to Linux: Basic architecture of Linux operating system, commands,

**Module II**

Random DNA generation, simulation of DNA mutation, Analyzing DNA from a file, Translation simulation. Find the relation between randomly generated and naturally occurring DNA, RNA and Protein.

**Module III**

Data types, Complex data types, lists, and dictionaries (Accessing values in dictionaries, Working with dictionaries, Properties, Functions).

**Module VI**

Decisions and Loops, Functions, Objects and Classes, Modules: Importing module, Math module, Random module, Packages, Composition, Advanced Python testing, Scikit Learn packages: Numpy, Scipy, Matplotlib.

**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**DATA MINING LAB****Course Code: BTF 822****Credit Units: 01****Course Contents:****Module I**

Using different data samples, practical experimentation with the various stages of data mining.  
Use of Meta-Search Engines.

Using different data samples, practical experimentation with the various stages of data mining.

**Module II**

Use and result interpretation of Pratt, MEME, Miner, and Mast servers.

Demonstration of free data mining Software like WEKA, Yale, TANAGRA, DB2 Intelligent Miner

**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**PROTEIN ENGINEERING LAB****Course Code: IBB 823****Credit Units: 01****Course Contents:**

1. Study of protein finger printing
2. Pull Down Assay
3. Hanging Drop vapor diffusion method
4. Protein-protein Interaction studies
5. Visualization of protein structure
6. Study of protein fractionation
7. Study of protein degradation.

**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**ANIMAL AND PLANT BIOTECHNOLOGY LAB****Course Code : IBB 824****Crédits: 01****Course Contents:****Module I**

Preparation of culture media

Effect of PGRs on explants

**Module II**

Study of viability of seeds

Embryo culture

**Module III**

Reagent preparation for cell culture

Culture and maintenance of cells

**Module IV**

Passaging of cells

Cells quantitation

Cell viability assay

Cell cytotoxicity assay

**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**NEUROLINGUISTICS****Course Code : ICN 801****Crédits : 03**

**Course Objectives:** To familiarize the student with central issues in brain and language research (from healthy and brain-damaged populations). To prepare the student to evaluate data from neurolinguistic and brain imaging studies. To prepare the student to design and conduct experimental work in Slovenian and other languages

**Module 1:** History, Language structure, Psycholinguistics and cognitive science, Methods, Crosslinguistics, Psycholinguistics, Recent advancements in methods and theory of psycholinguistics, Different communication systems. Representations in speech production and perception, Visual word recognition, Spoken word recognition, Connectionist models of speech perception, Eye movements in visual word recognition, EEG and fMRI evidences of word recognition, Word recognition and neuropsychological data, Current models of visual and spoken word recognition.

**Module 2:** Behavioral studies on process in language acquisition, Specific impairments in language acquisition i.e. SLI, Dyslexia, William's syndrome, Language development in Creole and Pidgin languages, Theories of language production, Dialogue processing, Phonological, Morphological and syntactic encoding in language production, Visual attention and language production, Models of speech production, EEG and fMRI evidences in language production, Language production in aphasia.

**Module 3:** Language, Mind and Brain: Experience Alters Perception. The Neural correlates of Language Production. Prelexical and Lexical Process in comprehension: Psycholinguistics and Functional Neuroimaging. Postlexical integration processes in Language comprehension: Evidences from Brain imaging Research.

**Module 4:** Acquisition of Languages: Infant and Adult data. The cognitive Neuroscience of Language Acquisition The Neural Architecture and Computational Modeling of Language disorders.

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
<b>Weightage (%)</b>	15	5	10	70

**Text and references:**

1. Gaskell. M. G. (2007). The Oxford Handbook of psycholinguistics.
2. Johnson. K. (2006).Acoustic and Auditory Phonetics. Blackwell.
3. Henderson. J.M. & Ferreira. F. (2004).The Interface of Language, vision and Action: Eye Movements and Visual World.
4. Libben et al. (2007).The Mental Lexicon. Core Perspectives. Elsevier.
5. Sekerina, et al (2008).Developmental psycholinguistics. On-Line Methods in Children's Language. John Benjamin
6. Guhe. M. (2008).Incremental Conceptualization in Language Production. Routledge.
7. Gazzaniga. The Cognitive Neuroscience.

**CLINICAL NEUROSCIENCES****Course Code : ICN 802****Crédits : 03**

**Course Objectives:** This course is designed to provide students with a fundamental understanding of clinical neuroscience. Students who complete this course will understand the normal anatomy and physiology of the nervous system and will recognize important symptoms and signs associated with neurological disease. In addition, students will understand the functional and clinical significance of the three-dimensional organization of anatomical structures, and the interconnections and spatial relationships that bind structures together in the nervous system.

**Module 1:** Electrophysiology: clinical application of EMG and Nerve conduction EMG in neurogenic and myopathic disorders, H-Reflex, F-wave and Blink Reflex, Brachial plexus study, Repetitive nerve stimulation study, Repetitive nerve stimulation study

**Module 2:** Electroencephalography in Status Epilepticus, EEG in Dementia and Degenerative Diseases, EEG in Psychiatric Disorders, Transient cognitive impairment during epileptiform discharges. Applications of USG in medical diagnosis, contrast media, tissue harmonic imaging intraoperative ultra-sonography.

**Module 3:** C-arm image intensifier, contrast media, computer radiography, digital radiography, automatic film processing, laser dry camera image processing, PACS F-MRI, MRI contrast media, MRI hazards and safety. Amino acids neurotransmitters, Excitatory and inhibitory neurotransmitters: GABA, glycine, glutamate and their receptors Agonists and antagonists, AMPA, Kainate and NMDA receptors; Glutamate mediated synaptic transmission; Glutamate excitotoxicity; NMDA receptor and LTP; Neurolathyrism.

**Module 4:** Catecholamines, Opiate and Peptide Neurotransmitters, Dopamine receptors structure; Function; Agonist and antagonists; Dopaminergic pathways; Dopamine transporters; MPTP; Parkinson's disease; Schizophrenia; Amphetamine cocaine and their mode of action; Opiate and their receptors; Agonist and antagonists.

**Module 5:** Drug addiction tolerance and withdrawal; Morphine pain relief; Neuropeptides: precursors' structure, common features, synthesis, processing and regulation; atecholamines and serotonin: structures, classifications and their receptors.

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
<b>Weightage (%)</b>	15	5	10	70

**Text and references:**

1. Siegel et al., Basic Neurochemistry, 6th Edition, Lippincott -Williams-Wilkins.
2. Kandel et al., Principles of Neural science, 4 Edition, McGraw-Hill Medical, 2000.
3. Zegmond, Fundamentals of Neuroscience, 1st Edition, Academic Press, 1999.
4. Bear: Neuroscience: Exploring the Brain, 2nd edition, Lippincott Williams & Wilkins, 2001.
5. Clinical neurophysiology – U K Mishra.

**COMPUTATIONAL NEUROSCIENCES****Course Code: ICN803****Crédits : 03**

**Course Objectives:** The objectives of the course is to expose students to the field of theoretical neuroscience that involves how actual biological neurons perform computations in the mammalian brain. Current understanding of the biophysics of computation is completely different from the field of artificial neural networks. Overall the course will equip students to provide different ways of solving problems related to learning using biologically plausible solutions and also allow interested candidates to take up research in neuroscience.

**Module 1:** Mathematical background and computational techniques: Introduction to dynamical Systems, review of basics of differential equations, introduction to phase plane analysis, elements of the bifurcation theory, Introduction to relevant computer software such as XPP and Matlab.

**Module 2:** Models of single neurons: Derivation of the Hodgkin-Huxely (HH) equations and various reductions such as the FitzHugh-Nagumo (FHN), Hindmarsh–Rose (HR), Morris Lecar, and Integrate and Fire models.

**Module 3:** Models of synaptic interactions: Description of synapses and neurotransmitter release. Mathematical models for excitatory and inhibitory synapses, Excitability and bursting of neurons.

**Module 4:** Small network dynamics: Focus on understanding and characterizing the dynamics of small networks of excitatory, inhibitory or mixed-type neurons, detailed analysis of conditions leading to complete synchronization, phase locking or chaotic behavior in such networks.

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

***Text and references:***

1.Theoretical Neuroscience: Computational and Mathematical Modeling of Neural Systems, by Peter Dayan and Larry F. Abbott. The MIT Press, 2001. ISBN 0-262-04199-5.

2.Dynamical Systems in Neuroscience: The Geometry of Excitability and Bursting, by Eugene M. Izhikevich. The MIT Press, 2007. ISBN 0-262-09043-8.

3.Simulating, Analyzing, and Animating Dynamical Systems: A Guide to XPPAUT for Researchers and Students, by Bard Ermentrout, SIAM 2002 ISBN 0-89871-506-7.

**NEUROIMAGING METHODS IN COGNITIVE NEUROSCIENCE****Course Code: ICN804****Crédits : 03**

**Course objectives :** This course aims at familiarizing students of our program with contemporary neuroimaging methods to study brain activity non-invasively. Biomedical applications of neuroimaging will be discussed throughout the lectures.

**Module 1:** History and Methods, Functional neuroimaging: A historical & Physiological perspective, Functional neuroimaging: Basic principle of f-MRI, Functional neuroimaging: Experimental Design & Analysis.

**Module 2:** Cognitive Domains, Functional neuroimaging of attention, Functional neuroimaging of skill learning, Functional neuroimaging of semantic memory, Functional neuroimaging of language, Functional neuroimaging of episodic memory, Functional neuroimaging of working memory, Functional neuroimaging of executive function.

**Module 3:** Application of functional neuroimaging, Early cognitive development, Cognitive ageing, Emotion & social cognition, Neurophysiologically impaired patients.

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

***Text and references:***

1. Text Book: Handbook of functional neuroimaging of cognition, 2nd edition, edited by Roberto Cabeza and Alan Kingstone, MIT Press.
2. Huettel, Song, McCarthy (eds) Functional magnetic resonance imaging. Sinauer 2004.
3. Logothetis NK (2008) What we can do and what we cannot do with fMRI. Nature 453:869–878. (pdf in the dropbox).

**IPR & Drug Regulatory Affairs****Course Code: ICN 805****Credit Units: 03**

**Course Objective:** Various types of Intellectual Property Rights Patentable Subject History of Indian Patent Protection, Patent filing procedure in India, Opposition- pre-grant opposition and post-grant opposition, Patent filing procedure under PCT, advantages, patent search and literature and Salient features of Indian Patents are discussed in detail.

**Module I** Introduction, Types of Intellectual Property Rights (Patents, Trademarks, Copyrights, Geographical Indications Industrial Designs and Trade secrets), Patentable Subject Matter (Novelty, NonObviousness, Utility, enablement and Best mode)

**Module II** History of Indian Patent Protection, Rationale behind Patent System, Objectives and Advantages of Patent System, and future challenges. Indian Patents Act 1970, Definitions and Key Terminology, Types of Patent applications, Inventions not patentable (section 3 and 4).

b) Patent filing procedure in India (Patent Prosecution), Specifications (Provisional and Complete), Claims- types of claims and legal importance of claims, Grant of patent, Rights of Patentee and coowners

c) Opposition- pre-grant opposition and post-grant opposition, Anticipation, Infringement, Compulsory Licensing, revocation of patents, and power of Controller.

d) Patent filing procedure under PCT, advantages, patent search and literature

**Module III**

a) Salient features of Indian Patents (Amendments) Act 1999, 2002 and 2005. US and European Patent System,

b) Background, Salient Features and Impact of International Treaties / Conventions like

i. Paris Convention, Berne convention

ii. World Trade Organization (WTO)

iii. World Intellectual Property Organization (WIPO)

iv. Trade Related Aspects of Intellectual Property Rights (TRIPS)

v. Patent Co-operation Treaty (PCT), Madrid Protocol

**Module IV** Pharmaceutical Regulatory Procedures in India: Hierarchy and working flow of FDA in India, Role of DCGI / CDSCO in drug control, Drug Control Authority and its documentation in the state.

**Module V** National drug regulatory requirements, national drug policy, drug and cosmetic act and rules, over view of schedule M, schedule Y, US FDA guidelines on IND, new drug approvals(NDA), ANDA approvals, SUPAC Changes, SNDA & post marketing surveillance. Overview of GMP, GLP, ISOs- Production design, certification.

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Suggested Books:**

1. Drug Regulatory Affairs by Dr. N.S. Vyawahare and SachinItkar, NiraliPrakashan.
2. Pharmaceutical Regulatory Affairs by C.V.S. Subrahmanyam & J. ThimmaSetty, VallabhPrakashan.
3. Quality Assurance of Pharmaceutics Vol I & II of WHO publications, 1999.
4. GMPs by Mehra
5. How to Practice GMP by P.P.Sharma.
6. GMP of Pharmaceuticals by Willing and Stoker.
7. Good Manufacturing Practices for Pharmaceuticals, S.H. Wiling, Vol. 78, Marcel Decker.
8. Drugs and Cosmetics act by Vijay Malik.

## Neuroscience Lab

**Course Code: ICN 821**

**Credit Units: 03**

**List of experiments:**

1. Working on the supervised and unsupervised learning process.
2. Processing of data for Machine Learning.
3. Algorithms on Machine Learning methods.
4. Working on the Artificial Neural network.
5. To MRI investigation of explicit and implicit memory in Alzheimer's Disease and healthy aging.
6. To collecting and analyzing EEG data in disease patients and healthy control.
7. To identify Intracranial Electrical Stimulation Testing (ECS) and Intracranial EEG.
8. To analysis of Functional imaging and electrocardiography- in disease patients and healthy control

**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

## Nanomedicine and Nanotoxicology

**Course Code: INN801**

**Crédits : 03**

**Course objectives:** At the end of the course, students will be able to comprehend the principles behind nanomedicine also Gain a broad understanding of concepts and applications of nanomedicine. Student will also get to know various toxic effects of nanomaterials.

**Course Content:**

**Module I:** Introduction to nanomedicine, Types of nanomaterials, Cellular processes at nanoscale, Nanonephrology, Nanoneurology and molecular imaging, Drug delivery, Nanomedicine and cancer (diagnostic and imaging).

**Module II:** Biocompatibility of traditional medical implants, Adhesive interactions with implant surfaces, Nanorobot immunoreactivity- nanopyrexia, Nanorobot, mutagenicity and carcinogenicity, Thermocompatibility, mechanocompatibility, Cell membrane disruption.

**Module III:** Nanotherapeutics, Drug delivery to CNS - drug delivery across blood brain barrier, Nanowires for monitoring brain activity, Neuroregeneration–nanoneurosurgery – nanolipoblockers - antirestenosis drugs.

**Module IV:** Sources of Nanoparticles; Epidemiological Evidence; Entry Routes into the Human Body – Lung, Intestinal Tract, Skin; Nano particle Size - Surface and Body Distribution; Effect of Size and Surface Charges; Nanoparticles, Thrombosis and Lung Inflammation; Nanoparticles and Cellular Uptake.

**Module V:** Nanoparticles in the Environment; Nanoparticles in Mammalian Systems; Health Threats; Nanomaterials and Biototoxicity; Iron Oxide; Titanium Dioxide; Dark Studies; UV Irradiation Studies; Other Metal Oxides; Toxicological Studies and Toxicity of Manufactured CNTs- case study; Toxicity of CNTs and Occupational Exposure Risk; Toxicity of MWCNTs/SWCNTs and Impact on Environmental Health.

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Text and references:**

1. Michael Giersig, Gennady B. Khomutov, “Nanomaterials for Application in Medicine and Biology”, Springer, 2008
2. Robert A. Freitas, “Nanomedicine, Volume IIA: Biocompatibility”, Landes Bioscience, 2011.
3. Challa. S. S. R, Kumar, “Nanomaterials - Toxicity, Health and Environmental Issues”, Wiley-VCH publisher, 2006.
4. Nancy. A, Monteiro-Riviere, Lang Tran. C, “Nanotoxicology: Characterization, Dosing and Health Effects”, Informa healthcare, 2007.

## Optoelectronic Devices

**Course Code:** INN802

**Crédits :** 03

### Module I

An introduction to optoelectronics, visible light-emitting diodes: Physics of LED, Optical and electrical properties of LEDs, Material systems for visible LEDs, Applications Semiconductor lasers, visible wavelength lasers, Tunable lasers and Quantum cascade lasers

### Module II

Optical detectors and receivers: Photoelectric effects, Spectral response characteristics of photodetectors, UV detectors, IR detectors, High-speed photodetectors

Optical fibre devices, Optical modulators, Optical amplifiers

### Module III

Ultrafast optoelectronics: Ultrafast laser pulse generation, Femtosecond pulse propagation effects and dispersion compensation, Measurement of optical waveforms with femtosecond resolution

### Module IV

Integrated optics: The integrated optics toolbox—waveguides and basic devices, Integrated optics materials and fabrication technology

### Module V

Infrared devices and techniques: Infrared system fundamentals, IR systems, Noncontact thermometers, Radiometers, Light detection and ranging (LIDAR), IR gas sensors

Organic light emitting devices and Microstructured optical fibres

### Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
<b>Weightage (%)</b>	15	5	10	70

### Reference Books

1. Handbook of Optoelectronics, Volume 1, John P Dakin and Robert G W Brown (ed.), Taylor & Francis, New York, London (2006).
2. Physics of Optoelectronic Devices, Shun L Chuang (ed.), Wiley Series of Pure and Applied Optics (1995).

# Nanocomposites

**Course Code: INN803**

**Crédits : 03**

## Module I

Bulk Metal and Ceramics Nanocomposites: Ceramic/Metal Nanocomposites, Nanocomposites by Mechanical Alloying, Nanocomposites from SolGel Synthesis, Nanocomposites by Thermal Spray Synthesis, Metal Matrix Nanocomposites, Bulk Ceramic Nanocomposites for Desired Mechanical Properties,

## Module II

Thin-Film Nanocomposites: Multilayer and Granular Films, Carbon Nanotube-Based Nanocomposites, Functional Low-Dimensional Nanocomposites

## Module III

Polymer-based and Polymer-filled Nanocomposites: Nanoscale Fillers, Inorganic Filler/Polymer Interfaces, Processing of Polymer Nanocomposites, Properties of Composites (Mechanical Properties, Permeability, Dimensional Stability, Thermal Stability and Flammability, Electrical and Optical Properties)

## Module IV

Natural Nanobiocomposites: Natural Nanocomposite Materials, Biologically Derived Synthetic Nanocomposites, Biologically Inspired Nanocomposites

## Module V

Modeling of Nanocomposites: The Need for Modeling, Current Conceptual Frameworks, Multiscale Modeling, Multiphysics Aspects, Validation

## Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

## Reference Books

1. Nanocomposite Science and Technology, P.M. Ajayan, (ed.) Wiley VCH Verlag Weiheim (2003).
2. Polymer Nanocomposites: Processing, Characterization, and Applications, Omar Manasreh (ed.) McGraw-Hill (2006).
3. Polymer Nanocomposites, Rakesh K. Gupta (ed.) Taylor & Francis Group (2010).

## Nanotechnology Business Applications and Commercialization

**Course Code: INN804**

**Crédits : 04**

**Course Objectives:** The course outlines the nano-related business and enables the students how to link scientific knowledge to the business. Develop qualitative and quantitative understanding to the relevant concepts of nanoscale systems, and revive the responsibilities of Distributed Economy of such systems.

**Module I:** Introduction – types of nanobusinesses – ease of entry – intellectual property – ethics– risks/dangers –standardization, investors and commercialization centers – business applications – social aspects of nanotechnology.

**Module II:** Nanotechnology landscape and commercially attributable sectors - Tools to map, understand and segment the nanotechnology marketplace – Potential nanotechnology end-users and applications- Global market for nanotechnology products – Attracting venture capital –How to liaise effectively with partners - academy-industry relationship –University and employee’s inventions

**Module III:** Frameworks for developing nanotechnology marketplace –Incentives for Commercial applications– Shaping the Nanotech Marketplace- Allocating Costs associated with Risks – Public perception of nanotechnology – Critical impact of Regulation of Nanotechnology .

**Module IV:** Environment, health and safety within the nanotechnology industry–Developments that could influence the nanotechnology market – Impact for Future technologies.

**Module V:** Relationship b/w technology development and new business creation– the company concepts– new technology–new opportunity– sole proprietorships– general and limited partnerships– professional and closed corporations

### Examination Scheme:

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

### Text and References:

1. Sherron Sparks, “Nanotechnology: Business Applications and Commercialization,” CRC Press, Taylor & Francis group, London 2012.
2. Jeffrey. H, Matsuura” Nanotechnology Regulation and Policy Worldwide”, Artech House; 1 Ed., 2006.
3. “Nanotechnology developments in India – A status repor”t, The Energy and Resources Institute (TERI), India 2009.

**IPR & Drug Regulatory Affairs****Course Code: INN 805****Credit Units: 03**

**Course Objective:** Various types of Intellectual Property Rights Patentable Subject History of Indian Patent Protection, Patent filing procedure in India, Opposition- pre-grant opposition and post-grant opposition, Patent filing procedure under PCT, advantages, patent search and literature and Salient features of Indian Patents are discussed in detail.

**Module I** Introduction, Types of Intellectual Property Rights (Patents, Trademarks, Copyrights, Geographical Indications Industrial Designs and Trade secrets), Patentable Subject Matter (Novelty, NonObviousness, Utility, enablement and Best mode)

**Module II** History of Indian Patent Protection, Rationale behind Patent System, Objectives and Advantages of Patent System, and future challenges. Indian Patents Act 1970, Definitions and Key Terminology, Types of Patent applications, Inventions not patentable (section 3 and 4).

b) Patent filing procedure in India (Patent Prosecution), Specifications (Provisional and Complete), Claims- types of claims and legal importance of claims, Grant of patent, Rights of Patentee and coowners

c) Opposition- pre-grant opposition and post-grant opposition, Anticipation, Infringement, Compulsory Licensing, revocation of patents, and power of Controller.

d) Patent filing procedure under PCT, advantages, patent search and literature

**Module III**

a) Salient features of Indian Patents (Amendments) Act 1999, 2002 and 2005. US and European Patent System,

b) Background, Salient Features and Impact of International Treaties / Conventions like

i. Paris Convention, Berne convention

ii. World Trade Organization (WTO)

iii. World Intellectual Property Organization (WIPO)

iv. Trade Related Aspects of Intellectual Property Rights (TRIPS)

v. Patent Co-operation Treaty (PCT), Madrid Protocol

**Module IV** Pharmaceutical Regulatory Procedures in India: Hierarchy and working flow of FDA in India, Role of DCGI / CDSCO in drug control, Drug Control Authority and its documentation in the state.

**Module V** National drug regulatory requirements, national drug policy, drug and cosmetic act and rules, over view of schedule M, schedule Y, US FDA guidelines on IND, new drug approvals(NDA), ANDA approvals, SUPAC Changes, SNDA & post marketing surveillance. Overview of GMP, GLP, ISOs- Production design, certification.

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
Weightage (%)	15	5	10	70

**Suggested Books:**

1. Drug Regulatory Affairs by Dr. N.S. Vyawahare and SachinItkar, NiraliPrakashan.
2. Pharmaceutical Regulatory Affairs by C.V.S. Subrahmanyam & J. ThimmaSetty, VallabhPrakashan.
3. Quality Assurance of Pharmaceutics Vol I & II of WHO publications, 1999.
4. GMPs by Mehra
5. How to Practice GMP by P.P.Sharma.
6. GMP of Pharmaceutics by Willing and Stoker.
7. Good Manufacturing Practices for Pharmaceutics, S.H. Wiling, Vol. 78, Marcel Decker.
8. Drugs and Cosmetics act by Vijay Malik.

## Nanomedicine and Nanotoxicology Lab

Course Code: INN821

Crédits : 01

### List of experiments:

1. Mutagenicity of inorganic nanoparticles
2. Mutagenicity of organic nanoparticles
3. Assess DNA damage due to NPs exposure.
4. Cell viability testing using organic NPs
5. Cell viability testing using inorganic NPs

### Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**Optoelectronic Devices Lab**

Course Code: INN822

Crédits : 01

**List of experiments:**

1. Synthesis of Quantum dots using III-V group of semiconductor.
2. Synthesis of ZnO/ZnS quantum dots and core/shell heterostructures.
3. Study of energy band gap of quantum dots using four probes method.
4. I-V characteristics of quantum dots and heterostructures.
5. Structural Characterization of quantum dots and heterostructures.
6. Optical Characterization of quantum dots and heterostructures.
7. Optoelectronics device fabrication using quantum dots and heterostructures.

**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

## Nanocomposites Lab

Course Code: INN823

Crédits : 01

### List of experiments:

1. Synthesis of polymer based Nanocomposite using nanofillers  
CNT/Graphene/nanoferrites
2. Electrical Characterization of Nanocomposites.
3. Structural Characterization of Nanocomposites.
4. Mechanical Characterization of Nanocomposites.
5. Dielectric Characterization of Nanocomposites.
6. Morphological Characterization of Nanocomposites.
7. Tribological Characterization of Nanocomposites.

### Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

## Waste water treatment

**Course Code: IET 801**

**L:3, T:0, P:2, C:3**

**Course Objectives:** The objective of this course is to provide comprehensive knowledge and understanding on technologies for wastewater characterization and treatment. The course will largely cover topics including the basic philosophy of wastewater treatment, principles of various wastewater treatment units, conventional treatment systems, advanced treatment processes, sludge management and industrial wastewater generation and treatment.

**Prerequisites:** Basic understanding about water pollution and sources of wastewater emission.

**Course Contents:**

**Module 1: Wastewater Characteristics with Disposal Standards, Wastewater Quantity Estimation and Collection System**

Introduction, Sources and Types of Wastewater, Pollutants in Wastewater: Point and Non-point Sources. Physical Characteristics, Chemical Characteristics, Biological Characteristics of Wastewater, Disposal standards. Water demand for various purposes, Estimation of sewage quantity, Variation in quantity of sewage with problems. Collection Systems: Municipal Sewers, Sewer Appurtenances, Sanitary and storm sewerage systems, pumping systems.

**Module 2: Domestic Wastewater Treatment**

Domestic Wastewater Treatment: Pre, Primary and secondary treatment with process description and design; Physical Unit Processes Screening; Commutation; Grit Removal; Equalization; Sedimentation; Chemical Unit Processes Coagulation and Flocculation, Primary Sedimentation; Biological Unit Processes. Aerobic treatment; Suspended growth aerobic treatment processes; Activated sludge process and its modifications; Attached growth aerobic processes; Tricking filters and Rotating biological contactors; Anaerobic treatment; suspended growth, attached growth, fluidized bed and sludge blanket systems.

**Module 3: Introduction to sludge management**

Sludge Quantity and Characteristics; Sludge Processing and Treatment Thickening; Digestion; Stabilization; Conditioning; Dewatering; Sludge drying; Composting; Disposal and Reuse

**Module 4: Tertiary and Alternate Wastewater Treatment**

Need and Objectives of advanced treatment; Nutrient Removal: Nitrification, denitrification; Phosphorus removal; Adsorption and Ion-exchange; Membrane processes; Disinfection and chemical treatment Alternate Methods of Treatment: Phytoremediation; Root Zone Treatment; SBR and SSBR; MBR and MBBR.

**Module 5: Industrial Effluent Management**

Process, Treatment, by-product recovery and reuse in the following industries: Sugar, Paper and Pulp, Tanning, Textile, Dairy and Petroleum Refinery.

**Examination Scheme:**

Components	CT	HA/S/V/Q	Attendance (A)	EE
Weightage (%)	15	10	5	70

**Text & References:**

- “Wastewater Engineering - Treatment and Reuse”, Metcalf and Eddy Inc., (2003), 4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
- “Wastewater Treatment Concepts and Design Approach”, Karia G.L., and Christian R.A., (2001), Prentice Hall of India Pvt. Ltd., New Delhi.

## **Environmental pollution and legislation**

**Course Code: IET 802**

**L:3, T:0, P:2, C:3**

**Course Objectives:** This course is envisioned to aware the students regarding the problem of environmental pollution and Law as a means of prevention of environmental pollution and protection of environment; to explore the development of international environmental law and its application in India for the protection of environment; to make the students aware about the provisions under the Indian Constitution for protection of environment and the various legislative measures. It also provides an opportunity to the students to understand the activist role played by Indian Judiciary in protection of environment and evolution of different principles such as polluter pay principle, precautionary principle, inter-generational equity and sustainable development.

**Prerequisites:** Basic knowledge of environment, pollution and protection.

### **Course Contents:**

#### **Module I: Introduction**

Meaning, Definition and Concept of Environment: Components of Environment, Biosphere and Ecosystem, Types of Environment.

Concept of Pollution – Sources of Pollution, Types of Pollution, and Effects of Pollution.

Nature and Scope of Environmental Law; Importance, Law as a tool for Environmental Protection.

#### **Module II: International Law and Environmental Protection**

History and Development of Environmental Protection under International Law; Major international instruments for environmental protection.

Fundamental Principles of International Environmental Law. United Nations Conference on Human Environment, 1972 (Stockholm Conference): Aims and Objectives of the Conference, Stockholm Declaration, 1972, Impact of Stockholm, UNEP, Vienna Convention & Montreal Protocol, World Charter for Nature, 1982.

WCED: The Brundtland Commission, Brundtland Report 1987.

United Nations Conference on Environment and Development (UNCED/Earth Summit): Aims and Objectives of Conference, Rio Declaration 1992, Agenda 21, Convention on Biological Diversity, 1992, Statement of Forest Principles, UNFCCC.

Earth Summit Plus Five - Kyoto Protocol, 1997; Millennium Development Goals. Johannesburg Conference 2002 (WSSD): Johannesburg Declaration & Major Outcomes.

#### **Module III: Protection of Environment under the Indian Constitution**

Introduction – Indirect Provisions, International Obligations, 42nd Constitution Amendment Act, 1976.

Directive Principles of State Policy - Fundamental Duties

Development of Fundamental Right to Environment - Judicial Role, Expansion of Locus Standi, PIL, Constitutional Remedy for Protection of Environment, Dynamic Interpretation of Article 21, 14 & 19 of the Constitution

Right to Wholesome Environment – Right to Clean and Pollution-free Environment, Right to Sweet Water

Incorporation of International Principles under Indian Constitution – Sustainable Development - Precautionary and Polluter Pays Principles, Absolute and Strict Liability, Doctrine of Public Trust, Inter-Generational Equity

#### **MODULE IV: Protection of Water, Air and Environment in India**

The Water (Prevention and Control of Pollution) Act of 1974 - The Framework of the Act, Regulatory Mechanism: Its Powers and Functions, Offences and Penalties under Water Act, Role of Judiciary in Prevention of Water Pollution – An appraisal

The Air (Prevention and Control of Pollution) Act of 1981 - The Framework of the Act, Regulatory Mechanism: Its Powers and Functions, Offences and Penalties under Air Act, Role of Judiciary in Prevention of Air Pollution – An appraisal.

The Environment Protection Act (EPA) of 1986 - Main Aims and Objectives of the Act, importance of Section 3 and 5 of EPA, Violation and Penalties under the Act – EIA Notifications – An appraisal d. Hazardous Waste Management and Handling Rules, 1989; Municipal Solid Waste Management and Handling Rules 2000; Biomedical Waste Management and Handling Rules 1998; Noise Pollution Regulation and Control Rules 2000. Importance of Forest and need for its Conservation, Indian Forest Act, 1927 and its Salient Features, Forest Conservation Act, 1980 and its Salient Features, Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 and its salient features, Judicial Approach for Forest Conservation.

The Wildlife Protection Act 1972 - Sanctuaries and National Parks, Licensing of Zoos and Parks, State Monopoly in the Sale of Wild Life and Wild Life Articles, Offences against Wild Life.

Biodiversity Conservation - Biological Diversity Act, 2002 and its Salient Features

### **MODULE V: Emerging Issues in Environmental Law**

Environment Impact Assessment – Definition and Meaning, Types: Mandatory and Discretionary Global Warming and Climate Change – Nature and Causes, Legal Framework: International and National Responses. Natural Resources Accounting. National Green Tribunal Act 2010- An Appraisal

#### **Examination Scheme:**

<b>Components</b>	<b>CT</b>	<b>HA</b>	<b>S/V/Q</b>	<b>A</b>	<b>EE</b>
<b>Weightage (%)</b>	15	5	5	5	70

#### **Text & References:**

1. D.K. Asthana and Meera Asthana, Environment Problems and Solutions, (2nd Edn.), S.Chand & Co. Ltd., New Delhi, 2001 {Chapter 1}. Ecology of Natural resources – Ramade
2. S.C. Shastri, Environmental Law, (3rd Edn.), Eastern Book Company, Lucknow, 2008.
3. Maheshwara Swamy, Textbook on Environmental Law, (2nd Edn.), Asia Law House, Hyderabad, 2008.
4. Amod S. Tilak, Environmental Law, (1st Edn.), Snow White Publication, Mumbai.
5. I.A. Khan, Environmental Law, (2nd Edn.), Central Law Agency, Allahabad, 2002.
6. S. Shantakumar, Introduction to Environmental Law, (2nd Edn.), Wadhwa & Company, Nagpur, 2005.
7. Maheshwara Swamy, Textbook on Environmental Law, (2nd Edn.), Asia Law House, Hyderabad, 2008 {Chapter 1- XI}.
8. S.C. Shastri, Environmental Law, (3rd Edn.), Eastern Book Company, Lucknow, 2008 {Chapter 1}.
9. S. Shantakumar, Introduction to Environmental Law, (2nd Edn.), Wadhwa & Company, Nagpur, 2005 {Chapter 5}.
10. Shyam Divan and Armin Rosencranz , Environmental Law and Policy in India, Oxford University Press, New Delhi, 2005 {Chapter 2}.
11. Shyam Divan and Armin Rosencranz, Environmental Law and Policy in India, Oxford University Press, New Delhi, 2005.
12. Maheshwara Swamy, Textbook on Environmental Law, (2nd Edn.), Asia Law House, Hyderabad, 2008.
13. P Leelakrishnan, Environmental Law in India, (2nd Edn.), Lexis Nexis, New Delhi, 2005.

# Environmental Engineering

**Course Code: IET 803**

**L:3,T:0, P:2, C:3**

**Course Objectives:** This course is intended to impart knowledge of environment and different types of pollution, causes and preventive measures against different type of pollutions.

**Learning outcomes:** On completion of this course, the students will be able to comprehend importance of environment and different types of pollution, causes and preventive measures against air pollution, water pollution, soil pollution and noise pollution.

**Prerequisites:** Basic knowledge of Science, Environment and its components.

**Course Contents:**

## **Module I: Introduction**

Introduction: Overview of socio-economic structure and occupational exposures to human; pollution problems due to urbanization & industrialization; Scope of Environmental Engineering.

## **Module II: Air and Environment**

Air Pollution: Causes, types & sources of air pollutants; Climatic & Meteorological effect on air pollution concentration- formation of smog and fumigation. Analysis of Air Pollutants: Collection of Gaseous Air Pollutants; Collection of Particulate Pollutants; Analysis of Air Pollutants such as Sulphur dioxide, Nitrogen oxide, Carbon monoxide, Oxidants, Ozone, Hydrocarbons, Particulate Matter. Air Pollution Control Measures and Equipment: Control of Particulate Emission; Control of Gaseous Emission; Flue Gas Treatment Methods: Stacks Gravitational and Inertial Separation, Settling Chambers, Dynamic Separators, Cyclones, Filtration, Liquid Scrubbing, Spray Chambers, Packed Towers, Orifice and Ventury Scrubbers, Electrostatic Precipitators, Gas/solid Adsorption, Thermal Decomposition. Methods and Approach of Air Pollution Control: Controlling smoke nuisance; Develop air quality criteria and practical emission standards; Creating zones suitable for industry based on micrometeorology of air area; Introducing artificial methods of removal of particulate and matters of waste before discharging to open atmosphere.

## **Module III: Water and Environment**

Water Sources: Origin of waste water; Types of water pollutants and their effects. Different sources of water pollution: Biological Pollution (point & non-point sources); Chemical Pollutants: Toxic Organic & Inorganic Chemicals; Oxygen demanding substances; Physical Pollutants: Thermal Waste, Radioactive waste; Physiological Pollutants: Taste affecting substances, other forming substances. Effect of Water Pollution & Its Control: Adverse effects on Human Health & Environment, Aquatic life, Animal life, Plant life; Water Pollution Measurement Techniques; Water Pollution Control Equipment & Instruments; Indian Standards for Water Pollution Control.

## **Module IV: Soil and Environment**

Soil Polluting Agencies and Effect of Solution: Liquid & Solid Wastes; Domestic & Industrial Wastes; Pesticides; Toxic: Inorganic & Organic Pollutants; Soil Deterioration; Poor Fertility, Septicity, Ground Water Pollution, Concentration of Infecting Agents in Soil Solid Waste Disposal: Dumping domestic & Industrial Solid Wastes: Advantages & Disadvantages; Incineration: Advantages & Disadvantages; Sanitary Land Field: Advantages & Disadvantages; Management of Careful & Sanitary Disposal of Solid Wastes.

## **Module V: Noise and Environmental Management System**

Noise pollution and control: Noise Pollution: Intensity, Duration; Types of Industrial Noise; Ill effects of Noise; Noise Measuring & Control; Permissible Noise Limits.

**Examination Scheme:**

<b>Components</b>	<b>CT</b>	<b>HA</b>	<b>S/V/Q</b>	<b>A</b>	<b>EE</b>
<b>Weightage (%)</b>	15	5	5	5	70

**Text & References:**

14. Ecology and Environment- P.D. Sharma
15. Ecology of Natural resources – Ramade
16. Fundamentals of Ecology: E. P. Odum
17. Modern concepts in Ecology: H. D. Kumar
18. Environmental Chemistry: A.K. De
19. Water Supply & Waste Water: D. Lal
20. Pollution Control Acts, Rules and Notification / Central Pollution Control Board, New Delhi
21. Heinsohn, R.J., Kabel, R.L., Sources and Control of Air Pollution, Prentice-Hall, 1999.
22. Wisner, B., Blaikie, P., Cannon, T. and Davis, I. (2004). At Risk 2nd Edition: Natural Hazards, People's Vulnerability and Disasters. Routledge.
23. Uberoi N.K. (2002). Environmental Management, New Delhi, Excel Books

## Separation Processes in Environmental Applications

**Course Code: IET 804**

**L:3, T:0, P:2, C:3**

**Course Objectives:** This course covers the general principles of separation by equilibrium and rate processes. Topics include staged cascades and applications to distillation, absorption, adsorption, and membrane processes. Phase equilibria and the role of diffusion are also covered.

**Learning outcomes:** On completion of this course, the students would be able to understand the separation principles of biphasic and triphasic systems, to design a process based on separation principles, appropriate application of separation steps in industrial processes and to compute the kinetics of various types of separation processes.

**Prerequisites:** Basic knowledge of environment, pollution and protection.

### Course Contents:

#### Module I: Introduction

Pollution sources, Environmental separations, Historic perspective of environmental pollution, Separation mechanisms, Equilibrium-based processes, Rate-based processes  
Countercurrent operation, Productivity and selectivity, separating agents

#### Module II:

Degrees of freedom analysis, Phase equilibrium, Equilibrium-limited analysis, Minimum number of stages, Rate-limited processes, Batch and Continuous distillation, Extraction in Environmental applications, Leaching processes, McCabe–Thiele analysis

#### Module III:

Absorption and stripping, packed columns, Adsorption principles, Sorbent selection-regeneration, Transport processes, Process design factors, Design of fixed-bed adsorber.

#### MODULE IV:

Ion exchange- Objectives, Environmental applications, Ion-exchange mechanisms, Ion exchange media, Equipment and design procedures; Extraction and leaching.

#### MODULE V:

Membranes-Merits and demerits of membrane processes, membrane materials, membrane modules, Environmental applications, Separation mechanisms-Membrane processes, membrane performance.

### Examination Scheme:

Components	CT	HA	S/V/Q	A	EE
Weightage (%)	15	5	5	5	70

### Text & References:

1. Noble, R.D and Terry P.A., Principles of Chemical Separations with Environmental Applications, Cambridge University Press, 2004.
2. Treybal R E, Mass Transfer Operations, McGraw Hill 1981.
3. Seader J D and Henley E J, Separation Processes Principles, 3rd Edition, John Wiley&Sons, 2011.
4. Separation process- Principles – J.D.Seader, Ernest.J. Henley, John Wiely & Sons
5. Green separation processes- C. A. M. Afonso, J. G. Crespo (Ed)- Wiley VCH
6. Transport processes and unit operations – Christie J. Geankoplis- Prentice Hall International
7. Principles of mass transfer and separation processes- B.K.Dutta- PHI Learning
8. Separation processes- C.J.King –Mc Graw Hill

**IPR & Drug Regulatory Affairs****Course Code: IET 805****Credit Units: 03**

**Course Objective:** Various types of Intellectual Property Rights Patentable Subject History of Indian Patent Protection, Patent filing procedure in India, Opposition- pre-grant opposition and post-grant opposition, Patent filing procedure under PCT, advantages, patent search and literature and Salient features of Indian Patents are discussed in detail.

**Module I** Introduction, Types of Intellectual Property Rights (Patents, Trademarks, Copyrights, Geographical Indications Industrial Designs and Trade secrets), Patentable Subject Matter (Novelty, NonObviousness, Utility, enablement and Best mode)

**Module II** History of Indian Patent Protection, Rationale behind Patent System, Objectives and Advantages of Patent System, and future challenges. Indian Patents Act 1970, Definitions and Key Terminology, Types of Patent applications, Inventions not patentable (section 3 and 4).

b) Patent filing procedure in India (Patent Prosecution), Specifications (Provisional and Complete), Claims- types of claims and legal importance of claims, Grant of patent, Rights of Patentee and coowners

c) Opposition- pre-grant opposition and post-grant opposition, Anticipation, Infringement, Compulsory Licensing, revocation of patents, and power of Controller.

d) Patent filing procedure under PCT, advantages, patent search and literature

**Module III**

a) Salient features of Indian Patents (Amendments) Act 1999, 2002 and 2005. US and European Patent System,

b) Background, Salient Features and Impact of International Treaties / Conventions like

i. Paris Convention, Berne convention

ii. World Trade Organization (WTO)

iii. World Intellectual Property Organization (WIPO)

iv. Trade Related Aspects of Intellectual Property Rights (TRIPS)

v. Patent Co-operation Treaty (PCT), Madrid Protocol

**Module IV** Pharmaceutical Regulatory Procedures in India: Hierarchy and working flow of FDA in India, Role of DCGI / CDSCO in drug control, Drug Control Authority and its documentation in the state.

**Module V** National drug regulatory requirements, national drug policy, drug and cosmetic act and rules, over view of schedule M, schedule Y, US FDA guidelines on IND, new drug approvals(NDA), ANDA approvals, SUPAC Changes, SNDA & post marketing surveillance. Overview of GMP, GLP, ISOs- Production design, certification.

**Examination Scheme:**

Components	CT	Attendance	Assignment/ Project/Seminar/Quiz	EE
<b>Weightage (%)</b>	15	5	10	70

**Suggested Books:**

1. Drug Regulatory Affairs by Dr. N.S. Vyawahare and SachinItkar, NiraliPrakashan.
2. Pharmaceutical Regulatory Affairs by C.V.S. Subrahmanyam & J. ThimmaSetty, VallabhPrakashan.
3. Quality Assurance of Pharmaceutics Vol I & II of WHO publications, 1999.
4. GMPs by Mehra
5. How to Practice GMP by P.P.Sharma.
6. GMP of Pharmaceuticals by Willing and Stoker.
7. Good Manufacturing Practices for Pharmaceuticals, S.H. Wiling, Vol. 78, Marcel Decker.
8. Drugs and Cosmetics act by Vijay Malik.

## Wastewater Treatment Lab

Course Code: IET821

Credits: 01

### List of Experiments:

- Physical Characterization of Wastewater
- Chemical Characterization of Wastewater
- Biological Characterization of Wastewater
- Physical treatment of sewage (lab scale)
- Chemical treatment of sewage (lab scale)
- Biological treatment of sewage (lab scale)

### Examination Scheme:

Components	Mid Sem	Q/A	Attendance (A)	EE
Weightage (%)	15	10	5	70

### Text & References:

- APHA. 1998. Standards Methods for the Examination of Water and Wastewater. 20th edition, American Public Health Association, Washington, D.C.
- Trivedy, R. K., and P. K. Goel. Chemical and biological methods for water pollution studies. Environmental publications, 1984.

**Environmental Pollution and legislation Lab****Course Code: IET822****Credits: 01****Cases: Protection of Environment under the Indian Constitution**

- i. Municipal Council, Ratlam vs. Vardichand (1980 (4) SCC 162
- ii. Rural Litigation and Entitlement Kendra, Dehradun vs. State of Uttar Pradesh (AIR 1988 SC 2187).
- iii. Subhash Kumar vs. State of Bihar (AIR 1991 SC 420).
- iv. Virender Gaur vs. State of Haryana (1995 (2) SCC 577).
- v. T. Damodar Rao vs. The Special Officer, Municipal Corporation of Hyderabad (AIR 1987 AP 171).
- vi. A.P. Pollution Control (II) vs. Prof. M. V. Nayadu, (1999) 2 SCC 718; (2001) 2 SCC62.
- vii. Olga Tellis vs. Bombay Municipal Corporation (AIR 1986 SC 180).
- viii. Banvasi Seva Ashram vs. State of Uttar Pradesh (AIR 1987 SC 374).
- ix. State of Uttar Pradesh vs. Raj Narain (AIR 1975 SC 865).
- x. S.P. Gupta vs. Union of India, (AIR 1982 SC 149).
- xi. Reliance Petrochemicals Ltd. vs. Proprietors of Indian Express Newspapers Bombay Pvt. Ltd. (AIR 1989 SC 190).
- xii. M.C. Mehta vs. Kamal Nath (AIR 2000 SC 1997).

**Cases: Protection of Water, Air and Environment in India**

- i. A.P. Pollution Control Board vs. Prof. M.V. Nayudu, (2001 (2) SCC 62).
- ii. Bombay Environmental Action Group vs. State of Maharashtra, (AIR 1991 Bom 301).
- iii. Indian Council for Enviro-Legal Action vs. Union of India, (1996 (3) SCC 212).
- iv. S. Jagannath vs. Union of India (Shrimp Culture Case) (AIR 1997 SC 811).
- v. Goa Foundation vs. Konkan Railway Corporation, (AIR 1992 Bom.171).
- vi. Vellore Citizens Welfare Forum vs. Union of India, (AIR 1996 SC 2715).
- vii. Narula Dyeing and Printing vs. Union of India, (AIR 1995 Guj. 185).
- viii. M.C. Mehta vs. Union of India, (Shriram Food and Fertilizer Case) (1986) 2 SCC 176).
- ix. Ganga Pollution Cases

**Cases: Protection of Forest, Wild Life and Biodiversity**

- i. T.N. Godavarman Thirumulpad vs. Union of India, (2001 (10) SCC 645)
- ii. Banvasi Seva Ashram vs. State of Uttar Pradesh, (1987 (3) SCC 304)
- iii. Tarun Bharat Sangh, Alwar vs. Union of India, (1998 supp (3) SCC 115
- iv. Pradip Krishnan vs. Union of India, (1996 (8) SCC 599)
- v. Indian Handicraft Emporium vs. Union of India, (AIR 2003 SC 3240)
- vi. Animal and Environmental Legal Defence Fund vs. Union of India, (AIR 1997 SC 1070)
- I. Centre for Environmental Law WWF-1 vs. Union of India, (AIR 1999 SC 354)
- II. Rural Litigation Entitlement Kendra vs. State of Uttar Pradesh, (AIR 1988 SC 2187)
- III. Fatesang Gimba Vasava vs. State of Gujarat, (AIR 1987 Guj. 9)
- IV. Ivory Traders and Manufacturers Association vs. Union of India, (AIR 1997 Del 267)

**Examination Scheme:**

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

**Text & References:**

1. P Leelakrishnan, Environmental Law in India, (2nd Edn.), Lexis Nexis, New Delhi, 2005.
2. R.A. Malviya, 'International Regulation of Global Warming: Problems and Prospects', The Banaras Law Journal, Vol. 31, Jan. 2002.
3. Anwar Sadat, 'Some Legal Aspects of Bali Summit on Climate Change' Indian Journal of International Law, Vol. 48, No. 1, JanMarch 2008.
4. Gianluca Rubagotti, 'The Clean Development Mechanism: Establishing a Regulatory Framework to Favour Climate-Friendly Investments in Developing Countries', Indian Journal of International Law, Vol. 46, No. 2, April-June 2006.
5. Krushna Chandra Jena, 'Ecological and Environmental Protection Movements: A Brief Conspectus', AIR 2005 Journal 288.
6. Venkatesh Vijayaraghavan, 'Implementation of the Biodiversity Convention in India and Canada', 2001 Indian Journal of Environmental Law, 21, Vol.2.
7. K.C. Leelavathy, 'Global Warming: A Global Concern', Peace and Development Digest, New Delhi, Vol. 5 No. 3-4, 2000.Montreal Protocol, 1987
8. Rio- Declaration, 1992
9. Kyoto Protocol, 1997
10. Johannesburg Declaration on Sustainable Development, 2002
11. UN Framework Convention on Climate Change, 1992
12. Copenhagen Accord, 2010.

## Environmental Engineering Lab

**Course Code: IET823**

**Credits: 01**

### List of Experiments

1. Studies on isolation of microorganism for wastewater treatment.
2. Sampling and analysis of air pollutants ambient and stacks (SPM, RPM, SO<sub>2</sub>, NOX and CO).
3. Physiochemical analysis of solid wastes.
4. Design of clarifier by using the data obtained through batch sedimentation.
5. Coagulation and flocculation for removal of suspended solids from water.
6. Water softening.
7. Biological aerobic treatment for removal of organic pollutants and determination of sludge volume index.
8. Studies on treatment of effluents using electrochemical reactor.
9. Batch adsorption studies using activated carbon and dye.
10. Treatment of waste water by Advanced Oxidation Technology

### Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

### Text &References:

1. Lab Book on General Chemistry. LAP LAMBERT Academic Publishing, OmniScriptum GmbH & Co. KG, Germany ISBN 9783-659-52374-8. 2014. Era Upadhyay.
2. Handbook of environmental management and technology: Gwendolyn Holmes.

## Separation Processes in Environmental Applications Lab

**Course Code: IET824**

**Credits: 01**

### List of Experiments

1. Simple Distillation: Verification of Rayleigh's Law
2. Simple Distillation: Temperature-Composition Relationship
3. Batch Distillation using Packed Column (Constant R)
4. Continuous Distillation using Tray Column (Different R)
5. Distillation Pilot Plant Line-Tracing and Case Study
6. Distillation Pilot Plant Operation using DCS (DeltaV)
7. Dynamic Simulation of Continuous Distillation Operation
8. Dynamic Simulation of Integrated Distillation Processes
9. Gas Absorption using 3 Packed Columns

### Examination Scheme:

IA			EE			
Class Test (Practical Based)	Mid Term Viva	Attendance	Major Experiment	Minor Experiment/Spotting	Practical Record	Viva
15	10	05	35	15	10	10

### Text & References:

1. Seader J D and Henley E J, Separation Processes Principles, 3rd Edition, John Wiley&Sons, 2011.
2. Separation process- Principles – J.D.Seader, Ernest.J. Henley, John Wiely &Sons
3. Principles of mass transfer and separation processes- B.K.Dutta- PHI Learning
4. Separation processes- C.J.King –Mc Graw Hill
5. <http://www.separationprocesses.com>

**COMMUNICATION SKILLS - VI****Course Code: BCS 801****Credit Units: 01****Course Objective:**

The modules are designed to enhance the communicative competence of the learners to equip them with efficient interpersonal communication.

**Course Contents:****Module I: Dynamics of Group Discussion**

Introduction,  
Methodology  
Role Functions  
Mannerism  
Guidelines

**Module II: Communication through Electronic Channels**

Introduction  
Technology based Communication Tools  
Video Conferencing  
Web Conferencing  
Selection of the Effective Tool  
E-mails, Fax etc.

**Module III: Effective Public Speaking**

Types  
Essentials  
Success in Public Speaking  
Dos and Don'ts

**Examination Scheme:**

Components	CT1	CT2	CAF	V	GD	GP	A
Weightage (%)	20	20	25	10	10	10	5

CAF – Communication Assessment File

GD – Group Discussion

GP – Group Presentation

**Text & References:**

- Jermy Comfort, Speaking Effectively, et.al, Cambridge.
- Krishnaswamy, N, Creative English for Communication, Macmillan.
- Raman Prakash, Business Communication, Oxford.
- Taylor, Conversation in Practice.

# UNDERSTANDING SELF FOR EFFECTIVENESS – VIII (POSITIVE PERSONAL GROWTH)

**Course Code:** BSS805

**Credit Units:** 01

**Course Objective:**

- To have a great deal of insight into one's character.
- Understanding of positive emotions
- To explore the dimensions of happiness, well-being, Optimism and hope
- Quick understanding of different situations and grasp new concepts.

**Course Contents:**

**Module I: Positivity in personality**

Importance of Positivity in personality

Positivity Vs Negativity

Introspection and personal growth

**Module II: Positive Emotions**

Understanding positive emotions

Importance of Positive emotion

Types and identification of positive emotions (Love, happiness, Contentment, Resilience, etc.)

**Module III: Hope, Optimism and Resilience**

Positive approach towards future

Benefits of Positive approach

Resilience during challenge and loss

**Module IV: Application of Positive Emotions**

Application of positive emotions in relationships, and organizations

Creating healthy organizational climate

Positive emotions enhances performance

**Module V: Happiness and Well Being**

Concept of Happiness & Well-Being

Secret of happy mind and healthy life

Work life balance

**Module VI: End-of-Semester Appraisal**

Viva based on personal journal

Assessment of Behavioral change as a result of training

Exit Level Rating by Self and Observer

**Text & References:**

- Raman, A.T. (2003) Knowledge Management: A Resource Book. Excel Books, Delhi.
- Kamalavijayan, D. (2005). Information and Knowledge Management. Macmillan India Ltd. Delhi

**FRENCH - VIII****Course Code:** FLT 801**Credit Units:** 02**Course Objective:**

Provide students with the necessary linguistic tools

- to face up to different situations of communication
- to enhance their capacity in oral/written comprehension/expression

**Course Contents:****Module B: Unités 4, 5, 6: PP. 48 - 86**

**Contenu lexical: Unité 4:**

1. Présenter une information/les circonstances d'un événement
2. Exprimer la possibilité/la probabilité
3. Exprimer une quantité indéfinie
4. Comprendre et raconter un fait div

**Unité 5:**

1. Parler d'une passion, d'une aventure
2. Choisir/créer
3. Exprimer la surprise/des sentiments

**Unité 6:**

1. Exprimer la cause et la conséquence
2. Exprimer la crainte et rassurer
3. Faire une démonstration

**Contenu grammatical:**

1. la construction passive
2. la forme impersonnelle
3. l'interrogation
4. les adjectifs et les pronoms indéfinis
5. les pronoms interrogatifs et démonstratifs
6. la construction avec deux pronoms
7. le subjonctif dans l'expression des sentiments, de la crainte, du but
8. constructions permettant l'expression de la cause et de la conséquence
9. l'enchaînement des idées : succession et opposition

**Examination Scheme:**

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & Références:**

- le livre à suivre : Campus: Tome 2

# GERMAN - VIII

Course Code: FLG 801

Credit Units: 02

## Course Objective:

To enable the students to converse, read and write in the language with the help of the basic rules of grammar, which will later help them to strengthen their language.

To give the students an insight into the culture, geography, political situation and economic opportunities available in Germany

Introduction to Advanced Grammar and Business Language and Professional Jargon

## Course Contents:

### Module I: Reading and comprehension

Reading texts and comprehending them

### Module II: Information about German History

Acquiring information about German History through appropriate texts and stories

### Module III: Bio data/Curriculum vitae

Writing a bio-data in the proper format with all essential components

### Module IV: Informal letters

Reading and writing informal letters

### Module V: Business etiquette

Business etiquette in Germany and types of companies

### Module VI: Interview skills

To learn to face interviews

Read a text 'Interviewspiel'

### Module VII: Picture Description

Firstly recognize the persons or things in the picture and identify the situation depicted in the picture;

Secondly answer questions of general meaning in context to the picture and also talk about the personal experiences which come to your mind upon seeing the picture.

## Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

## Text & References:

- Wolfgang Hieber, Lernziel Deutsch.
- Hans-Heinrich Wangler, Sprachkurs Deutsch.
- Schulz Griesbach, Deutsche Sprachlehre für Ausländer.
- P.L Aneja, Deutsch Interessant- 1, 2 & 3.
- Rosa-Maria Dallapiazza et al, Tangram Aktuell A1/1, 2.
- Braun, Nieder, Schmöe, Deutsch als Fremdsprache 1A, Grundkurs.

# SPANISH – VIII

Course Code: FLS 801

Credit Units: 02

## Course Objective:

To enable students to deal with Spanish situations putting things in perspective, using Past Tense. Enabling them to comprehend and form slightly complex sentences. Give students vocabulary of various situations.

## Course Contents:

### Module I

Situational exercises/Picture Description:

At the cine

At the Chemist's/Hospital

### Module II

At a corporate client's informal/formal meeting/gathering

Looking for accommodation

### Module III

Past Tense (Indefinido) of regular verbs

Past Tense (Indefinido) of irregular verbs

Exercises related to the above

### Module IV

Past Tense (Imperfecto)

## Examination Scheme:

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

## Text & References:

- Español En Directo I A, 1B.
- Español Sin Fronteras.
- Material provided by the teacher from various sources.

**CHINESE – VIII****Course Code: FLC 801****Credit Units: 02****Course Objective:**

Paper was first invented in China in 105 AD. It was a closely guarded secret and didn't reach Europe until the 8<sup>th</sup> Century. The course aims at familiarizing the student with the basic aspects of speaking ability of Mandarin, the language of Mainland China. The course aims at training students in practical skills and nurturing them to interact with a Chinese person.

**Course Contents:****Module I**

Drills

Dialogue practice

Observe picture and answer the question.

The aspect particle “le” and the modal particle “le”.

**Module II**

Optative verbs

Texts based on different topics

Enriching vocabulary by dealing with various daily scenarios and situations.

**Module III**

Sentences with subject predicate construction as its predicate

Pronunciation and intonation

Character writing and stroke order

**Module IV**

About china Part I Lesson 2,3

Chinese to English and English to Chinese translations from the news paper.

**Module V**

Questions with an interrogative pronoun

Essays, writing formal letters.

Conversation practice.

**Examination Scheme:**

Components	CT1	CT2	C	I	V	A
Weightage (%)	20	20	20	20	15	5

C – Project + Presentation

I – Interaction/Conversation Practice

**Text & References:**

- “Kan tu shuo hua” Part-I Lesson 8-13.

**MAJOR PROJECT -ICT 960 IX & X – SEMESTER****Course Code : ICT 960****Course Unit: 40****Course objective**

Final year project dissertation is an opportunity for the students to undertake a research project in industry or research institute in the area of their interest. Preferably the project should have converging technology approach along with the core domain.

**Course Content****PROJECT FILE**

Research experience is as close to a professional problem-solving activity as anything in the curriculum. It provides exposure to research methodology and an opportunity to work closely with a faculty guide. It usually requires the use of advanced concepts, a variety of experimental techniques, and state-of-the-art instrumentation.

Research is genuine exploration of the unknown that leads to new knowledge which often warrants publication. But whether or not the results of a research project are publishable, the project should be communicated in the form of a research report written by the student.

Sufficient time should be allowed for satisfactory completion of reports, taking into account that initial drafts should be critiqued by the faculty guide and corrected by the student at each stage.

The File is the principal means by which the work carried out will be assessed and therefore great care should be taken in its preparation.

**In general, the File should be comprehensive and include**

- A short account of the activities that were undertaken as part of the project;
- A statement about the extent to which the project has achieved its stated goals.
- A statement about the outcomes of the evaluation and dissemination processes engaged in as part of the project;
- Any activities planned but not yet completed as part of the project, or as a future initiative directly resulting from the project;
- Any problems that have arisen that may be useful to document for future reference.

**Report Layout**

The report should contain the following components:

**➤ Title or Cover Page**

The title page should contain the following information: Project Title; Student's Name; Course; Year; Supervisor's Name.

**➤ Acknowledgements (optional)**

Acknowledgment to any advisory or financial assistance received in the course of work may be given.

**➤ Abstract**

A good "Abstract" should be straight to the point; not too descriptive but fully informative. First paragraph should state what was accomplished with regard to the objectives. The abstract does not have to be an entire summary of the project, but rather a concise summary of the scope and results of the project

**➤ Table of Contents**

Titles and subtitles are to correspond exactly with those in the text. 5

➤ **Introduction**

Here a brief introduction to the problem that is central to the project and an outline of the structure of the rest of the report should be provided. The introduction should aim to catch the imagination of the reader, so excessive details should be avoided.

➤ **Materials and Methods**

This section should aim at experimental designs, materials used. Methodology should be mentioned in details including modifications if any.

➤ **Results and Discussion**

Present results, discuss and compare these with those from other workers, etc. In writing these section, emphasis should be given on what has been performed and achieved in the course of the work, rather than discuss in detail what is readily available in text books. Avoid abrupt changes in contents from section to section and maintain a lucid flow throughout the thesis. An opening and closing paragraph in every chapter could be included to aid in smooth flow.

➤ Note that in writing the various sections, all figures and tables should as far as possible be next to the associated text, in the same orientation as the main text, numbered, and given appropriate titles or captions. All major equations should also be numbered and unless it is really necessary never write in “point” form.

➤ **Conclusion**

A conclusion should be the final section in which the outcome of the work is mentioned briefly.

➤ **Future prospects**

➤ **Appendices**

The Appendix contains material which is of interest to the reader but not an integral part of the thesis and any problem that have arisen that may be useful to document for future reference.

➤ **References / Bibliography**

This should include papers and books referred to in the body of the report. These should be ordered alphabetically on the author's surname. The titles of journals preferably should not be abbreviated; if they are, abbreviations must comply with an internationally recognised system.

**Examples**

***For research article***

Voravuthikunchai SP, Lortheeranuwat A, Ninrprom T, Popaya W, Pongpaichit S, Supawita T. (2002) Antibacterial activity of Thai medicinal plants against enterohaemorrhagic *Escherichia coli* O157: H7. *Clin Microbiol Infect* , **8** (suppl 1): 116–117. 6

***For book:***

Kowalski, M.(1976) Transduction of effectiveness in *Rhizobium meliloti*. SYMBIOTIC NITROGEN FIXATION PLANTS (editor P.S. Nutman IBP), 7: 63-67