

# Indian Institute of Technology Indore

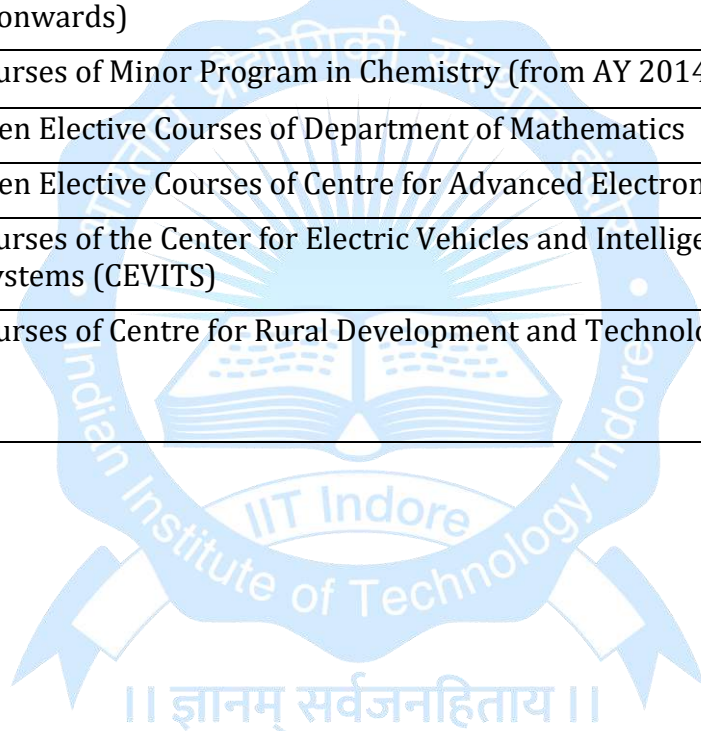


February 2026

[After incorporating decisions of the 61<sup>st</sup> meeting of the Senate held on February 26,  
2026

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### **Compulsory and Elective HSS Courses**

HS 107 -English Language (2-0-0-2)  
HS 111 -Introduction to Philosophy (3-0-0-3)  
HS 113 [for AY 2009-10] and HS 108 [from AY 2010-11 onwards]- Economics (3-0-0-3)  
HS 115 -Reading Literature L-T-P-Credits (3-0-0-3)  
HS 157 -English Language Lab (0-0-2-1)  
HS 159 - English Language and Communication (0-3-0-3)  
HS 302- Environmental Studies: Social Aspects (3-0-0-1.5) (Half Semester Course)  
HS 110- Thinking Tools and Thought Experiments (1-0-0-1)

### **Compulsory Basic Science Courses (CBSC)**

BSE 102 -Biosciences (2-1-0-3)  
CH 103 – Chemistry (3-1-0-4)  
CH 153 - Chemistry Lab- (0-0-3-1.5)  
MA 103 and MA 105 - Mathematics-I: Calculus – (3-1-0-4)  
MA 104 & MA 106 -Mathematics-II: Linear Algebra and Ordinary Differential Equations-I and Linear Algebra and Ordinary Differential Equations (3-1-0-4)  
MA 201 and MA 203 -Mathematics-III: Complex Analysis and Differential Equations-II (3-1-0-4)  
MA 204 - Numerical Methods (3-0-2-4)  
PH 103 and PH 105 - Physics-I: Modern Physics and Physics-I (2 -1-0-3)  
PH 104 and PH 106 -Physics-II: Electricity and Magnetism and Physics-II –(2 -1-0-3)  
PH 154 and PH 156 - Physics Lab (0-0-3-1.5)

### **Institute Core (IC) Courses and Compulsory Engineering Courses-**

CS 103- Computer Programming (2-0-0-2)  
IC 151 -Computer Programming Laboratory (0-0-3-1.5)  
EE 154 - Basic Electrical and Electronics Engineering Lab (0- 0-2-1)  
ME 104 -Basic Mechanical Engineering (3-0-0-3)  
ME 106 -Basic Mechanical Engineering (2-1-0-3)  
ME 153 and IC 153 -Engineering Graphics (1-0-3-2.5)  
ME 154 -Basic Manufacturing Techniques (2-0-2-3)  
IC 211 - Experimental Engineering Lab (0-0-3-1.5)  
ES 302 - Environmental Studies: Scientific and Engineering Aspects –(3-0-0-1.5) (Half Semester Course)  
EE 101-Basic Electrical Engineering -(1-1-0-2)  
EE 106 0Basic Electronics Engineering (1-0-0-1)  
ME 101-Engineering Mechanics Basic engineering (2-0-0-2)  
ME 108- Basic Manufacturing Processes (1-0-0-1)  
ME 110- Basic Thermal Engineering (1-0-0-1)  
PH 108- Basics of Laser Engineering (1-0-0-1)  
PH 107- Basics of Physics (2-1-0-3)  
PH 157 -Physics Lab- I (0-0-2-1)  
BSE 102 -Biosciences- (2-1-0-3)  
MA 101N -Calculus-I (3-1-0-2) (Half Semester)  
MA 103N -Calculus-II (3-1-0-2) (Half Semester)

MA 102N-Linear Algebra (2-1-0-1.5) (Half Semester)  
 MA 104N- Differential Equations-I (2-1-0-1.5) (Half Semester)  
 CH 105 Chemistry ( 3-0-0-3)  
 CH 155 Chemistry Lab ( 0-0-2-1)  
 ES 102 Environmental Studies: Scientific and Engineering Aspects (3-0-0-1.5) (Half Semester Course)  
 HS 109 Language and Composition (2-0-0-2)  
 HS 104 Fundamentals of Economics ( 2-0-0-2)  
 HS 117 Stress and Mental Health (1-0-0-1)  
 HS 119 Frontiers of Thinking (1-0-0-1)  
 HS 121 History of Tribal and Folk Art (1-0-0-1)  
 HS 123 Cultural Sociology (1-0-0-1)  
 HS 102 Environmental Studies: Social Aspects (2-1-0-3=1.5) (Half Semester)  
 AA 101 Introduction to Space Engineering (1-0-0-1)  
 CE 102 Computations in Civil Engineering (1-0-0-1)  
 IC 152 Makerspace (1 - 0 - 6 - 4)  
 MM 102 Introduction to Materials Engineering (1-0-0-1)

### List of Institute Elective Courses (IEC)

#### (A) School of Basic Sciences:

1. IPH 471N/ PH 671N/ AA 471N/ AA 671N: Relativity and Cosmology (2-1-0-3)
2. IPH 474 / PH 674 / AA 474 / AA 674: Basics of Radio Astronomy (2-1-0-3)

#### (B) School of Engineering:

1. ICS 419/ CS 419/ CS 619 : Computer Vision (2-1-0-3)
2. IEE 431 / EE 431/ EE 631 : Organic Electronics (2-1-0-3)
3. IME 451 / ME 651 : Mechatronics System Design (2-1-0-3)

#### (C) School of Humanities and Social Sciences

1. IHS 402 : Twentieth Century World History: Critical Perspectives (2-1-0-3)
2. IHS 416 : French Language (2-1-0-3)
3. IHS 422 / HS 622 : Development Economics (2-1-0-3)
4. IHS 425 : Money and Banking (2-1-0-3)
5. IHS 443 / HS 643 : Contemporary Short Fiction (2-1-0-3)
6. IHS 444 : Literature of the Twentieth Century (2-1-0-3)

7. IHS 482 : Introduction to International Development and Area Studies (2-1-0-3)

**(D) Inter-disciplinary Group of Biosciences and Bioengineering (BSBE)**

1. IBSE 401 : Introduction to Cell and Molecular Biology (2-1-0-3)

**(E) Center of Innovation, Incubation, Entrepreneurship and Industry Relations (CIEIR)**

1. IE 301/ IE 401/ IE 601 : Foundation for Entrepreneurship (2-0-2-3)

**Courses of Minor Program in Humanities and Social Sciences**

HS 211 Understanding Philosophy (3-0-0-3)

HS 203 Psychology (3-0-0-3)

HS 205 Sociology (2-1-0-3)

HS 206 Paradigms and Turning Points (3-0-0-3)

HS 207 French Language – I (2-1-0-3)

HS 208 French Language – II (2-1-0-3)

HS 209 Intermediate Microeconomics (2-1-0-3)

HS 210 Indian Economy (2-1-0-3)

HS 321 History of Modern Indian Business (2-1-0-3)

HS 329 Philosophy of Mind (3-0-0-3)

HS 334 Agricultural Economics (3-0-0-3)

HS 636/ HS 436 - Philosophy of Biology (3-0-0-3)

**Elective Courses for Professional/ Societal-Connect basket :-**

HS 220/320/420 : The Digital Economy

HS 232/332/432 : The Making of Digital Cultures



**Syllabi of 1<sup>st</sup> Year  
Compulsory and Elective  
HSS Courses**

Course Code	<b>HS 107</b> [from AY 2010-11 to AY 2013-14]
Title of the Course	<b>English Language</b>
Credit Structure	L-T-P-Credits 2-0-0-2
Name of the Concerned Department	English/HSS
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	<p>This course has a double purpose. It introduces literature and its forms and also helps students learn the English language.</p> <p>The linguistic aspect will be dealt with by concentrating on the dictionary skills and introducing principles of pronunciation, vocabulary development, and syntax. The main topics include:</p> <ul style="list-style-type: none"> <li>(a) <b>Pronunciation:</b> basic sounds of English (vowels and consonants) and word-stress</li> <li>(b) <b>Vocabulary:</b> word-formation (prefixes and suffixes), synonyms and antonyms</li> <li>(c) <b>Syntax:</b> parts of speech, active and passive voice, direct and indirect speech, tenses, basic sentence patterns, etc.</li> </ul> <p>The literary aspect will be dealt with through suitable texts such as poems, short stories and plays (chosen by the instructors). The main topics for discussion will be:</p> <ul style="list-style-type: none"> <li>(a) What is literature?</li> <li>(b) The nature of literary language (mainly “figurative” language)</li> <li>(c) The literary forms or genres</li> <li>(d) Literature and socio-cultural context.</li> </ul>
Suggested Books	Suitable texts are to be chosen by the instructors from the Texts and References listed below as well as from other sources.

1. W.W.S. Bhaskar and N. S. Prabhu, **English through Reading**. Books I & II. Macmillan, 1975.
2. X. J. Kennedy, and G. Dana (Eds.) **Literature: An Introduction to Fiction, Poetry, and Drama**. 10<sup>th</sup> edition, Longman, 2006.
3. D. Murdoch (Ed.). **The Siren's Song: An Anthology of British and American Verse**, Orient Longman, 1988.
4. M. Meyer, (Ed.) **The Bedford Introduction to Literature: Reading, Thinking, Writing**. 6<sup>th</sup> edition, Bedford/St. Martin's, 2001.
5. **Oxford Advanced Learner's Dictionary**. Oxford University Press, (8<sup>th</sup> edition) 2010 (with CD).
6. P. Sampson, **English Language through Literature: an introduction**. Rutledge, 1996.



Course Code	<b>HS 111</b> [for AY 2009-10]
Title of the Course	<b>Introduction to Philosophy</b>
Credit Structure	L-T-P-Credits 3-0-0-3
Name of the Concerned Department	Philosophy/HSS
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	<p><b>Introduction:</b> The value of Philosophy, Why do we do Philosophy</p> <p><b>Epistemology:</b> Basic Concepts, Belief, Knowledge &amp; Truth, Rationalism &amp; Empiricism, Knowledge &amp; Justification, Scientific Knowledge, Nature and Methodology of Science, Verification/Falsification, Induction &amp; Deduction, Scepticism</p> <p>Ancient and Modern Scepticism, Brain-in-a-Vat</p> <p><b>Basic Logic:</b> Aristotelian Logic, Laws of Thought - Truth Table, Epistemological Paradoxes</p> <p><b>Moral Philosophy:</b> Ethical Reasoning, Problems of Judgment, Moral Dilemmas, Subjectivity - Objectivity</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. B. Magee, <b>The Story of Philosophy</b>, A Dorling Kindersley Book, London, 1998.</li> <li>2. H. Bergson, <b>An Introduction to Metaphysics</b>, Palgrave Macmillan, New York, 2007.</li> <li>3. M. Clark, <b>Paradoxes from A to Z</b>, Routledge, London, 2002.</li> <li>4. J. Ladyman, <b>Understanding Philosophy of Science</b>, Routledge, London, 2002.</li> <li>5. Stephen, Law, <b>Philosophy</b>, A Dorling Kindersley Book, London, 2007.</li> <li>6. R. Norman, <b>The Moral Philosophers: An Introduction to Ethics</b>, Oxford University Press, Oxford, 1998.</li> <li>7. J. Rawls, <b>Lectures on the History of Moral Philosophy</b> Ed. by Barabara Herman, Harvard University Press, Massachusetts, 2000.</li> <li>8. R. Rorty, <b>Philosophy and the Mirror of Nature</b>, Princeton University Press, Princeton, 1979.</li> <li>9. B. Russell, <b>The Problems of Philosophy</b>, Oxford University Press.</li> </ol>

Oxford, 1998.

10. P. Stokes, **Philosophy: 100 Essential Thinkers**. Enchanted Books, New York, 2002.

11. M. Williams, **Problems of Knowledge: A Critical Introduction to Philosophy**, Oxford University Press, New York, 2001.



Course Code	<b>HS 113</b> [for AY 2009-10] <b>HS 108</b> [form AY 2010-11 onwards]
Title of the Course	<b>Economics</b>
Credit Structure	L-T-P-Credits 3-0-0-3
Name of the Concerned Department	Economics/HSS
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	<p><b>Microeconomics:</b> What is Economics? basic economic problems and nature of economics; demand and supply; consumer choice; individual and market demand; production and cost of production; profit maximization and perfect competition; market structure- monopoly, monopsony, monopolistic competition, and oligopoly; externalities and public goods; factor markets-land, labour and capital market.</p> <p><b>Macroeconomics:</b> National income accounting- income, expenditure and components of GDP; consumption and saving; investment spending and demand for money; financial systems- central bank, money, credit, financial markets and asset prices; income and spending; money, interest and income; fiscal and monetary policies; economic growth and accumulation; aggregate supply- wages, prices and unemployment; inflation.</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. R.S. Pindyck and D.L. Rubinfeld. <b>Microeconomics</b> (7<sup>th</sup> Edition), Pearson Prentice Hall, New Jersey, 2009.</li> <li>2. R. Dornbusch, S. Fischer, and R. Startz, <b>Macroeconomics</b> (9<sup>th</sup> Edition), McGraw-Hill Inc. New York, 2004.</li> </ol>

Course Code	HS 110
Title of the Course	Thinking Tools and Thought Experiments
Credit Structure	L - T - P - Credits 1-0-0-1
Name of the Concerned Discipline and Department	School of Humanities and Social Sciences
Pre-requisite, if any (for the students)	None
Scope of the Course	<ol style="list-style-type: none"> <li>1. To introduce the students with a general critical thinking paradigm.</li> <li>2. Familiarise the students with some seminal thought experiments and their importance in innovative thinking.</li> <li>3. To help students develop the skill of making their own thought experiments.</li> </ol>
Course Syllabus	<p>Module 1: Introduction to thinking tools; Introduction to thought experiments; Their importance and usage; Importance of making mistakes and lessons from them</p> <p>Module 2 Laws of thought; Rapoport's law; Sturgeon's Law; Occam's Razor (and his broom); Appeal to Universal Authority; Chess or Chmess; Galileo's thought experiment (Refutation of Aristotelian Physics); Turing Test; Chinese Room Argument.</p>
Suggested Books	<p>Textbooks:</p> <ol style="list-style-type: none"> <li>4. M. Stuart, Y. Fehige, J. R. Brown: <i>The Routledge Companion to Thought Experiments</i>: Routledge: London: 2023: 978-1-032-56971-0</li> <li>5. D. Dennett: <i>Intuition pumps and other tools for thinking</i>: W.W. Norton: New York: 2013: 978-0-393-34878-1</li> </ol>

Course Code	<b>HS 115</b> [for AY 2009-10]
Title of the Course	Reading Literature
Credit Structure	L-T-P-Credits 3-0-0-3
Name of the Concerned Department	English/HSS
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	Reading of and reading into (interpreting) a variety of literary texts; analyzing the art of literature; evaluation of the context(s) of reading and the reader-text relationship(s)
Suggested Books	Suitable texts will be chosen by the instructor(s) from the Texts and References listed below as well as from other sources. 1. M. Meyer, (Ed.) <b>The Bedford Introduction of Literature: Reading, Thinking, Writing.</b> 6 <sup>th</sup> edition, Bedford/St. Martin's, 2001. 2. X.J. Kennedy, and G. Dana, (Ed.) <b>Literature: An Introduction to Fiction, Poetry, and Drama.</b> 10 <sup>th</sup> edition, Longman, 2006. 3. S. N. Lawall, (Ed.) <b>The Norton Anthology of World Literature.</b> 2 <sup>nd</sup> expanded edition. Vol. A-F, W.W. Norton & Company; 2003

॥ ज्ञानम् सर्वजनहिताय ॥

Course Code	<b>HS 157</b> [from AY 2010-11 to AY 2013-14]
Title of the Course	<b>English Language Lab</b>
Credit Structure	L-T-P-Credits 0-0-2-1
Name of the Concerned Department	English/HSS
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	<p>The Laboratory Course for English Language and Literature is primarily meant to augment the language aspect of the course. The multi-media computer facility will be extensively used for the tutorial/lab sessions. The 8<sup>th</sup> edition of the <i>Oxford Advanced Learner's Dictionary</i> (with CD) will be extensively used along with the internet resources.</p> <p>All the students are expected to have access to the dictionary and they should learn to use it extensively. The CD of the <i>OALD</i> contains a section titled "Resources" consisting of Dictionary Skills and Grammar.</p> <p>From the Grammar section, the following topics will be focused upon: articles, regular verbs, tenses and their use, active and passive voice, modal verbs, and reported speech.</p> <p>From the Dictionary Skills section, the following topics will be focused upon: nouns, irregular verbs, adjectives and adverbs, grammatical patterns, the idioms, phrasal verbs and register (formal and informal, technical, slang).</p> <p>The pronunciation aspect will be handled by listening to the pronunciation of words which can be heard from the CD and also by learning the phonetic symbols used for the basic sounds.</p> <p>All these will be further practiced with the use of interactive internet material from the links mentioned below.</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. D. Jones, <b>English Pronouncing Dictionary</b>, (15<sup>th</sup> edition) Cambridge University Press, 1996 (with CD).</li> <li>2. <b>Oxford Advanced Learner's Dictionary</b>, (8<sup>th</sup> edition) Oxford University Press, 2010 (with CD).</li> <li>3. M. Swan, <b>Practical English Usage</b>, Oxford University Press, 1996.</li> </ol>

4. Internet Resources

<http://www.ego4u.com> (English Grammar Online 4u)  
<http://www.englishpage.com> , <http://a4esl.org>  
<http://sana.tkk.fi/awe/cohesion/signposts/contrast/exercises/1r.html>  
<http://www.manythings.org/vq/mc-adj.html>  
<http://www.ego4u.com/en/cram-up/grammar/adjectives-adverbs/adjectives/exercises>  
<http://a4esl.org/q/h/vm/fampeople.html>  
<http://a4esl.org/q/f/z/zz32mps.htm>  
<http://a4esl.org/q/f/x/xz61mrs.htm>  
<http://www.englishpage.com/verbpage/activepassive.html>  
<http://www.ego4u.com/en/cram-up/grammar/passive/exercises?simple-present>  
<http://www.ego4u.com/en/cram-up/grammar/passive/exercises?simple-past>  
<http://www.ego4u.com/en/cram-up/grammar/passive/exercises?future-1>  
<http://www.better-english.com/grammar/passive1.htm>



Course Code	<b>HS 159</b> [from AY 2014-15 onwards]
Title	<b>English Language and Communication</b>
Credit Structure	L-T- P-Credits 0-3-0-3
Name of the School/ Department	Humanities and Social Sciences/ English
Pre-requisite, if any	NIL
Scope of the course	To improve English Reading, Comprehension and Writing skills of the students.
Course Syllabus	-Writing, Reading, Comprehension skills in English - Paragraph Development -Grammar and mechanics
Suggested books	<ol style="list-style-type: none"> <li>1. M. Swan, <i>Practical English Usage</i>, Oxford University Press, 1996.</li> <li>2. W.W.S. Bhaskar and N. S. Prabhu, <i>English through Reading. Books I &amp; II.</i> Macmillan, 1975.</li> <li>3. P. Sampson, <i>English Language through Literature: an introduction.</i> Rutledge, 1996.</li> <li>4. Oxford Advanced Learner's Dictionary. Oxford University Press, (8th edition) 2010 (with CD).</li> <li>5. Bedford Martin Guide to College Writing</li> <li>6. Fowler Ramsey and Jane Aaron. <i>The Little Brown Handbook</i>, Pearson Publications</li> <li>7. Lunsford, Andrea, Keith Walters, et al. <i>Everything is an Argument</i>, : Bedford/St. Martin's; Sixth Edition edition (October 5, 2012)</li> <li>8. Turabian, Kate. <i>Student's Guide to College Writing</i>, University of Chicago Press, 4<sup>th</sup> Edition, 2010.</li> </ol>

Course Code	<b>HS 302</b>
Title of the Course	<b>Environnemental Studies: Social Aspects</b>
Credit Structure	L-T-P-Credits <b>3-0-0-1.5 (Half Semester Course)</b>
Name of the Concerned Department	Economics and Sociology/HSS
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	Social Issues and the environment, Public awareness and Human rights, Indicators of sustainability, Governance of Natural Resources - Common pool resources: issues and management. Environmental ethics, Religion and environment, Wilderness and Developing Trends, Environmental movements and Activism, Social Ecology and Bioregionalism, Environmental justice. Environmental economics, Trade and environment, Economics of environmental regulation, Natural resource accounting, Green GDP. Environment and development, Resettlement and rehabilitation of people, Impacts of climate change on economy and society, Vulnerability and adaptation to climate change.
Suggested Books	<ol style="list-style-type: none"> <li>1. N. Agar, <b>Life's Intrinsic Value</b>, Columbia University Press, New York, 2001.</li> <li>2. Dasgupta, P. and Maler, G. (eds.), <b>The Environment and Emerging Development Issues</b>, Vol. I, Oxford University Press, 1997.</li> <li>3. R. Guha, <b>Mahatama Gandhi and Environmental Movement</b>, <i>Debating on Gandhi</i> in by A. Raghuramaraju (ed.), Oxford University Press, New Delhi, 2006.</li> <li>4. R. Guha and Madhav Gadgil, <b>Ecology and Equity: The Use and Abuse of Nature in Contemporary India</b>, Penguin, New Delhi, 1995.</li> <li>5. Hanley, Nick, Jason F. Shogren and Ben White, <b>Environmental Economics in Theory and Practice</b>, MacMillan, New Delhi, 2004</li> <li>6. A. Naess, and G. Sessions, <b>Basic Principles of Deep Ecology</b>, <i>Ecophilosophy</i>, Vol.6., 1984.</li> <li>7. M. Redclift, and G. Woodgate, (eds.), <b>International Handbook of Environmental Sociology</b>, Edward Edgar, 1997</li> </ol>



Course Code	<b>BSE 102</b> [from AY 2014-15 onwards]
Title of the Course	<b>Biosciences</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department	Biosciences and Biomedical Engineering
Pre-requisite, if any	Nil
Scope of the course	This course intends to give knowledge about the basics of biology to engineering students who might not be in touch with this subject after their matriculation.
Course Syllabus	<p><b>Life and its origin:</b> Requirements for Life, Chemistry of life, Chemistry of water, Origin of life.</p> <p><b>Evolutionary History of Biological Diversity:</b> Phylogeny and the Tree of Life, Bacteria and Archaea, Protists. Plant Diversity I: How Plants Colonized Land, Plant Diversity II: The Evolution of Seed Plants, Fungi, An Overview of Animal Diversity, An Introduction to Invertebrates, The Origin and Evolution of Vertebrates</p> <p><b>Cell:</b> Prokaryotic and Eukaryotic cell, Animal cell and Plant cell, Structure and function of sub cellular organization, membrane and cell physiology, Chromosome and Gene, Genetics</p> <p><b>Cell Division:</b> Mitosis, Meiosis other types of cell divisions, Cancer</p> <p><b>Organization of Human body:</b> Tissues, Organ and Organ System;</p> <p><b>Micro- and Macromolecules in living system:</b> Amino Acid, Proteins, Types of sugar, Carbohydrates, Saturated and unsaturated fatty acid, lipid, Fat, Nucleotides and Nucleic Acid.</p> <p><b>Enzymes:</b> Basic concept, Classification and Function, Role of Enzymes in life.</p> <p><b>Ecology and Environment</b></p> <p><b>Perspective of Biology</b></p>

Suggested Books

1. Campbell; **Biology**, 9<sup>th</sup> edition. Pearson Higher Education 2011
2. [Colleen Belk](#), [Virginia Borden Maier](#); **Biology: Science for Life with Physiology**, Pearson New International Edition, 2013
3. Lehninger & Cox. **Principles of Biochemistry** (5th edition), W.H. Freeman & Company, USA



Course Code	<b>CH 103</b> [from AY 2010-11 to AY 2013-14]
Title of the Course	<b>Chemistry</b>
Credit Structure	L-T- P-Credits 3-1-0-4
Name of the Concerned Department	Chemistry
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	<p><b>Schrödinger equation:</b> origin of quantization; applications of particle in a box problem; hydrogen atom; properties of atomic orbitals; many electron atoms; molecular orbital theory; bonding and intermolecular forces.</p> <p><b>Thermodynamics:</b> Fundamental definition and concepts of thermodynamics; Work, heat and energy; First law: <math>C_p</math> and <math>C_v</math>; Second law: entropy; Helmholtz and Gibbs Energy; chemical potential; Third law; phase equilibria; chemical equilibrium.</p> <p><b>Chemical kinetics:</b> Rate laws; elementary reaction and chain reaction.</p> <p><b>Periodic table and periodic properties:</b> basis of periodic table, trends in size, electron affinity, ionization potential and electronegativity, Use of Ellingham diagram and thermodynamics in the extraction of elements; Transition metal chemistry: inorganic complexes, isomerism, nomenclature; bonding in transition metal complexes; valence bond and crystal field theory, magnetism, bonding aspects, structural distortion; Bioinorganic chemistry: storage and transport proteins; Catalysis: hydrogenation, hydroformylation and olefin metathesis.</p> <p><b>Organic Chemistry:</b> Hückel treatment of ethylene, butadiene and benzene, concept of aromaticity, configuration, molecular chirality and isomerism, conformation of alkanes and cycloalkanes, reactivity of carbonyl groups (additions, addition-eliminations, reactions due to acidic proton, reactivity of acid halide, ester and amide), functional group inter-conversions involving oxidation and reduction. Introduction to bio-organic chemistry: carbohydrates, amino acids and nucleic acids.</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. P.W. Atkins, <b>Physical Chemistry</b> (7<sup>th</sup> Edition), Oxford University Press, 2006.</li> <li>2. I. A. Levine, <b>Physical Chemistry</b>, McGrawHill, 2009</li> <li>3. D.A. McQuarrie and J.D. Simon, <b>Physical Chemistry</b> - a</li> </ol>

**Molecular Approach**, Viva Books Pvt. Ltd., 1998.

4. R.T. Morrison and R.N. Boyd, **Organic Chemistry**, 5<sup>th</sup> Ed, Prentice Hall of India Pvt. Ltd., 1990
5. G. Solomons and C. Fryhle, **Organic Chemistry**, John Wiley & Sons (Asia) Pte Ltd.
6. J.D. Lee, **Concise Inorganic Chemistry**, (5<sup>th</sup> Edition), ELBS, 1996.
7. D. F. Shriver and P. W. Atkins, **Inorganic Chemistry**, Oxford University Press, 2006.



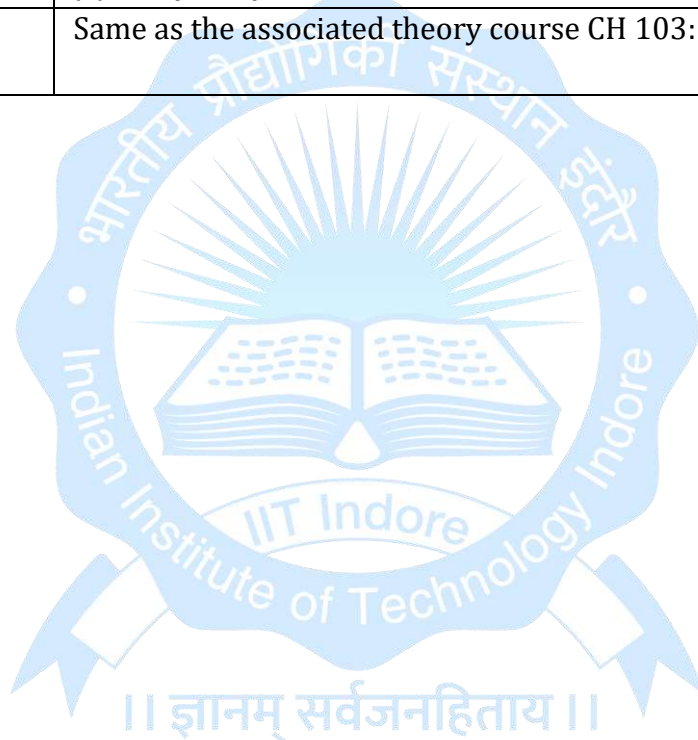
Course Code	<b>CH 103</b> [from AY 2014-15 onwards]
Title of the Course	<b>Chemistry</b>
Credit Structure	L-T-P-Credit 3-1-0-4
Name of the Department	Chemistry
Pre-requisite, if any	Nil
Scope of the Course	This course provides basic knowledge of chemistry involving organic, inorganic and physical chemistry
Course Syllabus	<p><b>Linking microscopic and bulk thermodynamic properties:</b> Distribution of molecular states and relation to entropy, Boltzmann distribution, ensembles, partition functions.</p> <p><b>Elucidation of structure and properties:</b> Experimental techniques, Interaction light with matter, absorption and emission spectra, intensities of spectral lines, Beer-Lambert law, spontaneous and simulated emission, transition moments and selection rules, Franck-Condon principle, lasers and fluorescence.</p> <p><b>Chemical Bonding:</b> Valence Bond Theory (VBT), Molecular Orbital Theory (MOT)</p> <p><b>Structure and Bonding of Coordination Complexes:</b> Tetrahedral, Octahedral, Square planar and Square Pyramidal complexes</p> <p><b>Introduction to Organometallic Complexes:</b> Structure and Bonding</p> <p><b>Application of Coordination Complexes, Metal Organic Frameworks (MOFs), and Organometallic Complexes:</b> Introduction to Metal organic Frameworks, Magnetic materials, Catalysis, Adsorption properties, Metal ions in Biology</p> <p><b>Organic Chemistry:</b> Hückel treatment of ethylene, butadiene and benzene, concept of aromaticity, orbital symmetry and chemical reactions, conformation of cycloalkanes, reactivity of carbonyl groups due to acidic protons, heterocyclic chemistry (thiophene, furan, pyridine, pyrrole, and indole), neighbouring group effect. Introduction to bio-organic chemistry: steroids, amino acids and nucleic acids.</p>
Suggested Books	<p><b>Text Books</b></p> <ol style="list-style-type: none"> <li>1. P.W. Atkins, J.D. Paula, <b>Physical Chemistry</b>, 8<sup>th</sup> Edn., Oxford University Press, <b>2006</b>, ISBN 9780716787594.</li> <li>2. I. A. Levine, <b>Physical Chemistry</b>, McGrawHill, <b>2009</b>, ISBN 978-007-2538625.</li> <li>3. D.A. McQuarrie and J.D. Simon, <b>Physical Chemistry - A Molecular Approach</b>, Viva Books Pvt. Ltd., <b>1998</b>.</li> <li>4. R.T. Morrison and R.N. Boyd, <b>Organic Chemistry</b>, Prentice Hall of India Pvt. Ltd., 6<sup>th</sup> Edn., <b>1992</b>, ISBN 0-13-643669-2.</li> <li>5. G. Solomons, C. Fryhle, S. A. Snyder, <b>Organic Chemistry</b>, John Wiley &amp; Sons (Asia) Pvt. Ltd., 11<sup>th</sup> Edn., <b>2013</b>, ISBN-10: 1118147391.</li> <li>6. J. D. Lee, <b>Concise Inorganic Chemistry</b>, 5<sup>th</sup> Edn., ELBS, <b>1996</b>, ISBN 978-8126515547.</li> <li>7. D. F. Shriver, P. W. Atkins, <b>Inorganic Chemistry</b>, Oxford University</li> </ol>

Press, **2006**, ISBN 978-0199236176.

8. R. C. Mehrotra, A. Singh, **Organometallic Chemistry**, 2<sup>nd</sup> Edn., New Age International (P) Ltd Publishers, **2007**, ISBN 978-0470210192.
9. 9. D. Farrusseng, **Metal-organic Frameworks: Application from Catalysis to Gas storage**, Wiley, **2011**, ISBN 978-3527328703.



Course Code	<b>CH 153</b>
Title of the Course	<b>Chemistry Lab</b>
Credit Structure	L-T- P-Credits 0-0-3-1.5
Name of the Concerned Department	Chemistry
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	Experiments illustrating the concepts of (1) galvanic cells, (2) Thermochemistry, (3) chemical kinetics, (4) equilibrium constant, (5) analysis by oxidation reduction titration.
Suggested Books	Same as the associated theory course CH 103: Chemistry



Course Code	<b>MA 103</b> [from AY 2009-10 to AY 2013-14] <b>MA 105</b> [from AY 2014-15 onwards]
Title of the Course	<b>Mathematics-I: Calculus</b> [from AY 2009-10 to AY 2013-14] <b>Calculus</b> [from AY 2014-15 onwards]
Credit Structure	L-T- P-Credits 3-1-0-4
Name of the Concerned Department	Mathematics
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	<p>Review of limits, continuity, differentiability.  Mean Value Theorem, Taylor Theorem, Maxima and Minima.  Riemann integrals, Fundamental theorem of Calculus, Improper integrals, application to area, volume.  Convergence of sequences and series, power series.  Partial Derivatives, gradient and directional derivatives, chain rule, maxima and minima, Lagrange multipliers.  Double and triple integration, Jacobians and change of variables formula.  Parametrization of curves and surfaces, vector fields, line and surface integrals. Divergence and curl, theorems of Green, Gauss, Stokes.</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. Huges-Hallett et al., <b>Calculus: Single and Multi Variable</b> (3<sup>rd</sup> Edition), John-Wiley &amp; Sons (USA), 2003.</li> <li>2. J. Stewart, <b>Calculus</b> (5<sup>th</sup> Edition), Thomson, 2003 (Indian Edition).</li> <li>3. T.M. Apostol, <b>Calculus: Volumes 1 and 2</b> (2<sup>nd</sup> Edition), Wiley Eastern (USA), 1980.</li> <li>4. G.B. Thomas and R.L. Finney, <b>Calculus and Analytic Geometry</b> (9<sup>th</sup> Edition), ISE Reprint, Addison-Wesley, 1998 (Indian Edition).</li> </ol>

Course Code	<b>MA 104</b> [from AY 2009-10 to AY 2013-14] <b>MA 106</b> [from AY 2014-15 onwards]
Title of the Course	<b>Mathematics-II: Linear Algebra and Ordinary Differential Equations-I</b> [from AY 2009-10 to AY 2013-14] <b>Linear Algebra and Ordinary Differential Equations-I</b> [from AY 2014-15 onwards]
Credit Structure	L-T- P-Credits 3-1-0-4
Name of the Concerned Department	Mathematics
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	<p><b>Linear Algebra:</b> Vectors in <math>R^n</math>, notion of linear independence and dependence, linear span of a set of vectors, vector subspace of <math>R^n</math>, basis of vector subspaces.</p> <p>Systems of linear equations, matrices and Gaussian elimination, row space, null space, and column space, rank of a matrix.</p> <p>Determinants and rank of a matrix in terms of determinants. Abstract vector spaces, linear transformations, matrix of a linear transformation, change of basis and similarity, rank-nullity theorem, Inner product spaces, Gram-Schmidt Process, orthonormal bases, projection and least squares approximations.</p> <p>Eigen values and Eigen vectors, characteristic polynomials, Eigen values of special matrices (orthogonal, unitary, hermitian, symmetric, skew-symmetric, normal).</p> <p>Algebraic and geometric multiplicity, diagonalization by similarity transformations, spectral theorem for real symmetric matrices, application to quadratic forms</p> <p><b>Differential Equations-I:</b> Exact equations, integrating factors and Bernoulli equations. Orthogonal trajectories.</p> <p>Lipschitz condition, Picard's theorem, examples on non-uniqueness.</p> <p>Linear differential equations generalities, Linear differential equations and Wronskians Dimensionality of space of solutions, Abel-Liouville formula, Linear ODEs with constant co-efficients, the characteristic equations, Cauchy Euler equations, Method of undetermined coefficients. Method of variation of parameters, Laplace transformation and generalities, shifting theorems, Convolution theorem.</p>
Suggested Books	1. H. Anton, <b>Elementary Linear Algebra with Applications</b> (8 <sup>th</sup>

- Edition), John-Wiley & Sons, 1995.
2. G. Strang, **Linear Algebra and its Applications** (4<sup>th</sup> edition), Thomson, 2006.
  3. S. Kumaresan, **Linear Algebra: a Geometric Approach**, Prentice Hall of India, 2000.
  5. E. Kreyszig, **Advanced Engineering Mathematics** (8<sup>th</sup> Edition), John Wiley & Sons, 1999.
  5. W.E. Boyce and R. Diprima, **Elementary Differential Equations** (8<sup>th</sup> Edition), John Wiley & Sons, 2005.
  6. T.M. Apostol, **Calculus, Volume 2** (2<sup>nd</sup> edition), Wiley-Eastern, 1980.



Course Code	<b>MA 201</b> [from AY 2009-10 to AY 2013-14] <b>MA 203</b> [from AY 2014-15 onwards]
Title of the Course	<b>Mathematics-III: Complex Analysis and Differential Equations-II</b> [from AY 2009-10 to AY 2013-14] <b>Complex Analysis and Differential Equations-II</b> [from AY 2014-15 onwards]
Credit Structure	L-T- P-Credits 3-1-0-4
Name of the Concerned Department	Mathematics
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	<p><b>Complex Analysis:</b> Definitions and properties of analytic functions. Cauchy-Riemann equations, harmonic functions. Power series and their properties. Elementary functions. Cauchy's theorem and its applications, Taylor series and Laurent expansion. Residues and Cauchy's residue formula. Evaluation of improper integrals. Conformal mappings, inversion of Laplace transformations.</p> <p><b>Differential Equations-II:</b> Review of power series and series solutions of ODE's. Legendre equation and Legendre Polynomials. Regular and singular points, method of Frobenius. Bessel's equation and Bessel's functions. Sturm-Liouville problems. Fourier series. D'Alembert solution to the wave equations. Classification of linear second order PDE's in two variables. Laplace, wave, and Heat equations using separation of variables. Vibration of a circular membrane. Heat equation in the half space.</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. R.V. Churchill and J.W. Brown, <b>Complex Variables and Applications</b> (7<sup>th</sup> edition), McGraw-Hill Inc. New York, 2003.</li> <li>2. J.M. Howie, <b>Complex Analysis</b>, Springer-Verlag, 2004 (Berlin).</li> <li>3. M.J. Ablowitz and A.S. Fokas, <b>Complex Variables: Introduction and Applications</b>, (Indian Edition) Cambridge University Press, 1998.</li> <li>4. E. Kreyszig, <b>Advanced Engineering Mathematics</b> (8<sup>th</sup> Edition), John Wiley &amp; Sons, 1999(Indian Edition).</li> <li>5. W.E. Boyce and R. DiPrima, <b>Elementary Differential Equations</b> (8<sup>th</sup> Edition), John Wiley &amp; Sons, 2005(USA).</li> <li>6. R.V. Churchill and J.W. Brown, <b>Fourier Series and Boundary Value Problems</b> (7<sup>th</sup> Edition), McGraw-Hill Inc. 2006(USA).</li> </ol>

Course Code	<b>MA 204</b>
Title of the Course	<b>Numerical Methods</b>
Credit Structure	L-T- P-Credits 3-0-2-4
Name of the Concerned Department	Mathematics
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	<ul style="list-style-type: none"> <li>• Interpolation by polynomials, divided differences, error of the interpolating polynomial, piecewise linear and cubic spline interpolation.</li> <li>• Numerical integration, composite rules, error formulae.</li> <li>• Solution of a system of linear equations, implementation of Caussian elimination and Gauss-Seidel methods, partial pivoting, row echelon form, LU factorization Cholesky's method, ill-conditioning, norms.</li> <li>• Solution of a nonlinear equation, bisection and secant methods.</li> <li>• Newton's method, rate of convergence, solution of a system of nonlinear equations, numerical solution of ordinary differential equations, Euler and Runge-Kutta methods, multi-step methods, predictor-corrector methods, order of convergence, finite difference methods, numerical solutions of elliptic, parabolic and hyperbolic partial differential equations.</li> <li>• Eigen-value problem, power method, QR method, Gershgorin's theorem.</li> <li>• Exposure to software packages like IMSL subroutines, MATLAB.</li> </ul>
Suggested Books	<ul style="list-style-type: none"> <li>• S.D. Conte and Carle de Boor, <b>Elementary Numerical Methods - An Algorithmic Approach</b> (3<sup>rd</sup> Edition), McGraw-Hill, 1980.</li> <li>• C.E. Forberg, <b>Introduction to Numerical Methods</b> (2<sup>nd</sup> Edition), Addison-Wesley, 1981.</li> <li>• E. Kreyszig, <b>Advanced Engineering Mathematics</b> (8<sup>th</sup> Edition), John Wiley &amp; Sons, 1999.</li> <li>• D. Watkinson, <b>Fundamentals of Matrix Computations</b>, Wiley-Interscience (2<sup>nd</sup> edition), 2002</li> </ul>

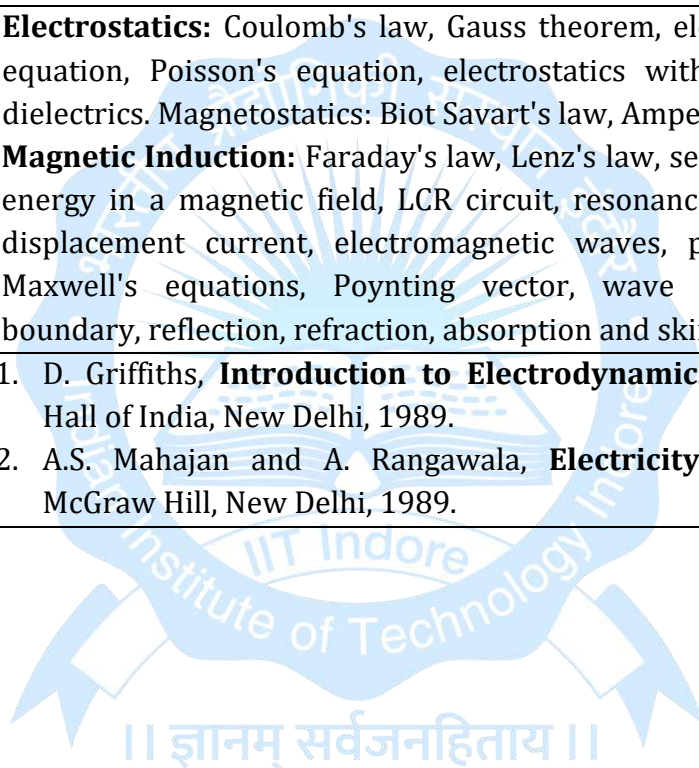
Course Code	<b>PH 103</b> [from AY 2009-10 to AY 2013-14] <b>PH 105</b> [from AY 2014-15 onwards]
Title of the Course	<b>Physics-I: Modern Physics</b> [from AY 2009-10 to AY 2013-14] <b>Physics-I</b> [from AY 2014-15 onwards]
Credit Structure	L-T- P-Credits 2 -1-0-3
Name of the Concerned Department	Physics
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	<p>Quantum Mechanics: Review of quantum concepts, Particle nature of light, Photoelectric effect, Compton effect, Waves, Wave packets, Phase and Group velocity, Davisson Germer Experiment, Heisenberg uncertainty principle. Schrodinger equation, Probabilistic interpretation of wave function.</p> <p>One dimensional problems- Particle in a box, Potential well, Potential barrier and Tunneling, Harmonic oscillator. Hydrogen atom.</p> <p>Elements of statistical physics: Maxwellian distribution, Bose-Einstein and Fermi-Dirac distributions.</p> <p>Solid State Physics: Crystalline and Amorphous Solids, Bonding in solids, Ionic Crystals, Covalent Crystals, Defects in crystals, Band Theory of Solids, Brillouin Zones, Origin of Forbidden bands, Semiconductor Devices, Superconductivity, Bound Electron Pairs, Quantum Hall Effect, Landau Levels.</p> <p>Wave Optics: Principle of superposition, Bi-Prism, Interference in thin films, Two Beam and Multiple Beam interferometers. Diffraction at single slit, Two slits and N-Slits, Diffraction grating. Vector nature of light, Malus and Brewster's Laws, Double refraction, Retardation plates, Circularly and Elliptically polarized lights.</p> <p>Lasers: Stimulated and Spontaneous emissions, Einstein's A and B coefficients, Population inversion, Pumping techniques, Resonators, Laser modes, Classes of lasers, Properties of lasers and Laser applications.</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. A. Beiser, S. Mahajan, S.R. Choudhury, <b>Concepts of Modern Physics</b> (6<sup>th</sup> Edition), McGraw Hill Inc., 2009.</li> <li>2. S.H. Patil, <b>Elements of Modern Physics</b>, Tata McGraw Hill, 1989.</li> <li>3. K.S. Krane, <b>Modern Physics</b> (2<sup>nd</sup> Edition), John Wiley and Sons, 1996.</li> <li>4. H.S. Mani and G.K. Mehta, <b>Introduction to Modern Physics</b>, East West Books Madras Pvt. Ltd., 1988.</li> <li>5. A. K. Ghatak, <b>Optics</b> (4<sup>th</sup> Edition), McGraw Hill, 1993.</li> <li>6. E. Hecht, <i>Optics</i>, Pearson Addison Wesley, 2002.</li> <li>7. A.K. Ghatak and K. Thyagarajan, <b>Lasers: Theory and Applications</b>,</li> </ol>

Macmillan India limited, 2003.

8. W. T. Silfvast, **Laser Fundamentals**, 2nd Edition, Cambridge University Press, 1996.
9. A. Yariv, **Optical Electronics in Modern Communication**, Oxford University Press, 1997.



Course Code	<b>PH 104</b> [from AY 2009-10 to AY 2013-14] <b>PH 106</b> [from AY 2014-15 onwards]
Title of the Course	<b>Physics-II: Electricity and Magnetism</b> [from AY 2009-10 to AY 2013-14] <b>Physics-II</b> [from AY 2014-15 onwards]
Credit Structure	L-T- P-Credits 2 -1-0-3
Name of the Concerned Department	Physics
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	<b>Electrostatics:</b> Coulomb's law, Gauss theorem, electric potential, Laplace's equation, Poisson's equation, electrostatics with conductors, capacitors, dielectrics. <b>Magnetostatics:</b> Biot Savart's law, Ampere's law, Lorentz force. <b>Magnetic Induction:</b> Faraday's law, Lenz's law, self and mutual inductance, energy in a magnetic field, LCR circuit, resonance. <b>Maxwell's equations:</b> displacement current, electromagnetic waves, plane wave solutions of Maxwell's equations, Poynting vector, wave propagation through a boundary, reflection, refraction, absorption and skin depth.
Suggested Books	1. D. Griffiths, <b>Introduction to Electrodynamics</b> , (2 <sup>nd</sup> edition), Prentice Hall of India, New Delhi, 1989. 2. A.S. Mahajan and A. Rangawala, <b>Electricity and Magnetism</b> , Tata McGraw Hill, New Delhi, 1989.



Course Code	<b>PH 154</b> [from AY 2009-10 to AY 2013-14] <b>PH 156</b> [from AY 2014-15 onwards]
Title of the Course	<b>Physics Lab</b>
Credit Structure	L-T- P-Credits 0-0-3-1.5
Name of the Concerned Department	Physics
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	<p>Determination of gravitational constant (g)</p> <p>Effect of magnetic field on materials (Hall Effect and Universal B-H Curve Tracer)</p> <p>Frank Hertz Experiment.</p> <p>LCR Circuit, and Thermal &amp; Electric Conductivity</p> <p>Kundt's Tube</p> <p>Fresnel's Bi-prism</p> <p>Grating Spectrometer</p> <p>Hydrogen Spectrum</p> <p>Specific Charge of Electron (e/m)</p> <p>Newton's Rings</p>
Suggested Books	1. G. L. Squires, <b>Practical Physics</b> , University Press, Cambridge, 1998.



**Syllabi  
Of  
Institute Core (IC) Courses  
and  
Compulsory Engineering Courses**

Course Code	<b>CS 103</b>
Title of the Course	<b>Computer Programming</b>
Credit Structure	L-T-P-Credits 2-0-0-2
Name of the Concerned Department	Computer Science and Engineering
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	<p>This course provides an introduction to problem solving with computers using a modern language such as Java or C/C++. Topics covered will include:</p> <ol style="list-style-type: none"> <li>1. Developer fundamentals such as editor, integrated programming environment, Turbo C++ and/or Microsoft Visual C++ Programming environment, modules, libraries.</li> <li>2. Programming features: Machine representation, primitive types, arrays and records, objects, expressions, control statements, iteration, procedures, functions, and basic i/o.</li> <li>3. Sample problems in engineering, science, text processing, and numerical methods.</li> </ol>
Suggested Books	<ol style="list-style-type: none"> <li>1. G. Dromey, <b>How to Solve It by Computer</b>, Prentice-Hall, Inc., Upper Saddle River, NJ, 1982</li> <li>2. Coohoon and Davidson, <b>C++ Program Design: An introduction to Programming and Object- Oriented Design</b> (3<sup>rd</sup> edition), Tata McGraw Hill, New Delhi, 2003.</li> <li>3. Yashwant Kanetkar, <b>Let us C</b>. Allied Publishers, 1998.</li> <li>4. G. Polya, <b>How to Solve It</b> (2nd ed.), Doubleday and co. (1957).</li> <li>5. <b>The Java Tutorial</b>, Sun Microsystems. Addison-Wesley, 1999.</li> </ol>

<b>Course Code</b>	<b>IC 151</b>
<b>Title of Course</b>	<b>Computer Programming Laboratory</b>
Credit Structure	L-T-P-Credits 0-0-3-1.5
Name of the Department	Institute Core Course
Pre-requisite, if any	Should be enrolled in parallel in CS 103 or should have already taken and successfully completed the CS 103 course
Scope of the course	To provide students with a thorough understanding of programming fundamentals through the route of practical exercises on the computer system
Course Structure	Students would be made to work through programming assignments on the following topics in C++: 1) Data types 2) Control Statements 3) Functions 4) Pointers and Arrays 5) Dynamic Memory Allocation 6) Classes and Objects 7) Constructors and Destructors 8) Operator Overloading 9) Inheritance 10) Virtual Functions 11) File Handling and I/O Operations
Suggested books	1. R. Lafore, Object Oriented Programming in C++, SAMS Publishing, 2001 2. B. Stroustrup, The C++ Programming Language, Addison-Wesley, 1997

Course Code	<b>EE 104</b>
Title of the Course	<b>Basic Electrical and Electronics Engineering</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department	Electrical Engineering
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	<p>Introduction: basic physical laws, basic circuit elements, Kirchoff's voltage law (KVL), Kirchoff's current law (KCL), and a few important circuit theorems, simple circuits.</p> <p>Transients in R-L, R-C, R-L-C, Sinusoidal Steady State, Real/ Reactive Power, Three phase power.</p> <p>Working Principles of Transformers/AC/DC machines.</p> <p>Functional Characteristics of Diode, BJT, OP-AMP.</p> <p>Analog circuit examples: rectifiers, amplifiers, oscillators, etc.</p> <p>Digital circuits: AND/OR gates, Flip Flops, DAC/ADC, etc.</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. L. S. Bobrow, <b>Fundamentals of Electrical Engineering</b> (2<sup>nd</sup> edition), Oxford University Press, New Delhi.</li> <li>2. Vincent Del Toro, <b>Electrical Engineering Fundamentals</b>, Prentice Hall, 1989.</li> <li>3. K.A. Krishnamurthy and M.R. Raghuvver, <b>Electrical and Electronics Engineering for Scientists</b>, Wiley Eastern Ltd., 1993.</li> </ol>

॥ ज्ञानम् सर्वजनहिताय ॥

Course Code	<b>EE 154</b>
Title of the Course	<b>Basic Electrical and Electronics Engineering Lab</b>
Credit Structure	L-T-P-Credits 0- 0-2-1
Name of the Concerned Department	Electrical Engineering
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	<p>Following experiments based on the associated theory course EE 104.</p> <ol style="list-style-type: none"> <li>1. Familiarization with CRO and function generator</li> <li>2. Characteristics of passive circuit elements (R,L,C)</li> <li>3. Verification of network theorems</li> <li>4. Time and frequency responses of RC, RLC circuits</li> <li>5. Electronic components and their characteristics: Diode, Zener Diode, Led, Photodetector, Microphone</li> <li>6. Half-wave rectifier and full-wave rectifier (with and without capacitive filter), Zener regulator and IC regulator.</li> <li>7. Bipolar Junction Transistor (BJT) circuits to obtain some small signal parameters of BJT.</li> <li>8. Voltage amplifiers using operational amplifiers to measure and analyze bias quantities (dc currents and voltages) and small-signal gain of the given common-emitter amplifier circuit.</li> <li>9. Wave shaping and waveform generation using op amps</li> <li>10. Basic combinatorial circuits</li> <li>11. Logic design using multiplexers and basic sequential circuits</li> <li>12. Synchronous and ripple counters</li> </ol>
Suggested Books	Same as the associated theory course EE 104: Basic Electrical and Electronics Engineering

Course Code	<b>ME 104</b> [from AY 2010-11 to AY 2013-14]
Title of the Course	<b>Basic Mechanical Engineering</b>
Credit Structure	L-T-P-Credits 3-0-0-3
Name of the Concerned Department	Mechanical Engineering
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	<p><b>Thermodynamics:</b> Definition and scope of thermodynamics, fundamentals and laws of thermodynamics, vapour compression and absorption refrigeration cycles, psychometry and its uses.</p> <p><b>Heat Transfer:</b> Various modes of heat transfer: conduction, convection and radiation, black body, heat exchangers.</p> <p><b>Energy Conversion:</b> Various types of power plants, steam power plants and accessories, renewable energy.</p> <p><b>Internal Combustion (IC) Engines:</b> Otto and diesel cycle, 2- stroke and 4- stroke engines, alternative fuels</p> <p><b>Fluid Mechanics:</b> Fundamental Concepts, Flow through Pipes, Laminar Boundary Layers, Introduction and classification of Turbo machines</p> <p><b>Power and Motion Transmission Devices:</b> Belt drive, Chain drive and Gear drive. Introduction to Flywheels, Governors, Clutches and Brakes.</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. Y.A. Cengel and M.A. Boles, <b>Thermodynamics: An Engineering Approach</b> (6<sup>th</sup> Edition), Tata McGraw Hill, New Delhi, 2008.</li> <li>2. P.K. Nag, <b>Engineering Thermodynamics</b> (2<sup>nd</sup> edition), Tata McGraw Hill, New Delhi, 2003. (ISBN: 0-07-460275-6).</li> <li>3. S.K. Som and G. Biswas, <b>Introduction to Fluid Mechanics and Fluid Machines</b> (2<sup>nd</sup> Edition), Tata McGraw-Hill Publishing Company, New Delhi, 2008.</li> <li>4. S.S. Rattan, <b>Theory of Machines</b>, (2<sup>nd</sup> Edition) Tata McGraw Hill, New Delhi, 2005.</li> </ol>

Course Code	<b>ME 106</b> [from AY 2014-15 onward]
Title of the Course	<b>Basic Mechanical Engineering</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department	Mechanical Engineering
Pre-requisite, if any	None
Scope of the course	Introduces all the basic concepts of Mechanical Engineering
Course Syllabus	<p><b>Introduction to Manufacturing:</b> Relating manufacturing, design, assembly, metrology, quality control and service to each other. Selection of manufacturing processes.</p> <p><b>Introduction to metal casting processes:</b> Sand molding and casting process. Outline of popular casting methods with easy examples of products being manufactured by them. Basic idea of steel solidification.</p> <p><b>Introduction to joining methods:</b> Concept of temporary semi-permanent and permanent joints. Shielded metal arc welding and oxy-fuel gas welding processes. Outline of different fusion and non-fusion welding processes and their applications. Idea of weldability.</p> <p><b>Introduction to machine tools:</b> Preliminary idea of basic machine tools, hand tools and their operations. Ways of specifying tools and operations. Composition of cutting tool materials. Introduction to CNC machine tools.</p> <p><b>Introduction to metal forming operations:</b> Fundamentals of mechanical behavior of materials. Basic requirements for bulk deformation of metals. Cold and hot working processes. Application of various forming processes.</p> <p><b>Thermal Engineering:</b> Definition and scope of thermodynamics, fundamentals and laws of thermodynamics, vapour compression and absorption refrigeration cycles, psychometry and its uses. Otto and diesel cycle, 2- stroke and 4- stroke engines, alternative fuels. Various types of power plants, steam power plants and accessories, renewable energy.</p> <p><b>Power and Motion Transmission Devices:</b> Belt drive, Chain drive and Gear drive. Introduction to Flywheels, Governors, Clutches and Brakes.</p>
Suggested Books	1. E.P. DeGarmo, J.T. Black, and R. A. Kohser, <b>Materials and Processes in Manufacturing</b> (8 <sup>th</sup> edition), Prentice Hall of India

Pvt. Limited, New Delhi, 2006.

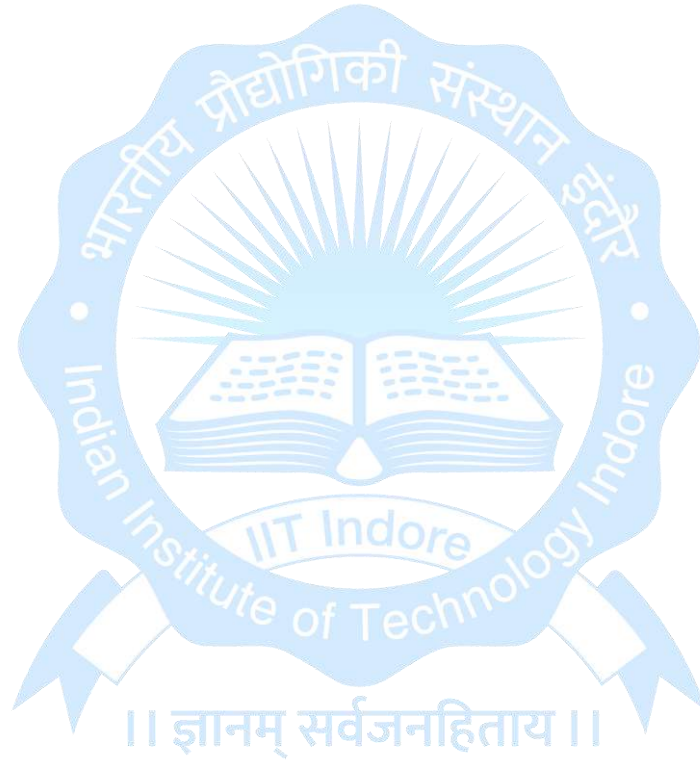
2. P.N. Rao, **Manufacturing Technology: Volume-1 and Volume-2** (3<sup>rd</sup> edition), Tata McGraw Hill, New Delhi, 2009.
3. S.K. Hajra Choudhury, S.K. Bose, and A.K. Hajra Choudhury, **Elements of Workshop Technology: Vol. I and Vol. II** (14<sup>th</sup> Edition) Media Promoters and Publishers, Mumbai, 2007.
4. M.P. Groover, **Fundamentals of Modern Manufacturing**, John Wiley & Sons Inc (Indian student edition), 2002.
5. Y.A. Cengel and M.A. Boles, **Thermodynamics: An Engineering Approach** (6<sup>th</sup> Edition), Tata McGraw Hill, New Delhi, 2008.
6. S.S. Rattan, **Theory of Machines**, (2<sup>nd</sup> Edition) Tata McGraw Hill, New Delhi, 2005.



Course Code	<b>ME 153</b> [from AY 2009-10 to AY 2015-16] <b>IC 153</b> [from AY 2016-17 onwards]
Title of the Course	<b>Engineering Graphics</b>
Credit Structure	L-T- P-Credits 1-0-3-2.5
Name of the Concerned Department	All the Engineering Departments
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	Introduction to engineering drawing and orthographic projections; Projection of points and straight line; Projection of planes and solids; Projection of simple machine elements; Development of surfaces, Intersection of surfaces; Construction of isometric views from orthographic projections.
Suggested Books	<ol style="list-style-type: none"> <li>1. N.D. Bhatt and V.M. Panchal, <b>Engineering Drawing</b>, Charotar Publishers, Anand, 2007.</li> <li>2. W.J. Luzadder and J. M. Duff, <b>Fundamentals of Engineering Drawing</b>, Prentice Hall of India, 2001.</li> <li>3. T. E. French, C.J., Vierck, and R.J. Foster, <b>Engineering Drawing and Graphic Technology</b> (14<sup>th</sup> Edition) McGraw Hill Science/Engg, 1993.</li> <li>4. A. D. Jolhe, <b>Engineering Drawing</b>, Tata McGraw Hill, New Delhi, 2007.</li> <li>5. M.B. Shah and B.C. Rana, <b>Engineering Drawing</b>, Dorling Kindersley (India) Pvt. Ltd, Pearson Education,</li> </ol>

Course Code	<b>ME 154</b> [from AY 2010-11 to AY 2013-14]
Title of the Course	<b>Basic Manufacturing Techniques</b>
Credit Structure	L-T- P-Credits 2-0-2-3
Name of the Concerned Department	Mechanical Engineering
Pre-requisite, if any	Nil
Scope of the course	
Course Syllabus	<p><b>Engineering Materials:</b> Introduction of engineering materials their types, applications, and manufacturability.</p> <p><b>Introduction to Pattern Making and Casting:</b> Pattern materials, pattern types, hand tools used in the wood working, pattern allowances, colour coding, molding sand composition and properties, sand casting, casting defects and their remedies.</p> <p><b>Plastic Parts Manufacturing:</b> Introduction and typical applications of the commonly used plastic parts manufacturing processes such as extrusion, injection molding, blow molding, rotational molding, compression molding, transfer molding, structural foam molding, thermoforming, etc.</p> <p><b>Introduction to Machining:</b> Machining fundamentals, Types of machining operations, Details and types of basic machine tools such as lathe, milling, and drilling and important machining operations on these machines and types of cutting tools used. Introduction of computer numerical controlled (CNC) machine tools.</p> <p><b>Introduction to Joining Methods:</b> Welding fundamentals, types of welded joints and welding positions, operations and details of gas welding process, manual metal arc welding processes. Soldering and brazing, their applications in electronics industry.</p> <p><b>Introduction to Metal Forming Operations:</b> Working principle and applications of forging, rolling, extrusion, wire drawing, tube drawing, and sheet metal operations.</p> <p><b>Practicals:</b> Simple workshop jobs to be made in the foundry, electric arc welding and gas welding, lathe, milling, and drilling machines. Demonstration of plastic parts manufacturing and Forming machines.</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. E.P. DeGarmo, J.T. Black, and R. A. Kohser, <b>Materials and Processes in Manufacturing</b> (8<sup>th</sup> edition), Prentice Hall of India Pvt. Limited, New Delhi, 2006.</li> <li>2. P.N. Rao, <b>Manufacturing Technology: Volume-1 and Volume-2</b> (3<sup>rd</sup> edition), Tata McGraw Hill, New Delhi, 2009.</li> </ol>

3. S.K. Hajra Choudhury, S.K. Bose, and A.K. Hajra Choudhury, **Elements of Workshop Technology: Vol. I and Vol. II** (14<sup>th</sup> Edition) Media Promoters and Publishers, Mumbai, 2007.
4. M.P. Groover, **Fundamentals of Modern Manufacturing**, John Wiley & Sons Inc (Indian student edition), 2002.



Course Code	<b>ME 156</b> [from AY 2014-15 onwards] <b>IC 156</b> [from AY 2016-17 onward]
Title of the Course	<b>Basic Manufacturing Techniques</b>
Credit Structure	L-T- P-Credits 0-0-3-1.5
Name of the Concerned Department	All the Engineering Departments
Pre-requisite, if any	Nil
Scope of the course	
Course Syllabus	<ol style="list-style-type: none"> <li>1. Preparation of single piece casting.</li> <li>2. Preparation of Lap joint in carpentry.</li> <li>3. Preparation of joint by Arc welding &amp; Gas welding.</li> <li>4. Preparation of simple job by fitting tool &amp; drilling.</li> <li>5. Preparation of job on Lathe machine by turning, facing, knurling, drilling etc.</li> <li>6. Basic Electrical Wiring system.</li> <li>7. Investigating the casting and weld defects using non-destructive examination.</li> <li>8. Characterize the defect size, location and distribution using ultrasonic method.</li> <li>9. Determination of density of the given Casting using Archimedes method.</li> </ol>
Suggested Books	

Course Code	<b>IC 211</b>
Title of the Course	<b>Experimental Engineering Lab</b>
Credit Structure	L-T- P-Credits 0-0-3-1.5
Name of the Concerned Department	All the Engineering Departments and Mathematics
Pre-requisite, if any	Nil
Scope of the course	
Course Syllabus	<ol style="list-style-type: none"> <li>1. Measurement of Resistance using Kelvin Bridge.</li> <li>2. Measurement of Inductance using Maxwell Bridge and Measurement of Capacitance using Desauty's and Schearing Bridge.</li> <li>3. Study of LVDT characteristics.</li> <li>4. Measurement of Pressure using U-tube manometer, inclined manometer and Dead weight pressure tester.</li> <li>5. Study of various types of Temperature Measurement Methods</li> <li>6. Study of Mechatronics sensors.</li> <li>7. Determination of elastic modulus using 3 point symmetric /asymmetric bending.</li> <li>8. Determination of surface tension of a given liquid using contact angle measurement.</li> <li>9. Chain Surveying: To Provide a skeleton or frame work consisting of a number of connected triangles.</li> <li>10. Prepare and develop a program for data acquisition and presentation from different sensors.</li> </ol>
Suggested Books	<p><b>Text Books</b></p> <ol style="list-style-type: none"> <li>1. J. P. Holman, <b>Experimental Methods for Engineers</b> (7th Edition), Tata McGraw-Hill, New Delhi, (Special Indian Edition) 2007.</li> <li>2. E.O. Doebelin, <b>Engineering Experimentation: Planning, Execution, Reporting</b>, McGraw-Hill, ISBN: 0070173397, 1995.</li> <li>3. E.O. Doebelin and D. N. Manik, <b>Measurement Systems</b>, McGraw Hill Educations, 2007</li> </ol> <p><b>Reference Books</b></p> <ol style="list-style-type: none"> <li>1. J.P. Holman, <b>Experimental Methods for Engineers</b>, McGraw- Hill Inc., New York, 1978.</li> <li>2. E.O. Doebelin, <b>Measurement Systems; Application and Design</b>, McGraw-Hill, 1976.</li> <li>3. C.F. Jeff Wu, and M.S. Hamada, <b>Experiments: Planning, Analysis, and Optimization</b>, Wiley, ISBN: 0471699462, 2009.</li> </ol>

4. A.J. Wheeler and A.R. Ganji, **Introduction to Engineering Experimentation**, Prentice Hall, ISBN: 0131742760, 1996.
5. W.J. Diamond, **Practical Experiment Designs: for Engineers and Scientists**, Wiley, ISBN: 0471390542, 2001.
6. R.H. Bishop, **Learning with LabVIEW**, Addison Wesley Longman, ISBN: 0201361663, 1999.
7. R.S. Figliola, and D.E. Beasley, **Theory and Design for Mechanical Measurements** - 4<sup>th</sup> Edition, Wiley, 2006.



Course Code	<b>ES 302</b> [from AY 2010-11 onwards]
Title of the Course	<b>Environnemental Studies: Scientific and Engineering Aspects</b>
Credit Structure	L-T-P-Credits 3-0-0-1.5 ( <b>Half Semester Course</b> )
Name of the Concerned Department	Multi-disciplinary
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	<p>Multidisciplinary nature of environmental studies, Ecosystems, Biodiversity and its conservation, Indicators of environmental pollution, Environment and human health.</p> <p>Consumption of natural resources and environmental degradation of forests, water, coal, minerals, energy, and land.</p> <p>Sustainable development, Environmental policy and legislation, Environmental impact assessment.</p> <p>Pollution of lakes, rivers, ground water, coasts, and oceans, Science and technology for drinking water and wastewater treatment and issues in management of systems.</p> <p>Solid and hazardous waste management: causes, effects and control measures.</p> <p>Air and noise pollution, science and engineering of pollution control, Global Issues including climate change, global warming, acid rain, ozone layer depletion, nuclear hazards, Disaster management, industrial accidents, floods, earthquakes, cyclones and landslides.</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. W.P. Cunningham and M.A. Cunningham, <b>Principles of Environmental Science</b>, Tata McGraw-Hill Publishing Company, New Delhi, 2002.</li> <li>2. J.A. Nathanson, <b>Basic Environmental Technology</b>, Prentice Hall of India, New Delhi, 2002.</li> <li>3. S.J. Arceivala, and S.R. Asolekar, <b>Wastewater Treatment for Pollution Control and Reuse</b> (3<sup>rd</sup> Edition), Tata McGraw Publishing Co. Ltd., New Delhi, 2006.</li> <li>4. S.R. Asolekar, and R. Gopichandran, <b>Preventive Environmental Management: An Indian Perspective</b>, Foundation Books Pvt. Ltd., New Delhi, 2005.</li> </ol> <p>Some selected book-chapters, monographs and journal papers</p>

<b>Course code</b>	<b>EE 101</b>
<b>Title of the course</b>	<b>Basic Electrical Engineering</b>
Course Category	Institute Core
Credit Structure	L-T-P-C (1-1-0-2)
Name of the Concerned Department	Electrical Engineering
Prerequisite, if any	None
Scope of the course (Objectives)	The objective of this course is to familiarize the students with different theorems and circuits associated with basic electrical engineering.
Course Outcomes	<ul style="list-style-type: none"> <li>• To acquire knowledge in different aspects of basic electrical engineering</li> <li>• To understand different theorems and their applications in electrical circuits.</li> </ul>
Course Syllabus	<p><b>Introduction:</b> Basic physical laws, Basic circuit elements, Kirchhoff's voltage law (KVL), Kirchhoff's current law (KCL), A few important circuit theorems (Mesh analysis, Nodal analysis, Superposition theorem, Thevenin theorem, Norton theorem, Supernode analysis, Supermesh analysis, Star-delta theorem), simple and complex circuits.</p> <p><b>Electrical circuits:</b> Transients in R-L, R-C, R-L-C, Sinusoidal Steady State, Real/ Reactive Power, Phasors, Three phase power, Magnetic circuit, Working principles of Transformers/AC/DC machines.</p> <p><b>Analog circuits:</b> OP-AMP.</p>
Suggested Books	<p>Textbooks:</p> <p>(1) L. S. Bobrow, <b>Fundamentals of Electrical Engineering</b> (2nd edition), Oxford University Press, 1996, ISBN: 0195105095.</p> <p>(2) C. K. Alexander, and M. Sadiku, <b>Fundamentals of Electric Circuits</b> (5th edition), McGraw Hill, 2013, ISBN: 1259098591.</p> <p>(3) R. L. Boylestad, and L. Nashelsky, <b>Electronic Devices and Circuit Theory</b> (4th edition), Longman Higher Education, 1987, ISBN: 013250457X.</p> <p>Reference books:</p> <p>1) V. D. Toro, <b>Electrical Engineering Fundamentals</b> (2nd edition), Prentice Hall, 1989, ISBN: 9332551766.</p> <p>(2) K. A. Krishnamurthy and M. R. Raghuvver, <b>Electrical and Electronics Engineering for Scientists and Engineerings</b>, Wiley-Blackwell, 1994, ISBN: 0470220627.</p> <p>(3) R. A. Gayakwad, <b>Op-Amps and Linear Integrated Circuits</b> (4th</p>

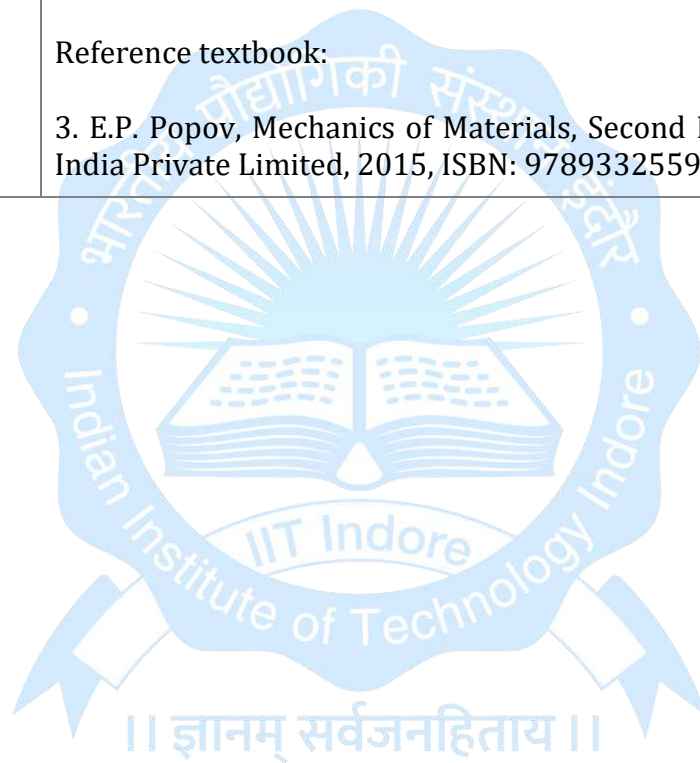
edition), Pearson, 2015, ISBN: 9332549915.



<b>Course code</b>	<b>EE 106</b>
<b>Title of the course</b>	<b>Basic Electronics Engineering</b>
Course Category	Institute Elective
Credit Structure	L-T-P-C (1-0-0-1)
Name of the Concerned Department	Electrical Engineering
Prerequisite, if any	None
Scope of the course (Objectives)	The objective of this course is to familiarize the students with the basics of different circuits, electronic devices and components associated with basic electronics engineering.
Course Outcomes	<ul style="list-style-type: none"> <li>• To acquire knowledge in different aspects of basic electronics engineering</li> <li>• To understand the operational mechanisms of different electronic circuits, devices, and components.</li> </ul>
Course Syllabus	<p><b>Introduction:</b> Functional Characteristics of Diode, Circuits (Clippers, clampers), Rectifiers, Bipolar Junction Transistor (BJT).</p> <p><b>Digital circuits:</b> Boolean algebra, Number System, Logic gates, Flip Flops.</p>
Suggested Books	<p><b>Text books:</b></p> <p>(1) R. L. Boylestad, and L. Nashelsky, <b>Electronic Devices and Circuit Theory</b> (4th edition), Longman Higher Education, 1987, ISBN: 013250457X.</p> <p>(2) B. G. Streetman, <b>Solid State Electronic Devices</b> (6th edition), Prentice Hall of India, New Delhi, 2006, ISBN: 812033020X.</p> <p>(3) A. S. Sedra and K. C. Smith, <b>Microelectronic Circuits</b> (7th edition), Saunder's College Publishing, 2014, ISBN: 9780199339136.</p> <p>(4) J. Millman and A. Grabel, <b>Microelectronics</b> (2nd edition), McGraw Hill, International, 2017, ISBN: 0074637363.</p> <p><b>Reference books:</b></p> <p>(1) H. Taub and D. Schilling, <b>Digital Integrated Electronics</b> (1st edition), McGraw Hill, 2017, ISBN: 9780070265080.</p> <p>(2) D. A. Hodges, H. G. Jackson, and R. A. Saleh, <b>Analysis and Design of Digital Integrated Circuits</b> (3rd edition), McGraw Hill, 2003, ISBN: 0072283653.</p>

<b>Course code</b>	<b>ME 101</b>
<b>Title of the course</b>	<b>Engineering Mechanics</b>
Course Category	Basic engineering
Credit Structure	L - T - P - Credits 2-0-0-2
Name of the Concerned Department	Mechanical Engineering/ Civil Engineering
Pre-requisite, if any	This is an introductory course to study and make use of the principles required to remedy engineering mechanics issues. Mathematics and physics Ideas can be applied on this course.
Scope of the course (Objectives)	Engineering mechanics involves the study of forces and their effects on matter, and the use of this knowledge to design and analyse structures, machines, and other systems. It is used to analyse and design structures to understand the behaviour of materials under different loading conditions.
Course Outcomes	<ul style="list-style-type: none"> <li>➤ To develop ability to model and analysis of mechanical engineering systems using vectoral representation of forces and moments.</li> <li>➤ To develop skills to use the basic principles of mechanics in engineering applications.</li> </ul>
Course Content	<ol style="list-style-type: none"> <li>1. Introduction to statics and dynamics: Mechanics, Basic Concepts, Scalars and Vectors, Newton's Laws, Units, Laws of Gravitation.</li> <li>2. Force Systems: Two- and Three-Dimensional Force Systems, Rectangular Components, Moment and Couple, Resultants.</li> <li>3. Equilibrium: Equilibrium in Two-and Three-Dimensions, System Isolation and Free-Body Diagram.</li> <li>4. Friction: Introduction, Laws of Coulomb Friction, Equilibrium of Bodies involving Dry friction.</li> <li>5. Centroid and Moment of Inertia: Centroid of the plane, curve, area, volume, and composite bodies, moment of inertia of plane area, parallel axes theorem.</li> <li>6. Structures: Plane trusses, method of joints, method of sections, frames, and machines.</li> <li>7. Kinematics of Rigid Body: Introduction, plane motion of the rigid body, velocity and acceleration under translation and rotational motions.</li> <li>8. Kinetics of Rigid Body: Introduction, force, mass and Acceleration, Work and Energy, Impulse and Momentum, D'Alembert's principles, and dynamic equilibrium.</li> <li>9. Simple Stress and Strain: Introduction, normal and shear stresses,</li> </ol>

	stress-strain diagrams for ductile and brittle material.
<b>Suggested books</b>	<p>Textbooks:</p> <ol style="list-style-type: none"><li>1. Irving H. Shames, Engineering Mechanics, Pearson Education, Prentice Hall, 2006, ISBN 9788177581232</li><li>2. James L. Meriam, L. G. Kraige, J. N. Bolton, Engineering Mechanics: Statics and Dynamics, Ninth edition, Wiley publication, 2018, ISBN: 978-1-119-39262-0</li></ol> <p>Reference textbook:</p> <ol style="list-style-type: none"><li>3. E.P. Popov, Mechanics of Materials, Second Edition, Prentice Hall of India Private Limited, 2015, ISBN: 9789332559547</li></ol>



<b>Course code</b>	<b>ME 108</b>
<b>Title of the course</b>	<b>Basic Manufacturing Processes</b>
Course Category	Flexible elective
Credit Structure	L - T - P - Credits 1-0-0-1
Name of the Concerned Department	Mechanical Engineering
Pre-requisite if any	Nil
Scope of the course (Objectives)	It focuses on the design, development, and operation of integrated systems of production to obtain high quality & economically competitive products.
Course Outcomes	<ul style="list-style-type: none"> <li>➤ This course helps in selecting suitable manufacturing processes to manufacture the products optimally.</li> <li>➤ This course also recommends the appropriate design of casting process systems, forming processes, welding process and machining (metal cutting) processes.</li> </ul>
Course Content	<ol style="list-style-type: none"> <li>1. Casting: Steps involved in making a casting, its applications, patterns, and types of patterns, pattern allowances and their construction, types of casting processes, solidification of casting.</li> <li>2. Introduction to machine tools: Preliminary idea of basic machine tools, hand tools and their operations. Ways of specifying tools and operations. Composition of cutting tool materials.</li> <li>3. Welding: Welding types, Oxy-fuel gas welding, cutting, Outline of different fusion and non-fusion welding processes and their applications.</li> <li>4. Forming: Hot working, cold working, strain hardening, comparison of properties of cold and hot worked parts, rolling fundamentals</li> <li>5. Forging processes: Forging operations and principles, tools, forging methods, forging hammers: Rotary forging, forging defects, cold forging.</li> </ol>
	<p><b>Suggested textbooks:</b></p> <ol style="list-style-type: none"> <li>1. P.N. Rao, Manufacturing Technology (Foundation Forming &amp; Welding), Tata McGraw Hill, 2013, ISBN: 978-</li> </ol>

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2. J. S. Campbell, Principles of manufacturing materials and processes, Tata McGraw Hill, 1995, ISBN: 9780070992528

**Reference textbooks:**

1. S. Kalpakjian and S.R. Scsimid, Manufacturing Engineering and Technology, 4th Edition, Pearson Education, 2001, ISBN: ISBN: 9788177581706
2. R. C. S. Mehta N. S. Gaira, Basic Manufacturing Process, 2017, VIVA BOOKS, ISBN: 978-8171881871



<b>Course code</b>	<b>ME 110</b>
<b>Title of the course</b>	<b>Basic Thermal Engineering</b>
Course Category	Flexible elective
Credit Structure	L - T - P - Credits 1-0-0-1
Name of the Concerned Department	Mechanical Engineering
Pre-requisite if any	Nil
Scope of the course (Objectives)	This course focuses on basic mechanical engineering starting from thermodynamics, fluid mechanics, Heat transfer to its application in different practical processes, analysis of the Internal combustion engines, and the Refrigeration cycle.
Course Outcomes	<ul style="list-style-type: none"> <li>➤ Able to obtain knowledge of different aspects of designing of a thermal system.</li> <li>➤ Get fundamental knowledge of fluid, its properties and behavior under various conditions.</li> <li>➤ Understand various types of I.C. Engines, refrigeration cycles and Heat transfer modes</li> </ul>
<b>Course Content</b>	<ol style="list-style-type: none"> <li>1. Basic concepts and laws of thermodynamics: Thermodynamic definition and scope, system - boundary, surrounding, thermodynamic systems Properties of system, Law of thermodynamics-Zeroth, first &amp; second laws of thermodynamics.</li> <li>2. Fluid Mechanics: Fluid statistics, Fluid kinematics, and Fluid dynamics</li> <li>3. Refrigeration &amp; air conditioning: Working principle of VCR and VAR cycles. Performance of refrigeration cycles</li> <li>4. IC engines: Working principle of Two Stroke and four stroke engine, petrol, and diesel engine. Engine performance and emissions.</li> <li>5. Heat Transfer: Introduction -Modes of heat transfer- Conduction, convection, and radiation, Simple problems on conduction.</li> </ol>
<b>Suggested books</b>	<b>Textbooks:</b> <ol style="list-style-type: none"> <li>1. Moran, M.J., Moran, H. N. Shapiro, D.D. Boettner, and M.B. Bailey, "Fundamentals of engineering thermodynamics". 8<sup>th</sup> Edition, John Wiley &amp; Sons; (2010), ISBN: 978-1-118-41293-0</li> </ol>

2. Y.A. Cengel and M.A. Boles, Thermodynamics: An Engineering Approach (6th Edition), Tata McGraw Hill, New Delhi, 2008, ISBN: 0071257713
3. F.M. White, Fluid Mechanics, Seventh edition, Tata McGraw Hill, 2008, ISBN: 978-0071333122

**Reference textbook:**

1. W. W. Pulkrabek, Engineering Fundamentals of the Internal Combustion Engine, PHI, (2002), ISBN: 978-0131405707
2. J. P. Holman, & Souvik Bhattacharyya, Heat Transfer, 10th Edition, 2017, ISBN: 978-0071069670



<b>Course code</b>	<b>PH 108</b>
<b>Title of the course</b>	<b>Basics of Laser Engineering</b>
Course Category	Elective for Basic Engineering Module
Credit Structure	L - T - P - Credits 1-0-0-1
Name of the Concerned Department	Physics
Pre-requisite, if any	-----
Scope of the course (Objectives)	Student will learn basic principle of lasers, their functioning and application.
Course Outcomes	Familiarity with the working mechanisms of lasers and it's applications.
Course Content	Stimulated and Spontaneous emissions, Absorption, Einstein's A and B coefficients, Population inversion, Pumping techniques, Resonators, Laser modes, Classes of lasers, Properties of lasers and Laser applications.
Suggested Books	Text Book: 1. A.K. Ghatak and K. Thyagarajan: Lasers: Fundamentals and Applications: Laxmi publications: 2019: ISBN: 978-9352745531 Reference Books: 2. W. T. Silfvast, Laser Fundamentals (2nd Edition): Cambridge University Press: 2004: ISBN: 978-0521833455

॥ ज्ञानम् सर्वजनहिताय ॥

<b>Course code</b>	<b>PH 107</b>
<b>Title of the course</b>	<b>Basics of Physics</b>
Course Category	Core
Credit Structure	L - T - P - Credits 2-1-0-3
Name of the Concerned Department	Physics
Pre-requisite, if any	None
Scope of the course (Objectives)	Student will learn Basics of Quantum Mechanics and Electromagnetic theory
Course Outcomes	<ul style="list-style-type: none"> <li>● Understanding of Quantum Mechanical concepts, their need, and applications</li> <li>● To develop ability to solve complex problems if electromagnetism using mathematical methods and tools</li> <li>● Analysis of complex real life problems through examples and physical understanding</li> </ul>
Course Content	<p><b>1. Quantum Mechanics &amp; Applications:</b> Review of quantum concepts, Inadequacies of Classical Mechanics – black body radiation, Photoelectric effect, Compton effect, Heisenberg uncertainty principle. Schrodinger equation, Probabilistic interpretation of wave function. One dimensional problems- Particle in a box, Potential well, Potential barrier and Tunnelling, Harmonic oscillator.</p> <p><b>2. Electrostatics:</b> Divergence and curl of electrostatic fields, electric potential, Poisson's equation, Laplace's equation, Uniqueness theorem, method of images, Separation of variables, multipole expansion, Polarization, bound charges, fields, forces and energy of dielectrics, applications</p> <p><b>3. Magnetostatics:</b> Biot-Savart law, divergence and curl of magnetic field, vector potential, Magnetic field inside matter, Electromagnetic induction, Faraday's law, Maxwell equations and Poynting's theorem, applications</p>
Suggested Books	<p><b><u>Text Books:</u></b></p> <ol style="list-style-type: none"> <li>1. A. Beiser, S. Mahajan, S.R. Choudhury: Concepts of Modern Physics (6th Edition): McGraw Hill Inc: 2009: ISBN-13 : 978-9351341857</li> <li>2. D. Griffiths: Introduction to Electrodynamics, (2nd edition): Prentice Hall of India: New Delhi: 1989: ISBN-13 : 978-1108822909</li> </ol> <p><b><u>Reference Books:</u></b></p>

1. S.H. Patil: Elements of Modern Physics:Tata McGraw Hill:1989: ISBN: 978-0074602256
2. K.S. Krane : Modern Physics (2nd Edition): John Wiley and Sons: 1996, ISBN: 978-9354244681
3. H.S. Mani and G.K. Mehta: Introduction to Modern Physics: East West Books Madras Pvt. Ltd.: 1988: ISBN: 978-8185095738
4. A.S. Mahajan and A. Rangawala: Electricity and Magnetism: Tata McGraw Hill: New Delhi: 1989 : ISBN: 978-0074602256
5. D. N. Vasudeva : Fundamentals of magnetism and electricity: S. Chand and Company: ISBN: 978-8121909556
6. E. M. Purcell and David Morin: Electricity and Magnetism : Cambridge University Press: ISBN: 978-1107014022
7. H. C. Verma, Classical Electromagnetism, ISBN: 978-9388704823



<b>Course code</b>	<b>PH 157</b>
<b>Title of the course</b>	<b>Physics Lab- I</b>
Course Category	Core
Credit Structure	L - T - P - Credits 0-0-2-1
Name of the Concerned Department	Physics
Pre-requisite, if any	Nil
Scope of the course (Objectives)	Student will learn to perform experiments in a methodical manner of data acquisition, data analysis and error estimation. They should be able to interpret their results and physical significance.
Course Outcomes	<ul style="list-style-type: none"> <li>• To conduct and analyse experiments in a scientific way</li> <li>• Learn logical interpretation of the data and physical interpretation</li> </ul>
Course Content	<ol style="list-style-type: none"> <li>1. Effect of magnetic field on materials (Hall Effect and Universal B-H Curve Tracer)</li> <li>2. Frank Hertz Experiment.</li> <li>3. LCR Circuit</li> <li>4. Thermal &amp; Electrical Conductivity</li> <li>5. Kundt's Tube</li> <li>6. Fresnel's Bi-prism</li> <li>7. Grating Spectrometer</li> <li>8. Hydrogen Spectrum</li> <li>9. Specific Charge of Electron (e/m)</li> <li>10. Newton's Rings</li> </ol>
Suggested Books	<p><b><u>Text Book:</u></b></p> <ul style="list-style-type: none"> <li>• Lab Manual</li> </ul> <p><b><u>Reference Books:</u></b></p> <ul style="list-style-type: none"> <li>• G. L. Squires, Practical Physics, University Press, Cambridge, 1998</li> </ul>

<b>Course Code</b>	<b>BSE 102</b>
<b>Title of the Course</b>	<b>Biosciences</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Discipline	Biosciences and Biomedical Engineering
Pre-requisite, if any	Nil
Scope of the course (Objectives)	This course intends to refresh the basics of biology to engineering students who might not be in touch with this subject after their matriculation
Course Outcomes	1. Gain an appreciation of vital life processes and principles governing homeostasis of the human body machine 2. Enthuse students to apply engineering principles to biological systems and vice-versa
Course Syllabus	<p><b>The perspective of Biology and Life and its origin:</b> Requirements for Life, Chemistry of life, Chemistry of water, Origin of life.</p> <p><b>Evolutionary History of Biological Diversity:</b> Phylogeny and the Tree of Life, Bacteria and Archaea, Protists. Plant Diversity I: How Plants Colonized Land, Plant Diversity II: The Evolution of Seed Plants, Fungi, An Overview of Animal Diversity, An Introduction to Invertebrates, The Origin and Evolution of Vertebrates</p> <p><b>Micro- and Macromolecules in the living system:</b> Amino Acids, Proteins, Carbohydrates, lipids and Fats, and Nucleic Acids.</p> <p><b>Enzymes:</b> Basic concept, Classification and Function, Enzyme kinetics, Role of Enzymes in life.</p> <p><b>Cell:</b> Prokaryotic and Eukaryotic cells, Animal cell and Plant cell, Structure and function of the sub-cellular organization, membrane and cell physiology, Chromosome and Gene, Genetics. Mitosis, Meiosis, other types of cell divisions, and Cancer</p> <p><b>Organization of the Human body:</b> Tissues, Organs, and the body</p> <p><b>Ecology and Environment:</b> Aquatic and terrestrial biomes, Pollution, Climate change, etc.</p> <p><b>Biomedical Imaging and Instrumentation:</b> Introduction to imaging modalities used in the clinic, and introduction to clinical instrumentations.</p>

Suggested Books	<p><b><u>Text Books:</u></b></p> <ol style="list-style-type: none"><li>1. Campbell; Biology, 9th edition. Pearson Higher Education 2011</li><li>2. Lehninger &amp; Cox. Principles of Biochemistry (5th edition), W.H. Freeman &amp; Company, USA</li></ol> <p><b><u>Reference Books:</u></b></p> <ol style="list-style-type: none"><li>1. Colleen Belk, Virginia Borden Maier; Biology: Science for Life with Physiology, Pearson New International Edition, 2013</li><li>2. Khandpur R.S., Handbook of Biomedical Instrumentation (2nd edition), Tata McGraw-Hill Publishing Company Limited, New Delhi</li></ol>
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<b>Course Code</b>	<b>MA 101N</b>
<b>Title of the Course</b>	<b>Calculus-I</b>
Course Category	Institute Core
Credit Structure	L-T- P-Credits 3-1-0-2 (=4/2) (1/2 Semester)
Name of the Concerned Discipline	Mathematics
Pre-requisite, if any	None
Scope of the course	This is a foundation course on single variable calculus for UG students.
Course Outcomes	Students will understand the concepts, like convergence of sequences and series, limits, continuity, differentiability and integrability, and their applications.
Course Syllabus	<ul style="list-style-type: none"> <li>● Review of limits, continuity, differentiability.</li> <li>● Mean Value Theorem, Taylor Theorem, Maxima and Minima.</li> <li>● Riemann integrals, Fundamental theorem of Calculus, Improper integrals, application to area, volume.</li> <li>● Convergence of sequences and series, power series.</li> </ul>
Suggested Books	1. G. B. Thomas, M. D. Weir, J. Hass, F. R. Giordano, <b>Thomas' Calculus</b> , Addison Wesley, 2004, 11 <sup>th</sup> Edition, ISBN: 0321185587,9780321185587
Reference Books	2. Huges-Hallett et al., Calculus: Single and Multi-Variable (3rd Edition), John-Wiley & Sons (USA), 2003. ISBN: 1119696550, 9781119696551 3. J. Stewart, Calculus (5th Edition), Thomson, 2003 (Indian Edition). ISBN: 053439339X, 9780534393397 4. T.M. Apostol, Calculus: Volumes 1 and 2 (2nd Edition), Wiley Eastern (USA), 1980. ISBN: 0471000051, 9780471000051 5. G.B. Thomas and R.L. Finney, Calculus and Analytic Geometry (9th Edition), ISE Reprint, Addison-Wesley, 1998 (Indian Edition). ISBN: 0201531747, 978-0201531749

<b>Course Code</b>	<b>MA 103N</b>
<b>Title of the Course</b>	<b>Calculus-II</b>
Course Category	Institute Core
Credit Structure	L-T- P-Credits 3-1-0-2 (=4/2) (1/2 Semester)
Name of the Concerned Discipline	Mathematics
Pre-requisite, if any	None
Scope of the course	This is a foundation course on multi-variables calculus for UG students.
Course Outcomes	Students will understand the concepts, like partial derivatives, gradient, directional derivatives, double and triple integration, and their applications.
Course Syllabus	<ul style="list-style-type: none"> <li>● Partial Derivatives, gradient and directional derivatives, chain rule, maxima and minima, Lagrange multipliers.</li> <li>● Double and triple integration, Jacobians and change of variables formula.</li> <li>● Parametrization of curves and surfaces, vector fields, line and surface integrals.</li> <li>● Divergence and curl, theorems of Green, Gauss, Stokes.</li> </ul>
Suggested Books	<p><b><u>Textbooks:</u></b></p> <ol style="list-style-type: none"> <li>1. G. B. Thomas, M. D. Weir, J. Hass, F. R. Giordano, <b>Thomas' Calculus</b>, Addison Wesley, 2004, 11<sup>th</sup> Edition, ISBN: 0321185587,9780321185587</li> </ol> <p><b><u>Reference Books:</u></b></p> <ol style="list-style-type: none"> <li>2. Huges-Hallett et al., Calculus: Single and Multi-Variable (3rd Edition), John-Wiley &amp; Sons (USA), 2003. ISBN: 1119696550, 9781119696551</li> <li>3. J. Stewart, Calculus (5th Edition), Thomson, 2003 (Indian Edition). ISBN: 053439339X, 9780534393397</li> <li>4. T.M. Apostol, Calculus: Volumes 1 and 2 (2nd Edition), Wiley Eastern (USA), 1980. ISBN: 0471000051, 9780471000051</li> <li>5. G.B. Thomas and R.L. Finney, Calculus and Analytic Geometry (9th Edition), ISE Reprint, Addison-Wesley, 1998 (Indian Edition). ISBN: 0201531747, 978-0201531749</li> </ol>

<b>Course Code</b>	<b>MA 102N</b>
<b>Title of the Course</b>	<b>Linear Algebra</b>
<b>Course Category</b>	Institute Core
<b>Credit Structure</b>	L-T- P-Credits 2-1-0-1.5 (=3/2) (1/2 Semester)
<b>Name of the Concerned Discipline</b>	Mathematics
<b>Pre-requisite, if any</b>	None
<b>Scope of the course</b>	This is a foundation course on linear algebra for UG students.
<b>Course Outcomes</b>	Students will understand solving a system of linear equations and the concepts, like matrices, determinants, vector spaces and linear transformations.
<b>Course Syllabus</b>	<ul style="list-style-type: none"> <li>● System of linear equations, matrices and Gaussian elimination, rank of a matrix.</li> <li>● Determinants and rank of a matrix in terms of determinants.</li> <li>● Vector spaces, linear independence and dependence, linear span of a set of vectors, vector subspace, basis of vector subspaces, row space, null space and column space, rank-nullity theorem.</li> <li>● Linear transformations, matrix of a linear transformation, change of basis and similarity, Inner product spaces, Gram-Schmidt process, orthonormal bases.</li> <li>● Eigenvalues and eigenvectors, characteristic polynomials, eigenvalues of special matrices, such as orthogonal, unitary, Hermitian, symmetric, skew-symmetric, normal.</li> <li>● Algebraic and geometric multiplicity, diagonalization, spectral theorem for real symmetric matrices.</li> </ul>
<b>Suggested Books</b>	<p><b><u>Textbooks:</u></b></p> <ol style="list-style-type: none"> <li>1. Gilbert Strang, <b>Introduction to Linear Algebra</b>, Fifth Edition (2016), Wellesley-Cambridge Press, ISBN: 978-09802327-7-6</li> </ol> <p><b><u>Reference Books:</u></b></p> <ol style="list-style-type: none"> <li>1. H. Anton, Elementary Linear Algebra with Applications (8th Edition), John-Wiley &amp; Sons, 1995. ISBN: 0471669598, 9780471669593</li> <li>2. G. Strang, Linear Algebra and its Applications (4th edition), Thomson, 2006. ISBN: 0030105676, 9780030105678</li> <li>3. S. Kumaresan, Linear Algebra: A Geometric Approach, Prentice Hall of India, 2000. ISBN: 8120316282, 9788120316287</li> <li>4. E. Kreyszig, Advanced Engineering Mathematics (8th Edition), John Wiley &amp; Sons, 1999, ISBN 978-0-470-45836-5.</li> </ol>

<b>Course Code</b>	<b>MA 104N</b>
<b>Title of the Course</b>	<b>Differential Equations-I</b>
Course Category	Institute Core
Credit Structure	L-T- P-Credits 2-1-0-1.5 (=3/2) (1/2 Semester)
Name of the Concerned Discipline	Mathematics
Pre-requisite, if any	None
Scope of the course	This is a foundation course on ordinary differential equations for UG students.
Course Outcomes	<ul style="list-style-type: none"> <li>• Students will be trained to solve various types of ordinary differential equations.</li> <li>• Students will also be exposed to the qualitative theory of ordinary differential equations such as existence and uniqueness.</li> </ul>
Course Syllabus	<ul style="list-style-type: none"> <li>• Exact equations, integrating factors, Orthogonal trajectories.</li> <li>• Lipschitz condition, Picard's theorem.</li> <li>• Linear differential equations generalities, Wronskians, Dimensionality of space of solutions, Abel-Liouville formula, Linear ODEs with constant coefficients, the characteristic equations, Cauchy-Euler equations.</li> <li>• Method of undetermined coefficients.</li> <li>• Method of variation of parameters.</li> <li>• Laplace transformation and generalities, shifting theorems, convolution theorem.</li> </ul>
Suggested Books	<p><b><u>Textbooks:</u></b></p> <ol style="list-style-type: none"> <li>1. E. Kreyszig, <b>Advanced Engineering Mathematics</b> (8th Edition), John Wiley &amp; Sons, 1999, ISBN 978-0-470-45836-5.</li> </ol> <p><b><u>Reference Books:</u></b></p> <ol style="list-style-type: none"> <li>1. W.E. Boyce and R. DiPrima, Elementary Differential Equations (8th Edition), John Wiley &amp; Sons, 2005(USA). ISBN: 0471433381, 9780471433385</li> <li>2. T.M. Apostol, Calculus, Volume 2 (2nd edition), Wiley-Eastern, 1980. ISBN: 0471000078, 9780471000075</li> <li>3. G. Simmons, Differential Equations with Applications and Historical Notes, McGraw Hill Education 2nd edition, 2017. ISBN: 0070575401, 9780070575400</li> <li>4. G. Simmons, Differential Equations: Theory-Technique and Practice, McGraw Hill Education, 1st edition, 2017. ISBN: 0072863153, 9780072863154</li> </ol>

Course Code	<b>CH 105</b>
Title of the Course	<b>Chemistry</b>
Credit Structure	L-T-P-Credit 3-0-0-3
Name of the Department	Chemistry
Pre-requisite, if any	Nil
Scope of the Course	This course provides basic knowledge of chemistry involving organic, inorganic and physical chemistry
Course Syllabus	<p><b>Linking microscopic and bulk thermodynamic properties:</b> Distribution of molecular states and relation to entropy, Boltzmann distribution, ensembles, partition functions.</p> <p><b>Elucidation of structure and properties:</b> Experimental techniques, Interaction light with matter, absorption and emission spectra, intensities of spectral lines, Beer-Lambert law, spontaneous and simulated emission, transition moments and selection rules, Franck-Condon principle, lasers and fluorescence.</p> <p><b>Chemical Bonding:</b> Valence Bond Theory (VBT), Molecular Orbital Theory (MOT)</p> <p><b>Structure and Bonding of Coordination Complexes:</b> Tetrahedral, Octahedral, Square planar and Square Pyramidal complexes</p> <p><b>Introduction to Organometallic Complexes:</b> Structure and Bonding</p> <p><b>Application of Coordination Complexes, Metal Organic Frameworks (MOFs), and Organometallic Complexes:</b> Introduction to Metal organic Frameworks, Magnetic materials, Catalysis, Adsorption properties, Metal ions in Biology</p> <p><b>Organic Chemistry:</b> Hückel treatment of ethylene, butadiene and benzene, concept of aromaticity, orbital symmetry and chemical reactions, conformation of cycloalkanes, reactivity of carbonyl groups due to acidic protons, heterocyclic chemistry (thiophene, furan, pyridine, pyrrole, and indole), neighbouring group effect. Introduction to bio-organic chemistry: steroids, amino acids and nucleic acids.</p>
Suggested Books	<p><b>Text Books</b></p> <ol style="list-style-type: none"> <li>1. P.W. Atkins, J.D. Paula, <b>Physical Chemistry</b>, 8<sup>th</sup> Edn., Oxford University Press, <b>2006</b>, ISBN 9780716787594.</li> <li>2. I. A. Levine, <b>Physical Chemistry</b>, McGrawHill, <b>2009</b>, ISBN 978-007-2538625.</li> <li>3. D.A. McQuarrie and J.D. Simon, <b>Physical Chemistry - A Molecular Approach</b>, Viva Books Pvt. Ltd., <b>1998</b>.</li> <li>4. R.T. Morrison and R.N. Boyd, <b>Organic Chemistry</b>, Prentice Hall of India Pvt. Ltd., 6<sup>th</sup> Edn., <b>1992</b>, ISBN 0-13-643669-2.</li> <li>5. G. Solomons, C. Fryhle, S. A. Snyder, <b>Organic Chemistry</b>, John Wiley &amp; Sons (Asia) Pvt. Ltd., 11<sup>th</sup> Edn., <b>2013</b>, ISBN-10: 1118147391.</li> <li>6. J. D. Lee, <b>Concise Inorganic Chemistry</b>, 5<sup>th</sup> Edn., ELBS, <b>1996</b>, ISBN 978-8126515547.</li> <li>7. D. F. Shriver, P. W. Atkins, <b>Inorganic Chemistry</b>, Oxford University</li> </ol>

Press, 2006, ISBN 978-0199236176.

8. R. C. Mehrotra, A. Singh, **Organometallic Chemistry**, 2<sup>nd</sup> Edn., New Age International (P) Ltd Publishers, 2007, ISBN 978-0470210192.
9. 9. D. Farrusseng, **Metal-organic Frameworks: Application from Catalysis to Gas storage**, Wiley, 2011, ISBN 978-3527328703.



<b>Course code</b>	<b>CH 155</b>
<b>Title of the course</b>	<b>Chemistry Lab</b>
Course Category	Core Course
Credit Structure	L - T - P - Credits 0-0-2-1
Name of the Concerned Department	Chemistry
Pre-requisite, if any	Not Required
Scope of the course (Objectives)	The lab course introduces students to basic chemical methods such as quantitative chemical analysis, separation techniques and useful chemical reactions.
Course Outcomes	<ol style="list-style-type: none"> <li>1. Basic laboratory skills in chemistry.</li> <li>2. Data handling and analysis.</li> <li>3. Experience in safety procedures in a chemical laboratory.</li> </ol>
Course Content	<ol style="list-style-type: none"> <li>1. Formation of Soap-Saponification- A process of converting Esters into Soaps by Addition of Alkali.</li> <li>2. Estimation of Iron Using Volumetric Analysis.</li> <li>3. Determination of Hardness of Water by Complexometric Titrations.</li> <li>4. Determination of Strength of Strong Acid/Base with Conductometric Titrations.</li> <li>5. Thin Layer Chromatography for Separating Non-Volatile Mixtures.</li> <li>6. Oscillatory Chemical Reactions for Understanding Non-Equilibrium Thermodynamics.</li> </ol>
Suggested Books	<ol style="list-style-type: none"> <li>1. A. I. Vogel: Textbook of Quantitative Inorganic Analysis 7th Edition: Pearson Education: India: 2012: ISBN 978-8131773710</li> <li>2. A. I. Vogel: Textbook of Practical Organic Chemistry 5th Edition: Pearson Education: India: 2003: ISBN 978-8177589573</li> <li>3. Laboratory manual CH-153</li> </ol>

Course code	<b>ES 102</b>
Title of the course	<b>Environmental Studies: Scientific and Engineering Aspects</b>
Course Category	Core / Departmental Elective / <b>Institute Elective</b>
Credit Structure	L - T - P - Credits <b>3-0-0-1.5 (Half Semester Course)</b>
Name of the Concerned Department	<b>Multidisciplinary</b>
Pre-requisite, if any	<b>None</b>
Scope of the course (Objectives)	This course aims to impart knowledge regarding various elements of Environmental Science and Engineering, including environmental quality assessment, environmental pollution and control, water and waste management, sustainable resource management, and various environmental legislations.
Course Outcomes	<ul style="list-style-type: none"> <li>• Understanding the impact of professional engineering solutions in societal and environmental contexts and demonstrating the knowledge of and need for sustainable development.</li> </ul>
Course Content	<ol style="list-style-type: none"> <li>1. Introduction to Environmental Science <ul style="list-style-type: none"> <li>• Overview of Environmental Studies and its interdisciplinary nature, ecosystem, biodiversity</li> <li>• Importance of Environmental Science in the modern world</li> </ul> </li> <li>2. Environmental Quality Assessment <ul style="list-style-type: none"> <li>• Physical, Chemical, and Biological Indicators</li> <li>• Monitoring and Assessment of Air, Water, Soil, and Biodiversity</li> </ul> </li> <li>3. Global Environmental Issues, Pollution, and Control <ul style="list-style-type: none"> <li>• Climate change, global warming, acid rain, ozone layer depletion, nuclear hazards, and natural disaster management.</li> <li>• Types, Causes &amp; Control of Environmental Pollution</li> <li>• Best Management Practices for Pollution Prevention</li> </ul> </li> <li>4. Water and Waste Management <ul style="list-style-type: none"> <li>• Science and Technology for Drinking Water and Wastewater Treatment</li> <li>• Issues in the Management of Water and Waste Systems (Causes, Effects, and Control Measures)</li> </ul> </li> <li>5. Sustainable Resource Management <ul style="list-style-type: none"> <li>• Natural Resources (Forests, Water, Coal, Minerals, Energy, and Land) Use and Degradation</li> <li>• Sustainable Development and Environmental Stewardship</li> <li>• Environmental Impact Assessment and Mitigation</li> </ul> </li> <li>6. Environmental Policy and Legislation <ul style="list-style-type: none"> <li>• Overview of Environmental Laws and Regulations</li> </ul> </li> </ol>

	<ul style="list-style-type: none"> <li>• Environmental Impact Assessment</li> <li>• Environmental Compliance and Enforcement.</li> </ul>
Suggested Books	<p><b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. G. M. Masters and Wendell P. Ela, "<b>Introduction to Environmental Engineering and Science</b>", Pearson, Boston, USA, 2018, ISBN-13: 978-0134219076</li> <li>2. A. Friedland and R. Relyea, "<b>Essentials of Environmental Science</b>", W.H. Freeman &amp; Co Ltd; 2nd ed. 2019 edition (14 December 2015), ISBN-13: 978-1319065669</li> </ol> <p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>1. J. R. Pfafflin and J. N. Swift, "<b>Encyclopedia of Environmental Science and Engineering</b>", Taylor &amp; Francis, Boca Raton, USA, 2013, ISBN-13-978-0849301039</li> </ol>



<b>Course code</b>	<b>HS 109</b>
<b>Title of the course</b>	<b>Language and Composition</b>
Course Category	Core
Credit Structure	L - T - P - Credits 2-0-0-2
Name of the Concerned Department	Humanities & Social Sciences
Pre-requisite, if any	NA
Scope of the course (Objectives)	To improve English Reading, Comprehension and Writing skills of the students.
Course Outcomes	<ul style="list-style-type: none"> <li>• This course will teach the tools of peer-reviewing, close-reading, and enable students to write argumentative and persuasive writing.</li> <li>• Develop composition and paragraph writing</li> <li>• Write effective reports and design documentation, make effective presentations.</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Writing Effective Sentences</li> <li>• Reading, Comprehension skills in English</li> <li>• Paragraph Development: Thesis, Claim, Evidence, Explanation, Analysis</li> <li>• Different forms of writing- Reflective, Compare and Contrast, argument, visual analysis</li> <li>• Grammar and mechanics</li> <li>• Essay, Report, Proposals, Statement of Purpose</li> </ul>
Suggested Books	<p><b>Text Books</b></p> <ul style="list-style-type: none"> <li>• Bloom, B: <i>Taxonomy of Educational Objectives: The Classification of Educational Goals</i>: Susan Fauer Company, Inc: New York: 1956: ISBN: 058228010</li> <li>• Nadell, J, Comodromos, E.A. and Langan, J: <i>The Longman Reader 9th Edition</i>: Pearson Education Publishing: New Delhi: 2008: ISBN: 0321914139</li> </ul> <p><b>Reference Books/texts</b></p> <ul style="list-style-type: none"> <li>• Chopin, K: "Story of an Hour": 1894. <i>Vogue Magazine</i>.</li> <li>• Yong, E: "The Butterflies that hear with their wings". <i>The Atlantic</i>: 2018</li> <li>• Bhattacharjee, K: "Back To Where I Never Belonged". <i>First Proof: The Penguin Book of New Writing From India</i>: Penguin Books India: Delhi: 2005. ISBN 9780143102441</li> <li>• Minto, Robert: "Entomology of Village Life", Pro Rege: Vol. 37:</li> </ul>



<b>Course code</b>	<b>HS 104</b>
<b>Title of the course</b>	<b>Fundamentals of Economics</b>
Course Category	Core
Credit Structure	L - T - P - Credits 2-0-0-2
Name of the Concerned Department	Humanities & Social Sciences
Pre-requisite, if any	NA
Scope of the course (Objectives)	The course is designed to introduce students to the fundamental concepts of economics. The key objectives of the course are: <ul style="list-style-type: none"> <li>• To develop analytical abilities with respect to the key economic aspects.</li> <li>• To critically analyze economic policies, its design, complexities, and potential impacts.</li> </ul>
Course Outcomes	<ul style="list-style-type: none"> <li>• Students will gain expertise in the key concepts of microeconomics and macroeconomics.</li> <li>• Learners will be exposed to real-world economic problems.</li> <li>• Students will be able to comprehend government's economic policy's design.</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Being an economist: A scientist and a policy maker.</li> <li>• Principles of economics: Tradeoff, opportunity cost, markets, invisible hand, prices</li> <li>• Market forces of demand and supply, elasticity, and its applications</li> <li>• Theory of Production and Theory of Cost</li> <li>• Microeconomic Thinking and Macroeconomic Models, Circular Flow, National Income Accounting</li> <li>• Production, Consumption, Investment, Government Purchases</li> <li>• Measuring Cost of Living- CPI, GDP Deflators, Inflation</li> <li>• The Monetary System- Functions of Money, Quantity of Money, Interest Rates</li> </ul>
Suggested Books	<b>Text Books</b> <ul style="list-style-type: none"> <li>• Rubinfeld, D.L. and Pindyck, R.S.: Microeconomics: Pearson Prentice Hall: New Jersey: 2012: 9780132857123</li> <li>• N. Gregory Mankiw: Macroeconomics: Macmillan Learning 10<sup>th</sup> ed.: New Delhi: 2019: 9781319436650</li> </ul> <b>Reference Books</b>

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|  | <ul style="list-style-type: none"><li>• N. Gregory Mankiw: Principles of Economics: Harcourt: New Delhi: 2020: 0324168624</li><li>• R. Dornbusch, S. Fischer, and R. Startz: Macroeconomics: McGraw-Hill Inc: New York: 2017: 9780073375922</li></ul> |
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<b>Course Code</b>	<b>HS 117</b>
<b>Title of the Course</b>	<b>Stress and Mental Health</b>
Course Category	Flexible Core
Credit Structure	L-T-P-C 1-0-0-1
Name of the Concerned Department	Humanities and Social Sciences
Pre-requisite if any	None
Scope of the Course (Objective)	Mental health is an important aspect of a healthy lifestyle and its awareness is important. The course aims to analyze the concepts of stress, mental health, and their management.
Course Outcomes	<ul style="list-style-type: none"> <li>• Learn how to analyse stress in the human body</li> <li>• Identify the factors which lead to stress</li> <li>• Effective management of mental health</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Introduction: Nature and physiology of stress; Types of stress; Responses to stress</li> <li>• Stress and Its Effect: Task performance; Cognitive functioning; Burnout; PTSD; Diathesis-Stress Model; Psychological problems and disorders; Positive effects</li> <li>• Psychology and Health: Habits, lifestyle, and health; Depression and heart disease; Stress and cancer; Stress and immune function</li> <li>• Methods of Stress Management and Well-Being Enhancement: Nutrition; Physical exercise; Restoration (Sleep vs Relaxation); Self-regulation; Positive healthy relationships; Enhancing happiness and well-being</li> </ul>
Suggested Books	<p><b>Textbook(s):</b> ज्ञानम् सर्वजनहिताय ॥</p> <ol style="list-style-type: none"> <li>1. Wayne Weiten, Dana S. Dunn, Elizabeth Yost Hammer: Psychology Applied to Modern Life: Adjustment in the 21st Century: Cengage Learning: USA: 2014: 9781305172081</li> <li>2. R. Harrington: Stress, Health and well-being: Thriving in the 21st century: Wadsworth Publishing: USA: 2013: 9781111831615</li> </ol>

<b>Course code</b>	<b>HS 119</b>
<b>Title of the course</b>	<b>Frontiers of Thinking</b>
Course Category	Flexible Core
Credit Structure	L - T - P - Credits 1-0-0-1
Name of the Concerned Department	Humanities & Social Sciences
Pre-requisite, if any	NA
Scope of the course (Objectives)	Natural sciences, biological sciences, and human sciences have unique and also mutually challenging approaches to understand reality. The course aims to open up our <i>thinking and understanding</i> of reality in these three forms.
Course Outcomes	<ul style="list-style-type: none"> <li>• Problem Analysis</li> <li>• Recognition of Domain Difference</li> <li>• Life-Long Learning</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• The Splendors of the cosmic – Cosmic Order</li> <li>• The Wonders of the Natural – Natural Order</li> <li>• The Enigma of the Social – Social Life</li> </ul>
Suggested Books	<p><b>Text Books</b></p> <ul style="list-style-type: none"> <li>• Crofton, Ian &amp; J. Black, <b>The Little Book of Big History</b>, London: Michael Omara Books Ltd.: 2016: 9781782536850</li> <li>• Lovelock, James, Gaia, Oxford University Press, Oxford, 2016: 9780198784883</li> </ul> <p><b>Reference Books</b></p> <ul style="list-style-type: none"> <li>• Ridley, Matt, <b>The Evolution of Everything</b>, Harper Collins, London, 2015, 9780007583126</li> <li>• Harari, Y.N., Sapiens, Penguin Random House, London, 2019: 9781784873646</li> </ul>

<b>Course code</b>	<b>HS 121</b>
<b>Title of the course</b>	<b>History of Tribal and Folk Art</b>
Course Category	Flexible Core
Credit Structure	L - T - P - Credits 1-0-0-1
Name of the Concerned Department	Humanities & Social Sciences
Pre-requisite, if any	NA
Scope of the course (Objectives)	Through a close study of Tribal and folk art across the centuries, this course examines the histories of the two well-known examples of tribal and folk art- Bhil and Gond- from the beginnings to contemporary times.
Course Outcomes	<ul style="list-style-type: none"> <li>• Demonstrate knowledge and understanding of Tribal and Folk Art</li> <li>• Appreciate the richness of Indian cultural heritage</li> <li>• Recognise the importance of sustainable and environment-friendly ingredients in creating traditional Indian art</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Tribal and folk art in India</li> <li>• Gond artists and artistic traditions</li> <li>• Bhil artists and artistic traditions</li> <li>• Bhil and Gond art after Independence</li> <li>• Field visits to Bhil and Gond artist workshops/workplaces</li> </ul>
Suggested Books	<p><b>Text Books</b></p> <ul style="list-style-type: none"> <li>• Kaiser, T: Painted Songs: Continuity and Change in Indian Folk Art: Arnoldsche Art Publishers: Zurich: 2012: 9783897903661</li> <li>• Wolf, G: Signature: Patterns in Gond Art: Tara Books: Delhi: 2010: 9789380340029</li> </ul> <p><b>Reference Book</b></p> <ul style="list-style-type: none"> <li>• Bachchan, K: The Bhils- An Ethno-Historic Analysis: Sharada Publishing House: Delhi: 1997: 8185616477</li> </ul>

<b>Course code</b>	<b>HS 123</b>
<b>Title of the course</b>	<b>Cultural Sociology</b>
Course Category	Flexible Core
Credit Structure	L - T - P - Credits 1-0-0-1
Name of the Concerned Department	Humanities & Social Sciences
Pre-requisite, if any	NA
Scope of the course (Objectives)	The course will provide an overview of Cultural Sociology, which traverses the relationship between sociology and cultural theory. It will discuss sociological approaches to understanding national, global, or regional cultures. Eventually, it will address key social tensions encoded within popular culture and new media cultures.
Course Outcomes	<ul style="list-style-type: none"> <li>• Problem Analysis in Cultural Sociology</li> <li>• Communication</li> <li>• Ethics</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• What is a Cultural System?</li> <li>• Interpretation of Cultures</li> <li>• Distinction, Judgement of Taste</li> <li>• Classical versus Popular Culture</li> <li>• Nation as Culture</li> <li>• Global Culture</li> <li>• Popular Culture</li> <li>• New Media Cultures</li> </ul>
Suggested Books	<p><b>Text Book</b></p> <ul style="list-style-type: none"> <li>• P. Bourdieu: <b>Distinction-A Social Critique of the Judgement of Taste</b>, Harvard University Press, Cambridge, MA : 1987 : 9780674212770</li> </ul> <p><b>Reference Book</b></p> <ul style="list-style-type: none"> <li>• J. Fiske, Understanding Popular Culture, Routledge : New York: 1989 : 9780415078764.</li> <li>• Clifford Geertz : The Interpretation of Cultures- Selected Essays : Basic Books : New York : 1973 : 9780465093557</li> </ul>

<b>Course code</b>	<b>HS 102</b>
<b>Title of the course</b>	<b>Environmental Studies: Social Aspects</b>
Course Category	Core
Credit Structure	L - T - P - Credits 2-1-0-3=1.5 (3/2)
Name of the Concerned Department	Humanities and Social Sciences
Pre-requisite, if any	None
Scope of the course (Objectives)	The course is designed to provide an overview of Environmental sociology, via landmark environmental movements and breakthroughs which have shaped the public discourse and consciousness about the environment as a common good. It will engage with some leading influential thinkers and material on the subject.
Course Outcomes	<ul style="list-style-type: none"> <li>• Acquainting students with discourses and debates on sustainable use of natural resources</li> <li>• Role of technology in engineering the environment and its limitations</li> <li>• Acknowledging geography and biodiversity as key elements of environmental consciousness</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Social movements and the environment</li> <li>• Human rights over natural resources</li> <li>• Chipko Movement &amp; Himalayan Ecology</li> <li>• Gandhi and the Environmental consciousness</li> <li>• Environmental conflict with Fashion &amp; International Trade</li> <li>• Environment and Public Relations, Greenwashing</li> <li>• Water Governance</li> <li>• Green Revolution in India</li> <li>• Industrial Farming and Food</li> <li>• 10. Topical discussions around contemporary issues</li> </ul>
Suggested Books	<p><b>Reference Books</b></p> <p>1. Ramchandra Guha: <i>The Unquiet Woods: Ecological Change and Peasant Resistance in the Himalaya</i> : University of California Press : Berkley : 2000 : 9780520222359.</p> <p>2. Rachel Carson : <i>Silent Spring</i> : Houghton Mifflin : Boston, MA : 1962 : 9780395075067.</p> <p>3. Ulrich Beck : <i>Risk Society: Towards a New Modernity</i> : Sage Publications : Thousand Oaks, CA : 1992 : 9780803983465.</p>

4. E F Schumacher : *Small Is Beautiful: A Study of Economics As If People Mattered* : Vintage : London : 1993: 9780099225614.



<b>Course code</b>	<b>AA 101</b>
<b>Title of the course</b>	<b>Introduction to Space Engineering</b>
Course Category	Flexible Engineering Elective
Credit Structure	L - T - P - Credits 1-0-0-1
Name of the Concerned Department	Astronomy, Astrophysics and Space Engineering
Scope of the course (Objectives)	The students will be introduced to the basic concept of space engineering and space exploration.
Course Outcomes	The students will be able to appreciate the complex process and physics behind launching and communicating with a space payload and their vast array of applications in solving various problems of the society and advancing the various domains of fundamental sciences.
Course Content	<p><b>Module-1</b> Two-body relative motion equation and polar coordinates, Kepler's laws &amp; Kepler's equation, Trajectory equation, orbital mechanics, Elliptical &amp; circular orbits</p> <p><b>Module-2</b> Overview of Sun and Heliosphere, Remote Sensing from Space; Vertical structure of the Atmosphere and circulations, space environment, space effects from Earth's surface, in situ measurements</p> <p><b>Module-3</b> Telescopes: radio, infrared, optical, X-ray, gamma ray; collecting area, diffraction limit, atmospheric seeing; optics, aperture synthesis, spectroscopy (prisms and gratings).</p> <p><b>Module-4</b> Exoplanets; Basic technique to detect exoplanets; Habitable zones; Search for Extraterrestrial Intelligence</p>
Suggested Books	<p><b>Text book:</b></p> <ol style="list-style-type: none"> <li>1. B. A. Campbell, S. W. McCandless, Jr., <b>Introduction to Space Sciences and Spacecraft Applications</b>, Gulf Professional Publishing, 1996, ISBN-978-0-88415-411-2</li> <li>2. Kivelson M G &amp; Russel C T, <b>Introduction to Space Physics</b>, Cambridge Univ. Press, Cambridge, 1995, ISBN-10, 0521457149</li> </ol> <p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>3. Carroll B. W. &amp; Ostlie, D. A., <b>An introduction to Modern Astrophysics</b>, Pearson Education-Addison Wesley, 2007. ISBN</li> </ol>

978-0805304022

4. G. Joseph and C Jeganathan, **Fundamentals of Remote Sensing**, Third Edition, Universities Press Pvt. Ltd., Hyderabad, India. 2018. ISBN 978-93- 86235-46-6. 606



<b>Course code</b>	<b>CE 102</b>
<b>Title of the course</b>	<b>Computations in Civil Engineering</b>
Course Category	Flexible Elective
Credit Structure	L - T - P - Credits 1-0-0-1
Name of the Concerned Department	Civil Engineering
Pre-requisite, if any	NIL
Scope of the course (Objectives)	To provide an overview of the role of computations in Civil Engineering.
Course Outcomes	Exposure to some of the computational techniques required in Civil Engineering.
Course Content	Role of differential equations in Civil Engineering, ordinary and partial differential equations; Role of probability in Civil Engineering, Random events, Random variables; Role of machine learning in Civil Engineering.
Suggested Books	<ul style="list-style-type: none"> <li>• E. Kreyszig, Advanced engineering mathematics, Wiley India Pvt. Ltd, 2015, ISBN: 9788126554232.</li> <li>• Papoulis and S.U. Pillai, Probability, Random Variables and Stochastic Processes, Fourth Edition, McGraw Hill, ISBN-10: 0070486581</li> <li>• J.R. Benjamin and C.A. Cornell, Probability Statistics and Decision for Civil Engineers, McGraw Hill, 1975, ISBN-10:0486780724</li> </ul>

<b>Course code</b>	<b>IC 152</b>
<b>Title of the course</b>	<b>Makerspace</b>
Course Category	Institute common core course
Credit Structure	L - T - P – Credits 1 - 0 - 6 - 4
Name of the Concerned Department(s)	All the Engineering Departments
Pre-requisite, if any	NIL
Scope of the course (Objectives)	<ul style="list-style-type: none"> <li>• To foster hands-on learning in the students</li> <li>• To impart basic designing and manufacturing skills</li> <li>• To promote exposure to multidisciplinary areas</li> </ul>
Course Learning Outcomes	<ul style="list-style-type: none"> <li>• Application of the principles and concepts learned in the class to solve interdisciplinary problems.</li> <li>• Collaborate effectively as a part of interdisciplinary teams.</li> <li>• Create a prototype or working model from the given project</li> </ul>
Course Content	<p style="text-align: center;"><b>Lecture component</b></p> <p><b><u>Introduction:</u></b> Lab safety and Orientation</p> <p><b><u>Design and Manufacturing</u></b> Introduction to Engineering Drawing, Projections, Section of Solids, Orthographic Projections, Section of solids, Development of surfaces (Freehand sketch followed by practice using software); 3D Solid Modelling: Parametric and feature-based modelling; Assembly and disassembly; Workshop Practices: Welding, Carpentry, Machining, Laser cutting, Computer Aided Manufacturing (additive/subtractive)</p> <p><b><u>Systems, Circuits, Drones, and Robotics</u></b> Basic Operation of amplifier circuits and networks, Basics of microprocessors and microcontrollers, IoT, Robotics, Basic aerodynamic concepts, Components of Drones – propulsion systems, frames, payloads</p> <p><b><u>Selection and Design of Materials:</u></b> Material property charts, Ashby maps</p> <p><b><u>Product Design:</u></b> Concepts of product design</p> <p style="text-align: center;"><b>Practical component</b></p> <ul style="list-style-type: none"> <li>• Stitching of Aprons using a sewing machine</li> <li>• Modelling of 2D and 3D components</li> <li>• 3D printing of parts, CNC machining of materials, Joining of metals</li> </ul>

	<ul style="list-style-type: none"> <li>• Simulation of the circuit, Assembly, and testing on Breadboard, the know-how of the Oscilloscope, function generator, Power source etc.,</li> <li>• Soldering of joints, PCB routing using software, PCB fabrication and testing, Coding and interfacing sensors to Arduino and Raspberry-PI, Basic signal generation and measurements with Arduin</li> </ul> <p style="text-align: center;"><b><u>Example list of projects</u></b></p> <ul style="list-style-type: none"> <li>• IoT-based home automation system, IoT-based car parking management system.</li> <li>• Innovative Road Intersection/Interchange Design, Testing of bridges.</li> <li>• Room temp adjustment based on occupancy – comprises 3 categories: Determination of occupancy, temperature detection, and control.</li> <li>• Scaled-down model of automatic Street light controller – (3D printing + Circuit design)</li> <li>• Design and development of Pick and Place mechanism for robotic application</li> <li>• Design and development of a punching machine using geneva mechanism</li> </ul>
Suggested Books	<p>Textbooks:</p> <ol style="list-style-type: none"> <li>1) N. D. Bhatt : Engineering Drawing : Charotar Publishers: 2010: ISBN: 9789380358963</li> <li>2) Mikell P. Groover: Groover's Principles of Modern Manufacturing: Materials, Processes, and Systems: Wiley India: 2018: ISBN: 978-8126573059</li> <li>3) W H Hayt, J E Kemmerly, and S M Durbin: Engineering Circuit Analysis: 8th edition: Mc Graw-Hill (Indian Edition): 2013: ISBN 978-1259098635</li> <li>4) A.S. Sedra, K. C. Smith, A.N. Chandorkar: Microelectronic Circuits 7th edition (Indian edition): Oxford University Press: 2017: ISBN: 978-0199476299</li> <li>5) James Garratt, "Design and Technology" 2nd edition, Cambridge University Press, 1998, ISBN:978-0521648318</li> </ol> <p>Reference Books:</p> <ol style="list-style-type: none"> <li>6) S.J. Schoonmaker, Marcel Dekker, Inc: The CAD Guidebook A Basic Manual for Understanding and Improving Computer-Aided Design,, 2002. ISBN: 978-0824708719</li> <li>7) D.K. Lieu, S.A. Sorby: Visualization, Modeling, and Graphics for Engineering Design, 2nd edition: Cengage Learning:2016: ISBN:978-1285172958</li> <li>8) K.T. Ulrich, S.D. Eppinger, M. C. Yang: Product Design and Development   7th Edition: McGraw Hill: 2020: ISBN: 978-9390113231</li> </ol>

Course code	<b>MM 102</b>
Title of the course	<b>Introduction to Materials Engineering</b>
Course Category	Flexible elective
Credit Structure	L-T-P-C (1-0-0-1)
Name of the Concerned Department	Metallurgy Engineering and Materials Science
Prerequisite, if any	None
Scope of the course (Objectives)	The objective of this course is to familiarize the students to the field of science and engineering of materials.
Course Outcomes	Students will be able to understand; 1) structure-property correlations. 2) application of materials in different fields.
Course Syllabus	Classification of materials, structure and properties of materials  Introduction and applications of: 1) metals and alloys, 2) polymers, ceramics, and composites 3) advanced and functional materials
Suggested Books	<b>Text books:</b> (1) Materials Science and Engineering- An introduction, William D. Callister, Jr. John Wiley and Sons, Inc. (2) Materials Science and Engineering- A first course, V Raghavan

**Syllabi  
of  
Institute Elective Courses (IEC)**



## List of Institute Elective Courses (IEC)

### (A) School of Basic Sciences:

1. IPH 471N/ PH 671N/ AA 471N/ AA 671N: Relativity and Cosmology (2-1-0-3)
2. IPH 474 / PH 674 / AA 474 / AA 674: Basics of Radio Astronomy (2-1-0-3)

### (B) School of Engineering:

1. ICS 419/ CS 419/ CS 619 : Computer Vision (2-1-0-3)
2. IEE 431 / EE 431/ EE 631 : Organic Electronics (2-1-0-3)
3. IME 451 / ME 651 : Mechatronics System Design (2-1-0-3)

### (C) School of Humanities and Social Sciences

1. IHS 402 : Twentieth Century World History: Critical Perspectives (2-1-0-3)
2. IHS 416 : French Language (2-1-0-3)
3. IHS 422 / HS 622 : Development Economics (2-1-0-3)
4. IHS 425 : Money and Banking (2-1-0-3)
5. IHS 443 / HS 643 : Contemporary Short Fiction (2-1-0-3)
6. IHS 444 : Literature of the Twentieth Century (2-1-0-3)
7. IHS 482 : Introduction to International Development and Area Studies (2-1-0-3)

### (D) Inter-disciplinary Group of Biosciences and Bioengineering (BSBE)

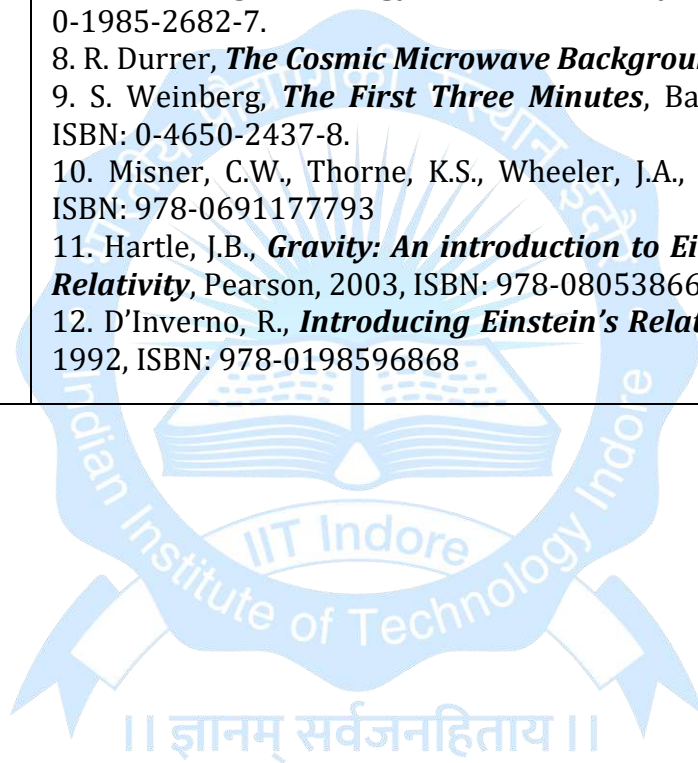
1. IBSE 401 : Introduction to Cell and Molecular Biology (2-1-0-3)

### (E) Center of Innovation, Incubation, Entrepreneurship and Industry Relations (CIEIR)

1. IE 301/ IE 401/ IE 601 : Foundation for Entrepreneurship (2-0-2-3)

Course Code	AA 471N/ AA 671N/ IPH 471N/ PH 671N
Title of the Course	<b>Relativity and Cosmology</b>
Credit Structure	L-T- P-Credits 2-1-0-3
Name of the Department of Center	Astronomy, Astrophysics and Space Engineering
Pre-requisite, if any	
Scope of the Course	This course aims to introduce students to cosmology through an understanding of the General Theory of Relativity. Special emphasis will be placed on linear perturbation theory in the early universe, leading to the formation of the cosmic microwave background, as this illustrates basic undergraduate physics in the context of the frontiers of research in cosmology.
Course Syllabus	<p><b>1. Special Relativity:</b> Michaelson-Morley Experiment, Galilean vs. Lorentz transformations, Lorentz invariance, scalars in special relativity, relativistic dynamics, acceleration in special relativity</p> <p><b>2. Cosmology:</b> Olber's paradox; difficulty with Newtonian cosmology; brief introduction to general theory of relativity, especially the line element; Schwarzschild metric, horizon, orbits, Hawking radiation; FRW metric as a consequence of cosmological principle; redshift, angular and luminosity distances; evolution of scale factor from Newtonian cosmology; density parameter; LCDM cosmology; flatness and horizon problems, basics of inflation theory; thermal history of the Universe, big bang nucleosynthesis; microwave background.</p> <p><b>3. Structure formation:</b> Jeans instability in an expanding background; initial perturbation and anisotropies in CMBR, formation of dark matter halos, galaxy formation and star formation; millennium simulation; Sunyaev-Zeldovich effect; neutral hydrogen and other elements in the IGM, Lyman <math>\alpha</math> forest and damped clouds; reionization, AGN/star-formation history of the universe; Gunn-Peterson effect.</p>

Suggested Books	<ol style="list-style-type: none"> <li>1. S. Dodelson, <i>Modern Cosmology</i>, Academic Press, 2003, ISBN: 0-1221-9141-2.</li> <li>2. S. Carroll, <i>Spacetime and Geometry: An Introduction to General Relativity</i>, 2003, ISBN: 0-8053-8732-2.</li> <li>3. J. A. Peacock, <i>Cosmological Physics</i>, Cambridge University Press, 1998, ISBN: 9780521422703.</li> <li>4. P. J. E. Peebles, <i>Principles of Physical Cosmology</i>, Princeton University Press, 1993, ISBN: 0-6910-1933-9.</li> <li>5. P. J. E. Peebles, <i>Large-Scale Structure of the Universe</i>, Princeton University Press, 1980, ISBN: 0-6910-8240-5.</li> <li>6. D. H. Lyth, &amp; A. R. Liddle, <i>The Primordial Density Perturbation</i>, Cambridge University Press, 2008, ISBN: 0-5218-2849-X.</li> <li>7. S. Weinberg, <i>Cosmology</i>, Oxford University Press, 2008, ISBN: 0-1985-2682-7.</li> <li>8. R. Durrer, <i>The Cosmic Microwave Background</i>, CUP 2008.</li> <li>9. S. Weinberg, <i>The First Three Minutes</i>, Basic Books, 1993, ISBN: 0-4650-2437-8.</li> <li>10. Misner, C.W., Thorne, K.S., Wheeler, J.A., Princeton, 2017, ISBN: 978-0691177793</li> <li>11. Hartle, J.B., <i>Gravity: An introduction to Einstein's General Relativity</i>, Pearson, 2003, ISBN: 978-0805386622</li> <li>12. D'Inverno, R., <i>Introducing Einstein's Relativity</i>, Clarendon, 1992, ISBN: 978-0198596868</li> </ol>
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Course Code	<b>IPH 474 / PH 674 / AA 474 / AA 674</b>
Title of the Course	<b>Basics of Radio Astronomy</b>
Credit Structure	L-T- P-Credits 2-1-0-3
Name of the Department	Physics
Pre-requisite, if any	Basics of Electronics procedure of conducting experiments
Scope of the Course	This course is intended to impart the hands-on Astronomy to students. It aims to introduce Radio Astronomy as well as basic instrumentation and Engineering in Astronomy. It also aims to introduce students to the basics of Extragalactic Astronomy and Cosmology.
Course Syllabus	<p><b>Review of Electromagnetic theory:</b> Maxwell's equations and basics of electric and magnetic fields, Basic Electromagnetic Theory and radiation of electromagnetic waves, E &amp; B Field Measurable quantities and Polarization.</p> <p><b>Radio Universe and Antenna:</b> The Radio Universe and the Atmospheric Radio Window Brightness, Flux density and antenna fundamentals-I, Effects of the earth's atmosphere, Basics of Radiative Transfer, Antenna fundamentals-II, Antenna Fundamentals-III.</p> <p><b>Radio Interferometry:</b> Introduction, Uses and Advantages, Essential Ingredients of an interferometer.</p> <p><b>Radiometers:</b> from Voltages to Spectra, Galactic Astrophysics and observations.</p> <p><b>Extragalactic Astrophysics:</b> Fundamentals, Galaxies, Clusters of Galaxies, A brief introduction to cosmology, Astrophysics with 21 cm emission.</p> <p><b>Experiments:</b></p> <ol style="list-style-type: none"> <li>1. Measuring Beam Patterns – 4 sessions</li> <li>2. Measuring telescope aperture efficiency – 2 sessions</li> <li>3. Measuring the brightness of the sun and the moon – 2 sessions</li> <li>4. Galactic Observations – 21 cm – 4 sessions</li> <li>5. Extragalactic Observations – 21 cm – 6 sessions</li> <li>6. Cosmological Continuum and spectral line observations – 4 sessions</li> <li>7. Final Projects – 8-10 sessions</li> </ol>
Suggested Books	1. Ryden, Barbara, <b>Introduction to Cosmology</b> , Addison Wesley, 2003. ISBN: 0-8053-8912-1

Course Code	<b>ICS 419 / CS 419 / CS 619</b>
Title of the Course	<b>Computer Vision</b>
Credit Structure	L-T- P-Credits 2-1-0-3
Name of the Concerned Department	Computer Science and Engineering
Pre-requisite, if any	None
Scope of the course	Objective of this course is to understand and create artificial vision systems which can reliably extract information from images. Study of vision problems require the basic understanding of image formation, image representation, ways of analyzing the images and patterns present in them. This course aims at providing the knowledge at all these fronts.
Course Syllabus	<p><b>Digital Image Processing:</b> Fundamentals, Types of Image Processing, Image Acquisition Methods, Human Perception of Color and Images, Transformations: Orthogonal, Euclidean, Affine, Projective etc.</p> <p><b>Low-level Image Processing:</b> Image Enhancement in Spatial Domain – Histogram Processing, Contrast Stretching, Log Transformation, Gamma Correction, Smoothing and Sharpening; Logical and Arithmetic Operations, Morphological Image Processing, Image Enhancement in Frequency Domain, Fourier Transform, Convolution and Filtering, Image Restoration.</p> <p><b>Image Feature Extraction:</b> Edge detection – Canny, Sobel, Prewitt, LOG, DOG, Line detector: Hough Transform; Corner detectors – Harris and Hessian Affine; Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis – Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.</p> <p><b>Image Segmentation:</b> Edge Based Approaches to Segmentation, Region Growing, Texture Segmentation, Object Detection and Segmentation: Graph-cuts, Active Contours, Mean-Shift.</p> <p><b>Object Recognition:</b> Structural Approaches, Model-based Approaches, Appearance and Shape-based Approaches, Probabilistic Paradigms.</p> <p><b>Pattern Analysis:</b> Clustering: K-Means; Gaussian Mixture Model (GMM); Classification – Discriminant Function, Supervised, Semi-supervised, Unsupervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.</p> <p><b>Motion Analysis:</b> Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis.</p> <p><b>Applications and Performance Measures:</b> CBIR, CBVR, Activity Recognition, Biometrics, Document processing, Super-resolution, Augmented Reality, Security and Surveillance, Performance Evaluation Measures.</p>

Suggested Books	<p><b>Text Books</b></p> <ol style="list-style-type: none"> <li>1. Computer Vision: A Modern Approach, D. A. Forsyth and J. Ponce, Pearson Education, 2003. (693 pages), ISBN: 9780130851987.</li> <li>2. Computer Vision: Algorithms and Applications, Richard Szeliski, Springer-Verlag, 2011. (832 pages), ISBN: 978-1848829343.</li> </ol> <p><b>Reference Books</b></p> <ol style="list-style-type: none"> <li>1. Digital Image Processing, Rafael C. Gonzalez and Richard E. Woods, Pearson Education, 2008. (976 Pages ), ISBN: 9788131726952.</li> <li>2. Pattern Classification, R.O. Duda, P.E. Hart and D.G. Stork, Wiley-Interscience, 2000. (654 pages), ISBN: 978-0471056690.</li> <li>3. Multiple View Geometry in Computer Vision, Richard Hartley and Andrew Zisserman, Cambridge University Press, 2004. (668 pages), ISBN: 978-0521540513.</li> <li>4. Introduction to Statistical Pattern Recognition, Keinosuke Fukunaga, Academic Press, 1990. (592 pages), ISBN: 978-0122698514.</li> </ol>
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Course Code	<b>IEE 431 / EE 431/ EE 631</b>
Title of the Course	<b>Organic Electronics</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department/Discipline	Electrical Engineering
Pre-requisite, if any	Basic Semiconductor Physics/ Basic electronics
Scope of the course	
Course Syllabus	<p>Background towards molecular electronics, surfaces and interfaces, structures and organization. Introduction to Schrodinger equation, Hartree-Fock Theory, Density Functional Theory. Molecular Solids, <math>\pi</math>-conjugated polymers, one dimensional band structure of linear conjugated polymers, optical absorption and emission in conjugated oligomers/polymers. Device motivation for interface studies, Metal-semiconductor and Metal-Insulator-Semiconductor Interface. Charge transport in conjugated polymers. Hopping and Multiple trap and release model. Interface effects viz. Dipole, doping, band bending etc. in organic semiconductor devices.</p> <p>Materials and Interface Engineering in Organic Light Emitting Diodes (OLEDs). OLED materials and device architecture for full color displays and solid state lighting. Theory and operation principle of Organic Field Effect Transistors (OFETs). Interface Characterization, Threshold Voltage and subthreshold swing and charge carrier mobility in OFETs. Application of OFETs in Displays. Organic Photovoltaic Devices (OPDs) using Polymer-Fullerene Bulk heterojunction thin films. Interface effects and improvement in Polymer Solar Cells (PSCs) efficiency. Introduction to some other advanced concepts viz. Organic electrochromic materials and devices, multiphoton absorbing materials and devices and Nonvolatile Organic Thin Film Memory Device.</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. S. M. Sze, <b>Physics of semiconductor devices</b>, John Wiley and Sons, 1981, ISBN: 0-471-05661-8</li> <li>2. R. Kelsall, I. Hamley and M. Geoghegan, <b>Nanoscale Science and Technology</b>, John Wiley and Sons Ltd, 2005, ISBN: 0-470-85086-8.</li> <li>3. K. Morigaki, <b>Physics of amorphous semiconductors</b>, Imperial College Press, 1999, ISBN: 981-02-1381-6.</li> <li>4. G. Hadziioannou and G. Malliaras, <b>Semiconducting Polymers: Chemistry, Physics and Engineering</b>, Wiley Interscience, 2007, ISBN: 978-3-527-31271-9.</li> </ol>

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|  | 5. <b>F. So, Organic Electronics: Materials Processing, Devices and Applications</b> , CRC Press, 2010, ISBN: 978-1-4200-7290-7. |
|  | 6. <b>Conjugated Polymer Surfaces and Interfaces</b> , Cambridge University Press, 1996, ISBN: 0-521-47206-7.                    |



Course Code	<b>IME 451 / ME 651</b>
Title of the Course	<b>Mechatronics System Design</b>
Credit Structure	L-T-P-Credit 3-0-0-3
Name of the Concerned Department/Discipline	Mechanical Engineering
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	<p><b>Mechatronics System design:</b> Introduction to Mechatronics- Integrated design issues- Key elements and design processes- Physical system modelling - Electrical systems- Micro processor based controller and micro electronics- Mechanical translation and rotational systems-Electromechanical coupling-Fluid system</p> <p><b>Actuating devices:</b> Direct current motor, Permanent magnet stepper motor, Mechanical actuation, Hydraulic and pneumatic power actuation devices, Linear and latching linear actuators, Rotatory actuators, Piezo electric actuators, Actuator parameters and characteristics.</p> <p><b>Sensors and Transducers:</b> An introduction to sensors and transducers, sensors for motion and position, Force torque and tactile sensors, Flow sensors, Temperature sensing devices, Ultrasonic sensors, Range sensors, Active vibration control using magnetostrictive transducers, Lasers and Opto-mechatronics based devices.</p> <p><b>Software and Hardware components in Mechatronics systems:</b> Signals , system and controls, system representation, Signal conditioning and devices, PLC, system representation, linearization of nonlinear systems, Time delays and measurement of system performance, Elements of Data acquisition and control systems, real time interfacing.</p> <p><b>MEMS and Microsystems:</b> Microsystems and miniaturization- lithography technique- Micro actuators- actuation using shape memory alloys, piezo electric crystals and electrostatic forces- micro valves and pumps- micro sensors- Overview on applications of Robotics in automobiles and other industries.</p>
Suggested Books	<p><b>Text books:</b></p> <ol style="list-style-type: none"> <li>1) W. Bolton, <b>Mechatronics</b>, Pearson publications (ISBN 978-81-3176253-3)</li> <li>2) Devdas Shett, Richard A. Kolk, <b>Mechatronics System Design</b>, Brooks/Cole, Thomson learning (ISBN 0-534-95285-2).</li> </ol> <p><b>Reference Books:</b></p>

- 1) J. Watton, **Fundamentals of Fluid power and control**, Cambridge university press (ISBN 9780521762502)
- 2) A. M. Pawlak, **Sensor and Actuators in Mechatronics Design**, Taylor and Francis (ISBN-13:978-0-8493-9013-5)
- 3) Tai-Ran Hsu, **MEMS and Microsystems design and manufacture**, Tata McGraw-Hill (ISBN 0-07-048709-X)
- 4) S. A. Campbell, **The Science and Engineering of microelectronic fabrication**, Oxford university press (ISBN 0-19-568144-4)



<b>Course Code</b>	<b>IBSE 401</b>
<b>Title of the Course</b>	<b>Introduction to Cell and Molecular Biology</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department	Biosciences and Bioengineering
Pre-requisite, if any	None
Scope of the Course	The course will give an overview of modern biology, in addition to fundamentals in the area of Cell and Molecular Biology.
Course Syllabus	<p><b>Cell:</b> prokaryotes and eukaryotes, Evolution, Eukaryotic cell structure, the nucleus,</p> <p><b>Chemistry of Bio-molecules:</b> Carbohydrates, proteins, nucleic acids, lipids,</p> <p><b>Proteins:</b> amino acids, different levels of structure; structure-function relationship; folding and mis-folding. Separation techniques. Hemoglobin: portrait of a protein in action; co-operativity,</p> <p><b>Enzymes:</b> basic concepts and kinetics, catalytic and regulatory strategies.</p> <p><b>Metabolism:</b> basic concepts and design. Glycolysis and gluconeogenesis. TCA cycle. Oxidative phosphorylation. Photosynthesis. Integration of metabolism.</p> <p><b>DNA and RNA:</b> Structure, properties, mutations, repair and diseases.</p> <p><b>Flow of genetic information:</b> replication, transcription and translation, gene expression, introns-exons. Exploring genes and genomes.</p> <p><b>Recombinant DNA technology,</b> sequences of genomes, manipulation of eukaryotic genes.</p> <p><b>Omics:</b> Genomics, transcriptomics and proteomics.</p>
Suggested Books	<p><b>Text / Reference Books</b></p> <ol style="list-style-type: none"> <li>1. J.M. Berg, J.L. Tymoczko, L. Stryer, <b>Biochemistry</b> (6<sup>th</sup> ed) W. H. Freeman, 2006. [ISBN-10: 0716730510 ISBN-13: 978-0716730514]</li> <li>2. D.J. Voet &amp; J.G. Voet. <b>Fundamentals of Biochemistry: Life at the molecular level</b> (3<sup>rd</sup> ed) Wiley. 2008. [ISBN-10: 0470129301   ISBN-13: 978-0470129302]</li> </ol>

3. H. Lodish et al., **Molecular Cell Biology**, (6<sup>th</sup> ed), W. H. Freeman, 2007. [ISBN-10: 0716776014 | ISBN-13: 978-0716776017]



Course Code	<b>IHS 416</b>
Title of the Course	<b>French Language</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department/School	HSS
Pre-requisite, if any ( for the student)	None
Objectives of the course	This is the first part of level A1 in the French language to impart basic conversational and writing skills to the students. The learner will learn the basics of phonetics and grammar. At the end of the semester, the student will be able to introduce himself and talk about everyday life.
Course Syllabus	<p><b>Grammar :</b> Introduction of conjugation of the verbs regular and irregular in basic present and future tenses, articles, possessive adjectives, three types of interrogation, negation, disjunctive pronouns, prepositions of situation in space, gender and number of nouns and adjectives etc.</p> <p><b>Vocabulary:</b> related to oneself, hobbies and activities, date and time, figures, festival, lodging, orientation, festivals, etc</p> <p><b>Oral Situation:</b> Self introduction, greetings and leave taking, express likes and dislikes, ask and understand simple questions.</p> <p><b>Phonetic:</b> basics: rhythm of French language, syllables, “enchaînement”, introduction to mute e and “liaison”, phonemes</p> <p><b>Reading Comprehension:</b> very short texts of information (maps, timetable, etc.), mails, personal diary and comprehension of chronology of events.</p> <p><b>Writing exercises:</b> filling a form, talking about oneself, small messages, etc.</p> <p><b>Introduction to French Culture and civilization</b></p>
Suggested Books and references	<ol style="list-style-type: none"> <li>1. Tech French (Leçon 1 à 8)</li> <li>2. Connexion 1</li> <li>3. Alter Ego 1</li> <li>4. French magazines</li> <li>5. Web references</li> </ol> <p><a href="http://www.franparler.org">http://www.franparler.org</a>; <a href="http://www.ciep.fr">http://www.ciep.fr</a>; <a href="http://www.rfi.fr">http://www.rfi.fr</a>  <a href="http://www.tv5.org">http://www.tv5.org</a>; <a href="http://www.lepointdufle.net">http://www.lepointdufle.net</a>; <a href="http://www.lepointdufle.net">h</a></p>

<b>Course code</b>	<b>IE 301/ EE 401/ EE 601</b>
<b>Title of the course</b>	Foundation for Entrepreneurship
Credit Structure	L-T-P-Credits 2-0-2-3
Name of the Concerned Department/Center	Center of Innovation, Incubation, Entrepreneurship and Industry Relations (CIIEIR)
Pre-requisite, if any	NIL
Scope of the course	The main scope of this course is to develop innovation and entrepreneurship skills among students
Course Syllabus/Contents	<ul style="list-style-type: none"> <li>● Becoming an entrepreneur: what is entrepreneurship, and how to get into the entrepreneurial mindset? Best practices and strategies.</li> <li>● Storytelling, Design thinking and Visual communication: harnessing the power of stories for ideation, design thinking, and visual communication for brand building.</li> <li>● How entrepreneurs identify business opportunities (case studies)</li> <li>● What it takes to be an entrepreneur and the role of leadership.</li> <li>● Entrepreneurial finance – Stages &amp; sources of start-up financing</li> <li>● Customer discovery and Customer value proposition</li> <li>● Marketing and Go-to-market</li> <li>● Business communication and pitching to investors: persuasive business communication to pitch ideas to prospective investors and develop an idea into an entrepreneurial business, marketing and communication, crisis communication competencies to avoid economic consequences and damage to a brand image</li> <li>● Government initiatives: “Pradhan Mantri Mudra Yojana”, “Aatma Nirbhar Bharat”, “Digital India”, “Make in India” and “Start-Up India”. Case studies.</li> <li>● Basics of IP for entrepreneurs and IP related special schemes for start-ups by GoI</li> <li>● Opportunities in agribusiness-Input, Processing, Machineries and Output Industries</li> <li>● Supply chain and Marketing management.</li> <li>● Characteristics of entrepreneurial environment</li> <li>● Opportunity identification &amp; evaluation</li> <li>● Innovation and entrepreneurship (Types of innovation)</li> <li>● Basics of new venture creation</li> <li>● New product development – Crossing the chasm (Concept of waste to wealth)</li> <li>● Practical: Idea presentation, Business plan presentation,</li> </ul>

	Guest lectures from successful entrepreneurs, eminent professors, industry experts, etc.
Suggested Books	<ol style="list-style-type: none"> <li>1. Oxford Handbook on Business and the Natural Environment - Environment entrepreneurship, Edited by: Prof. Pratima Bansal and Andrew J. Hoffman, Nov 2011 ISBN: 9780199584451 Published online: Jan 2012 DOI: 10.1093/oxfordhb/9780199584451.001.0001</li> <li>2. Newman, A; North-Samardzic, A, Bedarkar M and Brahmarkar, Y: Entrepreneurship in India: Routledge: New York:2022: ISBN 978-0-367-49770-5</li> <li>3. Drucker, Peter: Innovation and Entrepreneurship, Taylor and Francis, 2014: ISBN 10:1315747456</li> <li>4. Chan, Mable: English for Business Communication, Routledge Applied English Language Introductions, Taylor and Francis, 2020: ISBN 10: 1138481688</li> <li>5. Brown, Tim: Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation (Revised and updated edition), Harper Business, 2019, ISBN 10:0062856626</li> <li>6. McGrath, Rita Gunther and Ian MacMillan: The Entrepreneurial Mindset: Strategies for Continuously Creating Opportunity in an Age of Uncertainty, Harvard University Press, 2000, ISBN 10: 0875848346</li> </ol>



The logo of IIT Indore is a circular emblem with a blue border. Inside the border, the text "IIT Indore" is written in the center, and "Indian Institute of Technology Indore" is written around the perimeter. At the bottom of the emblem, the motto "॥ ज्ञानम् सर्वजनहिताय ॥" is inscribed. The logo is semi-transparent and serves as a background for the title text.

**Syllabi of  
Courses of Minor Program in Humanities and  
Social Sciences  
(from AY 2014-15 onwards)**

Course Code	<b>HS 201</b>
Title of the Course	<b>Understanding Philosophy</b>
Credit Structure	L-T-P-Credits 3-0-0-3
Name of the Concerned Department	Philosophy/HSS
Pre-requisite, if any	None
Scope of the course	
Course Syllabus	<ol style="list-style-type: none"> <li>1. Introduction: Knowing Anything Plato's Idol of the Cave The Value of Philosophy</li> <li>2. Knowledge and Justification: Certainty &amp; Uncertainty</li> <li>3. Nature, Science and Philosophy - In search of a 'Method'</li> <li>4. Brain-in-a-Vat - The Philosophy of Matrix</li> <li>5. Ethics: Reason and Human Behavior</li> </ol>
Background Readings	<ol style="list-style-type: none"> <li>1. A. F. Chalmers, <b>What is this thing Called Science?</b> (Indianapolis: Hackett Publishing Company Inc., 1972).</li> <li>2. D. J. Soccio, <b>Archetypes of Wisdom: An Introduction to Philosophy</b> (Belmont: Wadsworth Cengage Learning, 2010).</li> <li>3. E. Sober, <b>Core Questions in Philosophy: A text With Readings</b> (Prentice Hall Inc., 2008).</li> <li>4. J. Ladyman, <b>Understanding Philosophy of Science</b> (London: Routledge, 2002).</li> <li>5. J. J. Rousseau, <b>Essay Discourses on Arts and Sciences</b></li> <li>6. K. Jaspers, <b>Ways to Wisdom: An Introduction to Philosophy</b> (New Haven: Yale University Press, 1954).</li> <li>7. T. Nagel, <b>What Does it All Mean? A very Short Introduction to Philosophy?</b> (Oxford: Oxford University Press, 1987).</li> <li>8. T. Nagel, (Cambridge: Cambridge University Press, 1991).</li> </ol>

Course Code	<b>HS 203</b>
Title of the Course	<b>Psychology</b>
Credit Structure	L-T-P-Credit 3-0-0-3
Name of the Concerned Department	Psychology/ Humanities and Social Sciences
Pre-requisite, if any	None
Scope of the course	<p>The course is designed to be a survey of the topics of psychology. In general, this course will provide an overview of the discipline. Upon completion of this course, students will be able to:</p> <ol style="list-style-type: none"> <li>1. Define psychology and relate it to other allied fields and engineering.</li> <li>2. Understand the application of scientific method and basic principles of psychology.</li> <li>3. Have an idea of psychological tests.</li> <li>4. Understand concepts related to how individuals process basic stimuli and the limitations of these abilities.</li> <li>5. Identify and apply basic issues of psychology in workplaces.</li> </ol>
Course Syllabus	<p><b>Understanding Human Experience and Behavior:</b> Definition, Schools, Methods, Branches, Application of Psychology for Engineers.</p> <p><b>Measuring Human Abilities:</b> Intelligence, Personal Testing.</p> <p><b>The Individual Working Life:</b> Personality Definition, Approaches and Theories, Models of Memory, Information Processing, Attention, Learning, Thinking. Psychological Problem of Everyday Life: Stress and Coping, Psychological Disorders, Work &amp; Mental Health.</p> <p><b>Motivation:</b> The Concept and Theoretical Framework, Motivating People at Work, Attitude &amp; Work Behavior, Leadership &amp; Management.</p>
Suggested Books	<p><b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. E. E. Smith, S. Nolen-Hoeksema, B. Fredrickson, G. Loftus, <b>Atkinson and Hilgard's Introduction to Psychology</b>, Wadsworth Publishing Company, 2009.</li> <li>2. R. S. Feldman, <b>Understanding psychology</b> (9<sup>th</sup> Ed.), McGraw-Hill Higher Education, 2009.</li> </ol> <p><b>Reference Readings:</b></p> <ol style="list-style-type: none"> <li>1. C.T. Morgan, R.A. King, J.R. Weiss, and J. Schopler, <b>Introduction to Psychology</b> (7<sup>th</sup> Ed.), Tata Mcgraw Hill Education, 2004.</li> <li>2. J.S. Nevid, <b>Essentials of Psychology: Concepts and Applications</b> (3<sup>rd</sup> Ed.), Wadsworth Publishing Company,</li> </ol>

Cengage Learning, 2011.

3. B. Robert. **Social Psychology** (12<sup>th</sup> Ed.), Pearson Education, 2009.
4. I. Rothmann, C. L. Cooper, **Organizational and Work Psychology: Topics in Applied Psychology**, Hodder Education, 2008.
5. M. W. Matlin. **Cognitive Psychology** (7<sup>th</sup> Ed.), Wiley, 2009.

*For 2009 batch as a special case the course HS-203 was offered as an Institute Elective Course with course code & title IHS 403 – Psychology-I.*



Course Code	<b>HS 205</b>
Title of the Course	<b>Sociology</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Department/School	Sociology/Humanities and Social Sciences
Prerequisite, if any	None
Scope of the Course	Main objective of this course is to provide an introductory overview of the major schools of sociological theory incorporating diverse perspectives and illustrations drawn from different cultural contexts. It introduces the concepts and ideas of important classical and modern sociologists by elaborating the theoretical systems which derive their fundamental tenets in the works of these authors.
Course Syllabus	<p><b>What is Sociology:</b> defining sociological theory; Speculative vs. grounded theory; macro vs. micro theory; theories and models.</p> <p><b>Social interaction:</b> Communication, interpretation and understanding.</p> <p><b>Types of Society:</b> pre-modern, agrarian, industrial, postindustrial.</p> <p><b>Culture:</b> popular, elite, folk, consumer, pluralism, multiculturalism.</p> <p><b>Systems theory:</b> models of system analysis; mechanistic model, organismic model, structural model, Talcott Parsons' system theory.</p> <p><b>Socialization and Social control:</b> Conformity and deviance.</p> <p><b>Social stratification:</b> caste, class, status, power, gender, ethnicity; social mobility, social inclusion and exclusion.</p> <p><b>Theory of Anomie-</b> Durkheim, Merton, Parsons;</p> <p><b>Alienation-</b> Marx, Fromm, Mills; Anomie of Affluence.</p> <p><b>Symbolic Interactionism:</b> Charles H. Cooley, Mead; Blumer and the Chicago School; Kuhn and Iowa School.</p> <p><b>Structuralism</b></p>
Suggested Books/ Articles	<ol style="list-style-type: none"> <li>1. Jayram, N. 2000. Introductory Sociology. MacMillan Press, London.</li> <li>2. Gupta, D. 1992. Social Stratification. OUP, New Delhi.</li> <li>3. Wallace, R.A., Wolf, A. 1995. Contemporary sociological theory: continuing the classical tradition. Prentice Hall, New Jersey.</li> <li>4. Srinivas, M. N. 1992. Social change in modern India. Orient Longman, Hyderabad.</li> <li>5. Calhoun, C., Gerteis, J., Moody, J., Pfaff, S., Virk, I. (eds.). 2012. Contemporary sociological theory. Wiley-Blackwell, Oxford.</li> <li>6. Giddens, A. 1995. Politics, sociology and social theory: encounters with classical and contemporary social thought. Stanford University Press, California.</li> </ol>

Course Code	<b>HS 206</b>
Title of the Course	<b>Paradigms and Turning Points</b>
Credit Structure	L-T-P-Credits 3-0-0-3
Name of the Concerned Department	Interdisciplinary Course
Pre-requisite, if any	None
Scope of the Course	This course offers major historical paradigms that have shaped the world in many ways. By doing so the course attempts to educate students about great ideas from antiquity to the present, not in the chronological sense, but to bring to light deeper insights into their mutual contestations and collaborations. Through these ideas, students would be able to grasp the greatness and profundity of these contestations.
Course Syllabus	<ol style="list-style-type: none"> <li>1. Wisdom – <i>Notion of the Ideal Knowledge from Nowhere</i></li> <li>2. Religion – <i>Understanding the Supernatural Idea of an Other World?</i></li> <li>3. Science – <i>Mapping the Process: Evolution of Scientific Knowledge World as a Mechanical Clock</i> <i>The Structure of Scientific Revolutions</i></li> <li>4. Romanticism – <i>The Aesthetic Mind</i> <i>The Brighter Side of Imagination</i></li> <li>5. Politics – <i>Forming the Human World</i> <i>Understanding Humans and Human Societies</i> <i>Interplay of Ideologies</i></li> <li>6. Technology – <i>Creating the alternate world</i> <i>Artificial Intelligence – Science Fiction</i></li> <li>7. Moral – <i>Meaning of the Human</i> <i>The sense of Right and Wrong</i></li> </ol>
Suggested Books	<ol style="list-style-type: none"> <li>1. A. Pacey, <b>Technology in World Civilization: A Thousand Year History</b>, The MIT Press, Massachusetts, 1992, ISBN: 978-0262660723.</li> <li>2. D. R. Headrick, <b>Technology: A World History</b>. Oxford University Press, Oxford, 2009, ISBN: 978-0195338218.</li> <li>3. D. Chalmers, <b>Constructing the World</b>, Oxford University Press, Oxford, 2012, ASIN: B00DEKFI4</li> <li>4. G. E. R. Lloyd, <b>The Ideals of Inquiry: An Ancient History</b>, Oxford University Press, Oxford, 2014, ASIN: B00KU3BFQ0.</li> </ol>

5. H. Brown, **Wisdom of Science: Its Relevance to Culture and Religion**, Cambridge University Press, Cambridge, 1986, ISBN: 978-0521314480.
6. H. Zinn, **The Politics of History**, The University of Illinois Press, Illinois, 1990, ISBN: 978-0252061226.
7. H. Smith, **The Illustrated World's Religions: A Guide to our Wisdom Traditions**, Harper Collins, New York, 1995, ISBN: 978-0060674403.
8. P. Kreeft, **Back to Virtue: Traditional Moral Wisdom for Modern Moral Confusion** Ignatius Books, ASIN: B00JIBDOTG.
9. L. G. Perdue, **Wisdom Literature: A Theological History**, John Knox Press, Westminster, 2007, ISBN: 978-0664229191.
10. M. Matousek, **Ethical Wisdom: The Search for a Moral Life**, Anchor Books, New York, 2012, ISBN: 978-0767930680
11. M. Ferber, **Romanticism: A Very Short Introduction**, Oxford University Press, 2010, ASIN: B005CU4TQ4
12. M. Kenneth, **Politics: A Very Short Introduction**, Oxford University Press, 2000, ISBN: 978-0192853882.
13. R. Tagore, **The Religion of Man**, Martino Fine Books, 2013 edition, ISBN: 978-1614274834.
14. S. Aurobindo, **The Human Cycle: The Psychology of Social Development**, Lotus Press, 2010, ASIN: B003VD24S4.
15. T. Kuhn, **The Structure of Scientific Revolutions**, University of Chicago Press, Chicago, 2012 [50<sup>th</sup> Anniversary Edition], ISBN: 978-0226458120.
16. T. Dixon, **Science and Religion: A Very Short Introduction**, Oxford University Press, Oxford, 2008, ASIN: B003N2P408.

॥ ज्ञानम् सर्वजनहिताय ॥

Course Code	<b>HS 207</b>
Title of the Course	<b>French Language - I</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department	Linguistic/HSS
Pre-requisite, if any	None
Scope of the course	This is a basic level course in the French language to impart basic conversational and writing skills to the students. After completing this course, the learner can interact in a simple way. The course focuses on active student participation in conversational French as well as writing skills.
Course Syllabus	<p><b>Grammar :</b> Conjugation of the verbs regular and irregular in Present, Past and Future tenses, The articles, The Interrogation, The Negation, The disjunctive pronouns etc.</p> <p><b>Vocabulary:</b> Related to oneself, Places of the city and country, Hobbies and activities, Travels and transports, Food, Festival, Every day activities, Lodging, Orientation, etc.</p> <p><b>Oral Situation:</b> Self Introduction, How to take leave, Express liking and disliking, Narrate the activities in past tense.</p> <p><b>Phonetic:</b> Sound [ʒ] – [j]; Rhythm and linking of words ; Pronunciation difference of noun masculine , feminine and plural; Sounds [v] – [f]; Rhythm of groups « verbs + verbs » and negative sentences. Pronunciation difference in the sentences of present and past tense.</p> <p><b>Reading Comprehension:</b> Symbols of road; Small articles of press and portrait of a person; Post cards of invitation, acceptance and refusal; Personal diary and comprehension of chronology of events.</p> <p><b>Writing exercises:</b> Make correspondence, Small messages, post cards etc, acceptance and refusal; Express an experience in past tense, etc.</p> <p><b>Introduction to French Culture and civilization</b></p>
Suggested Books and references	<ol style="list-style-type: none"> <li>1. Echo 1 of CLE International (Leçon 1 to Leçon 4)</li> <li>2. Connexion 1</li> <li>3. Alter Ego 1</li> <li>4. French magazines</li> <li>5. Web references</li> </ol> <p><a href="http://www.francparler.org">http://www.francparler.org</a>; <a href="http://www.ciep.fr">http://www.ciep.fr</a>; <a href="http://www.rfi.fr">http://www.rfi.fr</a> <a href="http://www.tv5.org">http://www.tv5.org</a>; <a href="http://www.lepointdufle.net">http://www.lepointdufle.net</a>;</p>

<http://www.dailymotion.com/group/374>

<http://fr.youtube.com/user/campusfle>



Course Code	<b>HS 208</b>
Title of the Course	<b>French Language - II</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department	Linguistic/HSS
Pre-requisite, if any	<b>HS 207: French Language - I</b>
Scope of the course	This is advanced course in French language to impart advanced conversational and writing skills to the students.
Course Syllabus	<p><b>Grammar:</b> Conjugation of the verbs regular and irregular in Future tenses; The adjectives; The adverbs; The Prepositions, etc.</p> <p><b>Vocabulary:</b> Travels and transports; Food; Festival, Every day activities, Lodging, Orientation, etc.</p> <p><b>Oral Situation:</b> Give and ask an explanation, etc; Practical situations related to travel; Practical situations at hotel and restaurant; Ask the updates of someone Choose, buy and pay To get informed regarding the direction etc; Ask for the help.</p> <p><b>Phonetic:</b> Sound [ɔ] [ɔ̃], Difference between sound [y] and [u], [b], [v] and [f], [s] and [z], Rhythm and intonation, Rhythm of negative sentences, Rhythm of reflexive verbs, Intonation of imperative sentences.</p> <p><b>Reading comprehension:</b> Articles of Press, Extract of brochure touristic of Paris.</p> <p><b>Writing exercises:</b> Narrate the circumstances of trip; Present oneself on internet site; Drafting of a brief document of information; Drafting of a card or a message.</p> <p><b>French Culture and Civilization</b></p>
Suggested Books and references	<ol style="list-style-type: none"> <li>1. Echo 1 of CLE International (Leçon 5 to Leçon 8)</li> <li>2. Connexion 1</li> <li>3. Alter Ego 1</li> <li>4. French magazines</li> <li>5. Web references</li> </ol> <p><a href="http://www.francparler.org">http://www.francparler.org</a>; <a href="http://www.ciep.fr">http://www.ciep.fr</a>;  <a href="http://www.rfi.fr">http://www.rfi.fr</a>  <a href="http://www.tv5.org">http://www.tv5.org</a>; <a href="http://www.lepointdufle.net">http://www.lepointdufle.net</a>;  <a href="http://www.dailymotion.com/group/374">http://www.dailymotion.com/group/374</a>  <a href="http://fr.youtube.com/user/campusfle">http://fr.youtube.com/user/campusfle</a></p>

Course code	<b>HS 209</b>
Title of the course	<b>Intermediate Microeconomics</b>
Credit Structure	L - T - P - Credits 2-1-0-3
Name of the Concerned Department	Humanities & Social Sciences
Pre-requisite, if any	HS 108; Fundamentals of Economics
Scope of the course	This course aims to extend the students' knowledge of the basic microeconomics principles and provide insight into how economic models can help us think about important real-world phenomena.
Course Syllabus	<ol style="list-style-type: none"> <li>1. Basic theory of consumer behaviour, production and costs, supply in a competitive market</li> <li>2. Market power: monopoly and monopsony, imperfect competition</li> <li>3. Factor markets: Pricing of factors of production and income distribution</li> <li>4. General equilibrium and economic efficiency: General equilibrium analysis, efficiency in exchange and production</li> <li>5. Asymmetric information: Adverse selection, moral hazard and principal- agent model</li> <li>6. Externalities: Production and consumption externalities, solution to externalities problem and efficiency conditions in the presence of externalities</li> </ol>
Suggested Books	<ul style="list-style-type: none"> <li>• R. Pindyck and D. Rubinfeld : <i>Microeconomics</i> : Pearson : India : 2015 : 978-9332585096</li> <li>• H. Varian : <i>Intermediate Microeconomics</i> : A Modern Approach (9<sup>th</sup> edition) : W.W. Norton &amp; Company : New York : 2014 : 978-0393123975</li> <li>• A. Goolsbee, S. Levitt, and C. Syverson : <i>Microeconomics (3rd edition)</i> : Worth Publishers : New York : 2019 : 978-0716759751</li> <li>• J.M. Perloff: <i>Microeconomics: Theory and Applications with Calculus: 7th edition: Pearson Education Limited: USA: 2017: 9781292154459</i></li> </ul>

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Course Code	<b>HS 210</b>
Title of the Course	<b>Indian Economy</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department	Economics/Humanities and Social Sciences
Pre-requisite, if any	Fundamentals of Economics
Scope of the course	<p>This course examines the history and current state of economic landscape of India since independence. We plan to cover economic policies of the country post-independence focusing on agriculture, manufacturing, financial and trade sectors. The class discussions attempt to bring forth the implications of the policies on the economy and society at large.</p> <p>We aim to understand the present economic structure, status, reform experience, current issues, and likely future prospects of the Indian economy. The course begins with analysis of post-independence policies in view of the economic and social realities of the country. It is followed by the discussion on reform period across different sectors of the economy. It is expected that by the end of the course, the participants are aware of the evolution eras of India's economic structure and are able to provide an informed commentary on relevant topics.</p>
Course Syllabus	<p>Post-independence evolution of the economic policies; Five year Plans and economic growth before 1990's and the need for reforms in 1991.</p> <p>Indian agricultural sector: land reforms, issues of food management and security</p> <p>Manufacturing sector: the changes made following the reform period in the Industrial policy, Competition Policy and Policy for Small and Medium Enterprises.</p> <p>Indian international trade, WTO and Indian currency.</p> <p>Issues of inflation, poverty and inequality.</p> <p>Introduction to Indian financial sector.</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. S. Acharya and R. Mohan. <b>India's Economy: Performances and Challenges</b>. New Delhi: Oxford University Press, 2010. <i>Selected chapters</i>.</li> <li>2. U. Kapila. <b>Indian Economy: Performance and Policies</b> (14<sup>th</sup> Ed). New Delhi: Academic Foundation, 2014.</li> <li>3. J. Dreze and A. Sen. <b>India: Development and Participation</b> (2<sup>nd</sup></li> </ol>

- Ed). New Delhi: Oxford University Press, 2002. *Selected chapters*.
4. J. Bhagwati and A. Panagariya. **India's Tryst with Destiny**. New Delhi: Collins Publishers, 2012. *Selected chapters*.



Course Code	<b>HS 211</b>
Title of the Course	<b>German Literature and Culture Studies</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department/ School	Humanities and Social Sciences
Prerequisite, if any (for the students)	None
Learning Objectives	To provide an introduction to literature and culture in contemporary Germany. To provide an overview of major literary works, music, films, art and culture in modern Germany.
Course Syllabus	<p><b>German Literature:</b>  Historical overview of German literature in the following periods:  1789 to 1870: Period during and after the French Revolution.  1871 to 1918: Period after the foundation of second German Reich.  1919 to 1933: The Weimar Republic  1933 to 1945: The Third Reich.</p> <p><b>Understanding German Culture:</b>  The citizen and State in modern Germany  German education system  Music and Art in modern German culture  German Cinema and its critique (Goodbye Lenin; Das Leben der Anderen; Das Boot, The Good German; Jacob the Liar)</p>
<i>Suggested Books</i>	<ol style="list-style-type: none"> <li>1. Beutin W., Ehlert K., Emmerich W., et al. (1993). <i>A history of German literature: from the beginnings to the present day</i>. Routledge.NY.</li> <li>2. Watanabe-O' Kelly, H. (2008). <i>The Cambridge history of German literature</i>. Cambridge univ. press. NY.</li> <li>3. Kolinsky, E., Wilfried van der Will. (1998). <i>The Cambridge companion to modern German culture</i>. Cambridge univ. Press. NY.</li> <li>4. Gay, P. (2001). <i>The Weimar culture: the outsider as insider</i>. Norton paperback, NY.</li> <li>5. Ward, J. (2001). <i>Weimar surfaces: urban visual culture in 1920s Germany</i>. University of California Press. LA.</li> </ol>

<b>Course code</b>	<b>HS 212</b>
<b>Title of the course</b>	<b>History of India after Independence, 1947-2000</b>
Credit Structure	L - T - P - Credits 2-1-0-3
Name of the Concerned Department	Humanities & Social Sciences
Pre-requisite, if any	NA
Scope of the course	This course explores the History of India after Independence (1947-2000). It is structured around the following questions: •How did the constitution evolve as a document of Indian sovereignty, and what are its basic features and provisions? •How was India linguistically reorganized into states after Independence? •What role have institutions such as the Supreme Court, the Houses of Parliament, and the Election Commission played to preserve and uphold democracy in India? •What has been the role of educational institutions, particularly the Indian Institutes of Technology, to nation building? •How have international events in Asia, North America, Europe, and Africa shaped independent India's foreign policy?
Course Syllabus	<ol style="list-style-type: none"> <li>1. The Constitution and nationhood, 1947-56 (Evolution and basic features of the constitution, universal franchise and voting rights, linguistic reorganisation of states)</li> <li>2. Nation building and Education, 1957-73 (Democratic institutions, development projects, role of the Indian Institutes of Technology in nation building)</li> <li>3. Dissent and Consolidation, 1974-89 (JP Movement, the Emergency, Punjab crisis, Dravidian movement, Kerala, and West Bengal)</li> <li>4. Local reforms and global aspirations, 1990-2000 (The rise of the middle class, agrarian and manufacturing reforms, contribution of technological institutes to the making of new global diasporas)</li> <li>5. India's role in world affairs, 1950-2000 (Non-Alignment Policy, India as a member state of the United Nations, Policy towards the North Atlantic Treaty Organization and Europe, Asia and Africa)</li> </ol>
Suggested Books	<ol style="list-style-type: none"> <li>1. Chandra, B_ Mukherjee, A_ Mukherjee, M, <b><i>India after Independence, 1947-2000</i></b>, Penguin India, Delhi, 2000, ISBN-10:0140278255</li> <li>2. Bassett, R, <b><i>The Technological Indian</i></b>, Harvard University Press, Cambridge, Massachusetts, 2016, ISBN-10:0674245970</li> <li>3. Rothermund, D, <b><i>India- The rise of an Asian giant</i></b>, Yale</li> </ol>

University Press, London, 2009, ISBN-10:0300158274  
4. Talbot, I, *A History of Modern South Asia, Politics, States, Diasporas*, Yale University Press, London, 2016, ISBN:9780300216592



<b>Course code</b>	<b>HS 213</b>
<b>Title of the course</b>	<b>Cognitive Psychology</b>
Credit Structure	L - T - P - Credits 2-1-0-3
Name of the Concerned Department	Humanities & Social Sciences
Pre-requisite, if any	NA
Scope of the course	The course is designed to provide an overview of how information is processed by the brain. This course will help engineering students to understand how the human brain and mind process information. Through the knowledge gained by this course, students will be able to develop their creative and critical thinking. They will also be able to apply this knowledge in creating and designing ergonomically efficient engineered devices, products, etc. that can be consumer efficient. The knowledge of social cognition will make learners able to understand that how people interact with each other, what are their needs, how people develop their cognition, how people develop their understanding of others. Also, it will make students able to communicate better with their clients, which will make them able to understand what people want, etc.
Course Syllabus	<p><b>Foundation of Cognitive Psychology:</b></p> <ul style="list-style-type: none"> <li>• Introduction, Methods and Paradigms in Studying Cognitive Psychology, Mind and Brain</li> </ul> <p><b>Basic Cognitive Processes:</b></p> <ul style="list-style-type: none"> <li>• Perception: Introduction; Pattern Recognition, Theories; Processing involved: Top-Down and Bottom-Up Processing</li> <li>• Attention: Introduction; Types and Theories of Attentional Processes</li> <li>• Memory: Introduction and Overview; Short Term Memory/Working Memory, Long Term Memory, Memories of Everyday Life</li> </ul> <p><b>Advanced Cognitive Processes:</b></p> <ul style="list-style-type: none"> <li>• Language and Cognition: Language Structure, Phonology, Syntax, Semantics, Pragmatics</li> <li>• Thinking and Problem Solving: Nature of Problem Solving, Types of Problem, Approaches to Solve Problems,</li> <li>• Decision Making: Nature, Science of Decision Making, Phases of Decision Making</li> </ul> <p><b>Social Cognition:</b></p> <ul style="list-style-type: none"> <li>• Introduction, Social Facilitation, Social Loafing</li> <li>• Attitude: Nature and Meaning, Characteristics, Formation</li> <li>• Social Perception: Impression Formation and Attribution Process</li> </ul>

Suggested Books

1. K. M. Galotti, ***Cognitive psychology in and out of the laboratory***, Sage Publications, Minnesota, 2017, 9781506351568
2. R. J. Sternberg, & K. Sternberg, ***Cognitive Psychology***, Cengage Learning : Boston : 2011 : 9781111344764
3. E. E. Smith & S. M. Kosslyn, ***Cognitive Psychology: Mind and Brain***, Pearson Education, India, 2015, 9789332550452
4. M. W. Eysenck, & M. T. Keane, ***Cognitive Psychology : A Student's Handbook***, Psychology Press, New York, 2005 9781841693590



Course code	HS 214
Title of the course	History of Indian Culture and Civilization
Credit Structure	L - T - P - Credits 2-1-0-3
Name of the Concerned Department	Humanities & Social Sciences
Pre-requisite, if any	NA
Scope of the course	<p><b>Overview:</b> This course is an introduction to Ancient, Medieval and Modern India, 2600 BC-AD 1947.</p> <p><b>Objective:</b> The course covers a sizeable historical terrain to address a particular set of objectives. These are:</p> <ol style="list-style-type: none"> <li>1. What do 'culture', and 'civilisation' mean in the Indian context?</li> <li>2. When did Indian civilisation begin? What are its contents?</li> <li>3. Can one historically locate Indian culture?</li> <li>4. Was there a concept of India before the 19th century?</li> </ol>
Course Syllabus	<p><b>Harrapan Civilisation (2600-1900 BC):</b> society and urban life</p> <p><b>Vedic India (2000-1500 BC):</b> Vedic culture Varna and Jati</p> <p><b>Cities and Society (600-300 BC):</b> Janapadas, Buddhism and Jainism</p> <p><b>Ancient Empires (324 BC-AD 750):</b> Mauryan, Gupta and Chola Empires</p> <p><b>State and Community in Medieval India (AD 750-1525):</b> North and South Indian kingdoms, Islam and its development in India, Vijayanagar</p> <p><b>The transition to Early Modern India (AD 1526-1740):</b> Mughal Empire, Marathas</p> <p><b>Modern India (AD 1757-1884):</b> East India Company, 1857 Mutiny, British Raj</p> <p><b>Independence and partition (AD 1885-1947):</b> Early Congress and its opponents, Gandhi's campaigns, the Partition</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. B Stein, <i>A History of India</i>, Wiley-Blackwell, Delhi, 2010, ISBN-10, 1405195096, ISBN-13 : 978-140</li> <li>2. U Singh, <i>A History of Ancient and Early Medieval India- From the Stone Age to the 12 century</i>, Pearson Education India, Delhi, 2009, ISBN-10 : 8131716775 ISBN-13: 978-8131716779</li> <li>3. S Sarkar, <i>Modern India</i>, Pearson Education India, Delhi, 2014, ISBN-10, 9332535744, ISBN-13, 978-9332535749</li> </ol>

<b>Course code</b>	<b>HS 216</b>
<b>Title of the course</b>	<b>Introduction to Hindi Cinema</b>
Credit Structure	L - T - P - Credits 2-1-0-3
Name of the Concerned Department	Humanities & Social Sciences
Pre-requisite, if any	NA
Scope of the course	This course is designed to introduce the students to the diversity of Hindi Cinema, from its beginnings to the present. The course will provide a background to the industrial landscape of Hindi cinema as well as trace thematic concerns and generic tendencies. The course will journey through the silent cinema of the early studio years, the coming of sound, the consolidation of the star system and the post-globalization cinema.
Course Syllabus	Silent Cinema, Historicals and Devotionals, Socials and Stunt Film, Bombay as the Site of Modernity, Crime, Music and the Modern Vamp, Angry Young Man Era, Documentary Tradition, B-Film Circuits, Globalization and Film Form, Bollywoodisation, The Multiplex
Suggested Books	<ol style="list-style-type: none"> <li>1. M. Madhava Prasad, <i>Ideology of the Hindi Film: A Historical Construction</i>, Oxford University Press, New Delhi, 1998, 978-0195652956</li> <li>2. V. Vitali, <i>Hindi Action Cinema, Industries, Narratives, Bodies</i>, Indiana University Press, Bloomington, 2010, 978-0253222220</li> <li>3. B. Sarkar, <i>Mourning the Nation, Indian Cinema in the Wake of Partition</i>, Duke University Press, Durham, 2009, 978-0822344117</li> <li>4. K. P. Jayasankar and A. Monteiro, <i>A Fly in the Curry: Independent Documentary Film in India</i>, Sage, New Delhi, 2015, 978-9351505693</li> </ol>

Course code	<b>HS 220/320/420</b>
Title of the course	<b>The Digital Economy</b>
Credit Structure	L - T - P – Credits 2-1-0-1.5 Credits (3/2 half semester)
Course Category	Societal Basket Courses
Name of the Concerned Department	School of HSS
Pre-requisite, if any	<b>None</b>
Scope of the course (Objectives)	<ul style="list-style-type: none"> <li>• Understand the nature of technologies that underpin the Platform Capitalism and the Gig Economy</li> <li>• Explore the nature of work, employment, in the context of Platform Capitalism and the Gig Economy.</li> </ul>
Course Outcomes	<ul style="list-style-type: none"> <li>• Develop insights into how Work and Employment evolved during the Industrial Revolution and how it is being transformed by Automation and AI</li> <li>• Grasp the workings of platform capitalism and the gig economy, based on Data Extraction</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• <b>A General Overview of the Technologies:</b> <ul style="list-style-type: none"> <li>○ Digital Technologies, Internet and Digital Communication</li> <li>○ Cloud Computing, Virtualization, Dematerialization, Internet of Things, Blockchain</li> </ul> </li> <li>• <b>Historical Perspective:</b> The Evolution of Work in Industrial Capitalism <ul style="list-style-type: none"> <li>○ Automation of Work: Robotics, Artificial Intelligence</li> </ul> </li> <li>• <b>Platform Capitalism and Gig Economy</b> <ul style="list-style-type: none"> <li>○ Data Extraction, Privacy, Security and Surveillance Capitalism</li> </ul> </li> <li>• Creativity, Innovation and Efficiency in the Age of AI</li> </ul>
Suggested Books & References	<p><b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. J. Schor, After the Gig, University of California Press, 2020. ISBN: 978-0520325050.</li> <li>2. A. Rosenblat, Uberland - How Algorithms are Rewriting the Rules of Work, University of California Press, 2018. ISBN: 9780520324800</li> </ol> <p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>3. H. A. Rahman, Inside the Invisible Cage, University of California Press, 2024. ISBN:9780520395541</li> <li>4. S. Zuboff, The Age of Surveillance Capitalism, Hachette Book Group, 2019. ISBN: 9781781256855</li> </ol>

Course code	<b>HS 221</b>
Title of the course	<b>Fundamentals of Linguistics</b>
Course Category	Liberal Arts Minor; Institute Open Elective
Credit Structure	L - T - P - Credits 3 - 0 - 0 - 3 (3/2 = 1.5)
Name of the Concerned Department	English/Humanities and Social Sciences
Pre-requisite, if any	None
Course Objectives	<ul style="list-style-type: none"> <li>• Foster comprehension of Linguistics as a scientific discipline</li> <li>• Explore the fundamental principles of linguistics and various levels of analysis.</li> <li>• Create an awareness of the structure and features of natural languages.</li> </ul>
Course Outcomes	<ul style="list-style-type: none"> <li>• Define the properties of human language</li> <li>• Explain Linguistics as a scientific study of language</li> <li>• Analyse data in various languages by using the tools and techniques of Linguistics</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Theories of Linguistics (Prescriptive vs. Descriptive grammar, Behaviorism, Structuralism, Nativism, Generative linguistics)</li> <li>• Speech production (Organs of speech, speech production, speech sounds, place and manner of articulation)</li> <li>• Levels of linguistic analysis (Phonetics, phonology, morphology, syntax and semantics)</li> <li>• Applications of linguistics (Applied areas of linguistics)</li> </ul>
Suggested Books (Text Books , Reference Books)	<p><b>Text Books</b></p> <ul style="list-style-type: none"> <li>• N. Chomsky, <b>Aspects of the Theory of Syntax</b>, Vol. 11, MIT Press, 2014, ISBN: 9780262260503</li> <li>• S.K. Verma and S. Krishnasamy, <b>Modern Linguistics-An Introduction</b>, Oxford University Press, 2002, ISBN: 0195623711</li> <li>• G. Yule, <b>The Study of Language</b>, Cambridge University Press, 2010, ISBN: 9780521749220</li> </ul> <p><b>Reference Books</b></p> <ul style="list-style-type: none"> <li>• M. Atkinson, I. Roca and D. Kibly, <b>Foundations of General Linguistics</b>, Routledge, 2015, ISBN: 9781138974579</li> <li>• J. Cutting and K. Fordyce, <b>Pragmatics-A Resource Book for Students</b>, Routledge, 2020, ISBN: 9780367207250</li> </ul>

- P. Roach, **English Phonetics and Phonology- A Practical Course**, Cambridge University Press, 1991, ISBN: 0521282527



Course code	<b>HS 223</b>
Title of the course	<b>Language Variation: Culture and Society</b>
Course Category	Liberal Arts Minor; Institute Open Elective
Credit Structure	L-T-P-Credits 3-0-0 -3 (3/2 = 1.5)
Name of the Concerned Department	English/Humanities and Social Sciences
Pre-requisite, if any	Fundamentals of Linguistics
Course Objectives	<ul style="list-style-type: none"> <li>• This course analyses the relationship between language, society and culture.</li> <li>• It examines the interaction of language with society and the individual and how language establishes power, ethnicity, gender, and social identity.</li> <li>• Explore linguistic diversity in society and the methodology for sociolinguistic analysis of conversations.</li> </ul>
Course Outcomes	<ul style="list-style-type: none"> <li>• Learn social, cultural, and affective factors that influence language and communication.</li> <li>• Analyze conversations in natural languages and explain the characteristics of language use</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Language, society and sociolinguistics</li> <li>• Dialect and Variety- language variations vs change</li> <li>• Variations in English- World English(es), Global English, Colonialism and English, Connecting language and Indian English(es)</li> <li>• Ethnolinguistics-language and culture, language shift</li> <li>• Language and identity- language, language choice, identity, language attitude, language and power, language and gender etc.</li> <li>• Language families and Policy in India</li> </ul>

## Suggested Books

### Textbooks

1. P. Trudgill, **Sociolinguistic Variation and Change**, Edinburgh University Press, 2002, ISBN: 9780748615155
2. R. Mesthrie, J. Swann, A. Deumert and W.L. Leap, **Introducing Sociolinguistics**, Edinburgh University Press, 2009, ISBN: 9780748638444

### Reference Books

3. M. Meyerhoff, **Introducing Sociolinguistics**, Routledge, 2018, ISBN: 9780429507922
4. S. Romaine, **Language in Society- An Introduction to Sociolinguistics**, Oxford University Press, 2000, ISBN: 0198731922



Course Code	<b>HS 224</b>
Title of the Course	<b>Contemporary Short Fiction</b>
Course Category	Liberal Arts Minor; Institute Open Elective
Credit Structure	L-T- P-Credits 3- 0- 0 - 3
Name of the Concerned Discipline/School	English/Humanities and Social Sciences
Pre-requisite, if any	None
Course Objectives	In this course students will: <ul style="list-style-type: none"> <li>• Explore the historical and cultural contexts of contemporary short fiction.</li> <li>• Analyze the thematic concerns, narrative techniques, and stylistic innovations of contemporary short story writers.</li> </ul>
Course Outcomes	<ul style="list-style-type: none"> <li>• Analyze the thematic concerns, narrative techniques, and stylistic innovations of contemporary short story writers.</li> <li>• Explore the cultural, social, and political dimensions of contemporary short fiction.</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Fundamentals of the short fiction genre (Postmodernism, Short Metafiction, Intertextuality, Fragmentation)</li> <li>• Science Fiction (Dystopias, Utopias, and Alternate Realities)</li> <li>• Narratives of Ecological Consciousness (Nature Writing, Environmental Concerns, and Eco-Criticism)</li> <li>• Electronic Literature (Digital storytelling)</li> </ul>
Suggested Books	<p><b>Text Books</b></p> <ol style="list-style-type: none"> <li>1. M.H. Abrams, <b>Glossary of Literary Terms</b>, Wadsworth Publishing, 2011, ISBN: 9788131526354</li> <li>2. K. Hayles, <b>Electronic Literature- New Horizons for the Literary</b>, Notre Dame Press, 2008, ISBN: 9780268030858</li> </ol> <p><b>Reference Books</b></p> <ol style="list-style-type: none"> <li>3. V. Singh, <b>Ambiguity Machines and Other Stories</b>, Small Beer Press, 2018, ISBN: 9781618731432</li> <li>4. R. Vanita, <b>The Shroud Stories-Premchand</b>, Penguin Books, 2011, ISBN: 9780143415961</li> </ol>

Course code	<b>HS 226</b>
Title of the course	<b>Sociology of Cinema</b>
Course Category	Liberal Arts Minor; Institute Open Elective
Credit Structure	L - T - P - Credits 2 - 1 - 0 - 3
Name of the Concerned Department	Sociology/Humanities and Social Sciences
Pre-requisite, if any	None
Course Objectives	<ul style="list-style-type: none"> <li>• Introduction to the sociological intersections between cinema and society</li> <li>• Understanding Cinema vis-a-vis shifting historical landscape in post-independent India, and post-war US, Europe and Japan</li> <li>• Tracing key thematic and generic tendencies along major national events</li> </ul>
Course Outcomes	<ul style="list-style-type: none"> <li>• Assess economic and political undercurrents of cultural transformations in Cinema.</li> <li>• Analyse the role of technology in cinema's evolution and its overlap/competition with other media platforms (newspaper, radio and television)</li> <li>• Analyse the methods by which popular cinema has been designed to combine or segregate demographic clusters</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• How to study Cinema? <ul style="list-style-type: none"> <li>- Textual analysis</li> <li>- Framing society as historical, economic and political context</li> </ul> </li> <li>• Early Indian Sound Cinema, 1930s-40s <ul style="list-style-type: none"> <li>- Devotional Films</li> <li>- Action Cinema</li> </ul> </li> <li>• Classical Hollywood film language <ul style="list-style-type: none"> <li>- Hollywood Lighting</li> <li>- Douglas Sirk's "women's weepies"</li> </ul> </li> <li>• Post-War European Art cinema language <ul style="list-style-type: none"> <li>- Jump Cut</li> <li>- Long Take</li> </ul> </li> <li>• Post-War Japanese Horror films</li> <li>• Post-independence Hindi Melodramas, 1950s</li> <li>• Realist Representation</li> <li>• Indian New Wave Cinema</li> </ul>

	<ul style="list-style-type: none"> <li>• The Indian Documentary</li> <li>• Bollywood as a Culture Industry, post-liberalization</li> <li>• Multiplex Cinema, 2005 onwards</li> </ul>
Suggested Books	<p><b>Text Books</b></p> <ol style="list-style-type: none"> <li>1. M.M. Prasad, <b>Ideology of the Hindi Film- A Historical Construction</b>, Oxford University Press, 1998, ISBN: 9780195652956</li> <li>2. V. Vitali, <b>Hindi Action Cinema- Industries, Narratives, Bodies</b>, Indiana University Press, 2010, ISBN: 9780253222220</li> </ol> <p><b>Reference Books</b></p> <ol style="list-style-type: none"> <li>3. B. Sarkar, <b>Mourning the Nation- Indian Cinema in the Wake of Partition</b>, Duke University Press, 2009, ISBN: 9780822344117</li> <li>4. K.P. Jayasankar and A. Monteiro, <b>A Fly in the Curry- Independent Documentary Film in India</b>, Sage, 2015, ISBN: 9789351505693</li> </ol>



Course code	<b>HS 232/332/432</b>
Title of the course	<b>The Making of Digital Cultures</b>
Credit Structure	L - T - P – Credits 2-1-0-1.5 Credits (3/2 half semester)
Course Category	Societal Basket Courses
Name of the Concerned Department	School of HSS
Pre-requisite, if any	None
Scope of the course (Objectives)	<ul style="list-style-type: none"> <li>• To explore and assess facets of our personal and professional lives through the lens of a variety of technology-culture frameworks</li> <li>• Exploring how communication technologies shape mental health, beliefs, behavior, and democracy</li> </ul>
Course Outcomes	<ul style="list-style-type: none"> <li>• Become familiar with technology-society theories</li> <li>• Develop a sense of how technology has impacted societies and individuals</li> <li>• Identify the underlying mechanisms and business models that drive digital technologies</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• The Social, Economic and Political Context: How Societies Work to Produce Wealth and Culture; Technology Culture Theories</li> <li>• Digital Technologies, Internet and Digital Communication: Instant Messaging and Social Media</li> <li>• Data Extraction, Privacy, Security and Surveillance Capitalism</li> <li>• Attention Economy and Advertisement Revenue Based Business Models for Social Media</li> <li>• Disinformation and Fake News</li> <li>• Politics and Consumerism in the Digital Era</li> </ul>
Suggested Books & References	<p><b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. J. Baudrillard, Selected Writings (ed Mark Poster), Stanford University Press, 1988. ISBN 9780804714808</li> <li>2. J. Taplin, Move Fast and Break Things, Macmillan, 2017. ISBN 9780316275774</li> </ol> <p><b>Reference Books:</b></p> <ol style="list-style-type: none"> <li>3. L. Strate, Amazing Ourselves to Death, Peter Lang, 2014. ISBN 9781433119316</li> <li>4. J. Haidt, The Anxious Generation: How the Great Rewiring of Childhood is Causing an Epidemic of Mental Illness, Penguin</li> </ol>

(2024). ISBN 9780593655030

5. Y. N. Harari – Nexus: A Brief History of Information Networks from the Stone Age to AI. 2024. Random House. ISBN 9781911717096



Course Code	<b>HS 311</b>
Title of the Course	<b>Life and Thought of Gandhi</b>
Credit Structure	L-T-P-Credits 3-0-0-3
Name of the Concerned Department	Philosophy/HSS
Pre-requisite, if any	None
Scope of the course	The course focuses on the study of Gandhi's philosophy and life. The class will try to explore the man behind the legend, as well as explore his philosophy of <i>ahimsa</i> . The goal is to determine if his philosophy is relevant to our world and times.
Course Syllabus	Major themes of the course: Introduction to the man and the Mahatma Principal Texts: Hind Swaraj, <u>An Autobiography</u> The practice and theory of Satyagraha Gandhi and the quest for Swaraj and Moksha Debates on Gandhi Critical Evaluation
Suggested Books	<ol style="list-style-type: none"> <li>1. S. Sharma and T. Suhrud, <b><i>M.K. Gandhi's Hind Swaraj a critical edition</i></b>, New Delhi: Orient Blackswan, 2010.</li> <li>2. Parel, Anthony J. <b><i>Gandhi: Hind Swaraj and Other Writings</i></b>, Cambridge: Cambridge University Press. 1997.</li> <li>3. B.R. Nanda, <b><i>Gandhi and His Critics</i></b>, New Delhi: Oxford University Press, 2010.</li> <li>4. J. Brown, <b><i>Gandhi: Prisoner of Hope</i></b>, New Haven: Yale University Press, 1991.</li> <li>5. Raghurama A Raju, <b><i>Debating Gandhi</i></b>, New Delhi: Oxford University Press, 2006.</li> <li>6. C. Markovits, <b><i>The Un-Gandhian Gandhi</i></b>, New Delhi: Permanent Black, 2007.</li> <li>7. R. Gandhi, <b><i>The Good Boatman: A Portrait of Gandhi</i></b>, New Delhi: Penguin, 1995.</li> <li>8. D. Hardiman, <b><i>Gandhi in his Times and Ours: The Global Legacy of His Ideas</i></b>, New Delhi: Permanent Black, 2003.</li> <li>9. L. Fischer, <b><i>Life of Mahatma Gandhi</i></b>, New York: Harpercollins, 1997.</li> </ol>

10.B. Parekh, *Gandhi: A Very Short Introduction*, New Delhi: Oxford University Press, 2001.



Course Code	<b>HS 313</b>
Title of the Course	<b>History of Early Cinema</b>
Credit Structure	L-T-P-Credits 3-0-0-3
Name of the Concerned Department	Philosophy/HSS
Pre-requisite, if any	NIL
Scope of the course	
Course Syllabus	I. Cognition and Imagination Film and Knowledge - Film as Philosophy II. Philosophy of Motion Pictures Essence of Cinema: Perception, Illusion and Fantasy III. Film: Human Emotion - Meaning of Life IV. Film and Historical Imagination V. Film and Racism
Suggested books	<ol style="list-style-type: none"> <li>1. Bazin, Andre, <b>What is Cinema?</b> Vol 1, (New York: University of California Press, 2004).</li> <li>2. Carroll, Noel, <b>The Philosophy of Motion Pictures</b> (Oxford: Wiley Blackwell, 2007).</li> <li>3. Cavell, Stanley, <b>The World Viewed: Reflections on the Ontology of Film</b> (Harvard: Harvard University Press, 1979).</li> <li>4. Currie, Gregory, <b>Image and Mind: Film, Philosophy and Cognitive Science</b> (Cambridge: Cambridge University Press, 2008).</li> <li>5. McCuinn, Colin, <b>The Power of Movies: How Screen and Mind Interact</b> (Vintage Press, 2007).</li> <li>6. Perrson, Per, <b>Understanding Cinema: The Psychological Theory of Moving Imagery</b> (Cambridge: Cambridge University Press, 2003)</li> <li>7. Platinga, Carl &amp; Greg M. Smith, <b>Passionate Views: Film, Cognition and Emotion</b> (Johns Hopkins University Press, 1999).</li> </ol>

<b>Course code</b>	<b>HS 315</b>
<b>Title of the course</b>	<b>Sociology of Science and Technology</b>
Credit Structure	L - T - P - Credits 2-1-0-3
Name of the Concerned Department	Humanities & Social Sciences
Pre-requisite, if any	None
Scope of the course	The course is designed to provide the much needed exposure to students over interconnected domains of science, technology and society, by focusing on comprehensive and ever-changing relationship between technology and society. It also examines how cultural values/practices, public policies and political vision determine and at times be driving forces behind technological changes and vice versa
Course Syllabus	<p><b>Discourse of Science and Technology:</b> Nature of science and technology, Technology as an Idea, The structure of scientific revolution, Science and scientific community, Rhetoric of science and technology.</p> <p><b>Technological change and Society:</b> Source and agents of technological change, Do machines make history? Technology and everyday life, The technological life world, Technology as shadow constitution, Technological change as social process.</p> <p><b>Technology and Politics:</b> Intersection of culture, gender and technology, Feminization of work/workforce in the information age – politics, facts &amp; artifacts, Technology as dominant force.</p> <p><b>Technology and Ethics:</b> The rights and wrongs of science - case studies, Technology as a dominant social force, Technological momentum and determinism, Law and science/technology.</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. M. Bridgstock, <b>Science, Technology and Society : An Introduction</b>, Cambridge University Press, Cambridge, 1998, 0521583209</li> <li>2. A. Borgmann, <b>Technology and the Character of Contemporary Life</b>, University of Chicago Press, Chicago, 1987, 9780226066295</li> <li>3. K Thomas, <b>The Structure of Scientific Revolutions</b>, Chicago, Univesity of Chicago Press, 1962</li> </ol> <p><b>Reference readings:</b></p> <ol style="list-style-type: none"> <li>4. Wenda K. Bauchspies, <b>Science, Technology and Society</b>, A Sociological Approach, Blackwell Publishers, Boston, 2005, 0631232109</li> <li>5. B. Latour, <b>Laboratory Life: The Construction of Scientific Facts</b>, Princeton: Princeton University Press, 1986</li> <li>6. Chalmers A.F., <b>What is this thing called Science</b>, St Lucia, University of Queensland Press, 1999.</li> <li>7. R Volti, <b>Society and Technological Change</b>, (6<sup>th</sup> Edition) Newyork:</li> </ol>

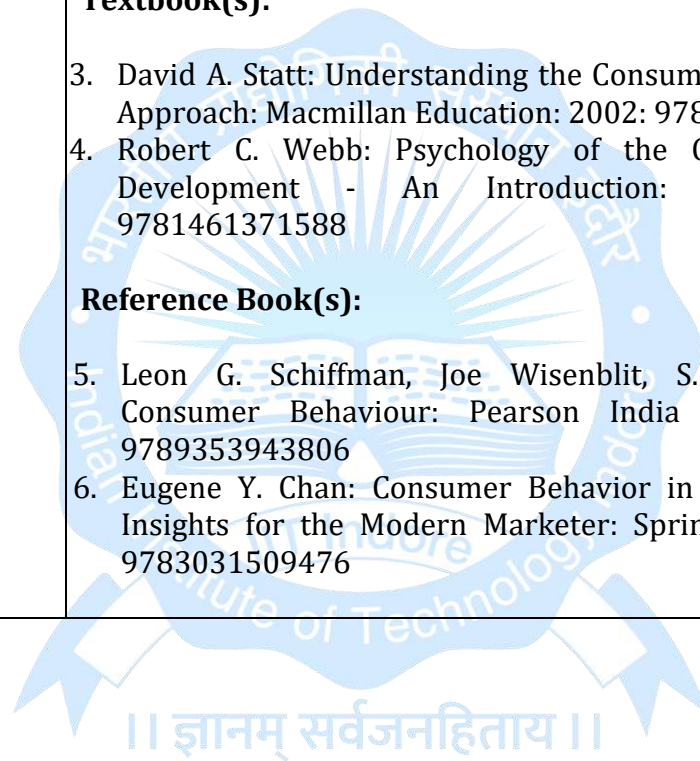
Worth Publishers, 2008

8. Deborah G. Johnson & Jameson M. Wetmore: *Technology and Society: Building Our Sociotechnical Future*: MIT Press: Cambridge: 2009 : 0262600730
9. S. Jasanoff, *Science at the Bar: Law, Science and Technology in America*, Cambridge, Harvard University Press, 1995



Course code	HS 317
Title of the course	Consumer Psychology and Marketing Dynamics
Course Category	Minor
Credit Structure	L - T - P - Credits 2 - 1 - 0 - 3
Name of the Concerned Department	Humanities and Social Sciences
Pre-requisite, if any	None
Objectives of the course	<ul style="list-style-type: none"> <li>• To examine cognitive, affective, and socio-cultural determinants of consumer behavior and their implications for market dynamics.</li> <li>• To foreground the application of consumer behavior principles to strategic decision-making in marketing, product development, and user-centred design.</li> </ul>
Outcomes	<ul style="list-style-type: none"> <li>• Explain major theoretical models of consumer decision-making and behavior.</li> <li>• Apply consumer behavior principles to marketing strategy.</li> <li>• Develop product design, marketing strategies, and user-centered solutions.</li> </ul>
Course Content	<p><b>Introduction:</b> Understanding consumers, Marketing and consumers, Scope and Theoretical Foundations (Classical and Operant Conditioning, Information Processing Theory)</p> <p><b>Market Segmentation:</b> Origin of segmented markets, Segmentation strategies, Traditional and data-driven approaches to segmentation, Bases of market segmentation (demographic, psychographic, behavioral, and geographic), Classical and Contemporary Case Studies</p> <p><b>Internal Dynamics of Consumers:</b> Consumer's perception, learning-memory and application in marketing, Theories (Social Identity Theory, Mental Accounting Theory) and their marketing implications, Consumer applications of Maslow's hierarchy of needs</p> <p><b>Decision Making:</b> Consumers decision making procedure,</p>

	<p>Rational and bounded rationality models, Heuristics vs. Prospect theory, Framing, Engel-Kollat-Blackwell (EKB) Model, Digital influences on consumer choice, Marketing implication of decision making</p> <p><b>Digital Marketing and Advertisement:</b> Digital consumer behavior, Influencer marketing, Integrated Marketing Communication (IMC), Emotional and persuasive advertising, Neuromarketing basics, AI-driven consumer analytics, Ethical and regulatory issues in advertising</p>
Suggested Books	<p><b>Textbook(s):</b></p> <ol style="list-style-type: none"> <li>3. David A. Statt: Understanding the Consumer: A Psychological Approach: Macmillan Education: 2002: 9781349254385</li> <li>4. Robert C. Webb: Psychology of the Consumer and Its Development - An Introduction: Springer: 2012: 9781461371588</li> </ol> <p><b>Reference Book(s):</b></p> <ol style="list-style-type: none"> <li>5. Leon G. Schiffman, Joe Wisenblit, S. Ramesh Kumar: Consumer Behaviour: Pearson India Education: 2015: 9789353943806</li> <li>6. Eugene Y. Chan: Consumer Behavior in Practice: Strategic Insights for the Modern Marketer: Springer Nature: 2024: 9783031509476</li> </ol>



<b>Course code</b>	<b>HS 321</b>
<b>Title of the course</b>	<b>History of Modern Indian Business</b>
Course Category	Open Elective/ Economics Minor
Credit Structure	L-T-P-Credit 2-1-0-3
Name of the Concerned Department	Humanities & Social Sciences
Pre-requisite, if any	NA
Scope of the course (Objectives)	This course focuses on the role of Indian Business Communities in History from c. 1700 AD-2005 AD
Course Outcomes	<ul style="list-style-type: none"> <li>• Evaluating the effects of colonialism on India's business environment in 1947.</li> <li>• Assessing the impact of the public sector on the growth of Indian business</li> <li>• Analysing the historical impact of Liberalization of the economy on Indian business</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Indian Business Communities and merchants in History (1700-50)</li> <li>• The impact of colonial economic policies on independent India (1757-1947)</li> <li>• British businesses in India (1834-1940)</li> <li>• Indian Business and the Nationalist Movement (1890-1947)</li> <li>• How to build an economy: The challenges of 1947 on Indian Business climate.</li> <li>• The impact of the License Raj on Companies, firms and sectors (1960-90)</li> <li>• The impact of Liberalisation (1991-2005)</li> </ul>
Suggested Books	<p><b>Text Books</b></p> <ul style="list-style-type: none"> <li>• Tripathi, D., &amp; Jumani, J. : The Oxford History of Contemporary Indian business : Oxford University Press : Delhi : 2017 : ISBN : 9780198082248, 019808224X</li> </ul> <p><b>Reference Books/texts</b></p> <ul style="list-style-type: none"> <li>• Habib, I., &amp; Raychaudhuri T. : The Cambridge Economic History of India, Volume I : Orient Blackswan : Delhi : 1983</li> </ul>

: ISBN : 9780521226929

- Kudaisa, M. : The Oxford India Anthology of Business History : Oxford University Press : Delhi : 2011 : ISBN-13 : 978-0198070191 ISBN-10 : 0198070195



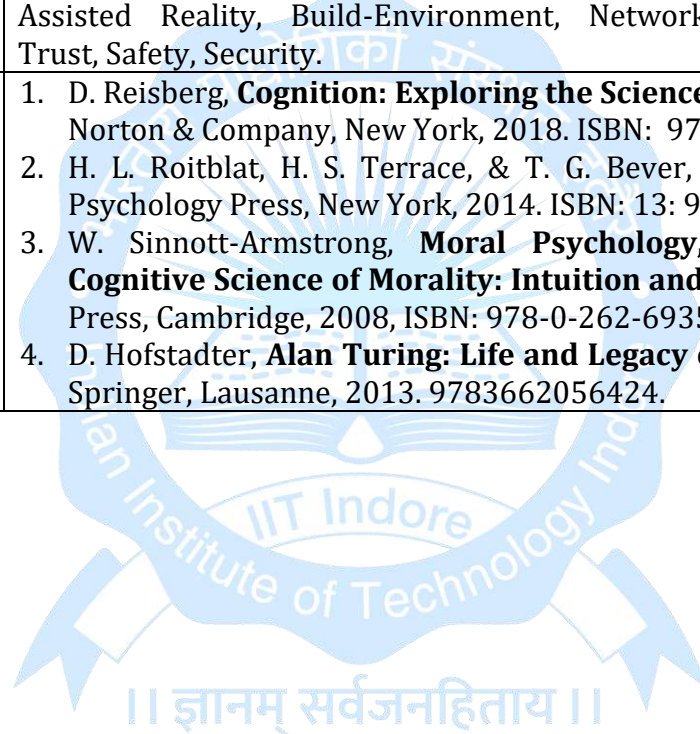
Course Code	<b>HS 323</b>
Title of the Course	<b>International Economics</b>
Credit Structure	L-T-P-Credits 3-0-0-3
Name of the Concerned Department	Economics/HSS
Pre-requisite, if any	Introduction to Economics
Scope of the course	
Course Syllabus	Global trade in goods and services; Growth and trade; Basic theory of international trade; Empirical Tests of Trade Theories; International trade and technical change; Economics of import tariff; Non-tariff import barriers; Arguments for and against protection; Trade policies for development; Benefits and costs of the Globalization Process; Introduction to macroeconomics of an open economy and international Finance; World Trading System.
Suggested Books	<ol style="list-style-type: none"> <li>1. Salvatore, Dominick. <b>International Economics</b>. 8th Edition. Tata Mcgraw Hill. 2004.</li> <li>2. Krugman, P.R. and M. Obstfeld. <b>International Economics: Theory and Policy</b>. 8th Edition. New York: Pearson. 2005.</li> </ol>



Course code	<b>HS 325</b>
Title of the course	<b>Industrial Organization</b>
Credit Structure	L - T - P - Credits 2-1-0-3
Name of the Concerned	Humanities & Social Sciences
Pre-requisite, if any	None
Scope of the course	This course uses economic analysis to understand competition among firms in an industry and the evolution of its market structure. The focus is on firms' decision making and its consequences for market outcomes like prices, quantities, the type of products offered, and social welfare.
Course Syllabus	<ol style="list-style-type: none"> <li>1. Theoretical background: Basic concepts of game theory, noncooperative game theory, normal, extensive, and repeated games</li> <li>2. Different market structures of industries, markets for homogenous and differentiated goods and strategic interactions among the firms. Concentration, mergers, and entry barriers in industries</li> <li>3. Pricing by firms in an industry, advertising, marketing, and pricing tactics</li> <li>4. Technology and industry: Market structure, R&amp;D, and patenting</li> <li>5. Competition policy and industry: Need for policy, relation with industrial policy and competition commission of India</li> <li>6. Case studies of different industries</li> </ol>
Suggested Books	<ul style="list-style-type: none"> <li>• O. Shy : <i>Industrial Organization – Theory &amp; Applications</i> : MIT Press : USA : 2000 : 9780262193665</li> <li>• J. Tirole : <i>The Theory of Industrial Organisation</i> : MIT Press : USA : 1988 : 978-0262200714</li> <li>• J. Church and R. Ware : <i>Industrial Organisation : A Strategic Approach</i> : McGraw-Hill : USA : 2000 : 0-256-20571</li> <li>• P. Belleflamme and M Peitz: <i>Industrial Organization: Markets and Strategies (2nd edition)</i>: Cambridge University Press: UK: 2015: 9781107687899</li> </ul>

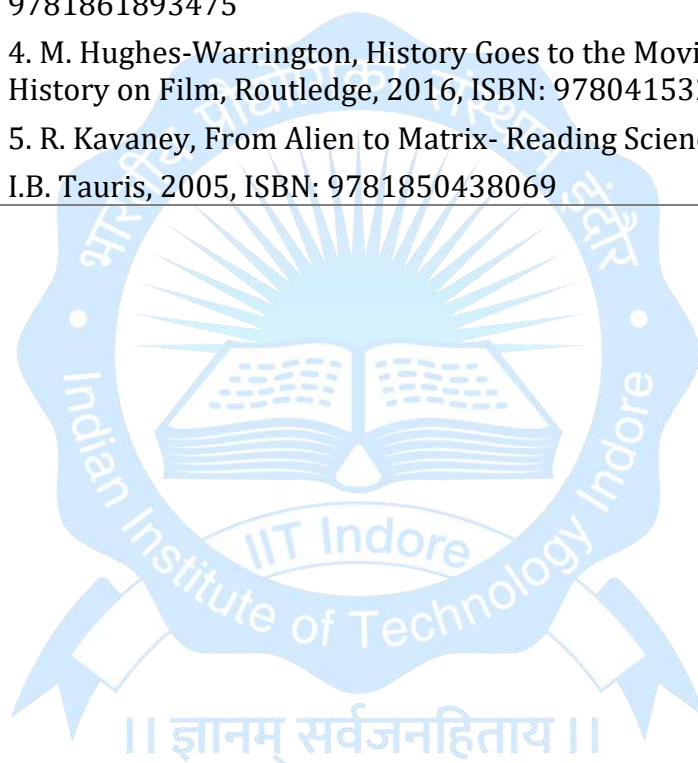
<b>Course Code</b>	<b>HS 327</b>
<b>Title of the Course</b>	<b>Mind, Action, and Technology</b>
Credit Structure	L-T-P-Credit 2-0-1-3
Name of the Concerned Department	Humanities and Social Sciences
Pre-requisite, if any (for the students)	None
Course Objective	This course will provide an overview of: <ol style="list-style-type: none"> <li>1. How does information enter our cognitive system?</li> <li>2. How does information become incorporated into our cognitive structures?</li> <li>3. How is information processed to allow us to complete complex tasks?</li> <li>4. Cognitive development.</li> <li>5. Advancements in human interaction with technology.</li> </ol>
Course Syllabus	<p><b>Fundamental Issues Concerning Cognition:</b> Common View: Nature, Reality, and Existence.</p> <p>Generality and Normativity, A Priori Reasoning and Conceptual Analysis, the Importance of Empirically Informed Reflection.</p> <p>Artificial vs Animate/Natural Cognitive System: Understanding what an artificial system needs.</p> <p>Essential Elements of Cognitive Systems: Receptors, Motor Control, Cognitive Process (Interpretation, Action Control, Guidance the Allocation of Cognitive Resources, Memory).</p> <p><b>Cognition and Nature</b> Extraneous to/Strangers to Nature, Instinct, Learned Aspects of Individuals.</p> <p><b>Understanding the World/Real World and Cognition</b> Sensory Modalities, Sensory Processing vs. Sensory Integration, Perceptual Process and Unitization, Embodied Cognition, Distributed Cognition.</p> <p>Cognitive Development, Moral Development, Aging &amp; Cognition, Altered State of Consciousness, Psychoactive Drugs, Cognitive Impairments, Music and Movement, Cognitive Evolution and Humans, Cognition, Science &amp; Beyond.</p> <p><b>Knowing Other's Mind</b></p>

	<p>Not So Plasticity of Cognition, Social Learning, Stereotype, Communication, Culture and Cognition, Micro and Macro Cognition.</p> <p>Cognitive Plasticity: Cognitive Performance Plasticity, Factors Affecting CPP (Social Context, Physical Environment, Internal Factors), Measurement Approaches (Behavioral Reaction Norm), Implications.</p> <p><b>The World and Its Real Mind</b> Representation and Computation, Relationship Between Humans and Machines, Artificial Intelligence, Cyber-Human System, Brain-Computer Interface, Human-Robot Interaction, Extended Reality, Assisted Reality, Build-Environment, Network-Enabled Systems, Trust, Safety, Security.</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. D. Reisberg, <b>Cognition: Exploring the Science of the Mind</b>, W. W. Norton &amp; Company, New York, 2018. ISBN: 978-0393877618.</li> <li>2. H. L. Roitblat, H. S. Terrace, &amp; T. G. Bever, <b>Animal Cognition</b>, Psychology Press, New York, 2014. ISBN: 13: 978-0-898-59334-1.</li> <li>3. W. Sinnott-Armstrong, <b>Moral Psychology, Volume 2: The Cognitive Science of Morality: Intuition and Diversity</b>, The MIT Press, Cambridge, 2008, ISBN: 978-0-262-69357-8</li> <li>4. D. Hofstadter, <b>Alan Turing: Life and Legacy of a Great Thinker</b>, Springer, Lausanne, 2013. 9783662056424.</li> </ol>



<b>Course code</b>	<b>HS 328</b>
<b>Title of the course</b>	<b>Philosophy and Film</b>
Course Category	Liberal Arts Minor; Institute Open Elective
Credit Structure	L - T - P - Credits 3 - 0 - 0 - 3
Name of the Concerned Department	Philosophy/Humanities and Social Sciences
Pre-requisite, if any	None
Course Objectives	<ul style="list-style-type: none"> <li>• This course analyses the role of philosophy in cinema.</li> <li>• It focuses on the contributions of the discipline of philosophy to cinema.</li> </ul>
Course Outcomes	<ul style="list-style-type: none"> <li>• Identify the role of philosophical ideas in cinema</li> <li>• Analyse the philosophical relationship between cinema and imagination</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Philosophy of Motion Pictures – <i>the Moving Image</i></li> <li>• Essence of Cinema: Perception, Illusion, Fantasy, Reality</li> <li>• Fiction vs. Reality – Collapse of a distinction</li> <li>• Cinema: the world of make beliefs and interaction between reality and fiction</li> <li>• Genres of Cinema [Science Fiction, Historical Films, Political and War Cinema, and Motivation Films]</li> <li>• Science Fiction Cinema – Reclaiming the Human [About bringing humanity to human kind]</li> <li>• History goes to the movies [Critique of Representation of historical greatness in western cinema]</li> <li>• War Cinema – [critique of War as Spectacle – projection of war, good and bad]</li> <li>• Holocaust Film – [talks about the inhuman condition and the possibility of human evil]</li> </ul>

Suggested Books	<p><b>Text Books</b></p> <ol style="list-style-type: none"> <li>1. R. Barsam and D. Monahan, Looking at Movies- An Introduction to Film, W.W. Norton &amp; Company, 2016, ISBN:9780393885835</li> <li>2. N. Carroll and J. Choi, Philosophy of Film &amp; Motion Pictures-An Anthology, Wiley, 2005, ISBN: 9781405120265</li> </ol> <p><b>Reference Books</b></p> <ol style="list-style-type: none"> <li>3. J. Chapman, War and Film, Reaktion Books, 2008, ISBN: 9781861893475</li> <li>4. M. Hughes-Warrington, History Goes to the Movies- Studying History on Film, Routledge, 2016, ISBN: 9780415328289</li> <li>5. R. Kavaney, From Alien to Matrix- Reading Science Fiction Film, I.B. Tauris, 2005, ISBN: 9781850438069</li> </ol>

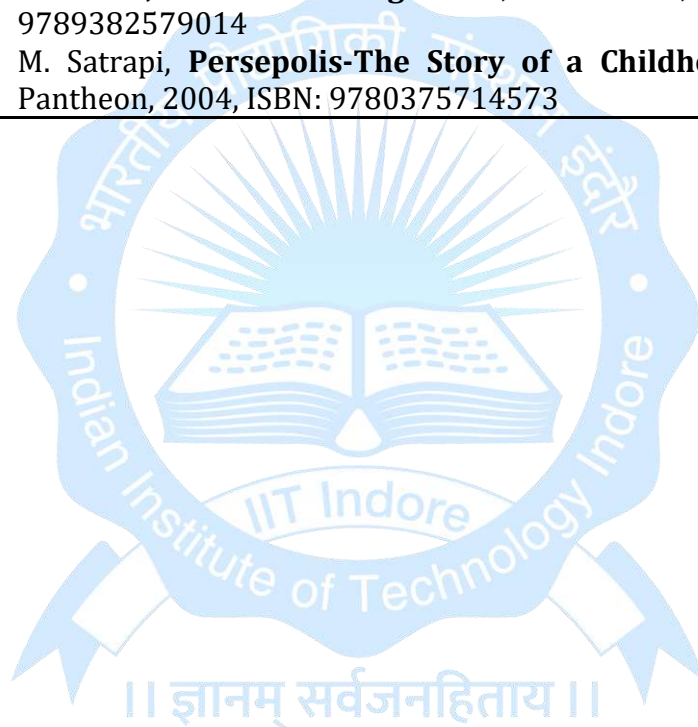


Course Code	HS 329
Title of the Course	Philosophy of Mind
Credit Structure	L - T - P – Credits 3-0-0-3
Name of the Concerned Discipline and Department	School of Humanities and Social Sciences
Pre-requisite, if any (for the students)	None
Scope of the Course	The course aims to introduce the students with the theories and debates in Philosophy of Mind through the most important thought experiments of the discipline.
Course Syllabus	<p>Module: 1-Understanding Consciousness The Floating Man, The Hard Problem of Consciousness, what it's like to be a Bat, Mary's Room, Philosophical Zombies, Coffee Tasters</p> <p>Module:2- Prominent Physicalist Solutions The Exclusion Problem, The Super-Spartans, The Blockhead, The Imitation Game, The Chinese Room, Inverted Qualia, Hempel's Dilemma</p> <p>Module:3- Understanding Content Swamp-man, Twin Earth, Otto's Notebook, The Brain in a Vat, The Shopping List</p> <p>Module:4- Perception and Imagination The Missing Shade of Blue, Perception as Controlled Hallucination, The Skywalk, Change Blindness, Blindsight</p> <p>Module:5- Self and Personal Identity Where am I, The Prince and the Cobbler, the Elusive Self, Mind Uploading</p>
Suggested Books	<p>Textbooks:</p> <ol style="list-style-type: none"> <li>1. T. Alter, A. Kind, R.J. Howell: <i>Philosophy of Mind: 50 Puzzles, Paradoxes, and Thought Experiments</i>: Routledge: New York: 2024: 978-1-032-01584-2</li> <li>2. J. Heil: <i>Philosophy of Mind-A Contemporary Introduction</i>: Routledge: New York: 2019: 978-1-138-58101-2</li> </ol> <p>Reference Books:</p> <ol style="list-style-type: none"> <li>3. D. Papineau, H. Selina: <i>Introducing Consciousness: A Graphic Guide</i>: Icon Books: London: 2010: 978-1-848-31171-8</li> <li>4. J. Heil: <i>Philosophy of Mind: A Guide and Anthology</i>: Oxford University Press: New York: 2003: 978-0-199-25383-8</li> </ol>

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Course Code	<b>HS 330</b>
Title of the Course	<b>Graphic Literature</b>
Course Category	Liberal Arts Minor; Institute Open Elective
Credit Structure	L-T- P-2-1-0-3
Name of the Concerned Discipline/School	English/Humanities and Social Sciences
Pre-requisite, if any	None
Course Objectives	<ul style="list-style-type: none"><li>• Explore the history, theory, and practice of graphic literature as a distinct form of artistic and literary expression.</li><li>• Analyze the conventions, techniques, and aesthetics of graphic storytelling across different genres, styles, and cultural contexts.</li><li>• Investigate the cultural, social, and political dimensions of graphic narratives, including their role in shaping identities, ideologies, and public discourse.</li></ul>
Course Outcomes	<ul style="list-style-type: none"><li>• Develop a critical understanding of the conventions and techniques of graphic storytelling, including the use of images, text, and layout</li><li>• Analyse graphic narratives, examining their thematic content, visual symbolism, and narrative structures</li><li>• Explore the cultural, social, and political significance of graphic literature, critically assessing its representation of diverse identities, experiences, and perspectives</li></ul>
Course Content	<ul style="list-style-type: none"><li>• History and Evolution of Graphic Literature (From Pioneers to Contemporary Storytellers)</li><li>• Conventions and Techniques of Graphic Storytelling (Visual Grammar and Narrative Syntax)</li><li>• Digital Graphic Narratives (Webcomics, Digital Graphic Narratives and New Platforms)</li><li>• Comics Journalism (Documentary Graphic Narratives, Climate fiction, Visual Reporting)</li><li>• Graphic Literature and Interdisciplinary Studies (Connections with Film, Literature, Visual Culture)</li></ul>

Suggested Books	<p>Text Books</p> <ol style="list-style-type: none"> <li>1. S. McCloud, <b>Understanding Comics</b>, Harper Perennial, 1993, ISBN: 9780060976255</li> </ol> <p>Reference Books</p> <ol style="list-style-type: none"> <li>2. A. Spiegelman, <b>Maus- A Survivors Tale</b>, Penguin Books, 1991, ISBN: 9780140173154</li> <li>3. S. Vyam and S. Anand, <b>Bhimayana- Experiences of Untouchability</b>, Navayana, 2011, ISBN: 9788189059170</li> <li>4. V. Ghosh, <b>Restorying Partition- Graphic Narratives from Pakistan, India and Bangladesh</b>, Yoda Press, 2013, ISBN: 9789382579014</li> <li>5. M. Satrapi, <b>Persepolis-The Story of a Childhood</b>, Pantheon, 2004, ISBN: 9780375714573</li> </ol>
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Course Code	HS 334
Title of the Course	Agricultural Economics
Credit Structure	L - T - P - Credits 3-0-0-3
Name of the Concerned Discipline and Department	Economics, School of HSS
Pre-requisite, if any	Basic knowledge of Economics
Objectives/Scope of the course	<ul style="list-style-type: none"> <li>• Understand economic principles shaping agriculture</li> <li>• Learning policies affecting agricultural production, markets, and finance</li> <li>• Study key issues: food security, sustainability</li> </ul>
Course outcomes	<ul style="list-style-type: none"> <li>• Helps the students to analyze agricultural production functions and apply farm management principles to optimize profit maximization and cost minimization.</li> <li>• Able to critically evaluate agricultural policies, including price distortions, market interventions, and the public distribution system.</li> </ul>
Course content	<p><b>Foundations of Agricultural Economics</b> Definition and Scope of Agricultural Economics, Global and Indian Context, Contemporary Issues in Agriculture:</p> <p><b>Agricultural Production and Farm Management</b> Production Functions, Farm Management and Resource Allocation, Decision-Making under Risk and Uncertainty with AI, Marginal Analysis and Factor Efficiency</p> <p><b>Agricultural Markets and Price Policies</b> Agricultural Markets: Factor Markets, Supply Chain and Value Chain Management in Agriculture, Public Distribution System (PDS), Agricultural Price Policies. Price forecasting models.</p> <p><b>Agricultural Finance and Credit Systems</b> Agricultural Credit: Role and sources, Microfinance, Agricultural Subsidies: Objectives, Trends, and Impact</p> <p><b>Food Security and Sustainable Agriculture</b> Concepts and Dimensions of Food Security, Agrarian Distress and Rural Livelihood Challenges, Impacts of Climate Change on Agriculture, Approaches to Sustainable Agriculture</p>
Suggested Books	<p><b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. Subba Reddy S., Raghu Ram P., Sastry T.V. Neelakanta, and I Bhavani Devi (2019) Agricultural Economics. CBS Publishers &amp; Distributors. ISBN: 9788120417861, 8120417860.</li> <li>2. <a href="#">Andrew Barkley</a>, <a href="#">Paul W. Barkley</a> (2016) Principles of Agricultural Economics. Routledge publications. 978-</li> </ol>

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**Reference Books:**

3. David L. Debertin (2012) Agricultural production economics. CreateSpace Independent Publishing Platform. ISBN: 1469960648.
4. Acharya, S.S. and N.L. Agarwal (2021) Agricultural Marketing in India. CBS Publishers & Distributors. ISBN: 978-9354661440.
5. Deaton, A. and Muellbauer, J. (1980) Economics and consumer behavior. Cambridge University Press. ISBN: 9780511805653.



Course Code	<b>HS 341</b>
Title of the Course	<b>Appreciating Indian English Literature</b>
Credit Structure	L-T-P-Credits 3-0-0-3
Name of the Concerned Department	English/HSS
Pre-requisite, if any	NIL
Scope of the course	
Course Syllabus	The Course will make an attempt at understanding the complex dynamics of the various socio-politico-cultural issues that lead to the marginalization of some sections in any given society. Though such deliberate marginalization is a universal malaise, this course will focus on the marginalized sections in the Indian context. The thrust here will be to try and understand how such oppressions, inequalities and marginalization are explored in the literatures of the very people who have been relegated to the margin through discriminations based on caste, gender, region, etc. The texts mentioned above are only indicative and other texts can be included depending on the directions that classroom discussions will take. The background readings will be helpful in familiarizing the students with some of the issues at hand and their complexities.
Background Readings	<ol style="list-style-type: none"> <li>1. Khair, Tabish. Babu Fictions: <b>Alienation in Contemporary Indian English Novels</b>. New Delhi: Oxford University Press. 2001.</li> <li>2. Kumar, Raj. Dalit Personal Narratives: <b>Reading Caste, Nation and Identity</b>. Hyderabad: Orient Blackswan Pvt. Ltd. 2010.</li> <li>3. Nubile, Clara. <b>The Danger of Gender: Caste, Class and Gender in Contemporary Indian Women's Writing</b>. New Delhi: Sarup Books Pvt. Ltd, 2008.</li> <li>4. Swami, Indu, Ed. <b>Exploring North-East Indian Writings in English</b>. New Delhi: Sarup Book Publishers Pvt. Ltd, 2011.</li> <li>5. Misra, Tilottama, ed. <b>The Oxford Anthology of Writings from North-East India (Fiction)</b>. New Delhi: Oxford University Press, 2011.</li> <li>6. Anand, Mulk Raj, ed. <b>An Anthology of Dalit Literature</b>. New Delhi: Gyan Publishing House, 1992. (selected Dalit writings)</li> </ol>

7. De Souza, Eunice and Pereira, Lindsay, Eds. **Women's Voices: Selections from Nineteenth and Early-Twentieth Century Indian Writing in English**. New Delhi: Oxford University Press, 2002.
8. Sarmila, Irom. **Fragrance of Peace**, New Delhi: Zubaan, 2010.
9. Hasan, Anjum. **Lunatic in My Head**. New Delhi: Penguin Books India, 2007.
10. Das, Narayan. **Writings and Speeches of Ambedkar**. New Delhi: Abd Publishers, 2009.
11. Rege, Sharmila, Ed. **Women Writing Caste: Testimonies of Dalit Women in Maharashtra**. New Delhi: Zubaan Books, 2006.



Course Code	<b>IHS 402</b>
Title of the Course	<b>Twentieth Century World History: Critical Perspectives</b>
Credit Structure	L-T-P-Credits 3-0-0-3
Name of the Concerned Department/School	Philosophy/HSS
Pre-requisite, if any	NIL
Scope of the Course	No other century witnessed such a quantum leap in civilizational progress as the Twentieth century has. It has witnessed great wars, great revolutions and formation of several nations based on manifold ideological principles. This way we are obligated to know what took us beyond imagination, but also cannot overlook off-shoots of this great leap – which are in several ways hindrances to a better world. The Scope of the Course of the course is to bring to notice those 'amazing ideas' that makes century's history a unique in the book of story of humankind. Further, it puts before for though reflection several challenges that we are faced with to maintain peace and harmony among several races and cultures.
Course Syllabus	Civilizations at the Crossroads – The Making of a Grand History War Among Nations The Cold War – Clash of Civilizations End of History Debate Post-Cold War World New Horizons of Peace and Conflict – Challenges to a Harmonious Universe – Drawbacks of International Law
Suggested Books	1. C.S. Adams & J. H. Conrad, <b>Ideologies in Conflict: A Cold War Docu-Story</b> (iUniverse, 2001). 2. E.H. Carr, <b>What is History?</b> 3. A.G. Frank, <b>The World System: Five Hundred Years or Five Thousand?</b> (Routledge, 1996). 4. F. Fukuyama, <b>The End of History and the Last Man</b> (Free Press, 2006). 5. C. Geertz, <b>The Interpretation of Cultures: Selected Essays</b> (New York: Basic Books, 1973).

6. M. Gilbert, **A History of the Twentieth Century: The Concise Edition of the Acclaimed World History** (William Marrow Paperbacks, 2002).
7. S. Huntington, **The Clash of Civilizations and the Remaking of World Order** (Simon & Schuster, 2011).
8. I. Kant, **Perpetual Peace** (FQ Classics, 2007)
9. E. Schrecker, **Cold War Triumphalism: The Misuse of History After the Fall of Communism** (New Press, 2006).
10. M. Trachtenberg, **The Cold War and After: History, Theory and the Logic of International Politics** (Princeton: Princeton University Press, 2012)



Course Code	<b>HS 403</b>
Title of the course	<b>The West in Twentieth Century: Critical Perspectives</b>
Credit Structure	L-T-P-Credits 3-0-0-3
Name of the Concerned Discipline	Humanities and Social Sciences
Prerequisite, if any	NA
The Scope of the course	<ul style="list-style-type: none"> <li>• The scope of this course is to bring to notice those ‘amazing ideas’ that makes the twentieth century’s history a unique one in the story of human kind.</li> <li>• The objective of the course is to bring to your attention great challenges that made the century – to endure the consequences of ways of the past century; especially, in achieving a peaceful world order.</li> </ul>
Course Syllabus	<ol style="list-style-type: none"> <li>1. Twentieth Century: The Dawn of a new horizon [the rise of modern political states, new age, and new hope]</li> <li>2. Political Revolution: The Socialist Experiment [gigantic efforts to replace equality with reckless freedom, by the spirit of “all humans are created equal”]</li> <li>3. World War – I [First modern war - considered as “The Great War”, a war to end all wars]</li> <li>4. Inter-War Period – The Great Depression – The Rise of powerful nations [Rise of Germany, Hitler and the Third Reich – and related forms of Totalitarianism]</li> <li>5. World War – II &amp; Holocaust [Human moral failure never seen</li> </ol>

	<p>before – Race Wars]</p> <p>6. The Cold War – The Ideological Age [Quantum leap forward, but without peace and integrity – Age of Extremes and Age of Violence, coming of Neo-Imperialism, Global Injustice]</p> <p>7. Clash of Civilizations &amp; The End of History [Fukuyama and Huntington – No Ideological War, No history and Rogues and Civilized Nations]</p> <p>8. 9/11 – Myth or Reality [History repeats again, Violence and catastrophes continues challenging the beginning of a new millenium]</p> <p>9. History and the Guilt Paradigm – Forgiveness [To bring peace, do we need to forgive and forget the past? History, Crime and Guilt – a profound dilemma]</p>
Suggested Books	<p>Textbooks</p> <ol style="list-style-type: none"> <li>1. Barkan, Elazar, &amp; Alexander Karn, <i>Taking Wrongs Seriously: Apologies and Reconciliation</i>, Stanford: Stanford University Press: 2006: ISBN: 9780804752251</li> <li>2. Bruckner, Pascal, <i>The Tyranny of the Guilt: Essays on Western Masochism</i>, Princeton: Princeton University Press: 2010: ISBN: 9780691154305</li> </ol> <p>References</p> <ol style="list-style-type: none"> <li>1. Cortright, David, <i>Peace: A History of Movements and Ideas</i>, Cambridge: Cambridge University Press: 2008: ISBN: 978-0-521-67000-5</li> <li>2. Barrett, Kevin, “9/11: Interpreting the Unspeakable: Myth or Reality” <a href="http://rl911truth.org/index.php/related-911-articles/58-barrett-kevin-interpreting-the-unspeakable-the-myth-of-911">http://rl911truth.org/index.php/related-911-articles/58-barrett-kevin-interpreting-the-unspeakable-the-myth-of-911</a></li> </ol>

<b>Course code</b>	<b>HS 410/ HS 610</b>
<b>Title of the course</b>	<b>Media Studies</b>
Credit Structure	L - T - P - Credits 2-1-0-3
Name of the Concerned Department	Humanities & Social Sciences
Pre-requisite, if any	NA
Scope of the course	The emergence and proliferation of new/digital/web-based media over the last two decades compels us to establish, investigate and reconfigure the idea of what old and new media are and if they could be understood independent of one another. In this course, we will conceptualise Media Studies, exploring their historical and theoretical provenance. We shall assess how and why media aggregate, appropriate and comment upon other media, and how ways of seeing and listening are consolidated via other media. We will try to establish a dialogue across old and new media, sound-and image-based representation in media, and media as technology vis-à-vis media as infrastructure.
Course Syllabus	New vs Old Media_ Platform Economy/Capitalism and Algorithmic Governance_ Immediacy and Hypermediacy in Mediation_ Liveness in News Television and Public Scandals_ Media in terms of the history of Infrastructure_ Media and Modernization Theory_ Attention Economy (Capital, Attention and Cinema in Industrial Economies)_ Convergence Culture (Hardware vs Software convergence_ Post-Cinema Perspectives on the Future of Media.
Suggested Books	<ol style="list-style-type: none"> <li>1. D. J. Bolter and R. Grusin, <b><i>Remediation : Understanding New Media</i></b>, MIT Press, Cambridge, 1999, 9780262522793</li> <li>2. B. Larkin, <b><i>Signal and Noise: Media, Infrastructure</i></b>, Duke University Press : Durham, NC : 2008 : 9780822341086</li> <li>3. J. Beller, <b><i>The Cinematic Mode of Production : Attention Economy and the Society of Spectacle</i></b>, Dartmouth Press, New Hampshire, 2006, 9781584655831</li> <li>4. S. Denson and J. Leyda, <b><i>Post-Cinema : Theorizing 21st Century Film</i></b>, Reframe Books, Falmer, 2016, 9780993199639</li> </ol>

Course Code	<b>HS 412 / HS 612</b>
Title of the Course	<b>Contemporary Indian Thought</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department	Philosophy
Pre-requisite, if any	None
Scope of the Course	
Course Syllabus	<p>Rabindranath Tagore, Swami Vivekananda, M.K. Gandhi, V.D. Savarkar, Sri Aurobindo, Krishnachandra Bhattacharyya, B.R.Ambedkar and Jawaharlal Nehru.</p> <p>(The course deals with key ideas of some of the contemporary Indian thinkers. The attempt will be to focus on important debates in contemporary Indian Philosophy)</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. Bhattacharya, Sabyasachi. <i>The Mahatma and the Poet: letters and debates between Gandhi and Tagore, 1915-1941</i>. 1997. New Delhi: National Book Trust.</li> <li>2. <b>Lal, B.K. <i>Contemporary Indian Philosophy</i>. 2010. Delhi: Motilal Banarasi Das.</b></li> <li>3. <b>Raghurama Raju A, <i>Debates in Indian Philosophy: Classical, Colonial and Contemporary</i> 2007 New Delhi: Oxford University Press.</b></li> <li>4. <b>Raju P.T., <i>Structural Depths of Indian Thought</i>.1985 New Delhi: South Asian Publishers.</b></li> <li>5. Moolchand. <i>Nationalism and Internationalism of Gandhi, Nehru and Tagore</i>.1989.New Delhi: M.M. Publishers.</li> <li>6. <b>Naravane, Vishwanath S., <i>Modern Indian Thought</i>, Bombay: Asia Publishing House 1964.</b></li> <li>7. Nagaraj D.R. "Self-purification versus Self-respect" in Raghurama Raju. A (Ed) <i>Debating Gandhi</i>. 2006.New Delhi: Oxford University Press.</li> <li>8. Nehru, Jawaharlal. <i>The Discovery of India</i>.1994. New York: Oxford University Press, Centenary Edition.</li> </ol>

9. Sharma, Chandradhar, *A Critical Survey of Indian Philosophy*, 2000, Delhi, Motilal Banarasi Das.



Course Code	<b>HS 418/ HS 618</b>
Title of the Course	<b>Sustainability Studies</b>
Credit Structure	L-T-P-Credits 3-0-0-3
Name of the Concerned Department	Humanities and Social Sciences
Pre-requisite, if any	None
Course Objective	The course introduces and details the concepts in sustainability from the social sciences and basic sciences perspectives. It will include definitions, theories, historical developments, applications and case study references. The course will also include a module on Eco-criticism in literature, theoretical discourses and examples from contemporary literature.
Course Syllabus	<p>Introduction to sustainability, Climate change, biosphere, physical resources: water, pollution, and minerals, resource economics</p> <p>Systems Dynamics, models in natural sciences</p> <p>Sustainable energy systems, Problem solving: metrics, and tools; Agro-food systems, renewable resources: water fish and forests, Non-renewable resources: oil</p> <p>Sustainable infrastructure Eco-criticism including eco-feminism and deconstruction of rhetoric of environment studies. Definition of eco-critical theory and practice, observing the more recent influence of interdisciplinary, ecological perspectives in criticism and theory (the emergence of 'eco-criticism') and considering their implications for the interpretation of literature and the creation of writing, environmental foundations of the global economy, Narratives of development in postcolonial writing</p>
Text Books	<ol style="list-style-type: none"> <li>1. Theis and Tomkin (Ed.) 2011. Sustainability: Comprehensive. Foundation University of Illinois Open Source Text Book Initiative. ID: 1741effd-9cda-4b2b-a91e-003e6f587263@43.5</li> <li>2. Bert J.M. de Vries 2012 Sustainability Science Cambridge University Press, ISBN 9780521184700</li> <li>3. Mulligan, M. 2015. An Introduction to Sustainability: Environmental, Social and Personal Perspectives. Routledge Publications ISBN 9780415706438</li> <li>4. Newton A.C. and Cantarello E. 2014 An Introduction to the Green Economy: Science Systems and Sustainability. Routledge Publications. ISBN 978 0415 711609</li> </ol>

5. Ed. Cheryl Glotfelty and Harold Fromm. 1996. *The Ecocriticism Reader*. University of Georgia Press
6. Amitav Ghosh 2010. *The Glass Palace* Harper Collins
7. Mahashweta Devi. 2008. *Imaginary Maps*. Routledge
8. Westling, Louise. "Literature and Ecology" (75-90). *Teaching Ecocriticism and Green Cultural Studies*. Ed. by Greg Garrard.
9. Timothy Clark, *The Cambridge Introduction to Literature and the Environment*



<b>Course code</b>	<b>HS 421/ HS 621</b>
<b>Title of the course</b>	<b>Historiography and Historical Methods</b>
Credit Structure	L - T - P - Credits 2-1-0-3
Name of the Concerned Department/School	Humanities & Social Sciences
Pre-requisite, if any	NA
The scope of the course	This course is a systematic exploration of approaches to research in history and how the discipline has been influenced by other subjects in the humanities and social sciences. <ol style="list-style-type: none"> <li>1. How is research in history done?</li> <li>2. How is the historian's construction of the past any different from the public perception of a historical event?</li> <li>3. Is interdisciplinarity in history possible?</li> <li>4. What is the relationship between history, the humanities, and social sciences?</li> </ol>
Course Syllabus	<ol style="list-style-type: none"> <li>1. <b>Introduction to History</b></li> <li>2. <b>Kinds of History</b> (global, cultural, social, economic, military, history of art)</li> <li>3. <b>Historical Knowledge</b> (standards, quality, reliability, frameworks)</li> <li>4. <b>Historical Theory</b> (historical truth, power, limits of objectivity, the challenge of postmodernism)</li> <li>5. <b>Sources</b> (written texts, paintings, epigraphy, numismatics)</li> <li>6. <b>Public History</b> (the ownership of the past, moral judgements and multiple audiences)</li> <li>7. <b>Periodisation</b> (Historical time, dividing the past, events and descriptions)</li> <li>8. <b>History and other disciplines</b> (Sociology, Philosophy, Anthropology and Literature)</li> </ol>
Suggested Books	<ol style="list-style-type: none"> <li>1. Jordanova, L: <b><i>History in Practice</i></b>: Bloomsbury Academic: London: 2005: ISBN: 0340663316</li> <li>2. Evans, R: <b><i>In Defense of History</i></b>: W W Norton &amp; Company: London: 2000: ISBN-10: 0393319598</li> <li>3. Appadurai, A: <b><i>The social life of things</i></b>: Commodities in cultural perspective: Cambridge University Press: New Delhi: 1986: ISBN 978-0-521-35726-5</li> <li>4. Hobsbawm, E: <b><i>On History</i></b>: Little, Brown Book Group: London: 1998: ISBN-10: 0349110506</li> </ol>

Course Code	<b>IHS 422 / HS 622</b>
Title of the Course	<b>Development Economics</b>
Credit Structure	L-T-P-Credits 3-0-0-3
Name of the Concerned Department/School	Economics/HSS
Pre-requisite, if any	None
Scope of the Course	This course offers a broader understanding of economic transformation of developing countries. It discusses issues in per capita income, economic growth, inequality, poverty, population. It also aims at analyzing land, labour and insurance sector. At the macro level the course will orient students about political economy of international trade, monetary policy and international relations from developing country perspective.
Course Syllabus	Trends in international development; Basic features of underdeveloped countries/ LDCs; Development indices, Growth and development theories, Dual economy models, Domestic resources and foreign resources and economic development, Industrialization, protection and trade policies, Strategy towards foreign capital external finances; Strategy towards imports /export balance of payments; Balanced / unbalanced growth approach; Sectoral strategy; population, poverty, employment, migration, Some recent contributions to development theory; Trade and development, The global strategy: new international economic order (NIEO); The policy of structural adjustment, environment and development.
Suggested Books	<ol style="list-style-type: none"> <li>1. S. Ghatak, <b>Introduction to Development Economics</b>, Routledge Publication. 2003. 4th edition.</li> <li>2. D. Ray. <b>Development Economics</b>, Princeton University Press. 1998.</li> <li>3. G. Meier, and J. Stiglitz, <b>Frontiers of Development Economics</b>, Oxford University Press, 2001.</li> </ol> <p><b>Reference Readings:</b></p> <ol style="list-style-type: none"> <li>1. A. Sen, <b>Development as Freedom</b>, Oxford University Press, 1999.</li> <li>2. P. Draper, P. Alves, R. Sally (editors), <b>The political Economy of Trade Reform in Emerging Markets: Crisis or</b></li> </ol>

**Opportunity?"** Edward Elgar Publishing, 2009.

3. R. Capello, and Nijkamp, **Handbook of Regional Growth and Development Theories**, Edward Elgar Publishing, 2009.
4. O. Galor, **Inequality and Economic Development: the Modern Perspective**, Edward Elgar Publishing, 2009.
5. D. Williams, **International Development and Global Politics: History, Theory and Practice**, Routledge Publication, 2011.
6. Y. Hayami, and Godo, **Development Economics: From the Poverty to the Wealth of Nations**, Oxford University Press, 2005.



Course Code	<b>HS 424/ HS 624</b>
Title of the Course	<b>Econometrics-I</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department	Economics
Pre-requisite, if any	Research Methods in Social Sciences; Basic Statistics
Scope of the Course	This aim of the course is to cover basic econometrics with focus on regression modeling and the problems encountered in dealing with cross-section and time series data.
Course Syllabus	Methodology of econometrics; Regression analysis; Assumptions of the classical linear regression Models; Two variable regression analyses; Multiple regression analyses; Heteroscedasticity; Autocorrelation and Multicollinearity; Dummy variable regression models; Model Selection; Time Series Econometrics (introduction); Panel data regression models (introduction).
Suggested Books	<ol style="list-style-type: none"> <li>1. D.N. Gujarati, Basic Econometrics, The McGraw-Hill Companies. 2005.</li> <li>2. G.S. Maddala, Introduction to Econometrics, (3<sup>rd</sup> edition) Wiley, 2001.</li> <li>3. J.M. Wooldridge, Introductory Econometrics: A Modern Approach, South Western, 2009.</li> </ol>

॥ ज्ञानम् सर्वजनहिताय ॥

Course Code	<b>IHS 425</b>
Title of the Course	<b>Money and Banking</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department/School	Economics/HSS
Scope of the Course	Give an overview of role of money, financial markets, financial institutions, conduct of monetary policy, monetary transmission mechanism, and the relationships between monetary policy and asset returns.
Pre-requisite, if any	None
Course Syllabus	<p><b>Introduction:</b> Why study money, banking and financial markets; Definition of money, banking and financial system.</p> <p><b>Financial Markets:</b> Understanding interest rates; Behavior of interest rates; Risk and term structure of interest rate; Stock Market.</p> <p><b>Financial Institutions:</b> Economic analysis of financial structure; Management of financial institutions; Financial regulation; Financial crises.</p> <p><b>Central Bank:</b> Central Bank, The Conduct of Monetary Policy, The Money Supply Process; Tools of Monetary Policy</p>
Suggested Books	<p><b>Text Book</b></p> <p>1. Mishkin, F. S. The Economics of Money, Banking and Financial Markets (10<sup>th</sup> edition) Pearson (ISBN-10: 0-13-247918-4)</p> <p><b>Reference Books</b></p> <p>2. Walsh, Carl E. Monetary Theory and Policy, 3<sup>rd</sup> edition. The MIT Press, 2010. (ISBN-10: 0262013770)</p> <p>3. Handa, Jagdish. Monetary Economics, 2<sup>nd</sup> Edition. Routledge, 2008. (ISBN-10: 0415772109)</p> <p>4. Romer, David. Advanced Macroeconomics. 4<sup>th</sup> edition. McGraw-Hill Education, 2011. (ISBN-10: 0073511374)</p> <p>5. Cecchetti, S. and K. Schoenholtz, Money, Banking and Financial Markets, 3<sup>rd</sup> Edition, McGraw Hill, 2011. (ISBN-10: 007337590X)</p> <p>6. Money and Banking: Select Research Papers by the Economists of reserve Bank of India. Edited by A. Vasudevan. Academic Foundation, 2003. (ISBN-10: 8171883184)</p>

Course Code	<b>HS 426</b>
Title of the Course	<b>Economics of Innovation</b>
Credit Structure	L-T-P-Credits 3-0-0-3
Name of the Concerned Department	Economics/Humanities and Social Sciences
Pre-requisite, if any	Fundamentals of Economics
Scope of the course	<p>The rapid innovation in the modern knowledge-based economy has increased the rate of production of information and contributed to the decline in the cost of producing it. Innovation as a harbinger of growth is also the prime focus of policy makers. Thus, policy makers are devising intellectual property rights and alternative mechanisms for creating incentives for innovation.</p> <p>This course will introduce the students to the basic concepts like public goods and externalities. The participants will learn about the innovation systems, incentive mechanisms like intellectual property, the relationship of IP to technology transfer, and private/public funding.</p>
Course Syllabus	<p>Basic concepts like public goods, externalities, different types of innovation like drastic vs non-drastic innovation; disruptive innovation. Innovation and economic development.</p> <p>Technological innovation and the theory of firm; Innovation as an evolutionary process.</p> <p>Policy for innovation: intellectual property rights.</p> <p>University research and public-private interaction.</p> <p>Geography of innovation.</p> <p>Markets for technology and issues related to technology transfer.</p> <p>Financing R&amp;D.</p> <p>Innovation in clusters.</p> <p>Diffusion of technology.</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. S. Scotchmer. <b>Innovation and Incentives</b>. Cambridge MA: MIT Press, 2004.</li> <li>2. B. Hall and N. Rosenberg. <b>Handbook of Economics of Innovation</b>. Netherland: Elsevier, 2010. <i>Selected chapters</i>.</li> <li>3. W. D. Nordhus. <b>Invention, Growth, and Welfare: A Theoretical Treatment of Technological Change</b>. Cambridge, MA: MIT Press, 1969.</li> <li>4. J. E. Stiglitz. "Knowledge as a Global Public Good." In <b>Global Public Goods: International Cooperation in the 21st Century</b>, edited by I. Kaul, I. Grunberg, and M.A. Stern. New York: Oxford University Press, 1999.</li> </ol>

	<p>5. <span style="float: right;">G.</span> Rosegger. <b>The Economics of Production and Innovation: An Industrial Perspective.</b> Oxford: Butterworth Heinemann Limited, 1996.</p> <p>6. A. Arora, A. Fosfuri and A. Gambardella. <b>Markets for Technology.</b> Cambridge, MA: MIT Press, 2002.</p> <p>7. A. S. Rao, M. Gulati, T. Sarkar, R. Singh, K.L. Kala, S. Gargav, and A. Khanna. <b>Promoting Innovation in Clusters.</b> New Delhi: Foundation for MSME Clusters, 2013.</p> <p>8. J. Watal. <b>Intellectual Property Rights in the WTO and Developing Countries.</b> New Delhi: Oxford University Press, 2001.</p>
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<b>Course code</b>	<b>HS 431</b>
<b>Title of the course</b>	<b>Innovation and Intellectual Property Rights</b>
Course Category	Institute Open Elective
Credit Structure	L-T-P-Credit 2-1-0-3
Name of the Concerned Department	HSS
Pre-requisite, if any	None
Scope of the course (Objectives)	The course will <ul style="list-style-type: none"> <li>• Identify different types of intellectual property rights and their characteristics.</li> <li>• Understand the legal frameworks governing intellectual property at the national and international levels.</li> <li>• Analyze and evaluate intellectual property issues in various contexts, including business, technology, and the arts.</li> </ul>
Course Outcomes	The learners will <ul style="list-style-type: none"> <li>• Develop understanding about different types of IPRs.</li> <li>• Critically analyse the use of IPRs to appropriate innovation.</li> <li>• Comprehend the strategic use of IPRs by firms and entrepreneurs.</li> <li>• Train the learners in drafting disclosure forms, and different IP related applications</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• <u>Innovation and IPRs</u> <ul style="list-style-type: none"> <li>○ Understanding innovation and its types</li> <li>○ Innovation strategy</li> <li>○ Innovation and economic growth</li> <li>○ Innovation policy</li> <li>○ Introduction to Intellectual Property rights: Appropriation Mechanism</li> </ul> </li> <li>• <u>Different Types of IPRS: Legal and economic aspects</u> <ul style="list-style-type: none"> <li>○ Copyrights and related rights</li> <li>○ Trademarks</li> <li>○ Geographical Indications</li> <li>○ Plant Variety Protection</li> <li>○ Industrial Design and Patents</li> </ul> </li> <li>• <u>International aspect of IPR</u> <ul style="list-style-type: none"> <li>○ Role of the World Intellectual Property Organization (WIPO) and TRIPS Agreement</li> </ul> </li> <li>• <u>Patent management and strategy</u> <ul style="list-style-type: none"> <li>○ Strategic Patenting, Patent Portfolio Races, and Patent Thickets</li> <li>○ Patent Trolls</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>○ IPRs for Entrepreneurs</li> <li>● <u>Current Issues in IPR</u> <ul style="list-style-type: none"> <li>○ Software, Business and Financial Methods, Open Source, and Artificial Intelligence</li> <li>○ Intellectual Property Rights and Economic Development</li> </ul> </li> </ul> <p>This course will focus on the legal aspects of the IPRs and train the learners about the practical aspects like drafting the invention disclosure form, industrial design applications, patent applications and filing forms related to various IPs. Discussion on case studies, on IPs and its use by companies, during tutorial will be included to enhance the learning experience of the students.</p>
Suggested Books	<p>Textbooks:</p> <ol style="list-style-type: none"> <li>1. B. Hall and C. Helmers. 2024. <b>The Economics of Innovation and Intellectual Property</b>. Oxford University Press: USA. ISBN-13: 978-0197630921</li> <li>2. Rupinder Tewari and Ms. Mamta Bhardwaj. 2021. <b>Intellectual Property: A Primer for Academia</b>. Publication Bureau: Panjab University Press: Chandigarh. ISBN: 81-85322-92-9</li> </ol> <p>References:</p> <ol style="list-style-type: none"> <li>3. Prashant Reddy T., and Sumathi Chandrashekar. 2017. <b>Create, Copy and Disrupt</b>. Oxford University Press: New Delhi. ISBN: 9780199470662</li> <li>4. Murphy Halliburton. 2017. <b>India and the Patent Wars</b>. Cornell University Press: Ithaca and London. ISBN 9781501713477</li> </ol>



<b>Course code</b>	<b>HS 642/ HS 442</b>
<b>Title of the course</b>	<b>Language and Mind</b>
Credit Structure	L - T - P – Credits 2-1-0-3
Name of the Concerned Department	Humanities & Social Sciences
Pre-requisite, if any	NA
Scope of the course	The course aims to build interest of students in the field of language and mind. Language is considered to be the most accessible output of the working of the mind and raises some very important questions for a phenomenon unique to human beings. The course addresses some fundamental questions including how language is represented in our minds, how children acquire language so quickly and effortlessly, the connection between language and thought among others.
Course Syllabus	<p><b>Nature of Language:</b> Language as an object of scientific study, essential components of Language, Standard and non-standard languages, basic universal features in phonological, morphological and syntactic systems of language.</p> <p><b>Biological Foundations:</b> Is Language unique to humans?, Animals learning language, Nature versus Nurture Debate for Language, Language Acquisition Device, Poverty of Stimulus, Principles and Parameters, Critical Period Hypothesis, Case Studies of Feral Children and language savants, Linguistic Relativism.</p> <p><b>Language in the Brain:</b> Language in the human brain, contra-lateralization, and language centres in the brain, aphasia and its types, specific language impairment, brain plasticity, fundamental differences between first and second language acquisition, sign language.</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. J. F. Kess, <i>Psycholinguistics : Psychology, Linguistics, and the Study of Natural Language</i>, John Benjamins Publishing, Amsterdam, The Netherlands, 1992, 9789027235848</li> <li>2. N. Chomsky, <i>Lectures on Government and Binding</i>, Mouton De Gruyter, Holland, 1981, 9783110141313</li> <li>3. S. D. Krashen, <i>Second Language acquisition and Second Language Learning</i>, Pergamon Press Inc, Oxford, 1981, 0080253385</li> <li>4. J. Aitchison, <i>The Articulate Mammal : An Introduction to Psycholinguistics</i>, Routledge, New York, 2008, 0415420164</li> </ol>

Course Code	<b>IHS 443 / HS 643</b>
Title of the Course	<b>Contemporary Short Fiction</b>
Credit Structure	L-T- P-Credits 3-0-0-3
Name of the Concerned Department/School	English/HSS
Pre-requisite, if any	NIL
Scope of the Courses of the course	This course aims to familiarize students with the genre of the short story, a form of writing that has been around ever since human beings began to write the stories. Students will learn to understand the features of the short story and read selected short works written in the 20 <sup>th</sup> century from different cultures across the world. Translations of stories in different languages will allow students to recognize the various modes of crafting and narrating short stories across the world. Examples of novellas or the 'long' short story will also be discussed.
Course Syllabus	Discussion of short stories, history of the short story, introduction to prominent short story authors from different cultures and their writings, identify and describe the different features of the genre, story and plot structure, critical writing in the genre, comparison of structure and form with other genres of literature.
Suggested Books	<ol style="list-style-type: none"> <li>1. D. Halpern (edited), <b>The Art of the Story: An International Anthology of Contemporary Short Stories</b>, Penguin 2000.</li> <li>2. N. Chimamanda Ngozi and J. Lahiri (Edited), <b>The Global Anthology of Short Stories</b>, New Internationalist Publishing, May 2009.</li> </ol> (Selected 10-12 stories from both these collections) <b>Background Readings:</b> <ol style="list-style-type: none"> <li>1. M H Abrams. <b>Glossary of Literary terms</b>, Wadsworth Publishing, 2011.</li> <li>2. Selected electronic articles that I will provide links to or copies from time to time.</li> </ol>

Course Code	<b>IHS 444</b>
Title of the Course	<b>Literature of the Twentieth Century</b>
Credit Structure	L-T-P-Credits 3-0-0-3
Name of the Concerned Department/ School	English/HSS
Pre-requisite, if any	NIL
Scope of the course	The Course will focus on selected writings and excerpts from the authors mentioned in the syllabus. The list is indicative and could include other writers depending on the directions that classroom discussions will take. The primary genres will be the Short Story, Non Fiction and Poetry. The course will survey the major themes and ideas that predominate in the literature of the twentieth century from across the globe and will include background readings that throw light on the socio cultural milieu and political context in which these works get published.
Course Syllabus	James Joyce, Virginia Woolf, T.S. Eliot, Premchand, Samuel Beckett, Albert Camus, Franz Kafka, J.D. Salinger, R.K. Narayan, Gabriel Garcia Marquez, Chinua Achebe, Knut Hamsun, V.S. Naipaul, Jorges Luis Borges, Alice Walker, Yukio Mishima, Mikhail Sholokhov, Orhan Pamuk, Amitav Ghosh, Zakaria Tamer, J.M. Coetzee, Thomas Pynchon, Umberto Eco, Italo Calvino, Mario Vargas Llosa, Ravindra Nath Tagore.
Suggested Books	<ol style="list-style-type: none"> <li>1. Brown, Nicholas. <b>Utopian Generations: The Political Horizon of Twentieth-Century Literature</b>. Princeton: Princeton Univ Press, 2005.</li> <li>2. Clifford, James. <b>The Predicament of Culture: Twentieth-Century Ethnography, Literature, and Art</b>. Cambridge: Harvard Univ Press, 1988.</li> <li>3. Clifford, James. <b>Routes: Travel and Translation in the Late Twentieth Century</b>. Cambridge: Harvard Univ Press, 1997.</li> <li>4. Heise, Thomas. <b>Urban Underworlds: A Geography of Twentieth-Century American Literature and Culture</b>. New Brunswick: Rutgers Univ Press, 2011.</li> <li>5. Johnson, David. <b>The Popular and the Canonical: Debating Twentieth-Century Literature 1940-2000</b>. London:</li> </ol>

Routledge, 2005.

6. North, Michael. **The Dialect of Modernism: Race, Language, and Twentieth-Century Literature**. New York: Oxford Univ Press, 1994.
7. Wyatt, David. **Secret Histories: Reading Twentieth-Century American Literature**. Baltimore: Johns Hopkins Univ Press, 2010.



<b>Course code</b>	<b>HS 445/ HS 645</b>
<b>Title of the course</b>	<b>Advanced Discourse Studies</b>
Credit Structure	L - T - P - Credits 2-1-0-3
Name of the Concerned Department	Humanities & Social Sciences
Pre-requisite, if any	NA
Scope of the course	<p><b>Scope:</b> This course is designed to focus on discourse analytic approaches to research in education and related areas of inquiry. The course has been conceived to provide insights through an interdisciplinary lens and caters to traditions that range from interactional sociolinguistics to conversation analysis and critical discourse analysis.</p> <p><b>Learning Objectives:</b> The course is intended for doctoral students who would like to learn about discourse analysis for an advanced understanding of their own set of research data. To develop interest and appreciation for theories of talk-in-interaction and conversation analysis as methods in the practice of research. Familiarity with research based on interactions deploying discourse analytic approaches.</p>
Course Syllabus	<p><b>Theoretical framework of discourse studies</b> Theories and methods of discourse, ethnography, discourse as a cultural practice.</p> <p><b>Methods of discourse analysis</b> Transcription, complexities involved in analysing written and spoken language, text and discourse, ethical treatment of data, conversational sequence, interaction and power structure.</p> <p><b>Analysing discourse using Conversation Analysis as a tool</b> Analysis of multiple set of interactions including classroom exchanges using conversation analysis as a method.</p>
Suggested Books/ References	<ol style="list-style-type: none"> <li>1. Foucault, M. (1972). <i>The Archaeology of knowledge</i>. New York: Pantheon Books.</li> <li>2. Garfinkel, H. (1967). <i>Studies in ethnomethodology</i>. Englewood Cliffs, NJ: Prentice Hall.</li> <li>3. Goffman, E. (1959). <i>The presentation of self in everyday life</i>. New York: Anchor Books, Doubleday.</li> <li>4. Goffman, E. (1981). <i>"Footing" in Forms of talk</i>. Philadelphia: University of Pennsylvania Press.</li> <li>5. Goodwin, C. (1981). <i>Conversational organization: Interaction between speakers and hearers</i>. New York: Academic Press.</li> <li>6. Gumperz, J. J. (1982). <i>Discourse strategies</i>. Cambridge: Cambridge University Press.</li> </ol>

7. Labov, W., & Fanshel, D. (1977). ***Therapeutic discourse: Psychotherapy as conversation***. New York: Academic Press.
8. Malone, M. J. (1997). ***Worlds of talk: The presentation of self in everyday conversation***. Cambridge: Polity Press.
9. Sacks, H. (1992). ***Lectures on conversation***. (Vol. I-II). Oxford: Blackwell.
10. van Dijk, T. A. (Ed.). (1997a). ***Discourse as social interaction***. London: Sage.



<b>Course code</b>	<b>HS 446</b>
<b>Title of the course</b>	<b>Music and Literary Modernism</b>
Credit Structure	L - T - P - Credits 2- 1- 0- 3
Name of the Concerned Department	Humanities & Social Sciences
Pre-requisite, if any	NA
Scope of the course	Music and literature are integrally connected. 'All art,' wrote English literary and art critic Walter Pater, 'constantly aspires to the condition of music.' This interdisciplinary course examines the critical role of music in the works of 20th-century writers such as T.S. Eliot, James Joyce, Ezra Pound, Virginia Woolf, and Marcel Proust. Collectively, their works are representative of a new literary form- modernism. Modernist literature was as influenced by music as music was by literature. Thus the relationship between modernism and music is a reciprocal one. In exploring the specific points of reciprocity where music and literature influence each other, this course highlights the importance of reading texts aurally by drawing attention to the role of music in a text; and, how in turn, music shapes literature.
Course Syllabus	<ul style="list-style-type: none"> <li>• <b>Introduction and significance of modernist literature:</b> The course explores why modernist literature continues to be important in the contemporary culture.</li> <li>• <b>Influence of music on modernist literature:</b> Selected works of writers such as T.S. Eliot, Ezra Pound, James Joyce, Mina Loy, James Weldon Johnson, Stéphane Mallarmé, Marcel Proust, Gertrude Stein, John Cage, Wallace Stevens, and Virginia Woolf will be paired with and read alongside touchstones of modern music.</li> <li>• <b>The influence of modernism on critical theory:</b> The readings of the above authors will be supported by critical commentaries on the relationship between sound and word. The critics include Walter Pater, Wilhelm Fürtwangler, Ezra Pound, T.S. Eliot, George Bernard Shaw, Roland Barthes, Arnold Schönberg, Northrop Frye, Henry Cowell, and Luigi Russolo.</li> <li>• <b>The reciprocal influence of modernist literature on music:</b> The importance of literary art for composers such as George Antheil, Olivier Messiaen, Pierre Boulez, and The Beatles will be discussed. Which were the literary sources that influenced their music? How did their music inspire the literature of the period? The trends articulated during the modernist period will be explored through the emergence of blues poetry and jazz poetry and how they got reformed in the work of avant-garde writers and</li> </ul>

	composers throughout the 20 <sup>th</sup> century. These explorations will show how the binary categories of 'music' and 'literature' dissolve- while music attempts to be like literature, poetry and fiction begin to sound more and more like music.
Suggested Books	<ol style="list-style-type: none"> <li>1. Brown, Calvin S.: <b>Music and Literature. A Comparison of the Arts:</b> University of Georgia Press: Athens: 1948: ISBN-10:1406739162</li> <li>2. Albright, Daniel: <b>Untwisting the Serpent: Modernism in Music, Literature, and Other Arts:</b> University of Chicago Press: Chicago: 2000: ISBN-13:9780226012544</li> <li>3. Bucknell, Brad: <b>Literary Modernism and Musical Aesthetics:</b> Cambridge University Press: Cambridge: 2010: ISBN-13: 9780521155083</li> <li>4. Ripple, Gabriele: <b>Handbook of Intermediality: Literature - Image - Sound - Music:</b> De Gruyter: Boston: 2015: ISBN-13: 9783110308365</li> </ol>



Course code	<b>HS 448/ 648</b>
Title of the course	<b>Indian Cinema: Nation, Region and Technology</b>
Course Category	Institute Open Elective
Credit Structure	L - T - P - Credits 2 - 1- 0 - 3
Concerned Department	Sociology/Humanities and Social Sciences
Pre-requisite, if any	None
Course Objectives	<ul style="list-style-type: none"> <li>• The course will address the diversity of Indian film productions, beginning with the regional production centers of undivided/British India – Lahore, Calcutta, Madras and Bombay.</li> <li>• It will analyze the wealth of co-productions, remakes and adaptations across Indian film industries to understand how forms and themes have traveled across.</li> </ul>
Course Outcomes	<ul style="list-style-type: none"> <li>• Identify region-specific themes and genres in Indian film history</li> <li>• Assess the cultural history of adaptations, remakes, cinematic crossovers</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Pre-Partition Film (Studios)</li> <li>• Cultural Translations across film Industries <ul style="list-style-type: none"> <li>- Co-productions</li> <li>- Remakes</li> <li>- Adaptations</li> </ul> </li> <li>• Thematic Overlaps in Representation <ul style="list-style-type: none"> <li>- Rural-Urban Migration</li> <li>- Middle-Class Family</li> <li>- Desires and Commodity Fetish (Fashion, Travel etc.)</li> </ul> </li> <li>• Key Representations in Art Cinema <ul style="list-style-type: none"> <li>- Poverty in urban slums</li> <li>- Exploitation in the countryside</li> <li>- Police Brutality</li> </ul> </li> <li>• Subtitling vs Dubbing</li> <li>• Globalization of Film Form</li> <li>• Over-the-Top (OTT) Platforms <ul style="list-style-type: none"> <li>- Films vs Long-form storytelling</li> <li>- Rise of Regional film industries</li> </ul> </li> <li>• Visual Effects (VFX) in Period Films</li> </ul>

## Suggested Books

### Textbook:

1. Vebhuti Duggal, Bindu Menon and Spandan Bhattacharya (eds): *Film Studies: An Introduction*: Worldview Publications: Delhi & Kolkata: 2022: 9789382267515.
2. Sudhir Mahadevan: *A Very Old Machine: The Many Origins of the Cinema in India*: State University of New York Press: Albany: 2015: 9781438458298.

### Reference Books:

1. M. Madhava Prasad: *Cine-Politics : Film Stars and Political Significance in South India*: Orient Blackswan: Hyderabad: 2014: 978-8125053569
2. Rajani Mazumdar: *Bombay Cinema: An Archive of the City*: University of Minnesota Press: Minneapolis: 2007: 978-0-816649426.
3. S. V. Srinivas: *Politics as Performance: A Social history of Telugu Cinema*: Permanent Black: Ranikhet: 2013: 977-8178243726.
4. Hrishikesh Ingle: *Marathi Cinema, Cultural Space, and Liminality*. Oxford University Press: New Delhi: 2022: 9780192859785.



Course Code	<b>HS 455/ HS 655</b>
Title of the Course	<b>Digital Humanities</b>
Credit Structure	(L-T-P)-Credits 2-0-2-3
Name of the Concerned Department	Humanities and Social Sciences
Pre-requisite, if any	NIL
Course Objective	<p>Scope of the Course</p> <ol style="list-style-type: none"> <li>1. Explain the broad spectrum and perspective of Digital Humanities (DH)</li> <li>2. Introduce the necessary tools and techniques to understand various DH research projects</li> <li>3. Critically discuss DH projects</li> <li>4. Explain DH in various disciplines.</li> <li>5. Plan, Evaluate, and Develop a DH research project</li> </ol>
Course Syllabus	<p><b>Introduction and History of DH:</b> Intersection of digital technology and humanities disciplines; the history of humanities computing</p> <p><b>Analysis of DH Projects, Platforms, and Tools:</b> Text and Document; Digital Tools; Digitization, OCR, Text Analysis</p> <p><b>Digital Environments:</b> Copyright, Digital Rights,</p> <p><b>Visual Cultures:</b> Images as visual cultures, Subject-Object debate; Power and Knowledge; Visual Cultures and Critical theory; Mapping-Geo spatial Humanities; role of place and space in cultural visibility; digital heritage, Digital Knowledge Spaces</p> <p><b>Archive and Its Evolution:</b> Introducing, Archive in historical time, politics and poetics of archiving, archive in the digital age</p> <p><b>Databases:</b> Types of Databases, repositories and their making Authorship, Open Access, Building Open Access Ecosystems, Open Access India, Databases across Indian languages.</p> <p><b>Laboratory:</b> Disciplinary Presentations, Digital Humanities Project Critiques, and Final Project</p>
Suggested Books	<p><b>Text Books:</b></p> <ol style="list-style-type: none"> <li>1. Eileen Gardiner, Ronald G. Musto (2015), The Digital Humanities: A Primer for Students and Scholars, Cambridge University Press. ISBN 9781139003865</li> <li>2. Eve, Martin (2019) Close Reading with Computers Paperback ISBN: 9781503609365 Ebook ISBN: 9781503609372</li> <li>3. Maya Dodd and Nidhi Kalra Edited (2020) Digital Humanities in India: Pedagogy, Publishing and Practices ISBN 9780367347932</li> <li>4. Gold, Matthew K. (2012), Debates in the Digital Humanities,</li> </ol>

University of Minnesota Press SBN 978-0-8166-7795-5

**Reference Books:**

1. Hockey, Susan. (2000), *Electronic Texts in the Humanities: Principles and Practice*, Oxford University Press. ISBN-13: 9780198711940
2. Schreibman, S., Siemens, R., Unsworth, J. (2004), *Companion to Digital Humanities*, Oxford: Blackwell. Print ISBN:9781405103213 |Online ISBN:978047099987



<b>Course code</b>	<b>HS 481/ HS 681</b>
<b>Title of the course</b>	<b>Language, Mind and Society</b>
Course Category	Institute Elective
Credit Structure	L-T- P-Credits 3-0-0-3
Name of the Concerned Department	Humanities and Social Sciences
Pre-requisite, if any	Nil
Scope of the` course (Objectives)	This course examines language as a social practice, focusing on how it is represented in our minds. The course addresses fundamental questions on language acquisition and language as a social practice. Students are introduced to key concepts, theories, and methods in linguistics
Course Outcomes	<ul style="list-style-type: none"> <li>● Analyze language as a special purpose cognitive ability and understand the underlying mental computation of natural languages.</li> <li>● Identify the differences in language use that manifests themselves in society at different social and linguistic levels</li> </ul>
Course Content	<ul style="list-style-type: none"> <li>• Language- as an object of scientific study: Universal features of language,</li> <li>• Language and Mind: Language as a species-specific species uniform faculty, Behaviorism, Biological foundations of language  Generative Linguistics Language centres in the brain and brain plasticity Language acquisition vs language learning</li> <li>• Language and Society Sociolinguistics,  Language variation and change  Language, identity and ideology  Language, culture, and intercultural communication.  Sociolinguistic phenomena (Multilingualism, <i>Lingua franca</i> , Language contact, Language evolution, Pidgins and creoles, Language endangerment and death)</li> </ul>

Suggested Books	<ul style="list-style-type: none"> <li>• India as a linguistic area (Language families and coexistence)</li> </ul> <p>Textbooks:</p> <ul style="list-style-type: none"> <li>• Chomsky, N.: <i>Language and Mind</i>: Cambridge University Press: Cambridge: 2006: 9781139448901</li> <li>• Nikolas Coupland: <i>Style: Language variation and identity</i>: Cambridge University Press: Cambridge: 2007: 9781403944146.</li> <li>• Peter Trudgill: <i>Sociolinguistic variation and change</i>: Edinburgh University Press: Edinburgh: 2002: 9780748615155</li> <li>• William Labov. <i>Principles of linguistic change, vol. 3: Cognitive and cultural factors</i>: John Wiley &amp; Sons: UK: 2011: 9781405112154</li> </ul> <p>Reference Books</p> <ul style="list-style-type: none"> <li>• Coupland, N.: <i>Style: Language variation and identity</i>: Cambridge University Press: Cambridge: 2007: 9781403944146.</li> <li>• Florian Coulmas: <i>The handbook of sociolinguistics</i>: Blackwell Publishing: USA: 2017: 9780631211938</li> <li>• Miriam Meyerhoff: <i>Introducing sociolinguistics</i>: Routledge: London: 2018:9780429507922</li> <li>• Nikolas Coupland and Adam Jaworski: <i>The new sociolinguistic reader</i>: Palgrave Macmillan: New York: 2009: 9781403944146</li> <li>• Suzanne Romaine: <i>Language in society: An introduction to sociolinguistics</i>: OUP: Oxford: 2000: 0198731922</li> <li>• William Labov: <i>Principles of linguistic change, Vol. 1: internal factors</i>: John Wiley &amp; Sons: UK: 1994: 9780631179146</li> <li>• William Labov. <i>Principles of linguistic change, vol. 2social factors</i>: John Wiley &amp; Sons: UK: 2011: 9780631179153</li> </ul>
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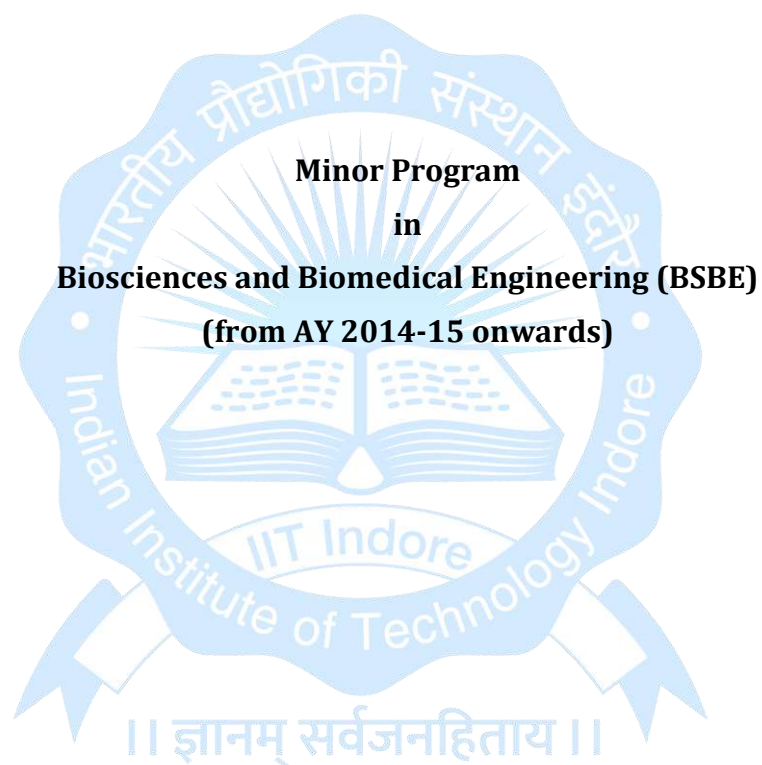
Course Code	<b>IHS 482</b>
Title of the Course	<b>Introduction to International Development and Area Studies</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department/ School	Sociology / Humanities and Social Sciences
Prerequisite, if any	None
Scope of the Course	To provide an introduction to development theory and practice from an interdisciplinary perspective and of the history of development; To explain the principal theories underlying past and present approaches to international development, problematize the Euro-centric/Western-centric nature of much of the debates and critically discuss the role of different actors and institutions. In the first part of the course the focus of the lectures will be on acquiring basic concepts and theories of international development. In the second part of the course the focus will be on applying this knowledge to present-day development problems.
Course Syllabus	<b>Definitions of Development:</b> Legacies of the Colonial era. International development in the post-war era: Decolonization, restructuring and economic growth. <b>Invention of 'Development'</b> - President Truman's Point Four and Underdevelopment. <b>Modernization</b> and Rostow's stages of economic growth, Criticizing Modernization. <b>Dependency</b> theories of Development, Neo-Marxism in USA and Latin America, Works of Raul Prebisch, Celso Furtado, Paul Baran, A.G. Frank. <b>Institutionalist development theory</b> - Gunnar Myrdal. Role of market, Neo-liberalism and people-centred development. <b>Post-development.</b> <b>Alternatives to development;</b> Amartya Sen's 'development as freedom'. Millennium Development Goals (MDGs) and their social, economic, political and environmental consequences for people in India.
Suggested Books	<b>Text Books:</b> 1. Greig, A., D. Hulme and M. Turner. Challenging Global Inequality: Development Theory and practice in the 21st Century. Palgrave-MacMillan. NY, 2007. 2. Rist, G. 2008. The History of Development: from western origins to global faith. Zed Books, London. <b>References:</b>

1. Roberts, J.T., Hite, A. (eds.). 2000. From Modernization to Globalization. Blackwell Publications, London.



Course Code	HS 636/ HS 436
Title of the Course	Philosophy of Biology
Credit Structure	L - T - P – Credits 3-0-0-3
Name of the Concerned Discipline and Department	Philosophy, School of Humanities and Social Sciences
Pre-requisite, if any (for the students)	None
Scope of the Course	The course aims to introduce the students with the fundamental issues of Philosophy of Biology that have been reflected upon by the Philosophers and the Evolutionary Biologists alike.
Course Syllabus	<p>Module:1- Introduction Introduction; Philosophy of Biology as a specific Philosophy of Science; Nature and Scope</p> <p>Module:2- Creationism and Intelligent Design Irreducible complexity and its collapse; Issues with Intelligent Design; Possibility of biological functions without a designer; Difference between malfunctions and diseases; Chosen functions vs co-rider (coextensive traits)</p> <p>Module:3 Fitness and Units of Selection Darwinian Fitness; (Random) Genetic Drift theory; Organisms and Genes; Selfish genes and levels of selection</p> <p>Module:4 Adaptationism A critique of adaptationism; Gradualism contra punctuated equilibrium; Exaptation; Role of Historical Contingencies; Evolution vis-à-vis perfection</p> <p>Module:5 Species and Systematics categorisation of organism in species; Kinds of categorization of biological species; Natural categories vis-à-vis convenient categories</p> <p>Module:6 Cultural Evolution and Memetics Darwinism as a universal explanatory paradigm; Memes and genes</p>
Suggested Books	<p>Textbooks:</p> <ol style="list-style-type: none"> <li>1. S. Okasha: <i>Philosophy of Biology: A Very Short Introduction</i>: Oxford University Press: Oxford: 2019: 978-0-198-80699-8</li> <li>2. P. Godfrey-Smith: <i>Philosophy of Biology</i>: Princeton University Press: Princeton: 2014: 978-0-691-14001-8</li> </ol> <p>Reference Books:</p> <ol style="list-style-type: none"> <li>1. S. Sarkar, A. Plutynski: <i>A companion to the Philosophy of Biology</i>: Blackwell Publishing: Oxford: 2008: 978-1-405-12572-7</li> </ol>

	2. E. Sober: <i>Philosophy of Biology</i> : Routledge: New York : 2000 : 978-0-813-39126-7
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Course Code	<b>BSE 201</b>
Title of the Course	<b>Biophysics</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Department	Biosciences and Biomedical Engineering
Pre-requisite, if any	None
Scope of the Course	This course will introduce students with the physical laws that govern biology. It will also focus on various physical techniques used in biology and medicine for characterization and diagnosis.
Course Syllabus	<p>Introduction to macroscopic and microscopic aspect of matter.</p> <p>Schrödinger equation, H-atom, chemical bonds.</p> <p>Quantitative discussion of Entropy, free energy, partition function, diffusion and rate equations.</p> <p>Basic principles of spectroscopy, particularly electronic, vibrational, rotational and magnetic resonance.</p> <p>Applications of spectroscopy techniques to understand biological, and medical systems.</p> <p>The physical basis of diffusive processes in biology and biochemistry.</p> <p>Optical microscopy fundamentals, visible and UV light absorption, fluorescence and phosphorescence, quasielastic light scattering.</p> <p>Biological networks, and chaos in biological systems.</p>
Suggested Books	<p><b>Text / Reference Books</b></p> <ol style="list-style-type: none"> <li>1. Philip Nelson, Biological Physics, 2007, First edition. [ISBN-10: 0716798972   ISBN-13: 978-0716798972]</li> <li>2. William Bialik, Biophysics: Searching for Principles, 2012. [ISBN-10: 0691138915   ISBN-13: 978-0691138916]</li> <li>3. Jack Tuszynski, Michal Kurzynski, Introduction to Molecular Biophysics. [ISBN-10: 0849300398   ISBN-13: 978-0849300394] CRC Series in Pure and Applied Physics</li> <li>4. James G. Fujimoto and Daniel Farkas, Biomedical optical imaging, 1st edition. [ISBN-10: 0195150449]</li> </ol>

Course Code	<b>BSE 202</b>
Title of the Course	<b>Biomedical Technologies</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department	Biosciences and Biomedical Engineering
Pre-requisite, if any	None
Scope of the Course	This course will focus on the basic working principles of common medical instruments that are routinely used in clinics. It will also discuss basic design considerations of biomedical instrumentation.
Course Syllabus	<p>Electrocardiography system: Electrocardiograph, ECG machines, instrumentation amplifier, ECG traces, faults and maintenance.</p> <p>Electroencephalography system: Overview, EEG electrodes, introduction to filters, EMG and related studies.</p> <p>Blood pressure measurement: Heart mechanics and blood pressure basics, non-invasive and invasive methods,</p> <p>Pacemakers: Pacing basics, external and internal pacemakers, defibrillators.</p> <p>Ventilators and respirators.</p> <p>Lasers and their applications in medicine and biology.</p> <p>Medical Imaging: X-rays, MRI, PET, mammography, ultrasound and other developing technologies.</p>
Suggested Books	<p><b>Text / Reference Books</b></p> <ol style="list-style-type: none"> <li>1. J. Carr and J. Brown, Introduction to Biomedical Equipment and Technology, 4<sup>th</sup> edition. [ISBN-10: 0130104922   ISBN-13: 978-0130104922]</li> <li>2. R. Aston, Principles of Biomedical Instrumentation and Measurement, 1<sup>st</sup> edition. [ISBN-10: 0675209439   ISBN-13: 978-0675209434]</li> <li>3. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, Bio-Medical Instrumentation and Measurements, 2<sup>nd</sup> edition, Pearson Education. [ISBN-10: 0130764485   ISBN-13: 978-0130764485]</li> <li>4. John G. Webster, Medical Instrumentation: Application and Design, 4th edition, Wiley, New York. [ISBN-10: 0471676004  </li> </ol>

	ISBN-13: 978-0471676003]
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Course Code	<b>BSE 301</b>
Title of the Course	<b>Introduction to Molecular Biology</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Department	Biosciences and Biomedical Engineering
Pre-requisite, if any	None
Scope of the Course	This course will give an overview of modern biology, in addition to fundamentals in the area of Molecular Biology.
Course Syllabus	<p>Macromolecules and Cells, Nucleus, Cell Cycle.</p> <p><b>DNA the unit of life:</b> Structure, Properties, Mutations, Repair and Diseases.</p> <p>Flow of genetic information: Replication of DNA and its repair,</p> <p><b>RNA:</b> the ribonucleic acid, Structure, Properties, Transcription of RNA and its modification, Gene expression, Introns-exons.</p> <p>Exploring genes and genomes.</p> <p><b>Translation:</b> Genetic Code, Protein synthesis, Function and structure of Proteins.</p> <p>Recombinant DNA technology, sequences of genomes, manipulation of eukaryotic genes.</p> <p><b>Omics:</b> Genomics, transcriptomics and proteomics.</p>
Suggested Books	<p><b>Text / Reference Books</b></p> <ol style="list-style-type: none"> <li>1. Robert F., Weaver, Molecular Biology, 4th ed., McGraw-Hill, 2003. [ISBN-10: 0071275487   ISBN-13: 978-0071275484]</li> <li>2. Lodish H., et al., Molecular Cell Biology. 6th ed., Freeman, W.H., 2007. [ISBN-10: 0716776014   ISBN-13: 978-0716776017]</li> <li>3. Alberts et al., Molecular Biology of the Cell, 4th ed., Garland Publishing, Inc., 2002.</li> <li>4. Tropp B.E., Molecular Biology: Genes to Proteins, 3rd ed., Jones &amp; Bartlett Publishers, 2007 [ ISBN-10: 0763709166 ISBN-13: 978-0763709167</li> </ol>

Course Code	<b>BSE 402</b>
Title of the Course	<b>Cancer Diagnosis and Therapy</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Department	Bioscience and Biomedical Engineering
Pre-requisite, if any	None
Scope of the Course	The purpose of this course is to provide an introduction to cancer and modern diagnostic methods available to detect cancer at an earlier stage. The diagnostic methods will include invasive and non-invasive methods.
Course Syllabus	<p><b>Introduction</b>  Definition, Benign Tumors Vs. Malignant Tumors, Types of Cancer, Common Symptoms, Molecular Hallmarks of Cancer – Growth Signal Autonomy, Evasion of Growth Inhibitory Signals, Evasion of Apoptosis (Programmed Cell Death), Unlimited Replicative Potential, Angiogenesis (Formation of New Blood Vessels), Invasion and Metastasis, Molecular Basis of Cancer - Cancer Genes (Oncogenes and Tumor Suppressor Genes), Carcinogenesis – A Multistep Process, Evidences for Multistage Models of Carcinogenesis</p> <p><b>Diagnostic Methods and Therapy</b>  <b>Cancer Screening and Treatment Modalities:</b> Screening - Definition, Principles, Evaluating Screening Tests, Developing and evaluating a Cancer Screening Programme, Different Kind of Screening Tests, Screening for Specific Types of Cancer, Genetic Counselling; Treatment – Essential Terms, Surgery, Radiation, Chemotherapy, Biological Therapy, Hormone Therapy, Transplantation, Targeted Therapies, Gene Therapy, Other Treatment Methods (Cryosurgery, Laser Therapy, Photodynamic Therapy, Hyperthermia), Cancer Clinical Trials</p>

Suggested Books	<p><b>Text Books</b></p> <ol style="list-style-type: none"> <li>1. R. A. Weinberg, <b>The Biology of Cancer</b>, Garland Science, <b>2012</b>, ISBN-10: 0815340761</li> <li>2. R. Hesketh, <b>Introduction to Cancer Biology</b>, Cambridge University Press, <b>2013</b>, ISBN-10: 1107601487</li> <li>3. V. T. DeVita, T. S. Lawrence, S. A. Rosenberg, <b>Cancer: Principles and Practice of Oncology, 9<sup>th</sup> Edition</b>, Lippincott Williams and Wilkins, <b>2011</b>, ISBN-10: 1451105452</li> </ol> <p><b>Reference Books</b></p> <ol style="list-style-type: none"> <li>1. S. Heim, F. Mitelman, <b>Cancer Cytogenetics</b>, 3<sup>rd</sup> Edition, Willy-Blackwell, <b>2011</b>, ISBN-10: 0470181796</li> <li>2. L. Pecorino, <b>Molecular Biology of Cancer: Mechanisms, Targets and Therapeutics</b>, Oxford University Press, <b>2008</b>, ISBN-10: 0199211485</li> <li>3. <b>American Cancer Society</b>, <a href="http://www.cancer.org">http://www.cancer.org</a>.</li> <li>4. <b>National Cancer Institute</b>, <a href="http://www.cancer.gov">http://www.cancer.gov</a>.</li> </ol>
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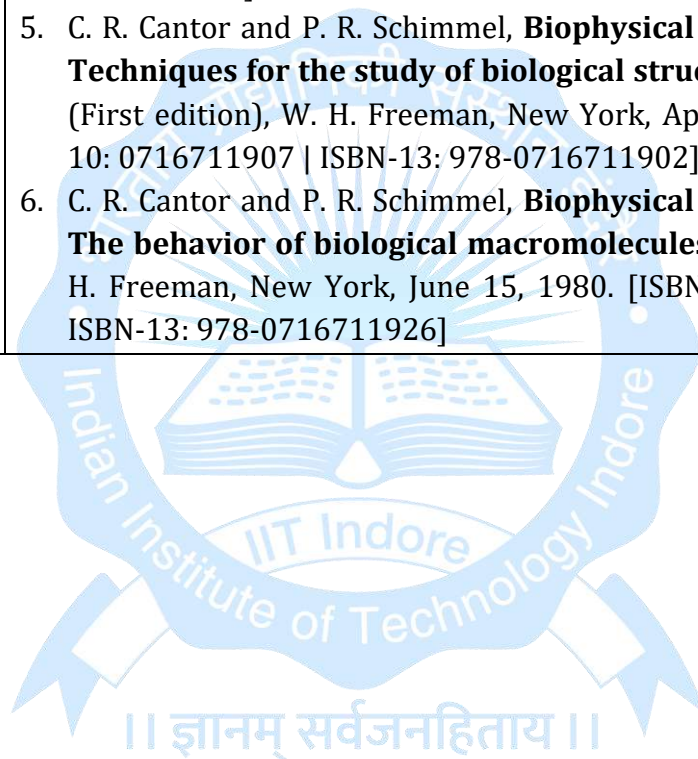


Course Code	<b>BSE 404 / BSE 604</b>
Title of the Course	<b>Biomedical Imaging</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department	Biosciences and Biomedical Engineering
Pre-requisite, if any	None
Scope of the Course	This course will give a comprehensive introduction to the fundamental and major aspects of biomedical imaging systems used currently. The fundamental physics and engineering of each imaging modality will be discussed.
Course Syllabus	<p>Radiation and interaction with matter, principle of diagnostic biomedical optical imaging.</p> <p>Radiation dosimetry, risk and protection.</p> <p>Radiography, mammography and fluoroscopy.</p> <p>Principle of ultrasound imaging and current status.</p> <p>Image analysis, image processing, image reconstruction theory, computed tomography system.</p> <p>Magnetic Resonance Imaging (MRI): principle of nuclear magnetic resonance, MR imaging, functional MR imaging, application of MR imaging.</p> <p>Single Photon Emission Computed Tomography (SPECT) principle, Positron Emission Tomography (PET).</p>
Suggested Books	<p><b>Text / Reference Books</b></p> <ol style="list-style-type: none"> <li>1. J. T. Bushberg et al, The essential physics of medical imaging, 2<sup>nd</sup> edition. [ISBN-10: 0683301187   ISBN-13: 978-0683301182]</li> <li>2. Richard R. Carlton, Principle of radiographic imaging: An art and a science. [ISBN-10: 1439058725   ISBN-13: 978-1439058725]</li> <li>3. James G. Fujimoto and Daniel Farkas, Biomedical optical imaging, 1<sup>st</sup> edition. [ISBN-10: 0195150449]</li> <li>4. Andrew G. Webb, Introduction to biomedical imaging, 1<sup>st</sup> edition. [ISBN-10: 0471237663   ISBN-13: 978-0471237662]</li> </ol>

<b>Course Code</b>	<b>BSE 405/ BSE 605</b>
<b>Title of the Course</b>	<b>Molecular Biophysics</b>
Credit Structure	L-T-P-C 2-1-0-3
Name of the Concerned Department	Biosciences and Biomedical Engineering
Pre-requisite, if any	Open to all graduates, with the prior permission of course instructor.
Scope of the Course	This course is designed to teach the basics of Physics, sufficient for BSBE graduate students. The fundamental physics of Biological phenomena will be discussed. It will also prepare students to learn and apply biophysical approaches to understand biochemical, biotechnological and medical problems.
Course Syllabus	<p>Review of calculus and its application in biology. Introduction to thermodynamics and role in biology. Discussion about various stages of evolution. Single cell machinery to multi-cellular organs.</p> <p>Structure of biomolecules. Elements of building blocks for macromolecules. Weaker interatomic interactions. Hydrogen bond and hydrophobic interactions. Amphiphilic molecular behavior in aqueous environments. Introduction to X-ray crystallography.</p> <p>Structures and physics of amino acids and proteins. Conformational transitions of proteins (folding and unfolding of proteins), Ramachandran plot. Physics of nucleic acid, membranes and membrane physics. Modeling membranes as elastic materials.</p> <p>Dynamics of biomolecules: diffusion, vibrations versus conformational transitions. Interaction of biomolecules with electromagnetic radiation.</p> <p>General characteristic of a cell. Cytoskeletal organizations and constituents molecules and their mechanism. Ion channels and ion pumps, osmotic pressure of cells.</p> <p>Cellular energetics: chloroplast and mitochondria. Cells as thermodynamic machines. Active transport.</p> <p>Review of fundamentals of electricity and magnetism. Bioelectricity, heart dynamics, anatomy of nerve cells, conducting properties of neurons. Structure and function of synapse.</p>
Suggested Books	<p><b>Text / Reference Books</b></p> <ol style="list-style-type: none"> <li>1. P. Nelson, <b>Biological Physics</b>, (Updated edition), W. H. Freeman, New York, December 16, 2013. [ISBN-10: 0716798972   ISBN-13: 978-0716798972]</li> <li>2. W. Bialik, <b>Biophysics: Searching for Principles</b>, Princeton</li> </ol>

University Press, October 28, 2012. [ISBN-10: 0691138915 | ISBN-13: 978-0691138916]

3. J. Tuszynski, and M. Kurzynski, **Introduction to Molecular Biophysics**, (First edition), CRC Press, New York, February 26, 2003. [ISBN-10: 0849300398 | ISBN-13: 978-0849300394] CRC Series in Pure and Applied Physics
4. C. R. Cantor and P. R. Schimmel, **Biophysical Chemistry, Part I: The conformation of biological macromolecules** (Their Biophysical Chemistry), (First edition), W. H. Freeman, New York, March 15, 1980. [ISBN-10: 0716711885 | ISBN-13: 978-0716711889]
5. C. R. Cantor and P. R. Schimmel, **Biophysical Chemistry, Part 2: Techniques for the study of biological structure and function**, (First edition), W. H. Freeman, New York, April 15, 1980. [ISBN-10: 0716711907 | ISBN-13: 978-0716711902]
6. C. R. Cantor and P. R. Schimmel, **Biophysical Chemistry, Part 3: The behavior of biological macromolecules**, (First edition), W. H. Freeman, New York, June 15, 1980. [ISBN-10: 0716711923 | ISBN-13: 978-0716711926]



<b>Course code</b>	<b>BSE 413/ BSE 613</b>
<b>Course code</b>	<b>BSE 413/ BSE 613</b>
<b>Title of the course</b>	<b>Omics Technologies</b>
<b>Credit Structure</b>	L - T - P - Credits 2-1-0-3
<b>Name of the Concerned Department</b>	Biosciences and Biomedical Engineering
<b>Pre-requisite, if any</b>	NA



Scope of the course	This course is designed for the students with the background in biology, chemistry and computer science. This course will emphasize at molecular level changes through the studies of Genomics, Transcriptomics, Proteomics, Metabolomics, Glycomics and Lipidomics. The goal of this course is to explain the details of modern OMICS technologies and their applications which control structure, function, and dynamics of organisms.
Course Syllabus	<p>OMICS: Introduction of omics, types of omics, methods to study, experimental approaches, bioinformatics algorithm. Genomics: Gene, Genome and their genomics, Status of genomics project, genome annotation, genome database, Prediction for transcription factor binding sites, Bioinformatic analysis for miRNA target and motif search, Single nucleotide polymorphisms (SNP) in bio-medical research. Transcriptomics: Principle and applications of experimental techniques: micro-arrays, Expressed Sequence Tag (EST), Serial analysis of gene expression (SAGE), tissue arrays. Data analysis and normalization through bioinformatics methods. Publicly available micro-arrays expression data. Proteomics: Principle and applications of proteomics technologies: 2D-electrophoresis, MALDI-TOF mass spectrometry, yeast 2-hybrid system. Protein-protein interactions, Protein-DNA interaction, Protein-RNA interaction. Computational prediction of interactions, protein databases. Metabolomics: Principles and applications of technologies in metabolomics: High-performance liquid chromatography (HPLC), Gas Chromatography, Mass Spectrometry, Nuclear Magnetic Resonance. Metabolic pathways resources, Metabolic health, and complications. Glycomics and Lipidomics: Principles and applications. Instrumentation and arrays to understand these structural changes in leaving organism.</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. C. Simo, A. Cifuentes, V. Garcia-Canas, <b><i>Fundamentals of Advanced Omics Technologies</i></b>, From Genes to Metabolites, Elsevier, United States of America, 2008, 978-0-44462-651-6</li> <li>2. D. Barh, K. Blum, M.A. Madigan, <b><i>OMICS: Biomedical Perspectives and Applications</i></b>, CRC Press, United States of America, 2017, 978-1-43985-008-4</li> <li>3. B. Mayer, <b><i>Bioinformatics for OMICS Data</i></b>, Springer, United States of America , 2011 , 978-1-61779-027-0</li> <li>4. E.C. Soo, J.P.M. Hui, <b><i>Metabolomics in Glycomics</i></b>, Springer, United States of America, 2009, 978-1-60761-453-1</li> </ol>

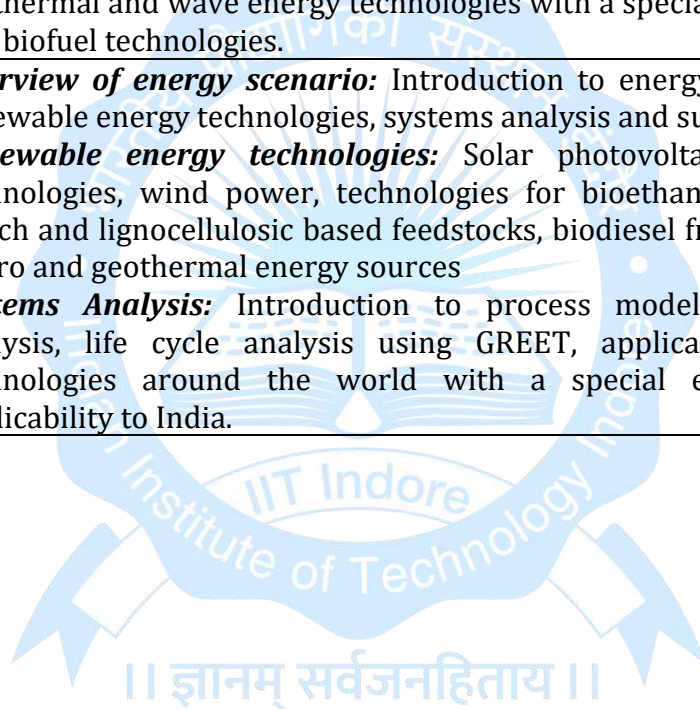
<b>Course code</b>	<b>BSE 417/ BSE 617</b>
<b>Title of the course</b>	<b>Biomolecular Modeling</b>
Credit Structure	L - T - P - Credits 2-1-0-3
Name of the Concerned Department	Biosciences and Biomedical Engineering
Pre-requisite, if any	NA
Scope of the course	This course is designed for the students with the background in biology, chemistry, physics, or computer science and who are interested in learning biomolecular modeling. The goal of the course is to introduce the principles of biomolecular modeling and to develop practical skills for using existing modeling software.
Course Syllabus	Elements of thermodynamics and statistical mechanics: laws of thermodynamics, entropy, ensembles in statistical mechanics: microcanonical, canonical, and grandcanonical ensembles, Partition function, Maxwell-Boltzmann distribution, Phase space. Introduction to stochastic phenomena: Gaussian noise, Brownian motion, diffusion (Fokker-Planck equation), Euler algorithm for Brownian motion. Molecular Mechanics: introduction, Morse potential, Harmonic Oscillator Model for molecules, Energy due to stretch, bend, stretch-bend, torsional strain, van der Waals and Dipole-Dipole interactions. Types of Force fields: AMBER, CHARMM, GROMOS, OPLS, Merck Molecular Force Field, Consistent Force Field, MM2, MM3, and MM4 force fields, force field optimizations. Potential Energy Surface:- Convergence Criteria, Optimization Criteria, Unidirectional Search, Finding Minimum Point, Gradient based Methods- Steepest Descent and Conjugate Gradient Methods Molecular Dynamics Simulations: Introduction, Newtonian dynamics, Integrators- Leapfrog and Verlet algorithm, Thermostats and barostats, Implicit and explicit solvation models, periodic boundary conditions, Ewald's summation for electrostatics, radial distribution functions, pair correlation function. Biased sampling: umbrella sampling and steered MD simulations. Free energy calculations: molecular recognitions, protein-drug interactions, Molecular Mechanics-Poisson-Boltzmann (Generalized Born) Surface Area (MMPBSA/MMGBSA), Free Energy Perturbation, Thermodynamic Integration (TI).
Suggested Books	1. R. Leach, <b>Molecular Modeling, Principles and Applications</b> , Pearson Education, India, 2009 and 978-

8131728604

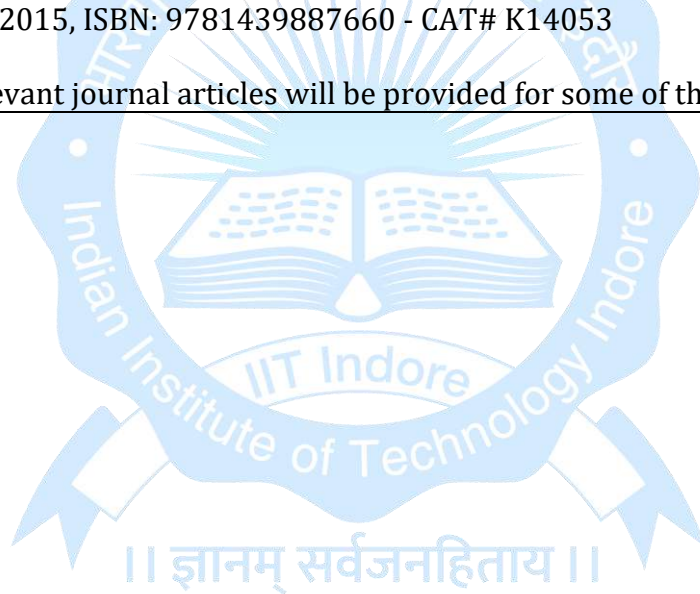
2. Frenkel, B. Smit, **Understanding Molecular Simulation, From Algorithms to Applications**, Academic Press, USA, 2001 and 978-0122673511
3. K. I. Ramachandra, G. Deepa, K. Namboori, **Computational Chemistry and Molecular Modeling-Principles and Applications**, Springer, New York, 2010 and 978-3642095986
4. T. Schlick, **Molecular Modeling and Simulation-An interdisciplinary Guide**, Springer, New York, 2010 and 978-1441963505



<b>Course Code</b>	<b>BSE 619/ BSE 419</b>
<b>Title of the Course</b>	<b>Renewable Energy Technologies</b>
Credit Structure	L-T-P- Credits 2-1-0-3
Name of the Concerned Department	Biosciences and Biomedical Engineering (to be cross listed with other engineering Departments especially Mechanical, Electrical and Civil Engineering)
Pre-requisite, if any	NA
Scope of the Course	This course will provide an overview of fundamentals and applications of renewable energy technologies. Current and emerging applications, challenges and potential solutions for various technical, economic and resource constraints for the technologies will be discussed. The course will cover renewable energy technologies such as Solar, wind, biofuels, geothermal and wave energy technologies with a special emphasis on solar and biofuel technologies.
Course Syllabus	<p><b>Overview of energy scenario:</b> Introduction to energy sources, available renewable energy technologies, systems analysis and sustainability.</p> <p><b>Renewable energy technologies:</b> Solar photovoltaics, solar thermal technologies, wind power, technologies for bioethanol from sugarcane, starch and lignocellulosic based feedstocks, biodiesel from oil seeds, algae, hydro and geothermal energy sources</p> <p><b>Systems Analysis:</b> Introduction to process modeling and economic analysis, life cycle analysis using GREET, application of renewable technologies around the world with a special emphasis on their applicability to India.</p>



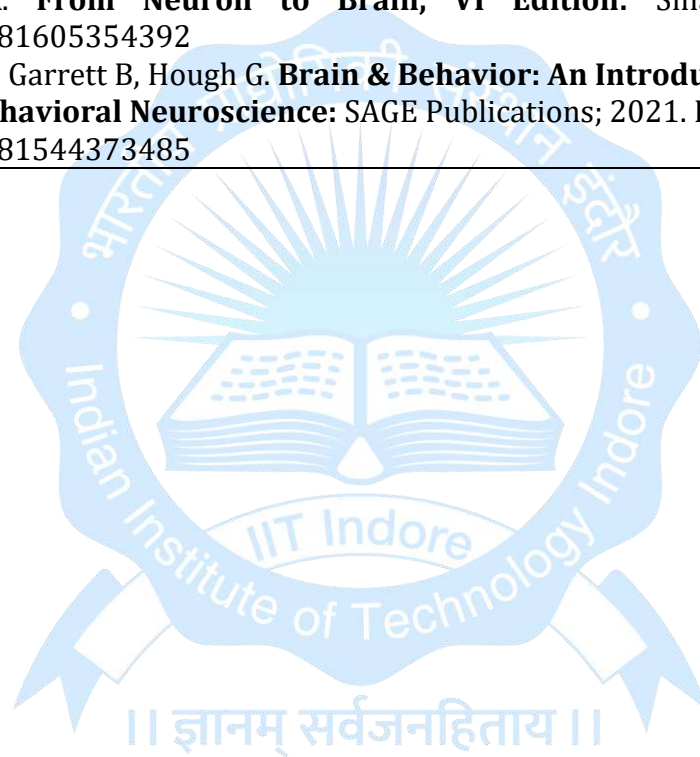
	<b>Summary:</b> State of the art and future outlook.
Suggested Books	<p>Recommended texts:</p> <ol style="list-style-type: none"> <li>1. David J.C. MacKay, <b><i>Sustainable Energy-Without the hot air</i></b>. UIT Cambridge, 2008, ISBN 978-0-9544529-3-3, This book can be freely downloaded from:</li> <li>2. M. Kanoglu, Y. Cengel and J. Cimbala, <b><i>Fundamentals and Applications of Renewable Energy</i></b>, McGraw-Hill Education, 2019, ISBN-13: 978-1260455304</li> <li>3. B. Sorensen, <b><i>Renewable Energy: Physics, Engineering, Environmental Impacts, Economics and Planning</i></b>, 4<sup>th</sup> edition, Academic Press. 2010, ISBN-13: 978-0123750259</li> <li>4. O. Jolliet, M. Saade-Sbeih, S. Shaked, A. Jolliet, P. Crettaz, <b><i>Environmental Life Cycle Assessment</i></b>, CRC Press, Taylor and Francis, 2015, ISBN: 9781439887660 - CAT# K14053</li> </ol> <p>Relevant journal articles will be provided for some of the lectures.</p>



Course code	<b>BSE 432/ BSE 632</b>
Title of the course	<b>Measurement and Testing of Medical Devices</b>
Course Category	Core
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department	Biosciences and Biomedical Engineering
Prerequisite, if any	None
Course Objectives	<ul style="list-style-type: none"> <li>● Covers principles and concepts of biomedical measurements and origins of biopotential</li> <li>● This will provide various facets of medical device development</li> </ul>
Course Outcomes	<ol style="list-style-type: none"> <li>1. The students will be able to describe the medical device measurements and facets of medical device development.</li> <li>2. It helps to apply principles and concepts of electronics, and signal processing in medical measurements.</li> </ol>
Course Content	<p><b>Biomarkers:</b> Cell resting potential and action potentials, origin of bioelectric potentials, pressure, motion, and force measurement. Measurement of flow, biomarkers used in diagnostic medical devices.</p> <p><b>Instrumentation types:</b> Fundamental &amp; importance of instrumentation, types of instruments, selection of instruments, performance of instruments, error in measurement, calibration &amp; standard, calibration of instruments. Methods &amp; analysis, introduction to transducer &amp; types, process instrumentation, recording instruments, indicating &amp; recording instruments.</p> <p><b>Medical measurements:</b> Types of medical measurements, characteristics, considerations in the design of medical devices, precision, accuracy, noise characterization and filtering, Electrocardiogram, Electroencephalogram, Electromyogram.</p> <p><b>Medical devices case studies:</b> Principles of diagnostic and therapeutic equipment: blood pressure monitors, pulse oximeters, pH meters, pacemakers, defibrillators, nerve and muscle stimulators, dialysis machines, nebulizers, inhalators, aspirators, humidifiers, ventilators and spirometry. Infrared and near-infrared application, ultra-violet lamp and laser application, endoscopy, laparoscopy.</p>
Suggested Books (Text Books, Reference Books)	<p><b>Text Books:</b></p> <ol style="list-style-type: none"> <li>1. J. G. Webster. <b>Medical Instrumentation: Application and Design</b>, 4th edition. John Wiley &amp; Sons, 2015. ISBN: 9788126553792.</li> <li>2. R. A. Normann, <b>Principles of Bioinstrumentation</b>, 1st edition, John Wiley &amp; Sons, 1988. ISBN: 9780471605140.</li> </ol> <p><b>Reference Book:</b></p> <ol style="list-style-type: none"> <li>3. P. David and N. Michael, <b>Design and development of Medical Electronic instrumentation</b>, 1st edition, Wiley, 2004. ISBN 9780471676232.</li> </ol>

Course Code	<b>BSE 442/ BSE 642</b>
Title of the Course	<b>Fundamentals of Neuroscience</b>
Course Category	<b>Elective</b>
Credit Structure	L-T-P-Credits, 2-1-0-3
Name of the Concerned Department	Biosciences and Biomedical Engineering
Pre-requisite, if any	Nil
Course objectives	<ul style="list-style-type: none"> <li>• Comprehend the fundamental principles of neuroscience and their implications in brain function and behavior.</li> <li>• Explore the pathophysiology of neurogenetic diseases and their impact on neurological functions.</li> </ul>
Course outcomes	<ul style="list-style-type: none"> <li>• This course provides a strong foundation for understanding the organization and structural intricacies of the brain.</li> <li>• Students will acquire knowledge of various neurological processes, such as memory formation and sensory processing.</li> </ul>
Course Syllabus	<p><b>Brain structure:</b> Brain Organisation, Structure of Cerebellum and Basal Ganglia, Blood Brain Barrier. Histology of Brain Sections (Coronal/sagittal) – Normal vs. Diseased.</p> <p><b>Learning and memory:</b> Theories of memory, Classification, short-term and long-term storage of memory, Retrieval, Memory consolidation, anterograde and retrograde amnesia, Different types of plasticity, Cell &amp; molecular basis of learning and memory, Neural oscillations basis of learning and memory. Modelling of synaptic potentials.</p> <p><b>Sensation and Sensory Processing:</b> The Somatic Sensory System: Touch and Proprioception; Pain; Vision – The Eye and Central Visual Pathways. The Auditory System ;Olfactory System; Gustatory System</p> <p><b>Neuroendocrinology:</b> Function of hypothalamus, pituitary, circumventricular organs, Hypophysiotropic hormones; Feedback loops; Pineal gland &amp; neuroendocrine regulation of biological rhythms.</p> <p><b>Brain metabolism:</b> Brain metabolism of carbohydrate, lipids &amp; amino acids, Metabolism of neurotransmitters. Neuro-glial interaction, Effect of malnutrition on brain metabolism.</p> <p><b>Neurogenetic diseases:</b> Autosomal (recessive and dominant) and X-linked neurological diseases –neurodegenerative diseases, and molecular pathology. Metabolic defects causing neurological diseases. Complex genetic diseases, gene environment interactions, Pathogenetic of migraine, epilepsy, autism and schizophrenia.</p>

Suggested Books	<p><b>Text Books:</b>  [1] Eric R. Kandel, John D. Koester, Sarah H. Mack, Steven A. Siegelbaum. <b>Principles of Neural Science, VI Edition:</b> McGraw-hill New York; 2021. ISBN: 1259642232  [2] Larry Squire, Darwin Berg, Floyd E. Bloom, Sascha du Lac, Anirvan Ghosh, Nicholas C. Spitzer. <b>Fundamental Neuroscience, IV Edition,</b> Elsevier Science; 2012. ISBN: 9780123858702</p> <p><b>Reference Books:</b>  [1] Bear MF, Connors BW, Paradiso MA. <b>Neuroscience: Exploring The Brain, Enhanced Edition</b> Wolters Kluwer; 2020. ISBN: 1284211282  [2] Nicholls JG, Martin AR, Fuchs PA, Brown DA, Diamond ME, Weisblat DA. <b>From Neuron to Brain, VI Edition:</b> Sinauer; 2015. ISBN: 9781605354392  [3] Garrett B, Hough G. <b>Brain &amp; Behavior: An Introduction to Behavioral Neuroscience:</b> SAGE Publications; 2021. ISBN: 9781544373485</p>
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Course Code	<b>BSE 458/658</b>
Title of the Course	<b>Preclinical and Clinical Trial Design</b>
Course Category	<b>Core</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department	Biosciences and Biomedical Engineering
Pre-requisite, if any	Nil
Course Objective	<ul style="list-style-type: none"> <li>● Learn preclinical and clinical research conduct, ensuring compliance with national and international regulations for marketing approval.</li> <li>● Learn to use a risk-based approach to ensure the safety and effectiveness of medical devices.</li> <li>● Explore statistical considerations for effective study design and address ethical issues related to preclinical and clinical research.</li> </ul>
Course outcomes	<ol style="list-style-type: none"> <li>1. Students will be able to make plans and decide on preclinical and clinical trials development and documentation.</li> <li>2. Able to understand concepts in the design of clinical trials.</li> </ol>
Course Syllabus	<p><b>Introduction:</b> Overview of drug development process, Stages from discovery to market approval, preclinical versus clinical trials, Regulatory agencies and guidelines, Role of Central Drug Standard Control Organization, European Medicines Agency, Indian Pharmaceutical Association, and Food and Drug Administration.</p> <p><b>Preclinical trial design:</b> Non-clinical testing fundamentals- importance and types (in vitro, in vivo, ex vivo). Preclinical models, selection criteria, model types and relevance to human conditions. Safety and toxicity testing-adverse effects and dose determination.</p> <p><b>Clinical trial phases and design:</b> Real-world evidence, Early feasibility studies, Patient preference, Phases-I (safety), II (efficacy), III (confirmatory), and IV (post-marketing), trial design-randomized controlled trials, cohort studies, case-control studies, cross-sectional studies. Endpoints and outcomes-primary and secondary endpoints, surrogate markers. Sample size calculation-statistical consideration and power analysis.</p>

	<b>Clinical trial reporting and post-trial considerations:</b> Consolidated Standards of Reporting Trials guidelines, and ethics in reporting results. Post-trial considerations, long-term follow-up, and post-marketing surveillance.
Suggested Books	<p><b>Text books:</b></p> <ol style="list-style-type: none"> <li>1. L. Friedman, C. Furberg, D. DeMets, D. Reboussin and C. Granger, <b>Fundamentals of Clinical Trials</b>, 5th edition, Springer, 2015. ISBN: 9783319307732.</li> <li>2. J. Cook, <b>An Introduction to Clinical Trials</b>, 1st edition, Oxford University Press, 2023. ISBN: 9780198885238.</li> <li>3. D. Machin, S. Day, and S. Green, <b>Textbook of Clinical Trials</b>, 2nd edition, Wiley, 2010. ISBN: 9788126524945.</li> </ol> <p><b>Reference Book:</b></p> <ol style="list-style-type: none"> <li>4. D. Machin, P. Fayers and BC Tai, <b>Randomized Clinical Trials: Design, Practice and Reporting</b>, 1st edition, Wiley-Blackwell, 2021. ISBN: 9781119524649.</li> </ol>



Course Code	<b>BSE 443 / BSE 443</b>
Title of the Course	Applied Biomechanics
Course Category	Elective
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department	Biosciences and Biomedical Engineering
Pre-requisite, if any	Nil
Course Objective	This course will describe biomechanics of human body including the study of human motion and design of assistive biomedical devices for rehabilitation and augmentation.
Course Outcomes	<ul style="list-style-type: none"> <li>● Students will know tissue mechanics and measurement techniques for tissue physical properties.</li> <li>● Learn about different types of human movement.</li> <li>● Learn about design principles for prosthetics, assistive and rehabilitation devices.</li> </ul>
Course Syllabus	<p><b>Tissue mechanics:</b> Electrochemical signaling and excitation contraction in different cells; Components of convective tissue; Structure, functions and mechanical properties of different tissue types; Mathematical models of tissue structure and properties; Measurement methods for tissue mechanical properties.</p> <p><b>Human body motion:</b> Neuromusculoskeletal system; Interactions between nerves, muscles and the skeleton; Muscles coordination; Vision-motion coordination; Kinematics and musculature; Forces, torques, and equilibrium, motion in one plane and levers in 2D and 3D for human body joints; Defining body orientation; Mechanics of different human motions; Acceleration and collisions of the human body; Motion capture and gait analysis systems; Vision tracking systems; Wearable motion analysis systems.</p> <p><b>Prosthesis design:</b> Principles of prosthesis and exoskeleton design; Bar and links mechanisms; Compliant mechanisms; Sensors and actuators in assistive devices; Computer aided analysis of artificial joints and limbs; Mathematical modeling of artificial joints and limbs motion; Modeling of multi-joint systems and system chains – forward and inverse kinematics; Feedback control design in prosthesis.</p>
Suggested Books	<p><b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. David A Winter, <b>Biomechanics and motor control of human movement</b>. John Wiley &amp; Sons, 2009. [ISBN - 9780470398180]</li> <li>2. Susan J. Hall, <b>Basic Biomechanics</b>, 9th Edition, McGraw Hill, 2022 [ISBN13: 9781264169665]</li> </ol>

3. William Craelius, **Prosthetic Designs for Restoring Human Limb Function**, 2022, Springer Cham [ISBN: 9783030310769]

**Reference Books:**

4. Irving P. Herman, **Physics of the Human Body**, Springer Cham, 2<sup>nd</sup> Edition, 2016. [ISBN: 9783319239309]



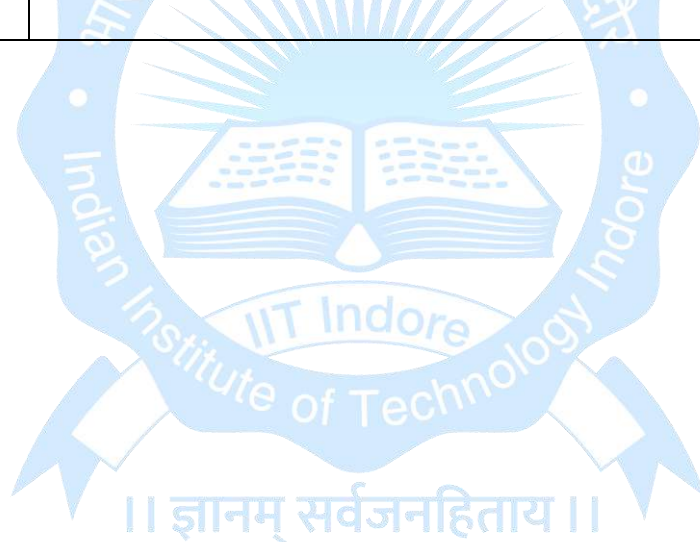
<b>Course code</b>	<b>BSE 444/ BSE 644</b>
<b>Title of the course</b>	<b>Biomedical Signal and Image Processing</b>
Course Category	Elective
Credit Structure	L - T - P - Credits 2-1-0-3
Name of the Concerned Department	Bioscience and Biomedical Engineering
Prerequisite, if any	None
Course Objectives	<ul style="list-style-type: none"> <li>• This course is designed to cover digital signal and image processing techniques, with a focus on problems associated with biomedical engineering.</li> <li>• It covers the implementation of signal and image processing algorithms and offers a hands-on learning experience.</li> </ul>
Course Outcomes	<ul style="list-style-type: none"> <li>• It provides a strong foundation for those interested in pursuing careers in biomedical signal and image processing.</li> <li>• Students will be able to choose and implement signal and image processing algorithms for processing biomedical data.</li> </ul>
Course Content	<p>Introduction to Probability Density Functions (PDFs) and their estimation in biomedical signals and images. Correlation and coherence analysis. Frequentist and Bayesian statistics for biomedical signal and image data.</p> <p>Deterministic and random signals in human electrophysiology. Theory and application of convolution, Fourier analysis in biomedical signals. Estimation of signal properties in the time domain and artifact identification in EEG, EMG, and ECG.</p> <p>Common medical image compression, segmentation, and registration techniques. Standard biomedical signal and image features and their analysis.</p> <p>Discussion of image enhancement techniques, filtering methods, and morphological operations in the context of medical images. 2D Discrete Fourier analysis and filtering techniques for the medical images.</p> <p>Medical image formation. Common medical imaging artifacts. Design of filters, spectral and time-frequency analysis of human physiological signals.</p>
Suggested Books	<p><b>Text Books:</b></p> <p>1) AV Oppenheim and RW Shafer, "Discrete-time Signal Processing", Pearson Education India, 3rd ed, 2014. ISBN</p>

978-9332535039.

- 2) N Kayvan and S Robert, "Biomedical Signal and Image Processing", Taylor & Francis, CRC Press, 2012. ISBN 978-1439870334
- 3) D C Reddy, "Biomedical Signal Processing: Principles and Techniques", Tata McGraw-Hill Publishing Co. Ltd, 2005. ISBN 978-0070583887.

**Reference Books:**

- 4) R.B. Pachori, "Time-frequency analysis techniques and their applications", CRC Press, 2023, ISBN: 9781032392974.
- 5) Richard Newbold, "Practical Applications in Digital Signal Processing", Prentice Hall, 2012. ISBN 978-0133038385.
- 6) RC Gonzalez and RE Woods, "Digital Image Processing", Pearson India Ltd, 2011. ISBN 978-9353062989



Course Code	<b>BSE 649/449</b>
Title of the Course	<b>Modeling and Controls in Medical Devices</b>
Course Category	<b>Core</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department	Biosciences and Biomedical Engineering
Pre-requisite, if any	Nil
Course Objective	<ul style="list-style-type: none"> <li>● Covers principles and concepts of control systems and estimation theory for biomedical systems and devices.</li> <li>● Providing relevant biomedical applications of the control systems and estimation techniques.</li> </ul>
Course outcomes	<ol style="list-style-type: none"> <li>1. An in-depth understanding of control systems relevant to medical devices.</li> <li>2. Understand the principles and concepts of control systems for modeling and estimation applicable to biomedical devices.</li> </ol>
Course Syllabus	<p><b>Basic concepts of statistical decision theory:</b> models and detector structures; performance evaluation; Chernoff bounds and large deviations; sequential detection, quickest change detection, robust detection. Applications in noninvasive diagnosis, parameter estimation.</p> <p><b>Filters:</b> Linear minimum variance filter and properties, processing and estimation of movements from noisy sensor recording, sensor fusion.</p> <p><b>Control Fundamentals</b></p> <ul style="list-style-type: none"> <li>● Mathematical modeling of Electrical/Mechanical systems, Force-Velocity, Force-Current analogy. Block diagram, signal flow graph. Laplace transformation.</li> <li>● Transient response; transient performance specifications Steady-state errors; final value theorem; system type; steady-state performance specifications.</li> <li>● Root locus analysis and stability; closed-loop root locations and transient performance.</li> <li>● Frequency response analysis methods; frequency response performance specifications</li> </ul>

	<ul style="list-style-type: none"> <li>● Feedback control techniques: Proportional, Integral, Derivative, Proportional-Integral, Proportional- Derivative, Proportional-Integral-Derivative control</li> </ul> <p><b>Case study:</b> Control of mechanical ventilator.</p>
Suggested Books	<p><b>Text Books:</b></p> <ol style="list-style-type: none"> <li>1. K. Ogata, <b>Modern Control Engineering</b>, 5<sup>th</sup> edition. Pearson, 2015, ISBN: 9789332550162.</li> <li>2. O. Boubakar, <b>Control Theory in Biomedical Engineering Application in Physiology and Medical Robotics</b>. 1<sup>st</sup> edition, Academic Press. 2020. ISBN: 9780128213506.</li> </ol> <p><b>Reference Book:</b></p> <ol style="list-style-type: none"> <li>3. J. S. Bendat and A. G. Pearsol, <b>Random Data - Analysis and Measurement Procedures</b>. 4<sup>th</sup> edition, Wiley, 2010, ISBN: 978-0470248775.</li> </ol>



**Syllabi of Courses**  
**of**  
**Minor Program in Chemistry**  
**(from AY 2014-15)**

Course Code	<b>CH 201</b>
Title of the Course	<b>Molecules that Change the World</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Department	Chemistry
Pre-requisite, if any	Nil
Scope of the Course	The purpose of this course is to describe the molecules have had a dramatic impact on society in sustenance and maintenance of life on planet earth. This course will expound our knowledge of Nature's most intriguing molecules and man's ability to discover, modify and use them to our advantage that was not formerly envisioned. The lectures will touch upon fascinating tales about molecules and their presence in, among many items, foods, perfumes, dyes, textiles, vitamins, nutritional supplements, pesticides, insecticides, and above all, medicines.
Course Syllabus	Introduction, Atomic theory and total Synthesis; Importance of the life saving molecules, mode of action and their applications-Urea, Acetic acid, Glucose, Aspirin, Camphor, Tropinone, Haemin, Morphine, Steroids, Strychnine, Pencillin, Longifolene, Prostaglandins, Vitamin B12, Erythronolide B and A, Monensin, Avermectin, Amphotericin, Ginkgolide, Cyclosporin, FK 506, and Rapamycin, Calcheamicin, Palytoxin, Taxol, Mevacor, Zaragozic Acid, and the CP Molecules, Brevetoxin B, Ecteinascidin 743, Epothilones, Resiniferatoxin, Vancomycin, Quinine and Thiostrepton.
Suggested Books	<b>Text Books</b> 1. K. C. Nicolau, T. Montagnon, <b>Molecules that Changed the World, 2008</b> , ISBN: 978-3-527-30983-2. <b>References</b> 1. Online Journals: <a href="http://www.pubs.acs.org">http://www.pubs.acs.org</a> ; <a href="http://www.rsc.org">www.rsc.org</a> ; <a href="http://www.elsevier.com">http://www.elsevier.com</a> , <a href="http://onlinelibrary.wiley.com/journal">http://onlinelibrary.wiley.com/journal</a>

Course Code	<b>CH 202</b>
Title of the Course	<b>Applications of Transition Metals and Lanthanides</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Department	Chemistry
Pre-requisite, if any	Nil
Scope of the Course	This course provides basic knowledge of various topics in inorganic chemistry, particularly related to coordination chemistry of transition metals and lanthanides.
Course Syllabus	<p><b>Properties of Transition Metals and Lanthanides</b> General properties of Transition metals, magnetic behaviour, L-S and J-J coupling. General properties of lanthanide elements, Lanthanide contraction. Occurrence and principles of separation of lanthanides.</p> <p><b>Applications of Transition Metals and Lanthanides</b> Properties of Transition metals and Lanthanides, generation of new age materials, metal-organic frameworks (MOF), application in gas storage, gas separation, sensors, catalysis, magnetism and drug delivery.</p>
Suggested Books	<p><b>Text Books</b></p> <p>1) D. F. Shriver, P. W. Atkins, <b>Inorganic Chemistry</b>, Oxford University Press, <b>2006</b>, ISBN 978-0-199-23617-6.</p> <p>2) L. R. MacGillivray, <b>Metal-Organic Frameworks: Design and Applications</b>, John Wiley &amp; Sons, <b>2010</b>, ISBN 978-0-470-19556-7.</p> <p>3) D. Farrusseng, <b>Metal-Organic Frameworks: Applications from Catalysis to Gas Storage</b>, Wiley-VCH, <b>2011</b>, ISBN 978-3-527-32870-3.</p> <p>4) A. G. Sharp, <b>Inorganic Chemistry</b>, 3<sup>rd</sup> Edition,</p>

Pearson Education Ltd., 2009, ISBN 978-81-317-0699-0.

**Reference Book**

1) M. Schröder, **Functional Metal-Organic Frameworks: Gas Storage, Separation and Catalysis**, Springer, 2010, ISBN 978-3-642-14612-1.



Course Code	<b>CH 301</b>
Title of the Course	<b>Functional Materials</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Department	Chemistry
Pre-requisite, if any	Nil
Scope of the Course	The development of functional materials for various applications has been a key focus area. Specially, with the development of materials in the nanometer level, the application of materials for various applications have increased manifold. This course will give the basics of synthesis and design of the functional materials from chemistry point of view.
Course Syllabus	Introduction of chemical functionalities at the molecular level. Relevant chemical reactions. Basic concepts of surface and colloid chemistry emphasizing the physical and chemical aspects of surfaces important for applications in colloids, catalysis, microelectronics and biocompatibility, surfactants and micelles, self-assembled monolayers, synthesis and properties of metallic, semiconducting and magnetic nanoparticles. carbon nanoparticles: graphene oxide and carbon nanotubes, applications in environmental studies, water purification, catalytic converter, solar cell materials, Liquid crystals, conducting polymers, nanomaterials as contrast agents for biomedical applications, sensor applications. Molecular nanomachines. Basics of Instrumentation techniques: electron microscopy, force microscopy and X-ray diffraction, Inorganic porous materials and metal-organic frameworks.
Suggested Books	<p><b>Text Books</b></p> <p>1. T. Pradeep, <b>Nano: The Essentials</b>, Tata McGraw-Hill New Delhi, <b>2007</b>, ISBN: 978-0-07-061788-9.</p> <p>2. G. A. Ozin, A. C. Arsenault, L. Cademartiri, <b>Nanochemistry A Chemical Approach to Nanomaterials</b>, RSC Publishing, <b>2009</b>, ISBN: 978-1-84755-895-4.</p> <p><b>References</b></p> <p>1. Online Journals: <a href="http://www.pubs.acs.org">http://www.pubs.acs.org</a>; <a href="http://www.rsc.org">www.rsc.org</a>; <a href="http://www.elsevier.com">http://www.elsevier.com</a>, <a href="http://onlinelibrary.wiley.com/journal">http://onlinelibrary.wiley.com/journal</a></p>

Course Code	<b>CH 402</b>
Title of the Course	<b>Chemistry in Industry</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Department	Chemistry
Pre-requisite, if any	Nil
Scope of the Course	Industrial Chemistry is the branch of chemistry which studies physical and chemical processes applied for the transformation of raw materials into products that are of benefit to mankind. The goal of this undergraduate course is to equip students with high skills and knowledge in those industrial subjects which link engineering, chemical processing, economics and industrial management.
Course Syllabus	<p>1. <b>Fuels: Solid, Liquid and Gaseous fuels</b></p> <p>(a) <b>Solid:</b> Origin of coal, analysis of coal, high and low temperature carbonization of coal</p> <p>(b) <b>Liquid:</b> Petroleum and petrochemicals: petroleum hydrocarbons-classification. Chemicals structure, crude oil, naptha, kerosene, diesel, lube oil, separation of crude oil, (distillation-atmospheric and vacuum), cracking, octane number, cetane number, flash point.</p> <p>(c) <b>Gaseous:</b> Natural gas, LPG, coal gas, producer gas, water gas.</p> <p>2. <b>Some important industrial products (manufacture and application):</b></p> <p>(a) <b>Polymers:</b> PVC, polyethylene, bakelite, nylon-66, terylene, natural rubber, buna and neoprene rubber, vulcanization of rubber.</p> <p>(b) <b>Detergents:</b> Dodecylbenzene sulphonates etc</p> <p>(c) <b>Pesticides:</b> DDT, BHC etc</p> <p>(d) <b>Dyes and Pigments:</b> Methyl orange, phenolphthalein, mercurochrome, ultramarine, zinc-white, litho phone, carbon black etc</p> <p>(e) <b>Fertilizers:</b> Superphosphate of lime, urea, ammonium sulphate etc</p> <p>(f) <b>Ceramics:</b> Glass</p> <p>(g) <b>Cement</b></p> <p>3. <b>Oils, fats, and waxes:</b> Types oil, fat and waxes, analysis of oils, saponification, recovery of glycerin, hydrogenation of oils, determination of adulteration in edible oils.</p>
Suggested Books	<p><b>Text Books</b></p> <p>1. <b>Davis &amp; Berner Handbook of Industrial Chemistry, Vol. 1</b>, CBS Publishers, New Delhi, <b>2004</b>, ISBN: <a href="#">9788123910567</a>.</p> <p>2. M. Ali, Bassam Ali, <a href="#">Handbook of Industrial Chemistry: Organic Chemicals, McGraw-Hill Handbooks</a>, 1<sup>st</sup> Edition, 2004, ISBN: 978-0071410373</p>

3. **Reigel Handbook of Industrial Chemistry and Biotechnology**, 11<sup>th</sup> Edition, Springer Verlag, Editor, J. A. Kent, **2007**, ISBN: 9780387278421
4. George T. Austin, **Shreve's Chemical Process Industries**, 5<sup>th</sup> Edition, McGraw-Hill International, Singapore, **1984**.

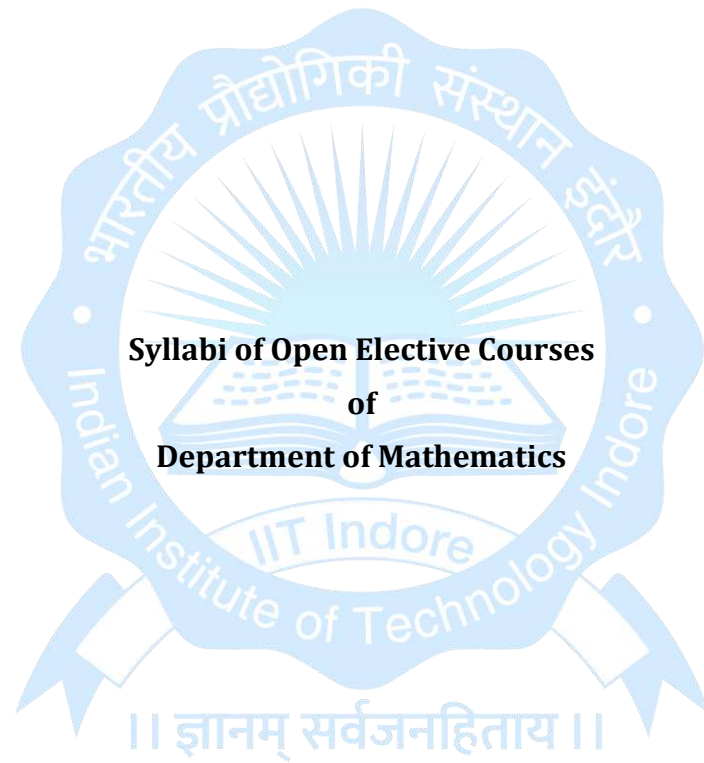
**References**

Online Journals: <http://www.pubs.acs.org>; [www.rsc.org](http://www.rsc.org);  
<http://www.elsevier.com>, <http://onlinelibrary.wiley.com/journal>



Course Code	<b>CH 404</b>
Title of the Course	<b>Chemical Physics</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Department	Chemistry
Pre-requisite, if any	Nil
Scope of the Course	The goal of this course is to understand chemical structures and reactions from the first principles, specifically in looking for answers to questions such as: How do chemical reactions really take place? Can we understand chemical reactions from first principles? What is the step-by-step process that occurs during solvation?
Course Syllabus	Probing the structure and dynamics of: ions, molecules/bio-molecules, clusters, free radicals, nanoparticles. Understanding: intermolecular forces, hydrogen bonding, electron transfer, intra/inter molecular charge transfer, multipole moments, concept of polarizability, basic idea on polarity of a solvent, the formation and dissolution of chemical bonds, the basic idea on transition state theory, thermodynamics aspect of transition state theory, basic idea of diffusion and its applications, thermodynamic view of diffusion, molecular collisions.
Suggested Books	<p><b>Text Books</b></p> <ol style="list-style-type: none"> <li>1. J. L. McHale, <b>Molecular Spectroscopy</b>, 1<sup>st</sup> Edn., Prentice-Hall, Inc: New Jersey, <b>1999</b>, ISBN: 978-0132290630</li> <li>2. M. R. Wright, <b>Fundamental Chemical Kinetics</b>, Harwood Publishing, <b>1999</b>, ISBN: 978-1898563600</li> <li>3. D. A. McQuarrie, J. D. Simons, <b>Physical Chemistry</b> 1st Edn., Viva Books Private Limited, New Delhi, <b>1998</b>, ISBN 0935702997</li> </ol> <p><b>Reference Books</b></p> <ol style="list-style-type: none"> <li>1. K. J. Laidler, <b>Chemical Kinetics</b>, TMH Publishing Company Limited, <b>1988</b>, ISBN 9788131709726</li> <li>2. D. Chandler, <b>Introduction to Modern Statistical Mechanics</b>, Oxford University Press <b>1987</b>, ISBN 0195042778</li> <li>3. C. N. Banwell, E. M. McCash, <b>Fundamentals of Molecular Spectroscopy</b>, 4<sup>th</sup> Edn., Tata McGraw-Hill Publishing Company Ltd., New Delhi, <b>1994</b>, ISBN: 978-007-128-221-5</li> </ol>

Course Code	<b>CH 406</b>
Title of the Course	<b>Nuclear Science</b>
Credit Structure	L-T-P-Credit 2-1-0-3
Name of the Department	Nuclear Chemistry
Pre-requisite, if any	Nil
Scope of the Course	This course provides basic knowledge of radiochemistry, nuclear structure, nuclear forces and applications
Course Syllabus	<p><b>Nuclear Properties:</b> Nuclear Mass, terminology, binding energy per nucleon, nuclear size and shape</p> <p><b>Radioactive decay:</b> Decay equation, decay equilibrium, branching decay, natural radioactivity, dating</p> <p><b>Radiotracers:</b> Different mode of synthesis, applications, Isotope dilution analysis</p> <p><b>Nuclear force and nuclear structure</b></p> <p><b>Nuclear reactions:</b> Energetic, reaction type; Nuclear fission and fusion.</p>
Suggested Books	<p><b>Text Books</b></p> <ol style="list-style-type: none"> <li>1. W. Loveland, D. J. Morrissey and G. T. Seaborg, <b>Modern Nuclear Chemistry</b>, John Wiley &amp; Sons, <b>2006</b>, ISBN 13 978-0-471-11532-8</li> <li>2. G. R. Choppin, J. Rydberg, J-O, Liljenzin and C. Ekberg, <b>Radiochemistry &amp; Nuclear Chemistry</b>, 4<sup>th</sup> Edn., Elsevier, ISBN 978-0-12-405897-2</li> <li>3. J. V. Kratz, K. H. Leiser, <b>Nuclear and Radiochemistry Fundamentals and Applications</b>, <b>2013</b>, Wiley-VCH, ISBN 978-3-527-32901-4</li> </ol>



Course code	<b>MA 405/ MA 605</b>
Title of the course	<b>Differential Equations in Population Dynamics</b>
Credit Structure	L-T-P-Credits 2-0-2-3
Name of the Concerned Department/ Centre	Mathematics
Prerequisite, if any	Differential Equations and Numerical Methods
Scope of the course	The objective of the course is to present differential equation models arising in population dynamics, physical, mechanical and chemical systems, etc. The course will give an opportunity to apply several mathematical theories, methodologies and computational techniques of differential equations in the aforementioned areas. Current research advances in the field of modelling will also be discussed. After completing the course, students are expected to start research work in advanced topics.
Course Syllabus	<p><b>Introduction:</b> Mathematical models: Necessity, advantages and limitations; Brief history of population models, Different tools and modeling frameworks, Birth and death processes in population models.</p> <p><b>Ordinary differential equations:</b> The Malthus, Verhulst, Lotka-Volterra, Rosenzweig-MacArthur and Hestings-Powell models, Routh-Hurwitz criteria, Mean population density in cyclic and chaotic dynamics, Population harvesting, Resilience in Ecology, Hydra effects, Population genetic models, FitzHugh-Nagumo model.</p> <p><b>Partial differential equations:</b> Fisher equation, Turing instability, Pattern formation, Spatiotemporal chaos, Reaction-diffusion in Ecological and Chemical systems, Diffusion in delayed predator-prey systems.</p> <p><b>Delay differential equations:</b> Discrete and distributed delays in population dynamics, Hopf bifurcation and stability switching, Delayed harvesting in Nicholson blowflies model, Delayed dispersal in patchy environment, Mackey-Glass equation.</p> <p><b>Impulsive differential equations:</b> Fixed-time and variable-time impulses, Impulses in biological control theory and epidemic models.</p> <p><b>Applications of softwares:</b> Several measures will be quantified in all the models using computer simulations, and graphical representations will be provided to interpret the system dynamics.</p>

Suggested Books

1. J. D. Murray, **Mathematical Biology: I. An Introduction**, Springer, 2002: ISBN 978-0-387-95223-9.
2. R. K. Upadhyay, S. R. K. Iyengar, **Spatial Dynamics and Pattern Formation in Biological Populations**, Chapman and Hall/CRC, 2021: ISBN 9780367555504.
3. K. Gopalsamy, **Stability and Oscillations in Delay Differential Equations of Population Dynamics**, Springer, 1992: ISBN 978-0-7923-1594-0.
4. V. Lakshmikantham, D. D. Bainov, P. S. Simeonov, **Theory of Impulsive Differential Equations**, World scientific, 1989: ISBN 978-9971-5-0970-5.



<b>Course code</b>	<b>MA 450/ MA 650</b>
<b>Title of the course</b>	<b>Mathematical Theory of Waves</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department	Mathematics
Pre-requisite, if any	Multivariable Calculus, Differential Equations
Scope of the course	To expose the students to the basic ideas that underline linear wave motion. To derive important mathematical tools to deal with problems of wave theory. To consider simple examples of linear waves on strings, sound waves and water waves. To develop the mathematical models of waves and to ultimately apply those models to understand the elastic waves, sound waves and light waves.
Course Syllabus	<ul style="list-style-type: none"> <li>• Introduction to waves and Review of the wave equation;</li> <li>• Traveling and standing waves; Waves on strings; Waves in membranes; Longitudinal waves in bars and springs; Waves in liquids; Sound waves: Plane, cylindrical and spherical sound waves; Waves associated with the conservation laws; Electric waves;</li> <li>• General considerations on waves: Doppler effect, beats, amplitude modulation, group velocity, motion of wave packets, dispersion, Kirchhoff's solution, Fresnel's principal, Fraunhofer diffraction theory; Wave propagation in an inhomogeneous media;</li> <li>• Characteristics of nonlinear waves: general effect of nonlinearity, wave-fronts bounding a constant state, Riemann invariants, Piston problem, Discontinuous solutions and shock waves, Wave localization phenomena.</li> <li>• <b>Free vibration, forced harmonic vibration and resonance.</b></li> <li>• Some special waves: Seismic waves, Traffic waves, Water waves.</li> </ul>
Suggested Books	<ol style="list-style-type: none"> <li>1. R. Knobel, <i>An Introduction to the Mathematical Theory of Waves</i>, American Mathematical Society, 2000, ISBN: 0-8218-2039-7.</li> <li>2. C.A. Coulson and Alan Jeffrey, <i>Waves: A mathematical approach to the common types of wave motion</i>, Longman Group Limited, London, 1977, ISBN: 0-582-44954-5</li> <li>3. G.B. Whitham, <i>Linear and Nonlinear Waves</i>, Pure and Applied Mathematics, Wiley, 1999, ISBN: 0-471-35942.</li> <li>4. Sir J. Lighthill, <i>Waves in Fluids</i>, Cambridge Mathematical Library, CUP, 2001, ISBN: 0-521-01045.</li> <li>5. J. Billingham &amp; A.C. King, <i>Wave Motion</i>, Cambridge Texts in Applied Mathematics, CUP, 2001, ISBN: 0-521-634504</li> </ol>

Course code	MA 452/ MA 652
Title of the course	Theory of Transforms
Credit Structure	L - T - P - Credits 2-1-0-3
Name of the Concerned Department	Mathematics
Pre-requisite, if any	Calculus, Complex Variable, Differential Equations
Scope of the course	This course provides a working knowledge of analytical methods required in pure and applied mathematics, physics and engineering. It also gives a systematic exposition of the basic properties of various integral transforms and their applications to the solution of initial and boundary value problems in mathematical physics, engineering, and applied mathematics.
Course Syllabus	<p>Fourier Series, Riemann-Lebesgue Lemma, Gibbs Phenomenon, Fourier Sine and Cosine Series, Fourier Transform, Fourier Integral Theorem, Convolution and Parseval's Theorem, Applications to Partial Differential Equations.</p> <p>Laplace Transform: definition and properties, Complex Inversion, Convolution Theorem, Heaviside's Expansion Theorem, Bromwich Contour Integral, Applications to Initial and Boundary Value Problems.</p> <p>Fundamental Theorem of the Discrete Fourier Transform, Cyclical Convolution, and Parseval's Theorem. Z Transform: definition and examples, Basic Operational Properties of Z Transforms, Inverse</p> <p>Z Transform and Examples, Applications of Z Transforms to Finite Difference Equations and Summation of Infinite Series.</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. L. Debnath, D. Bhatta, <b><i>Integral transforms and their applications</i></b>, Chapman &amp; Hall/CRC, New York, 2006, 1584885750</li> <li>2. R. J. Beerends, H. G. ter Morsche, J. C. van den Berg, E. M. van de Vrie, <b><i>Fourier and Laplace Transforms</i></b>, Cambridge University Press, New York, 2003, 0521534410</li> <li>3. A. Pinkus, S. Zafrany, <b><i>Fourier Series and Integral Transforms</i></b>, Cambridge University Press, New York, 1997, 0521597714</li> <li>4. U. Graf, <b><i>Applied Laplace Transforms and Z-Transforms for Scientists and Engineers</i></b>, Birkhauser Verlag, Basel, Switzerland, 2004 : 3034895933</li> </ol>

<b>Course code</b>	<b>MA 454/ MA 654</b>
<b>Title of the course</b>	<b>Mathematical Modeling and Simulations</b>
Credit Structure	L - T - P - Credits 2-1-0-3
Name of the Concerned Department	Mathematics
Pre-requisite, if any	Differential Equations, Linear Algebra
Scope of the course	The Mathematical model plays a significant role providing a quantitative framework for understanding and solving many real-life problems under certain conditions. Most of the mathematical models have been like individual works of art that reflected the personal characteristics and scientific views of the modeler. At the end of the course, students should be exposed to fundamental knowledge of implementing the models in real-world situations. They will get the bright idea about constructing or selecting the appropriate model, identify the problem, Analytically or numerically computing the solution and test the validity of models. This course provides an introduction to modeling through in-depth discussion of a series of real examples.
Course Syllabus	<p><b>Introduction to Mathematical Modeling:</b> Characteristics, Classifications, Tools, Techniques, Deterministic and stochastic models, Modeling approaches, Compartmental models, Introduction to Discrete Models and Continuous Models, Dynamical systems and its mathematical models.</p> <p><b>Models from systems of natural sciences:</b> Population models for a single species (discrete and continuous-time models), Modeling of population dynamics of two interacting species, Analytical Tool: Kolmogorov Theorem, Linear Stability Analysis, Lotka-Volterra Model, Variation of the Classical LV Model, Leslie-Gower Model, Prey-Predator Model, Arms Race Model, Holling-Tanner Model, Modified HT Model, Applications of Lyapunov functions.</p> <p><b>Modeling of Atmospheric, Mining and Engineering systems:</b> Spatial Models Using Partial Differential Equations, Modeling with Stochastic Differential Equations, Models of Heating and Cooling, Models for traffic flow, Model for detecting land mines, Models in Mechanical Systems, Models in Electronic systems, Models for vehicle dynamics, Kicked Harmonic oscillator, Modeling the ventilation system of a mine.</p>

	MATLAB/MATHEMATICA programs to study the dynamics of the developed model systems.
Suggested Books	<ol style="list-style-type: none"> <li>1. B. Barnes, G. R. Fulford, <b>Mathematical Modeling with Case Studies</b>, CRC PRESS, Taylor &amp; Francis, London, New York, 2009, 13, 978-1-4200-8348-4</li> <li>2. Edward A. Bender, <b>An Introduction to Mathematical Modeling</b>: John Wiley &amp; Sons, United States of America, 1978, 0-471-02951-3</li> <li>3. R. K. Upadhyay, S. R. K. Iyengar, <b>Introduction to Mathematical Modeling and Chaotic Dynamics</b>, CRC Press Taylor &amp; Francis, London, New York, 2014, 13: 978-1-4398-9887-1</li> <li>4. S. Banerjee, <b>Mathematical Modeling</b>, Models, Analysis and Applications, CRC Press, Taylor &amp; Francis, London, New York, 2014, 13: 978-1-4822-2916-5</li> </ol>



Course Code	<b>MA 456/ MA 656</b>
Title of the Course	<b>Stochastic Approximation</b>
Course Category	Elective
Credit Structure	L-T- P-Credits 2-1-0-3
Name of the Concerned Department	Mathematics
Pre-requisite, if any	Theoretical knowledge of probability
Scope of the course (Objectives)	This course provides basic tools and techniques for studying Stochastic Algorithms and their convergence analysis
Course Outcomes	The student is able to use iterative method to find the approximate zeros of class of function whose numerical value is not directly available. The student will expose to theoretical convergence analysis of recursive stochastic algorithms.
Course Content	<ul style="list-style-type: none"> <li>• Introduction to stochastic approximation.</li> <li>• Conditional Expectation, Independence, Filtration, Martingales, Doob's Maximal inequality, Martingale convergence theorem, Burkholder-Davis-Gundy Inequality.</li> <li>• Robbin-Monro method, Kiefer-Wolfowitz method, Robbins-Siegmund Lemma, stochastic gradient method, the ordinary differential equation method, rate of convergence, asynchronous schemes</li> </ul>

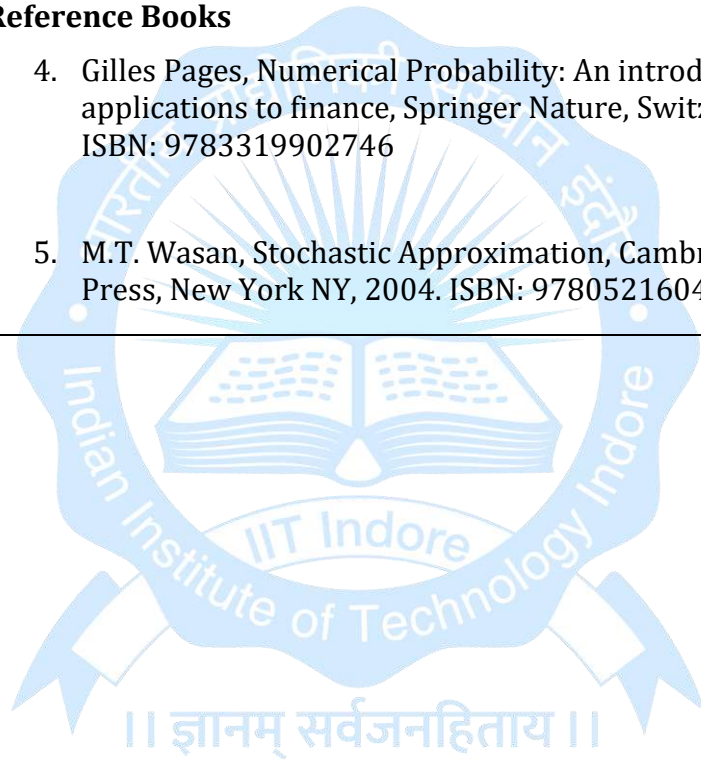
Suggested Books

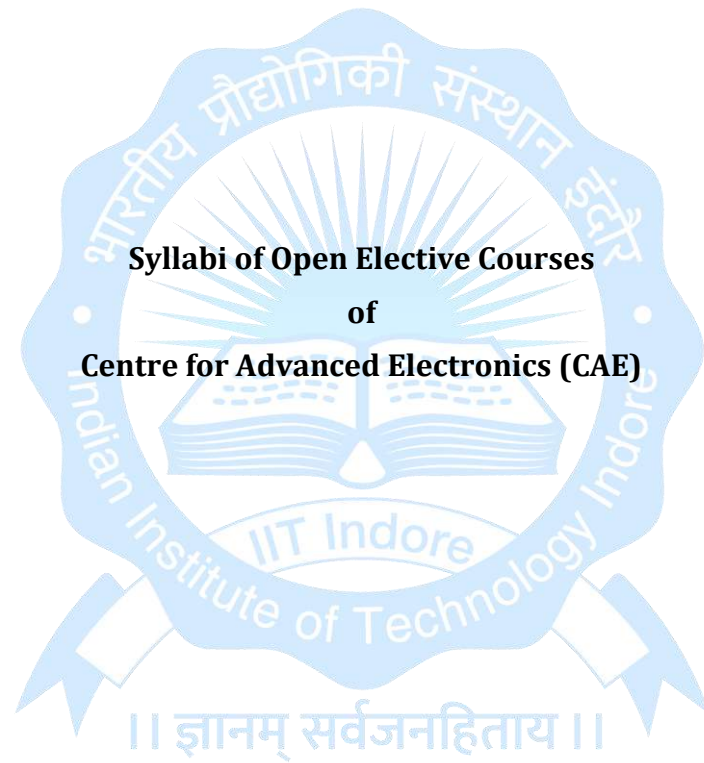
**Text Books:**

1. R. L. Karandikar, B.V. Rao, Introduction to Stochastic Calculus, Springer Nature Singapore, 2018. ISBN: 978981108318
2. H. J. Kushner, G.G. Yin, Stochastic Approximation and Recursive Algorithms and Applications, Springer, New York NY, 2011. ISBN: 9780387891194
3. Vivek S. Borkar, Stochastic Approximation: A dynamical systems viewpoint, Springer, Singapore, 2023. ISBN: 9789819982769

**Reference Books**

4. Gilles Pages, Numerical Probability: An introduction with applications to finance, Springer Nature, Switzerland, 2018. ISBN: 9783319902746
5. M.T. Wasan, Stochastic Approximation, Cambridge University Press, New York NY, 2004. ISBN: 9780521604857





**Syllabi of Open Elective Courses  
of  
Centre for Advanced Electronics (CAE)**

Course code	<b>CAE 601/ CAE 401</b>
Title of the course	Advanced Microwave & Optical Devices
Credit Structure	L - T - P - Credits 2-1-0-3
Name of the Concerned Department	Centre for Advanced Electronics
Pre-requisite, if any	Not Applicable
Scope of the course	This course is designed for the UG and PG students with the background in Electronics, Electrical Engineering, Physics and Material Science. This course will emphasize on the fundamentals of microwave and optical devices and their multidisciplinary applications. The course aims to explain basics, advances and technology of high frequency devices & components.
Course Syllabus	<p><b>Introduction to Microwave Engineering &amp; Photonics:</b> Elements of electromagnetic field theory; Wave propagation in microwave and optical waveguides.</p> <p><b>Microwave and High Frequency Devices:</b> Microwave waveguides &amp; components; Tunnel diode, High frequency transistors – HBTs, HEMTs; Charge coupled devices. Transferred electron devices, Avalanche transit time devices; Microwave generation; Monolithic microwave integrated circuits.</p> <p><b>Advanced Optical Devices:</b> Advanced optical waveguides and cavities, LIDAR, semiconductor optoelectronics, Optical switches, Cavity opto-mechanics.</p> <p><b>Elements of Microwave Photonics:</b> Microwave photonic links, Radio over fibre; Photonic generation of microwave signals.</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. Microwave devices and circuits, S. Y. Liao, Pearson, ISBN No. 8177583530</li> <li>2. Chuang, Physics of Optoelectronic Devices, Wiley (2008), ISBN 9780470293195</li> <li>3. Solid state electronic devices, by Bannerjee &amp; Streetman, Prentice Hall, ISBN: 9789332555082</li> <li>4. Microwave photonics, Jianping Yao, Wiley, ISBN: 9780470905371</li> </ol>

The logo of the Indian Institute of Technology Indore is a circular emblem with a scalloped border. It features a central sunburst above an open book. The text "भारतीय प्रौद्योगिकी संस्थान इन्दौर" is written in Hindi along the top inner edge, and "Indian Institute of Technology Indore" is written in English along the bottom inner edge. Below the emblem, the motto "॥ ज्ञानम् सर्वजनहिताय ॥" is inscribed.

**Syllabi of Courses  
of  
Center for Electric Vehicles and Intelligent Transport Systems (CEVITS)**

<b>Course code</b>	<b>EV 401/ EV 601</b>
<b>Title of the course</b>	<b>Vehicle Dynamics</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department	Mechanical Engineering
Pre-requisite, if any	NA
Scope of the course	This course is designed for students from diverse engineering fields of study. This course shall cover fundamental approaches for vehicle dynamics modelling as well as study of important dynamic systems of the automotive systems including vehicle handling performance.
Course Syllabus	<p><b>Mechanisms, kinematics and balancing:</b> Introduction.</p> <p><b>Introduction to vehicle dynamics:</b> History of motor vehicle age; Fundamental approach for modelling; lumped mass, vehicle and earth fixed coordinate systems; and Dynamic axle loads.</p> <p><b>Acceleration and braking analysis:</b> Characteristics of conventional vehicle engines; Power train and different elements in it; Automatic transmissions; Selection of gear ratios; and Traction-limited acceleration. Basic equations; Braking forces; Tire-road friction; Requirement for braking performance; Brake proportioning; Anti-lock brake systems; Braking efficiency; Rear wheel lock-up; and Pedal force analysis.</p> <p><b>Road loads and ride:</b> Aerodynamics: Mechanics of air flow and pressure distribution on vehicle, aerodynamic forces and aids, and different forces and moments; Rolling resistance; and Total road loads. Excitation sources; Vehicle response; and Perception of ride.</p> <p><b>Steady state cornering:</b> Low-speed turning; High-speed cornering; Suspension effects on cornering; and Measurement of understeer gradient.</p> <p><b>Suspensions:</b> Solid axles; Independent suspensions; Anti-squat and anti-pitch suspension geometries; Anti-drive suspension geometry; Roll center analysis; and Active analysis.</p> <p><b>Steering systems:</b> Axis systems; Steering linkages; Steering geometry error; Front wheel geometry; Steering system forces and moments; Steering models; Effect of front-wheel drive; and Four-wheel steer.</p> <p><b>Rollover:</b> Quasi-static rollover of rigid and suspended vehicles; Transient rollover; and Rollover accidents.</p> <p><b>Tires:</b> Tire construction; Size and load rating; Terminology and axis system; Forces and moments acting on tire; Free rolling tire; Rolling resistance; Tire under braking, driving and cornering conditions; Combined cornering and braking/driving; Physical tire models; Camber thrust; Aligning moment; Conicity and ply steer; Durability forces; and Tire transient behavior and vibrations.</p>

	<b>Vehicle handling performance:</b> Criteria for good handling; Single-track vehicle modeling; Steady and non-steady state analysis; and Graphical assessment methods.
Suggested Books	<ol style="list-style-type: none"> <li>1. J.J. Uicker, G.R. Pennock, and J.E. Shigley, <b>Theory of Machines and Mechanisms</b>, Oxford University Press, New York, 2014, ISBN 978-0199454167</li> <li>2. D.H. Myszka, <b>Machines and Mechanisms: Applied Kinematic Analysis</b>, Pearson, 2011, ISBN 978-0132157803</li> <li>3. T.D. Gillespie, <b>Fundamentals of Vehicle Dynamics</b>, SAE International, 1992, ISBN 978-1560911999</li> <li>4. J.P. Pauwelussen, <b>Essentials of Vehicle Dynamics</b>, Butterworth-Heinemann, 2014, ISBN 978-0081000366</li> <li>5. R. N. Jazar, <b>Vehicle Dynamics: Theory and Application</b>, Springer, Boston, 2008, ISBN 978-0-387-74243-4</li> </ol>



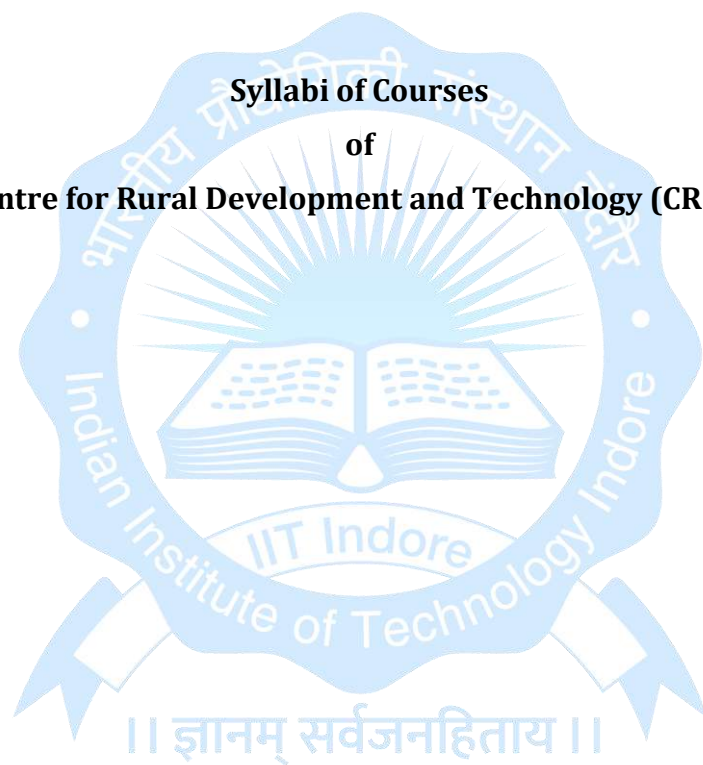
<b>Course code</b>	<b>EV 402/ EV 602</b>
<b>Title of the course</b>	<b>Vehicular Communication Systems</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned School/ Department/ Centre	Center for Electric Vehicles and Intelligent Transport Systems
Pre-requisite, if any	Basic knowledge of signal processing.
Scope of the course	This course will provide fundamentals of vehicular communications, networks, and advanced network security techniques specific to vehicular networks.
Course Syllabus	<p><b>Vehicular Communications:</b> Basics of Communication Systems in the context of vehicular communications, Vehicle-to-Everything (V2X), Vehicle-to-Infrastructure (V2I), Infrastructure-to-Vehicle (I2V), Vehicle-to-Vehicle (V2V), Infrastructure-to-Infrastructure (I2I) communications and architectures, Intelligent transportation systems, Standards for wireless access in vehicular environments (IEEE 802.11p), Vehicular Channel characterization and basic modelling.</p> <p><b>Vehicular Networks:</b> Manually driving vehicular networks, Automated driving vehicular networks, Routing protocols.</p> <p><b>Communication Security in EV Charging Systems:</b> EV Charging Security Requirements and Security Risks, Communication Security: Confidentiality and Message Integrity in Local Controllers, Non Repudiation, Firmware Integrity and Access Control in Local Controller and Authentication Terminal, Authentication Mechanisms, and Signature Schemes in Vehicular Networks, Cryptographic Communication protocols in EV Systems, Variants of security events and logging of security events in local controllers and authentication terminals.</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. C. Sommer and F. Dressler, <b><i>Vehicular Networking</i></b>, Cambridge University Press, 2014, ISBN: 9781107046719</li> <li>2. X. Cheng, R. Zhang, and L. Yang, <b><i>5G Enabled Vehicular Communications and Networking</i></b>, Springer publication, 2019, ISBN: 9783030021764</li> <li>3. D. Stinson, <b><i>Cryptography: Theory and Practice</i></b>, Chapman and Hall, CRC, 2006, ISBN: 9781138197015</li> </ol>

<b>Course Code</b>	<b>EV 407/ EV 607</b>
<b>Title of the Course</b>	<b>Energy Storage in Electric Vehicle</b>
Credit Structure	L-T-P-Credits 2-1-0-3
Name of the Concerned Department	Metallurgy Engineering and Materials Science
Pre-requisite, if any	None
Scope of the Course	This course is designed for the students of science and engineering Departments to understand the use of energy storage materials in electrical vehicles. The basics of energy storage performance and cutting edge research developments will be covered from various books, research reports, articles and review papers.
Course Syllabus	<p><b>Battery Technology:</b> Introduction to common battery terminologies, Overview of the development of battery technology, Electrochemical energy storage mechanism in LIBs, Intercalation, conversion, and alloys type electrodes, Factors limiting the energy; power densities and cyclability of LIBs, Cell form factors (cylindrical, prismatic, and pouch), Capacity fading and battery failure mechanisms, Case study of commercially available LIBs, Emerging trends and beyond Li-ion battery technologies for EVs.</p> <p><b>Battery Management System:</b> Introduction to BMS, charging discharging process, BMS requirements, Battery state of charge and state of health estimation, thermal management of battery.</p> <p><b>Supercapacitor Technology:</b> Introduction to supercapacitor, Types and energy storage mechanism of SCs, Advances in supercapacitor, EDLC for transportation applications, Analysis and evaluation of EDLC, Thermal analysis and ageing in EDLC, Battery-Supercapacitor hybridization for large vehicles, Case studies, Emerging trends in supercapacitor.</p> <p><b>Fuel Cell Technology:</b> Introduction to Fuel Cell, Types of Fuel Cell, Fuel cell thermo-chemistry and materials</p>
Suggested Books	<ol style="list-style-type: none"> <li>1. Edson R. Leite, <b>Nanostructured Materials for Electrochemical Energy Production and Storage</b>, Springer, 2009, ISBN 978-0-387-49323-7</li> <li>2. Rui Xiong, Weixiang Shen, <b>Advanced Battery Management Technologies for Electric Vehicles</b>, Wiley, 2019, ISBN 9781119481645</li> <li>3. B. E. Conway, <b>Electrochemical Supercapacitors Scientific Fundamentals and Technological Applications</b>, Springer, 1999, ISBN 978-1-4757-3058-6</li> <li>4. Devid Linden and Thomas B. Reddy, <b>Handbook of Batteries, 3<sup>rd</sup> Edition</b>, McGraw-Hill, 2002, ISBN 9780071359788</li> </ol>

5. C. G. Granqvist, **Handbook of Inorganic Electrochromic Materials**,  
Elsevier, 1995, eBook ISBN: 9780080532905



**Syllabi of Courses  
of  
Centre for Rural Development and Technology (CRDT)**



Course Code	<b>RDT 201</b>
Title of the Course	<b>Immersion for Rural Technology Development</b>
Credit Structure	L-T-P-Credits 1-0-2-2
Name of the Concerned Department	Centre for Rural Development and Technology
Pre-requisite if any	Nil
Course Objective	Scope of the Course: The student will learn methods to understand the landscape of the rural areas. Through extensive field visits they will be able to identify different kinds of challenges faced by the communities.
Course Syllabus	<p><b>Module-I:</b> Basic project management for rural development; Primary and secondary data collection methods, Qualitative and Quantitative Analytical methods; Documentation and reporting techniques/ methods for the field-based projects.</p> <p>Participatory Rural Appraisal; Effective Communication, Interview Methods; Governance System, 73<sup>rd</sup> Amendment of Constitution, Observation and Assimilation</p> <p><b>Module II:</b> Field Work: Field survey in the rural area and data gathering preparation of questionnaire, identification of problems and prospects, data compilation and analysis, preparing field reports.</p> <p><b>Module-III:</b> Assimilating and writing Project reports; Narrative and writing of the project report. Field Based Projects in agriculture, health care, water conservation, housing, automation/mechanization/engineering and other areas relevant to the rural domains.</p>
Suggested Books	<p><b>Textbooks:</b></p> <ol style="list-style-type: none"> <li>1. A. Bryman, <b>Social Research Methods</b>, Oxford University Press, 2016, ISBN 9780199689453 0199689458</li> <li>2. R. K. Yin, <b>Case Study Research: Design and Methods</b>, SAGE Publications, 2009.</li> <li>3. S. Taylor, R. Bogdan, M. DeVault, <b>Introduction to Qualitative Research Methods: A Guidebook and Resource</b>, John Wiley &amp; Sons, 2015, ISBN: 978-1-118-76721-4</li> </ol>

Course Code	<b>RDT 301</b>
Title of the Course	<b>Design Thinking for Rural Applications</b>
Credit Structure	L-T-P-Credit 1-1-2-3
Name of the Concerned Department	Centre for Rural Development and Technology
Pre-requisite, if any	NIL
Course Objective	Scope of the Course: Classroom component and Field work towards the overall process of technology-based product development for rural community.
Course Syllabus	<ul style="list-style-type: none"> <li>• <u>Rural Community requirements</u>: Data gathering and analysis for rural community indicators, determinants, and challenges; Concept testing through field survey and stakeholder experiences of rural community; Analysis of existing products and product market fit; Minimum Viable Product; Case studies on technologies implemented in rural communities</li> <li>• Government schemes supporting rural technology development and transfer; Self-help group and co-operative society for major technological interventions</li> <li>• <u>Product Conception and Prototype Development for Rural Community</u>: Design methodology and design philosophy; Establishing product function; Concept Generation and evaluation; Embodiment design; Value Engineering; Product conception; Prototype development</li> <li>• <u>Product Development and Assessment for Rural Community</u>: Product development ; Field testing; Scaling up; Packaging; Cost estimate of business case study</li> <li>• <u>Implementation of New Technology in Rural Community</u>: Technology transfer; Product marketing; Technology impact assessment; Field application of developed prototype/product and stakeholder feedback</li> </ul>
Suggested Books	<p><b>Text Books</b></p> <ol style="list-style-type: none"> <li>1. K. Singh, K. “<b>Rural development: principles, policies and management</b>” 2009, SAGE Publications India, ISBN10: 9789351509981</li> <li>2. J. P. Shukla, (Ed).. “<b>Technologies for sustainable rural development: having potential of socio-economic upliftment (TSRD-2014) (Vol. 1)</b>” 2014, Allied Publications India . ISBN-978818424862-3</li> <li>3. R. Chambers “<b>Rural Development: Putting the last first</b>”, 1983, Routledge-Taylor and Francis group. ISBN 9780367474560.</li> </ol>

4. K. T. Ulrich and D. S. Eppinger, "**Product Design and Development**", 2007 Tata McGraw Hill, ISBN10: 1260043657

**Reference Books**

5. A. F. McCalla, & W. S. Ayres, "**Rural development: From vision to action.**" 1997, The World Bank.

6. M. J. Campbell, & M.J. Campbell (Eds.), "**New technology and rural development: the social impact**", 1990, Routledge, ISBN 041500911-1

7. K. Otto and K. Wood, "**Product design**", 2013, Pearson, ISBN-10: 0131742795



